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ORIGINAL ARTICLE

Epidemiology and surgical management of 184 obturator hernias: a nationwide registry-based cohort study

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Abstract

Purpose We aimed describe the patient characteristics, surgical details, postoperative outcomes, and prevalence and incidence of obturator hernias. Obturator hernias are rare with high mortality and no consensus on the best surgical approach. Given their rarity, substantial data is lacking, especially related to postoperative outcomes.

Methods The study was based on data from the nationwide Danish Hernia Database. All adults who underwent obturator hernia surgery in Denmark during 1998–2023 were included. The primary outcomes were demographic characteristics, surgical details, postoperative outcomes, and the prevalence and incidence of obturator hernias.

Results We included 184 obturator hernias in 167 patients (88% females) with a median age of 77 years. Emergency surgeries constituted 42% of repairs, and 72% were laparoscopic. Mesh was used in 77% of the repairs, with sutures exclusively used in emergency repairs. Concurrent groin hernias were found in 57% of cases. Emergency surgeries had a 30-day mortality of 14%, readmission rate of 21%, and median length of stay of 6 days. Elective surgeries had a 30-day mortality of 0%, readmission rate of 10%, and median length of stay of 0 days. The prevalence of obturator hernias in hernia surgery was 0.084% (95% CI: 0.071%–0.098%), with an incidence of one per 400,000 inhabitants annually.

Conclusions This was the largest cohort study to date on obturator hernias. They were rare, affected primarily elderly women. The method of repair depends on whether the presentation is acute, and emergency repair is associated with higher mortality.

Keywords Obturator · Hernia · Surgery · Laparoscopic · Mortality · Prevalence

Introduction

Obturator hernias are rare, constituting 0.073–1% of all abdominal hernias [1, 2]. Due to the rarity of the condition, data on obturator hernias are sparse, and mostly available from case reports without long-term follow-up [3]. Obturator hernias typically affect elderly females and are associated with high mortality with rates ranging from 10 to 28% [4–7]. Obturator hernias are present bilaterally up to 25% of the time [3, 6]. Traditionally, the surgical approach to an obturator hernia has been laparotomy due to bowel obstruction [8]. However, laparoscopic repairs have recently become more common [3], with promising results such as lower mortality compared with open surgery [9]. There is still no consensus on the treatment of obturator hernias, as the method of hernia repair is often affected by patient age, morbidity, and the expertise of the surgeon. A review found a recurrence rate of 10% after suture repair, while laparoscopic mesh repairs appeared to have lower recurrence rates [3]. Despite advances in treatment, obturator hernias remain a challenge for surgeons because they are rare, and often present in the emergency setting. The published evidence of obturator hernias consists of mainly case reports along with retrospective cohort studies, with a recent review identifying data on a total of only 937 obturator hernias published worldwide [3]. The Danish Hernia database is a nationwide registry that contains prospectively collected data from all groin and abdominal hernia operations performed in Denmark [10]. The database contains, until now, unexplored data on obturator hernias and allows for long-term follow-up. Using this nationwide, prospective database, we can

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substantially contribute to the existing evidence regarding obturator hernias.

We aimed to describe the characteristics, surgical details, and postoperative outcomes of obturator hernias in a large register-based nationwide cohort. Secondarily, we aimed to estimate the overall prevalence and incidence of obturator hernias.

Methods

This is a register-based cohort study based on prospectively collected data from the Danish Hernia Database [10] and is reported according to The Reporting of Studies Conducted using Observational Routinely-collected Health Data (RECORD) guideline [11].

