

# A single-center study on the factors affecting the surgical approach in emergent inguinal hernias

*Acil inguinal hernilerde cerrahi yaklaşıma etki eden faktörler: tek merkez deneyimi*

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## Abstract

**Purpose:** The aim is to establish the principles of surgery for patients who have undergone emergency groin hernia surgery by examining risk factors, diagnostic modalities, time to operation, and surgical techniques.

**Materials and methods:** A retrospective analysis was conducted on patients who underwent groin hernia repair surgery between the years 2017 and 2022. The study evaluated various parameters such as demographic characteristics, physical examination findings, co-morbidities, radiologic assessments, operation notes, time of arrival to the hospital, and the duration of the operation. Data was collected from the hospital's electronic medical records system. Based on the mode of pre-operative assessment, patients were classified into two groups: group 1, comprising patients whose decision for surgery was based on physical examination alone, and group 2, comprising patients who underwent radiologic assessment prior to the operation.

**Result:** The risk evaluation of patients who underwent emergent hernia surgery revealed a higher incidence of women gender (25%) and femoral hernia type (16.6%) as compared to the elective surgery group, where the incidence was 6.7% and 1.6%, respectively. The diagnosis of patients was primarily based on physical examination findings, although radiologic methods were used preoperatively in 75% of the cases. It was observed that radiologic assessments increased the duration of the operation and resulted in higher morbidity and intestinal resection rates.

**Conclusion:** Radiologic methods, apart from in cases of suspected conditions such as obesity and recurrent hernias, may lead to delayed treatment and increased morbidity and mortality rates in patients undergoing emergent hernia surgery. Prompt surgical intervention based on physical examination findings is crucial in cases of strangulation or incarceration. In instances of spontaneous reduction, incisional exploration, hernioscopy, laparoscopy, or laparotomy should be considered if there is any suspicion of intestinal viability.

**Keywords:** Inguinal, hernia, emergency, surgery.

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## Öz

**Amaç:** Kasık fıtığı nedeniyle acil girişim gereken hastalarda risk faktörlerini, tanı yöntemlerini, operasyon zamanını ve tekniklerini inceleyerek cerrahi prensipleri belirlemek.

**Gereç ve yöntem:** 2017 ile 2022 yılları arasında kasık fıtığı onarımı ameliyatı geçiren hastalar retrospektif olarak incelendi. Çalışmada; demografik özellikler, fizik muayene bulguları, eşlik eden hastalıklar, radyolojik değerlendirmeler, operasyon notları, hastaneye varış zamanı ve operasyon süresi gibi çeşitli parametreler değerlendirildi. Veriler hastanenin elektronik tıbbi kayıt sisteminden toplandı. Hastalar, ameliyat öncesi değerlendirme şekline göre iki gruba ayrıldı: grup 1, ameliyat kararı sadece fizik muayene bulgularına dayanan hastaları içerirken; grup 2, ameliyattan önce radyolojik değerlendirmeye tabi tutulan hastaları içermekteydi.

**Bulgular:** Kadın cinsiyet (%25) ve femoral fıtığa (%16,6) sahip hastalarda inkarasyon ve buna bağlı acil cerrahi gereksinimi daha yüksek oranda izlenmiştir. Hastaların tanısı genellikle fizik muayene bulgularına dayanıyordu ancak radyolojik yöntemler de vakaların %75'inde ameliyat öncesi değerlendirmede kullanıldı. Radyolojik değerlendirmelerin operasyon süresini artırdığı ve daha yüksek morbidite ve bağırsak rezeksiyonu oranlarına neden olduğu gözlemlendi.

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**Sonuç:** Obezite ve nüks fitik gibi şüpheli durumlar dışında, acil fitik cerrahisi geçiren hastalarda radyolojik yöntemler, tedaviyi geciktirebilir ve morbidite ve mortalite oranlarını artırabilir. İnkarserasyon veya strangülasyon durumlarında fizik muayene bulgularına dayalı hızlı cerrahi müdahale hayati önem taşır. Spontan redüksiyon durumlarında bağırsak canlılığına dair herhangi bir şüphe varsa eksplorasyon, hernioskopi, laparoskopik veya laparotomi düşünülmelidir.

