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Incarcerated abdominal wall hernia surgery: relationship between risk factors and morbidity and mortality rates (a single center emergency surgery experience)

Boğulmuş abdominal duvar herni cerrahisi: Morbidite ve mortalite insidansının risk faktörleriyle ilişkisinin analizi (Tek merkezli acil cerrahi deneyimi)

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BACKGROUND

The aim of the present study was to investigate morbidity- and mortality-related risk factors in patients undergoing surgery due to incarcerated abdominal wall hernia.

METHODS

The patients were grouped according to the type of hernia (inguinal, umbilical, incisional, femoral), and these groups were evaluated in terms of risk factors affecting morbidity and mortality such as age, gender, American Society of Anesthesiologists (ASA) score, type of anesthesia, concomitant diseases, and the presences of intestinal strangulation and necrosis.

RESULTS

Inguinal hernia was frequent in males, whereas femoral hernia was frequent in females ($p<0.001$). The rate of intestinal resection due to strangulation and necrosis was found significantly higher among femoral hernias as compared to the other types of hernia ($p<0.005$ and $p<0.001$, respectively). Advanced age (≥65 years), concomitant disease, strangulation, necrosis, high ASA score (III-IV), time from the onset of symptoms, and time to hospital admission were found to have significant influences on morbidity and mortality. General anesthesia was found to be a risk factor for morbidity as well ($p<0.05$).

CONCLUSION

Incarcerated abdominal wall hernias are surgical problems with high morbidity and mortality rates. Therefore, surgery should be planned under elective conditions when hernia is detected.

Key Words: Abdominal wall hernia; incarceration; necrosis; strangulation.

AMAÇ

Bu çalışmada, acil cerrahi kliniğimizde boğulmuş abdominal duvar hernisi nedeniyle ameliyat edilen hastalarda morbidite ve mortaliteyle ilişkili risk faktörlerinin insidansı araştırıldı.

GEREÇ VE YÖNTEM

Hastalar hem fıtık türüne göre (inguinal, umblikal, insizyonel, femoral) kendi aralarında hem de morbidite ve mortalite üzerine etkili faktörler bakımından; yaş, cinsiyet, Amerikan Anesteziyoloji Derneği (AAD) skoru, anestezi tipi, eşlik eden hastalıklar, intestinal boğulma ve nekroz varlığı gibi verilerle değerlendirildi.

BULGULAR

İnguinal herni erkeklerde, umblikal ve femoral herni kadınlarda sıktı ($p<0,001$). Femoral hernide boğulma ve nekrozdan dolayı intestinal rezeksiyon diğer fıtık türlerine göre anlamlı olarak yüksek saptandı (sırasıyla, $p<0,005$ ve $p<0,001$). Morbidite ve mortalite üzerine; ileri yaş (≥65 yaş), ek hastalık, strangülasyon, nekroz, yüksek AAD skoru (III, IV), semptomların başlama ve hastaneye başvuru süresinin anlamlı etkisi bulundu. Genel anestezinin de morbidite için risk oluşturduğu görüldü ($p<0,05$).

SONUÇ

Boğulmuş abdominal duvar hernileri yüksek morbidite ve mortalite oranına sahip bir cerrahi problemdir. Bu yüzden herni saptandığında elektif koşullarda ameliyat planlanmalıdır.

Anahtar Sözcükler: Abdominal duvar hernisi; inkarserasyon; nekroz; strangülasyon.

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Abdominal wall hernia (AWH) surgery is among the most frequently performed general surgical operations throughout the world.[1] Incarceration and strangulation are the most severe complications and account for a substantial portion of the patients presenting to emergency surgery clinics with acute abdominal complaints. Of the AWH cases, approximately 5%-13% may require emergency surgery due to incarceration and obstruction, and of the cases undergoing emergency surgery, 10%-15% may require intestinal resection due to necrosis.[2,3] In such surgical operations, inadequate preoperative preparation and the advanced age of the majority of the patients lead to a remarkable increase in morbidity and mortality.[4]

The aim of the present study was to evaluate the rate of morbidity- and mortality-related risk factors in patients undergoing surgical operation in our emergency surgery clinic due to incarcerated AWH.

