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Introduction

An abdominal wall hernia is an acquired defect or a weakening of an existing opening in the abdominal wall with an intermittent or continuous protrusion of abdominal contents through the opening. The word “hernia” is a Latin word, which means a “tear” or “rupture”.

An abdominal wall hernia occurs in humans far more frequent than in any other mammal. It has left an indelible mark throughout our earliest recorded history and is probably the penalty we pay in evolution due to the ability to distinguish ourselves from other mammals by walking in an erect position. The Egyptians (1500 BC), Phoenicians (900 BC) and ancient Greeks (400 BC) already described abdominal wall hernias and its (surgical) treatments through paintings, sculptures and ancient writings on papyrus. In history, various surgical and non-surgical treatments for (inguinal) hernia repair were used with a total ignorance of the anatomy of the groin, including castration, cauterization, bloodletting and tobacco enemas. It was because of publications by great anatomists and surgeons named Petit (1674 – 1750), Pott (1714 – 1788), Camper (1722 – 1789), Gimbernat (1734 – 1816), Richter (1742 – 1812), Hesselbach (1759 – 1816), Bogros (1786 – 1823) and Fruchaud (1894 – 1960) which helped us to untangle and understand the complexity of the anatomy of the abdominal wall and groin.^{1,2} At the end of the 19th century, the Italian surgeon Bassini developed a novel technique for inguinal hernia repair. He reconstructed the weakened transversalis fascia by suturing the autologous fascial, muscular and aponeurotic layers together, but under significant tension.^{3,4} In the mid-forties, the Canadian surgeon Shouldice further improved this technique by suturing these layers separately. Unfortunately, other surgeons who used this technique could never match the low recurrence rates reported by both Bassini and Shouldice.^{5,6} Even before Shouldice was born, experiments were performed using different woven grafts as reinforcement material in an attempt to reduce recurrence rates after inguinal hernia repair. A real breakthrough was the arrival of the polypropylene mesh; it was strong, biocompatible, could be sterilized and had a low price. By the end of the 1960s an American surgeon named Newman had already successfully used the polypropylene mesh in over 1600 procedures.⁷ Despite this success, it took his colleague Irving Lichtenstein until the eighties to convince the surgical world of a “tension-free” repair using a polypropylene mesh to reinforce the transversalis fascia without approximating the defect.⁸ To date the Lichtenstein repair is still considered the gold standard in open inguinal hernia surgery with recurrence rates of less than 5%, even when performed by non-experts hands. Over the past decades the minimally invasive laparoscopic techniques have made their entrance using a totally extra-peritoneal (TEP) or a trans abdominal pre-peritoneal (TAPP) approach. These techniques are increasingly used and associated with less postoperative pain compared to open inguinal hernia repair.⁹

OUTLINE OF THE THESIS

Abdominal wall surgery comprises the spectrum of procedures used in the treatment of abdominal wall hernias, including inguinal, umbilical and incisional hernias. As a group these are one of the more frequently performed operations worldwide and considered the ideal teaching surgical procedure for young trainees due to the diversity of technical aspects, challenging anatomy, and its relatively low risk of serious complications. This is particularly true for the relatively healthy general population in which abdominal wall hernias are commonly found. However, there are groups of frail individuals prone to an abdominal wall hernia due to their age or underlying disease such as elderly men, premature born infants and patients with liver cirrhosis. In these patients, a surgical procedure should be carefully planned or sometimes even avoided. Both surgery and watchful waiting can lead to serious complications. In the following chapters groups of elderly patients, premature born infants and patients with liver cirrhosis – prior, during and after liver transplantation, are discussed with regard to the incidence of abdominal wall hernias, risk factors associated with it and the (surgical) management of the most common hernias in these specific groups.

Over the last 20 years, the number of general surgical procedures being performed on elderly patients has increased rapidly. Despite more advanced surgical, anesthetic and medical techniques, older patients still continue to suffer more from postoperative complications compared to their younger counterparts.^{10,11} The incidence of inguinal hernias and its repair also appears to increase with age.¹² Literature on this topic is sparse, especially in the middle-aged and elderly population. In **Chapter 2** the data of the Rotterdam Study – a prospective cohort study that started in 1990 in a district of Rotterdam, are analyzed in order to determine the incidence of inguinal hernias over time in men aged 45 years and older, and to gain insight into potential risk factors of inguinal hernia in these men.

