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ORIGINAL ARTICLE

A consecutive series of 235 epigastric hernias

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Abstract
Background Epigastric herniation is a common, though not always symptomatic condition. It is likely, that in accordance to the tension-free principles for other hernias, epigastric hernia repair should be mesh based.
Methods Patients from two large hospitals were investigated retrospectively if they were operated on an epigastric hernia for the past 6 years. Follow-up was completed with a postal questionnaire.
Results A total of 235 patients (50 % male) were operated. Sixty-eight patients were operated with mesh and 167 patients with suture repair. Forty-six patients were loss-to follow-up (19.6 %). In the mesh operated patients the recurrence rate was 10.9 % ($n = 6$) compared to 14.9 % ($n = 20$) in the suture repair group. Cox-regression analysis showed an increased risk for recurrence in the suture repair group (odds ratio 1.43; 95 % CI 0.56–3.57; $p = 0.44$). Operation time for mesh repair (47 min) was significantly longer compared to suture repair (29 min) ($p < 0.0001$). Thirty-seven patients had previous or other anterior wall hernias. A total of 51 patients smoked and 14 patients had diabetes mellitus. Fourteen patients used steroids and 22 patients suffered from a chronic lung disease. Subgroup analysis showed a significant difference for pain in patients in which re-operation for a recurrence occurred ($p = 0.004$).
Conclusions This is one of the largest reported series on solely epigastric hernias. A recurrence occurred more often after sutured repair compared to mesh repair. No differences in chronic pain was seen between mesh and suture repaired patients. Male:female ratio of 1:1, which is different from the 3:1 ratio found in previous older smaller studies, could be more reliable.

Keywords Mesh repair · Primary repair · Epigastric hernia · Suture herniorrhaphy · Mesh herniorrhaphy

Introduction

An epigastric hernia is a protrusion of extra-peritoneal fat, with or without a peritoneal pouch. In the case of a peritoneal fat protrusion alone, the epigastric hernia is called a false hernia. If there is a peritoneal pouch, it is labeled a true epigastric hernia. Epigastric hernias occur from the xyphoid process to the umbilicus [1]. These hernias are the second most common type of linea alba abdominalis defect in adults [2, 3]. Some studies have shown an incidence of 0.5–10 % for epigastric hernias, although presumably only minority are symptomatic, resulting in scarce literature on the subject [4, 5].

It is likely that, in accordance with the tension-free principles for the correction of other hernias, epigastric hernia repair should be mesh based. However, evidence concerning this issue is lacking. Therefore, the primary goal of this study was to evaluate the recurrence rate for epigastric hernias repaired with mesh-based versus suture-based techniques. The difference in pain between the groups was also measured but was seen as a secondary outcome. Pain following epigastric herniorrhaphy is an important issue, and recent studies show a high rate of

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chronic pain after repair [6]. To evaluate these topics, we retrospectively reviewed the data for epigastric hernia repair in two large medical centers.

Methods

Two researchers (JP/BL) independently reviewed the data for all patients who underwent epigastric hernia repair in two large medical centers from January 2006 until December 2011. Both centers are teaching hospitals located in comparable regions. Medical charts were reviewed, and data were collected in a database format. Patients were excluded from the analyses if the procedure turned out not to be an epigastric hernia repair as coded or if it was concomitant with another intervention. Patients who underwent emergency procedures or had incarcerated epigastric hernias were also excluded. In addition, exclusion occurred if follow-up was not completed because of death, unrelated to hernia repair, within the investigated 6 years. The recorded patient characteristics included co-morbidity, age, and gender. Operative details, including duration, hernia size, material used (suture or mesh), and approach (laparoscopic or open) were noted for both first and recurrent procedures.

In both medical centers, the standard was to use non-absorbable monofilament sutures (Surgipro®, Prolene®) for suture-based repair. For the mesh repair, a flat polypropylene mesh was used and was cut to size during the procedure. A composite mesh was used in the laparoscopic repairs. In all open mesh repairs, underlay or pre-peritoneal mesh placement was performed, and the mesh was always fixed with non-absorbable monofilament sutures (Surgipro®, Prolene®) on at least four sides. The fascia was closed over the mesh with absorbable or non-absorbable, monofilament or braided sutures. Intraperitoneal mesh placement was performed in the laparoscopic procedures; in these patients the composite mesh was fixed with absorbable tackers.