MATERIALS AND METHODS

One hundred and ninety patients underwent emergency surgery due to incarcerated AWH in the 5th General Surgery Clinic of Haydarpasa Training and Research Hospital between December 2003 and January 2011. Indications for emergency surgery included irreducible mass, pain localized to the abdominal wall, and the signs and symptoms of mechanical intestinal obstruction. All patients were systematically evaluated prior to the operation. Complete blood count, biochemical analysis, and electrocardiography (ECG) were performed. Chest and direct abdominal radiographs were obtained while the patient was in a standing position. Those with a concomitant disease were preoperatively referred to the related clinics for consultation according to pathological data and medical histories. A single dose of second-generation cephalosporin was administered as prophylaxis. Cases with intestinal necrosis, which failed to normalize despite hot saline application and waiting after the release of the neck of the hernia sac, required resection and anastomosis. In patients with intestinal necrosis, antibiotherapy was continued in the postoperative period for an additional five days on average. All the patients underwent surgical operation within the first 24 hours of their hospital admission. General anesthesia was preferred for incarcerated umbilical hernia and incisional hernia of the upper abdomen, whereas spinal or general anesthesia was performed for incarcerated inguinal and femoral hernias and incisional hernia of the lower abdomen. The anesthesiologist decided the type of anesthesia to be performed. Inguinal incisions were used for inguinal and femoral hernias. However, the operation was completed by converting the incision into superior and inferior umbilical incision in inguinal and femoral hernia cases undergoing intestinal resection and anastomosis. Cooper's ligament hernioplasty (McWay) and anterior prosthetic mesh-plug hernioplasty methods were used in femoral hernia cases, whereas tension-free hernia repair was performed with monofilament polypropylene mesh in the other types of hernia. The term morbidity was used for postoperative major and minor complications (wound site, pulmonary and cardiac complications). The term mortality was used for deaths within 30 days of the operation or before discharge from the hospital. The patients were grouped according to the hernia type, and the groups were then evaluated with respect to the factors affecting morbidity and mortality, such as age, gender, American Society of Anesthesiologists (ASA) score, type of anesthesia, intestinal strangulation and necrosis, and the presence of a concomitant disease. Statistical analyses of the data were performed using Number Cruncher Statistical System (NCSS) 2007 and Power Analysis and Sample Size (PASS) 2008 Statistical Software (Utah, USA) program. In addition to the descriptive statistical methods (mean, standard deviation, ratio), Kruskal-Wallis test was used for the intergroup comparison of the quantitative data, whereas Mann-Whitney U-test was used to identify the group that caused the difference and for the comparison of two groups. Qualitative data were compared using chi-square test and Fisher's exact test. A p value <0.05 was considered statistically significant.

RESULTS

Of the 2,380 AWH cases (inguinal, umbilical, incisional, femoral) operated in the 5th General Surgery Clinic of Istanbul Haydarpasa Training and Research Hospital between December 2003 and January 2011, 190 (7.98%) underwent emergency surgery due to incarceration. Considering the hernia type, the rate of emergency surgery was the highest among femoral hernias (47.1%), but the lowest among inguinal hernias (6.1%) (Table 1). Of the emergency cases with incarceration, 55.8% had inguinal, 21.1% had umbilical, 14.7% had incisional, and 8.4% had femoral hernias. The mean age of the cases was 60.81±15.51 (range, 27-92 years). Of the cases, 64.7% (n=123) were males and 35.3% (n=67) were females.

