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ORIGINAL ARTICLE

Mortality following emergency groin hernia surgery in Denmark

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Abstract
Purpose The mortality following emergency groin hernia repair in Denmark is more than twice as high (7%) as in comparable countries. This article describes in detail the population that died following emergency herniotomy in order to identify aspects of care that may improve outcome.
Methods Patients ≥18 years of age who died within 30 days following emergency hernia surgery from June 2003 through June 2008 were identified using the Danish Hernia Database (DHDB) and the Danish National Hospital Registry (n = 158). In total, 156 records were collected and reviewed.
Results The median age of the patients was 83 years (range 54–97) and 80% had co-morbidity. There was an almost equal distribution of men and women and inguinal and femoral hernias. More than 60% of the patients with a hernia upon admission had symptoms lasting ≥48 h prior to admission and 41% were not examined for hernia at admission and had delayed diagnosis. Only 23% underwent surgery within 8 h of admission and 35% of the patients were admitted to a medical or non-abdominal surgical ward. Laparotomy and bowel resections were frequent (53.1 and 49.2%, respectively).
Conclusion Delay to admission, diagnosis and surgery are common in patients undergoing emergency groin hernia surgery in Denmark. Patients admitted with acute abdominal symptoms should be examined for a hernia and operated on soon after admission.

Keywords Hernia · Mortality · Emergency · Surgery

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Purpose

Groin hernia surgery is common. The lifetime risk of undergoing surgery for groin hernia is 27% in men and 3% in women [1]. Elective hernia surgery is a safe procedure carrying low mortality, even with high age, whereas emergency surgery has a substantial mortality rate which, in Denmark, was found to be high (7%) [2] compared to other countries (1.7–2.9%) [1, 3, 4]. Most studies concerning hernia focus on recurrence rate, acute and chronic pain, convalescence, type of anaesthesia and risk of complications, but description of results after emergency hernia is scarce. Due to its low prevalence, only large-scale epidemiological studies are relevant.

Based on the nationwide Danish Hernia Database (DHDB) [5], we conducted a detailed review of patients dying after emergency groin hernia repair to identify aspects of care with potential for improvement, in order to reduce the high mortality.

Methods

Data was obtained from the records of patients who fulfilled the inclusion criteria: death within 30 days after an emergency groin hernia repair in the 5-year period from

June 2003 to June 2008. Exclusion criteria were: operations for hernias incorrectly registered as inguinal or femoral and cases where groin hernia repair was not the primary operation. The DHDB is a nationwide database in which surgeons record data on a simple case record form online. The database contains data on all patients aged 18 years and older undergoing inguinal or femoral hernia repair. Among other variables, the surgical technique, emergency or elective surgery and type of hernia are recorded. Registration is based on the patient's unique social security number [2]. The social security number was used to identify all patients who died within 30 days of surgery using the Danish National Hospital Registry. Patient charts among these patients were collected and relevant information was abstracted from those who fulfilled the inclusion criteria. The type of hernia was determined using the description of the intra-operative findings. The cause of death was taken from the death certificate when possible. If the death certificate was unavailable or incomplete, the cause of death was determined using standard forensic guidelines for underlying cause of death if death occurred in the hospital. If death occurred after discharge and no death certificate was available, the cause of death was recorded as unknown. Co-morbidities were compiled from previous medical history from the records, newly diagnosed co-morbidities during the course of admission and discharge abstracts from earlier admissions. Post-operative complications were defined as disorders affecting patients after surgery. The time from admission to surgery was calculated as hours from admission to the beginning of anaesthesia of the herniotomy and was grouped in 2-h categories. Surgical technique was determined using the description of the operation. Bowel resection refers to all types of bowel resection and to all types of enterostomy.

In our 5-year study period, 158 patients in the DHDB matched the inclusion criteria. The records of 156 (98.7%) patients were obtained, while two records could not be retrieved from the hospitals. These two were included in the number of deaths following emergency groin hernia surgery when calculating the mortality rate to avoid underestimation, but were not included in any other analysis. Ten patients were excluded, five because their herniotomy was not the primary operation and five due to incorrect registration. One patient did not have sufficient information in the records to be included in the analysis, leaving a total of 145 records for analysis. Patients were grouped according to the time of diagnosis in relation to the time of admission. The early diagnosis group (ED; $n = 73$) had their hernia diagnosed within 4 h of admission and patients in the late diagnosis group (LD; $n = 55$) had their hernia diagnosed 4 h or later after admission. A group of patients ($n = 16$) had their emergency hernia episode while admitted for another disease, while one patient could not be grouped.

The data were stored in an Access database. Descriptive analyses were performed using Excel and Kaplan–Meier plots using the SPSS statistical software package. This study was approved by the Danish Data Protection Agency.