Postal questionnaires and medical file reviews were used to obtain data on recurrences. If patients reported a swelling or experienced pain, they were invited to schedule an outpatient clinic visit. An ultrasound was performed if a recurrence was suspected, and re-operation took place if necessary. In the postal questionnaire, pain sensation and sensory disturbances were measured with the Verbal Descriptor Scale for pain (VDS; pain was graded as none, mild, moderate, or severe).

Chronic pain was defined as pain of more than mild intensity on the VDS and persisting for at least 3 months post-operatively. The occurrence of other ventral hernias as well as hernia risk factors, such as smoking, physical activity, diabetes mellitus, chronic lung disease, and chronic corticosteroid use was also recorded. Non-responders were contacted up to three times by telephone.

The primary objective was to identify any difference in recurrence following mesh versus suture herniorrhaphy. The secondary objective was to evaluate post-operative pain.

Data analysis

We used a Cox regression analysis to assess the risk of recurrence according to the type of surgery. Descriptive and univariate analyses were performed to evaluate the association of factors with the occurrence or recurrence of epigastric hernias. Multivariate analysis was performed to assess the significance of differences in baseline characteristics. Because of a non-equal length of follow-up, Kaplan–Meier analysis was performed. SPSS (version 17, SPSS Inc., Chicago, IL, USA) was used for data analysis. A p value below 0.05 was considered significant.

Results

A total of 235 patients underwent surgical epigastric hernia repair. Forty-six patients were lost to follow-up (19.6 %). The baseline characteristics of the remaining 189 patients are shown in Table 1. One hundred and thirty-four patients (71 %) had primary suture repair, and 55 (29 %) had mesh repair. Gender was equally distributed as 50 % of patients were male. In the total patient population, the mean age was 51 years (SD 13 years), and the median body mass index (BMI) was 26 kg/m^2 (SD 4.7). Patients were significantly older and had higher BMIs in the mesh-based group.

Table 1 Baseline characteristics

	Sutures ($N = 134$)	Mesh ($N = 55$)	Difference (p)
Sex (male:female)	62:72	32:23	0.137
Age (mean in years)	49 (SD 13)	56 (SD 10)	0.002
Hernia size (median/mean in mm)	10/12 (SD 7.7)	20/21 (SD 11)	<0.001
BMI (mean kg/m^2)	26 (SD 4.6)	28 (SD 4.8)	0.004
Smokers (n)	41	12	0.222
Diabetes (n)	7	7	0.074
Other hernia (n)	24	15	0.149
Chronic lung disease (n)	18	4	0.230
Corticosteroid use (n)	10	4	0.964

Table 2 Evidence table

	Sutures	Mesh
Number	134	55
Mean operation time in min (SD)	28.6 (12.7)*	46.6 (17.1)*
Number of recurrence (%)	20 (14.9)	6 (10.9)
Mean months to recurrence	16.3	6.1

* $p < 0.05$

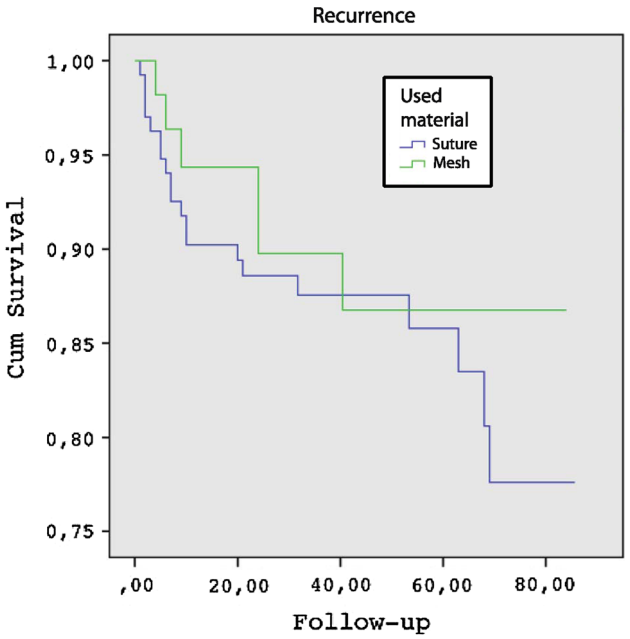

Fig. 1 Kalpan–Meier curve with follow-up in months

Operation time

The mean operation time was 46.6 min (SD 12.7 min) for mesh repair and 28.6 min (SD 17.1 min) for primary suture repair. The duration was significantly longer for mesh-based repair compared with suture-based repair ($p < 0.0001$).