Table 1. The prevalence of emergency surgical procedures according to the hernia type

Type of hernia	Emergency surgical procedure n (%)	Total surgical procedures n
Inguinal	106 (6.12%)	1732
Umbilical	40 (9.95%)	402
Incisional	28 (13.2%)	212
Femoral	16 (47.05%)	34

Table 2. Evaluations according to the hernia types

	Type of hernia				
	Inguinal (n=106)	Incisional (n=28)	Umbilical (n=40)	Femoral (n=16)	*p*
Age					
<65	64 (60.4%)	12 (42.9%)	25 (62.5%)	8 (50%)	0.309
≥65	42 (39.6%)	16 (57.1%)	15 (37.5%)	8 (50%)	
Gender					
Male	90 (84.9%)	16 (57.1%)	12 (30%)	5 (31.3%)	**0.001****
Female	16 (15.1%)	12 (42.9%)	28 (70%)	11 (68.8%)	
American Society of Anesthesiologists					
I	6 (5.7%)	2 (7.1%)	6 (15%)	0 (0%)	**0.026***
II	42 (39.6%)	15 (53.6%)	16 (40%)	8 (50%)	
III	46 (43.4%)	3 (10.7%)	12 (30%)	4 (25%)	
IV	12 (11.3%)	8 (28.6%)	6 (15%)	4 (25%)	
Anesthesia					
General	58 (54.7%)	24 (85.7%)	40 (100%)	13 (81.3%)	**0.001****
Spinal	48 (45.3%)	4 (14.3%)	0 (0%)	3 (18.7%)	
Intestinal strangulation					
Positive	44 (41.5%)	16 (57.1%)	18 (45%)	14 (87.5%)	**0.005****
Negative	62 (58.5%)	12 (42.9%)	22 (55%)	2 (12.5%)	
Concomitant disease					
Positive	51 (49.2%)	12 (42.8%)	17 (42.5%)	7 (43.7%)	0.913
Negative	55 (51.8%)	16 (57.2%)	23 (57.5%)	9 (56.3%)	
Intestinal necrosis					
Positive	14 (13.2%)	7 (25%)	6 (15%)	10 (62.5%)	**0.001****
Negative	92 (86.8%)	21 (75%)	34 (85%)	6 (37.5%)	
Morbidity					
Positive	14 (13.2%)	7 (25%)	4 (10%)	2 (12.5%)	0.336
Negative	92 (86.8%)	21 (75%)	36 (90%)	14 (87.5%)	
Mortality					
Positive	5 (4.7%)	1 (3.6%)	0 (0%)	0 (0%)	0.443
Negative	101 (95.3%)	27 (96.4%)	40 (100%)	16 (100%)	
Recurrence					
Yes	6 (5.9%)	1 (3.8%)	1 (2.5%)	0 (0%)	0.642
No	95 (94.1%)	25 (96.2%)	39 (97.5%)	16 (100%)	

Chi-square test was used *p<0.05; **p<0.01.

General anesthesia was preferred in 135 (71.0%) and spinal anesthesia in 55 (29.0%) cases. The rate of using general anesthesia was significantly higher in umbilical and incisional hernia surgeries (p<0.001).

Hernias were simply reduced in 98 (51.5%) patients; however, strangulation was detected in 92 (48.5%) patients during the surgery. Whereas intestinal blood circulation recovered in 55 (29%) patients, 37 (19.5%) patients underwent intestinal resection (33 [17.3%] small intestine and 4 [2.2%] colon) and anastomosis due to necrosis. Omental resection was required in 6 (3.1%) patients.

There was a significant difference between genders in terms of hernia types. Inguinal hernia was more common in males, whereas umbilical and femoral hernias were more common in females (p<0.001) (Fig. 1, Table 2). The rate of intestinal resection due to strangulation and necrosis was found significantly higher in femoral hernias as compared to the other types of hernia (p<0.005 and p<0.001, respectively) (Table 2). There was no significant difference between the types of hernia in terms of age, morbidity, mortality, or recurrence rates (p>0.05) (Table 2).

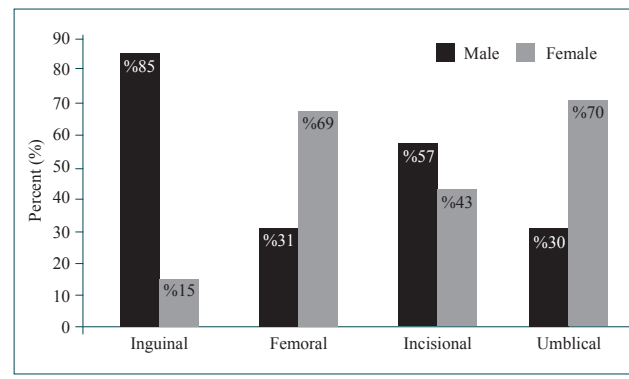

Fig. 1. Distribution of types of hernia according to genders.

