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Factors Affecting Strangulation and Necrosis in Incarcerated Abdominal Wall Hernias

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BACKGROUND/AIMS
The goal of the present study was to determine the factors affecting strangulation and necrosis in incarcerated abdominal wall hernias (AWHs).

MATERIAL and METHODS
This was a retrospective study conducted by reviewing the medical records of 44 patients who underwent surgery for incarcerated abdominal wall hernia at a university hospital between April 2009 and January 2018.

RESULTS
Of the 44 study patients, 28 were men and 16 were women of mean age 68.95 years. Of all, 30 patients (68.2%) had groin hernias (femoral: 7, inguinal: 23) and 14 (31.8%) had ventral hernias (incisional: 8, umbilical: 5, epigastric: 1). The intraoperative findings were strangulation in 24 (54.5%) and necrosis in 20 (45.5%) cases. Accordingly, omental resection was performed in 4, small bowel resection in 14, and large bowel resection in two patients. The hernia was repaired using a polypropylene mesh in 33 patients (of them 20 were Lichtenstein, 8 were on-lay, and 5 were plug-mesh) and without using a mesh in ten patients. The hernia was not repaired in one patient. The mean duration of hospitalization was 7.43 (range: 1-5) days. The mortality rate was 13.6%. In univariate analysis, the mortality was positively related to necrosis (p=0.045). The duration of these symptoms was the only factor that affected strangulation and necrosis.

CONCLUSION
The mortality rate was high in incarcerated abdominal wall hernias, while necrosis was the most significant variable associated with mortality. The duration of the symptoms was the most significant factor that affected necrosis; therefore, it is essential to perform surgical intervention within the first 24 h of admission.

Keywords: Abdominal wall hernia, incarcerated hernia, irreducible hernia, necrosis, obstruction, strangulated hernia

INRODUCTION

Although majority of the abdominal wall hernias (AWHs) are asymptomatic, they can cause serious problems if they are complicated or left untreated. An incarcerated hernia may not require immediate surgery, but it may develop into strangulated hernia, which can be fatal. The studies on complicated hernias generally focus on strangulated groin hernias of rates 0.29–2.9% (1). It is the most severe complication, representing a higher risk for mortality (2). The World Society of Emergency Surgery (WSES) guideline recommends emergency hernia repair in case of strangulation suspicion (3). However, early diagnosis of strangulation may be difficult (4, 5).

The aim of this study was to determine the factors affecting strangulation and necrosis in incarcerated AWHs.

MATERIAL and METHODS

Case Selection Criteria

A retrospective study was conducted by reviewing the medical records of the patients who underwent surgery for incarcerated AWHs at a university hospital between April 2009 and January 2018. The electronic database of the hospital

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were searched with all codes for hernia repair. The exclusion criteria included patients aged<18 years, presence of hernia other than AWHs, presence of hernia unsuitable for the diagnosis of incarcerated hernia, and patients with insufficient data; based on this criteria, 44 patients who underwent surgery for incarcerated AWHs were recruited for the study. The diagnosis of incarcerated hernia (irreducible hernia) was based on the physical examination when a hernia could not be reduced or pushed back manually. The diagnosis of strangulation (referring to ischemia caused by a compromised blood supply leading to gangrene when not relieved) and necrosis (referring to irreversible injury to the contents of the hernia resulting from insufficient blood flow) were made during the surgery. The duration of symptom presentation was defined as ''the time elapsed from the start of the first symptom until the start of surgery.'' The term ''mortality'' refers to death associated either directly or indirectly with the surgery.

The factors of age, gender, presence of additional diseases, type and lateralization of hernia, the duration of symptoms, type of anesthesia, presence of strangulation, and necrosis were recorded and selected as variables to conduct statistical analysis associated with mortality. The factors of age, gender, presence of additional diseases, types and lateralization of hernia, and duration of symptoms were selected as variables to conduct statistical analysis associated with strangulation and necrosis.

Surgical Technique

The resection of the necrotic content (such as omentum and small and large bowels) was performed in all cases with necrosis. Open hernia repair with or without mesh was conducted in accordance with the surgeon's preferences. All patients received prophylactic antibiotics prior to the surgery, and antibiotics were continued in patients with clinically and/or microbiologically verified infections.