**Anahtar kelimeler:** İnguinal, herni, acil, cerrahi.

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## Introduction

Groin hernias (GH) are a common occurrence and typically require surgical intervention, with emergency surgery being necessary in 5-13% of cases [1, 2]. However, there is controversy regarding the identification of risk factors for incarceration (IC) or strangulation (SG), the use of diagnostic methods, and the optimal timing for surgery [3]. Factors such as femoral hernias and a history of hospitalization within the past year increase the likelihood of IC or SG and the need for emergent intervention, particularly among women [4, 5]. While GH surgery is generally considered low risk, emergency situations with SG or IC can lead to complications and even mortality, particularly in patients who are older than 65, experiencing intestinal obstruction, taking anticoagulants, classified as ASA III and IV, female, or have a body mass index over 30 [4-8]. Among the factors that contribute to increased mortality and morbidity rates are the presence of a long-term hernia, delayed diagnosis and treatment, IC hernias lasting exceeding 24 hours, symptoms lasting extending beyond 3 days, a prolonged duration between diagnosis to surgery, femoral hernia, a previous occurrence of exploration through midline incision post hernia reduction, and hernia recurrence [6, 8-11]. The present study seeks to examine the risk factors associated with the development of surgical emergencies such as strangulated (SG) or incarcerated (IC) hernias, as well as the timing of surgical intervention and the methods of treatment utilized in patients who have undergone emergent groin hernia (GH) surgery.

## Materials and methods

The study titled “Surgical Treatment of Inguinal Hernia and Cord Lipomas” was conducted between 2017-2022 after obtaining approval from the Clinical Research Ethics Committee of Istanbul Medeniyet University Goztepe Training and Research Hospital.

Between 2017 and 2022, patients who were diagnosed with incarcerated groin hernia and underwent surgery in our general surgery emergency department were included in the cohort. All patients underwent a physical examination by the on-call general surgeon after initial assessment in the emergency department. Pre-operative imaging was requested in selected cases for differential diagnosis according to the preference of the on-call general surgeon. Initially, ultrasound (US) was the preferred imaging modality, and if access to US was not available after midnight, computed tomography (CT) was performed. All surgeries were performed by on-call general surgeons with a minimum of 3 years of experience under emergency conditions. Hernia repair was performed either mesh or primary repair based on the contamination status of the wound site. Hernioscopy was performed in patients with spontaneous hernia sac reduction, and laparotomy was performed in patients requiring bowel resection.

In the cohort group, various parameters such as demographic characteristics, physical examination findings, comorbidities, radiological evaluations, operation notes, time of arrival

at the hospital, and operation duration were retrospectively evaluated.

Two distinct patient groups were established: Group 1, whose surgeries were based solely on physical examination results, and Group 2, whose surgeries were preceded by preoperative imaging. The data collected was subjected to analysis utilizing SPSS Statistics Version 26, descriptive statistics were presented as counts and percentages for categorical variables, and as mean  $\pm$  standard deviation, median, and minimum-maximum values for continuous variables. The presence of a normal distribution was assessed using histograms and the Shapiro-Wilk test. Depending on whether the data followed a normal distribution or not, Student's t-test or Mann-Whitney U test was used for comparing continuous variables between two independent groups. Categorical variables were compared using Pearson's chi-squared test or Fisher's exact test. A statistical significance level of  $p < 0.05$  was considered.