Table 3. Evaluations according to morbidity

	Morbidity		*p*
	Positive n (%)	Negative n (%)	
Age			
<65	4 (14.8%)	105 (64.4%)	**0.001****
≥65	23 (85.2%)	58 (35.6%)	
Gender			
Male	17 (63%)	106 (65%)	0.835
Female	10 (37%)	57 (35%)	
Type of hernia			
Inguinal	14 (51.9%)	92 (56.4%)	0.336
Femoral	2 (7.4%)	14 (8.6%)	
Incisional	7 (25.9%)	21 (12.9%)	
Umbilical	4 (14.8%)	36 (22.1%)	
Concomitant disease			
Positive	21 (77.7%)	66 (40.4%)	**0.001****
Negative	6 (22.3%)	97 (59.6%)	
Intestinal strangulation			
Positive	22 (81.5%)	70 (42.9%)	**0.001****
Negative	5 (18.5%)	93 (57.1%)	
Symptom duration			
≤24 hours	6 (22.2%)	114 (69.9%)	**0.001****
>24 hours	21 (77.8%)	49 (30.1%)	
ASA			
I-II	2 (7.4%)	93 (57.1%)	0.001**
III-IV	25 (92.6%)	70 (42.9%)	
Intestinal necrosis			
Positive	14 (51.9%)	23 (14.1%)	0.001**
Negative	13 (48.1%)	140 (85.9%)	
Anesthesia			
General	25 (92.6%)	114 (69.9%)	0.017*
Spinal	2 (7.4%)	49 (30.1%)	

ASA: American Society of Anesthesiologists. Chi-square test was used. *p<0.05; **p<0.01.

Table 4. Evaluations according to mortality

	Mortality		*p*
	Positive n (%)	Negative n (%)	
Age			
<65	0 (0%)	109 (59.2%)	**0.005****
≥65	6 (100%)	75 (40.8%)	
Gender			
Male	5 (83.3%)	118 (64.1%)	0.427
Female	1 (16.7%)	66 (35.9%)	
Type of hernia			
Inguinal	5 (83.3%)	101 (54.9%)	0.443
Femoral	0 (0%)	16 (8.7%)	
Incisional	1 (16.7%)	27 (14.7%)	
Umbilical	0 (0%)	40 (21.7%)	
Intestinal strangulation			
Positive	4 (66.7%)	88 (47.8%)	0.433
Negative	2 (33.3%)	96 (52.2%)	
Symptom duration			
≤24 hours	1 (16.7%)	119 (64.7%)	**0.026***
>24 hours	5 (83.3%)	65 (35.3%)	
Concomitant disease			
Positive	6 (100%)	81 (44.0%)	**0.008****
Negative	0 (0%)	103 (56%)	
ASA score			
I-II	0 (0%)	95 (51.6%)	**0.029***
III-IV	6 (100%)	89 (48.4%)	
Intestinal necrosis			
Positive	4 (66.7%)	33 (17.9%)	**0.014***
Negative	2 (33.3%)	151 (82.1%)	
Anesthesia			
General	5 (83.3%)	134 (72.8%)	1.000
Spinal	1 (16.7%)	50 (27.2%)	

ASA: American Society of Anesthesiologists. Chi-square test, Fisher's exact test were used. *p<0.05; **p<0.01.

Mortality was detected in 6 (3.1%) patients, and the reasons for mortality were congestive cardiac insufficiency in 4, pulmonary embolism in 1, and adult respiratory distress syndrome (respiratory insufficiency) in 1 patient.