The Danish Hernia Database consists of The Inguinal Hernia Database, containing data from 1998 and onwards [12], and the Ventral Hernia Database, containing data from 2007 and onwards [13], both still collecting data. Whenever a surgeon repairs a hernia in an adult patient in Denmark, they mandatorily register the operation in the database. Data include patient characteristics, hernia type, surgical details, and postoperative outcomes from adult patients from both private and public healthcare providers. The two databases were not created with obturator hernias in mind. Therefore, it is only possible to register rare hernias by describing them in a free-text field labeled either "additional information" or "specify other hernia type" [14]. The Danish Hernia Database is linked to the Danish National Patient Registry through each Danish citizen's unique personal identification number [15]. The Danish National Patient Registry consists of routinely collected health data such as limited patient characteristics, diagnosis codes, surgical codes and date of operation from both private and public healthcare providers [15]. The Danish Hernia Database is also linked to the Danish Civil Registration System through the same unique personal identification number of Danish citizens, which makes it possible to identify participants who died or emigrated during follow-up [16]. These linkages ensure that if obturator hernia repairs were not registered by the operating surgeon in the Danish Hernia Database, some data are still available such as patient identification, age, sex, date of operation, diagnostic code, length of stay, readmissions and reoperations. Data were extracted from the Danish Hernia Database through the Danish Clinical Quality Program—National Clinical Registries (RKKP) [17] which also handled the linkage to both the Danish National Patient Registry and the Danish Civil Registration System.

Eligible patients were all adults registered with surgical repair for an obturator hernia in any Danish public or private hospital from January 1, 1998, to February 22, 2023. Follow-up was until death, emigration, re-operation, or time of data extraction on February 22, 2023. As obturator hernias may be registered in the Inguinal or Ventral Hernia Database, we identified patients across both databases using several approaches. We searched all free-text fields of the Danish Hernia Database for any spelling of obturator hernia to identify as many as possible. We also searched the Danish Hernia Database for diagnostic codes of obturator hernias (DK451I, DK450I, and DK458I according to the Danish version of the International Classification of Disease version 10 codes). The diagnosis codes are obtained through the linkage with the Danish National Patient Registry [15].

We extracted variables describing patient characteristics such as patient identification, sex, age, date of surgery, hernia type, side of hernia, other hernias present during surgery, and Charlson Comorbidity Index [18]. Charlson Comorbidity Index is categorized into three grades of comorbidity: mild, 1–2; moderate, 3–4; and severe, >5 [18]. Additionally, we extracted data of perioperative characteristics such as: open/laparoscopic surgery, mesh/suture-repair, type of mesh, and method of mesh fixation. We extracted postoperative outcome variables, including 30-day mortality, 90-day readmission, length of stay, and reoperation due to recurrence, defined as a subsequent obturator hernia repair.

The study size was determined by sampling by convenience, as all adult patients who were identified as having an obturator hernia repair were included in this cohort study. Prevalence was calculated as the number of obturator hernia repairs divided by the total number of hernia repairs in Denmark as a measure of obturator hernia prevalence among other hernias in Denmark. Incidence was calculated as the number of obturator hernia repairs per inhabitant per year. For the prevalence and incidence, we used data from the most recent 10 years, as reporting of obturator hernias have improved over time and the most recent data would thereby provide a better estimate of prevalence and incidence.

Data cleaning and statistical analyses were done using IBM SPSS Statistics for Windows, version 28 (IBM Corp, Armonk, New York, US). The normal distribution of data was assessed by visual inspection of histogram and Q-Q plots. Continuous numerical data were reported as median and interquartile range (IQR). Differences between the subgroups, elective and emergency obturator hernia surgery, were tested using Chi-Squared test and Fisher's exact test for categorical data, and with Mann–Whitney U test for continuous numerical data. A p-value ≤ 0.05 was considered significant. Any missing data were excluded in statistical tests. This study was approved by The Danish Data Protection Agency (P-2021-68) and Danish Clinical Quality Program. There was no requirement for ethics committee approval or informed consent from patients according to Danish legislation.