Results

The overall mortality rate after emergency groin hernia surgery was 147/1,829 (8%). Deaths following emergency hernia surgery occurred in an elderly population (median age 83 years, range 54–97) with concomitant disease, where half of the cases were women and half of the cases suffered from femoral hernias (Tables 1, 2 and 3). Of all the patients who died within 30 days after emergency groin hernia surgery, 34/145 (23.4%) underwent surgery <8 h after admission. Of the patients who had a hernia upon admission (ED group and LD group), 64.8% had symptoms for >48 h prior to admission. Thirty-five percent of the patients were admitted to a medical or a non-abdominal surgical ward. Laparotomy and bowel resection was performed in 53.1 and 49.2% of the patients, respectively. The hernia was the underlying cause of death in 73.1% of the population. In-hospital mortality was 94.5%. At admission, only 92 patients (63.4%) were examined for a hernia. Of the 53 patients not examined for a hernia at admission, 36 (67.9%) were primarily admitted to a medical or non-abdominal surgical ward. In the ED group, 67 patients (91.8%) were admitted with abdominal symptoms and six (8.2%) were admitted for non-abdominal symptoms. Four of these did not have incarcerated hernia upon admission. Another five patients were operated on sub-acutely, three because their incarcerated hernia was reduced in the emergency room and two because of severe concomitant disease. In the LD group, 48 (87.3%) patients were admitted with abdominal symptoms and seven with non-abdominal symptoms.

Table 1 Statistics from the Danish Hernia Database (DHDB), 1 June 2003 to 31 May 2008

Operations in DHDB (n)	51,233
Number of emergency operations (n)	1,829
Median age at emergency operation (years)	73
Emergency operation (%)	
Inguinal hernia	70
Femoral hernia	30
Gender (%)	
Male	67
Female	33
Deaths within 30 days, recorded in the DHDB as emergency operation (n)	158

Table 2 Characteristics of patients with hernia upon admission

	ED	LD	ED + LD
Hernia upon admission (*n*)	73	55	128
Median age, years (range)	83 (54–97)	83 (65–96)	83 (54–97)
Gender (%)			
Male	60.3	40.0	51.6
Female	39.7	60.0	48.4
ASA class (%)			
1–2	19.2	21.8	20.3
3–5	45.2	52.7	48.4
Missing	35.6	25.4	31.3
Duration of symptoms prior to admission (%)			
<6 h	2.7	1.8	2.3
6–23:59 h	27.4	7.3	18.8
24–47:59 h	13.7	7.3	10.9
≥48 h	52.1	81.8	64.8
Missing	4.1	1.8	3.1
Primarily admitted to (%)			
Medical ward or non-abdominal surgical ward	13.7	54.5	31.3
Abdominal surgical ward	86.3	45.5	68.8
Time from admission to surgery (%)[a]			
<6 h	28.8	–	16.4
6–11:59 h	28.8	5.5	18.8
12–23:59 h	26.0	21.8	24.3
24–47:59 h	6.8	29.1	16.4
≥48 h	8.2	43.6	23.4
Surgical technique (%)			
Groin incision	52.1	49.1	50.8
Laparoscopy	–	3.6	1.6
Laparotomy	49.3	58.2	53.1
Bowel resection	47.9	50.9	49.2
Type of hernia (%)			
Femoral	42.5	60.0	50
Inguinal	57.5	40.0	50
Underlying cause of death (%)			
Hernia	76.7	78.2	77.3
Not hernia	11.0	9.1	10.2
Unknown	12.3	12.7	12.5

ED early diagnosis group, hernia diagnosed within 4 h of admission; *LD* late diagnosis group, hernia diagnosed 4 h or more after admission

[a] One patient in the ED group did not have sufficient information in the records to determine the time from admission to surgery

Table 3 Co-morbidity in the total population ($n = 145$)

	n[a]	%
Cardiovascular diseases	64	44.1
Respiratory diseases	40	27.6
Dementia	27	18.6
Endocrinologic diseases	26	17.9
Neurologic diseases	25	17.2
Malignancy	22	15.2
Gastro-intestinal diseases	19	13.1
Renal diseases	7	4.8
Other co-morbidities	17	11.7
No co-morbidity	29	20.0

[a] Patients may appear in the table more than once

In the LD group, 23 (41.8%) patients had unspecific abdominal causes of admission, e.g. nausea, vomiting or unspecific abdominal pains. Seventeen (73.9%) of these were admitted to a medical ward and 18 (78.3%) were not examined for hernia upon admission, even though their symptoms could be caused by hernia. Nineteen of the 23 (82.6%) had hernia as the cause of death. Fifteen of the 23 (65.2%) had a femoral hernia. Eighteen of the 55 patients (32.7%) in the LD group were examined for hernia at admission, but a hernia was only found in six patients and was not recognised as the cause of symptoms.

