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Summary and conclusions



Abdominal wall surgery is comprised of surgical procedures used in the treatment of abdominal wall hernias. Abdominal wall hernias discussed in this thesis are inguinal hernias, umbilical hernias, and incisional hernias. In general, repair of these hernias are considered relatively simple procedures with a low risk of serious complications. There are, however, groups of frail patients prone to abdominal wall hernias due their age or underlying disease in which hernia repair should be carefully planned or sometimes avoided as not only surgery, but also a watchful waiting strategy can lead to serious complications. In **Chapter 1** a general outline of this thesis is given and the topic of abdominal wall surgery is introduced with a special focus on incidence, risk factors and hernia management in specific groups of frail patients.

The incidence of an inguinal hernia appears to increase with age, especially in men through the fifth to seventh decade of life. In **Chapter 2** the results on incidence and risk factors for inguinal hernias among Dutch males aged 45 years and older who participated in the Rotterdam Study are presented. A total of 416 incident cases (7.2%) of inguinal hernia in 5,780 male participants were found after a follow-up of more than 20 years. The age-adjusted hazard ratio was 12.4 in favour of men compared to women. Multivariate analysis showed ageing to be a risk factor for inguinal hernias with an increase in hazard of 1.03 per year. The hazard of an inguinal hernia almost doubled in men aged 75 years and older compared to men aged under 65 years. Increased body mass index showed to have a protective effect on inguinal hernias.

In **Chapter 3** the results of a multicenter randomized trial are described which compared watchful waiting to elective repair of asymptomatic or mildly symptomatic inguinal hernias in male patients aged 50 years and older after a follow-up of 3 years. Two hundred and thirty-four patients were randomized to elective repair and 262 to watchful waiting. Using a 0.20-point difference as a clinically relevant margin, it was hypothesized that watchful waiting was non-inferior to elective repair. The results of our trial showed a difference in means (watchful waiting minus elective repair) of -0.23 (95% CI -0.32 to -0.14) with regard to the primary endpoint (4-point pain and discomfort score) after 2 years of follow-up. Because the 95 percent confidence interval of the difference of means ranged from -0.32 to -0.14, a difference of 0.20 or greater cannot be excluded and, therefore, the trial was inconclusive in this respect. In the watchful waiting group 35.4 percent underwent inguinal hernia repair due to some degree of pain or discomfort and 2.3 percent required emergency surgery due to incarceration or strangulation of the bowel. Postoperative morbidity and mortality were comparable between the elective repair group and operated men initially assigned to the watchful waiting group. Recurrence rates of inguinal hernias were approximately 9.0 percent in both groups after 3 years of follow-up. No difference in

recurrence rates could be found between different surgical techniques, types of mesh and between participating centers.

The risk of an inguinal hernia is not only increased in the middle-aged and elderly, but also in the youngest amongst us. In **Chapter 4** risk factors for emergency surgery in prematurely born infants with an inguinal hernia were studied. In this retrospective study, data from 142 prematurely born infants (gestational age less than 37 weeks) who underwent inguinal hernia repair within 3 months after birth were analyzed. More than half of these prematurely born infants presented at the hospital with a symptomatic inguinal hernia, of which 55.7 percent required emergency surgery because of incarceration. Postoperative complication rates and recurrence rates were significantly higher in prematurely born infants following emergency surgery compared to prematurely born infants who underwent elective repair. Multivariate analysis showed 'very low birth weight' (birth weight of 1,500g or less) to be an independent risk factor with a 3-fold greater risk of incarceration with subsequent emergent repair compared to prematurely born infants weighing over 1,500 grams.