Recurrence

The recurrence rate was 10.9 % ($n = 6$) in the mesh group compared with 14.9 % ($n = 20$) in the suture group (Table 2). A Cox regression analysis showed an increased risk of recurrence in the suture group [odds ratio 1.43; 95 % confidence interval (CI) 0.56–3.57; $p = 0.44$]. Ten of the mesh-based procedures were performed laparoscopically (18 %), none of which resulted in a recurrence. Recurrence occurred after a median time of 6.5 months (range 1–69 months). However, the recurrences were earlier for mesh repair (6.1 months) than for suture repair (16.3 months). Because of a non-equal follow-up length, a Kaplan–Meier analysis was performed (Fig. 1). This figure illustrates the difference in the time to recurrence post-operatively.

Hernia size

The hernia size could be extracted from the operative report or ultrasound report in nearly all cases. The mean size of all epigastric hernias was 14 mm (SD 9.6). There was a significant difference in hernia size between the two groups (12 mm in the suture group vs. 21 mm in the mesh group; $p < 0.0001$; Table 1). Because of the significant difference in hernia size, an additional size analysis was performed. A multivariate analysis showed that hernia size did not affect the recurrence rate (odds ratio 1.02; 95 % CI 0.98–1.05).

Pain

Seven patients (4 %) reported moderate to severe pain at rest and 26 (14 %) during physical exercise that persisted for at least 3 months after herniorrhaphy. This pain can be classified as chronic pain [7]. A Cox regression analysis showed that there was no significant difference between the mesh and suture groups in regard to the occurrence of chronic pain ($p = 0.90$ and 0.81, respectively). A subgroup analysis showed a significant difference in pain for patients who underwent re-operation for a recurrence compared with the non-recurrence patient group ($p = 0.004$).

Physical activity

A subgroup analysis was performed for physical exercise in the recurrence and non-recurrence patient groups. A non-significant difference was found ($p = 0.78$) between the physically active group and the less physically active group.

Risk factors

Thirty-nine patients had previous or other ventral hernias (20.6 %). No reliable data were found for comparison regarding the prevalence of non-epigastric primary abdominal wall hernias. A total of 53 patients smoked (28 %). This proportion is equal to the 28 % who were found to be smokers in a 2004 survey of the Dutch population [8]. Fourteen patients had diabetes (7.4 %). This is somewhat higher than the 4.0 % prevalence found in a 2007 national survey [8]. Among the study population, 11.6 % had chronic lung disease compared with 2.0 % of the Dutch population in 2003 [8]. Fourteen patients used corticosteroids long term (7.4 %). No reliable data were

found for the prevalence of long-term corticosteroid use in the Netherlands.

Discussion

Several studies have shown the superiority of mesh over suture repair in minimizing recurrences in umbilical hernias occurring alone or in combination with other ventral hernias [9–14]. In these studies, epigastric hernias are studied in combi th other abdominal wall hernias. For instance, some of these studies combine the results for patients with epigastric and umbilical hernias [14]. However, there are different pathophysiological causative mechanisms for different types of abdominal wall hernias, particularly in the case of epigastric hernias [4, 15–18].

This is one of the largest series describing isolated epigastric hernias. Although this retrospective report cannot give a clear and straightforward answer to the question of whether epigastric hernia repair should always be mesh or suture based, the results point in the direction of mesh repair. We found a tendency for more recurrences after suture-based repair, which seems to be in accordance with data on other hernia repair.

This series of epigastric hernias shows a rather high incidence of recurrence. However, this is in accordance with other retrospective reports on umbilical and epigastric hernias, which have reported recurrence rates of up to 25 % [19]. In a trial setting, recurrence rates (for example, in inguinal hernia cases) are reported to be around 1 %, contrasting with the much higher recurrence rates (10–15 %) seen in nationwide databases [20]. In this study, the recurrence rate may look comparatively higher because we labeled asymptomatic or non-operated cases as recurrences; other retrospective studies have measured recurrence as occurring only if a recurrence was operated on [21]. Furthermore, a number of cases in this report were lost to-follow-up, which could have caused an overestimation.