Results

We found a total of 184 obturator hernia repairs in 167 patients. The data selection process is depicted in Fig. 1. There were more obturator hernias than patients because 11 patients had bilateral obturator hernias, four patients had a recurrence operation, one patient had a repair of a contralateral obturator hernia 6 months after initial obturator hernia repair, and lastly, one patient was operated a second time after 6 years, however, the side of the first obturator hernia for this patient was not reported, therefore, it was unclear if it was a recurrence or a contralateral obturator hernia presenting later in life. Thus, the unadjusted reoperation rates for the different repair types were as follows: 11% (2/19) for suture repair, 0.7% (1/143) for mesh repair, and 50% (1/2) for no repair. Overall, the obturator hernias affected primarily females of advanced age, Fig. 2 represents the incidence of obturator hernia repairs based on age. Right-sided obturator hernias (n = 66, 36%) were slightly more common than left-sided obturator hernias (n = 54, 29%), and laparoscopic mesh repair was the most common method.

Table 1 contains patient and perioperative characteristics for all obturator hernias and is further divided into two subgroups: the elective repair group containing 106 obturator hernias, and the emergency repair group containing 77 obturator hernias. There was one hernia with missing data on elective/emergency surgery, therefore, it was excluded from the subgroups.

For both the elective and emergency repair group there were more females than males. However, the fraction of females was larger in the emergency group ($p = 0.003$). The emergency repair group was older than the elective repair group, but there were no differences in the Charlson Comorbidity Index, Table 1. Elective repairs were mainly performed laparoscopically (95%), whereas the emergency repairs were performed by both laparoscopic (39%) and open surgical approach (48%). The elective repair cohort consisted almost exclusively of mesh repairs (98%), whereas the repair method was not reported for the remaining 2%. The cohort of only emergency repairs was grouped into open or laparoscopic repair, and included both suture and mesh repairs, Table 2. The presence of concurrent inguinal and femoral hernias was significantly more common during elective repairs, i.e., performed by laparoscopy. In the elective