Statistical Analysis

Descriptive statistical analysis and Chi-square test of independence were conducted by using the Statistical Package of the Social Sciences software version 17.0 (SPSS Inc.; Chicago, IL, USA).

Ethics Committee Approval

Ethics committee approval was received for this study from the Ethics Committee of İnönü University (Approval Date: 19.02.2019, Approval Number: 2019/4-38). Informed consent was not necessary due to the retrospective nature of this study.

RESULTS

The mean age of the 28 men and 16 women patients was 68.95 years (age range: 41–102 years). A total of 30 patients (68.2%) had groin hernias (femoral: 7, inguinal: 23) and 14 patients (31.8%) had ventral hernias (incisional: 8, umblical: 5, epigastric: 1). Ventral hernias were more frequently noted in women (62.5% vs. 14.3%), and groin hernias in man (85.7% vs.

Main Points:

- Newly diagnosed AWHs should be repaired electively to avoid urgent surgery.
- Surgical repair have to be performed within the first 24 h for incarcerated AWHs.
- In spite of emergency repair, mortality remain high in incarcerated AWHs.

TABLE 1. The factors affecting mortality in incarcerated abdominal wall hernias

Characteristic	Mortality (-)	Mortality (+)	p
Age			
<70	16 (84.2%)	3 (15.8%)	0.717
≥70	22 (88%)	3 (12%)	
Gender			
Male	24 (85.7%)	4 (14.3%)	0.868
Female	14 (87.5%)	2 (12.5%)	
Additional disease (+)	26 (86.4%)	5 (16.1%)	0.457
Hernia type			
Groin hernia	26 (86.7%)	4 (13.3%)	0.932
Ventral hernia	12 (85.7%)	2 (14.3%)	
Lateralization			
Right	17 (85%)	3 (15%)	0.880
Left	9 (81.8%)	2 (18.2%)	
Bilateral	1 (100%)	-	
Median	11 (91.7%)	1(8.3%)	
Duration of symptoms			
24 hour	22 (95.7%)	1 (4.3%)	0.06
>24 hour	16 (76.2%)	5 (23.8%)	
Strangulation			
Negative	19 (95%)	1 (5%) 0.128	
Positive	19 (79.2%)	5 (20.8%)	
Necrosis			
Negative	23 (95.8%)	1 (4.2%)	0.045
Positive	15 (75%)	5 (25%)	
Mesh usage			
Negative	7 (63.6%)	4 (36.4%)	0.011
Positive	31 (93.9%)	2 (6.1%)	
Type of anesthesia			
Local	1 (50%)	1 (50%)	0.186
Spinal	7 (100%)	-	
General	30 (85.7%)	5 (14.3%)	

TABLE 2. The mesh usage in cases without or with necrosis and/or strangulation

Characteristic	Mortality (-)	Mortality (+)	p
Necrosis (Cases resection performed)			
Negative	3 (12.5%)	21 (87.5%)	0.036
Positive	8 (40%)	12 (60%)	
Strangulation			
Negative	3 (15%)	17 (85%)	0.162
Positive	8 (33.3%)	16 (66.7%)	

TABLE 3. The factors affecting strangulation in incarcerated abdominal wall hernias

Characteristic	Strangulation (-)	Strangulation (+)	p
Age			
<70	9 (47.4%)	10 (52.6%)	0.824
≥70	11 (44%)	14 (56%)	
Gender			
Male	15 (53.6%)	13 (46.4%)	0.153
Female	5 (31.3%)	11 (68.8%)	
Additional disease			
Negative	8 (61.5%)	5 (38.5%)	0.165
Positive	12 (38.7%)	19 (61.3%)	
Hernia type			
Groin hernia	16 (53.3%)	14 (46.7%)	0.124
Ventral hernia	4 (28.6%)	10 (71.4%)	
Lateralization			
Right	10 (50%)	10 (50%)	
Left	5 (45.5%)	6 (54.5%)	0.556
Bilateral	1 (100%)	-	
Median	4 (33.3%)	8 (66.7%)	
Duration of symptoms			
24 hour	15 (65.2%)	8 (34.8%)	**0.006**
>24 hour	5 (23.8%)	16 (76.2%)	

