INGUINAL HERNIA SURGERY

PERSPECTIVES BEYOND LICHTENSTEIN

BAUKJE VAN DEN HEUVEL
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CHAPTER 1
INTRODUCTION
INTRODUCTION

A big step in a small field can still be a revolutionary step. Inguinal hernia surgery is generally not regarded as heroic or lifesaving. It is a small field for devoted and diligent surgeons, seeking for profound knowledge of the inguinal anatomy, with admiration for small details. Considering that approximately 20 million inguinal hernias are repaired worldwide annually, and that inguinal hernia repair is one of the most common operations done by a general surgeon, inguinal hernia surgery suddenly becomes significantly more relevant and puts small changes within this field into a whole other perspective. The principles of hernia surgery have changed throughout history, but one change is to be regarded as revolutionary, when in the 1950s the prosthetic mesh was introduced.

HISTORY

The basic principles of modern inguinal hernia surgery derive from 1884 when the Italian surgeon Edoardo Bassini (1844-1924) introduced a new surgical technique [1-3]. Bassini discovered that the inguinal floor played an important role in the etiology of inguinal hernias. He approached the hernia at the anterior side, resected the hernia sac, incised the fascia transversalis and reconstructed the posterior wall of the inguinal canal by a triple layer method. The three layers consisted of the fascia transversalis, the aponeurosis of the musculus transversus abdominis and the aponeurosis of the musculus obliquus internus abdominis, which he all sutured to the inguinal ligament [4]. Bassini published his results showing a recurrence rate of 2.8% after 5 years of follow-up. His technique was adopted and modified by many others, but eventually failed in about 30% of the patients. However, the Bassini repair was the leading procedure for inguinal hernias until 1945 when the Canadian surgeon Earle Shouldice (1890-1965) opened a small hospital treating only inguinal hernias [5]. His surgical technique resembled the Bassini technique, but did have some alterations and reconstructed the posterior wall of the inguinal canal by a four layer method. Shouldice revisited the ideas of peri-operative care of inguinal hernia patients as well, including early mobilization, short hospital admittance and resuming normal activities as soon as the patient felt comfortable [4]. The recurrence rate decreased impressively to 1% in experienced hands and specialized clinics [5]. In the general practice long-term results are less satisfying and show a recurrence rate of 1.7-15% [6]. However, until today, the Shouldice technique is still the best suturing technique for a primary inguinal hernia in experienced hands and specialized clinics.

At the same time, surgeons kept searching for new possibilities to augment the posterior wall of the inguinal canal. The Bassini technique did fail in about 30% of the patients [3]. The increased tension on the inguinal floor was vulnerable for tearing, resulting in high recurrence rates. In 1958 the American surgeon Francis Usher (1908-1980) introduced the
INTRODUCTION

The armamentarium of the inguinal hernia surgeon [12, 13]. Stoppa approached the 1975, the French surgeon René Stoppa (1921-2006) added a new technique to the armamentarium of the inguinal hernia surgeon [12, 13]. Stoppa approached the abdominal cavity onto the preperitoneal space through a midline incision and placed a large mesh at the posterior side of the abdominal wall for bilateral augmentation, known as the giant prosthetic reinforcement of the visceral sac, resulting in equally low recurrence rates.

In 1982, the South African surgeon Ralph Ger (1921-2012) was the first to describe the laparoscopic approach of the inguinal canal. He reported a series of 12 cases in which he primarly sutured the hernia defect in the abdominal wall laparoscopically [14]. Hernia surgeons explored the possibilities that the laparoscopic approach offered and within short time, the first synthetic mesh was placed at the posterior side of the abdominal wall preperitoneally covering the hernia defect. Endeavours to find the ideal position led to the introduction of intro-abdominal placement of the mesh in 1991 [15]. An intraperitoneal onlay mesh was placed intra-abdominaly covering the hernia defect by fixing it to the peritoneum of the abdominal wall. This procedure initially seemed to be considerably simple with short operative times, but long-term results revealed high recurrence rates and increased rates of neuralgia [16-18]. This technique is generally perceived to be inferior compared to other minimal invasive techniques [19].

In the Netherlands, the first laparoscopic inguinal hernia surgery was performed in 1991 [3]. The laparoscopic technique is gaining popularity due to advantages such as short recovery and less post-operative pain compared to open tension-free mesh repair. The recurrence rate after laparoscopic repair is comparable to open repair and varies between 1-4%. There are two laparoscopic techniques in inguinal hernia surgery. In both techniques the hernia defect is approached at the posterior side of the abdominal wall, and a mesh is placed in the preperitoneal space. The difference is however that in the Total Extraperitoneal Preperitoneal repair (TEP) the preperitoneal space is entered and the intra-abdominal space is left untouched. The hernia orifice is visualized from the preperitoneal space and a mesh is placed to cover the defect. While in the Trans-Abdominal Preperitoneal Plasty (TAPP) the intra-abdominal space is entered and the hernia orifice is visualized from within the abdominal cavity. The peritoneum at the groin is opened laparoscopically and the mesh is placed in the same location as with TEP repair, where after the peritoneum is closed. Up till now, no technique seems to be superior towards the other [20]. Both techniques show equal advantages over open techniques, equal rates of complications and equal operative times. The TEP technique might require more procedures to achieve surgical competence compared to the TAPP technique. After laparoscopic inguinal hernia repair less chronic pain, less impairment of inguinal sensibility, less functional loss in the lower extremity, shorter hospital stay and faster recovery is reported compared to an open mesh repair [21-32].

IMPACT

The revolutionary introduction of the tension-free mesh, resulted in several significant changes in inguinal hernia treatment. First of all, the tension-free mesh repair became the gold standard because of low recurrence rates. As the recurrence rates dropped significantly, another outcome after inguinal hernia surgery became a matter of interest. An outcome that was previously regarded as minor since the recurrence rates dominated this outcome, which is chronic pain. Chronic pain appeared to be much more disabling and more common than assumed and rates as high as 11% after mesh repair were reported [33]. The risk for developing chronic pain put surgical repair for asymptomatic inguinal hernias much under debate. The issue has not resolved yet and clinicians and medical industries still try to decrease chronic pain by developing different materials and techniques. The medical industry has therefore became an indispensable partner in inguinal hernia repair.

Secondly, with the expansion of laparoscopic techniques in inguinal hernia repair, new challenges are encountered. Challenges during trans-abdominal approach such as incidental finding of a contralateral inguinal hernia, or sheer absence of a hernia while the patient presented with a bulge in the groin. And which surgical technique is to be recommended after previous laparoscopic repair? Can a laparoscopic technique be repeated, or is an anterior repair the preferred method? And what to do after previous...
INTRODUCTION

As understanding and knowledge of inguinal hernias grows, the gap between international standards of care shrinks. Study results are published in online journals and are worldwide accessible on the internet through databases such as Pubmed or Embase. Surgery, but more so health care, has become much more of an international matter. Outcomes after a treatment or intervention can be analyzed and compared throughout the world, and physicians intent to treat according to the latest international best medical evidence.

The best medical evidence is graded by statistical classification systems such as the “Oxford Classification for Levels of Evidence”. Studies can be classified according to the reader's judgment based on such a classification system. The reader is now faced with a dilemma. If for example Pubmed is consulted for the latest insights on inguinal hernia repair and the search terms “Inguinal”, “Hernia” and “Repair” are entered, 5044 hits are displayed. How can the searcher possibly grade all these results? How can all this “evidence” possibly be digested? The searcher must extensively screen and grade all hits displayed by Pubmed, to distinguish between the varying relevance and quality of articles. Understandably, this is a time consuming business.

Surgical societies try to tackle this problem by initiating the publication of summaries in forms of guidelines. Guidelines provide a grading of all the available evidence and a summary of recommendations based on expert opinion, consensus and available evidence. The guidelines function as a tool to the surgeon to standardize and improve quality of care.

However, guidelines themselves need to be updated periodically, and the quality is largely dependent on the initiators. Besides, several national and international surgical societies publish guidelines on the same subject. It is unclear to the reader which guideline should be used and how to compare recommendations. Overall, the guidelines are of great help to the reader, but its value still needs to be assessed and the quality standardized, to provide the surgeon with a truly valuable tool in his or her hernia practice.

AIM OF THESIS

With the introduction of the tension-free mesh, the addition of the laparoscopic techniques to the surgical armamentarium and the growing exposure of “medical evidence”, the general practice of the hernia surgeon has changed and the hernia surgeon is faced with new challenges. In this thesis we have tried to tackle several clinical dilemmas by setting up a literature study, retrospective and prospective studies, a patient satisfaction survey, and a concluding consensus meeting amongst European hernia experts. This thesis is structured by the clinically. We follow the steps of a patient with an inguinal hernia during the clinical “Inguinal Hernia pathway” starting by consulting a surgeon. The clinical challenges that the hernia surgeon comes across at all different stages were the inspiration to set up all research that has led to this thesis.

SPECIFIC AIMS AND OUTLINE OF THESIS

A male patient with an inguinal hernia visits the surgical clinic. The patient has signs of a non-tender bulge in the groin. Should the patient opt for surgical repair? What is the rationale for surgery? In Chapter 2 a review of the literature was conducted to analyze the appropriateness of surgical repair in asymptomatic inguinal groin hernias.

The surgeon has confirmed the diagnosis of an inguinal hernia by physical examination. The surgeon wonders whether it is possible to differentiate between type of inguinal hernia by physical examination. In Chapter 3 a prospective study was initiated to validate a new method of physical examination in differentiation in hernia type pre-operatively by physical examination.

The patient is scheduled for unilateral inguinal hernia repair. During trans-abdominal laparoscopic inspection an occult contralateral inguinal hernia is found. What should the surgeon do? The patient had pre-operatively no signs or symptoms of a contralateral inguinal hernia. In Chapter 4 an analysis was done in a retrospective study to evaluate the incidence and natural course of contralateral defects found during laparoscopic inguinal hernia repair.

While the surgeon retracts the hernia sac during surgical repair an accompanying inguinal lipoma is found. What is the clinical relevance of such a lipoma and how should it be treated? In Chapter 5 the incidence of inguinal lipomas in laparoscopic inguinal hernia is evaluated. Two different inguinal lipomas are described, each originating form a different entity, presenting differently and requiring a different therapeutical approach. A new nomenclature of inguinal lipomas is proposed.

The patient is successfully operated and recuperated well. However after 11 months the patient returns with a symptomatic recurrence. The surgeon suggests to repair the recurrence. The surgeon wonders, whether it is possible to repeat laparoscopic repair after a previous laparoscopic repair? In Chapter 6 the feasibility, safety and reliability is
investigated of a repeated laparoscopic repair for a recurrent inguinal hernia after previous posterior repair.

The patient is operated again and discharged. The patient has recuperated successfully and 6 weeks after surgery he is excluded from follow-up. No routine follow-up is scheduled. However the surgeon does like to keep track of the patients to evaluate the outcomes of the inguinal hernia repair that is done. The surgeon wonders whether there is a method of follow-up after inguinal hernia repair. Time consuming for the patient and the surgeon than clinical visit and physical examination? In Chapter 7 a new method of follow-up is validated to detect symptomatic and asymptomatic recurrences after inguinal hernia repair.

Waiting times in elective surgery is one of the main concerns in health care systems such as the Canadian system. To decrease waiting time for elective inguinal hernia surgery, a group model of care was applied to a Canadian hernia clinic in 2006. Waiting time was reduced significantly. Public concerns raised whether a group model of care would endanger patient compliance with the care provided. In Chapter 8 a patient survey was initiated to evaluate patient compliance with a group model of care.

Health care providers need to stay updated with medical literature to provide treatment according to the best available evidence. With the increased accessibility of medical publications surgical societies initiate the construction of guidelines to support clinicians and improve quality. In Chapter 9 statements and recommendations are formulated concerning laparoscopic inguinal hernia repair, based on the consensus conference of the members of the European Association of Endoscopic Surgery in 2012.

Results of all studies are discussed in Chapter 10. General conclusions are drawn and future perspectives are provided.

REFERENCES
1. Read RC. The contributions of Usher and others to the elimination of tension from groin herniorrhaphy. Hernia 2005; 9(3):208-11
19. Ekland A, Montgomery AK, Bergkvist et al. Chronic pain 5 years after randomized comparison


CHAPTER 2

IS SURGICAL REPAIR FOR AN ASYMPTOMATIC GROIN HERNIA APPROPRIATE?

ABSTRACT

Introduction: Groin herniorrhaphy is the most common operation performed by general surgeons. Annually, more than 20 million groin hernias are repaired worldwide. The general approach towards groin hernias is surgical repair regardless the presence of symptoms. The rationale to recommend surgery for asymptomatic groin hernias is prevention of visceral strangulation. The goal of this review is to evaluate the appropriateness of surgery in patients with asymptomatic groin hernias.

Methods: The review was based on an extensive literature search of Pubmed, Medline and the Cochrane Library.

Results: The risk of incarceration is approximately 4 per 1000 patients with a groin hernia per year. Risk factors for incarceration are age above 60 years, femoral hernia site and duration of signs less than 3 months. Morbidity and mortality rates of emergency groin hernia repair are higher in patients who are older than 49 years, have a delay between onset of symptoms and surgery of more than 12 hours, have a femoral hernia, have nonviable bowel and have an ASA-class of 3 or 4. The recurrence rate after tension-free mesh repair in the management of emergency groin hernias is comparable to that of elective repair. There is no difference in pain and quality of life after elective repair compared to watchful waiting. There is no advantage in cost-effectiveness of elective repair compared to watchful waiting.

Conclusion: Watchful waiting for asymptomatic groin hernias is a safe and cost-effective modality in patients who are under 50 years old, have an ASA class of 1 or 2, an inguinal hernia and a duration of signs of more than 3 months.
present as emergencies due to incarceration or strangulation [5, 8-13]. Inguinal hernias are 9 to 12 times more common in men than in women, whereas femoral hernias are 4 times more common in women [4, 7-9]. Strangulated inguinal hernias are more common in males and strangulated femoral hernias are more common in females [14].

The presenting symptom of a groin hernia is either discomfort or pain in the groin in two-thirds of all patients [15]. One third of all patients is asymptomatic at presentation and presents with the sign of a non-tender bulge in the groin. When a groin hernia cannot be diagnosed by physical examination, imaging is indicated. Ultrasonography reveals groin hernias at sensitivity and specificity rates greater than 90% [16]. MRI is most commonly employed differentiating the causes of groin pain in absence of a hernia [1].

MORBIDITY AND MORTALITY OF ELECTIVE GROIN HERNIA REPAIR

The most common short-term complications after groin hernia surgery are pain, hematoma, seroma and wound infection. The most common long-term complication is chronic pain in the groin and recurrence of the hernia. The reported short term morbidity rates in the literature are shown in Table 1. The average morbidity rate of groin hernias is 8%.

### Table 1. Type, morbidity and mortality in elective groin hernia repair

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Inguinal hernia</th>
<th>Femoral hernia</th>
<th>Morbidity</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palumbo [26]</td>
<td>604</td>
<td>36 (5.9%)</td>
<td></td>
<td>1 (0.1%)</td>
<td></td>
</tr>
<tr>
<td>Williams [40]</td>
<td>222</td>
<td>222 (100%)</td>
<td>0 (0.0%)</td>
<td>59 (27%)</td>
<td>4 (2%)</td>
</tr>
<tr>
<td>Ponka [12]</td>
<td>200</td>
<td>140 (70%)</td>
<td>60 (30%)</td>
<td>75 (38%)</td>
<td>1 (0.5%)</td>
</tr>
<tr>
<td>Tingwald [39]</td>
<td>44</td>
<td>43 (98%)</td>
<td>1 (2%)</td>
<td>8 (18%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Nehme [52]</td>
<td>1044</td>
<td>273 (26%)</td>
<td></td>
<td>14 (15%)</td>
<td></td>
</tr>
<tr>
<td>Allen [53]</td>
<td>51</td>
<td>49 (96%)</td>
<td>2 (4%)</td>
<td>0 (0.0%)</td>
<td></td>
</tr>
<tr>
<td>Lichtenstein [25]</td>
<td>6321</td>
<td>6125 (94%)</td>
<td>196 (3%)</td>
<td>331 (5%)</td>
<td>2 (0.04%)</td>
</tr>
<tr>
<td>Lewis [34]</td>
<td>97</td>
<td>21 (21.6%)</td>
<td></td>
<td>0 (0.0%)</td>
<td></td>
</tr>
<tr>
<td>Oishi [13]</td>
<td>1777</td>
<td>1758 (99%)</td>
<td>19 (1%)</td>
<td>116 (6.5%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Primatesta [7]</td>
<td>27937</td>
<td>366 (1.3%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nilsson [8]</td>
<td>4879</td>
<td>4137 (85%)</td>
<td>173 (3.5%)</td>
<td>286 (6%)</td>
<td>3 (0.07%)</td>
</tr>
<tr>
<td>Haapaniemi [54]</td>
<td>17061</td>
<td>16086 (94%)</td>
<td>375 (6%)</td>
<td>24 (1.1%)</td>
<td></td>
</tr>
<tr>
<td>Bay-Nielsen [21]</td>
<td>25148</td>
<td>251 (4.2%)</td>
<td></td>
<td>55 (2.2%)</td>
<td></td>
</tr>
<tr>
<td>Ohana [38]</td>
<td>200</td>
<td>200 (100%)</td>
<td></td>
<td>21 (10.5%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>85585</strong></td>
<td><strong>28560 (93%)</strong></td>
<td><strong>826 (2.7%)</strong></td>
<td><strong>1226 (8.0%)</strong></td>
<td><strong>470 (0.5%)</strong></td>
</tr>
</tbody>
</table>

1. total percentage of numbers published (28560/ 30555)
2. total percentage of numbers published (826/ 30555)
3. total morbidity rate of numbers published (1226/ 15388)

Chronic pain is generally defined as pain or discomfort lasting longer than 3 months after surgery [17]. The incidence of chronic pain after hernia repair reported in the literature varies widely. This wide range is due to different techniques being used and to a large variability of the description of pain [18]. Chronic pain after suture repair has been reported by Cunningham et al and 63% of the patients had pain in the groin area after one year, decreasing to 54% after two years [19]. The incidence of chronic pain after open tension-free mesh and laparoscopic repair is lower but still considerable. Thirteen to 37% of the patients report chronic pain after open tension-free mesh repair [20-23]. The incidence of chronic pain after laparoscopic repair is similar and varies from 10 to 30% [20-23]. A recent multicenter randomized controlled trial by Eklund et al compared the incidence of chronic pain after both open tension-free mesh (Lichtenstein) and laparoscopic (TEP) repair [17]. A total of 1370 patients were included and randomized.

After 5 years, 9% of the patients reported any kind of pain after laparoscopic repair versus 19% after Lichtenstein repair. The percentage of patients that reported pain interfering with daily activities was 2% after TEP repair versus 3.5% after Lichtenstein repair. A similar study by Langeveld et al also compared TEP and Lichtenstein repair [24]. After one year, 25% of the patients reported postoperative pain after TEP repair compared to 29% after Lichtenstein repair. These rates are higher than reported by Eklund et al, but it is not clear whether these patients were impaired in their daily activities. These results show the difficulty in interpreting postoperative pain rates and comparing them. A universal approach to assess chronic pain after herniorrhaphy is proposed by Kehlet et al [17] and should be implemented to interpret incidences of chronic pain and to compare results.

Recurrence rates after herniorrhaphy depend mostly on the surgical technique used for repair. Recurrence rates after suture repair have been reported as high as 62% [4, 25, 26]. When Lichtenstein introduced the open tension-free mesh repair in the 1970s, recurrence rates were greatly reduced to 0-10% [25, 27-30]. In the early 1990s, laparoscopic techniques using a tension-free mesh were developed for groin hernia repair. The recurrence rates after laparoscopic repair are comparable to these after open tension-free mesh repair and stretch out between 2-4% [20, 22, 24, 31].

The mortality rate after elective groin hernia repair is low. The causes of death in elective groin hernia repair are mostly cardiovascular, advanced cancer, sepsis and pulmonary diseases. Table 1 provides an overview of mortality rates found in the literature averaging 0.5%. Nilsson et al studied mortality rates after elective groin hernia repair in a time period of 13 years in Sweden [32]. These rates were defined in a standardized mortality ratio (SMR), comparing observed deaths of operated patients to expected deaths considering age and gender of the population in Sweden. They found that the mortality rate after elective groin hernia repair does not transcend the expected mortality, implying the elective groin hernia repair is a safe and low-risk operation.
RISK OF INCARCERATION AND STRANGULATION

Accurate determination of the actual risk of incarceration and strangulation of a groin hernia is complex because of a paucity of studies on actual incidence of these events. An indirect parameter of incarceration and strangulation is the rate of emergency groin hernia repair, assuming that emergency repairs are done in patients with either incarcerated or strangulated groin hernias. Table 2 summarizes emergency ratios reported in the literature. Almost 7% of all hernia repairs are emergency repairs.

### Table 2. Emergency groin hernia repairs

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Emergency repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Williams [40]</td>
<td>270</td>
<td>48 (18%)</td>
</tr>
<tr>
<td>Kauffman [42]</td>
<td>966</td>
<td>102 (10.5%)</td>
</tr>
<tr>
<td>Palumbo [4]</td>
<td>3572</td>
<td>86 (2.4%)</td>
</tr>
<tr>
<td>Ponka [12]</td>
<td>200</td>
<td>34 (17%)</td>
</tr>
<tr>
<td>Tingwald [39]</td>
<td>62</td>
<td>18 (29%)</td>
</tr>
<tr>
<td>Nehme [42]</td>
<td>1279</td>
<td>235 (18%)</td>
</tr>
<tr>
<td>Lewis [34]</td>
<td>116</td>
<td>19 (16%)</td>
</tr>
<tr>
<td>Gallegos [11]</td>
<td>476</td>
<td>34 (7%)</td>
</tr>
<tr>
<td>Oishi [13]</td>
<td>1859</td>
<td>82 (4.4%)</td>
</tr>
<tr>
<td>Primatesa [7]</td>
<td>30575</td>
<td>2738 (9%)</td>
</tr>
<tr>
<td>Nilsson [8]</td>
<td>4879</td>
<td>284 (6%)</td>
</tr>
<tr>
<td>Nilsson [55]</td>
<td>12152</td>
<td>719 (6%)</td>
</tr>
<tr>
<td>Haapaniemi [54]</td>
<td>18170</td>
<td>1109 (6.1%)</td>
</tr>
<tr>
<td>Hair [56]</td>
<td>5506</td>
<td>294 (5%)</td>
</tr>
<tr>
<td>Bay-Nielsen [21]</td>
<td>26304</td>
<td>1156 (4%)</td>
</tr>
<tr>
<td>Kulah [14]</td>
<td>3010</td>
<td>385 (13%)</td>
</tr>
<tr>
<td>Malek [3]</td>
<td>532</td>
<td>38 (7.1%)</td>
</tr>
<tr>
<td>Ohana [38]</td>
<td>2331</td>
<td>67 (2.9%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>103537</strong></td>
<td><strong>7448 (6.6%)</strong></td>
</tr>
</tbody>
</table>

N = total amount of groin hernia repairs

In Columbia an epidemiologic study was done to assess the incidence of incarceration and strangulation [6]. A random stratified sample was taken of the civilian population to assess the prevalence of groin hernias. Regionally, all emergency repairs were observed during a 5 year period. The number of emergency repairs was divided by the prevalence of groin hernias to provide an estimation of the incidence of incarceration and strangulation. The overall risk of incarceration and strangulation was 3.6 per 1000 male adults and 5.4 per 1000 female adults with a groin hernia per year.

Several risk factors have been identified that may predict incarceration and strangulation. Acknowledgement of these risk factors would help allocating a patient to a high- or low-risk group and decide for which patient elective repair is desirable and which patient can be treated conservatively. Many different risk factors for incarceration and strangulation are analyzed in the literature. Femoral hernias incarcerate and strangulate significantly more frequently than inguinal hernias [8, 12-14, 33]. Table 3 summarizes details and outcomes of emergency groin hernia repair, including hernia site.

### Table 3. Mean age, hernia type, morbidity and mortality in emergency groin hernia repair

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Age</th>
<th>Inguinal hernia</th>
<th>Femoral hernia</th>
<th>Morbidity</th>
<th>Mortality</th>
<th>Bowel resection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Williams [40]</td>
<td>48</td>
<td>&gt;60</td>
<td>48 (100%)</td>
<td>0 (0.0%)</td>
<td>25 (52%)</td>
<td>6 (13%)</td>
<td></td>
</tr>
<tr>
<td>Kauffman [42]</td>
<td>102</td>
<td>&gt;60</td>
<td>102 (100%)</td>
<td>0 (0.0%)</td>
<td>10 (10%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andrews [9]</td>
<td>190</td>
<td>68</td>
<td>82</td>
<td>72</td>
<td>19 (11%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tingwald [39]</td>
<td>18</td>
<td>76,9</td>
<td>15 (83%)</td>
<td>3 (17%)</td>
<td>10 (56%)</td>
<td>4 (22%)</td>
<td>2 (11%)</td>
</tr>
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<td>&gt;65</td>
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<td>Rai [10]</td>
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<td>204 (18%)</td>
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<tr>
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<td>189</td>
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<td>108 (57%)</td>
<td>42 (22%)</td>
<td>48 (25%)</td>
<td>10 (5%)</td>
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<td>222 (58%)</td>
<td>69 (18%)</td>
<td>75 (19.5%)</td>
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<td>67</td>
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<td>16 (23.4%)</td>
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Total 7404 1868 (68%) 600 (22%) 424 (32%) 424 (5.8%) 259 (14%)
incarceration and strangulation increases over time. Three months after the onset of signs of an inguinal hernia, the cumulative probability of incarceration and strangulation is 2.8%. This percentage rises to 4.5% after 2 years. For femoral hernias the cumulative probability is much higher, 22% at three months and 45% at 21 months [11]. The cumulative probability increases most in the first period after the onset of signs of a groin hernia. Two thirds of the patients that present with an emergency hernia have had their groin hernia for less or equal to one year [10]. In the elective group two thirds of the patients had their hernia for longer than one year. In conclusion risk factors for incarceration or strangulation are age, hernia site and duration of signs.

**MORBIDITY AND MORTALITY OF EMERGENCY GROIN HERNIA REPAIR**

Emergency groin hernia repair is associated with higher morbidity and mortality rates than elective groin hernia repair [8, 11, 13, 34, 37, 38]. An overview of these rates reported in the literature are summarized in Table 3. The average morbidity rate is 32% and the average mortality rate is 5.8%, compared to 8% and 0.5% respectively of elective repair. In Sweden, Nilsson et al studied the mortality rates after emergency groin hernia repair using the standardized mortality ratio (SMR) [32]. The observed deaths after emergency groin hernia repair transcends the expected deaths significantly when the age of the patient is above 49 years, when the patient has an ASA class above 2, in case of a femoral hernia and when bowel resection was required during surgery. These result are confirmed by other studies [14, 35, 37, 39, 40].

Table 3 shows that 14% of all emergency hernias contain necrotic bowel necessitating bowel resection. Bowel resections are more common in patients above the age of 65 years, late hospitalization, coexisting diseases and femoral hernias [3, 9, 12-14, 33, 35, 37, 41, 42]. The morbidity and mortality rate after emergency hernia repair necessitating bowel resection is significantly higher compared to no bowel resection [14]. Bekoe related the presence of nonviable bowels in strangulated hernias to duration of symptoms [43]. The incidence of nonviable bowels requiring bowel resection increases 15 fold within 24 hours, rising from 3% when duration of symptoms was less than 12 hours to 50% when duration of symptoms was over 24 hours. Andrews showed that late hospitalization in general correlates with higher morbidity and mortality rates after emergency groin hernia repair [7]. A mortality rate of 1% was found when patients were hospitalized within the first 24 hours after onset of symptoms, increasing to 21% after a delay of more than 47 hours. In conclusion, age over 49 years, late hospitalization, femoral hernia site, nonviable bowel and ASA-class above 2 increase the morbidity and mortality rate after emergency repair significantly.

**RECURRENT RATE AFTER EMERGENCY GROIN HERNIA REPAIR**

Different techniques are used in case of an emergency hernia [35]. The use of a prosthetic mesh in emergency repair is presumed to mesh-related complications such as an increased risk of infection [44, 45]. Recent studies have shown that the use of a tension-free mesh in emergency groin hernia repair is not associated with higher morbidity rates. Elsebae et al compared the tension-free mesh repair to the Bassini repair in emergency groin hernias in a randomized controlled trial [44]. Patients with preoperative peritonitis, an inflammatory hernia and ischemic necrosis necessitating bowel resection were excluded from the study. Postoperative complication rates did not differ between the two groups. During follow-up of 22 months no recurrence was observed in the tension-free mesh group compared to three recurrences in the Bassini group (p<0.001). Bessa et al compared the use of mesh in elective and emergency groin hernia repair [45]. Twenty-five patients with the mean age of 60 years old and ASA class 1 or 2, presented with an emergency groin hernia. All emergency hernias were repaired with a tension-free mesh according to Lichtenstein. The results were compared to a matching group of 25 patients who underwent elective tension-free mesh hernia repair. Results show that the tension-free mesh repair in the management of emergency groin hernias is not associated with a higher rate of complications, including recurrence rate, compared to its use in the elective setting.