A group of 16 patients had their acute groin hernia operation during admission for another specific disease, of which 14 were admitted for non-abdominal causes, and the median time from admission to the beginning of abdominal symptoms was 168.5 h, range 14–382 h ($n = 10$). The median time from symptoms to surgery was 24 h, range 14–83 h ($n = 9$). Six of the 16 patients had hernia as the underlying cause of death.

The time from admission to surgery varied between femoral and inguinal hernia. Of the patients with femoral hernia, 28.1% underwent surgery >48 h after admission, compared with 16.1% with inguinal hernia.

In femoral herniotomy, laparotomy occurred in 39 of 67 cases (58.2%) and bowel resection in 39 of 67 cases (58.2%). Thirteen patients had laparotomy without bowel resection and 13 patients had bowel resection without laparotomy. In inguinal herniotomy, laparotomy occurred in 34 of 78 cases (43.6%) and bowel resection in 28 of 78 cases (35.9%).

Table 4 shows the distribution of specific post-operative complications. Twenty-seven (18.6%) patients underwent abdominal re-operations. The majority of patients ($n = 106$ [73.1%]) had hernia as the underlying cause of death, while 17 (11.7%) had other causes of death, 12 of which were medical and five surgical. Ten patients (6.9%) died after discharge and their cause of death was recorded as unknown. In another 11 patients (7.6%), the underlying cause of death could not be established.

Analysis of the cumulated death rate within 30 days post-operatively in the total population of 1,829 patients (Fig. 1) shows that the majority of patients died within the first week post-operatively.

Table 4 Specific complications identified in patients dying after emergency inguinal hernia surgery ($n = 145$)

	n^a	%
Number of patients with identified specific complications	118	81.4
Surgical	28	19.3
Leak	7	4.8
Bleeding	6	4.1
Infection	4	2.8
Wound dehiscence	3	2.1
Bowl ischaemia	3	2.1
Other	5	3.4
Medical	93	64.1
Respiratory	52	35.9
Sudden death	21	14.5
Cardiovascular	20	13.8
Multiple organ failure	19	13.1
Renal	15	10.3
Sepsis	14	9.7
Neurological	3	2.1
Other	1	0.7

[a] Patients may suffer more than one post-operative complication

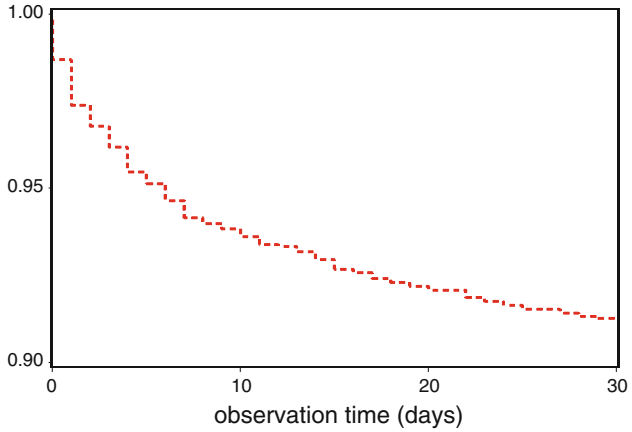

Fig. 1 Thirty-day survival in all patients who underwent emergency hernia surgery in the 5-year study period

Discussion

The patients in this study of emergency groin hernia surgery have a high age and suffer from co-morbidity. Therefore, it is advisable to focus on the pre-operative optimisation of the patients and make sure that surgery is performed by an experienced surgeon [6]. Furthermore, delay to admission, delay to diagnosis and delay to surgery was frequent. A delay in referral, diagnosis and surgery is associated with increased mortality [6, 7] and these three delays could be improved if general practitioners advised patients on the symptoms of incarceration, improved focus on clinical examination for hernia upon admission, especially in medical wards, and by improving pre-operative management by a co-operative team of anaesthetists and surgeons. Most of the deaths in this study occurred within 7 days of surgery and post-operative complications were very frequent. Increased focus on post-operative observation and care would, therefore, be advisable. The relatively high prevalence of femoral hernias found in this study supports current treatment strategies, in that femoral hernias should be operated electively at the time of diagnosis, in contrast to inguinal hernias, where a more conservative strategy has been argued [8, 9].

The large difference in mortality rates between Denmark and other countries [3, 4, 7, 10] can be explained by differences in defining emergency surgery. In a study based on the Swedish Hernia Register [4], a mortality rate of 2.9% was found using a definition of surgery within 24 h of emergency admission, whereas in the DHDB, the surgeon determines if the operation is an emergency. In this study, only 52.4% of the patients were operated on within 24 h of admission. Strength in this study stems from the national coverage provided by the DHDB.

In summary, delay to admission, diagnosis and surgery is frequent in the population dying following emergency hernia surgery. Any patient presenting with abdominal symptoms should be examined for hernia both in a medical and in a surgical setting, and undergo early operation after the diagnosis and correction of co-morbidities.

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