Laparoscopic herniorrhaphy for epigastric hernias is a matter of debate. In this series, only a small number of laparoscopically repaired epigastric hernias were included. This small number is because of evolution in our medical practice and opinions on the subject. Some authors have mentioned economic reasons for performing laparoscopic herniorrhaphy [9]; however, it is the author's belief that a laparoscopic approach should not be advocated in all epigastric hernia cases. Although none of the ten laparoscopically repaired patients in this series experienced a recurrence at the time of follow-up, laparoscopic intraperitoneal mesh placement does not resolve a false epigastric hernia. If there is any uncertainty about the true or false nature of the hernia, open mesh repair should be performed.

The topic of post-herniorrhaphy pain has become more important over the years, probably because of the lower recurrence rates seen in ventral hernia research secondary to mesh-based herniorrhaphy. An interesting finding in our series is that there were no differences in chronic post-operative pain between mesh and suture herniorrhaphy. Our initial hypothesis was that more chronic pain would be seen after mesh repair because of the more extensive dissection and the reaction of the tissues to a foreign body. However, this difference was not observed in the series. We think our outcome is representative because of the large number of cases included in the study. Although these findings conform to those of other retrospective series [6], this topic should be investigated in a randomized controlled setting.

Other studies have shown an association between recurrent hernias and higher pain levels [19]. This series showed that patients with a repaired recurrence experienced significantly more chronic post-operative pain than patients who only underwent one repair. This seems to be a logical finding, but it has never before been objectively studied in recurrent epigastric hernias. It is an important finding in regard to the pre-operative informed consent from patients with a recurrent hernia who are facing a second repair.

A unique feature of this retrospective report is the finding of an aberrant male-to-female ratio of 1:1 in this population. Typically, a 3:1 ratio has been reported [1, 22]; this ratio has been criticized by other studies as being outdated, but these studies have described smaller populations than that used in our study [18, 23, 24]. This leveling of the incidence between the genders may be because of fewer pregnancies in women compared with several years ago; pregnancy and the associated increase in intra-abdominal pressure are thought to be important risk factors for epigastric herniation [23]. Other risk factors are obesity; less gender-restricted roles for women, which have allowed them to perform more heavy physical work; smoking; and chronic lung disease, which is associated with smoking [18, 24].

In this study, the decision of when to use mesh was not standardized because of the retrospective design. The choice of surgical technique seems to have been influenced by hernia size; this can be deducted from the significant difference in hernia size between the mesh and the suture groups. Importantly, however, multivariate analysis showed that hernia size was not related to hernia recurrence.

A limitation of this study is clearly the retrospective design. Because of the retrospective design, no standardized method was used for either mesh or suture herniorrhaphy. Another concern is that not all patients were clinically evaluated for recurrence. Because of the follow-

up method of a phone call or questionnaire, a slight underreporting of asymptomatic recurrences may have occurred, although this is not necessarily clinically relevant. Randomized controlled studies are needed to address this subject in the future and should involve a physical follow-up for all patients. Finally, 20 % of patients in this study were lost to follow-up. However, although this rate is considered high, this is not uncommon in retrospective hernia-related research.

In future studies, a stricter definition of chronic pain could be used. Because of the very heterogenic follow-up time in this study, no clear conclusions can be made about the course of chronic pain. For the complete evaluation of chronic pain, prospective studies and equal follow-up time are ideal, and we recommend a randomized controlled trial incorporating this approach in the future.

Conclusion

In this study, the largest reported series on isolated epigastric hernias, we compared the outcome of mesh- versus suture-based repair in terms of the recurrence rate and the development of chronic pain. We found a male-to-female ratio of 1:1, which is in contrast to the 3:1 ratio previously reported. In accordance with the findings for other hernias, we identified a tendency for more recurrences after suture-based repair, although our findings may have been biased by the retrospective design. Probably the most interesting and pioneering finding is that no difference in chronic pain was seen between mesh and suture repair of these hernias. In addition, hernia size was not associated with the development of chronic pain. We recommend future studies on the possible superiority of mesh-based repair in epigastric hernias, which should focus on size and include the analysis of complications as well as the risk factors for clinical recurrence and re-operation.

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Conflict of interest The authors declare that there are no conflicts of interest.

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