Morbidity was detected in 27 (14.2%) patients, and the reasons for morbidity were local wound site complications in 14 (10 wound site infection, 4 seroma), postoperative ileus in 4, testicular edema in 3, atelectasis in 2, pneumonia in 2, and congestive cardiac insuffi-

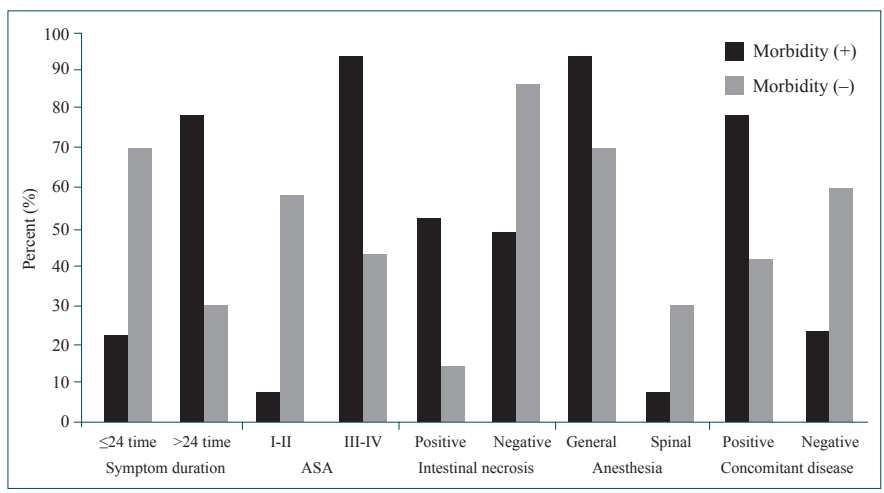

Fig. 2. Factors affecting morbidity.

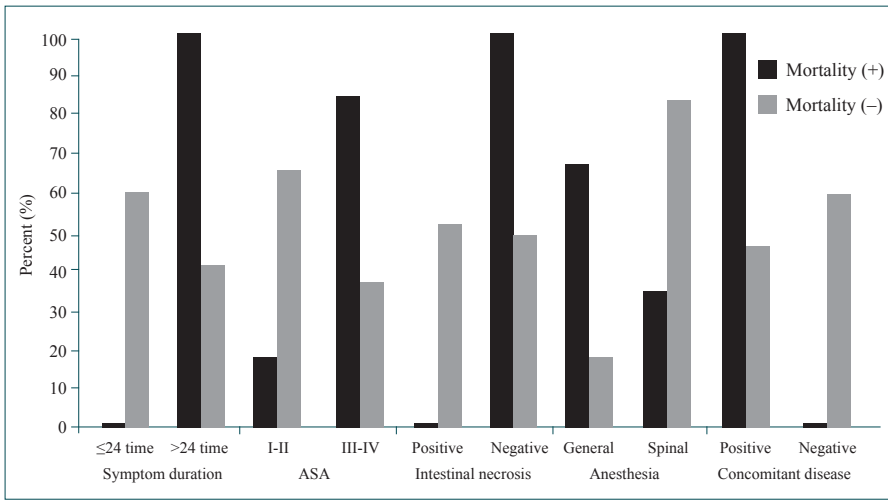

Fig. 3. Factors affecting mortality.

ciency in 2 patients. Concomitant disease was detected in 87 (45.7%) patients. Concomitant diseases included chronic obstructive pulmonary disease (COPD), coronary artery disease, congestive cardiac insufficiency, hypertension, and type 2 diabetes mellitus.

The rates of advanced age (≥65 years), strangulation, necrosis, high ASA score (III-IV), symptom duration, and presence of concomitant diseases were found significantly high in the group with morbidity and mortality as compared to the group without morbidity and mortality (Tables 3, 4, Figs. 2, 3). The present study demonstrated that general anesthesia was a risk for morbidity as well ($p<0.05$).

There was a significant difference between hernia types in terms of duration of hospital stay ($p<0.01$). Duration of hospital stay was found significantly shorter in the inguinal hernia group as compared to the femoral, incisional and umbilical hernia groups ($p<0.003$, $p<0.001$ and $p<0.004$, respectively). No significant difference was found between the femoral, incisional and umbilical hernia groups in terms of duration of hospital stay (Table 5) ($p>0.05$). Duration of hospital stay was significantly higher in the cases with necrosis as compared to those without necrosis (Table 6) ($p<0.001$).

