Chapter 1

General introduction and outline of this thesis
The abdominal wall

The abdominal wall serves many functions such as stabilization and movements of the trunk, containment of the viscera and respiration. Adaptation of the abdominal wall to accommodate increasing intra-abdominal volume due pregnancy, obesity or ascites is another distinct feature of the abdominal wall. The strength of the abdominal muscles decreases with age due to reduced activity and degeneration. Decrease of muscle volume and tone results in enlargement of pre-existing hernias of the abdominal wall. The groin, the umbilicus and the hiatus of the diaphragm are sites of predilection for hernia formation. Incomplete fusion of tissues during embryologic development causes epigastric, above the umbilicus, or hypogastric, below the umbilicus, hernias. The intersections of the different layers of the abdominal wall muscles predispose to the development of rare hernias such as Petit and Grynfeltt hernias. Groin hernias, particularly those cranially to the iliopubic ligament are the most common hernias. Annually, more than 25,000 patients with inguinal hernias undergo surgical repairs in the Netherlands.

These congenital hernias, hernias due to ageing together with hernias arising due to impaired healing of incisions of the abdominal wall, i.e. incisional hernias, constitute the entire spectrum of hernias of the abdominal wall. The optimal management of abdominal wall hernias has remained unresolved despite the fact that the first hernia repairs occurred more than two centuries ago.

Incisional hernias

Incisional hernias are defects of the fascia of the abdominal wall, which can only develop after abdominal surgery. Bulging of abdominal contents through the scar is visible and palpable when patients are standing or coughing. These hernias occur in at least 10-15% of patients within 10 years after open abdominal surgery (1). Incisional hernias may be asymptomatic, but are frequently associated with pain or discomfort. Strangulation of herniated bowel is the most concerning consequence of an incisional hernia. Incisional hernias affect the quality of life and economic productivity of patients (2).

Pre-disposing factors for developing an incisional hernia are obesity and post-operative surgical site infections (3). The pathogenesis of incisional hernias is multifactorial. Altered collagen metabolism and extra-cellular matrix disorders are important contributory factors (4).

When considering the ingenious design of the abdominal wall, one would suppose that repair of abdominal wall hernias is complicated. Nevertheless, abdominal wall surgery is generally not considered very challenging.
Incisional hernia repair

Over 100,000 laparotomies are performed annually in the Netherlands, more than 10,000 of these patients will develop an incisional hernia. Eighty percent of all patients with an incisional hernia undergo surgical repair (5). The natural course of an incisional hernia is unknown. It is unclear whether surgery should be recommended to asymptomatic patients to prevent obstruction or strangulation of the bowel. Thirty-three to seventy-eight percent of the patient with an incisional hernia are reported to become symptomatic over time (6,7). The only way to resolve this disease is to repair the hernia surgically.

The aim of an incisional hernia repair is to reestablish the function of the abdominal wall; the barrier between viscera and the external environment, the muscular function and the cosmesis of the abdominal wall should be restored. Before the introduction of synthetic meshes to reinforce the abdominal wall, repairs of incisional hernias were done by primary suture repairs. Recurrence rates of suture repairs, particularly in larger defects, were high at long-term follow up. With the introduction of prosthetic meshes at the end of the nineteenth century, recurrence rates significantly dropped below 15% (8). However, the perfect solution for restoring all abdominal wall functions has not yet been found. Because “mesh repair” is the best available surgical technique so far, it is considered the gold standard. However, the surgical procedure to perform this “mesh repair” is far from standardized.

A wide array of prosthetic meshes is available for incisional hernia repair. Most of these meshes are comparable in terms of adhesion formation and incorporation into the abdominal wall and do not differ in clinically significant outcomes such as post-operative complication rates or recurrences (9,10).

Uniform indications for laparoscopic or open incisional hernia repair have not been determined. Several randomized controlled trials, reviews and meta-analysis have shown that laparoscopic incisional hernia repair is safe and is associated with a shorter hospital stay and fewer wound infections (11-14). Recurrences rates, chronic pain and quality of life after open and laparoscopic incisional hernia repair are similar (1,12,15). Patients with large abdominal wall defects appear to benefit from reconstruction of the midline, which is usually done in open repair, in order to restore the functionality of the abdominal wall (16). The fear for intra-abdominal adhesions due to former (complicated) surgeries might direct the surgeon to choose an open repair. It remains unclear whether the cost-effectiveness of the laparoscopic repair is superior to open surgery (12-14).
Proper evaluation of outcomes of incisional hernia repair requires clear definition of size and location of these hernias. The European Hernia Society (EHS) categorized incisional hernias to facilitate scientific incisional hernia research (17). A classification system of abdominal wall hernias has been formulated. The classification of incisional hernias might help in and defining the optimal treatment approach per subgroup.