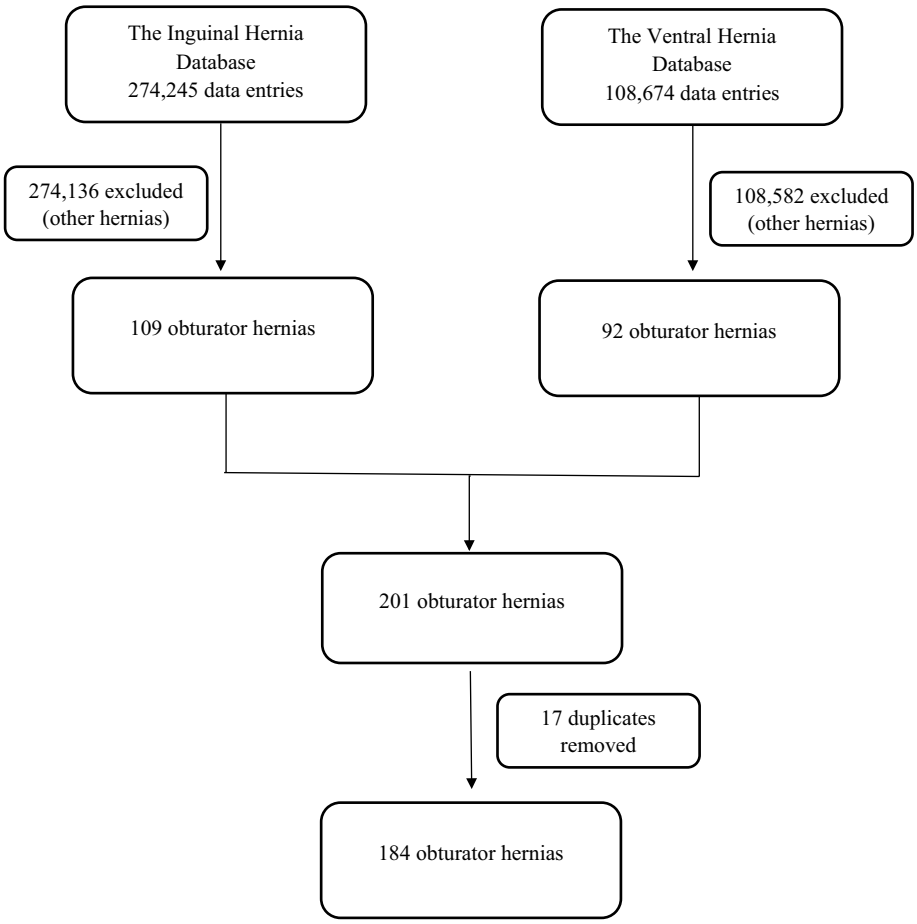

Fig. 1 Flow diagram of the selection data from both databases

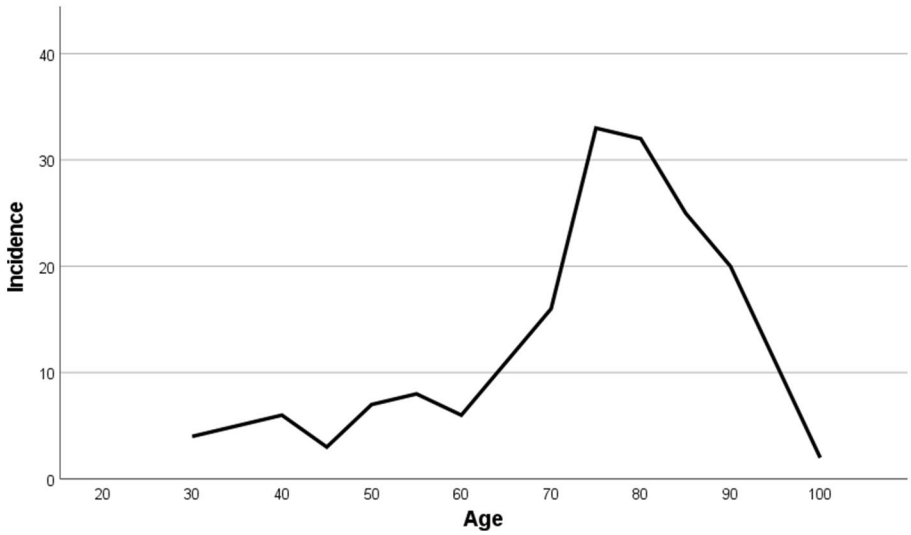

Fig. 2 Distribution of obturator hernia repairs (y-axis) by age at the time of surgery (x-axis)

repair group, 26 repairs (25%) were exclusively for obturator hernias, while 78 (74%) of the repairs were a combination of obturator and either inguinal (n = 57) or femoral hernias (n = 32). Eleven of these repairs were a combination of both inguinal and femoral hernias along with an obturator hernia. For 2 (2%) of the repairs, the presence of other hernias was not reported. In the emergency repair group, 51 (66%) repairs were exclusively for obturator hernias, 11 (14%) were a combination of either inguinal (n = 7) or femoral hernias (n = 5), and one repair included both an inguinal and femoral hernia. For 15 (20%) of the repairs in the emergency group, data on concurrent hernias were not reported.

The postoperative outcomes after obturator hernia repair were as follows. Length of stay was median 1 day (IQR 0–6 days), and the emergency repair group was hospitalized longer than the elective group. All 11 deaths within 30 days after surgery occurred in the emergency surgery group. In total, 15% of obturator hernia repairs were readmitted within 90 days after the operation, Table 1. Table 2 depicts an overview of the emergency repairs further divided into laparoscopic and open surgery. Table 2 contains data on 71 obturator hernias in 67 patients due to two bilateral obturator hernias and two reoperations. There were missing data on laparoscopic or open approach for six emergency procedures, therefore these were excluded from Table 2. The open emergency surgery group had both longer length of stay and higher mortality compared with laparoscopic emergency surgery. There were four reoperations in the entire cohort consisting of 184 obturator hernias after a median follow-up time of almost 4 years. One reoperation was after 5 months, after laparoscopic suture repair, and 19 months after open suture repair. One reoperation was 1 month after laparoscopic surgery without repair of the hernia defect, and the last reoperation was 21 years and 5 months after open mesh repair. Follow-up were median 47 months [19–85], and during the follow-up period 74 (40%) died, 3 (2%) emigrated, and 95 (52%) were still alive at the time of data extraction.