**WATCHFUL WAITING**

In 2006 two randomized controlled trials about watchful waiting versus elective repair in asymptomatic inguinal hernias were published. Fitzgibbons et al randomized 720 patients to either the tension-free mesh repair group or the watchful waiting group [46]. The main outcomes were pain and discomfort interfering with usual activities measured in the physical component score of the Short Form-36, Version 2. After 2 years both groups reported less pain than at baseline. The amount of change from baseline in pain while at rest, during normal activities, and during work or exercise did not differ between the groups. The reduction in perception of pain unpleasantness was significantly greater for patients in the surgical repair group. The mean follow-up was 3.2 years. During follow-up two cases (0.6%) of incarceration were observed in the watchful waiting group, resulting in an accident rate of 1.8 per 1000 patients per year. Twenty-three percent of the patients assigned to the watchful waiting group did receive surgical repair within 2 years, mostly because of increasing pain and discomfort. Seventeen percent of the patients assigned to the surgery group did not undergo surgical repair in 2 years, no reason given in the majority of cases.

Stroupe et al assessed costs, quality-adjusted life-years (QALY) and cost-effectiveness at two years follow-up of the same group of subjects as the above-mentioned trial of
Fitzgibbons et al [47]. QALY incorporates health-related quality of life and medical outcomes into a single measure [47]. The average direct costs for the surgical repair group were significantly higher than the watchful waiting group with a difference of $1831 ($7875 versus $6044). The patients in the surgical repair group had a 0.031 higher mean QALY than the patients in the watchful waiting group. The incremental cost-effectiveness ratio, which refers to the cost per additional QALY, was $59,065/QALY. A cost per QALY of approximately $50,000 is generally viewed as a reasonable cutoff for public funding of a medical procedure in the United States of America [48].

O’Dwyer et al randomized 160 patients with an asymptomatic or minimally symptomatic inguinal hernia to elective tension-free mesh repair or to observation [49]. The primary outcome was pain at rest and movement measured by the use of the 100 mm visual analogue pain score (VAS) and general health status measured by the Short Form-36 (SF-36) at 12 months. At 12 months no significant differences were found between both groups with regards to pain at rest or at movement. General health status increased for both the surgical and the observational arm over 12 months. The general health status in the surgical arm increased significantly more compared to the observational arm. Despite improvement in general health in the surgical arm, no significant difference in QALY was found at 12 months. Another outcome measured was cost to the Health Service. Results show a difference in direct cost of £402 per patient for the operation group compared to the observation group. One case of incarcerated hernia (1.3%) was observed in the wait and see group during follow-up of 12 months. At 12 months 19% of the patients in the observational arm crossed-over to surgery mostly due to increase of pain. Summarizing, both studies compared surgical repair to watchful waiting in the treatment of inguinal hernias. Fitzgibbons showed that both groups reported less pain after 2 years than at baseline. The reduction in perception of pain unpleasantness was significantly greater for patients in the surgical repair group. During follow-up two cases (0.6%) of incarceration were observed in the watchful waiting group. O’Dwyer showed no differences between the two groups in pain at rest or at movement at 12 months follow-up. There also was no difference in QALY at 12 months. One case of acute hernia was observed (1.3%) during follow-up.

DISCUSSION

In this review of more than 10,000 patients we have critically appraised the appropriateness of surgery in patients with asymptomatic groin hernia repair. The rationale of repairing all groin hernias surgically, including asymptomatic hernias, is the possible risk of incarceration and strangulation. Surprisingly, it is unknown how high this risk actually is. An indirect parameter of this risk is the rate of emergency groin hernia repair, considering that emergency repairs are done in patients with either incarcerated or strangulated groin hernias. Multiple observational studies estimated this rate, averaging 7% of all groin hernia repairs are emergency repairs. Two recent randomized controlled studies by Fitzgibbons et al and O’Dwyer et al reported on the risk of incarceration in asymptomatic hernias [46, 49]. In both trials patients with an asymptomatic inguinal hernia were randomized to either watchful waiting or elective repair. The incidence of incarceration in the watchful waiting group was 1.8 and 6.25 per 1000 patients per year respectively. These rates do not correspond with the average emergency rate of 7%. An explanation for this difference can be that a considerable number of patients with a groin hernia do not consult a physician and do not undergo elective repair, resulting in a larger elective/emergency ratio. Recalling, the rationale of repairing all groin hernias surgically is the possible risk of incarceration and strangulation. This risk, due to the lack of evidence, has been overestimated and corresponds most likely to the rates reported by Fitzgibbons et al and O’Dwyer et al [46, 49].

The risk of incarceration and strangulation is increased by age over 60 years, femoral hernia site and short duration of signs. When a groin hernia does incarcerate or strangulate and emergency repair is required, the morbidity and mortality rates are higher compared to elective repair in so-called high-risk patients. Risk factors for increased morbidity and mortality are age above 49 years, delay between onset of symptoms and surgery greater than 12 hours, femoral hernia site, nonviable bowel and ASA-class 3 and 4. Therefore, an elective repair should be recommended to patients with an increased risk of incarceration and strangulation and to patients who are at risk for increased morbidity and mortality after emergency repair.

Different techniques are used during emergency repair. In low risk patients, tension-free mesh repair is a safe procedure [44, 45]. This technique is not associated with mesh related complications, such as infections or increased recurrence rates compared to the use in elective setting. The long-term cure of a groin hernia repaired in emergency setting is not inferior to elective repair in low-risk patients. In high risk patients it is unclear which technique should be used during emergency groin hernia repair, and whether the use of mesh is contraindicated. More research should be done for future recommendations.

The elective groin hernia repair is considered to be a safe procedure. The short-term morbidity, the recurrence rate and the mortality rate are low. Nevertheless, over the past decade reports showed high incidences of chronic pain after tension-free mesh hernia repair, ranging from 2 to 37% [17, 20-24]. An inconsistency is observed, since these rates exceed the morbidity rates after elective groin hernia repair of 8% mentioned earlier. An explanation to this discrepancy and wide variety might be the lack of consensus about the definition of pain, the lack of assessing chronic pain, or the lack of reporting chronic pain. Fitzgibbons et al and O’Dwyer et al both assessed pain in the surgical repair and in the watchful waiting group. Fitzgibbons showed that both groups reported less pain after 2
years compared to baseline [46]. O'Dwyer found that at 12 months there were no significant differences between both groups with regards to pain at rest or at movement [49]. Summarizing the two studies, results are indifferent towards surgical repair or watchful waiting in the treatment of an asymptomatic or minimal symptomatic groin hernias with regards to pain.

Fitzgibbons et al also assessed quality of life by means of the SF-36 and found a reduction in perception of pain unpleasantness for both groups [46]. This reduction was significantly greater for patients in the surgical repair group. O'Dwyer et al found that general health status, one of the 8 health concepts of the SF-36, increased for both the surgical and the observational arm over 12 months [49]. The general health status in the surgical arm increased significantly more compared to the observational arm. Despite improvement in general health in the surgical arm, no significant difference in QALY was found at 12 months.

Stroupe et al calculated cost-effectiveness of surgical inguinal hernia repair and watchful waiting [47]. They assessed that the incremental cost-effectiveness ratio for elective hernia repair is $59,065/QALY. A cost per QALY of approximately $50,000 is generally viewed as a reasonable cutoff for public funding of a medical procedure [48]. This means that the elective hernia repair is hardly considered a worthwhile procedure, and that conservative treatment is a responsible approach from the viewpoint of cost-effectiveness. The calculations of Stroupe et al were done in the United States of America, meaning that this analysis will be different for other health care systems and should be considered on a national level. O'Dwyer et al reported no difference in QALY for the surgical repair group compared to watchful waiting group but did report a difference in cost [49]. Results show a difference in direct cost of £402 per patient for the operation group compared to the observation group at 574 days. Again, these costs were calculated in the United Kingdom and should be reviewed on a national level.

In summary, surgical repair of an asymptomatic or minimal symptomatic inguinal hernia can hardly be considered a worthwhile procedure from the viewpoint of cost-effectiveness.

It is estimated that approximately 70,000 hernia repairs are performed in Canada each year [50]. One third of the patients that present with a groin hernia are asymptomatic [38,51]. This suggests that approximately 23,000 hernia repairs could be treated conservatively in Canada. Stroupe et al assessed the difference in costs between watchful waiting and elective repair to be $1831 (US) [47]. An amount up to $42,113,000 (US) could be saved annually. Considering the long waiting lists and the scarce resources in health care, watchful waiting should be suggested in every low-risk patient with an asymptomatic groin hernia.

Until this day, two trials report on experience with watchful waiting in the treatment of asymptomatic or minimal symptomatic inguinal hernias [46,49]. In both trials patients in the watchful waiting group crossed over to the surgical repair group, mostly due to increase in pain. About 20% of the asymptomatic or minimal symptomatic inguinal hernias will become symptomatic during watchful waiting, requiring surgical repair. The other 80% of patients with an asymptomatic or minimal symptomatic inguinal hernia will remain so. Approximately 1% of these patients will present with an incarcerated inguinal hernia requiring surgical repair.

Considering all outcomes we propose the following algorithm (Figure 1) to help the physician assess whether a conservative approach is a safe approach towards a patient with an asymptomatic or minimal symptomatic groin hernia.

**Figure 1. Treatment algorithm for minimal or asymptomatic groin hernias**

When a patient has an asymptomatic or minimal symptomatic inguinal hernia for more than 3 months, is younger than 50 years and has an ASA class of 1 or 2, a conservative treatment is justified. When the inguinal hernia does incarcerate in such a patient, the hernia can be safely repaired with a tension-free mesh technique. In patients with an asymptomatic or minimal symptomatic inguinal hernia for less than 3 months, who are older than 49 years or have an ASA class of 3 or 4, an elective repair should be recommended. Patients with a femoral hernia should also be recommended elective repair. When the groin hernia does incarcerate in patients that fit the latter characteristics, it is unclear which technique should be used in emergency repair. Further
research should be done to evaluate different techniques and outcomes in emergency hernia repair.

For implementing a conservative treatment of an asymptomatic or minimal symptomatic inguinal hernia some issues should be considered. Patients need to be well informed, understand the symptoms of incarceration and instructed to come to the hospital at the onset of symptoms. If the physician has the impression the patient does not fulfill those requirements, the patient should be excluded from conservative treatment. Also patients should live within reasonable distance of a hospital, considering the significant increase in bowel resections in incarcerated hernias if duration is more than 12 hours. It is therefore important that the patient could reach a hospital within this timeframe.

Considering the best evidence available a conservative treatment for asymptomatic or minimal symptomatic inguinal hernias is a safe and cost-effective treatment. Patients with an increased risk of incarceration or with an increased risk of higher morbidity and mortality after emergency repair should be excluded from conservative treatment. Nevertheless, prospective studies are needed to improve recommendations.

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CHAPTER 3

DIFFERENTIATION OF INGUINAL HERNIA TYPE BY PHYSICAL EXAMINATION; A NEW ACCURATE METHOD

W. Tromp | B. van den Heuvel | B. Dwars |
Accepted for publication by Surgical Endoscopy
ABSTRACT

Introduction: It is generally stated that preoperative differentiation between an indirect or direct inguinal hernia by physical examination is inaccurate and irrelevant. With the expansion of the laparoscopic technique new relevance has emerged. Laparoscopic correction of an indirect inguinal hernia is more challenging and time-consuming than of a direct hernia. Preoperative knowledge of the type of hernia informs the laparoscopic surgeon about required expertise and expected operative time, which is also useful knowledge for training programs and management. We therefore developed a new accurate and easy method of physical examination to differentiate in type of inguinal hernia. We conducted a prospective study to determine the accuracy of this new method, combining physical examination with a hand-held Doppler device (not ultrasound) to differentiate in type of inguinal hernia.

Methods: This prospective diagnostics study consists of two consecutive parts. Each part includes 100 consecutive patients presenting with an inguinal hernia. The inguinal occlusion test is used to differentiate in type of inguinal hernia during physical examination in the first part of our study. The occlusion test includes the reduction of the protruding hernia together with manual compression on the presumed location of the internal inguinal ring. A hand-held Doppler device is used for adequate localization of the epigastric vessels in addition to the occlusion test in the second part of the study. Preoperative remarks are compared with findings during laparoscopic inguinal hernia repair. The McNemar symmetry chi-square test is used for statistical evaluation.

Results: The first part of the study shows a preoperative accuracy of 35% of direct inguinal hernias and 86% of indirect inguinal hernias (p < 0.001). The second part of the study shows a preoperative accuracy of 79% of direct inguinal hernias and 93% of indirect inguinal hernias (p < 0.001).

Conclusion: The inguinal occlusion test combined with the use of a hand-held Doppler device is accurate in distinguishing direct and indirect inguinal hernias and provides useful management information in laparoscopic inguinal hernia repair.

INTRODUCTION

For generations, careful physical examination of the groin region on patients presenting with inguinal pathology has been regarded as an essential skill in surgical clinic. Already in the 18th century the famous Dutch surgeon Petrus Camper emphasized: “among the defects of our body there are none of any more concern therefore requiring precise investigation, than hernias” [1]. In present clinical practice the presence of an inguinal hernia can be diagnosed with sufficient accuracy and additional diagnostic modalities are seldom needed [2, 3]. The differentiation by physical examination in types of inguinal hernia, medial (direct) or lateral (indirect), is considered inaccurate and sometimes challenging with additional diagnostic modalities [4-6]. Even, an atmosphere of sceptis exists in whether determination of type of inguinal hernia is relevant. Antagonists of preoperative differentiation advocate that knowledge of type of inguinal hernia does not have consequences on operative course or surgical approach chosen [7]. However, with the emergence of minimally invasive procedures surgeon’s armamentarium of different techniques in inguinal hernia correction has greatly extended. With the laparoscopic posterior approach to the abdominal wall we experienced marked differences in complexity between the correction of a direct and an indirect hernia, while these differences are not present in the open anterior approach. The laparoscopic dissection with a posterior approach of a direct hernia consists merely of the separation of two distinct planes, the peritoneum and the insufficient transversal fascia. As these planes have no relation to each other separation is easily performed. The laparoscopic dissection of an indirect hernia however can be technically demanding, as scar tissue of the obliterated vaginal process results in peritoneal fixation to the funicular structures and as the peritoneal sac is mostly closely related to the funicular structures. Insecure dissection of the peritoneum inevitably leads to the risk of damage to the vas deferens and the vascular funicular structures. The laparoscopic repair of an indirect hernia requires well developed endoscopic skills of the surgeon and may be time consuming when performed with essential care, while the laparoscopic repair of a direct hernia is generally far less challenging and takes less operative time. In our transabdominal preperitoneal hernia repair (TAPP) experience, operation time for an indirect hernia exceeds the time needed to repair a direct hernia with 10 to 40 minutes. This time difference can even be more significant when the laparoscopic hernia correction is performed by a less skilled surgeon in training setting. Because of the differences in hernia pathology, with consequent required skills and operative time needed, preoperative determination of the type of inguinal hernia offers the laparoscopic surgeon useful management information, both in
training programs and in preoperative planning. Therefore we reconsidered the value of physical examination of the groin. We conducted a prospective diagnostic study to find an accurate and easy to perform method of physical examination to differentiate in types of inguinal hernia, thereby avoiding time-consuming and costly additional imaging techniques.

METHODS
From 2009 to 2012 a prospective diagnostic study was conducted consisting of two consecutive parts with each part a different method of physical examination. In both parts a total of 100 consecutive patients with an inguinal hernia were included. Patients were selected from a continuous patient population presenting at the surgical clinic of our institute. Each patient was subjected to physical examination by one experienced surgeon. In both parts of the study the inguinal occlusion test was used as method to differentiate between a direct and indirect inguinal hernia. The inguinal occlusion test implies manual reduction of the protruding hernia followed by manual compression on the presumed location of the deep inguinal ring. Patients were asked to perform Valsalva manoeuvre after which it was observed whether the hernia remained reduced until release of the compression (indirect hernia) or immediately protruded while the inguinal internal ring still being compressed (direct hernia) at its presumed location. Our presumption was that the inguinal internal ring is located just lateral to the midpoint between the anterior superior iliac spine and the pubic tubercle, where the femoral artery can be palpated as it passes under the inguinal ligament and where the origin of the epigastric vessels from the femoral artery and vein are located. In the first part of the study patients were investigated in upright position, because the hernia protrudes more easily then. In the second part of the study a hand-held Doppler device (not ultrasound) was used in physical examination for detecting the epigastric vessels and thereby indirectly locate the deep inguinal ring (DIR) more accurately. This simple maneuver added approximately one minute of time to the duration of the physical examination. In this part of the study patients were examined in supine position to facilitate the use of the hand-held Doppler. When the inguinal occlusion test could not clearly distinguish the type of inguinal hernia at forehand, because the hernia failed to protrude, the presenting patient was excluded from the study. The definitive differentiation of type of inguinal hernia was determined by intra-operative findings (gold standard) during TAPP repair. At the end of both study parts analysis was made of the results by comparing the findings of the physical examination with the operative findings. The McNemar symmetry chi-square test was used for statistical evaluation.

RESULTS
PART 1
A total of 100 patients were included. The mean age was 61 (range 23-91) and the majority was male (99%). A total of four patients were excluded from analysis because a pantaloon hernia was found intra-operatively. Twenty-three hernias were scored as direct hernias and 77 as indirect hernias by physical examination. Operative findings showed that 43 inguinal hernias were direct hernias and 57 indirect hernias. Preoperative differentiation was correct in 35% of the direct inguinal hernias and 86% of the indirect inguinal hernias (p < 0.001) (Table 1).

PART 2
A total of 100 patients were included. The mean age was 59 (range 23 - 85) and the majority was male (97%). A total of 29 patients were excluded from analysis because of failure of protrusion of the hernia in supine position (21 patients) and the intra-operative finding of eight pantaloon hernias. A total of 100 groin hernias were included of which 37 were scored as direct hernias and 63 as indirect hernias by physical examination. Forty-two hernias were diagnosed as direct hernias and 58 as indirect hernias during operative evaluation. Preoperative differentiation was correct in 79% of the direct inguinal hernias and 93% of the indirect inguinal hernias (p < 0.001) (Table 2).

Table 1. Results first part study

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Table 2. Results second part study

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</table>
DISCUSSION

The aim of this study was to find an accurate and easy to perform method of physical examination to differentiate in type of inguinal hernia. In present literature a total of six studies did research on the accuracy of physical examination to differentiate in type of inguinal hernia. All six studies were retrospective and the total of examined groins ranged from 134 to 278 [2, 5, 6-9]. Reference test in all studies was surgical exploration. The overall accuracy to diagnose an indirect hernia with physical examination ranged from 72% to 92% and 55% to 65% for direct hernias. Only the study of Moreno-Egea et al postulated that thorough physical exploration of the groin area might help classify hernias with great accuracy. They reported an accuracy of 85% and 64% for indirect and direct hernia respectively. However, the majority of the studies concluded that physical examination to differentiate in type of inguinal hernia is not sufficient [2, 5, 6, 8, 9]. The European Hernia Society guidelines on the treatment of inguinal hernia in adult patients state that differentiation of hernia types by physical examination is unreliable [10].

An explanation for the inaccuracy in differentiating between the types of hernia in present literature is the difficulty of determining the exact location of the deep inguinal ring. During physical examination, the deep inguinal ring cannot be palpated, so its exact location can only be derived from anatomic landmarks. Present literature shows no uniformity of description on the exact surface marking of the deep inguinal ring [11]. The position of the deep inguinal ring is subjected to inter patient variability; natural variation and variation caused by distortion of the protruding inguinal hernia [12, 13].

Four anatomical landmarks are of importance in assessing the location of the deep inguinal ring: the anterior superior iliac spine (ASIS), the femoral artery (FA) and inferior epigastric artery (IEA) and the pubic tubercle (PT) (Figure 1).

Standard anatomical textbooks all tell that the deep inguinal ring is located at the mid-inguinal point (MIP - midway between the ASIS and pubic tubercle where the origin of the inferior epigastric artery is located) or lateral from this point [11]. This is confirmed by the study of Koliyadan et al which stated that the deep inguinal ring in an anatomically normal groin is located lateral to the mid-inguinal point [13]. The studies of Conaghan et al and Andrews et al show that the deep inguinal ring is located lateral or on average at the mid-inguinal point in patients with groin pathology [12, 14]. On contrary, two other studies describe that the deep inguinal ring is at, or slightly medial to the mid-inguinal point in patients with an indirect hernia [11, 15]. Sanjay et al suggest that this discrepancy can be explained by the difference in location of the deep inguinal ring in case of a direct versus indirect hernia. Protrusion of an indirect hernia is more likely to alter the location of the deep inguinal ring more medially [11]. In this way, some of the indirect hernias, emerging through a dislocated deep inguinal ring, will protrude medial from the mid-inguinal point.

Despite existing anatomic diversity, the deep inguinal ring is located lateral from the inferior epigastric vessels both in the normal groin as well as in the groin with hernia pathology. With this premises we contrived the idea of hand-held Doppler examination, which provides more precise localization of the inferior epigastric vessels and thereby indirectly the deep inguinal ring. During the study period the surgeon taught students to use the inguinal occlusion test with Doppler examination, which appeared easy to perform for them. The results of the second part of our study are far more accurate in preoperative differentiation of inguinal hernia type then previous reports, including the first part of our study. With the additional use of a stethoscope-like device in physical examination 79% of direct hernias and 93% of indirect hernias are diagnosed correctly now. These results are comparable with the accuracy in differentiating type of inguinal hernia with ultrasound. In the literature four studies assessed the accuracy of ultrasound examination in distinguishing type of inguinal hernia [16-19]. All studies were retrospective and the total
of patients included in these studies ranged from 19 to 118 patients. The accuracy of ultrasound in differentiating in type of inguinal hernia ranged from 84% to 100% for indirect hernias and 71% to 86% for direct hernias. All authors concluded that ultrasound can accurately differentiate in type of hernia. In contrast with ultrasound investigation of the inguinal region, our newly introduced hand-held Doppler examination can be easily used during primary physical examination in the outpatient clinic.

In our study a total of 28 of the presenting inguinal hernias were excluded from analysis because of inability to use the inguinal occlusion test at presentation. In 21 of these cases there was no protrusion of the hernia during physical examination in the supine position. Almost half of these hernias were indirect and half direct. To increase the number of patients suitable for the inguinal occlusion test with Doppler examination it might be necessary to perform examination with the patient in upright position. Using this position, possibly more hernias will protrude. A total of eight pantaloon hernias were excluded from analysis. They accounted for 6% of the total inguinal hernias.

In conclusion, with the use of a hand-held Doppler device during physical examination the inguinal occlusion test can predict with sufficient accuracy whether an inguinal hernia is direct or indirect. This maneuver is simple, easy to learn and little time-consuming. Preoperative differentiation of type of inguinal hernia derived from physical examination provides the laparoscopic surgeon with useful information about the inguinal hernia pathology that will be encountered during surgery. Especially in a laparoscopic procedure this may be indicative for the complexity and for the expected operative time. Both in respect of training programs as in operative time management, simply acquired pre-operative differentiation in types of inguinal hernia can be used for a tailored made surgical approach in laparoscopic hernia repair.

REFERENCES

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Oh MY, DR TRANSVERSE,
LOOK AT THE CONTRALATERAL
SIDE, THERE'S ANOTHER
HERNIA!

FIX THE OCCULT
CONTRALATERAL HERNIA

CHAPTER 4
THE INCIDENCE AND NATURAL COURSE OF OCCULT
HERNIAS DURING TAPP REPAIR

B. van den Heuvel | N. Beudeker | J. van den Broek |
A. Bogte | B. Dwars |
Surgical Endoscopy 2013; 27(11):4142-6
ABSTRACT

Introduction: One of the proposed advantages of laparoscopic inguinal hernia repair is complimentary inspection of the contra-lateral side and possible detection of occult hernias. Incidence of occult contralateral hernias is as high as 50%. The natural course of such occult defects is unknown and therefore operative rationale is lacking. This study aims to analyse the incidence of occult contralateral inguinal hernias and its natural course.

Methods: 1,681 patients were diagnosed pre-operatively with a unilateral inguinal hernia. None of these patients had complaints of the contralateral side pre-operatively. All patients underwent laparoscopic inguinal hernia TAPP repair. Operative details were analyzed retrospectively. Patients with occult contralateral defects were identified and tracked. Patients with an evident occult hernia received immediate repair. Patients with a smaller, beginning or incipient hernia were followed.

Results: In 218 (13%) patients an occult hernia was found at the contralateral side during peroperative exploration. In 129 (8%) patients an occult true hernia was found. In 89 (5%) patients an occult incipient hernia was found. An incipient hernia was defined as a beginning hernia. All patients with an incipient hernia were followed. The mean follow-up was 112 (range 16-218) months. Twenty-eight (31.5%) patients were lost to follow-up. In the 61 remaining patients 13 (21%) occult incipient hernias became symptomatic requiring repair. The mean time between primary repair and development of a symptomatic hernia on the contralateral side was 88 (range 24-210) months.

Conclusion: This study shows that the incidence of occult contralateral hernias is 13% during TAPP repair of unilateral diagnosed inguinal hernias. In 5% of the cases the occult hernia consisted of a beginning hernia. Eventually 1 in 5 will become symptomatic requiring repair. These outcomes support immediate repair of occult defects, no matter its size.

INTRODUCTION

One of the many advantages of laparoscopic inguinal hernia repair is routine visualization of the contralateral myopectineal space. Simultaneous complimentary inspection of the myopectineal space during laparoscopic inguinal hernia repair revealed occult contralateral inguinal hernias, but also femoral, Spigelian or obturator hernias [1]. This phenomenon was new, but rather common. In case of a unilateral inguinal hernia, a contralateral occult hernia was found in 11-51% of the patients [2-8]. And although it was promoted that immediate repair of an occult detected hernia during laparoscopic repair was easily done within the same operational session, would avoid reoperation and minimize convalescence from work, questions were raised about the clinical relevance of such occult, asymptomatic inguinal hernias. We therefore conducted a study to assess the incidence of occult contralateral defects detected during laparoscopic unilateral inguinal hernia repair. We distinguished between true occult inguinal hernias and beginning or incipient hernias. We assessed the natural course of these incipient hernias and evaluated whether these hernias become symptomatic, requiring eventual repair.

METHODS

In our series of 2,026 consecutive laparoscopic inguinal hernia repairs, 1,681 (83%) patients were diagnosed pre-operatively with a unilateral inguinal hernia. Presence of an inguinal hernia was diagnosed by physical examination by one expert surgeon. In case of a reducible swelling, provoked during Valsalva manoeuvre, an inguinal hernia was confirmed. None of the patients had complaints on the contralateral side. The contralateral side was examined routinely. In case of a reducible swelling provoked during Valsalva manoeuvre a bilateral inguinal hernia was diagnosed and the patient was excluded from analysis. All unilateral inguinal hernias were repaired by a transabdominal preperitoneal (TAPP) repair. All repairs were done or supervised by the same expert surgeon. During TAPP repair the contralateral side was inspected and presence and details of occult defects were documented in the operation report. A distinction was made between presence of an evident inguinal hernia, a so called true occult hernia, and an incipient inguinal hernia. An incipient inguinal hernia is a beginning or a looming inguinal hernia. A discrete protrusion or bulging of the peritoneum is seen during laparoscopic inspection, but is considered to be too small and shallow to be regarded as a hernia sac. There is indeed a defect or hernia orifice in the abdominal wall, but this defect is too small to facilitate any actual herniation of intra-abdominal contents. In case of an evident occult inguinal hernia at the contralateral side an immediate repair was done with a polypropylene mesh in a routine matter, see “Technique”. In case of an incipient inguinal hernia no repair was carried out. Patients with an incipient inguinal hernia were not informed post-operatively about the peroperative findings of the contralateral side. All the
operation reports were analyzed retrospectively. Operation reports with any remarks on the contralateral side were identified. Data from the operation reports was extracted such as gender, age, type of hernia, side and type of occult or incipient hernia.

All patients who had an incipient inguinal hernia on the contralateral side were contacted by phone and subsequently invited to clinic. The main outcome was development of a symptomatic inguinal hernia. Time from primary inguinal hernia repair until development of an actual symptomatic inguinal hernia on the contra-lateral site was assessed in patients with an incipient inguinal hernia. Approval was obtained by the local ethics committee.

TECHNIQUE

Under general anesthesia patients are positioned supine. Pneumoperitoneum is established and an intra-abdominal pressure of 12 mmHg is maintained throughout surgery. A standard transabdominal approach is set up with three trocars. Adhesions are dissected if present. The myopectineal space is inspected bilaterally. Preperitoneal access is gained by an incision of the peritoneum cranially to the internal ring, starting laterally and ending at the obliterated umbilical artery. The preperitoneal space is explored. The hernia is dissected and care is taken not to damage the vas deferens or the testicular vessels. When the hernia is dissected completely a mesh is introduced and positioned with fixated on indication. The peritoneal incision is closed with a running suture. Removal of the trocars and closure of the skin is done in a standard manner.

RESULTS

In the Slotervaarthospital in Amsterdam, The Netherlands, 1,681 patients were operated with a pre-operative diagnosed unilateral inguinal hernia (1993-2010). In 218 (13%) patients an occult defect was found at the contralateral side during laparoscopic inspection. The majority of patients were male (97%) and the mean age was 58 (range 18-91) years. In 129 (8%) patients a true occult inguinal hernia was found at the contralateral side. None of the patients had complaints of the contralateral side pre-operatively. All but one patient was male. The affected side of the primary inguinal hernia was the right side in 72 (56%) patients and the left side in 57 (44%) patients. The primary inguinal hernia was an indirect hernia in 68 (53%) patients, a direct hernia in 55 (43%) patients and a pantaloon hernia in 6 (5%) patients. The secondary occult inguinal hernia found per-operatively was an indirect hernia in 52 (40%) patients, a direct hernia in 65 (50%) patients, a pantaloon hernia in 6 (5%) patients and a femoral hernia in 6 (5%) patients. The correlation between the type of the primary and the secondary occult hernia was analyzed (Table 1).