DISCUSSION

Despite the advances in anesthesia, antisepsis, antibiotics, and fluid replacement, the morbidity and mortality following incarcerated AWH surgery remain high. The rates of mortality and morbidity have been reported to be approximately 5% and 20%-30%, respectively.[2,4-6] The results obtained in the present study were consistent with the literature showing a mortality rate of 3.1% and a morbidity rate of 14.2%. Many factors affecting mortality and morbidity have been reported. In the present study, the morbidity rate was the highest in incisional hernia, whereas the mortality rate was the highest in inguinal hernia, and no significant effect of the hernia type was determined ($p>0.05$).

While incarcerated inguinal hernias have been more commonly reported in males, femoral and umbilical hernias are more common in females, and no significant effect of gender on mortality and morbidity has been shown.[2,7] Similarly, in the present study, inguinal hernia was more common in males and femoral and umbilical hernias were more common in females

Table 6. Duration of hospital stay according to intestinal necrosis

	Duration of hospital stay		*p*
Intestinal necrosis	Mean±SD	Median	
Positive	8.78±6.42	4.0	0.001**
Negative	4.63±2.49	7.0	

Mann-Whitney U test **p<0.01.

Table 5. Evaluation of time of discharge according to the hernia types

	Type of hernia				*p*
	Inguinal Mean±SD (median)	Femoral Mean±SD (median)	Incisional Mean±SD (median)	Umbilical Mean±SD (median)	
Time of discharge (days)	4.20±2.23 (4)	7.75±6.84 (5)	6.22±2.61 (6)	6.30±4.51 (5.5)	0.001**

Chi square test; **p<0.01.

(p<0.001); no significant effect of gender on morbidity (p=0.835) or mortality (p=0.427) was observed.

Advanced age (≥65 years) is an effective factor on morbidity and mortality in incarcerated AWH surgeries.[8,9] Alverez et al.[7] reported that postoperative pulmonary and cardiovascular complications were frequently encountered in the elderly, and consequently, the duration of hospital stay was prolonged in such patients. Martínez-Serrano et al.[6] stated that advanced age was an effective factor on morbidity and mortality in incarcerated AWH cases. Likewise, in the present study, it was demonstrated that advanced age had a significant effect on morbidity (p<0.001) and mortality (p<0.005). Of the patients with morbidity, 85.2% were ≥65 years, whereas all patients with mortality were ≥65 years.

High ASA score (III-IV) and concomitant diseases are the other factors that affect mortality and morbidity.[7] Gloub et al.[10] reported that high ASA score was one of the most important independent risk factors affecting mortality. A significantly longer hospital stay and a significantly higher morbidity rate have also been reported in elderly patients with ASA class III or IV who underwent emergency hernia repair.[4] The study conducted by Alvarez et al.[7] reported that high ASA score was a factor affecting morbidity and mortality. The present study demonstrated that patients with high ASA score had significant morbidity (p<0.001) and mortality (p=0.029).

Late presentation to the hospital is also an important factor for morbidity and mortality since it is likely to form a basis for intestinal necrosis and resection. Ashirov et al.[11] stated that the mortality was high among the femoral hernia cases presenting to the hospital later than 48 hours. Kulah et al.[4] demonstrated that morbidity and mortality rates were increased due to strangulation and necrosis in incarcerated hernia cases presenting to the hospital later as compared to those presenting earlier. Patients presenting to the hospital 24 hours after the development of incarceration accounted for 81.8% of the cases who died. In the present study, 83.3% of the cases who died and 77.8% of the cases with morbidity were the patients who presented to the hospital 24 hours after the development of incarceration. Late presentation to the hospital was attributed to the socioeconomic status of the patient, to presentation to small hospitals that lack a relevant specialist, and to misdiagnosis by the physicians. The present study also demonstrated that late presentation to the hospital had a significant effect on morbidity and mortality (p<0.001 and p=0.026, respectively).