To date, there is general consensus that preventing an inguinal hernia from an incarceration per se is not a proper indication to perform inguinal hernia repair. Interestingly, more than one-third of inguinal hernias are not even symptomatic at first presentation. Two randomized trials were performed comparing a watchful waiting strategy and surgical approach in the treatment of mildly symptomatic and asymptomatic inguinal hernia.^{13,14} Both trials reported that no superiority could be found for elective repair over watchful waiting with regard to pain/discomfort. They concluded that watchful waiting is an acceptable strategy for men with minimally symptomatic hernia. However, long-term results showed extremely high crossover rates, especially in older men.^{15,16} In **Chapter 3** the results of a multicenter randomized clinical trial

are described. The value of watchful waiting compared to elective repair in men aged 50 years and older with mildly symptomatic or asymptomatic inguinal hernia will be investigated.

The risk of inguinal hernia repair is not only increased in elderly men, but also in very young patients. Approximately 10 percent of prematurely born infants will undergo inguinal hernia repair before the age of 7, of whom more than half in the first year of life.^{17,18} The most important factor that contributes to the increased risk of inguinal hernias in premature born infants is a persistent processus vaginalis, representing an embryological protrusion of peritoneum that precedes the descent of the testes during the second trimester of pregnancy. Normally it will obliterate immediately after birth. If this process fails, the result is a patent processus vaginalis and birth of a potential congenital or indirect inguinal hernias.^{19,20} In these patients inguinal hernia repair is often postponed until a certain weight or age is reached. Surgery in premature born infants can be technically challenging due to comorbidities and risk of potential anaesthetic complications, especially in prematurely born infants with a very low birth weight (birth weight of 1,500g or less).^{21,22} Postponing surgery however could not only increase the risk of incarceration of contents of the hernia sac, but it might also lead to an even more challenging repair due to a more thickened hernia sac and fibrous adhesions.^{18,22,23} In **Chapter 4** risk factors of emergency surgery in order to optimize inguinal hernia management and timing of repair in prematurely born infants are identified.

Another group of frail individuals, who are generally advised to refrain from surgery unless it is absolutely necessary, are patients with liver cirrhosis and particularly those who suffer from concomittent ascites. Overall morbidity rates are reported as high as 70 percent for patients with cirrhosis undergoing non-hepatic surgery.^{24,25} Although literature on this topic is abundant, it varies highly in quality and is full of individual, not necessarily evidence-based opinions and similarly valued underlying assumptions. **Chapter 5** includes a systematic review to give an overview of which procedures are most hazardous in patients with liver cirrhosis undergoing non-hepatic surgery.

Patients with liver cirrhosis and refractory ascites have a 20 percent risk of developing an umbilical hernia in the course of their disease.²⁶ Despite the high incidence, optimal management of an umbilical hernia in patients with liver cirrhosis remains controversial. It is often advised not to perform umbilical hernia repair in these patients, because of the presumed high peri- and postoperative risk of complications such as bacterial contamination of ascites, worsening of liver function, and high recurrence rates after elective repair.²⁷⁻²⁹ A watchful waiting strategy, however, can

be complicated by incarceration or spontaneous rupture and evisceration following necrosis of the overlying skin. This could lead to an emergency procedure, which puts patients at an even greater risk for serious complications than after elective surgery.^{30,31} In **Chapter 6** the postoperative outcomes of 30 consecutively performed umbilical hernia repairs in patients with liver cirrhosis and ascites with an expected time to liver transplantation of over 3 months are reported.

Based on the results of the prospective cohort study outlined in the previous chapter, in **Chapter 7** the study protocol of a randomized controlled trial is presented. This trial will compare watchful waiting with elective repair of umbilical hernias in patients with liver cirrhosis and ascites.

Umbilical hernias that are not corrected during liver transplantation are still at risk for incarceration of the bowel which can result in serious morbidity or even death.³⁰ Therefore, umbilical hernia repair seems to be warranted in all candidates for liver transplantation in which umbilical hernia repair is not already performed prior to the transplantation. Two approaches for umbilical hernia repair during liver transplantation can be used, either through a separate, umbilical incision or from within the abdominal cavity through the laparotomy wound used to perform the liver transplantation. In **Chapter 8** both approaches are compared in a retrospective study.