In 89 (5%) patients an incipient hernia was found. An incipient inguinal hernia is a beginning or a looming inguinal hernia. There is indeed a defect or hernia orifice in the abdominal wall with peritoneal bulging, but this defect is too small and the sac too shallow to facilitate any actual herniation of intra-abdominal contents. None of the patients had complaints of the contralateral side pre-operatively. All but one patient was male. The affected side of the primary inguinal hernia was the right side in 38 (43%) patients and the left side in 51 (57%) patients. The primary inguinal hernia was an indirect hernia in 60 (67%) patients, a direct hernia in 26 (29%) patients, a pantaloon hernia in 2 (2%) patients and a femoral hernia in one (1%) patient. The incipient inguinal hernia found per-operatively was categorized as a beginning indirect hernia in 56 (63%) patients, as a beginning direct hernia in 30 (34%) patients and as a beginning pantaloon hernia in 3 (3%) patients. The correlation between the type of the primary inguinal and the incipient inguinal hernia was analyzed. In 75 (84%) patients the type of primary hernia matched the incipient hernia, in 5 (6%) patients either the primary or the incipient hernia was a pantaloon hernia and in 9 (10%) patients the primary and incipient hernia mismatched. There was no statistical difference between the mismatch of primary and incipient inguinal hernia with regards to type of hernia (Table 2).

All patients with an incipient inguinal hernia were followed. The mean follow-up was 112 (range 16-218) months. Twenty-eight (32%) patients were lost to follow-up, of which 18 patients died, 2 patients were not capable of participating due to physical or mental disabilities and 8 patients were untraceable, including emigration abroad. In the group of the remaining 61 patients 13 (21%) patients developed a symptomatic inguinal hernia on the contralateral side. Their incipient inguinal hernia was in 8 (62%) patients an indirect hernia, in 4 (31%) patients a direct hernia and in 1 (8%) patient a pantaloon hernia.

Table 1. Type of primary and occult hernia

<table>
<thead>
<tr>
<th>Hernia Type</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>Occult</td>
</tr>
<tr>
<td>Direct</td>
<td>Indirect</td>
</tr>
<tr>
<td>Indirect</td>
<td>55 (43%)</td>
</tr>
<tr>
<td>Pantaloon</td>
<td>6 (5%)</td>
</tr>
<tr>
<td>Femoral</td>
<td>9 (13%)</td>
</tr>
<tr>
<td>Pantaloon</td>
<td>1 (17%)</td>
</tr>
<tr>
<td>Indirect</td>
<td>1 (17%)</td>
</tr>
<tr>
<td>Femoral</td>
<td>4 (67%)</td>
</tr>
<tr>
<td>Total</td>
<td>129 (100%)</td>
</tr>
</tbody>
</table>
Twenty-eight percent of the patients with an incipient direct or pantaloon hernia developed a symptomatic inguinal hernia and 19% of the patients with an incipient indirect hernia did. Eleven patients underwent surgical repair for the symptomatic inguinal hernia, and two patients were still awaiting surgical repair. The mean time between initial operation of the primary inguinal hernia and development of a symptomatic inguinal hernia on the contralateral side was 88 (range 24-210) months. The remaining 48 patients with an incipient hernia on the contralateral side had no clinical signs (pain or bulge) of an inguinal hernia.

### Table 2. Type of primary and incipient hernia

<table>
<thead>
<tr>
<th>Primary hernia</th>
<th>Incipient hernia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indirect</td>
<td>Direct</td>
</tr>
<tr>
<td></td>
<td>Pantaloon</td>
</tr>
<tr>
<td>Direct</td>
<td>Direct</td>
</tr>
<tr>
<td></td>
<td>Indirect</td>
</tr>
<tr>
<td>Pantaloon</td>
<td>Direct</td>
</tr>
<tr>
<td>Femoral</td>
<td>Direct</td>
</tr>
<tr>
<td>Total</td>
<td>89 (100%)</td>
</tr>
</tbody>
</table>

#### DISCUSSION

In our large series of 1,681 unilateral TAPP repairs we found an incidence of occult contralateral hernias of 13%. This incidence is in accordance with rates reported by others in the literature [3, 4, 6-8]. In our series we have made the distinction between presence of an evident inguinal hernia, a so called true occult hernia, and an incipient inguinal hernia. An incipient inguinal hernia is a beginning or a looming inguinal hernia. There is indeed a defect or hernia orifice in the abdominal wall, with peritoneal bulging, but this defect is too small and too shallow to facilitate any actual herniation of intra-abdominal contents. It was therefore assumed that such an incipient hernia would not be clinical relevant and accordingly no repair was undertaken and patients were followed. In case of an evident inguinal hernia an immediate repair was undertaken with a mesh.

There are a few reports on the incidence of occult hernias found during exploration in inguinal hernia repair. The main difficulty in interpreting or comparing these reports are the variety of definitions of an occult inguinal hernia and therefore also the clinical judgement or assessment, the lack of routine contralateral exploration, the lack of details concerning these occult defect, e.g. a direct or indirect defect and the lack of follow-up. Used definitions reported in studies vary from “presence of a peritoneal reflection towards the internal ring during a preperitoneal dissection in TEP repair” to “a hole, an open sinus tract, a peritoneal dimpling or invagination on the region of inguinal hernias or patent processus vaginalis” [8, 9]. These descriptions leave quite some liberty to the interpreter evaluating the presence of an occult hernia. Without a well described definition the entity of an occult hernia remains unclear.

Bochkarev et al found 22% occult contralateral defects in 100 patients undergoing laparoscopic TEP repair [8]. All occult defects were indirect hernias, in which one was accompanied by a direct defect as well. Crawford et al discovered in 37 (51%) out of 73 patients with a unilateral inguinal hernia an occult contralateral defect during laparoscopic exploration [5]. The majority of the occult defects involved direct inguinal hernias. Koehler found 9 (13%) occult contralateral hernias in 69 patients during transabdominal inspection, followed by a TEP repair [4]. These 9 hernias comprised of 5 direct, 2 indirect and 2 pantaloon hernias.

TAPP repair allows easy evaluation of a potential occult defect on the contralateral side without any additional dissection, while TEP repair requires additional dissection for evaluating the contralateral side. Some suggest that an occult hernia might be falsely assessed during TEP repair due to an artefact of the preperitoneal dissection itself. The peritoneum is sometimes adherent to the internal ring, possibly mimicking an occult defect. The incidence of occult lesions during TEP repair might therefore be overestimated [5, 8].

Some experts suggest that occult hernias should not be mistaken by a patent processus vaginalis (PPV). In our series we found 8% true occult hernias and 5% incipient hernias. We have assumed that a true occult hernia will not be mistaken by a PPV, but an incipient hernia might. Van Veen et al analyzed the presence of a PPV during trans-peritoneal laparoscopic surgery for other indications than hernia repair [10]. In 15% of 337 patients a PPV was found. A PPV was defined as a protrusion of peritoneum at the side of the internal ring [11]. The group of patients with a PPV was compared to a control group of patients with an obliterated PPV. During follow-up of more than 5 years 12% of the patients with a PPV developed an inguinal hernia versus 3% in the obliterated group. The authors conclude that a PPV is a common phenomenon during laparoscopy and a risk factor in developing an inguinal hernia.

Based on the definitions given in the literature for an occult hernia and a PPV no distinction between the two entities can be made [8, 11]. A PPV can be mistaken for an indirect occult inguinal hernia or vice versa. In our series 19% of the patients with an incipient indirect hernia developed a symptomatic hernia over 11 years. Compared to the outcome of Van Veen et al, in which 12% of the patients with a PPV developed a symptomatic hernia over 5 years, these outcomes are much alike. These results suggest that the natural course of a PPV and indirect incipient hernia are alike and that both
entities can be regarded as one and the same as distinction is clinically irrelevant.

There is one other small study of Thumbe and Evans exploring the natural course of 21 patients with an occult contralateral defect [3]. These occult defects included 5 direct, 14 indirect and 2 pantaloon defects. During follow-up of 8 months 6 patients (29%) developed a clinically demonstrable hernia, including 2 direct, 3 indirect and 1 pantaloon hernia. One could assume that over time more occult hernias will become symptomatic and require repair. These results advocate the clinical relevance of repairing a contralateral occult inguinal hernia when encountered during laparoscopic exploration.

In our study we have made a distinction between occult and incipient occult inguinal hernias. The difference between the two entities is based on the size of the hernia orifice and sac and the possibility of herniation of intra-abdominal structures, which is an arbitrary interpretation of the surgeon. As long as no clear definitions are defined for incipient and occult hernias, and patent processus vaginalis, uniform comparisons and interpretation of results will be limited for future researchers. A distinction could be made based on size of hernia orifice and depth of the hernia sac. We believe that a hernia orifice with a diameter of less than 3 centimetres and depth of the hernia sac of no more than 2 centimetres will not allow any herniation and we apply these cut off points in our hernia practice nowadays for defining an incipient hernia.

A limitation of our study is the subjectivity of one hernia expert. One hernia expert clinically assessed all patients and diagnosed the presence of a unilateral hernia and absence of a contralateral hernia. Did this large amount of 218 patients truly miss any clinical signs of a contralateral hernia? As only one hernia expert assessed these patients this is hard to verify. As long as an inguinal hernia is a clinical diagnosis, and not a radiological one, this problem will remain for future researchers.

At last, our study had a retrospective design. Almost one third of the patients with an incipient hernia were loss to follow-up in a period of more than 11 years, resulting in some omission of data. A prospective set-up would diminish the amount of loss to follow-up especially in such a long period of time. The strength of our study is its size and length of follow-up. Our series is the largest on occult contralateral hernias including 1,681 unilateral TAPP repairs. All patients with incipient hernias were followed for more than 11 years, the longest follow-up reported so far.

In our series we have found an incidence of 8% of true occult contralateral hernias. Repairing a contralateral occult hernia in the same session will prolong the operation time with 7-25 minutes [1, 6, 8, 12-14]. However, a second operation is prevented, resulting in minimizing convalescence and without differences is morbidity [3, 5-8, 13, 14]. In 5% of the patients an incipient inguinal hernia was present. The key question in evaluating its clinical relevance is, what are the benefits of immediate repair and does it outweigh the disadvantages. Our series show that 21% of the incipient hernias will become symptomatic. The number needed to treat is 5, implying that five patients require repair of their incipient hernia to prevent one to become symptomatic. The additional repair will prolong operation time and will increase operation costs by one additional mesh and some additional time. However, immediate repair will prevent a second operation in one in five, including pre-operative assessment by a surgeon and anaesthesiologist, actual operating time, operation costs, hospital admittance, post-operative follow-up, work convalescence and has no increase in morbidity compared to unilateral repair [13, 14]. Although the cost-benefit analysis will vary for different health care systems in different countries, in most cases the cost-benefit analysis will support preventive repair [3]. Patients with a unilateral inguinal hernia should be informed about the possible incidence of an occult contralateral defect and consent to immediate repair preoperatively.

**CONCLUSION**

An occult contralateral hernia is a common phenomenon encountered during laparoscopic repair of a unilateral inguinal hernia. In our series we have found an incidence of occult contralateral hernias of 13% (8% true hernias and 5% incipient hernias). The natural course of a small beginning or looming hernia has never been analyzed in such large series. Twenty-one percent of all incipient hernias will become symptomatic and will require repair. Immediate repair of occult contralateral hernias is easily done in the same operation session and is supported by our results, no matter its size or type.

**REFERENCES**

CHAPTER 5

INGUINAL LIPOMAS; A NEW NOMENCLATURE

So reduction of the lipoma shows a defect, tada!

AHA! No peritoneal sac, but a plica lipoma...

This needs to be fixed with mesh.
ABSTRACT

Introduction: With the expansion of experience in laparoscopic inguinal hernia repair, new insights in inguinal lipomas appear. We have discovered two different kinds of lipomas in the preperitoneal space, that have never been described previously. This study aims to describe the different inguinal lipomas, their clinical relevance and according treatment.

Methods: We have analysed 854 consecutive laparoscopic trans-abdominal preperitoneal inguinal hernia repairs (TAPP). Presence of an inguinal lipoma was specified in origin and location, type of inguinal hernia and presence of a peritoneal sac.

Results: In 204 (24%) of 854 repairs an inguinal lipoma was found. In 42 (21%) cases no peritoneal sac was present. In 139 (68%) cases the lipoma originated from the fatty part of the plica umbilicalis medialis and did either herniate through an insufficient fascia transversalis or through the internal ring. This plica lipoma has a close relation with the peritoneum and retraction of the lipoma results in reposition of the hernia sac. In 65 (32%) patients a lipoma originating from the lateral preperitoneal space (Bogros) was found and herniated through the internal ring along the spermatic cord. This Bogros lipoma has no relation with the peritoneum. In 4 (0.5%) repairs a fatty funiculus was found.

Conclusion: Inguinal lipomas are a common phenomenon during laparoscopic hernia repair. Plica lipomas should be regarded as incipient true inguinal hernias and should be treated as such. Bogros lipomas may mimic an indirect inguinal hernia. They are not true hernias and treatment is optional. A fatty funiculus requires no treatment.

INTRODUCTION

The posterior laparoscopic approach of the abdominal wall in inguinal hernia repair has improved our understanding of the anatomy of groin. The transabdominal preperitoneal (TAPP) approach especially gives insight in the dynamic anatomy of the groin area. During this technique the intra-abdominal insufflation of carbon dioxide simulates the dynamics in intra-abdominal pressure in the erect patient. Herniation of peritoneum can be visualized accurately with this technique and is therefore of value in the evaluation of presence of a peritoneal sac in inguinal hernia surgery. The surgeon is able to classify the inguinal hernia as a direct or indirect hernia. The following step in the transabdominal approach is opening the peritoneum and an excellent overview of the preperitoneal structures is obtained [1].

A prevalent phenomenon encountered during preperitoneal exploration in hernia surgery are inguinal lipomas that can accompany or mimic an inguinal hernia. Presence of an inguinal lipoma might be related to BMI [2]. According to recent studies, the incidence of inguinal lipomas discovered during hernia surgery appeared to be as high as 21-26% [3, 4]. Lipomas in the groin are regarded as of significant importance since they can mimic an inguinal hernia or a recurrence after inguinal hernia repair [5, 6]. The patient presents with an inguinal bulge, but during surgical exploration no hernia sac is found. Lipomas in the groin are therefore considered as a pitfall in hernia surgery [7].

Despite the clinical importance the nomenclature of this phenomenon varies in the literature. ‘Lipoma of the spermatic cord’ or ‘cord lipoma’ is commonly used [8], but it is also described as ‘retroperitoneal adipose tissue’ [8] or ‘inguinal canal lipoma’ [9]. The reason for this variation can be explained by the fact that the exact origin of these lipomas or fatty structures has never been described accurately.

With the expansion of our experience with the transabdominal approach for inguinal hernia repair, new insights in inguinal lipomas have appeared. The new laparoscopic approach at the posterior side of the inguinal canal has revealed the true origin of the lipomas that are encountered during anterior repair. We have discovered two distinct types of inguinal lipomas. The clear overview of the preperitoneal space during the transabdominal approach enables to distinguish between the different anatomical origins and different presentations of these lipomas. This study aims to describe the different types of inguinal lipomas and their different clinical relevance, providing new insights for future hernia surgery. We propose a new nomenclature for inguinal lipomas and the according treatment.
METHODS
From 2006 till 2010, 854 laparoscopic transabdominal inguinal hernia repairs (TAPP) were done at the Slotervaarthospital in Amsterdam, The Netherlands. Patients were preoperatively seen by a senior surgeon and a symptomatic reducible bulge was found in the groin. In case of doubt an ultrasound was made of the groin in addition to physical examination. When an inguinal hernia was diagnosed, patients were scheduled for surgical repair. All repairs were done in a routine matter with a transabdominal laparoscopic technique. All 854 consecutive repairs were included for analysis. When an inguinal lipoma was encountered during surgery, the location, origin and presentation of the lipoma was specified and presence of a peritoneal sac was evaluated. Specimens for histopathological investigation of the different types of lipomas were obtained. All data were collected from the operation report and analyzed. The analysis was carried out in SPSS version 17.0.

TECHNIQUE
Under general anaesthesia patients are positioned supine. Pneumoperitoneum is established and an intra-abdominal pressure of 12 mmHg is maintained throughout surgery. A standard transabdominal approach is set up with three trocars. Adhesions are dissected if present. The inguinal region is inspected bilaterally. Preperitoneal access is gained by an incision of the peritoneum cranially to the internal ring, starting laterally and ending at the plica umbilicalis medialis. The preperitoneal space is explored. The hernia is dissected and care is taken not to damage the vas deferens or the testicular vessels. When the hernia is dissected completely a mesh is introduced and positioned with at least a three centimeter overlap of the mesh covering the defect. The mesh is only fixated on indication. The peritoneal incision is closed with a running suture. Removal of the trocars and closure of the skin is done in a standard manner.

RESULTS
From 2006 to 2010 a total of 854 laparoscopic transabdominal inguinal hernia repairs were done. All 854 consecutive repairs were included for analysis. In 204 (24%) repairs some kind of inguinal lipoma was found. Eighty-nine (44%) of these repairs contained an inguinal hernia on the left side and 115 (56%) repairs on the right side. Seventy-one (35%) repairs were done for a direct hernia, 84 (41%) for an indirect hernia, 3 (2%) for a pantaloon hernia and 4 (2%) for a femoral hernia. In 42 (21%) repairs a herniating lipoma was found but no peritoneal sac was present (Figure 1). The origin of the lipomas was clearly visible during the preperitoneal inspection and exploration. We found two distinct locations where the lipoma could originate from.

Figure 1. Presence of peritoneal sac and types of lipomas

Patients with bulge in groin undergoing TAPP repair (854)

Peritoneal sac (812)

No peritoneal sac (42)

Accompanied by inguinal lipoma
Bogros (162)
Plica (125)

Not accompanied by inguinal lipoma
Bogros (37)
Plica (650)

Presence of inguinal lipoma:
Bogros (28)
Plica (14)

Firstly, in 139 (68%) repairs the lipoma originated from the preperitoneal fatty tissue of the plica umbilicalis medialis; we designate these as a “plica lipoma”. The plica umbilicalis medialis is one of the plicas (or folds) of the peritoneum in the abdominal wall. This plica is bilaterally present and consists of peritoneum and the right and left obliterated umbilical arteries. The plica umbilicalis medialis is situated laterally of the plica umbilicalis medians and medially of the plica umbilicalis lateralis (Figure 2). The plica umbilicalis medians is a remnant of the obliterated urachus in the midline between the umbilicus and bladder. The plica umbilicalis lateralis is bilaterally present and contains the right and left inferior epigastric vessels. As the internal inguinal ring is just lateral to these vessels, this lateral plica is the border line between direct (medial) and indirect (lateral) inguinal hernia. Lipomas that originate from the plica umbilicalis medialis, originate from the fatty tissue of this plica. This fatty tissue is attached to the peritoneum and so are these lipomas (Figure 3-4). These lipomas can therefore present as a herniating lipoma with or without a peritoneal protrusion, possible depending on its stage or size, but are always closely related to the peritoneum/ peritoneal sac. In 125 (90%) of these repairs a peritoneal sac was present and in 14 (10%) no peritoneal sac was found. Reduction of the peritoneal sac when present results in retraction of the lipoma. Next, the plica lipoma requires further dissection to be reduced completely. Plica lipomas can either herniate with their...
accompanying peritoneal sac as a paraperitoneal hernia, through an insufficient fascia transversalis, presenting as a direct hernia, or herniate through a dilated internal ring and presenting as an indirect hernia. In case of presence of a peritoneal sac, the plica lipoma and peritoneal sac presented in 64 (51%) repairs as a direct inguinal hernia, in 56 (45%) repairs as an indirect hernia, in 2 (2%) repairs as a pantaloon hernia and in 3 (2%) repairs as a femoral hernia. A peritoneal sac was absent in 14 (10%) of the 139 repairs. Eleven (79%) repairs exposed a plica lipoma that herniated through an insufficient fascia transversalis as a direct hernia and 3 (21%) repairs showed a plica lipoma herniating through the internal ring as an indirect hernia (Table 1). All patients that underwent repair showing a lipoma but no peritoneal sac, presented with a bulge in the groin preoperatively.

Figure 2; Anatomy of the abdominal plicae


Figure 3. Sliding plica lipoma herniating through the internal ring at the right side

A. Laparoscopic view of right inguinal area with the plica umbilicalis medialis (*) and attached lipoma, forceps indicating indirect inguinal hernia. B-D. Retraction of the lipoma shows complete reduction of indirect hernia demonstrating the close relation between lipoma and peritoneal sac.
Figure 4. Plica lipoma herniating as left direct hernia in absence of a peritoneal sac

A. Laparoscopic view of left inguinal area with fatty plica umbilicalis medialis (*). B. After dissecting preperitoneal plane it is clear that plica lipoma attached to the peritoneum herniates through abdominal wall. C. Further dissection of lipoma. D. Complete reduction of lipoma, defect of abdominal wall visualized (arrow).

Secondly, in 6 (32%) repairs a lipoma was found that originated from the preperitoneal fat lateral from the internal ring, the Bogros space. The Bogros space lies between the peritoneum internally and the fascia transversalis externally. It contains loose connective tissue and fat. Lipomas that originate from this plane are located inferiorly and laterally from the internal ring (Figure 5). Bogros lipomas are not related to the peritoneum, but to the preperitoneal fat. The lipoma that originates from the Bogros space, which we designate as a “Bogros lipoma”, runs laterally along the spermatic cord through the internal ring into the inguinal canal. As it runs through the internal ring it can present as a bulge in the groin, mimicking an indirect hernia without the presence of a peritoneal sac. In 28 (43%) repairs done in patients in whom a Bogros lipoma was found, no peritoneal sac was present. All patients presented with a bulge in the groin pre-operatively. In 37 (57%) repairs in which a Bogros lipoma was present, we found a concomitant peritoneal sac, which presented in 7 (19%) repairs as a direct hernia, in 28 (76%) repairs as an indirect hernia, in one (3%) repair as a pantaloon hernia and in one (3%) repair as a femoral hernia (Table 2). These peritoneal sacs and Bogros lipomas have no relation to each other. The reduction of the peritoneal sac does therefore not result in any change in the protruding position of the Bogros lipoma. This lipoma is dissected separately.

In 4 (0.5%) of 854 repairs an abundance of fat in the funiculus was found. This fat originated from the fatty tissue of the spermatic cord structures. These clinical findings were not regarded as herniating lipomas. We designate these as a “fatty funiculus”.

<table>
<thead>
<tr>
<th>1. Plica lipomas</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peritoneal sac</td>
<td>125 (90%)</td>
</tr>
<tr>
<td>Direct hernia</td>
<td>64 (51%)</td>
</tr>
<tr>
<td>Indirect hernia</td>
<td>56 (45%)</td>
</tr>
<tr>
<td>Pantaloon hernia</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>Femoral hernia</td>
<td>3 (2%)</td>
</tr>
<tr>
<td>No peritoneal sac</td>
<td>14 (10%)</td>
</tr>
<tr>
<td>Direct hernia</td>
<td>11 (79%)</td>
</tr>
<tr>
<td>Indirect hernia</td>
<td>3 (21%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>139 (100%)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Bogros lipomas</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peritoneal sac</td>
<td>37 (57%)</td>
</tr>
<tr>
<td>Direct hernia</td>
<td>7 (19%)</td>
</tr>
<tr>
<td>Indirect hernia</td>
<td>28 (76%)</td>
</tr>
<tr>
<td>Pantaloon hernia</td>
<td>1 (3%)</td>
</tr>
<tr>
<td>Femoral hernia</td>
<td>1 (3%)</td>
</tr>
<tr>
<td>No peritoneal sac</td>
<td>28 (43%)</td>
</tr>
<tr>
<td>Direct hernia</td>
<td>28 (100%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>65 (100%)</strong></td>
</tr>
</tbody>
</table>
Figure 5. Plica lipoma originating with accompanying peritoneal sac herniating as left direct hernia, with left Bogros lipoma as well

HISTOPATHOLOGY

Histopathology was obtained from the two different types of lipomas. All tissues were analyzed by a senior pathologist who was blinded for the macroscopic findings. Microscopically, in all lipomas a lobular pattern was present, all were composed of mature adipose tissue and vascular proliferation was recognized. There were no signs of neoplasia. In both plica and Bogros lipomas the size and the amount of vessels was relatively large. Also a greater amount of connective tissue in the capsula was present. Furthermore in one of the plica lipomas peritoneal mesothelial cells were found. However, in general the lipomas were not distinguishable from ordinary fatty tissue.

DISCUSSION

Due to the extended experience with laparoscopic transabdominal preperitoneal inguinal hernia repair a profound understanding of the preperitoneal anatomy has been gained. New insights are attained that could not have been attained during the anterior surgical approach of an inguinal hernia. A lipoma encountered during anterior surgical repair was called a funicular lipoma or a lipoma of the spermatic cord. The origin of this lipoma was unclear. Presence of a lipoma was regarded as an incidental finding and easily dealt with by dividing it from the spermatic cord and optionally resecting it. It did not change the treatment of the inguinal hernia.

However, the laparoscopic transabdominal preperitoneal approach gives new and better insight in the dynamic anatomy of the groin area and inguinal hernias. During this technique the intra-abdominal insufflation of carbon dioxide simulates the dynamics in intra-abdominal pressure in the erect patient. A new surgical problem was encountered. A patient presented with a bulge in the groin, but no peritoneal sac was seen during laparoscopic repair [10]. During preperitoneal exploration a herniating inguinal lipoma was found without a peritoneal sac and new surgical interest to this phenomenon developed.

A patient presenting with a bulge in the groin but in absence of a peritoneal sac was considered a pitfall [7]. Several studies have mentioned the presence of inguinal lipomas encountered during laparoscopic repair. Gersin et al found in 114 TAPP repairs a peritoneal sac to be absent in 6 patients [7]. During preperitoneal exploration a lipoma was found located at the spermatic cord, and they subsequently called it a cord lipoma. In two of those patients a previous exploration was performed but were withdrawn from repair, due to the absence of a peritoneal sac. As a result of persistent complaints a second exploration was undertaken and a lipoma was found. Lilly et al found a prevalence of inguinal lipomas of 23% in 280 hernia repairs (laparoscopic TEP and open repairs) [11]. The lipomas protruded through the internal ring and were positioned on the anterolateral aspect of the cord. The lipomas were called cord lipomas. During dissection of the lipoma a filmy connection containing the blood supply was seen extending to the preperitoneum, inferior to the cord structures. The lipoma and blood supply were found outside the internal spermatic fascia. Lau et al report an incidence of cord lipomas in 27% of 610 TEP procedures [4]. The lipomas are called cord lipomas. The cord lipomas were reduced during surgical repair to the peritoneal reflection line after division of the feeding vessels form the pelvic floor and the spermatic cord.

In our study histopathological examination showed mature adipocytes, and no benign neoplasia. The lipomas were not distinguishable from ordinary fatty tissue. Results from the literature confirm this. The cord lipomas from Lau et al showed histopathologically lobules of mature adipocytes [4]. Carilli et al examined one hundred spermatic cord lipomas that also showed mature adipose tissue, indicating no neoplastic origin [2]. For this matter the phrase lipoma used in this context is not entirely correct. However, we propose to use the term lipoma still, since no other nomenclature covers the entity of the accumulated mature adipocytes.

The European Hernia Society Guidelines addresses lipomas in the following way: “Penetration of a peritoneal hernia sac (or preperitoneal lipoma) through the orifice is referred to as a hernia” [12] implying that lipomas are referred as hernias. However during
the expansion of our laparoscopic experience we have discovered that this is not true for all lipomas. The plica lipoma is a herniating lipoma, but the Bogros lipoma is not. These lipomas have a different origin and require a different approach.