An overview of the obturator hernias reported per year is depicted in Fig. 3. Over the past 10 years, obturator hernia repairs represented 147 of 175,054 hernia procedures in the Danish Hernia Database which corresponds to 0.084% (95% CI 0.071% to 0.098%) of all hernia procedures in Denmark. Each year, there is a median 15 obturator hernia repairs reported in the database, which, based on Denmark's population of 5.8 million inhabitants, corresponds to an incidence of one obturator hernia repair per 400,000 inhabitants per year.

Discussion

In this nationwide register-based cohort study, we identified 184 obturator hernia repairs in the Danish population from 1998–2023, using prospectively collected data from the Danish Hernia Database. Most patients were elderly females and were operated differently depending on whether it was emergency or elective surgery. All deaths within 30 days after the operation occurred after emergency obturator hernia repair, resulting in a mortality rate of 14%. Obturator hernias constituted 0.084% of all abdominal hernia operations in Denmark, and the incidence was one obturator hernia pr. 400,000 inhabitants per year, likely with increased risk for females and the elderly.

We found a prevalence of obturator hernia repair of 0.084%. The previous prevalence of obturator hernia repairs in a Western country was reported by the Mayo Clinic in 1988 with a prevalence of 0.073% of all hernia repairs [1]. We used nationwide data from the last 10 years to calculate the prevalence and incidence to get an estimate of the

Table 1 Patient and surgical detail and outcomes

	Total	Elective repair group	Emergency repair group	P value
Demographic data				
No. of hernias	184	106	77	–
Females, no. (%)	161 (88%)	86 (81%)	74 (96%)	0.003
Age, median [IQR]	77 [68–85]	71 [57–77]	85 [81–92]	<0.001
Charlson Comorbidity Index, no. (%)				
0 (none)	87 (47%)	54 (51%)	32 (42%)	0.209
1–2 (mild)	69 (37%)	37 (35%)	32 (42%)	0.359
3–4 (moderate)	23 (13%)	12 (11%)	11 (14%)	0.550
> 5 (severe)	5 (3%)	3 (3%)	2 (2%)	1
Side of hernia, no. (%)				
Left	54 (29%)	44 (42%)	10 (13%)	0.870
Right	66 (36%)	53 (50%)	13 (17%)	0.870
Not reported	64 (35%)	9 (8%)	54 (70%)	–
Surgical data, no. (%)				
Laparoscopy	132 (72%)	101 (95%)	30 (39%)	< 0.001
Open surgery	41 (22%)	4 (4%)	37 (48%)	< 0.001
Conversion	4 (2%)	0 (0%)	4 (5%)	0.026
Not reported	7 (4%)	1 (1%)	6 (8%)	–
Method of repair				
No repair	2 (1%)	0 (0%)	2 (3%)	0.137
Suture repair	19 (10%)	0 (0%)	19 (25%)	< 0.001
Mesh repair	143 (77%)	104 (98%)	39 (50%)	< 0.001
Not reported	19 (11%)	2 (2%)	17 (22%)	–
Mesh fixation				
Tackers	62 (43%)	50 (48%)	12 (32%)	0.049
Suture	19 (13%)	3 (3%)	16 (42%)	< 0.001
Glue	33 (23%)	27 (26%)	6 (13%)	0.076
Clips	8 (6%)	8 (8%)	0 (0%)	0.105
No Fixation	6 (4%)	4 (4%)	2 (5%)	0.670
Not reported	15 (11%)	12 (15%)	3 (8%)	–
Concurrent hernias, no. (%) per patient				
Bilateral obturator hernias	11 (6%)	9 (9%)	2 (3%)	0.174
Concurrent inguinal hernia	64 (35%)	57 (55%)	7 (8%)	< 0.001
Concurrent femoral hernia	37 (20%)	32 (31%)	5 (5%)	< 0.001
Not reported	17 (9%)	2 (2%)	15 (20%)	–
Outcome data				
Length of stay in days, median [IQR]	1 [0–6]	0 [0–1]	6 [2–10]	< 0.001
30-day mortality, no. (%)	11 (6%)	0 (0%)	11 (14.3%)	< 0.001
90-day readmission, no. (%)	27 (15%)	11 (10%)	16 (21%)	0.059
Follow-up time in months, median [IQR]	47 [19–85]	65 [28–101]	24 [4–64]	–