As mentioned previously, abdominal wall hernias such as inguinal and umbilical hernias can be congenital, acquired during life, or the result of an underlying disease. In contrast, an incisional hernia is considered a postoperative complication after abdominal surgery. In the general population incidences range between 11 and 20 percent.^{32,33} In patients operated upon for an abdominal aortic aneurysm and in obese patients undergoing abdominal surgery through a midline laparotomy incidences of incisional hernias of more than 30 percent have been reported.³⁴ With improved long-term survival after liver transplantation, incisional hernias have also become an increasingly diagnosed and clinically relevant complication in patients after liver transplantation.^{35,36} In **Chapter 9** the incidence of incisional hernias after liver transplantation with the use of a right subcostal (J-shaped) incision is reported, potential risk factors for incisional hernias are identified and its impact on health-related quality of life is determined.

In **Chapter 10** the (surgical) management issues of abdominal wall hernias in elderly patients, premature born infants and patients with liver cirrhosis are discussed additionally providing perspectives for further research.

Finally, in **Chapter 11** and **Chapter 12** (Dutch summary) the main findings of this thesis are summarized.

REFERENCES

1. Rutkow IM. A selective history of hernia surgery in the late eighteenth century: the treatises of Percivall Pott, Jean Louis Petit, D. August Gottlieb Richter, Don Antonio de Gimbernat, and Pieter Camper. *Surg Clin North Am* 2003; 83(5): 1021-44, v.
2. Rutkow IM. A selective history of groin hernia surgery in the early 19th century. The anatomic atlases of Astley Cooper, Franz Hesselbach, Antonio Scarpa, and Jules-Germain Cloquet. *Surg Clin North Am* 1998; 78(6): 921-40, v.
3. Thomas AD, Rogers A. Edoardo Bassini and the wound that inspires. *World J Surg* 2004; 28(10): 1060-2.
4. Read RC. Herniology: past, present, and future. *Hernia* 2009; 13(6): 577-80.
5. Bendavid R. Biography: Edward Earle Shouldice (1890-1965). *Hernia* 2003; 7(4): 172-7.
6. Simons MP, Aufenacker T, Bay-Nielsen M, et al. European Hernia Society guidelines on the treatment of inguinal hernia in adult patients. *Hernia* 2009; 13(4): 343-403.
7. Read RC. Milestones in the history of hernia surgery: prosthetic repair. *Hernia* 2004; 8(1): 8-14.
8. Lichtenstein IL, Shulman AG. Ambulatory outpatient hernia surgery. Including a new concept, introducing tension-free repair. *Int Surg* 1986; 71(1): 1-4.
9. Eker HH, Langeveld HR, Klitsie PJ, et al. Randomized clinical trial of total extraperitoneal inguinal hernioplasty vs Lichtenstein repair: a long-term follow-up study. *Arch Surg* 2012; 147(3): 256-60.
10. Anaya DA, Johanning J, Spector SA, et al. Summary of the panel session at the 38th Annual Surgical Symposium of the Association of VA Surgeons: what is the big deal about frailty? *JAMA Surg* 2014; 149(11): 1191-7.
11. Partridge JS, Harari D, Dhesei JK. Frailty in the older surgical patient: a review. *Age Ageing* 2012; 41(2): 142-7.
12. Ruhl CE, Everhart JE. Risk factors for inguinal hernia among adults in the US population. *Am J Epidemiol* 2007; 165(10): 1154-61.
13. Fitzgibbons RJ, Jr., Giobbie-Hurder A, Gibbs JO, et al. Watchful waiting vs repair of inguinal hernia in minimally symptomatic men: a randomized clinical trial.[Erratum appears in JAMA. 2006 Jun 21;295(23):2726]. *JAMA* 2006; 295(3): 285-92.
14. O'Dwyer PJ, Norrie J, Alani A, Walker A, Duffy F, Horgan P. Observation or operation for patients with an asymptomatic inguinal hernia: A randomized clinical trial. *Ann Surg* 2006; 244(20003-4932): 167-73.
15. Fitzgibbons Jr RJ, Ramanan B, Arya S, et al. Long-term results of a randomized controlled trial of a nonoperative strategy (watchful waiting) for men with minimally symptomatic inguinal hernias. *Ann Surg* 2013; 258(30003-4932 1528-1140): 508-14.
16. Chung L, Norrie J, O'Dwyer PJ. Long-term follow-up of patients with a painless inguinal hernia from a randomized clinical trial. *Brit J Surg* 2011; 98(4): 596-9.