The first most common lipoma in our series is the plica lipoma, originating from the plica umbilicalis medialis. The plica lipoma is closely related to the peritoneum and can present with or without a peritoneal sac. As plica lipomas protrude through the insufficient abdominal wall or a dilated internal ring, they present as a direct or indirect hernia. And in due time, they may develop to true hernias since these lipomas are closely related to the peritoneum. A peritoneal protrusion gradually comes along with the herniating lipoma, resulting in a paraperitoneal hernia. Therefore, plica lipomas that herniate without a peritoneal sac should also be regarded as incipient, true hernias and be treated as such. The second most common lipoma in our series is the Bogros lipoma, originating for the preperitoneal Bogros space. As these lipomas run along the spermatic cord through the internal ring they can mimic an indirect inguinal hernia. Some suggest that it might be possible that a Bogros lipoma can dilate the internal ring by exerting a continuous pressure on the internal ring and cause a true hernia to develop. However this causal relation has not been demonstrated and remains unclear. Bogros lipomas are not related to the peritoneum, but to the preperitoneal fat. A Bogros lipoma should therefore not be regarded as a true hernia, as suggested by the EHS guidelines. When a solitary Bogros lipoma is found without simultaneous herniation of a peritoneal sac in a patient with an asymptomatic bulge in the groin, treatment is not necessary from a medical point of view. The least common fatty structure encountered in our series is the fatty funiculus. The fatty funiculus is generally regarded as a common encountered phenomenon. Heller et al performed 36 groin dissections in adult male post-mortem subjects to establish the prevalence of inguinal lipomas [9]. In 27 (75%) of the dissections a fatty mass was identified in the inguinal canal. No inguinal hernias were found. These masses were aligned with the spermatic cord and laid deep into the cremaster muscle and fascia. The masses were embedded by an internal spermatic fascia and were in continuity with the preperitoneal fat. Histopathological investigation showed mature adipose tissue, and no evidence of a benign neoplasma. It is thought that the fatty mass might be a remnant of the gubernaculum or a fatty degeneration of the cremasteric muscles or the surrounding spermatic fascia. As Heller shows, a fatty funiculus is closely connected to the structures of the spermatic cord. A fatty funiculus should be regarded as an increased thickness of the spermatic cord and not as a lipoma or a hernia. There is never a reason for trying to dissect it. Dissection will inevitably lead to damage to the spermatic cord tissues with no therapeutic reason.

**ALGORITHM**

During our laparoscopic experience new insights have appeared in the preperitoneal anatomy and we have been able to clearly distinguish two types of inguinal lipomas and a fatty funiculus. Until now, many terms have been used to describe inguinal lipomas, but these are confusing. In an attempt to contribute to a clear understanding we propose a new nomenclature of inguinal lipomas. We propose the use of the following terms:

- Plica lipoma
- Bogros lipoma
- Fatty funiculus

In the algorithm we use the appropriate nomenclature and propose the according treatment for both types of inguinal lipoma and fatty funiculus in case of a patient presenting with an asymptomatic bulge in the groin (Figure 7).

**CONCLUSION**

Inguinal lipomas are a common phenomenon encountered during laparoscopic hernia repair. Two distinct types of inguinal lipomas can be distinguished; the plica lipoma originating from the plica umbilicalis medialis and the Bogros lipoma originating from the Bogros space. The plica lipoma should be regarded as an incipient true hernia and treated as such. The Bogros lipoma without the presence of a peritoneal sac can mimic an inguinal hernia, but is not a true hernia. A fatty funiculus should not be regarded as an inguinal lipoma or hernia and should be left in situ, since dissection will lead to damage and no treatment is indicated.
Figure 7. Algorithm for patients presenting with asymptomatic bulge in groin and absence of peritoneal sac

CHAPTER 6

REPEATED LAPAROSCOPIC TREATMENT OF RECURRENT INGUINAL HERNIAS AFTER PREVIOUS POSTERIOR REPAIR

Look at that! A medial recurrence after previous posterior repair!

We'll fix it for sure with an additional mesh by TAPP!

B. van den Heuvel | B. Dwars |
Surgical Endoscopy 2013; 27(3):795-800
ABSTRACT

Introduction: The reported recurrence rates after laparoscopic inguinal hernia repair vary between 0-4%. It is unclear which technique could best be offered to a patient with a recurrent hernia after a previous posterior repair. The aim of this retrospective study is to determine the safety, the feasibility and the reliability of a repeated laparoscopic repair (TAPP) for a recurrent hernia after a previous posterior inguinal hernia repair.

Methods: The study group contained 2,594 consecutive trans-abdominal inguinal hernia repairs (TAPP). Of these 53 repairs were attempted in 51 patients for recurrent hernias after a previous posterior repair. In the follow-up period patients were examined for recurrences and for presence of a portside hernia. Pain was scored by the Visual Analogue Pain Scale (VAS).

Results: 51 patients underwent a TAPP repair for a recurrent inguinal hernia after previous posterior hernia repair. Two patients presented a bilateral recurrent inguinal hernia. In two thirds of the patients the recurrence was located caudally or medially from the previous placed mesh. Two attempted repairs had to be converted to an open technique due to severe adhesions. One intra-operative complication was encountered when the vas deferens was ligated during surgery due to adhesions of the previous placed mesh. Nine patients encountered an adverse event post-operatively, but none of them were serious events. No mesh infections were reported.

The mean follow-up was 70 (range 1-198) months. At follow-up no recurrences were found at physical examination. Four patients developed a portside hernia. Four patients had complaints of post-operative pain and were restricted in daily activities due to groin pain. The mean VAS-score (scale 0-100), including the four patients with persistent pain, was 5.7 (range 0-61).

Conclusion: It is concluded that repeated laparoscopic hernia repair (TAPP) is a definite repair for recurrent inguinal hernias. The procedure is feasible, safe and reliable.

INTRODUCTION

Inguinal herniorrhaphy is the most common operation performed by a general surgeon. Annually over 20 million groin hernias are repaired worldwide [1]. In the Netherlands over 30,000 inguinal hernia repairs are done annually. Inguinal hernia repairs account for 10-15% of all general surgical procedures [2]. There are many different surgical techniques described for hernia repair, and still new techniques are being developed. Most techniques include a tension-free repair with a mesh to cover the defect. A relatively new technique for hernia repair is the laparoscopic technique, developed in the early 1990s. The major difference between the open and the laparoscopic technique is that in an open repair the defect is approached and repaired at the anterior side and in a laparoscopic repair at the posterior side of the defect. The laparoscopic technique has gained increasing popularity the last couple of years due to promising results, such as lower rates of post-operative pain, rapid return to normal activities and a lower incidence of infection [3-6]. The most common used methods of repairing an inguinal hernia laparoscopically are the transabdominal pre-peritoneal (TAPP) and the totally extraperitoneal technique (TEP). So far, neither technique seems to be superior to the other. There are no statistical differences found between the two techniques with regards to recurrence rates, operating time, complications and time to return to normal activities. Some suggest that the TEP procedure is technically more challenging and requires more procedures before one becomes an experienced operator. However, for both procedures the learning curve takes between 30 and 100 procedures to become experienced [4, 7].

The recurrence rates after laparoscopic repair are comparable to these after open tension-free mesh repair and stretch out between 0 and 4% [6, 8-10]. It is unclear which technique should be used to correct a recurrent hernia after previous laparoscopic repair. The repeated posterior laparoscopic approach is considered to be more difficult, due to scarring of the peritoneum that has occurred following the previous posterior approach. Due to this scarring there is an increased risk of complications, and an anterior approach is preferred. The aim of this retrospective study is to determine the safety, the feasibility and the reliability of a repeated laparoscopic repair for a recurrent hernia after previous posterior inguinal hernia repair.

METHODS

Since 1993, 2,594 inguinal hernias in 2,026 patients were repaired laparoscopically in the Slotervaarthospital in Amsterdam, The Netherlands. All laparoscopic repairs were TAPP repairs. Of these, 53 inguinal hernia repairs were done in 51 patients for recurrent hernias after a previous posterior repair. In all patients a prosthetic mesh was used in the previous posterior repair. Some of those patients had been treated initially in our hospital and some were referred to us by fellow surgeons. All repairs for recurrent hernias were done...
by one staff surgeon, who has extensive experience in TAPP repairs of inguinal hernias. Patients were seen post-operatively in a routine matter; one week after surgery and on indication.

After obtaining approval by the local ethics committee, these 51 patients were approached by telephone and invited to attend the outdoor clinic to complete a questionnaire and to be physically examined. Patients who were not able to visit the outdoor clinic were questioned on the telephone or visited at home. Data of the telephone interviews were included for analysis. Details of the operation (type of hernia, affected side, location of the recurrence, peri-operative complications and conversion) and postoperative course (postoperative complications and days of admission) were collected from the patients’ files, documented and analyzed.

Patients were asked about current pain in their operated groin. Pain was quantified by the Visual Analogue Pain Scale (VAS). This measure gave the patient the opportunity to indicate how much pain was present in the operated groin. The patient was asked to mark the amount of pain on a straight line. The number zero was placed at the left outer side corresponding to no pain at all, and the number 100 was placed on the right outer side, corresponding to worst pain imaginable. The patient was asked to mark the line with a cross indicating their current pain in their groin. The distance from the number zero to the patient’s mark was measured and translated to a number by ratio, the VAS-score.

Secondarily, the patient was asked to indicate how strongly he or she agreed on a three-level Likert scale with the statement that the pain in the operated groin restricts the patient in daily activities. The three-level Likert scale ranged from agree, no specific opinion, to disagree.

Subsequently, a physical examination was performed and the presence of a recurrence or a portside hernia was evaluated. In case of doubt an ultrasound of the groin and abdominal wall was made.

**TECHNIQUE OF TAPP REPAIR OF A RECURRENT HERNIA AFTER POSTERIOR REPAIR**

Under general anaesthesia patients were positioned supine. A standard transabdominal approach with three trocars was established. Adhesions were dissected if present. The inguinal region was inspected bilaterally. The type of recurrence was identified on the affected side. Preperitoneal access was gained by an incision of the peritoneum cranially to the defect and the previous placed mesh. The mesh was inspected and no attempts were made to replace or remove it. Depending on the size of the encountered defect and the patency of the previous placed mesh a custom shaped additional mesh or a complete new mesh was added preperitoneally. Care was taken to achieve at least a three-centimeter overlap of the mesh covering the defect. The mesh was not fixated unless there was doubt about the reliability of the new construction in case of extremely large defects. In that case, staplers were used to fixate the mesh around the defect to the abdominal wall or Cooper’s ligament. The peritoneal incision was closed with a running suture. Removal of the trocars and closure of the skin was done in a standard manner. Post-operatively patients were allowed to leave the hospital as soon as they felt good enough to do so.

**RESULTS**

From March 1993 till May 2011 53 TAPP repairs were done in 51 patients with a recurrent inguinal hernia after a previous posterior repair. Most patients were male (96%) and the mean age was 62 (range 33-83) years. The mean follow-up after the repeated posterior repair was 70 (range 1-198) months. Four patients had died and four patients were loss to follow-up due to emigration or admission to elderly homes. Ten patients were not physically able to attend the outdoor patient clinic due to co-morbidities and a questionnaire was taken by telephone. None of these patients had any complaints, except one who reported a bulge at the umbilicus. The family doctor confirmed a port-site hernia at the umbilicus. In 37 (70%) patients the previous posterior technique used was the TAPP technique, in 12 (23%) patients the TEP technique and in 4 (8%) patients another technique (Table 1). The mean number of previous hernia repairs per patient, both posterior and anterior, was 2 (range 1-5). In 33 (62%) patients the number of previous repairs was one, meaning that their previous inguinal hernia was repaired with a posterior repair and that the second posterior repair was done for a first recurrence. Twenty (38%) patients had 2 hernia repairs or more in their past medical history, of which one was a posterior repair and at least one an anterior repair. We have registered the interval between the first posterior repair and the second laparoscopic repair in 18 patients and found a mean interval of 40 months (range 1-168) to develop and detect the recurrence.

<table>
<thead>
<tr>
<th>Table 1. Type of previous repair</th>
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<tbody>
<tr>
<td>Technique</td>
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<tr>
<td>----------</td>
</tr>
<tr>
<td>TAPP</td>
</tr>
<tr>
<td>TEP</td>
</tr>
<tr>
<td>Stoppa</td>
</tr>
<tr>
<td>Grid-iron</td>
</tr>
<tr>
<td>Wantz</td>
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<tr>
<td>Total</td>
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Twenty-eight (53%) recurrent hernias were classified as a direct inguinal hernia, 21 (40%) recurrent hernias as an indirect inguinal hernia, 3 (6%) recurrent hernias as a femoral hernia and 1 (2%) as a pantaloon hernia. The affected side was in 27 (51%) patients the left side, in 24 (45%) patients the right side and 2 (4%) patients had a bilateral hernia. The mean length of stay was 2 (range 1-6) days including the day of operation.

During the repair the location of the recurrence was assessed with reference to the previous placed mesh. In two thirds of the patients the recurrence was located caudally or medially from the previous placed mesh (Table 2). In 6 (11%) patients no previous mesh was found or recognised in the scar tissue and in 4 (8%) patients it was not reported where the recurrence was located. In all but two patients it was possible to repair the recurrence with a repeated posterior approach. These two operations were converted to an open technique, due to severe adhesions and were treated with an anterior mesh repair. During one repair the vas deferens was ligated due to adhesions at the previous placed mesh.

<table>
<thead>
<tr>
<th>Location</th>
<th>N (%)</th>
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</thead>
<tbody>
<tr>
<td>Caudal of previous mesh</td>
<td>19 (36%)</td>
</tr>
<tr>
<td>Medial of previous mesh</td>
<td>12 (23%)</td>
</tr>
<tr>
<td>Lateral of previous mesh</td>
<td>4 (8%)</td>
</tr>
<tr>
<td>Cranial of previous mesh</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>Caudomedial of previous mesh</td>
<td>4 (8%)</td>
</tr>
<tr>
<td>Caudolateral of previous mesh</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>No previous mesh recognised</td>
<td>6 (11%)</td>
</tr>
<tr>
<td>Unclear</td>
<td>4 (8%)</td>
</tr>
<tr>
<td>Total</td>
<td>53 (100%)</td>
</tr>
</tbody>
</table>

Altogether in 17 (32%) patients an adverse event occurred post-operatively. In nine patients a short-term transient complication occurred and in eight patients a long-term complication occurred (Table 3). Two patients presented with a hematoma after surgery and 4 patients with a seroma. One patient required one single aspiration of the seroma. Two patients developed a portside infection, which was drained and treated successfully. The administration of antibiotics was not necessary. One patient had complaints of difficult urination post-operatively and symptoms subsided within a month. No mesh infections were found. At the mean follow-up of 70 months, no recurrences were found. In one case a recurrence was suspected and an ultrasound was made and remained inconclusive. A laparoscopic exploration was done, but no recurrence was found.

Four patients developed a portside hernia, of which two patients required an operative repair. The other two patients had asymptomatic portside hernias and were treated conservatively. Four patients had complaints of pain in their groins post-operatively and they were restricted in daily activities due to the pain. In one of these patients a recurrence was suspected and an anterior exploration was undertaken. During exploration no recurrence or evident cause of the pain was found. However, a prosthetic mesh was placed. Post-operatively the pain increased and indicated a VAS score of 48. Eventually the latter placed mesh was taken out operatively. Pain subsided immediately and restrictions in daily activities vanished. In one patient with persistent pain an ultrasound of the groin showed some protrusion of the mesh through the abdominal wall. This patient indicated a VAS-score of 61, the highest in our series, but had no specific opinion about being restricted in daily activities. The other two patients showed no abnormalities during physical examination or at imaging. These patients indicated a VAS-score of 24 and 39 at 29 and 13 months of follow-up respectively. Both patients were restricted in daily activities and were referred to the anaesthesiologist for pain consultation, with no result. At 70 months of follow-up 42 patients were able to indicate a VAS-score. The mean VAS-score, including the four patients with persistent pain, was 5.7 (range 0-61). If the VAS-scores of the four patients with persistent pain are excluded from analysis, the mean VAS-score at is 1.8 (range 0-23).

<table>
<thead>
<tr>
<th>Type of complication</th>
<th>N(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term and peroperative</td>
<td>9 (17%)</td>
</tr>
<tr>
<td>hematoma</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>seroma</td>
<td>4 (8%)</td>
</tr>
<tr>
<td>transient urination complaints</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>infection trocar side</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>Long-term</td>
<td>8 (15%)</td>
</tr>
<tr>
<td>persistent pain</td>
<td>4 (8%)</td>
</tr>
<tr>
<td>portside hernia</td>
<td>4 (8%)</td>
</tr>
<tr>
<td>Total</td>
<td>17 (32%)</td>
</tr>
</tbody>
</table>

DISCUSSION
Almost 10-15% of all hernia repairs concern repairs of recurrent groin hernias and is therefore considered an important surgical problem [11, 12]. The risk for recurring increases every time a hernia recurs as demonstrated by the outcomes of the Swedish Hernia Register. At 24 moths of follow-up the risk for having a reoperation is 4.6% after recurrent hernia repair compared to 1.7% after primary hernia repair [13]. A definite method still needs to be found for dealing with recurrent groin hernias, to prevent that
surgical repair 1 in 20 patients fails. The aim of this retrospective study was to evaluate the reliability, feasibility and safety of a TAPP repair for recurrent inguinal hernias after previous posterior repair. In our series at a follow-up of 0-15 years we have not found any recurrences in our series of 53 TAPP repairs. We therefore consider the repeated laparoscopic repair as reliable and as definite. In the literature reported recurrence rates after laparoscopic repair of a recurrent hernia vary among different studies between 0 and 20 percent and seems to be much related to the learning curve of the operating surgeon [3, 5, 14, 15]. Leibl et al found in their series of 46 TAPP repairs for recurrent inguinal hernias after a previous TAPP repair no recurrences at a mean follow-up of 26 months [16]. Knook et al repaired 34 recurrent hernias with a TAPP after previous laparoscopic repair and found no recurrences at 35 months of follow-up [17]. It is thought that recurrences after laparoscopic repair occur due to technical errors and therefore occur early. Phillips et al [18] found that the recurrences after laparoscopic repair occur on average 5 months after surgery, Felix et al [10] found 6 months after surgery, Deans et al [19] found 8 months after surgery and Feliu et al [14] within 12 months after surgery. The mean interval we registered between the first posterior repair and the second laparoscopic repair was 40 months (range 1-168). We consider our follow-up period of 70 months sufficient to detect recurrences. Many authors have tried to identify reasons for inguinal hernias to recur after laparoscopic repair. Insufficient mesh size is one of these identified reasons for hernias to recur [6, 10, 18]. A new inguinal hernia could develop when the insufficient abdominal wall is not adequately covered by prosthetic mesh, but also could the primary hernia recur. A slit in the mesh is also identified as a reason for recurrences to develop [10, 20]. Leibl at al found in their series that 40% of their recurrences was due to insufficiency of the mesh at the slit site [16]. Insufficient mesh fixation and mesh migration are also quoted as reasons for hernias to recur [10, 16, 20]. However, Choy et al tested mesh migration before and after mesh fixation with staplers immediately after surgery in 32 patients, by stressing the position of the patient by flexing and extending the operation table. Intra-abdominal re-inspection showed no mesh migration in any of the patients [21]. We do not fixate the prosthetic mesh in a routine matter in primary laparoscopic hernia repair. In recurrent hernias we do fixate the additional mesh in case of doubt about the reliability of the new construction. In that case, staplers are used to fixate the mesh around the defect to the abdominal wall or Cooper’s ligament. In our series we found that the majority of recurrences were either caudally or medially located from the previous placed mesh. In other studies similar results are found. Chowbey et al treated 4 recurrent inguinal hernia after TEP repair with a TAPP repair [22]. They found one missed medial hernia, and in three cases the mesh had medially rolled up from its initial position. Deans et al found in 10 cases of a recurrent hernia after a previous TAPP repair that the mesh had rolled away from the medial border, exposing Hesselbach’s triangle [19]. All ten recurrences were medial recurrences. Knook et al found in their series of 34 patients with a recurrent hernia after laparoscopic repair that in the majority of the cases a medial hernia occurred [17]. They assume that either the previous placed mesh did not have sufficient overlap medially or that the mesh had moved laterally, exposing Hesselbach’s triangle, allowing a new medial hernia to occur. Attention should be paid to position the prosthetic mesh covering the internal ring and the complete triangle of Hesselbach’s with sufficient overlap. Re-entering the pre-peritoneal space is considered to be difficult. The European Hernia Society guidelines published in 2009 recommend an anterior mesh repair for a recurrent hernia after previous posterior repair [23]. A posterior repair is recommended in patients with a recurrence after an anterior repair. However, it remains unclear which technique and approach is recommended in cases when patients have had both an anterior and a posterior repair. Thirty-eight percent of the patients in our series have had an anterior and posterior repair in their past medical history. To re-enter the pre-peritoneal space, great understanding of the groin anatomy and surgical experience is required to recognize all vital structures and to prevent collateral damage. Dissection of the peritoneum is hindered by changed anatomy and scar tissue of the previous posterior repair and prosthetic material. When a recurrent hernia is approached transabdominally, the surgeon is able to identify the defect in the abdominal wall before dissection through scar tissue. Seeing and localizing the defect, the surgeon can go straight to target and minimize the amount of dissection through scar tissue. This TAPP-technique is therefore better technically feasible and safer than the total extra-peritoneal approach (TEP), as the chance of collateral damage in the repeated repair is minimised. One study of Fezli et al reports about the conversion rate of the repeated TEP repair [20]. They found the repeated TEP repair to be feasible in 16 of 21 patients. In five cases (24%) a conversion to a open anterior approach with a tension-free mesh was required. The reported conversion rate of a repeated TAPP repair is 0% and described in two studies. Felix et al re-operated 33 patients after a laparoscopic repair and completed the repair with a TAPP technique in all patients [10]. In four cases the laparoscopic technique was combined with an anterior approach to either remove a cord lipoma or an encapsulated fluid collection. Also Knook et al repaired 34 recurrent hernias with a TAPP technique after previous laparoscopic repair and had no conversions in their series [17]. The results from our series match the reported rates and show that the repeated laparoscopic repair is feasible in most cases. It was possible to complete the repair in 51 (96.2%) of the 53 recurrent hernias.
The complication rate in our series is comparable to complication rates after open or laparoscopic repair of a primary inguinal hernia and is therefore considered to be safe [8]. In one case there was collateral damage to the vas, when it was accidently ligated during dissection of the peritoneum due to severe adhesions of the previous placed mesh. Post-operatively an adverse event occurred in 9 (17%) patients. Two patients had a groin hematoma, 4 patients a groin seroma, 2 patients a portside infection and one patient transient dysuria. These events were all of limited duration and subsided over time spontaneously, or with minimal intervention (e.g. aspiration of one seroma and draining a wound infection). Leibl et al reported in their series one seroma and one urinary retention in 46 patients [16]. Knoop et al repaired 34 recurrent hernias with a TAPP after previous laparoscopic repair and found a post-operative complication in 7 patients (21%); six hematomas and one urinary retention [17].

Four of 51 (7.8%) patients had complaints of post-operative pain and were restricted in daily activities due to groin pain. It has become clear in recent studies that chronic pain after hernia repair has been underestimated. This rate is comparable to reported rates. Nienhuijs et al found in their review an incidence of chronic pain after a mesh-based repair of 11% [24]. Langeveld et al report that chronic pain one year after laparoscopic or open inguinal hernia repair is present in one in four patients [8].

Four patients developed a portside hernia, of which two required an operative repair. The incidence of portside hernias in our series is quite high (7.8%). It might be due to the assumed weakened quality of collagen and increased chance of developing a defect at the trocar site. It might also be explained by the omission of physical examination during long-time follow-up in other published series and that the incidence cited so far is an understatement of the true incidence. The portside hernias in our series were all discovered during physical examination. We do recommend in accordance to European Hernia Society Guidelines, to pay attention to closing the fascia at the trocar sites of 10 mm or more in these collagen compromised patients to prevent the development of a portside hernia [23].

The very long-term results of our series of almost 6 years of follow-up, with no recurrences after this TAPP-repair of their recurrent hernias, convinced us to offer patients this repair as a definite treatment. This posterior repair can be offered to any patient with a recurrent hernia; after a previous anterior repair, after a previous posterior repair, or after both repairs.

CONCLUSION
From the long-term results of our series of 53 repeated laparoscopic hernia repairs (TAPP) it is concluded that the procedure is a definite repair for any recurrent inguinal hernia. The procedure is feasible, safe and reliable.
CHAPTER 7

A NEW METHOD OF FOLLOW-UP AFTER INGUINAL HERNIA REPAIR; THE PINQ-PHONE
ABSTRACT

Introduction: The most important long-term complications after inguinal hernia repair are chronic pain and recurrence. Previous follow-up studies showed that physical examination is the only reliable method of follow-up to detect recurrences. However, physical examination is laborious and time consuming. We designed a telephone questionnaire as method of follow-up after inguinal hernia surgery; the PINQ-PHONE (Post-INguinal-hernia-repair-Questionnaire by telePHONE). The aim of this study is to validate the PINQ-PHONE for detecting both asymptomatic and symptomatic recurrences.

Methods: This prospective study contained 300 randomly selected patients after inguinal hernia repair. All patients were contacted by telephone and the PINQ-PHONE was carried out. The PINQ-PHONE contains 4 elements; 3 questions and a do-it-yourself Valsalva manoeuvre. Subsequently, all patients were seen in clinic and physical examination (gold standard) was done.

Results: The majority (96%) was male and the mean age was 66 (range 26-93) years old. The mean interval between surgery and study inclusion was 58 (range 6-141) months. In 5 (1.7%) patients a recurrence was found. All of them replied positively to one or more elements of the PINQ-PHONE. Two-hundred-fifty-two (84%) patients replied negatively to all elements and none of them had a recurrence. The overall sensitivity was 1.00 and the overall specificity 0.86.

Conclusion: This study validated the PINQ-PHONE. It is a reliable, practical and simple method of follow-up after inguinal hernia repair to detect both symptomatic and asymptomatic recurrences.
phones. We conducted a prospective study to validate our Post-Inguinal-hernia-repair-Questionnaire by telephone, the PINQ-PHONE.

METHODS
This prospective study included 300 patients who were randomly selected from the database of all patients that were operated for an inguinal hernia between 2001 and 2012. All patients were operated or supervised by two expert surgeons and underwent either TEP or TAPP repair. Inclusion criteria were age more than 18 and a previous laparoscopic inguinal hernia repair at the Slotervaart Hospital. All operations were done in a routine manner, with a preperitoneal positioned polypropylene mesh. Exclusion criteria were insufficient understanding of the Dutch language, mental disorder or inability to do a physical examination by oneself. A telephone questionnaire was developed to assess the presence of an asymptomatic recurrence after inguinal hernia repair. This Post-Inguinal hernia repair Questionnaire by phone (PINQ-PHONE) contains 4 elements; 3 questions about the patient’s operated groin and one element includes the instructions of a physical examination done by the patients themselves. Patients are instructed to do a Valsalva manoeuvre at their operated groin (Table 1).

Table 1. PINQ-PHONE

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Do you have any symptoms at your operated groin?</td>
</tr>
<tr>
<td>2</td>
<td>Have you noticed anything at your operated groin?</td>
</tr>
<tr>
<td>3</td>
<td>Have you noticed something at your operated groin when coughing, sneezing or squeezing?</td>
</tr>
<tr>
<td>4</td>
<td>Could you please stand up and put your flat hand in your operated groin. Now please put the other hand to your mouth and blow. Do you feel something at your operated groin?</td>
</tr>
</tbody>
</table>

After registration and approval by the local ethics committee patients were contacted by phone. Trial information and informed consent forms were sent by mail to patients’ home addresses. After obtaining returned written informed consent forms, patients were phoned again. The PINQ-PHONE was carried out. Outcomes of the telephone questionnaire were registered and saved in a database. Subsequently patients were scheduled for a clinical visit. The interval between the PINQ-PHONE and the clinical visit was no more than 2 weeks. The same questions were asked in clinic and a physical examination was done by one of two researchers. Both researchers were independent, not involved by the initial treatment, nor responsible for the health care related consequences of the outcomes. A recurrence was defined as a clinical detectable bulge in the operated groin, protruding during straining observed by the researcher and confirmed by an expert clinician. In case of doubt an ultrasound was made in addition. Outcomes were registered and saved in the same database.

The primary outcome was detection of a recurrence. Details of the operation technique, type and side of the hernia were obtained from the patients’ files.

STATISTICAL ANALYSES
The sample size was calculated based on recurrence percentages reported in the literature and our own experience, and estimated to be 3.5%. We aimed to calculate the specificity, but especially the sensitivity with a certain reliability, and we therefore needed a minimum of 10 patients with a recurrence. The sample size accordingly is 10/3.5 * 100 = 286 participants. Considering the risk of some loss we invited 300 patients. The sensitivity and specificity of the PINQ-PHONE as a diagnostic tool was calculated by comparing its outcomes with the outcomes of the gold standard; clinical examination. In case of doubt an ultrasound was made. The 95% confidence intervals were calculated. For all statistical procedures a probability value (p-value) < 0.05 was considered to be statistically significant. The test-retest reliability of the PINQ-PHONE is tested using the Kappa-value, comparing the answers of the PINQ-PHONE to the answers of the questionnaire at clinic.

Analysis of data was performed in SPSS version 20 and the program Confidence Interval Analysis.

RESULTS
Three hundred patients were randomly selected and included between October 2011 and April 2013. The majority of the patients had a unilateral repair done, and in case of a bilateral repair one side was randomly selected to be included for analysis. The majority (96%) was male and the mean age was 66 (range 26-93) years old. The mean interval between surgery and study inclusion was 58 (range 6-141) months. Ninety-two percent of the patients underwent TAPP repair and 8% TEP repair. The affected side was in 52% of the patients the right side and in 48% the left side. Fifty-six percent of the patients had an indirect hernia, 37% a direct hernia, 5% a pantaloon hernia and 1% had a femoral hernia. Clinically, in none of the patients an ultrasound was indicated. Altogether in 5 (1.7%) patients a recurrence was found at physical examination during clinical visit. None of these patients had consulted a physician yet.