Patient and surgical characteristics, and outcomes of all obturator hernias and for the subgroups elective and emergency repair. One registration did not contain information on elective/emergency procedure. *IQR* interquartile range, Charlson Comorbidity Index used as a measure of patient comorbidity

true occurrence, as obturator hernias were reported more frequently in the past decade, as depicted in Fig. 3. The increased reporting of obturator hernia repairs in the past decade is likely due to the increased use of laparoscopic groin hernia repair [19], which makes it possible to diagnose occult obturator hernias during other groin hernia repairs. A cohort study from Asia suggested a higher prevalence of 1% of all hernias [2]. Most published evidence of obturator hernias originate from Asia [3], perhaps suggesting a higher prevalence of obturator hernias in Asian populations. The patients in our study were almost all females with a median age of 77 years, which coincides with the patient

Table 2 Subgroup analysis on the emergency obturator hernia repairs

	Laparoscopic	Open	P value
Demographic data			
No. of hernias	30	41	–
Female, no. (%)	29 (97%)	40 (98%)	1.000
Age in years, median (IQR)	86 (81–91)	85 (82–92)	0.911
Charlson Comorbidity Index, no. (%)			
0 (none)	12 (40%)	17 (42%)	0.901
1–2 (mild)	14 (47%)	16 (39%)	0.520
3–4 (moderate)	4 (13%)	7 (17%)	0.750
> 5 (severe)	0 (0%)	1 (2%)	1.00
Surgical data, no. (%)			
No repair	2 (7%)	0 (0%)	0.168
Suture repair	6 (20%)	13 (32%)	0.204
Mesh repair	19 (63%)	20 (49%)	0.906
Not reported	3 (10%)	8 (19%)	
Concurrent hernias, no. (%) per patient			
Bilateral obturator hernia	2 (7%)	0 (0%)	–
Concurrent inguinal hernia	6 (20%)	0 (0%)	0.026
Concurrent femoral hernia	3 (10%)	1 (2%)	0.616
Outcome data			
Length of stay in days, median (IQR)	3 (1–7)	8 (5–13)	0.006
30-day mortality, no. (%)	1 (3%)	8 (20%)	0.043
90-day readmission, no. (%)	10 (33%)	6 (15%)	0.131

IQR Interquartile range. Charlson Comorbidity Index was used as a measure of patient comorbidity. Open or laparoscopic approach was not reported for 6 of the emergency operations, therefore n = 71 for this table