Traditional open repair involves repair of the hernia employing the scar of the previous surgery. A preperitoneal, sublay or onlay mesh repair (picture 1), sometimes combined with an augmentation of the abdominal wall through component separation technique can be performed. The mesh is held in position between the muscular layers of the abdominal wall, usually in combination with sutures.

The morbidity of open incisional hernia repair varying from respiratory infections, severe chronic pain, recurrences to wound and mesh infections occur in 15 percent of patients. The position of the mesh whether onlay, inlay or sublay does not affect the morbidity rate (2).

Component separation technique is a procedure based on enlargement of the abdominal wall by separating the muscular layers in order to close the abdomen tension-free. The amount of soft tissue dissection that needs to be done in the abdominal wall is considerable, leading to wound related complications in up to 50% of the cases (18). The component separation technique without the use of a mesh should only be used when contents of the gut are present in the abdominal cavity due to perforation of the gut, because bacteria will lodge on the mesh resulting in chronic infection.

Picture 1.
With the growing interest of general surgeons in laparoscopy, which started in the late 1980s, surgeons started to perform laparoscopic incisional hernia repairs (19). The laparoscopic repair entails employment of mesh that is placed intraperitoneally covering the fascial defect while leaving the hernia sac in place. The mesh is fixed to the abdominal wall with transfascial sutures and/or with the use of tackers (picture 2). In general, the fascial edges are not brought together in the laparoscopic repair although some early experiences of laparoscopic closure of the midline have been reported.

![Picture 2.](image)

Repair of incisional hernias is associated with considerable morbidity for the patient as well with costs due to the surgical procedure and loss of economic productivity. A reduction of the complication rate of incisional hernia surgery may lead to earlier recovery, which in turn shortens hospital stay and promotes a faster return to work. Optimizing and standardizing the surgical treatment of patients with an incisional hernia potentially saves our patients morbidity, and could save our society millions of euros.

**Central questions and outline of this thesis**

The main question of this thesis is:

Is it possible to determine the optimal management of incisional abdominal and groin hernias through clinical evaluation, literature research and assessment by experts throughout Europe?
In the first two chapters, the open onlay mesh technique for the repair of large incisional hernias was evaluated. Other open techniques, such as the component separations technique, are accepted for the repair of large incisional hernias. These techniques are invasive and some require entering the abdominal cavity. The modified onlay technique was used to repair the more complicated abdominal wall defects, i.e. after open-abdomen treatment or fascial necrosis. A retrospective analysis of these patients was performed to analyze whether this is an appropriate technique for the repair of large incisional hernias (chapter 2). The next step was to examine the quality of life of these patients after surgery (chapter 3).

Patients with an open abdomen develop a specific form of incisional hernia when there is no delayed fascial closure. A standard approach to the management of an open abdomen is absent. Patients who were treated with an open abdomen at a university hospital and a large teaching hospital were selected and evaluated (chapter 4). A review of the literature was performed to record the outcomes of various methods of fascial closure and correlate these with the development of an incisional hernia.

A large clinical trial randomizing patients with incisional hernias either for open or laparoscopic repair, called the “INCH trial” was started. The aim of this trial is to examine if laparoscopic incisional hernia repair is superior to open incisional hernia repair in terms of hospital stay and return to normal activities. Patients with an incisional hernia suitable for laparoscopic repair are randomized to either laparoscopic or open repair. Alongside the trial, all the patients with an incisional hernia who do not want to participate, whose hernia is considered to be unsuitable for laparoscopic repair and the patients who are treated conservatively will be registered in a prospective database. The preparations of the INCH trial started in 2010 and a study protocol was written (chapter 7). Funding was gained through national and European societies. Ethical approval was obtained and the trial started in July 2012 and is still running.

Two studies were initiated in preparation of the start of the INCH trial. A review was performed to determine the influence of surgical technique (overlap, use of transfascial sutures and type of mesh) on the recurrence rate in laparoscopic incisional hernia repair (chapter 6).

The Carolina Comfort Scale, a disease specific questionnaire to measure quality of life that has been validated in English, was validated in Dutch in order to use this questionnaire in the INCH trial (chapter 5).
While initiating the INCH trial, the Consensus Development Conference on endoscopic groin hernia repair was organized for the European Association of Endoscopic Surgeons (chapter 9). The aim was to provide practical guidelines employing available medical evidence combined with the opinions of an expert panel and the membership of the EAES.
References