The first question concerned the presence of symptoms in the operated groin. Thirty-nine patients had some kind of symptoms in their operated groin, such as pain, discomfort or the sensation of “something in the way”, of which 3 patients had indeed a recurrence. Two-hundred-sixty-one patients did not have any symptoms, of which 2 patients had a recurrence. The sensitivity of question 1 was 0.60 and the specificity was 0.88 (Table 2).
The second question referred to whether the patient had noticed anything in the operated groin. Seven patients had noticed something, of which 4 patients had a recurrence during clinical physical examination. Two-hundred-ninety-three patients had not noticed anything at the operated groin, of which 1 patient had a recurrence. The sensitivity of question 2 was 0.80 and the specificity was 0.99 (Table 3).

The third question related to whether the patient had noticed anything in the operated groin during moments of increased abdominal pressure, such as sneezing, coughing or squeezing. Eleven patients noticed something in the operated groin during increased abdominal pressure, of which 4 had a recurrence at clinical physical examination. Two-hundred-eighty-nine patients noticed nothing during increased abdominal pressure, of which 1 patient had a recurrence. The sensitivity of question 3 was 0.80 and the specificity was 0.98 (Table 4).

The fourth question referred to whether the patient had noticed anything by doing the do-it-yourself Valsalva manoeuvre. Patients were asked whether they noticed anything at the groin during the Valsalva manoeuvre. Four patients felt something in the operated groin, of which 3 patients had a recurrence during clinical physical examination. Two-hundred-ninety-six patients did not notice anything during the do-it-yourself Valsalva manoeuvre, of which 2 patients did have a clinical recurrence. The sensitivity of element 4 was 0.60 and the specificity was 1.00 (Table 5).

Altogether, in 5 (1.7%) patients a recurrence was found at physical examination. Table 6 shows the results of all 5 patients with a recurrence and the according outcomes of the PINQ-PHONE. Three out of 5 patients were symptomatic and had symptoms such as pain, swelling or the sensation of "something". Two patients were asymptomatic. None of the patients had consulted a physician.

Patient number 3 only had symptoms of feeling “something”, but he had not noticed anything physically. This 74-year old patient was re-contacted and had forgotten that he had participated. His wife revealed that her husband appeared to suffer from progressive dementia. In retrospect this patient should have not been included in the first place, but at the time of inclusion dementia was not diagnosed yet.

Table 2. Question 1

<table>
<thead>
<tr>
<th>Q-phone Q1</th>
<th>Physical Examination</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Symptoms</td>
<td>Swelling</td>
<td>No swelling</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>36</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>No symptoms</td>
<td>2</td>
<td>259</td>
<td>261</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>5</td>
<td>295</td>
<td>300</td>
</tr>
</tbody>
</table>

Table 3. Question 2

<table>
<thead>
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<th>Physical Examination</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Noticed something</td>
<td>Swelling</td>
<td>No swelling</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Noticed nothing</td>
<td>1</td>
<td>292</td>
<td>293</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>5</td>
<td>295</td>
<td>300</td>
</tr>
</tbody>
</table>

Table 4. Question 3

<table>
<thead>
<tr>
<th>Q-phone Q3</th>
<th>Physical Examination</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Noticed something by ↑ pressure</td>
<td>Swelling</td>
<td>No swelling</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Noticed nothing by ↑ pressure</td>
<td>1</td>
<td>288</td>
<td>289</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>5</td>
<td>295</td>
<td>300</td>
</tr>
</tbody>
</table>

Table 5. Question 4

<table>
<thead>
<tr>
<th>Q-phone Q4</th>
<th>Physical Examination</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Swelling</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>No swelling</td>
<td>2</td>
<td>294</td>
<td>296</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>5</td>
<td>295</td>
<td>300</td>
</tr>
</tbody>
</table>

Table 6. Outcomes PINQ-PHONE patients with recurrence

<table>
<thead>
<tr>
<th>Patient</th>
<th>Q1 Complaints</th>
<th>Q2 Noticed something</th>
<th>↑ abdominal pressure</th>
<th>Q4 Valsalva</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>None</td>
<td>swelling</td>
<td>swelling</td>
<td>swelling</td>
</tr>
<tr>
<td>2</td>
<td>None</td>
<td>swelling</td>
<td>swelling</td>
<td>swelling</td>
</tr>
<tr>
<td>3</td>
<td>something</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>4</td>
<td>Pain</td>
<td>swelling</td>
<td>swelling</td>
<td>swelling</td>
</tr>
<tr>
<td>5</td>
<td>swelling</td>
<td>swelling</td>
<td>swelling</td>
<td>swelling</td>
</tr>
</tbody>
</table>
Overall, 252 (84%) patients answered "NO" to all questions. None of these patients were diagnosed with a recurrence (Table 7). Forty-eight patients answered “YES” to some or more questions, of which 5 patients were diagnosed with a recurrence. The overall sensitivity was 1,00 (CI 0,57-1,00) and specificity was 0,85 (CI 0,81-0,89). The positive predictive value was 0,10 (CI 0,05-0,22) and the negative predictive value 1,00 (0,99-1,00).

Table 7. Overall outcomes PINQ-PHONE

<table>
<thead>
<tr>
<th>PINQ-PHONE</th>
<th>Physical Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
</tr>
<tr>
<td>Positive</td>
<td>5</td>
</tr>
<tr>
<td>Negative</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
</tr>
</tbody>
</table>

The test-retest reliability of our PINQ-PHONE is tested using the Kappa-value, comparing the answers of the PINQ-PHONE with the answers of the questionnaire in clinic. The Kappa-value was 1,000 (CI 1.00-1.00).

DISCUSSION

In our hernia practice, containing more than 2500 patients, we were searching for a reliable, simple and practical method of follow-up after inguinal hernia repair to detect both symptomatic and asymptomatic recurrences. We developed a telephone questionnaire, the PINQ-PHONE, including 4 elements; 3 questions and the instructions of a physical examination by means of a do-it-yourself Valsalva manoeuvre. The purpose of this study was to validate the PINQ-PHONE for detecting symptomatic and asymptomatic recurrences.

The overall sensitivity of the PINQ-PHONE was 1.00, meaning that all recurrences, either symptomatic or asymptomatic, were detected by the PINQ-PHONE. None of the patients that replied negatively to all elements of the PINQ-PHONE had a recurrence. This is an excellent outcome, validating our PINQ-PHONE and showing 100% reliability in excluding a recurrence when replied negatively to all elements of the PINQ-PHONE.

The Kappa-value of PINQ-PHONE was 1.00. Patients showed absolute consistency giving the exact same answers on the phone as they do in clinic, resulting in a 100% agreement. This implies that the questions of the PINQ-PHONE are clear, simple and the answers to be reliable. We introduced a do-it-yourself Valsalva manoeuvre. Patients appeared to be capable of following instructions and recognizing a bulge in their groin during Valsalva as the majority of the patients with a recurrence scored positively for this element.

Altogether it took the physician approximately 3-4 minutes to carry out the PINQ-PHONE, demonstrating that PINQ-PHONE is a time-saving and practical method of follow-up after inguinal hernia repair.

Not all recurrences were symptomatic. Three (60%) patients had swelling, pain or sensation of “something”, and two (40%) patients were asymptomatic. None of the patients with a recurrence had consulted a physician yet. When patients are not followed in a routine manner after inguinal hernia surgery, and patients are expected to report themselves when symptoms are present, our study shows that 40% of the recurrences will be missed, because they are asymptomatic. For physicians to gain reliable feedback of the outcomes of their inguinal hernia surgery, it is of the great importance to detect asymptomatic recurrences as well. Until now, this could only have been obtained by examining all patients in clinic.

The outcomes of the PINQ-PHONE imply that when a patient responds negatively to all elements of the PINQ-PHONE, the physician can be 100% sure that the patient has no recurrence, either symptomatic or asymptomatic. If the patient responds positively to one of the elements of the PINQ-PHONE a recurrence cannot be excluded. These patients should be invited for a clinical assessment. In our series 48 patients responded positively to one of the elements, of which 5 patients had a recurrence and 43 patients had not. This implies that 14% of the patients will be invited to clinic to exclude a recurrence.

This outcome has a huge impact on the daily practice of a hernia surgeon. Follow-up after inguinal hernia repair can now firstly be carried out by the PINQ-PHONE and if scored positively to one of the elements, subsequently at clinic. By implementing this method 84% of the patients can refrain from visiting clinic, saving large amounts of time to the physician and also to the patient. None of the recurrences will be missed, all of them will be detected.

We have the impression, since the questions are simple and the kappa value is 1.00, this method can be easily taught to others. In our practice we will train a dedicated nurse or physician assistant to carry-out the PINQ-PHONE at all our patients annually after inguinal hernia repair as method of follow-up.

Patients that have to be excluded from this method of follow-up are patients with physical disability that are not able to carry out a physical examination by themselves, patients who are deaf, patients with a language barrier, or patients with a mental disorder.

In our series of 300 patients we found a recurrence rate of 1.7%. We estimated the recurrence rate to be 3.5% and used this number in our sample size calculations. Since the actual recurrence rate appeared to be lower than expected, the confidence intervals of the sensitivity are broader.
CONCLUSION
The PINQ-PHONE is a validated method of follow-up after inguinal hernia repair. It is reliable, simple and practical. This method is less time-consuming compared to physical examination and widely applicable since everybody is reachable with the wide use of mobile phones. All recurrences, either symptomatic or asymptomatic can now be reliably detected. If a patients replies negatively for all elements of the PINQ-PHONE, a recurrence can be excluded with certainty. This simple method provides surgeons all over the world with a tool to reliably appraise outcomes of their mostly performed surgical procedure, inguinal hernia repair. Future employment of the PINQ-PHONE will establish its role in evaluating outcomes after inguinal hernia repair.

REFERENCES
CHAPTER 8

PATIENT COMPLIANCE WITH A GROUP MODEL OF CARE: THE HERNIA CLINIC

B. van den Heuvel | B. Vair | G. Porter | D. Klassen |
K. Inglis | H. Bonjer |

“WE WORK TOGETHER IN A GROUP”

“MY HERNIA IS FIXED. I SUPPORT THIS GROUP MODEL OF CARE.”

“WAITING TIME IS REDUCED.”

“My hernia is fixed. I support this group model of care.”

“We work together in a group.”

“Waiting time is reduced.”
ABSTRACT

Introduction: In February 2006 the Hernia Clinic was established at the Queen Elizabeth II in Halifax, Nova Scotia. The Hernia Clinic was based on a group model of care and set up to increase effective use of resources to reduce waiting times. All referrals of patients with hernias were triaged, pooled and booked into the clinic. Patients were assessed according to a standardized protocol. Patients requiring surgery were placed on a common waitlist. Assignment of the surgeon was determined by availability. The primary goal of this survey was to determine patient compliance with the Hernia Clinic.

Methods: All 236 patients who visited the Hernia Clinic were mailed a questionnaire. Data were entered and analyzed. Differences between subgroups were calculated by the 2-tailed Fisher’s exact test. Waiting times were recorded.

Results: Ninety-four questionnaires were sent back. Sixty-eight percent of patients had the same surgeon for surgery as for assessment and 31% had a different surgeon for surgery. Two-thirds of all patients was comfortable having their surgery performed by a surgeon whom they met the day of surgery. Most patients had confidence in the competence of any surgeon and considered service to be better and faster in a specialized centre. Most felt that a group of surgeons providing hernia care use resources more effectively. The waiting times from referral to initial consult decreased from 208 days (SD 139) in 2007 to 59 days in 2009 (SD 70).

Conclusion: Patient compliance with a group model of care for hernia surgery is high.

INTRODUCTION

Waiting for elective surgery is today’s main concern in Canadian health care. Some consider the long waiting lists to be the Achilles’ heel of Canadian Medicare [1,2]. In 2005, the federal government and the provincial ministries of health announced a $41 billion initiative to reduce waiting lists [3]. Several projects have been initiated to decrease waiting lists and improve effective use of recourses. The Joint Replacement Access Clinic at Lions Gate Hospital in British Columbia, the Richmond Hip and Knee Reconstruction Project and the Alberta Hip and Knee Replacement Pilot Project are examples of such projects [4]. Common waitlists instead of waitlists of individual physicians and sharing resources between groups of health care providers were found helpful in reducing and equalizing wait times and increasing capacity of care.

In February 2006, an initiative for a joint Hernia Clinic at the Queen Elizabeth II Health Sciences Center in Halifax, Nova Scotia, Canada (QE II) was developed to improve access to surgery for groin, umbilical and epigastric hernias. Until that time, patients with hernias had been referred to any of the general surgeons at the QE II. Patients were assessed by the individual surgeons and booked for surgery in the operating time allotted to the individual surgeons. Waiting times for initial consultation and surgery varied widely across the general surgeons’ offices due to variation in case load and focus of practice. Some patients had to wait as long as 18 months for surgical repair of a hernia.

One of the concerns regarding a group model of care is patient compliance. The objective of this report was to assess patient compliance with our group model of care and to monitor waiting times from referral to first assessment.

METHODS

The Hernia Clinic is a joint clinic run by four general surgeons, a fellow in Minimally Invasive Surgery, surgical residents, medical students, a registered nurse, a research nurse, a data manager and an administrative assistant. The surgeons take turns attending the Hernia Clinic based on availability. A specific database for the Hernia Clinic patients has been developed. Physicians, nurses and administrative assistants enter all clinical data in the clinic. When surgery is indicated, nurses provide standardized education to the patients. When surgery is indicated, nurses provide standardized education to the patients. Patients are placed on a common waitlist for hernia surgery. The administrative office of the Hernia Clinic books operating time designated for hernia surgery. Surgeries are preferably performed consecutively on the same day and by the same surgical team at Hants Community Hospital, one of Capital Health’s sites. The general surgeons who participate in the Hernia Clinic perform hernia surgery on a rotational basis.

At the onset of the Hernia Clinic, a letter was sent to family doctors informing them about the principles of the Hernia Clinic including a specific fax number for referrals. Referrals from medical doctors for patients with groin, umbilical and epigastric hernias or groin pain...
received by the offices of all general surgeons were forwarded to the Hernia Clinic. All referrals were triaged by one surgeon to confirm appropriateness.

Patients received a letter stating the time and date of clinic appointment together with information about hernias, the Hernia Clinic, a health questionnaire and a quality of life questionnaire. Patients were informed in writing and during the clinic visit that surgery might be done by another surgeon than the one who was assessing them. Patients were offered the option of requesting a specific surgeon.

A questionnaire of 19 items was developed to assess patients’ compliance with the Hernia Clinic and their comfort with different physicians involved in their care. The first 9 questions referred to details of their assessment at the Hernia Clinic and their hernia surgery. The last 10 items were statements and patients were asked to indicate how strongly they agreed on a four-level Likert scale (Table 1) ranging from strongly agree, agree, disagree to strongly disagree. A Likert questionnaire item requested patients to specify their level of agreement to a statement ranging from strongly agree, agree, disagree and strongly disagree. The questionnaires were mailed to the patients who had surgery after assessment in the Hernia Clinic.

Data were analyzed for the entire study group and for two subgroups (I and II). Patients in group I had the same surgeon for assessment and surgery while patients in group II had a different surgeon for assessment and surgery. We compared both groups with regards to first assessor, surgery-related problems and outcomes of the questions and analyzed the significance of differences between the two groups. We divided the answers into two categories: the agree/strongly agree category and the disagree/strongly disagree category. The answer ‘not applicable’ was added to the disagree/strongly disagree category.

None of the questionnaires that were returned could be linked to the sending patient. Data were entered and analyzed in SPSS, version 13.0. Differences were calculated by the 2-tailed Fisher’s exact test. P-values less than 0.05 were considered statistically significant.

RESULTS

Between February 2006 and March 2007, 236 visiting patients had hernia surgery after assessment in the Hernia Clinic. Four patients were excluded from this study because their home addresses were unknown. Questionnaires were mailed to 232 patients. One hundred and five questionnaires were returned. Nine questionnaires were returned because patients had moved. Three questionnaires were returned because surgery had not been done. One patient had deceased. A total of 94 questionnaires were analyzed, representing 43% of the studied population.

<table>
<thead>
<tr>
<th>Table 1. Contents Questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Did your first assessment take place at the hernia clinic?</td>
</tr>
<tr>
<td>2. Who did your assessment?</td>
</tr>
<tr>
<td>3. Do you remember the name of the assessing surgeon?</td>
</tr>
<tr>
<td>4. Do you remember the face of the assessing surgeon?</td>
</tr>
<tr>
<td>5. Was the surgeon who assessed you the same as the surgeon who did your surgery?</td>
</tr>
<tr>
<td>6. Do you remember the name of the operating surgeon?</td>
</tr>
<tr>
<td>7. Do you remember the face of the operating surgeon?</td>
</tr>
<tr>
<td>8. Where did you undergo surgery?</td>
</tr>
<tr>
<td>9. Did any surgery-related problems occur?</td>
</tr>
<tr>
<td>10. It is important to me that the same surgeon assesses my hernia and does the operation.</td>
</tr>
<tr>
<td>11. I had confidence in the surgeon doing my assessment.</td>
</tr>
<tr>
<td>12. I had confidence in the surgeon doing my surgery.</td>
</tr>
<tr>
<td>13. I have confidence in the competences of any surgeon working in the hernia clinic.</td>
</tr>
<tr>
<td>14. I believe service is better in a specialized centre like the hernia clinic.</td>
</tr>
<tr>
<td>15. I believe service is faster in a specialized centre like the hernia clinic.</td>
</tr>
<tr>
<td>16. I believe that a group of surgeons providing hernia care uses resources effectively.</td>
</tr>
<tr>
<td>17. I understood I could request the assessing surgeon also to do my surgery.</td>
</tr>
<tr>
<td>18. I understood that if I chose the assessing surgeon also to do my surgery that the wait time might be longer.</td>
</tr>
<tr>
<td>19. I am comfortable having my surgery performed by a surgeon whom I meet on the day of surgery.</td>
</tr>
</tbody>
</table>

INITIAL ASSESSMENT

At assessment in the Hernia Clinic, 83% of the patients were seen by a surgeon only, while 9% were initially seen by a resident. Patients who were initially assessed by a resident were subsequently assessed by a surgeon. Almost 9% of the patients were unaware whether they had been seen by a surgeon or a resident.

REMEMBERING THE SURGEON

The majority of patients remembered the name and face of the assessing surgeon as well as the name and face of the operating surgeon (Table 2). The number of patients that remembered the name and face of the operating surgeon was higher compared to remembering the name and face of the assessing surgeon, but this difference was not significant (P > 0.2).

SUBGROUPS

The last 10 items of the questionnaire contained statements about a group model of care and patients were asked how strongly they agreed with these statements. Data were analyzed for the entire study group and for two subgroups (I and II).
Patients in group I (n = 63) had the same surgeon for assessment and surgery while patients in group II (n = 29) had a different surgeon for assessment and surgery. There was no difference between the groups in post-operative complication rate and no difference in who assessed the patient first (Table 3).

In group I 98.4% of patients considered it important to have the same surgeon for assessment and surgery. In group II, 48.3% of patients felt having the same surgeon for assessment and for surgery was important. This was a significant difference (p < 0.0001). Ninety-eight percent of patients in group I had confidence in the assessing surgeon, compared to 86% of patients in group II (p = 0.034). All patients in group I had confidence in the operating surgeon, compared to 86% of patients in group II (p = 0.009).

Two-third of all patients had confidence in the competences of any surgeon and believed that service was better and faster in a specialized centre like the Hernia Clinic. The majority also believed that a group of surgeons providing hernia care uses resources more effectively. Fifty-two percent of all patients understood that they could request the assessing surgeon also to do their surgery (59% in group I versus 41.4% in group II, p = 0.175). Half of all patients understood that if they requested the assessing surgeon also to do their surgery, the waiting time might increase (49.2% in group I versus 55.2% in group II, p = 0.656). On average, two-third of all patients was comfortable having their surgery performed by a surgeon whom they meet the day of surgery (59.7% in group I versus 75.9% in group II, p = 0.161).

WAITING TIMES

The wait time from referral by the family doctor to intial consult in the Hernia Clinic decreased from 208 days (SD 139) in 2007 to 59 days in 2009 (SD 70).

Table 2. Memorizing the surgeon

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remembering the name of the assessing surgeon</td>
<td>79.3</td>
<td>12</td>
</tr>
<tr>
<td>Remembering the face of the assessing surgeon</td>
<td>75</td>
<td>17.4</td>
</tr>
<tr>
<td>Remembering the name of the operating surgeon</td>
<td>86.2</td>
<td>8.5</td>
</tr>
<tr>
<td>Remembering the face of the operating surgeon</td>
<td>82.8</td>
<td>11.8</td>
</tr>
</tbody>
</table>

DISCUSSION

In 2003 an extensive survey was designed by the Canadian government to provide data regarding patients’ experience accessing health services [5]. One of the topics of the “Health Services Access Survey” was access to specialized services. Nationwide 32,005 people filled out the survey, of which 2,930 resided in the province of Nova Scotia. Thirteen percent of the population in Nova Scotia visited a specialist in 2003 and 9% required elective surgery. In Nova Scotia 13% of the patients waited more than 3 months for a consultation by a medical specialist for a new illness or condition, compared to 11% nationwide. When the joint Hernia Clinic was established in 2007, waiting times from referral to consultation by a surgeon were over 6 months. The “Health Services Access Survey” showed that two-third of the patients who were waiting for elective surgery, such as hernia repair, experienced worry, anxiety and stress and one third of the patients had problems with their daily activities due to waiting. Almost 20% of the patients considered the waiting time for non-emergency surgery unacceptable.

The primary goal of this survey was to determine patient compliance with a group model of care with a common waitlist in the Hernia Clinic. The joint Hernia Clinic was established to improve access to consultation and elective hernia surgery. The Hernia Clinic pooled patients on one common waitlist and standardized peri-operative care. One of the parameters to measure access to elective surgery and the success of a common waitlist is waiting time. In our experience, waiting times from referral to initial consultation in the Hernia Clinic dropped from 208 days in 2007, when the project was started, to 59 days in 2009. These numbers clearly demonstrate the efficacy of a common waitlist.

Table 3. Results item 2, 9-19 entire group and subgroups

<table>
<thead>
<tr>
<th>Question</th>
<th>Entire group (%)</th>
<th>Group I (%)</th>
<th>Group II (%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>8.5</td>
<td>6.5</td>
<td>14.3</td>
<td>p = 0.22</td>
</tr>
<tr>
<td>9</td>
<td>17.0</td>
<td>19</td>
<td>13.8</td>
<td>NS</td>
</tr>
<tr>
<td>10</td>
<td>82.8</td>
<td>98.4</td>
<td>48.3</td>
<td>p = 0.000</td>
</tr>
<tr>
<td>11</td>
<td>94.6</td>
<td>98.4</td>
<td>86.2</td>
<td>p = 0.034</td>
</tr>
<tr>
<td>12</td>
<td>97.5</td>
<td>100</td>
<td>86.2</td>
<td>p = 0.009</td>
</tr>
<tr>
<td>13</td>
<td>67</td>
<td>65.6</td>
<td>71.4</td>
<td>p = 0.634</td>
</tr>
<tr>
<td>14</td>
<td>88.6</td>
<td>90.2</td>
<td>89.7</td>
<td>NS</td>
</tr>
<tr>
<td>15</td>
<td>78.3</td>
<td>80.3</td>
<td>75.9</td>
<td>p = 0.783</td>
</tr>
<tr>
<td>16</td>
<td>87.1</td>
<td>83.9</td>
<td>93.1</td>
<td>p = 0.325</td>
</tr>
<tr>
<td>17</td>
<td>52.2</td>
<td>59</td>
<td>41.4</td>
<td>p = 0.175</td>
</tr>
<tr>
<td>18</td>
<td>53.3</td>
<td>49.2</td>
<td>55.2</td>
<td>p = 0.656</td>
</tr>
<tr>
<td>19</td>
<td>65.6</td>
<td>59.7</td>
<td>75.9</td>
<td>p = 0.161</td>
</tr>
</tbody>
</table>
Similar projects to improve access to elective surgery such as the Hernia Clinic were initiated in the last couple of years throughout Canada. The Joint Replacement Access Clinic at Lions Gate Hospital in British Columbia shortened their waiting times for hip and knee replacement significantly by a project started in 2005 [4]. Patients were pooled on a common waitlist and agreed to accept the first surgeon available or one of their own choice. A single clinic was developed with dedicated personnel, such as trained nurses, clerks and orthopaedic surgeons, to coordinate and streamline all aspects concerning the period before and after joint replacement, such as laboratory tests and radiography. Waiting times for a first surgical consult were reduced from one year to 2-4 weeks. Waiting times for surgery from the decision that surgery was indicated to actual operation decreased from 2 years to 6 months or less.

Two other initiatives to shorten waiting times for hip and knee replacement are the Richmond Hip and Knee Reconstruction Project and the Alberta Hip and Knee Replacement Pilot Project. Both projects reorganized and improved the complete surgical process, by providing all facets of care in one single focused centre, standardizing surgical procedures and clinical practices and using resources more efficiently. The Richmond Hip and Knee Reconstruction Project in the lower mainland of the province of British Columbia reduced waiting times by 80% within two years, from 20 to 4 months [6]. The Alberta Hip and Knee Replacement Pilot Project reduced waiting times for consultation with an orthopaedic surgeon form 35 to 6 weeks and waiting times for surgery after the decision was made that joint replacement was indicated from 47 weeks to 6 weeks [7].

Our study shows that the patients’ confidence in surgeons is high. Even if patients have a different operating surgeon for their surgery than for their assessment, their confidence is high (86%). It also shows that almost all patients who have the same surgeon for assessment and surgery deem this important, but that the majority of patients who actually have a different surgeon no longer consider it to be important. When patients are unfamiliar with the concept of having a different surgeon for their surgery, they indicate less confidence in the operating surgeon and that having the same surgeon is important to them. However, when they ultimately have a different surgeon for their procedure, they no longer consider this to be important and they express high confidence in the actual operating surgeon. This demonstrates that patients are very flexible in terms of their preferred doctor.

A limitation of this study is its response rate, which was 43%. The experiences of the non-responders are unknown which could create bias.

In this survey we have asked patients whether they believed that service in a specialized centre like the Hernia Clinic was faster and better. We also inquired if they believed resources were used more efficiently. Approximately 80% of all patients confirmed these statements. In addition, two-third of the patients had confidence in the competences of any surgeon. These results show the great public support to a group model of care and results stimulate expanding of a group model of care to decrease waiting times and use health care resources more efficiently. Further studies tracking patient compliance are necessary as well as the development of a valid standardized method to measure patient compliance. On-going documentation and analysis of patient compliance data is mandatory to enhance transformation to patient centered health care.

The Canadian health care system has a long tradition of allowing patients to choose a surgeon of their preference. In a group model of care the choice to request a specific surgeon exists, although this may result in longer waiting times. This survey showed that almost half (48%) of all patients did not understand this possibility, even though the patients were informed in writing prior to the Hernia Clinic visit about the possibility of choosing a surgeon of preference. Communication skills are one of the seven CanMEDS competencies [8] that surgeons and physicians are expected to attain. For future implementation of a group model of care, our abilities as communicators need to improve, and patients need to understand that they still have the right to choose a surgeon of their preference.

Patient compliance with a group model of care for hernia surgery is high. Access to health care can be improved by using this model. More experience with this model needs to be accumulated.

REFERENCES
5. Sanmartin C, Gendron F, Berthelot JM et al. Health analysis and measurement group; access to health care services in Canada 2003; Statistics Canada, Catalogue 82-575-XIE
6. Alberta Hip and Knee Replacement Pilot Project; Scientific Evaluation Report; Alberta Bone and Joint Health Institute 2007; June
CHAPTER 9

EAES CONSENSUS DEVELOPMENT CONFERENCE ON
ENDOSCOPIC REPAIR OF GROIN HERNIAS

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INTRODUCTION
Groin hernia repair is one of the most common surgeries performed globally in more than 20 million people per year [1, 2]. The first surgeries for groin hernias were done by the end of the 16th century [3, 4]. Repairs that involved reduction and resection of the hernial sac and enforcement of the posterior wall of the inguinal canal by approximating its muscular and fascial components were done by the end of the 19th century. Utilization of prosthetic material was introduced in the 1950’s, initially only in elderly patients with recurrent inguinal hernias. Favorable long-term results of these mesh repairs allowed adoption of mesh repair in a larger group of patients. At the present time, the majority of surgeons prefers the use of mesh in inguinal hernia repair.

In the early 1980’s, minimally invasive techniques for groin hernia repair were first reported, adding another modality to the management of inguinal hernias [4]. Transperitoneal laparoscopic and extraperitoneal endoscopic techniques, collectively coined ‘endoscopic surgery’, have been developed. There is considerable variation of surgical techniques in endoscopic repair of groin hernias rendering development of consensus prudent.

The European Association of Endoscopic Surgery (EAES) initiated a consensus development conference on endoscopic groin hernia surgery during its annual congress in 2012. The aim of this conference was to provide practical guidelines employing available medical evidence combined with the opinions of an expert panel and the membership of the EAES. The findings of this conference are reported here.

METHODS
The coordinator of the consensus development conference (HJB) and two members of the consensus panel (BvdH and MMP) selected a group of 14 surgeons, representing the European countries, with both clinical and scientific expertise in groin hernia surgery. Six medical scientists supported this panel of experts. Key topics were presented, adapted and eventually approved by the panel of experts. All topics were assigned to two experts and medical scientists.