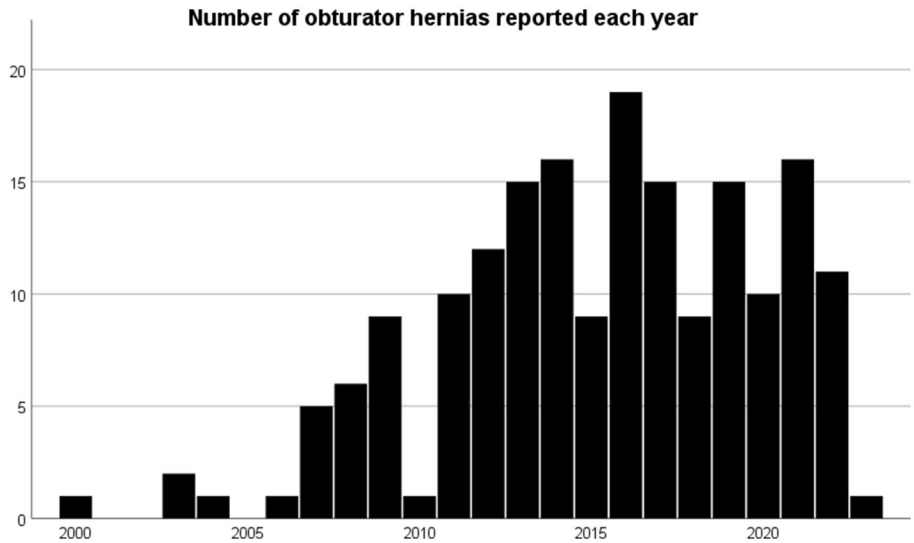

Fig. 3 Distribution of number obturator hernia repairs (y-axis) by year (x-axis). Data were extracted February 22, 2023

demographic of previous retrospective observational studies [2, 5, 7]. Right sided obturator hernias were slightly more frequent, which has also previously been described [2, 6, 9], and is thought to be due to the sigmoid colon covering the left obturator foramen [20], however, according to a previous systematic review, there seems to be no difference in demographics or outcomes based on hernia side [6].

For elective obturator hernia repairs, laparoscopic surgery with mesh repair was almost exclusively performed. Conversely, the emergency obturator hernia repairs consisted of more open surgeries and more frequently suture repair compared with elective surgery. The common choice of suture repair in emergency surgery may be due to the difficulty of placing a preperitoneal mesh during open surgery, or due

to contamination of the surgical field after bowel resection. Emergency obturator hernia surgery has been associated with frequent bowel resection [4, 21], which in turn is associated with increased risk of mesh infection [22, 23]. However, a previous retrospective observational study supports the safety of mesh repair in incarcerated groin and obturator hernias, even in case of bowel resection [24].

We found a reoperation rate for suture repair of 11% which was very similar to a previous review [3]. A previous retrospective observational study found a 3-year reoperation rate of 22% for all non-mesh repairs, including both suture repair and repair using adjacent viscera like the broad ligament or the uterus to cover the hernia defect [5]. In this nationwide study, mesh repair had a lower reoperation rate compared with suture repair. In a previous systematic review, mesh repair has been found to have a significantly lower reoperation rate than suture repair [5]. However, given the low crude reoperation rate, these results should be considered with caution. Consequently, we also chose not to conduct Cox regression of the recurrence rate, as only four events of reoperation were found.

For elective obturator hernia surgery, obturator hernias appeared frequently with other coexisting inguinal or femoral hernias. A scoping review of obturator hernias reported coexisting inguinal hernias in 19%, coexisting femoral hernias in 11%, and bilateral obturator hernias in 25% of repairs, all during laparoscopic surgery [3]. The elective obturator hernia repairs in this study were almost all laparoscopic surgery. The laparoscopic approach allows visualization of the pelvic floor, making it possible to identify obturator hernias as an incidental finding during surgery for other hernias [25]. This may explain the common occurrence of coexisting inguinal and femoral hernias, as several of the elective obturator hernias may be incidental findings during the more common inguinal or femoral hernia repair. For 25% of the elective repairs, obturator hernias were the only hernia present, indicating that they were the reason for surgery. However, for the remaining cases, we are unable to comment on whether the obturator hernia was symptomatic or an incidental finding. The incidental obturator hernias may be asymptomatic and thus a potential recurrence may also be asymptomatic, thus lowering the reoperation rate compared with the true recurrence rate. With the available data set we are not able to approach this hypothesis further. The emergency operations have very few concurrent groin hernias, indicating that the obturator hernias are likely the indication for emergency surgery. The emergency surgeries had longer length of stay and higher 30-day mortality compared with elective surgery. Emergency surgery is a known predictor of mortality [26]. Emergency obturator hernia surgery has a higher occurrence of bowel resection [27] which is associated with higher mortality and morbidity [6]. In the subgroup analysis in Table 2 of the emergency surgeries, there were longer length of stay and higher mortality after an open approach compared with laparoscopic surgery. However, the relationship between open surgery and mortality should be interpreted with care, as bowel resection is a confounder that increases both mortality and morbidity [6] and is more likely to be managed by an open approach [9].