17. Pan ML, Chang WP, Lee HC, et al. A longitudinal cohort study of incidence rates of inguinal hernia repair in 0- to 6-year-old children. *Journal of Pediatric Surgery* 2013; 48(11): 2327-31.
18. Lautz TB, Raval MV, Reynolds M. Does timing matter? A national perspective on the risk of incarceration in premature neonates with inguinal hernia. *Journal of Pediatrics* 2011; 158(4): 573-7.
19. van Veen RN, van Wessem KJ, Halm JA, et al. Patent processus vaginalis in the adult as a risk factor for the occurrence of indirect inguinal hernia. *Surg Endosc* 2007; 21(2): 202-5.
20. van Wessem KJ, Simons MP, Plaisier PW, Lange JF. The etiology of indirect inguinal hernias: congenital and/or acquired? *Hernia* 2003; 7(2): 76-9.
21. Gonzalez Santacruz M, Mira Navarro J, Encinas Goenechea A, Garcia Ceballos A, Sanchez Zaplana H, Jimenez Cobo B. Low prevalence of complications of delayed herniotomy in the extremely premature infant. *Acta Paediatrica, International Journal of Paediatrics* 2004; 93(1): 94-8.
22. Lee SL, Gleason JM, Sydorak RM. A critical review of premature infants with inguinal hernias: Optimal timing of repair, incarceration risk, and postoperative apnea. *Journal of Pediatric Surgery* 2011; 46(1): 217-20.
23. Baird R, Gholoum S, Laberge JM, Puligandla P. Prematurity, not age at operation or incarceration, impacts complication rates of inguinal hernia repair. *Journal of Pediatric Surgery* 2011; 46(5): 908-11.
24. Demetriades D, Constantinou C, Salim A, Velmahos G, Rhee P, Chan L. Liver cirrhosis in patients undergoing laparotomy for trauma: effect on outcomes. *J Am Coll Surg* 2004; 199(4): 538-42.
25. Carbonell AM, Wolfe LG, DeMaria EJ. Poor outcomes in cirrhosis-associated hernia repair: A nationwide cohort study of 32,033 patients. *Hernia* 2005; 9(4): 353-7.
26. Belghiti J, Durand F. Abdominal wall hernias in the setting of cirrhosis. *Semin Liver Dis* 1997; 17(3): 219-26.
27. Belghiti J, Desgrandchamps F, Farges O, Fekete F. Herniorrhaphy and concomitant peritoneovenous shunting in cirrhotic patients with umbilical hernia. *World J Surg* 1990; 14(2): 242-6.
28. O'Hara ET, Oliai A, Patek AJ, Jr., Nabseth DC. Management of umbilical hernias associated with hepatic cirrhosis and ascites. *Ann Surg* 1975; 181(1): 85-7.
29. Leonetti JP, Aranha GV, Wilkinson WA, Stanley M, Greenlee HB. Umbilical herniorrhaphy in cirrhotic patients. *Arch Surg* 1984; 119(4): 442-5.
30. Marsman HA, Heisterkamp J, Halm JA, Tilanus HW, Metselaar HJ, Kazemier G. Management in patients with liver cirrhosis and an umbilical hernia. *Surgery* 2007; 142(3): 372-5.
31. Reissfelder C, Radeleff B, Mehrabi A, et al. Emergency liver transplantation after umbilical hernia repair: a case report. *Transplant Proc* 2009; 41(10): 4428-30.
32. Hoer J, Lawong G, Klinge U, Schumpelick V. [Factors influencing the development of incisional hernia. A retrospective study of 2,983 laparotomy patients over a period of 10

years] Einflussfaktoren der Narbenhernienentstehung. Retrospektive Untersuchung an 2.983 laparotomierten Patienten über einen Zeitraum von 10 Jahren. *Chirurg* 2002; 73(5): 474-80.

33. Mudge M, Hughes LE. Incisional hernia: a 10 year prospective study of incidence and attitudes. *Br J Surg* 1985; 72(1): 70-1.
34. Timmermans L, Eker HH, Steyerberg EW, et al. Short-term results of a randomized controlled trial comparing primary suture with primary glued mesh augmentation to prevent incisional hernia. *Ann Surg* 2015; 261(2): 276-81.
35. Heisterkamp J, Marsman HA, Eker H, Metselaar HJ, Tilanus HW, Kazemier G. A J-shaped subcostal incision reduces the incidence of abdominal wall complications in liver transplantation. *Liver Transpl* 2008; 14(11): 1655-8.
36. Porrett PM, Hsu J, Shaked A. Late surgical complications following liver transplantation. *Liver Transpl* 2009; 15 Suppl 2: S12-8.