TABLE 4. The factors affecting necrosis in incarcerated abdominal wall hernias

Characteristic	Necrosis (-)	Necrosis (+)	p
Age			
<70	10 (52.6%)	9 (47.4%)	0.824
≥70	14 (56%)	11 (44%)	
Gender			
Male	16 (57.1%)	12 (42.9%)	0.647
Female	8 (50%)	8 (50%)	
Additional disease			
Negative	8 (61.5%)	5 (38.5%)	0.546
Positive	16 (51.6%)	15 (48.4%)	
Hernia type			
Groin hernia	19 (63.3%)	11 (36.7%)	0.087
Ventral hernia	5 (35.7%)	9 (64.3%)	
Lateralization			
Right	11 (55%)	9 (45%)	
Left	7 (63.6%)	4 (36.4%)	0.571
Bilateral	1 (100%)	-	
Median	5 (41.7%)	7 (58.3%)	
Duration of symptoms			
24 hour	17 (73.9%)	6 (26.1%)	**0.007**
>24 hour	7 (33.3%)	14 (66.7%)	

37.5%). Femoral hernias occurred more frequently in women (25% vs. 10.7%). Incisional hernias also predominated in the women (43.8%) and inguinal hernias in men (75%). The presenting symptoms were pain (93.1%), bulging (63.6%), nausea and vomiting (34%), and the absence of defecation and flatus (13.6%). Of all cases, 47.72% had been symptomatic for >24 h and only 40.9% underwent surgery within 6 h of admission. A total of 31 (70.5%) patients had one or more additional diseases (cardiovascular system (n=24), respiratory system (n=16), endocrine system (n=5), central nervous system (n=3), and hepatopancreatobiliary system (n=1).

The intraoperative findings were strangulation in 24 (54.5%) and necrosis in 20 (45.5%) cases. Omental resection was performed in 4 (9.09%) patients, small bowel resection in 14 (31.8%) patients, and large bowel resection in 2 (4.54%) patients. The hernia was repaired using a polypropylene mesh in 33 patients (of them, 20 were Lichtenstein, 8 were on-lay, and five were plug-mesh) and without using a mesh in ten patients. The hernia was not repaired in a 58-year-old woman who was operated for giant recurrent incisional hernia requiring bowel resection. She had chronic obstructive pulmonary disease and hypertension and died 5 days after the operation due to pulmonary complications.

The mean duration of hospitalization-stay was 7.43 (range: 1–35 days) days. The overall mortality rate was 13.6%. Univariate analysis revealed that age, gender, type and lateralization of hernia, strangulation, the presence of additional diseases, and the type of anesthesia were not associated with the mortality rate. The mortality rate was however positively related to necrosis (p=0.045), but inversely related to mesh usage (p=0.011). (Table 1). Reinforcement of the hernia with mesh was statistically lower in cases who underwent resection for necrosis due to the preference of the surgeon (Table 2). In univariate analysis, the factors of age, gender, type and lateralization of hernia, and the presence of additional diseases were associated with neither strangulation nor necrosis. The duration of the symptoms was the only factor affecting both strangulation and necrosis (Tables 3 and 4). The characteristics of six patients who died are presented in Table 5. One of them was aged 102 years and the remaining 5 had coexisting diseases that resulted in pneumonia and/or liver rupture.

DISCUSSION

The management of complicated AWHs remain one of the most challenging surgical emergencies (3). The WSES guideline recommend emergency hernia repair on suspicion of intestinal strangulation (3). However, early diagnosis of strangulation may be difficult (4, 5). While the WSES guidelines strongly recommend systemic inflammatory response syndrome, contrast-enhanced computerized tomography findings as well as the levels of lactate, serum creatinine phosphokinase, and D-dimer are predictive of bowel strangulation, albeit their quality of evidence is low (grade IC recommendation) (3). Thus, difficulty in diagnosis can lead to delayed treatment and result in the development of serious complications.