The medical scientists performed a critical appraisal of the literature and selected the best available evidence on each topic. A literature search was performed (from 1970 - June 2012) for each specific topic. All relevant articles were reviewed and articles with the highest level of evidence were selected. The level of evidence was assessed according to the Oxford classification (Table 1) [5]. The best available evidence was summarized. PubMed and the Cochrane database were used. BvdH and MMP supervised the medical scientists and checked all the searches and summaries. A summary of the best available evidence, including complete search and grading of the level of evidence of each study, was completed and distributed to the experts allotted for that particular topic two weeks prior to the first meeting in Amsterdam.

First statements were formulated (by HJB) in preparation of the first meeting. These statements and the summary of the best available evidence on each topic were given to the expert panel at the first meeting.

Table 1. Oxford classification for levels of evidence

<table>
<thead>
<tr>
<th>Level</th>
<th>Therapy / Prevention / Etiology / Harm</th>
<th>Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>Systematic review of RCTs</td>
<td>Systematic review of inception cohort studies</td>
</tr>
<tr>
<td>1B</td>
<td>Individual RCT</td>
<td>Individual inception cohort study with &gt; 80% follow-up</td>
</tr>
<tr>
<td>1C</td>
<td>All or none</td>
<td>All or none case-series</td>
</tr>
<tr>
<td>2A</td>
<td>Systematic review of cohort studies</td>
<td>Systematic review of retrospective cohort studies or untreated control groups in RCTs</td>
</tr>
<tr>
<td>2B</td>
<td>Individual cohort study</td>
<td>Retrospective cohort study or follow-up of untreated control patients in an RCT.</td>
</tr>
<tr>
<td>2C</td>
<td>&quot;Outcomes&quot; Research</td>
<td>&quot;Outcomes&quot; Research</td>
</tr>
<tr>
<td>3A</td>
<td>Systematic review of case-control studies</td>
<td></td>
</tr>
<tr>
<td>3B</td>
<td>Individual Case-Control Study</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Case-series</td>
<td>Case-series</td>
</tr>
<tr>
<td>5</td>
<td>Expert opinion without explicit critical appraisal</td>
<td>Expert opinion without explicit critical appraisal</td>
</tr>
</tbody>
</table>

On April 20th 2012, 14 members of the expert panel attended a full day meeting. The coordinator of the consensus development conference HJB chaired the meeting. Each topic was discussed individually. Discussion was initiated by presenting the summary of the reviewed literature pertaining to that specific topic by one of the medical scientists. The levels of evidence of the reviewed manuscripts as determined by the medical scientists were discussed and either confirmed or modified.

The statements were submitted to all members of the expert panel for acceptance. Statements were accepted, modified or rejected. Subsequently, each statement was discussed and the level of agreement was determined, if the majority agreed, the statement was accepted in the consensus. The statements and levels of evidence were distributed among all members of the expert panel after the meeting for approval. After approval, the topics and statements were posted on the EAES website prior to the annual conference of the EAES on June 22 2012 in Brussels.
The members of the expert panel presented all topics, statements and associated level of evidence to an audience of attendees of the EAES conference. Voting pads allowed all attendants present to vote in favor or against each statement. The level of consensus was determined according to the classification shown in Table 2. The conference was recorded and was posted on the EAES-website after the congress was held. EAES members could vote in favor or against the statement through a secured link. Two reminders to vote were sent by email via the general EAES secretary.

**Table 2. Classification of consensus**

<table>
<thead>
<tr>
<th>Strength of consensus</th>
<th>Percentage of agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong consensus</td>
<td>&gt;95% of participants</td>
</tr>
<tr>
<td>Consensus</td>
<td>75-95% of participants</td>
</tr>
<tr>
<td>Moderate consensus</td>
<td>50-75% of participants</td>
</tr>
<tr>
<td>No consensus</td>
<td>&lt;50% of participants</td>
</tr>
</tbody>
</table>

**RESULTS**

One thousand eighty-one delegates from 82 countries attended the EAES congress in Brussels in 2012. Of these, between 92 and 164 surgeons voted during the consensus conference. After the conference was posted on the EAES-website, 17 surgeons voted (at least for some statements) online.

The level of evidence (LoE), as determined by the expert panel, will be provided after each statement. The level of consensus (LoC) (Table 2) will be provided, including the votes in favor of the statement, the total amount of votes and the calculated percentage. The statement themselves are presented in italics and preceded by a number.

**FACTORS PREDISPOSING TO DEVELOPING GROIN HERNIAS**

The impact of predisposing factors on the development of groin hernias is under debate. Many clinicians assume that occasional lifting, constipation and prostatism increase the risk for developing groin hernias. However, evidence is lacking [6, 7]. A patent processus vaginalis does predispose for developing a groin hernia [8]. Patients who have ascites, who are treated with intra-abdominal dialysis, who suffer from COPD and those who perform long-term heavy work have an increased risk for developing a groin hernia due to an elevated intra-abdominal pressure [6, 7]. Surgery in the lower abdomen such as an open appendectomy or prostatectomy might cause a groin hernia [6, 7]. Patients with a decreased type I:III collagen metabolism and patients with an abdominal aortic aneurysm (AAA’s) have an increased propensity for abdominal wall hernia development. In a recent meta-analysis the correlation between AAA’s and abdominal wall hernias was confirmed [10]. The study compared the incidence of incisional and inguinal hernias in patients with AAA’s to patients with aorto-iliac occlusive disease and found a relative risk of inguinal hernia of 2.3 (odds-ratio, 2.30; 95% CI, 1.52-3.48; p<0.0001).

**ASSESSMENT OF GROIN HERNIA**

In daily practice, the majority of groin hernias can be diagnosed accurately by physical examination. Imaging studies are only indicated when the presence of a groin hernia is unclear or when the clinician is unsure whether the swelling in the groin is caused by a hernia [12, 13]. However, in case of groin pain without a swelling at clinical presentation, the diagnosis of a groin hernia by physical examination can be challenging and additional imaging modalities may be necessary to identify the actual groin pathology [14, 15]. Herniography, radiography of the pelvic area after intra-peritoneal injection of radioactive dye, has been the standard imaging procedure since 1967 [16]. However, this is an invasive procedure with inherent risk of visceral of vascular damage. A recent review showed an overall sensitivity rate ranging from 81 to 100% and specificity rate from 92 to 98.4%. Other non-invasive imaging modalities such as ultrasound, CT-scan and MRI have been evaluated. A non-contrast CT-scan has an overall accuracy of 94% [17]. A small study
In case of clear clinical diagnosis of inguinal hernia, no additional imaging studies are necessary. LoE: 2C / LoC: consensus, 137/147=93%

3. In case of clear clinical diagnosis of inguinal hernia, no additional imaging studies are necessary. LoE: 2C / LoC: consensus, 137/147=93%

4. When a groin hernia is suspected but clinical findings are equivocal, the first step in imaging is dynamic ultrasonography, followed by dynamic MRI. LoE: 2C / LoC: consensus, 138/149=93%

5. Ultrasonography and MRI have a high sensitivity and specificity considering the detection of an occult inguinal hernia and have replaced herniography as a diagnostic instrument. LoE: 2C / LoC: consensus, 138/149=93%

6. Ultrasonography and MRI have a high sensitivity and specificity considering the detection of an occult inguinal hernia and have replaced herniography as a diagnostic instrument. LoE: 2C / LoC: consensus, 138/149=93%

7. Physical examination does not allow distinguishing direct i.e. medial from indirect i.e. lateral inguinal hernias. LoE: 2 / LoC: majority, 103/154=67%

OPERATIVE OR CONSERVATIVE APPROACH OF GROIN HERNIAS

The general strategy toward groin hernias is surgical repair. The presenting symptom of a groin hernia is either discomfort or pain in the groin in two-thirds of all patients [30]. One third of all patients has no symptoms at clinical presentation, but only a sign of a non-tender bulge in the groin. The rationale to recommend surgery is to prevent visceral incarceration and subsequently ischemia (strangulation). However, little is known about the natural history of untreated groin hernias [31]. Recently, two large randomized controlled studies have been published to analyze the natural course of asymptomatic inguinal hernias [32, 33]. These studies concluded that watchful waiting was safe in asymptomatic inguinal hernias. However, a later study showed that the majority of patients with an asymptomatic inguinal hernia eventually becomes symptomatic and concluded that the evidence for a watchful waiting policy is lacking [34]. The rationale for surgery in inguinal hernias is, therefore, treatment of current or future symptoms and not to prevent incarceration.

Considering that most patients with an asymptomatic groin hernia eventually become symptomatic, an occult contralateral hernia, discovered during endoscopic repair of a symptomatic unilateral hernia, can be repaired during the same surgical procedure. This can only be done when this option has been discussed prior to surgery and informed consent was obtained. In absence of a groin hernia, prophylactic mesh-placement on the contralateral side in endoscopic repair of a symptomatic unilateral hernia is not advisable. Femoral hernias seem to incarcerate significantly more than inguinal hernias. The actual risk of incarceration of femoral hernias has only been described in observational cohort studies, but shows a 7-8 fold increase compared to inguinal hernias [31, 35-38]. The rationale for surgery in femoral hernias is therefore to prevent incarceration.

Endoscopic repair can be done for all groin hernias, inguinal and femoral, unilateral and bilateral, primary and recurrent. The expert panel states that there are no absolute contra-indications for endoscopic repair in adolescents, age 14 to 18 years. Endoscopic groin hernia in complicated situations, such as in patients after radical prostatectomy or cystectomy, in patients with a scrotal hernia, ascites, on peritoneal dialysis and redo endoscopic repairs, should only be performed by a surgeon that has a high level of experience in endoscopic groin hernia repair.

The two major endoscopic techniques are transabdominal preperitoneal repair (TAPP) and total preperitoneal repair (TEP). In the best available evidence, no technique seems to be superior to the other with regards to outcomes and complication rates [39, 40]. Both techniques were associated with similar operative time, postoperative complications, postoperative pain, time to return to work, and recurrences. TAPP was associated with a slightly longer hospital stay compared with TEP.

Endoscopic groin hernia repair is favored over open groin hernia repair in certain patients. Endoscopic groin hernia repair is associated with less post-operative pain than open repair [41-44]. This difference in pain seems to disappear during the first 6 weeks after surgery. Young active adults benefit mostly from endoscopic groin hernia repair since they gain most from early convalescence. It is therefore stated that young active adults with a groin hernia are preferably repaired with an endoscopic technique. Endoscopic surgery is also preferred in patients with a recurrent groin hernia after open repair [40]. The posterior route is free of scar tissue and therefore the groin can be reached more easily with an endoscopic approach.

Endoscopic surgery is favored over open surgery in certain patients. Endoscopic surgery is associated with less post-operative pain than open repair [41-44]. This difference in pain seems to disappear during the first 6 weeks after surgery. Young active adults benefit mostly from endoscopic groin hernia repair since they gain most from early convalescence. It is therefore stated that young active adults with a groin hernia are preferably repaired with an endoscopic technique. Endoscopic surgery is also preferred in patients with a recurrent groin hernia after open repair [40]. The posterior route is free of scar tissue and therefore the groin can be reached more easily with an endoscopic approach.
In patients with bilateral groin hernias, the expert group stated that endoscopic repair is ideal because both groins can be reached using two or three small incisions, whereas in open repair one large incision in each groin is necessary.

**Statements**

8. Endoscopic surgery is preferred in patients with a recurrent groin hernia after open repair. LoE: 1B / LoC: strong consensus, 151/158=96%

9. Redo endoscopic repair is only feasible, when the surgeon has a high level of experience in re-do endoscopic groin hernia repair (TAPP). LoE: 5 / LoC: consensus 109/134=81%

10. Especially in bilateral groin hernia endoscopic surgery is an excellent approach. LoE: 5 for TEP / 2B for TAPP / LoC: strong consensus, 154/161=96%

11. Concerning the repair of (a bilateral) groin hernia, there is no clear advantage of TEP over TAPP or vice versa. LoE: 2A / LoC: majority, 105/142=73%

12. When an occult contralateral hernia is discovered during endoscopic repair of a symptomatic unilateral hernia, the occult and the symptomatic hernia can be repaired in the same surgical procedure. LoE: 5 / LoC: strong consensus, 148/154=96%

13. In absence of a groin hernia, prophylactic mesh-placement on the contralateral side in endoscopic repair of a symptomatic unilateral hernia is not advisable. LoE: 5 / LoC: consensus, 124/138=90%

14. In complex situations, endoscopic hernia repair should only be considered when the surgeon has a high level of experience in endoscopic groin hernia repair. The following situations are considered to be (highly) complex: patients after radical prostatectomy or cystectomy, and patients with a scrotal hernia, ascites, previous posterior mesh repair or peritoneal dialysis. LoE: 5 / LoC: consensus, 135/152: 89%

15. Young active adults with a groin hernia are preferably repaired with an endoscopic technique. LoE: 1A / LoC: consensus, 112/148=76%

16. There are no absolute contraindications for endoscopic repair in adolescents; age 14 to 18 years. LoE: 5 / LoC: majority, 96/150=64%

17. Endoscopic repair is the preferred surgical approach in case of a femoral hernia. LoE: 5 men / 2C women / LoC: consensus, 108/144=75%

**ENDOSCOPIC REPAIR OF STRANGULATED HERNIA**

The definitions of the terms strangulation and incarceration vary. The EAES consensus group adheres to the following definition: Strangulation to indicate that there is a bulge in the hernia sac, with compromised blood supply to the strangulated viscera. The term incarceration is used for a non-reducible bulge in the groin that can either be symptomatic or asymptomatic. Strangulated groin hernias or symptomatic incarcerated hernias should be operated on urgently to prevent for ischemia of the incarcerated viscera. In case of strangulation or symptomatic incarceration, the intra-abdominal cavity should be inspected, followed by either TEP or TAPP [45]. Some surgeons dread the use of a mesh in emergency hernia repair, particularly when a bowel resection is required, because of the fear for a mesh infection. However, there is insufficient evidence to avoid mesh repair in these situations routinely. Recent studies showed few to no mesh infections in patients who underwent bowel resection during an emergency endoscopic procedure [46, 47].

A recently performed trial randomized patients with spontaneously reduced strangulated groin hernias to either laparoscopic inspection of the hernia sac and abdominal cavity or to open inspection of the hernia sac with or without explorative laparotomy (at the surgeon’s discretion) [48]. In the laparoscopy group, 2 out of 21 patients had resections of a necrotic ileal bowel loop during abdominal inspection. In the open group, 4 out of 20 patients had explorative laparotomy with 2 out of 4 bowel resections. One patient in the open group had a delayed laparotomy because of missed bowel ischemia. Overall, the endoscopic approach of incarcerated and strangulated groin hernias allows for laparoscopic inspection of the intra-abdominal cavity in all patients, hence could prevent missed bowel ischemia. A diagnostic laparoscopy is preferred followed by an endoscopic repair in selected cases.

**Statements**

18. Repair of incarcerated, non-reducible, groin hernias has to be done urgently and can be performed with an endoscopic technique. LoE: 2A / LoC: consensus, 124/155=81%

19. When performing an endoscopic repair, the abdominal cavity should be inspected followed by either TAPP or TEP. LoE: 5 / LoC: consensus, 113/123=92%

20. Mesh placement during surgery for strangulated groin hernia is possible in clean-contaminated situations; i.e. in case of a bowel resection. LoE: 2A / LoC: majority, 103/150=69%

21. In suspicion of a strangulated groin hernia a diagnostic laparoscopy is preferred. LoE: 5 / LoC: majority, 109/149=73%

**ENDOSCOPIC REPAIR OF SPORTSMAN’S HERNIA**

Among professional athletes groin pain is a common injury. Causes for chronic groin pain are lumbar spine problems such as compression syndrome and herniated lumbar disc, leg length differences, tendinitis of the adductor muscle, osteitis pubis, prostatitis and sportsman’s hernia. In athletes with chronic groin pain a sportsman’s hernia can be diagnosed only when other causes have been excluded [49]. Because of the large differential diagnosis of groin pain in athletes, it is extremely important to evaluate each patient in whom a sportsman’s hernia is suspected in a multidisciplinary setting.
Various imaging techniques are used to diagnose a sportsman’s hernia, or exclude other causes of groin pain [50]. The expert panel agreed that MRI is the preferred imaging technique because of its capacity to differentiate between several groin pathologies. MRI has the advantage to work with magnetic fields instead of X-rays, but is expensive and has never been proven the best technique to diagnose groin hernias.

Several studies have been undertaken over the past few years to define the best treatment method for sportsman’s hernia. In a prospective randomized setting the endoscopic TEP mesh placement was compared with conservative therapy (i.e. rest, physiotherapy, steroid injections and oral anti-inflammatory analgesics) in 60 athletes with a groin hernia [51]. This study reported that operative repair was more effective than non-operative treatment for chronic pain after 1 up to 12 months of follow up (p<0.001). Ninety per cent of the patients who underwent surgery returned to sports activities after 3 months compared to 27% in the conservative group (p<0.001). Two studies have treated athletes with chronic groin pain unresponsive to conservative treatment with TEP [50, 52]. In these study groups, 93% to 100% returned to full sports activity three months after TEP repair.

**Statements**

22. A multidisciplinary team should evaluate possible sportsman’s hernia in order to exclude other causes of groin pain such as lumbar spine problem (compression syndrome, herniated lumbar disc), leg length differences, tendinitis of the adductor muscle, osteitis pubis or prostatitis. MRI is the preferred imaging modality. LoE: 5 / LoC: consensus, 141/161=88%

23. Endoscopic placement of a mesh in the groin is effective in athletes with a sportsman’s hernia. LoE: 1B / LoC: consensus, 129/147=88%

**ANTIBIOTIC PROPHYLAXIS**

There is very little evidence for the use of antibiotics during endoscopic groin hernia repair [53]. In open groin hernia repair, the effectiveness of antibiotic prophylaxis in reducing postoperative wound infection rates has been studied extensively. In 2012, a large Cochrane review was published concerning this subject. It included 7843 patients from 17 RCTs. It was concluded that no universal recommendation for antibiotic prophylaxis could be given; neither can it be recommended against when high infection rates are observed [54].

**Statement**

24. There is not enough evidence to support the routine use of prophylactic antibiotics in elective endoscopic groin repair. LoE: 5 / LoC: consensus, 123/162=76%

**PROCEDURAL AND TECHNICAL ASPECTS OF ENDOSCOPIC GROIN HERNIA REPAIR**

The particular technical details of TEP and TAPP groin hernia repair are beyond the aim of this manuscript. The choice and fixation of the mesh and how to approach the absence of a hernia sac during surgery will be discussed in this chapter.

To evaluate the type of mesh used during endoscopic groin hernia repair a meta-analysis of lightweight-mesh versus heavyweight-mesh in both TEP and TAPP inguinal hernia repair was performed [55]. Eight randomized clinical trials were included, a total of 1667 hernias in 1592 patients were analyzed [56-62]. The mean study follow-up was between 2 and 60 months. No significant effect on recurrence, chronic pain, postoperative pain, seroma formation or return to work was found and both meshes appeared to result in similar long- and short-term postoperative outcomes. Future long-term analysis of recurrence and post-operative chronic pain may guide surgeons’ selection of mesh weight for endoscopic groin hernia repair.

Mesh fixation technique is a frequently studied topic since post-operative pain has become one of the major outcomes in inguinal hernia surgery. In TAPP repair the mesh is usually fixed with glue, tackers or staples. In TEP repair, the mesh is not fixed at all, or fixed with glue, tackers or staples. Several studies have been published concerning the difference between glue and tacker fixation in TAPP hernia repair with regard to the incidence of recurrences [63-67]. The type of fixation did not influence the recurrence rate. Also, the type of fixation did not seem to influence acute or chronic pain [64-68]. Some studies suggest that tacker fixation may lead to higher acute and chronic pain scores but other studies repudiate this [66]. Three groups recently performed meta-analyses of the influence of fixation versus non-fixation of the mesh in TEP repair [69-71]. Only one group reported a difference in chronic post-operative pain favoring the non-fixation group [71]. The other two did not find any difference in recurrence rate or (chronic) pain [69, 70]. A recent randomized controlled trial (that was not included in these meta-analyses) compared post-operative pain between fixation and non-fixation of the mesh and did not show any difference in acute or chronic pain [72]. Moreover, the incidence and amount of post-operative pain is also likely to be influenced by the number and location of tackers/staples. The expert group agreed that diverse types of inguinal hernias (i.e. direct vs. indirect and large vs. small hernias) should be distinguished and treated in a different way. Randomized controlled trials have not differentiated between large and small hernias; the use of a lightweight mesh with or without fixation of the mesh in case of a large direct (medial) hernia might lead to a higher recurrence rate.

A prevalent phenomenon during endoscopic repair of a groin hernia is absence of a hernia sac. Patients present with a bulge in the groin, but during surgical exploration no sac is found. Even when a sac is absent, herniation through the abdominal wall is not excluded. Preperitoneal fatty tissue could protrude through an insufficient fascia transversalis as a
direct hernia or through the internal ring along the spermatic cord as an indirect hernia. Inguinal lipomas are therefore considered to be a pitfall in hernia surgery [73]. The incidence of an inguinal lipoma is around 20% and might be related to BMI [74-76].

Statements
25. Sufficient overlap of the mesh is more important than fixation of the mesh. LoE: 5 / LoC: consensus, 116/141=82%
26. There is currently not enough evidence supporting the general use of lightweight mesh over heavyweight mesh in endoscopic groin hernia repair. LoE: 1A / LoC: consensus, 127/147=86%
27. The mesh in groin hernia repair measures minimally 15x10cm. LoE: 5 (TEP)/ 2C (TAPP) / LoC: consensus, 136/153=89%
28. The use of a heavy weight mesh, larger mesh size, mechanical fixation and reduction of the dead space (i.e. fixation of the transversalis fascia) could be considered in patients with a large medial i.e. direct hernia. LoE: 5 / LoC: consensus, 121/142=85%
29. Tacker or suture fixation for groin hernia (with the exception of large direct inguinal hernias) should be avoided. LoE: 5 / LoC: majority, 104/158=66%
30. In all endoscopic groin hernia repairs, an active search for herniating lipomas should be done. LoE: 5 / LoC: consensus, 136/172=79%
31. Herniated adipose tissue present in the internal ring should be reduced. LoE: 5 / LoC: consensus, 125/135=93%

COMPLICATIONS OF ENDOSCOPIC GROIN HERNIA REPAIR
Complications after endoscopic groin hernia repair are widely described. The most common short-term complication is formation of a hematoma or a seroma. The average incidence of hematoma reported in several randomized controlled trials lies around 8% [40, 42, 77-85]. The incidence of a post-operative seromas after endoscopic repair is approximately 7%. It is of great importance to inform patients about the possibility of seroma formation, as seroma is not a seldom side effect. Patients might confuse the swelling formed by the seroma as a persistent groin hernia and might conclude that surgery has failed. However, seroma formation most often lacks clinical significance or clinical relevance. Therefore, all panel members agreed that when seroma formation occurs, generally there is no need for aspiration.
In contrast to complications such as hematoma and seroma, wound infection after endoscopic repair occurs rarely and reported rates are around 1% [40, 42, 77, 79-83, 85-87]. Also mesh infection occurs seldom. A Cochrane review shows that only one mesh infection occurred in 2179 patients who underwent endoscopic groin hernia repair [40]. The expert panel agrees that in case of a mesh-infection, removal of the mesh is generally not necessary.
A frequently mentioned drawback of laparoscopic repair of an inguinal hernia is the possible collateral damage of vital adjacent structures such as bowels or vessels. The incidence of serious collateral damage might be higher during the learning curve. Some studies show that the incidence of vascular and visceral damage is slightly higher in endoscopic groin repair compared to open groin hernia repair. Vascular damage was reported in 0.14% in TAPP versus none in TEP and open repair. Visceral damage was reported in 0.65% in TAPP, 0.16% in TEP and 0.14% in open repair [88]. However, a large meta-analysis of 2005 comparing laparoscopic inguinal hernia repair versus open repair that included about 3500 repairs and analyzed the incidence of collateral damage, did not find any significant difference. In the laparoscopic group (TAPP/ TEP), an incidence was documented of 0.1% of intra-operative bowel lesions, versus 0.06% in the open group. This difference was not significant. The incidence of vascular damage in the laparoscopic group was 0.09% versus none in the open. This difference was also not significant [79].
The most common long-term complications are recurrence and (chronic) pain. The recurrence rate after endoscopic surgery is consistently low and varies between 0.5%-5% in randomized trials [77, 89-91]. Chronic pain on the other hand is a more common adverse outcome of (endoscopic) hernia repair and lacks a uniform definition. Incidences therefore vary widely, and rates as high as 25% are reported [77]. The expert panel consented that a proper meta-analysis of the vast amount of studies is needed.
Quality of life and incidence of (acute) pain differ from one technique to the other and might be influenced by fixation of the mesh and type of mesh. Most studies comparing the effect of open and laparoscopic repair of inguinal hernia on quality of life and pain, favor the latter, because of a reduction in acute pain [77, 92-95]. However, the difference in post-operative pain scores in favor of the laparoscopic approach diminishes over time.
Recently more attention is paid to the effect of mesh repair on male fertility. Testicular atrophy due to impaired vascularization and hydrocele are identified as long-term complications after inguinal hernia repair [83, 96, 97]. A recent study suggests that the use of a lightweight mesh in TEP negatively influences sperm-motility [59]. However, in a large epidemiologic study no association has been found between inguinal hernia repair and increased incidence of infertility [98].

Statements
32. Infections of the mesh rarely occur after endoscopic groin hernia repair (LoE 1A). In case of mesh-infection, removal of the mesh is generally not necessary (LoE 5). LoE: 1A / 5 / LoC: majority, 103/150=69%
33. Formation of a seroma is a frequent occurrence after endoscopic groin hernia repair but lacks clinical relevance or significance in most cases. It is advised to explain the possibility of seroma formation to the patient pre-operatively to prevent anxiety. LoE: 5 / LoC: consensus, 146/155=94%

34. In general, the aspiration of a seroma is not advised. LoE: 5 / LoC: consensus, 129-157=82%

35. Endoscopic surgeons should strive for wound infection rates below 2% after endoscopic groin hernia repair. LoE: 5 / LoC: consensus, 102/111=92%

36. Endoscopic surgeons should strive for symptomatic recurrence rates below 5% five years after endoscopic groin hernia repair. LoE: 5 / LoC: consensus, 130/142=92%

37. Endoscopic surgeons should strive for severe chronic groin pain rates below 2% five years after endoscopic groin hernia repair. LoE: 5 / LoC: consensus, 99/120=83%

38. Mesh repair in general does not seem to cause infertility in males. LoE: 2C / LoC: consensus, 133/145=92%

POSTOPERATIVE CONSIDERATIONS IN ENDOSCOPIC GROIN HERNIA REPAIR

The general approach towards physical restrictions after groin hernia repair differs considerably [99]. Many surgeons and general practitioners recommend a few weeks of rest, including no driving, working or lifting. However, those recommendations seem to depend more on local tradition than clear evidence and therefore need to be reconsidered [100].

Studies failed to show any disadvantageous effect of a short period of convalescence with regard to the development of a recurrence [101-105]. Early and active encouragement of patients after groin hernia repair is associated with shortened convalescence and earlier return to work [104]. Hand and foot reaction times return to pre-operative levels 7-10 days after surgery [106,107].

The value of follow-up after inguinal hernia repair is unclear. Most studies on this subject stress the importance of prolonged follow-up for quality assessment of inguinal hernia surgery. These studies use postal questionnaires to select patients with a suspected recurrence with varying degrees of success [108-110]. No studies were found on the need for regular check-ups after inguinal hernia repair, to detect asymptomatic recurrences or prevent incarceration. Therefore, routine follow-up after groin hernia surgery lacks medical evidence.

Quality assessment after endoscopic inguinal hernia surgery consists of two long-term complications; recurrence and pain. A variety of questionnaires and tools are being used to assess the quality of life (QoL) and pain after inguinal hernia repair. Traditionally, QoL-measurements after surgery were conducted using the generic Short Form-36 (SF-36) [111]. The SF-36 is thought to be an adequate tool to measure QoL in patients over time, but it is too extended and universal to measure specific complaints after a specific treatment. In addition to general health related quality of life instruments as the SF-36, disease specific instruments focus on particular health conditions and are useful to detect the changes resulting from specific treatment. The Carolina Comfort Scale (CCS) was developed as a disease specific questionnaire for evaluating the QoL after the mesh hernia repair [112]. It evaluates the sensation of the mesh, pain and movement limitations in different aspects of common daily life. Another disease specific questionnaire has recently been proposed, but it has not been validated yet [113]. The expert-panel agreed that an internationally accepted hernia-specific questionnaire to monitor pain and discomfort after inguinal hernia repair is necessary.

For the evaluation of pain, the Visual Analogue Scale (VAS) is often used, although the Verbal Rating Scale (VRS) might be better for post-herniorrhaphy pain assessment [114]. The Visual Analogue Scale (VAS) for pain can be used when specific cut-off points are used to define mild, moderate and severe pain. Another questionnaire that has been used for pain-assessment is the Inguinal Pain Questionnaire that has been proven a reliable instrument to assess pain after inguinal hernia repair [115].