Our study has several strengths. It is based on prospectively collected data from a large nationwide database, containing data from all hospitals in the country. To our knowledge, this is the largest and only nationwide dataset on obturator hernias to date. The registration rate for the Inguinal Hernia Database is 94.2%, and 89.3% for the Ventral Hernia Database [28], thus coverage is high. We have reported our findings according to the RECORD guideline to increase the transparency and quality of the reporting [11]. There are, however, also limitations to our study. As obturator hernias cannot be specifically reported in neither the Inguinal nor the Ventral Hernia Database, they might be underreported. However, some data from unreported obturator hernias still appear in the database due to linkage with the National patient registry [15], provided they have had the proper diagnosis code. We only assessed reoperations, and the recurrences that are not surgically managed are therefore not reported. The true recurrence rate could be much higher, as a previous study found up to 40% greater recurrence rate for groin hernias compared with re-operation rates [29]. Another study of ventral hernias found a fivefold increase between reoperation and clinical recurrence [30]. The true incidence/prevalence is unknown, since our estimates are based on hernias undergoing surgery. However, this is likely the best available estimate.

The high mortality and readmission rate after obturator hernia repairs are likely affected by the old age of the patients. Mortality is also affected by emergency surgery which is associated with higher mortality compared with elective repair [26]. Patients with obturator hernia seem to frequently have other hernias, which may indicate that these patients are at increased risk of other hernia types as well. During laparoscopic hernia repair, it is reasonable to examine the pelvic floor for other hernias. If an obturator hernia is incidentally found during other laparoscopic groin hernia mesh repair, it can relatively easily be repaired simultaneously by ensuring the mesh also covers the obturator foramen thereby likely lowering the risk of an incarcerated obturator hernia and emergency operation with poorer outcomes later in life. This may favor the choice of laparoscopic hernia repair, especially for elderly women, who are at increased risk of obturator hernias. As depicted in Fig. 2, the occurrence of obturator hernias appears to rapidly increase after 60 years of age, reaching its peak at 80 years of age whereafter it declines most likely due to fewer living patients and fewer receiving surgical treatment due to advanced age. This underlines the importance of being aware of the possibility

of an obturator hernia in elderly female patients. Life expectancy is expected to increase in the future, and most of the population of Europe, especially females, are expected to live to be older than 90 years by 2050 [31–33], which may increase the prevalence of age-related diseases such as obturator hernias.

In conclusion, obturator hernias are very rare and affect primarily elderly women, and the method of surgery depends on whether the presentation is acute. Emergency repair is associated with longer length of stay and high mortality. Mesh repair was the most common type of repair, and when performed laparoscopically it allows for detection of occult obturator hernias or other concurrent groin hernias which are common, thereby making it possible to repair these hernias electively and avoid an emergency operation with poor outcomes in the future.

Data sharing Data cannot be shared due to Danish legislation. Please contact the corresponding author for enquiries.

Declarations

Conflict of interest MAH, JJB, KA, SF and JR declare that they have no conflict of interest.

Ethical approval, human rights and informed consent The study is based on routinely-collected health data. There was no requirement for ethics committee approval or informent consent from patients according to Danish legislation.

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