General anesthesia has been reported to be one of the factors affecting mortality due to the presence of concomitant disease.[4,7] Derici et al.[5] reported that the type of anesthesia had no effect on mortality, but general anesthesia significantly increased the morbidity as compared to spinal anesthesia. The present study demonstrated that general anesthesia increased the morbidity as compared to spinal anesthesia (p=0.017), but had no significant effect on mortality (p=1.00).

Strangulation of a hernia is a surgical emergency and has high mortality. Mortality increases in case there is a need for intestinal resection.[12] Femoral type hernia substantially leads to incarceration and strangulation, and thus requires intestinal resection.[13,14] Among the hernia types, intestinal necrosis is most commonly encountered in femoral hernias. However, no significant effect of the hernia type on mortality and morbidity has been demonstrated.[4,15] Femoral hernia may be misdiagnosed as inguinal hernia, lymphadenopathy, lipoma, or psoas abscess.[16] The rate of incarceration and strangulation has been reported to be 44%-86% in femoral hernias.[8,17] In the present study, the rates of strangulation and necrosis in femoral hernias were found as 87.5% and 62.5%, respectively.

In the study conducted by Kurt et al.,[3] intestinal necrosis was most common in femoral hernia cases. In the present study, the rate of necrosis was found significantly higher in femoral hernia cases as compared to the other types of hernia.

In the present study, while strangulation was found to have a significant effect on morbidity (p=0.001), it had no significant effect on mortality (p=0.433). However, it was observed that necrosis had a significant effect on both morbidity (p=0.001) and mortality (p=0.014).

The duration of hospital stay increases due to necrosis and resection. Kurt et al.[3] reported that the period after the resection due to necrosis was effective on morbidity and prolonged the duration of hospital stay. In the present study, the duration of hospital stay was found to be prolonged in the patients undergoing resection due to necrosis (p=0.001). Necrosis was lowest in inguinal hernia cases, and the time to discharge was shorter as compared to the other hernia types (p<0.001).

The gold standard in the surgical treatment of incarcerated AWHs is repair of the hernia with low morbidity and mortality and low recurrence rate in the long-term follow-up. Factors that influence recurrences in hernia surgery include inadequate surgical technique, size of the hernia, obesity, wound site infection, cigarette smoking, diabetes, COPD, advanced age, and the use of steroid.[18-22] Recurrence rate has been reported in the literature as 1-22% for incarcerated inguinal hernias[23,24] and as 1-10% for incarcerated femoral hernias.[25] In the present study, recurrence was determined in totally 8 (4.2%) cases; the recurrence rate was highest in inguinal hernia (n=6, 5.9%)

as compared to all hernia types.

Synthetic grafts have been used in hernia surgery for 30 years. The polypropylene graft is durable and stimulates fibroplasia due to its monofilament structure. It neither triggers infection nor is rejected by the tissues.[26,27] Mesh use has no contraindication in many patients that require intestinal resection. It has been reported that polypropylene meshes can be used safely in inguinal hernia cases that undergo intestinal resection.[28] Polypropylene meshes are resistant against infections due to their macroporous structure and can be used safely in AWH defects. Repair techniques performed using Prolene mesh in anterior AWHs in the hands of experienced surgeons and in accordance with the technique would provide lower morbidity and recurrence rates. In their study, Beltran et al.[29] used mesh in both elective and strangulated hernia repairs and could not find any significant difference in terms of postoperative complications. Bessa et al.[30] stated that there was no difference between elective or emergency mesh use in terms of postoperative complications and that mesh could be used safely. Papaziogas et al.[31] found no difference between inguinal hernia repair with and without mesh in terms of postoperative complications and wound infection. Surgical repair using mesh is the current trend in the treatment of primary or recurrent umbilical hernias in both obese and non-obese adults due to its lower recurrence rate as compared to surgical repair by suturing (1% *vs.* 11%).[32,33]

In conclusion, the present study demonstrated that advanced age (≥65 years), presence of concomitant disease, intestinal strangulation, necrosis and intestinal resection, high ASA score (III-IV), and time from onset of the symptoms were effective on morbidity and mortality. General anesthesia poses a risk for morbidity as well. As AWH is identified, surgery should be performed under elective conditions in order to avoid the risks of emergency surgery.

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