Statements

39. Active encouragement after groin hernia repair is associated with shortened convalescence. LoE: 3 / LoC: consensus, 86/110=78%

40. Early activity after groin hernia repair does not seem to increase recurrence rates. LoE: 3 / LoC: consensus, 125/159=79%

41. Routine follow-up after (endoscopic) groin hernia repair is not necessary. LoE: 5 / LoC: consensus, 67/126=53%

42. Quality of life after endoscopic hernia repair is generally excellent in most patients. LoE: 1A / LoC: consensus, 138/153=88%

EDUCATIONAL, ORGANIZATIONAL AND FINANCIAL ASPECTS

Competency in surgery is of great importance for patient safety. In endoscopic surgery of groin hernias competency has not been consistently defined. Hence, it is very difficult to determine the criteria for reaching full competency. Endoscopic groin hernia repair is considered more difficult than open groin hernia repair. The number of procedures needed to reach full competency (formerly known as learning curve) is dependent on several factors such as previous experience and type of training method.

The existing literature reflects mostly series of hernia surgeries performed by a single surgeon or a small group of surgeons who adopted the technique of endoscopic surgical repair of hernias in a non-structured fashion. The results of individual surgeons have been analysed in large retrospective and prospective studies [116-120]. These studies showed...
significant reduction of operating times, conversion rates and complication rates after 30 to 100 TEP procedures and 50 to 75 TAPP procedures. These studies reveal that the number of cases required to accomplish competency is determined by various factors such as previous experience with other minimally invasive procedures and experience in open groin hernia surgery. An American group demonstrated that surgeons in training reach competence after fewer cases in a structured educational programme [121, 122]. Development of structured training programs is therefore mandatory to improve the efficacy of educational modules and increase patient safety. Clear evidence supporting centralisation of hernia repair in specialized hospitals is not available. However, one study demonstrated that centralisation of hernia repair within one hospital by referring all patients with hernias to a single dedicated surgeon resulted in fewer wound infections (5.9% to 0.45%, p <0.005), fewer systemic complications (2.05% to 0.45%, p < 0.05) and lower recurrence rates (4.6% to 0.45%, p < 0.001) [121]. The use of evidence-based protocols for hernia repair result in lower perioperative complications rates (2.16%) and lower recurrences rates (0.78%) [123]. These results favour specialization in and centralization of hernia care.

Endoscopic groin hernia repair is more expensive compared to open groin hernia repair. The increased costs are particularly due to the need of special equipment and general anaesthesia. Costs of disposable devices and operating time can be calculated accurately while determination of costs of personnel and amortization of non-disposable equipment is more difficult. Calculation of indirect costs is even more complex, because methods of estimating lost income vary. In the available literature, the direct medical costs of laparoscopic inguinal hernia repair were higher than those of open repair [41, 77, 78, 92, 124-136]. When including societal costs, total costs were often similar or lower after endoscopic repair in many studies [6, 95, 137-141]. However, a recent study shows that overall, TEP is more expensive than open groin hernia repair [41]. Costs will become progressively more important in healthcare. Overall calculation of costs however is very complex and is therefore prone to bias.

Statements
43. Endoscopic groin hernia repair is considered to be more complex than open groin hernia repair. LoE: 2C / LoC: consensus, 115/142=81%
44. Broad implementation of a structured educational program in endoscopy is recommended to familiarize surgeons in training with endoscopic surgery and to prevent rare but serious complications of vascular damage or bowel perforation. LoE: 5 / LoC: strong consensus, 126/133=95%
45. Numbers needed to reach competence in endoscopic groin hernia repair will decrease when participating in a structured educational program. LoE: 2C / LoC: strong consensus, 127/133=95%
46. Specializing in groin hernia repair promotes standardizing peri-operative care, which reduces morbidity and lowers the recurrence rate. LoE: 2C / LoC: consensus, 101/132=77%
47. Numbers needed to reach competence in TAPP-repair appear to be lower than for TEP-repair. LoE: 3C / LoC: consensus, 89/108=82%
48. Total costs of endoscopic groin hernia repair appear to be similar to those of open repair: direct costs are higher while indirect costs are lower. LoE: 1A / LoC: majority, 86/117=74%

DISCUSSION
Consensus, which we defined as agreement among at least 75 percent of participants in the consensus conference, was reached in three-quarters (36/48) of the statements. Five of 36 statements with consensus were supported by level 1 evidence while 21 statements with consensus were based on level 5 evidence, illustrating the paucity of high level evidence for endoscopic repair of groin hernias. Interestingly, consensus was reached in 63 percent of the level 1 statements (5/8) and in 84 percent (21/25) of the level 5 statements. Apparently, high level of evidence statements are not consistently associated with strong consensus of the surgical community and vice versa.

The existing guidelines published by the EHS and IEHS both are based on review of the literature by a small group of experts without formal contributions of their members. Several surgical scientists of the EHS and IEHS were included in the expert panel of the EAES consensus development conference to ensure a platform consisting of representatives from all societies with a special focus on groin hernia surgery. Combining medical evidence with the opinions of both experts and the surgical community provides a unique method to develop best practice guidelines.

A limitation of this study is the involvement of less than 10 percent of approximately 2700 EAES members. To increase involvement, the statements of the consensus development conference were posted on the EAES website four weeks before the meeting in Brussels. In addition, a recording of the consensus development conference was posted on the EAES website after the meeting with a digital voting module to allow members who could not attend the conference to contribute. In spite of the limited number of members that used this opportunity, employment of digital communication methods deserves further attention to reach out to those who cannot readily attend conferences in person.

In conclusion, more than three-quarters of surgeons involved in the 2012 EAES consensus development conference agreed on three-quarters of 48 statements regarding endoscopic repair of groin hernias. Collaboration between all societies with a focus on groin hernias...
such as the EAES, EHS and IEHS, high caliber scientific studies (i.e. RCT’s and registries) on groin hernias and including opinions and experiences of the surgical community at large are the elements to further improve the quality of care for our patients with groin hernias.

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CHAPTER 10
SUMMARIZING DISCUSSION, CONCLUSIONS AND FUTURE PERSPECTIVES
Inguinal hernia repair is one of the most common performed operations done by a general surgeon. Annually over 20 million inguinal hernias are repaired worldwide [1]. Inguinal hernia repair accounts for 10 to 15% of all general surgical procedures [2]. In this thesis several aspects of the clinical pathway of a patient with an inguinal hernia are addressed, extending from indication for surgery to follow-up post-operatively and consensus amongst hernia experts.

The general policy towards symptomatic inguinal hernias is surgical repair. The gold standard for treatment of an inguinal hernia is by means of a tension free repair with a mesh to cover the hernia defect and augment the abdominal wall. The mesh can either be implemented at the anterior side of the hernia defect, by Lichtenstein repair, or at the posterior side, by a laparoscopic repair. Hernia training is started early in the career of a surgical resident. The learning curve of the Lichtenstein repair is considered to be shorter than for laparoscopic repair, with a required number of laparoscopic procedures to achieve competence between 50-100 with the first 30-50 being the most critical [3]. Morbidity and mortality rates of elective inguinal hernia repair are low. The most common short-term complications are hematoma, seroma and wound infection. The most common long-term complications are chronic pain and recurrence. The incidence of chronic pain is much under debate, since high rates are reported. A recently published systematic review reports that approximately 11% of the patients suffer from chronic pain after a mesh repair [4]. However no uniform scoring system is used, resulting in difficulties drawing any conclusions or comparing the outcomes of studies published. The recurrence rates after open Lichtenstein and laparoscopic repair are low and vary between 1-4% [5-12]. Inguinal hernia repair is therefore generally considered to be feasible, reliable and save.

The presenting symptom of an inguinal hernia is either discomfort or pain in the groin in two-thirds of all patients [13]. One third of all patients however, is asymptomatic at consultation and presents with the sign of a non-tender bulge in the groin. Since inguinal hernia repair is associated with a chance of recurring of up to 4% and a risk of chronic pain of up to 11%, surgical repair is not without risk. In addition, with an increasing political climate where health care costs rise and governmental budgets are cutback, critical evaluation is applied to the aptness of certain therapies. Not surprisingly, the appropriateness of surgery in asymptomatic inguinal hernias was questioned. The rationale to recommend surgery for asymptomatic groin hernias is to prevent visceral incarceration and subsequently ischemia (strangulation). Two large randomized controlled studies were performed in 2006, comparing surgical repair versus watchful waiting in two groups of patients with asymptomatic inguinal hernias [14, 15]. Both studies concluded after a period of follow-up of 1-2 years that watchful waiting is cost effective, showing equal decrease in pain in the watchful waiting group compared to surgical repair and that the risk for incarceration is low. We conducted a review to evaluate the appropriateness of inguinal hernia repair in asymptomatic groin hernias and extracted risk factors for incarceration and increased morbidity and mortality to design a more tailor made approach to patients with asymptomatic inguinal hernias (Chapter 2). To patients with an asymptomatic or minimal symptomatic inguinal hernia with a duration of less than 3 months, who are older than 49 years or have an ASA class of 3 or 4, elective repair should be recommended. Watchful waiting in these patients should be discouraged due to an increased risk of incarceration and increased morbidity and mortality when operated in an emergency setting. However, in patients who have an asymptomatic or minimal symptomatic inguinal hernia for more than 3 months, are younger than 50 years and have an ASA class of 1 or 2, a conservative treatment is justified. When the inguinal hernia does incarcerate in such a patient, the risk of morbidity and mortality is low and the hernia can be safely repaired with a mesh technique if bowel necrosis is absent.

Just recently the long-term follow-up outcomes of both randomized trials have been published and reveal remarkable outcomes [16, 17]. Both studies show that eventually most patients with an asymptomatic or minimally symptomatic inguinal hernia become symptomatic requiring repair. Watchful waiting is still a safe option in patients with no or minimal symptoms, but future analysis should be done to re-calculate its cost-effectiveness.

The diagnosis of an inguinal hernia can be established quite accurately by physical examination and further diagnostic modalities are rarely indicated [18, 19]. When additional imaging is needed, ultrasonography reveals inguinal hernias with a sensitivity and specificity rate greater than 90% [20]. MRI is most commonly employed differentiating the causes of groin pain in absence of a hernia [1]. Differentiation between hernia type, direct or indirect, during physical examination is considered to be difficult and even challenging with imaging techniques [21-23]. As this information seldom modifies the surgical indication or surgical technique, little importance is given to preoperative differentiation between the two types of inguinal hernia. However, some surgeons advocate that in the older patient with a unilateral direct hernia a prophylactic mesh should be placed on the contralateral side, due to the expectation of increased risk for developing a contralateral inguinal hernia in this group. Moreover, in laparoscopic surgery the dissection of the peritoneal sac in reducing an indirect hernia can be technically demanding, while reducing a direct hernia is easily performed. Preoperative differentiation in hernia type would help the surgeon in operative planning and surgical training programs. We conducted a prospective study in which we evaluated two types of preoperative physical diagnostic tests to differentiate in hernia type in 200 patients.
outcomes of both tests were compared to the intra-operative assessment of type of hernia during laparoscopy (gold standard). In the first one hundred patients the inguinal occlusion test was used as method to differentiate. The inguinal occlusion test implies manual reduction of the protruding hernia together with manual compression on the presumed location of the deep inguinal ring. Patients were asked to perform Valsalva manoeuvre after which it is observed whether the hernia remained reduced until release of the compression (indirect hernia) or immediately protruded while the inguinal internal ring still being compressed (direct hernia). Assessing an indirect hernia was rather accurate with a correct diagnosis in 86% of the patients, while assessing a direct hernia was hardly accurate. Thirty-five percent of all patients with a direct hernia were correctly diagnosed by using the inguinal occlusion test. We concluded that the inguinal occlusion test was not accurate as a method in differentiatation in hernia type. In the second one hundred patients the inguinal occlusion test was enriched by a hand-held Doppler device to locate the epigastric vessels, and subsequently the internal ring more precisely. Preoperative differentiation increased substantially and was correct in 79% of the direct inguinal hernias and 93% of the indirect inguinal hernias. It was therefore concluded that our newly developed method in differentiating between hernia type was accurate and reliable.

As it is generally recommended to structure teaching and training of inguinal hernia surgery in specialized centers or high-volume institutions, preoperative differentiation in hernia type can be of growing clinical relevance [3, 24]. This differentiating method can be taught to surgical residents and hernia surgeons in such a specialized or high-volume contralateral side for inspection and possible additional treatment peroperatively. With hernia repair are less postoperative pain, faster recovery and simultaneous access to the possibility to perform surgery under local anesthetics, while advantages of laparoscopic ExtraPeritoneal repair (TEP), or transabdominally in the so called TransAbdominal laparoscopic mesh repair are roughly the two treatment modalities. The approach in When surgical repair is indicated in a patient with a symptomatic inguinal hernia, open or laparoscopic mesh repair are roughly the two treatment modalities. The approach in laparoscopic inguinal hernia repair can be preperitoneally in the so called Total ExtraPeritoneal repair (TEP), or transabdominally in the so called TransAbdominal PrePeritoneal repair (TAPP). An advantage of an open (Lichtenstein) repair is the possibility to perform surgery under local anesthetics, while advantages of laparoscopic hernia repair are less postoperative pain, faster recovery and simultaneous access to the contralateral side for inspection and possible additional treatment peroperatively. With the expansion of the laparoscopic technique the phenomenon of finding a so called “occult” contralateral defect became rather common. In patients diagnosed with a unilateral inguinal hernia occult defects were reported in up to 51% [25-31]. It was generally advised to commence immediate repair, yet surgical rationale was lacking. We conducted a retrospective study to assess the incidence of occult contralateral defects and assess their natural course (Chapter 4). All patients with a unilateral inguinal hernia undergoing laparoscopic hernia repair from 1993-2010 were included. All were diagnosed with a unilateral inguinal hernia and had been subjected to routine physical examination of the contralateral side with negative outcomes preoperatively. In case of diagnosing a bilateral hernia the patient was excluded from analysis. Occult contralateral defects were found peroperatively during laparoscopy in 13% of all 1,681 included patients. Two types of occult defects were found. Firstly, an evident occult hernia was found with an orifice size allowing herniation of intra-abdominal contents. This was the case in 8% of the patients and an immediate repair was undertaken. Secondly, a so called incipient occult defect was found in 5% of the patients. An incipient hernia is a looming or a beginning hernia, with a true peritoneal sac and a true hernia orifice, but the orifice is too small and too shallow to allow any actual herniation of intra-abdominal contents through the abdominal wall. In these patients no immediate repair was undertaken and patients were followed. After a follow-up period of more than 9 years, 21% of the patients developed a symptomatic inguinal hernia at their contralateral side. Immediate repair of such an incipient hernia will prolong surgery with 5-10 minutes and will add operative costs with the prize of an additional mesh. Yet, it will prevent a second operation in the future, diminish convalescence, saves preoperative assessment by surgeon and anaesthesiologist, saves actual operative time and hospital admittance, and is therefore in most countries cost-beneficial, with no differences in morbidity compared to unilateral repair [32, 33]. Patients should preoperatively be informed about the possible contralateral finding and consent on immediate repair. We consequently concluded that immediate repair of an occult contralateral defect is recommended no matter its size.

Another prevalent phenomenon encountered during laparoscopic preperitoneal exploration in hernia surgery is the finding of an inguinal lipoma that can accompany or mimic an inguinal hernia. The incidence of inguinal lipomas discovered during hernia surgery is as high as 21-26% [34, 35]. Lipomas in the groin are regarded as of significant importance since they can mimic an inguinal hernia or a recurrence after inguinal hernia repair [36, 37]. The patient presents with an inguinal bulge, but during surgical exploration no hernia sac is found. Lipomas in the groin are therefore considered as a pitfalls in hernia surgery [38]. With the extension of our experience with laparoscopic inguinal hernia repair and these lipomas, we noticed that two different lipomas exist. In the literature so far, no distinction as such is made, presumably because the origin of the lipomas remains unrevealed in the anterior approach of the inguinal canal. We conducted a study to describe the different lipomas in the inguinal region, their origin, clinical behaviour and the according treatment (Chapter 5). We analyzed 854 consecutive laparoscopic inguinal
hernia repairs. In 24% of the patients an inguinal lipoma was found. The first most common inguinal lipoma in our series is the plica lipoma, originating from the plica umbilicalis medialis. This lipoma was found in 68% of the patients in whom an inguinal lipoma was present. The plica lipoma is closely related to the peritoneum and can present with or without a peritoneal sac. As plica lipomas protrude through the insufficient abdominal wall or a dilated internal ring, they present as a direct or indirect hernia. In due time, they may develop to true hernias with a peritoneal sac, since these lipomas are closely related to the peritoneum. A peritoneal protrusion gradually comes along with the herniating lipoma, resulting in a paraperitoneal hernia. Therefore, plica lipomas that herniate without a peritoneal sac should also be regarded as incipient true hernias and be treated as such. The second most common lipoma in our series is the Bogros lipoma, originating for the preperitoneal Bogros space, lateral to the internal ring. This lipoma was found in 32% of the patients in whom an inguinal lipoma was present. As these lipomas run along the spermatic cord through the internal ring they can mimic an indirect inguinal hernia. Bogros lipomas are not related to the peritoneum, but to the preperitoneal fat. A Bogros lipoma should therefore not be regarded as a true hernia. When a solitary Bogros lipoma is found without simultaneous herniation of a peritoneal sac in a patient with an asymptomatic bulge in the groin, treatment is not necessary from a medical point of view. There is no evidence that reduction of a solitary herniating Bogros lipoma leads to any risk reduction of developing an inguinal hernia or improved health. When a Bogros lipoma is encountered with a concomitant peritoneal sac, the Bogros lipoma should always be reduced to prevent confusion postoperatively and during follow-up. A Bogros lipoma left in situ can easily be mistaken for a recurrence. If it would be possible with imaging studies to distinguish between a solitary Bogros lipoma and a true inguinal hernia or plica lipoma, one could refrain from surgical treatment in the case of a solitary Bogros lipoma. In our studies 28 (3%) out of 854 patients had a solitary Bogros lipoma. In the Netherlands approximately 30,000 inguinal hernia repairs are done annually. If according to our studies 3% of the patients present with a solitary Bogros lipoma surgery can be dispensible in 900 patients annually. We suggest to use our proposed nomenclature for inguinal lipomas. Future studies should reveal whether preoperative differentiation with imaging modalities is possible to apply such strategy towards inguinal lipomas.

Almost 10-15% of all hernia repairs concern repairs of recurrent groin hernias and are therefore considered to be an important surgical problem [39, 40]. The risk for a hernia to recur increases every time a hernia recurs as demonstrated by the outcomes of the Swedish Hernia Register. At 24 months of follow-up the risk for having a reoperation is 4.6% after recurrent hernia repair compared to 1.7% after primary hernia repair [41]. A definite method still needs to be found for dealing with recurrent groin hernias to prevent that surgical repair fails in 1 out of 20 patients. It is unclear which technique should be used to correct a recurrent hernia after previous laparoscopic repair. The European Hernia Society Guidelines recommend a recurrence to be repaired posteriorly after an anterior repair and vise versa, based on consensus of an expert committee. A repeated posterior laparoscopic approach is considered to be more difficult, due to scarring of the peritoneum that has occurred following the previous posterior approach and subsequently an increased risk of complications. In a retrospective study, we determined the safety, the feasibility and the reliability of a repeated laparoscopic repair for a recurrent hernia after previous posterior inguinal hernia repair (Chapter 6). Fifty-three repairs were done in 51 patients for recurrent hernias after previous posterior repair. In two-thirds of the patients the recurrence was located medially or caudally from the previous placed mesh. Two attempted repairs had to be converted to an open technique due to severe adhesions. One intraoperative complication was encountered when the vas deferens was ligated during surgery due to adhesions of the previous placed mesh. Nine patients encountered a postoperative complication such as hematoma or seroma. No mesh infections were reported. At a mean follow-up of 70 months 4 patients developed a portsite hernia. Four patients had complaints of post-operative pain and were restricted in daily activities due to groin pain. The mean VAS-score (scale 0-100) of all patients was 5.7 (range 0-61). No recurrences were found at physical examination. It is concluded that the repeated laparoscopic procedure is a definite repair for any recurrent inguinal hernia. The procedure is feasible, safe and reliable. We do consider the repeated laparoscopic technique to be difficult and we think that the number of required procedures to reach competence is larger compared to primary laparoscopic inguinal hernia repair. In a specialized or high volume centre such techniques might be easier adopted and taught to surgical residents or hernia surgeons.

Since the introduction of tension-free mesh repair, new meshes and fixation techniques are continuously introduced by the medical industry. It is of utter importance as a surgeon to receive feed-back on the technique and material used by adequate follow-up. The gold standard in follow-up is clinical visit with a physical examination. This method is time consuming, and most patients in absence of any complaints will apt to refraining. There is some experience with different methods of follow-up, such as written questionnaires. Even though this method is much less laborious, many false-positive test results were found and asymptomatic recurrences remained unidentified. Written questionnaires were concluded to be unreliable as method of follow-up [42-44]. In search of a simple, practical and reliable method of follow up to detect asymptomatic and symptomatic recurrences we developed a new method, the “Post-Inguinal repair Questionnaire by telePHONE”
A telephonic questionnaire was designed containing 4 elements; 3 questions about the operated groin and instructions for a physical examination carried out by the patient himself including a do-it-yourself Valsalva-maneuver. We conducted a prospective study including 300 patients to validate the PINQ-PHONE by comparing it to a physical examination at clinic (gold standard). Altogether 5 recurrences were diagnosed; of which 3 were symptomatic and 2 were asymptomatic. None of these patients had consulted a physician yet. All of them scored positively to one or more elements of the PINQ-PHONE. Two-hundred-fifty-two patients scored negatively to all elements and none of them had a recurrence. The overall sensitivity of the PINQ-PHONE was 1.00, meaning that all recurrences, either symptomatic or asymptomatic, were detected by the PINQ-PHONE. The outcomes of the PINQ-PHONE imply that when a patient responds negatively to all elements of the PINQ-PHONE, the physician can be 100% sure that the patient has no recurrence, symptomatic or asymptomatic. If the patient responds positively to one of the elements of the PINQ-PHONE a recurrence cannot be excluded. These patients should be invited for a clinical assessment. In our series 48 patients responded positively to one of the elements, of which 5 patients had a recurrence and 43 patients had not. This implies that 14% of the patients will be invited to clinic to exclude a recurrence. This outcome has a huge impact on the daily practice of a hernia surgeon. Follow-up after inguinal hernia repair can now firstly be carried out by the PINQ-PHONE and if scored positively to one of the elements, subsequently at clinic. By implementing this method 84% of the patients can refrain from visiting clinic, saving large amounts of time of the physician and also of the patient. None of the recurrences will be missed, all of them will be detected. For physicians to gain reliable feedback of the outcomes of their inguinal hernia surgery, it is of utter importance to detect asymptomatic recurrences as well. Until now, this could only have been obtained by examining all patients at clinic. We conclude that the PINQ-PHONE is a reliable, practical and simple method of follow-up after inguinal hernia repair to detect both symptomatic and asymptomatic recurrences.

Waiting for elective surgery is one of today’s concerns in health care. The consumption of health care increases and consequently waiting lists are prolonged. The Canadian “Health Services Access Survey” showed that two-thirds of the patients who are waiting for elective surgery, such as hernia repair, experience worry, anxiety and stress and one third of the patients has problems with their daily activities due to waiting [45]. To improve access to surgery for groin, umbilical and epigastric hernias an initiative for a joint Hernia Clinic was developed in February 2006 at the Queen Elizabeth II (QEII) Health Sciences Centre in Halifax, Nova Scotia, Canada. Until that time, patients with hernias had been referred to any of the general surgeons at the QE II. Patients were assessed by the individual surgeons and booked for surgery in the operating time allotted to the individual surgeons. Waiting times for initial consultation and surgery varied widely across the general surgeons’ offices due to variation in case load and focus of practice. Some patients had to wait as long as 18 months for surgical repair of a hernia. One of the concerns regarding a group model of care is patient compliance. We designed a patient survey to assess patient compliance with this group model of care in the Hernia Clinic (Chapter 8). The Hernia Clinic is a joint clinic run by general surgeons, surgical residents, medical students, nurses, data managers and administrative assistants. When surgery is indicated, patients are placed on a common waitlist for hernia surgery. The administrative office books surgery in the operating time designated for hernia surgery. Patients are operated by the first available surgeon whom they would meet the day of surgery, or by their attending surgeon on request. The wait time from referral by the family doctor to initial consult in the Hernia Clinic decreased from 208 days in 2007 to 59 days in 2009. A questionnaire of 19 items was developed to assess patients’ compliance with the Hernia Clinic and their comfort with different physicians involved in their care. Altogether, two-thirds of all patients were comfortable having their surgery done by a surgeon whom they meet the day of surgery. Patients showed high confidence in the operating surgeon, even if they had only just met this surgeon (86%). These results show the great public support to a group model of care and results stimulate expanding the group model of care to decrease waiting times and use health care resources more efficiently. Ongoing documentation and uniform analysis of patient compliance data is mandatory to enhance transformation to patient centered health care.

In the last decade two guidelines on inguinal hernia repair have been developed by international surgical societies, the European Hernia Society (EHS) Guidelines in 2009 and the International EndoHernia Society (IEHS) in 2011 [3, 24]. Both guidelines are written by a group of hernia experts based on best available evidence and expert opinion. The guidelines provide hernia surgeons with tools for the daily hernia practice. In 2012 the European Association of Endoscopic Surgery (EAES) initiated a Consensus Development Conference. The aim of this conference was to develop guidelines, based not only on best available evidence and expert opinion, but also on consensus amongst members of the EAES. An international expert panel critically appraised the available evidence and made statements on a variety of aspects of laparoscopic inguinal hernia repair prior to the conference with the members of the EAES. During the conference members were enabled to vote for all the statements and level of consensus per statement was calculated. A manuscript was written, providing best available evidence, expert opinion and opinion of the members of the EAES expressed in level of consensus (Chapter 9). Remarkably, the level of consensus was not related to the level of evidence, showing the true meaning and
additional value of such a conference. For example, in case of a statement based on a level of evidence of 1A according to the Oxford Classification, recommendations are based on a systematic review of (homogenous) randomized controlled studies. The Oxford Classification however, is a methodological classification, but does not refer to the level of quality of surgical technique being studied or the applicability of such a technique in daily practise. The opinion of the members of a surgical society is therefore not equivalent to best available evidence and of additional value in providing tools to the hernia surgeon.

CONCLUSIONS OF THIS THESIS
Watchful waiting is safe in patients who have an asymptomatic or minimal symptomatic inguinal hernia for more than 3 months, are younger than 50 years and have an ASA class of 1 or 2.

The inguinal occlusion test in combination with a handheld Doppler device to locate the epigastric vessels is a reliable and accurate method in differentiating in hernia type and can help the surgeon in operative planning and training programs.

Occult contralateral hernias are a frequent encountered phenomenon and should be repaired immediately, no matter the size of the orifice of the occult hernia defect.

Two types of inguinal lipomas can be distinguished; the plica lipoma and the Bogros lipoma. The plica lipoma should be regarded as a true hernia, while the Bogros lipomas should not.

A repeated laparoscopic repair after previous posterior repair is a safe, reliable, feasible and definite method in treating recurrent hernias.

The PINQ-PHONE is a simple, reliable, practical and little time-consuming method of follow-up after inguinal hernia repair.

There is high patient compliance with a group model of care.

The level of consensus amongst members of a surgical society (such as the EAES) does not correspond to the level of evidence.
FUTURE PERSPECTIVES

Optimal management of inguinal hernias has not yet been firmly established in spite of vast experience with surgical repairs for more than one century. During the past thirty years, two major transitions have occurred in the management of inguinal hernias: substitution of the tension repair by the tension free repair employing mesh, followed in the 1990’s by introduction of minimally invasive techniques to repair inguinal hernias. Use of both extraperitoneal (TEP) and transabdominal routes (TAPP) to the inguinal region have added two more procedures to the armamentarium of surgical repairs of inguinal hernia rendering determination of the optimal management more complex. Where are we now and where should we go next?

The majority of surgeons appears to have accepted the use of tension free repairs with mesh in adult patients with inguinal hernias. This leaves the options of open surgery and minimally invasive surgery for the patient and the surgeon. Do we know what is best for the patient? There is accumulating evidence that chronic pain and recurrence of the inguinal hernia are less likely after minimally invasive surgery. However, sufficient experience is, as in all interventions, essential to yield these favourable outcomes. TAPP and TEP to a greater degree are technically more challenging than open mesh repair of inguinal hernias. This is reflected by a large number of procedures, 50 to 100, required to reach proficiency. And, unlike in open surgery, minimally invasive repair of large scrotal hernias provides an additional technical challenge while previous prostate or bladder surgery with subsequent distortion of the retropubic anatomy obviate the possibility of a minimally invasive repair. Hence, patient’s characteristics, surgeon’s skills and expertise play an important role in selecting the technique of choice in the individual patient. New randomized trials with timely and accurate measurements of direct and indirect costs, quality of life and long term outcomes at a time that expertise in minimally invasive surgery approaches that of open surgery appear prudent. Such studies will reveal the value of both minimally invasive and open repair of inguinal hernias, and contribute to establishing guidelines based on solid scientific evidence.

The discussion on the necessity to place mesh prophylactically in patients with direct hernias takes place simultaneously with a debate whether surgical repair is necessary in elderly patients with asymptomatic inguinal hernias. Anticipation and keeping aloof go hand in hand. Long term observational studies in large cohorts of patients are necessary to learn more about the natural course of inguinal hernias. This will allow identifying those who are at risk and providing unique advice to the individual patient. Hence, personalized surgery would come within reach.