## Result

Over a five-year period, 2321 patients received groin hernia (GH) surgery, of which 2098 were male and 151 were female among the 2249 patients who underwent elective surgery. Recurrent hernia was the cause of surgery in 139 patients, while 36 had femoral hernia ( $p < 0.01$ ). Among the 72 patients who required emergency surgery, 54 were male and 18 were female, and 12 had strangulated or incarcerated recurrent or femoral inguinal hernias, all of which were diagnosed through pre-operative physical examination. Furthermore, Ultrasonography (US) was conducted on 39 patients, while 15 patients underwent a

Computerized Tomography (CT) scan. Notably, 18 patients received surgery based solely on physical examination, without the aid of any imaging modality.

The average age of our patients is  $61.9 \pm 17.5$  years, with Group 1 having an average age of  $64.9 \pm 12.9$  and Group 2 having an average age of  $60.8 \pm 18.7$  ( $p: 0.462$ ). In Group 1, 77.8% of the patients were male, while in Group 2, 74.1% were male ( $p: 0.753$ ). In both groups, inguinal hernia was the most common, but in Group 2, femoral and recurrent hernias were more common compared to Group 1 (femoral 20.4% and 5.6%, recurrent 18.5% and 11.1%, respectively) ( $p: 0.157$ ). Mesh repair was performed in 83% of patients in both groups ( $p: 1.000$ ). Strangulation was observed in 22.2% of Group 1 and 27.8% of Group 2 ( $p: 0.643$ ). Intestinal resection was performed in 11.1% of Group 1 and 14.8% of Group 2, with no significant difference ( $p: 0.694$ ). Hernioscopy was performed in 2 patients in each group due to spontaneous reduction ( $p: 0.235$ ). In Group 1, omentum was most commonly found in the hernia sac (58%), while in Group 2, small intestine was found in 50.9%, which was statistically significant ( $p: 0.033$ ). The time from emergency room admission to surgery was  $6.2 \pm 4.5$  hours in Group 1 and  $9.8 \pm 11.1$  hours in Group 2 ( $p: 0.203$ ); the length of hospital stay was  $48.6 \pm 37.4$  hours in Group 1 and  $78.0 \pm 67.6$  hours in Group 2 ( $p: 0.074$ ), with no statistically significant difference observed. There was no significant difference in pre-operative WBC and CRP values in both groups (Pre-op WBC,  $p: 0.123$ ; Pre-op CRP,  $p: 0.396$ ). The information provided above has been summarized in Table 1.

**Table 1.** The demographic, laboratory, and surgical data of the patients

	<b>Total</b>	<b>Group I</b>	<b>Group II</b>	<b>p</b>	<b>N</b>
<b>Age, mean±SD</b>	61.9±17.5	64.9±12.9	60.8±18.7	0.462	72
<b>Gender, n (%)</b>					
Female	18 (25)	4 (22.2)	14 (25.9)	0.753	72
Male	54 (75)	14 (77.8)	40 (74.1)		
<b>Hernia side, n (%)</b>					
Right	44 (61.1)	11 (61.1)	33 (61.1)	1.000	72
Left	28 (61.1)	7 (61.1)	21 (61.1)		
<b>Hernia Type, n (%)</b>					
Inguinal	48 (66.7)	15 (83.3)	33 (61.1)	0.157	72
Femoral	12 (16.7)	1 (5.6)	11 (20.4)		
Recurrent	12 (16.7)	2 (11.1)	10 (18.5)		
<b>Repair Technique, n (%)</b>					
Mesh	60 (83.3)	15 (83.3)	45 (83.3)	1.000	72
Suture	12 (16.7)	3 (16.9)	9 (16.9)		
<b>Strangulation, n (%)</b>					
Yes	19 (26.4)	4 (22.2)	15 (27.8)	0.643	72
No	53 (73.6)	14 (77.8)	39 (72.2)		
<b>Bowel resection, n (%)</b>					
Yes	10 (13.9)	2 (11.1)	8 (14.8)	0.694	72
No	62 (86.1)	16 (88.9)	46 (85.2)		
<b>Hernioscopy, n (%)</b>					
Yes	4 (5.6)	2 (11.1)	2 (3.7)	0.235	72
No	68 (94.4)	16 (88.9)	52 (96.3)		
<b>Structure in hernia sac, n (%)</b>					
Omentum	24 (34.3)	10 (58.8)	14 (26.4)	0.033	70
Small intestine	32 (45.7)	5 (29.4)	27 (50.9)		
Colon	14 (20.0)	2 (11.8)	12 (22.6)		
<b>Length of hospitalization, h, mean±SD</b>	70.7±62.5	48.6±37.4	78.0±67.6	0.074	72
<b>Time to operation, h, mean±SD</b>	8.8±9.9	6.2±4.5	9.8±11.1	0.203	72
<b>Pre-op WBC, 10<sup>3</sup>/uL, mean±SD</b>	11.4±4.7	10.3±4.8	11.8±4.7	0.123	72
<b>Pre-op CRP, mg/dl, mean±SD</b>	2.7±6.1	1.8±3.0	3.0±6.7	0.396	65