There exists a few reports on the relationship between the complications of incarcerated hernia and the time elapsed

TABLE 5. The characteristics of the patients who died in the study

Patient no	P 1	P 2	P 3	P 4	P 5	P 6
Age	58	66	68	73	78	102
Gender	Female	Male	Male	Female	Male	Male
Additional disease	COPD HT	CHF HT CVA	CRF HT	COPD HT CVA RCC (liver met)	CAD	-
Hernia type	Insicional	Inguinal	Femoral	Insicional	Inguinal	Inguinal
Duration of symptoms	>24 hour	>24 hour	>24 hour	>24 hour	>24 hour	>24 hour
Strangulation	(+)	(+)	(+)	(+)	(+)	(+)
Resected content	Small intestine	Large intestine	Small intestine	Large intestine	Small intestine	(-)
Necrosis	(+)	(+)	(+)	(+)	(+)	(-)
Mesh usage	(-)	(-)	(+)	(-)	(+)	(-)
Type of anesthesia	General	General	Local	General	General	General
Complication	Pneumonia	(-)	Pneumonia Wound infection	Liver laceration (perop)	(-)	Pneumonia
The day of death	5	1	29	3	3	35

from the start of the first symptom until the start of surgery (6-10). Some past authors have reported that symptoms lasting for >6 h were associated with necrosis resulting in more severe complications (6, 7). In a study conducted by Kulah et al., the rates of strangulation and bowel necrosis were found to be significantly higher in patients who presented after 24 h [for strangulation (58.3% vs. 24.1%); for bowel necrosis (23.9% vs. 7.4%)]. Although the rate of mortality was higher in patients who presented after 24 h (6.6% vs. 1.9%), it was not statistically significant. The authors found that bowel necrosis had a significant effect on mortality (2% for cases without necrosis, 19.4% for cases with necrosis). They also found that coexisting diseases had a significant effect on mortality (9). These results may be attributed to the elderly subjects in whom the coexisting diseases increased. Koizumi et al. (10) also stated a statistical difference in the rate of bowel necrosis among patients operated within 24 h and those after 24 h (29% vs. 49%). Derici et al. (8) operated 182 patients for incarcerated AWHs within 24 h and found that only bowel necrosis was significantly associated with mortality. Unfortunately, delay in prompt surgical intervention continues to be an issue that needs to be resolved for most surgeons. According to the Danish hernia registry, incarcerated hernias are not always treated as rapidly as can be expected, even in Europe. It has been revealed that 60% of the cases are symptomatic for >48 h and only 23% undergo surgery within 8 h of admission (11).

Although conflicting results on the effect of duration of symptoms on mortality have been reported, there is no doubt that delayed surgery increases the rate of strangulation and necrosis in incarcerated AWHs. In the current study, 47.72% of the cases had been symptomatic for >24 h and only 40.9% had undergone surgery within 6 h of admission. Therefore, surgeons had to face the bitter truth about the consequences of delayed surgical intervention with a mortality rate of 13.6%, which is similar to that reported in the literature (ranging from 1.4 to 13.4%) (8). In concordance with the study conducted by Kulah et al., the duration of the symptoms was not a risk factor for increased mortality, rather it was associated with an increased risk of strangulation and necrosis (cut-off value was 24 h). The rates of strangulation increased from 34.8% to 76.2% and necrosis from 26.1% to 66.7% in patients who presented after 24 h of the onset of the symptoms. The mortality rate, which was 4.2% in patients without necrosis, increased up to 25% in cases with necrosis. The resection of any organ, especially of the bowel, may exacerbate surgical stress leading to severe complications, especially in high-risk patients. One of the six patients who died was aged 102 years and the remaining 5 had coexisting diseases, which caused pneumonia and liver rupture eventually.

Owing to its retrospective nature, this study was limited by the records of patients. It was also limited by the small number of cases.

In conclusion, a delay in surgery of >24 h since the onset of the symptoms for incarcerated AWHs is more likely to develop necrosis, which is associated with a higher mortality rate, irrespective of statistical significance. Therefore, it is essential to perform surgical intervention within the first 24 h. In spite of emergency repair, mortality remain high in incarcerated AWHs. Thus, elective repair should be advised for patients with a newly diagnosed AWHs to avoid complications that may necessitate urgent surgery.

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