Development of light weight meshes with physical properties which comply with those of the abdominal wall, and manufacturing glues, which are administrated separately or are integrated in the mesh, replacing sutures, staples and tackers, may reduce the risk of chronic pain and discomfort. Close evaluation of the use of new technologies either in randomized clinical trials or registries is mandatory. Follow-up is therefore essential. The PINQ-PHONE method provides a time saving follow-up method to select patients who need physical examination to rule out a recurrent hernia. Only 16% of the patients need to come to the clinic utilizing this method.

Inguinal hernia surgery is currently recognized to benefit from experienced surgical teams. In Western Europe, several surgeons have dedicated themselves to inguinal hernia surgery and have developed streamlined care pathways for patients with inguinal hernias. Governmental bodies and insurance companies are progressively requesting that individual surgeons perform a minimal number of hernia repairs annually to improve the outcomes of hernia surgery. Audits of these specialized centres and of other hospitals without a structured focus on inguinal hernia surgery will reveal the added value of centralizing inguinal hernia surgery.

Surgeons and patients seek standardization of procedures and consistent guidelines. At the present time, high level evidence is not readily available for all aspects of management of inguinal hernias to develop guidelines based on scientific evidence. Consensus conferences such as done by the EAES in 2012 combine the best available evidence with the opinions of experts and the surgical community to provide guidelines and recommendations. The European Hernia Society, International Endo Hernia Society and the European Association for Endoscopic Surgery are currently in the process of a joint European consensus conference on both open and minimally invasive surgery in patients with inguinal hernias.

In conclusion, clinicians, patients, researchers and the industry need to collaborate closely to develop, record, evaluate and implement new techniques to offer patients with inguinal hernias optimal and personalized surgery.
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CHAPTER 11

NEDERLANDSE SAMENVATTING
De liesbreukcorrectie is een van de meest uitgevoerde operaties van de algemeen chirurg. Jaarlijks worden meer dan 20 miljoen liesbreuken wereldwijd geopereerd. In dit proefschrift worden verscheidene aspecten van het "zorgpad" liesbreuk besproken. We volgen daarbij het pad en de chronologie van de patiënt met een liesbreuk waarbij de operatie-indicatie, het lichamelijk onderzoek, de operatieve overwegingen, de methode van follow-up, de organisatie van een liesbreukenkliniek en de beschouwing van de literatuur aan bod komen.

Indien er sprake is van een symptomatische liesbreuk luidt het algemene advies om de liesbreuk chirurgisch te herstellen. De gouden standaard voor chirurgisch herstel maakt gebruik van een mat die spanningsloos over het defect in de achterwand van het lieskanaal wordt geplaatst. Deze mat kan zowel aan de anteriele zijde van het defect geplaatst worden, zoals bij de veelvoorkomende lichtenstein plastiek, alsook aan de posteriele zijde van het defect, zoals bij de laparoscopische TEP en TAPP techniek. Het leerpocess voor liesbreukchirurgie start vroeg in de chirurgische opleiding en is aanzienlijk korter voor een open anteriele procedure dan voor een laparoscopische posteriele procedure. De morbiditeit en mortaliteit na liesbreukchirurgie zijn laag. Liesbreukchirurgie wordt als betrouwbaar en veilig beschouwd. De meest voorkomende korte-termijn complicaties zijn hematoom, seroorn en wondinfectie. De meest voorkomende lange-termijn complicaties betreffen pijn en recidief. De laatstes jaren is er meer aandacht gekomen voor postoperatieve chronische pijn, omdat dit vaker bleek voor te komen dan initieel gedacht. Recent bleek dat ongeveer 11% van de patiënten chronische pijn heeft na een liesbreukoperatie. Tot op heden wordt geen uniforme methode toegepast om pijn te kwantificeren en registreren, waardoor het moeilijk is om duidelijke conclusies te trekken en om uitkomsten van verschillende studies met elkaar te vergelijken. Het recidiefpercentage na liesbreukchirurgie bedraagt 1-4%.

In twee derde van de patiënten betreft de symptomatologie van een liesbreuk zwelling in de lies met pijn of ongemak. Zoals eerder genoemd, luidt het behandelingadagium chirurgisch herstel. Echter, één derde van de patiënten presenteert zich met een niet pijnlijke zwelling in de lies. Omdat chirurgisch herstel niet zonder risico is en omdat kritisch gekeken wordt naar kosten in de zorg, werd het nut van liesbreukcorrectie bij patiënten met een asymptomatische liesbreuk ter discussie gesteld. In 2006 verschenen twee gerandomiseerde studies gepubliceerd. Daaruit blijkt dat de meeste patiënten met een asymptomatische liesbreuk uiteindelijk toch pijnklachten ontwikkelden en in aanmerking komen voor chirurgisch herstel. Nauwkeurige observatie lijkt nog steeds een veilige optie, maar de kosteneffectiviteit dient in de toekomst opnieuw bekeken te worden.

Voor het diagnosticeren van een liesbreuk kan veelal volstaan worden met een lichamelijk onderzoek en zelden is aanvullende diagnostiek benodigd, zoals echo of MRI. Differentiatie in het type liesbreuk, te weten mediaal of lateraal, wordt als moeilijk en uitdagend beschouwd bij lichamelijk onderzoek, maar ook bij aanvullende modaliteiten. Omdat deze wetenschap zelden iets veranderd aan de indicatie tot operatie of operatietechniek, wordt er erin ingegaan op basis van de operatieindicatie. Echter, sommige chirurgen propageren indien er sprake is van een unilateral mediale breuk bij de oudere patiënt, om gelijktijdig een profylactische mat te plaatsen aan de contralaterale zijde. Gedacht wordt dat het risico op het ontwikkelen van een tweede liesbreuk aan de contralaterale zijde verhoogd is in deze groep. Daarbij is het laparoscopisch corrigeren van een mediale breuk gezien de beperkte dissectie simpeler dan het corrigeren van een laterale breuk. Preoperatieve kennis van het type breuk draagt dan wel degelijk bij aan de preoperatieve planning en ook in trainingsverband. Om die reden hebben we een prospectieve studie uitgezet om bij 200 patiënten vast te stellen of het mogelijk is om op basis van het lichamelijk onderzoek onderscheid te maken tussen een mediale en laterale liesbreuk (hoofdstuk 3). Bij de eerste 100 patiënten werd de vinger-occlusie test gebruikt om preoperatief onderscheid te maken en werden deze uitkomsten vergeleken met de intra-operatieve bevindingen (gouden standaard). De vinger-occlusie test houdt manuele reductie van de liesbreuk in, met tegelijkertijd compressie op de vermoedelijke annulus internus. Bij het uitvoeren van de Valsalva
maneuvr wordt gekeken of de breuk direct tevoorschijn komt gedurende de compressie
op de annulus internus (mediale liesbreuk) of pas later bij het loslaten van de annulus internus (laterale liesbreuk). Het bleek dat middels deze methode een correctie diagnose
kon worden gesteld in 86% van de patiënten wanneer het een laterale breuk betrof, maar bleek bij patiënten met een mediale liesbreuk onnauwkeurig. Bij de tweede groep van 100
patiënten werd de vinger-occlusie test uitgebreid en werd lokalisatie van de epigastrische
vaten met een Doppler-apparaatje toegevoegd om zo de vermoedelijke plek van de
annulus internus nauwkeuriger te bepalen. De uitkomsten verbeterde aanzienlijk en nu
was de diagnose correct in 93% van de laterale breuken en in 79% van de mediale
breuken. Geconcludeerd werd dat middels deze nieuwe methode accuraat
differen teerd kan worden tussen mediale en laterale liesbreuken.

Wanneer chirurgisch herstel van een liesbreuk geïndiceerd is, bestaan er grofweg twee
chirurgische methoden. De eerste methode betreft de open methode waarbij de
achterwand van het lakensaal via een anterieure wijze benaderd en versterkt met een
mat wordt. De tweede methode betreft de laparoscopische methode waarbij de
achterwand van het lakensaal via een posterieure wijze benaderd en versterkt met een
mat wordt. Deze laparoscopische methode kan zowel via een pre-peritoneale route
uitgevoerd worden zoals bij een TEP (total extraperitoneal repair) alsook via de intra-
abdominale route zoals bij een TAPP (transabdominal preperitoneal repair). Een voordeel
van de open benadering is dat deze operatie ook onder lokale verdoving uitgevoerd kan
worden. Minder postoperatieve pijn, snel herstel en de mogelijkheid om direct de
contralaterale zijde te inspecteren en eventuele contralaterale defecten te corrigeren zijn
voordelen van een laparoscopische operatie. Een dergelijk contralateraal defect wordt ook
wel een occulte breuk genoemd. Bij patiënten met een unilaterale symptomatische
liesbreuk, wordt bij mogelijk 51% een occulte contralaterale breuk gevonden. Hoewel men
nen zeker weet of een dergelijke breuk symptomatisch kan worden en wetenschappelijk
bewijs daarvoor ontbreekt, wordt in het algemeen toch geadviseerd om een occulte breuk
direct te corrigeren. Om deze reden hebben we een retrospectieve studie opgezet om de
incidentie van occulte breuken vast te stellen en het natuurlijke beloop van
asymptomatic occulte breuken te vervolgen (hoofdstuk 4). Alle patiënten die tussen
1993-2010 aan een unilaterale liesbreuk werden geopereerd werden geïncludeerd. Geen
van hen had preoperatief een zwelling aan de contralaterale zijde bij routine lichamelijk
onderzoek. Indien dat wel het geval was, werd de patiënt geëxcludeerd. Tijdens de
laparoscopische liesbreukcorrectie werd bij 13% van de 1681 geïncludeerde patiënten een
occulte contralaterale liesbreuk gevonden. Er werden twee soorten occulte defecten
gevonden. Ten eerste was er bij 8% van de patiënten sprake van een evidentie breuk,
waarbij de breukpoort zo groot was dat herniati e van intra-abdominale organen mogelijk
was. Indien een dergelijke breuk werd gevonden werd deze direct gecorrigeerd. Ten
tweede werd er bij 5% een zogenaamde hernia incipiens gevonden, ofwel een “dreigende”
breuk. Een dreigende breuk is een beginnende breuk met een heuse breukpoort en
peritoneale intrekking, maar waarbij de breukpoort te klein is om herniati e van intra-
abdominale organen toe te laten. In dat geval werd er geen correctie ondernomen en
werden de patiënten vervolgd. De patiënten werden postoperatief niet geïnformeerd over
de aanwezigheid van de occulte hernia incipiens aan de contralaterale zijde. Na follow-up
van meer dan 9 jaar had 21% van de patiënten waarbij een hernia incipiens peroperatief
werd gediagnosticeerd een symptomatische breuk ontwikkeld aan diezelfde zijde.
Indien een hernia incipiens direct gecorrigeerd wordt, verlengt dit de operatie met 5-10
minuten en worden de totale operatieve kosten verhoogd met de toegenomen operatietijd
en een extra kunststof matje. Echter, directe correctie voorkomt een toekomstige
operatie, met bijbehorend ziekteverzuim, preoperatieve consultatie van een chirurg en
anesthesist en ziekenhuisopname, en is daarom in de meeste landen kosteneffectief,
zo zonder verschillen in morbiditeit en mortaliteit vergeleken met unilateraal herstel. We
concludeerden daarom dat in het geval van een occulte breuk aan de contralaterale zijde,
directe correctie aanbeveling verdient, ongeacht de grootte. Patiënten met een
unilaterale liesbreuk kunnen daarom preoperatief geïnformeerd worden over de
mogelijkheid van het aantreffen van een symptomatische breuk aan de contralaterale
zijde en eventueel instemmen met directe correctie.

Een ander veelvoorkomend fenomeen bij de liesbreukchirurgie is het aantreffen van een
inguinaal lipoom tijdens de preperitoneale exploratie. Een inguinaal lipoom is een lipoom
in de lies dat een liesbreuk kan vergezellen, maar ook solitair kan voorkomen. De patiënt
presenteert zich dan met een zwelling in de lies, maar tijdens intra-abdominale inspectie
wordt geen peritoneale intrekking gevonden. Wanneer het peritoneum geopend wordt,
can een hernierend lipoom gevonden, zonder evidentie breukzaak. Om deze reden wordt
een inguinaal lipoom als een valkuil gezien binnen de liesbreukchirurgie. Ook kunnen
inguinale lipomen een recidief na liesbreukchirurgie imiteren. De incidentie van het
inguinaal lipoom betreft 21-26%.

Tijdens het uitbreiden van onze laparoscopische liesbreuk ervaring hebben we twee
verschillende inguinale lipomen onderscheiden, welke alle twee verschillende inguinaal
li pomen ontdekt, in de literatuur wordt tot dusver geen onderscheid gemaakt tuss en de twee
enti teiten, vermoedelijk omdat de origine van de twee verschillende inguinaal lipom en verborgen blijft bij een open anterieure benadering van
het lakensaal. In hoofdstuk 5 beschrijven we de origine, klinische presentatie en
bijbehorende behandeling van de twee verschillende inguinaal lipomen. We hebben 854
opeenvolgende laparoscopische liesbreukcorrecties geanalyseerd. In 24% van de
liesbreukcorrectie was een inguinaal lipoom aanwezig waarbij we onderscheid konden
makten tussen twee entiteiten. Het meest voorkomende inguinale lipoom (68%) is het plica lipoom dat zijn oorsprong vindt aan de plica umbilicalis medialis. Dit lipoom is nauw gerelateerd aan het peritoneum en kan zich met of zonder peritoneale intrekkings/ breukzak presenteren. Dit lipoom kan zowel door een insufficiënt achterwand herniën als een mediale breuk, als door de verwijde annulus internus als een laterale breuk. Met verloop van tijd, zouden deze plica lipomen zich tot echte liesbreuken kunnen ontwikkelen, vanwege de nauwe relatie met het peritoneum. De peritoneale protrusie zal geleidelijk toenemen met het hernierende lipoom, resulterend in een glijbreuk. Om die ontwikkelen vanwege de nauwe relatie met het peritoneum. De peritoneale protrusie zal vanuit een medisch oogpunt geen strikte indicatie om het Bogros lipoom te behandelen. In onze serie von den we bij 3% van de patiënten een solitair Bogros lipoom worden gevonden zonder vergezellende peritoneale intrekkings. Een Bogros lipoom wordt om die reden niet als een ware liesbreuk beschouwd. Indien een solitair Bogros lipoom wordt gevonden zonder vergezellende peritoneale intrekking is er vanuit een medisch oogpunt geen strikte indicatie om het Bogros lipoom te behandelen. In onze serie vonden we bij 3% van de patiënten een solitair Bogros lipoom zonder peritoneale intrekkings. Er is geen bewijs dat de repositie van een hernierende Bogros lipoom leidt tot risicoreductie voor het ontwikkelen van een liesbreuk of tot een verbeterde fysieke toestand. Indien een Bogros lipoom echter simultaan met een liesbreuk gevonden wordt, moet het Bogros lipoom altijd gereponeerd worden om postoperatieve verwarring te voorkomen. In Bogros lipoom dat in situ wordt gelaten kan gemakkelijk voor een recidief worden aangezien. We stellen voor om de bovengenoemde benaming van de inguinale lipomen toe te passen. Toekomstige studies kunnen aantonen of het mogelijk is om preoperatief met beeldvormende modaliteiten een onderscheid te maken tussen de verschillende lipomen en eventuele behandelstrategie daarop aan te passen.

Bijna 10-15% van alle liesbreukoperaties betreft een correctie van een recidief liesbreuk. De correctie van een recidief liesbreuk wordt als moeilijk beschouwd. De uitkomsten van het Zweedse Liesbreuk Register tonen aan dat de kans op een recidief steeds groter wordt naarmate de liesbreuk vaker recidiveert. Na 24 maanden is de kans op een recidief 4.6% na correctie van een recidief liesbreuk, vergeleken met 1.7% na een primaire liesbreukoperatie. Er is tot dusver geen definitieve techniek gevonden om te voorkomen dat 1 op de 20 chirurgische recidiefcorrecties faalt.
een simpele, praktische en betrouwbare methode van follow-up na liesbreukchirurgie ontwikkelden wij een nieuwe methode, de "Post-INguinal hernia repair Questionnaire by telePHONE" (PINQ-PHONE) die wij beschrijven in hoofdstuk 7. We ontwikkelden een telefonische vragenlijst die 4 elementen omvat; drie vragen over de geopereerde lies en instructies voor het uitvoeren van een zelfonderzoek middels een do-it-yourself Valsalva manoeuvre. We voerden een prospectieve studie uit met 300 patiënten om de PINQ-PHONE te valideren door deze te vergelijken met poliklinisch lichamelijk onderzoek als gouden standaard. In totaal werden 5 recidieven gevonden waarvan drie recidieven symptomatisch waren en 2 asymptomatisch. Geen van deze vijf patiënten was bij een arts geweest wegens het recidief. Alle vijf patiënten scoorden op één van de elementen van de PINQ-PHONE positief. Tweekhonderd-en-twee-en-vijftig patiënten scoorden negatief op alle vier de elementen van de PINQ-PHONE en geen van hen had een recidief bij lichamelijk onderzoek. De overal sensitiviteit van de PINQ-PHONE was 1.00, wat betekent dat alle recidieven zowel symptomatisch als asymptomatisch werden gedetectedeerd door de PINQ-PHONE. De uitkomsten tonen aan dat indien een patiënt negatief scoort op één van de elementen van de PINQ-PHONE een recidief met 100% zekerheid uitgesloten kan worden. Indien een patiënt positief scoort op een van de elementen van de PINQ-PHONE kan een recidief niet uitgesloten worden en dient de patiënt uitgenodigd te worden voor een poliklinisch bezoek. In onze serie betrof dit 48 patiënten waarvan 5 patiënten een recidief hadden, en 43 patiënten niet. Dit houdt in dat 14% van de totale patiëntengroep recidieven te zien had die voor een poliklinisch bezoek werden uitgenodigd om een recidief uit te sluiten. Deze uitkomst kan grote invloed op de dagelijkse praktijk van een liesbreukchirurg hebben. Follow-up na liesbreukchirurgie kan nu betrouwbaar uitgevoerd worden door eerst de PINQ-PHONE af te nemen, en indien een patiënt positief scoort op één van de elementen vervolgens uit te nodigen voor een poliklinisch bezoek. Indien deze methode toegepast wordt, weerhoudt men 84% van de patiënten een onnodig bezoek naar de polikliniek. Geen enkel recidief wordt gemist, of deze nu symptomatische os asymptomatisch is. We concluderen daarom dat de PINQ-PHONE een betrouwbare, praktische en simpele methode van follow-up na liesbreukchirurgie is om recidieven op te sporen.

In electieve chirurgische zorg, zoals liesbreukchirurgie, zijn wachtijden een belangrijk punt van aandacht. Omdat de jaren de zorgconsumptie toeeneemt, worden wachtijden langer. In Canada werd een onderzoek verricht door de overheid waaruit bleek dat twee derde van de patiënten die wachten op electieve chirurgie angst, zorgen en stress ervaren vanwege het wachten. Eén derde van de patiënten heeft zelfs problemen met het uitvoeren van de dagelijkse activiteiten vanwege het wachten. Om de toegang naar herniachirurgie, zoals lies-, navel- en epigastrische breuken te verbeteren, werd in 2006 in het Queen Elizabeth Health Science Centre in Halifax, Nova Scotia, Canada de "Hernia Clinic" opgericht. Tot die tijd werden patiënten met een breuk naar één van de herniachirurgen verwezen door de huisarts. Op de polikliniek werd de patiënt door de desbetreffende chirurg gezien en werd de indicatie tot operatie gesteld. De patiënt werd op de wachtlijst gezet van de desbetreffende chirurg met zijn specifieke operatie-capaciteit/ mogelijkheid. De wachtijden van het eerste poliklinisch bezoek tot aan operatie varieerden tussen de verschillende chirurgen, afhankelijk van de grootte van de praktijk van de desbetreffende individuele chirurg. Sommige patiënten wachten 18 maanden voor een liesbreukoperatie.

De nieuw opgezetten "Hernia Clinic" is een gezamenlijke praktijk van chirurgen, chirurgen in opleiding, medische studenten, verpleegkundigen, data managers en administratieve medewerkers. Wanneer een patiënt met een breuk naar deze praktijk wordt verwezen, wordt die patiënt door de eerstvolgende beschikbare chirurg op de polikliniek gezien en op een gemeenschappelijke wachtlijst geplaatst. De eerstvolgende beschikbare chirurg zal de patiënt opereren. De patiënt maakt op de dag van de operatie kennis met de opererende chirurg. Op verzoek van de patiënt kan de operatie ook door een specifieke chirurg uitgevoerd worden, met als consequentie dat de wachtijd mogelijk langer is. Met de oprichting van de "Hernia Clinic" werd de wachtijd van verwijzing tot poliklinische bezoek gereduceerd van 208 dagen in 2007 naar 59 dagen in 2009.

Eén van de zorgen in Canada omtrent een dergelijke groepspraktijk is patiënttevredenheid. We hebben daarom een enquête ontwikkeld om de patiënttevredenheid met de "Hernia Clinic" te evalueren. In hoofdstuk 8 beschrijven we de resultaten van deze schriftelijke enquête. Deze bestond uit 19 vragen die betrekking hadden op de tevredenheid van de patiënt met de "Hernia Clinic" en hun ervaring met verschillende chirurgen die betrokken waren bij hun zorg. Twee derde van de patiënten voelden zich op hun gemak om kennis te maken met de opererende chirurg op de dag van de operatie. Het vertrouwen in de opererende chirurg was groot (86%), ondanks dat de patiënten de opererende chirurg pas op de dag van de operatie leerden kennen. Deze resultaten tonen de publieke steun aan het model van een groepspraktijk. De resultaten stimuleren om dit model uit te breiden om zo de wachtijden te reduceren en de beschikbare zorg beter te benutten.

initiatief om een consensus bijeenkomst te organiseren voor alle leden van deze internationale chirurgische vereniging, met als doelstelling om een richtlijn te ontwikkelen die niet alleen gebaseerd is op wetenschappelijk bewijs en expertise van een select gezelschap, maar ook op de mate van consensus van de leden van de EAES. Een internationale geselecteerd panel van de EAES evalueerde de bestaande literatuur kritisch en formuleerde stellingen over verschillende aspecten van laparoscopische liesbreukchirurgie voorafgaand aan de bijeenkomst van alle leden van de EAES. Gedurende deze bijeenkomst die plaatsvond in Brussel, konden alle leden aangeven in welke mate zij het eens waren met de verschillende stellingen. De mate van consensus werd berekend per stelling. Een manuscript werd geschreven (hoofdstuk 9) waarin een overzicht wordt gegeven van het best beschikbaar wetenschappelijk bewijs, de opinie van de experts en de mate van consensus van de leden van de EAES. Opvallend was dat de mate van consensus van de leden van de EAES niet per definitie overeenkomt met de mate van het wetenschappelijke bewijs. Wetenschappelijk bewijs wordt dikwijls beoordeeld op de kwaliteit van de gebruikte methodologie, zoals bij de veel gebruikte Oxford Classification. De gebruikte methodologie zegt echter niets over de gebruikte chirurgische techniek en de toepasbaarheid ervan. De consensus van de chirurgische verenigingen kan daarom verschillen van de wetenschappelijke bewijsvoering en is om die reden van additionele waarde in het opstellen van richtlijnen voor de liesbreuk chirurg.
Oh my, Dr. Transverse, look at the contralateral side, there's another hernia!
CURRICULUM VITAE

Baukje van den Heuvel was born on the 21st of July 1981 in Amsterdam, the Netherlands as the youngest daughter of Johannes Cornelis van den Heuvel and Grietje Wilhelmina de Vries. In 1999 she graduated from high school (Gemeentelijk Gymnasium, Hilversum) and travelled around the world the following year. In 2000 she enrolled the University of Maastricht and studied International Business. After completing the first year she started studying Medicine. During her internships, it soon turned out to be clear that surgery became her field of interest. In 2007 she moved to Halifax, Nova Scotia, Canada and researched inguinal hernias under guidance by prof. dr. H.J. Bonjer at the Dalhousie University. The beginning of this thesis was founded. After six months she returned to the Netherlands and graduated. She started as a surgical house officer at the Slotervaartziekenhuis, Amsterdam, the Netherlands under guidance of dr. B.J. Dwars and dr. E.J. Derksen. Together with dr. B.J. Dwars research on inguinal hernias continued and eventually led to the completion of this thesis. On the 1st of July 2008 she started with her surgical training at the Slotervaartziekenhuis (dr. B.J. Dwars). In 2012 she worked for three months as a surgeon in training at the Sint Elisabeth Hospitaal at Willemstad Curacao (dr. P.R. Fa-Si-Oen). She returned on the 1st of July 2013 to finish her surgical training at the VU Medical Center (dr. D.L. van der Peet). She expects to finish her surgical training on June 30th 2014.
LIST OF PUBLICATIONS


Patient compliance with a group model of care - The Hernia Clinic; B van den Heuvel, B Vair, D Klassen, G Porter, K Inglis, HJ Bonjer; Can J Surg 2012; 55(4): 259-63

Image of the month – Acute abdominal pain with gas in portal vene; B van den Heuvel, BJ Dwars; Nederlands Tijdschrift voor Heelkunde 2011


A rare case of a groin hernia: the Hesselbach’s hernia; B van den Heuvel, RM Munoz Brands, EY Beuerle, BJ Dwars; Hernia 2013 Epub ahead of print

Repeated laparoscopic treatment of recurrent inguinal hernias after previous posterior repair; B van den Heuvel, BJ Dwars; Surg Endosc 2013; 27(3):795-800


Physical examination in the differentiation of inguinal hernia type; a new accurate method; W. Tromp, B. van den Heuvel, B. Dwars; Accepted for publication Surgical Endoscopy

A new valid method of follow-up for detecting recurrences after inguinal hernia repair; The Pinq-PHONE; B. van den Heuvel, J. van Jarwaarde, P. Wicher, E. de Lange-Klerk, H. Bonjer, B. Dwars; Submitted

Inguinal lipomas; a new nomenclature; B. van den Heuvel, J. van den Broek, B. Dwars; Submitted

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Dr. B.J Dwars: Dr D! Waar te beginnen? Woorden schieten tekort. Ik dank je voor je vertrouwen, humor, ruimte die je me geeft om me persoonlijk, professioneel en wetenschappelijk te ontwikkelen, je diplomatieke oplossingen, je enthousiasme, je tips and tricks, je geduld, je correcte en ethische moraal, je nuanceringen, het podium dat je me biedt om mijn werk te presenteren en zichtbaar te worden, de steun, je sympathie en voor de allerleukste momenten op de OK. Je bent een uniek opleider met ongelooflijk veel talenten. Ik had me geen fantastischere opleider en co-promotor kunnen wensen; een lot uit de loterij! We hebben het toch mooi voor elkaar gekregen! Boudewijn, bedankt voor alles! Ik hoop dat Rookje en jij nog lang in mijn vizier blijven, professioneel alsook privé.

Prof.dr. R.R. Bittner: Dear prof Bittner, thank you kindly for your willingness to participate in my thesis committee. It is a true honor to me that you are here today. Thank you for that. You are a great example to us TAPPers!

Prof.dr. J. Jeekel: Beste professor, de eerste keer ontmoette ik u in Halifax. Sindsdien heeft u zich als een soort nestor over mij ontfermd en zei u herhaaldelijk: “Vergeet niet wat je wilt bereiken”. En nu is het zover, het boek is af. Ik wil u heel erg danken voor alle adviezen en inhoudelijke en gezellige gesprekken over de liesbreuken maar ook over de muziek. Ik voel me zeer vereerd dat u plaatsneemt in de leescommissie en ik wil u daar zeer voor bedanken.

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Dr. A.K. Montgomery: Dear Agneta, thank you deeply for being here today. You are a great example to me as a hernia, but also as a female surgeon! You are an inspiring, enthusiastic and very knowledgeable person and I thank you greatly for participating in my thesis committee.

Mede-auteurs: Pieter Wichers, Rutger Munoz Brands, Jorien van Jarwaarde, Joris van den Broek, Nikki Beudeker en Wouter Tromp. Heel veel dank voor al jullie inzet, jullie nauwkeurigheid en ijver. Zonder jullie was dit boek niet af. Het was een groot plezier om met jullie te werken. Ik hoop dat er nog veel wetenschap gezamenlijk tot stand gebracht gaat worden.


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(oud) Assistenten Slotervaartziekenhuis. Lieve allemaal, Sjoerd, Robert, Eva, Yair, Peter, Jesse, Derk, Sybrand, Xander, Wouter, Ingrid, Daan, Jacob, Rutger F, Nicole, Jorgos, Noelle en alle anderen, heel veel dank voor de samenwerking, steun en gezelligheid. Het waren geweldige jaren!


“Inguinal Hernia Surgery; Perspectives Beyond Lichtenstein” is the thesis Baukje van den Heuvel wrote during her surgical residency. The clinical challenges of a hernia surgeon in daily practice inspired Baukje van den Heuvel, Boudewijn Dwars and co-authors to set up a research program and look for answers. The results are presented in this book and offer practical tools, useful for everybody involved in inguinal hernia surgery.

Baukje believes that science should serve all. It should serve patients to be treated better and surgeons to be able to treat better. Therefore, Baukje aimed to present her thesis such that it could be appreciated by surgeons as well as patients. As modern art is one of Baukje’s other interests, it was a logical step to connect the contemporaries Irving Lichtenstein and Roy Lichtenstein; the surgeon and the artist. Simple and colorful comics are used to capture the essence of this thesis and to explain science.

More information can be found on www.baukjevandenheuvel.com