Another group of frail patients who are generally advised to refrain from surgery unless it is absolutely necessary are patients with liver cirrhosis and ascites. In **Chapter 5** an overview of morbidity and mortality for different non-hepatic procedures, including abdominal wall hernia repair in patients with liver cirrhosis is provided. The level of evidence of included studies in this review varied greatly. Postoperative mortality and morbidity were higher in patients suffering from liver cirrhosis compared to matched patients without liver cirrhosis who underwent non-hepatic surgery. In addition to the Child-Turcotte-Pugh (CTP) score the preoperative model for end stage liver disease (MELD) was found to be an adequate prediction model for assessment of the 30-day postoperative mortality in patients with liver cirrhosis after non-hepatic procedures (c-statistic = 0.80). With regards to abdominal wall hernia management, reported overall morbidity after elective umbilical hernia repair in patients with liver cirrhosis ranged between 7 and 20 percent and the overall mortality ranged between 0 and 5.5 percent. In the presence of portal hypertension or in case of emergency surgery, the results were even less favorable. In the presence of refractory ascites the risk of a recurrent umbilical hernia was increased with a relative risk of 8.5 percent after primary umbilical hernia repair. One randomized trial was performed comparing primary suture versus mesh repair in patients with liver cirrhosis. Recurrence rate was 2.7 percent in the mesh repair group compared to 14.2 percent in the primary suture group. In the mesh repair group the number of surgical site infections was almost doubled compared to the primary suture group. The percentage of surgical site infection was not significantly different between groups. The reported overall

morbidity after inguinal hernia repair was comparable to patients without liver cirrhosis. The overall mortality ranged between 0 and 2.7 percent. Complications after inguinal hernia repair appeared to be independent of CTP grade and not affected by the presence of (refractory) ascites. The majority of non-hepatic surgical procedures could be performed safely in patients with liver cirrhosis and low MELD scores or CTP grade A without portal hypertension. It was suggested that inguinal hernia repair could even be performed in patients with CTP grade C liver cirrhosis and in the presence of refractory ascites.

Patients with liver cirrhosis and refractory ascites have a 20 percent risk of developing an umbilical hernia in the course of their disease. In **Chapter 6** the results of a prospective study on the feasibility and safety of elective repair of an umbilical hernia in patients with liver cirrhosis and ascites are presented. A total of 30 patients underwent elective umbilical hernia repair. In 33 percent of patients a mesh was used. More than two-third of patients were classified as CTP grade B or C with a median MELD score of 12. Complications occurred in only 2 patients without negative sequelae. After a median follow-up period of 25 months 2 deaths occurred, of which none were related to the surgical procedure.

In **Chapter 7** the study protocol of a multicenter randomized controlled trial, which stems from the previously mentioned prospective study, is presented. This trial was designed to compare watchful waiting to elective repair of an umbilical hernia in patients with liver cirrhosis and ascites. The trial was designed to include a total of 100 patients to be randomized between the two strategies, stratified for participating center and MELD score. The primary endpoint consisted of a composite endpoint of overall morbidity related to the umbilical hernia treatment after 24 months of follow-up. Secondary endpoints included cumulative recurrence rate, classification of complications obtained during follow-up, pain and quality of life. The objective of this trial was to determine the superiority of elective repair to watchful waiting in management of umbilical hernias in patients with liver cirrhosis and ascites.

Candidates for liver transplantation who did not undergo umbilical hernia repair prior to the transplantation should be corrected during transplantation. In **Chapter 8** two different approaches for umbilical hernia repair during liver transplantation are compared. In a retrospective study patients who underwent umbilical hernia repair through a separate umbilical incision and patients who underwent umbilical hernia correction from within the abdominal cavity without a separate incision through the subcostal laparotomy wound used for the transplantation were compared. A total of 27 patients were included in the analysis with a mean MELD score of 17. In the group

in which the umbilical hernia was repaired through the laparotomy wound 40 percent of patients were diagnosed with a recurrent umbilical hernia compared to only 6 percent in the group in which a separate umbilical incision was used. The results of our study suggest that umbilical hernia repair during liver transplantation using a separate umbilical incision is associated with less recurrent umbilical hernias compared to repair from within the abdominal cavity through the subcostal laparotomy used for transplantation.

In contrast to inguinal and umbilical hernias, incisional hernias are postoperative complications after abdominal surgery. In **Chapter 9** the results of a cross-sectional study in which the incidence of an incisional hernia was assessed, identified potential risk factors are presented and its impact on quality of life after liver transplantation using a right-sided subcostal (J-shaped) incision was evaluated. The incidence of incisional hernias after liver transplantation through a J-shaped incision was 43 percent, which was 6 times higher compared to the retrospective data published prior to this study. Surgical site infection and age were found to be the most important risk factors for incisional hernias after liver transplantation.