## Discussion

After analyzing patients who underwent surgery for IC or SG the study's observation was that 75% of the patients were male, while 25% were female. However, when elective cases were examined, it was found that 93.3% of male patients and 6.7% of female patients underwent surgery, indicating a higher incidence of SG and IC in women [7, 12, 13]. Moreover, our study showed that women were more commonly affected by SG and IC when compared to patients who underwent elective surgery.

Patients with femoral hernias had a significantly higher risk of developing SG [7, 8, 14]. Despite the fact that femoral hernias constituted only 1.6% of elective hernia surgeries, they constituted 16.6% of all emergency hernia surgeries, indicating a much higher risk of emergency SG and IC in these patients than in those who underwent elective inguinal hernia surgery.

According to the literature, physical examination is generally deemed adequate for diagnosing emergent inguinal hernias and should be performed on all patients [3]. Conducting a physical examination not only enables earlier surgical intervention but also minimizes the requirement for imaging techniques [15]. In our study, all patients were diagnosed with hernias based on physical examination, indicating the effectiveness of this method in diagnosing hernias. Additionally, 25% of the patients underwent surgery solely based on physical examination.

Research suggests that ultrasound (US) is an effective diagnostic tool for evaluating incarcerated organs, identifying recurrent hernias, and differentiating groin-related pathologies such as abscesses, hydrocele, and painful lymphadenopathy especially in obese patients [16-18]. The low cost, accessibility, non-invasive nature, and ease of application of US contribute to its increased usage in selected cases. In our study, 21% of patients received preoperative US examinations in addition to physical examinations.

CT scans are not commonly recommended for incarcerated and strangulated groin hernias, but may be used in some cases to diagnose patients with obstruction [3, 19]. In our study,

CT scans were performed in only 21% of cases to investigate other intra-abdominal pathologies. Prolonged duration of IC or SG lasting more than 24 hours increases the risk of requiring intestinal resection [11]. Many studies have identified the 24-hour mark as the cut-off value for IC duration [2, 20, 21]. In our study, patients who underwent intestinal resection had a duration of IC or SG exceeding 24 hours. In patients with IC or SG duration longer than 24 hours, intestinal resection was deemed necessary in 10% of cases.

Postponing surgery following a hernia diagnosis may heighten the likelihood of morbidity and mortality [9]. A higher duration of IC and SG is linked to a greater probability of intestinal resection [22, 23]. Among patients who needed intestinal resection, we found that Group 2 had a longer mean duration from hospital admission to surgery than Group 1. Moreover, the use of imaging tests in Group 2 resulted in a longer time until surgery, increasing the likelihood of intestinal resection.

The decision to perform preoperative imaging does not create a significant difference between the two groups in terms of strangulation, bowel resection rates, and the surgical techniques applied as a result. Especially considering that the viability of the bowel is significantly related to the time elapsed until surgery, particularly in cases of incarcerated and/or strangulated hernias, there is no need for unnecessary time delay by performing preoperative imaging. Furthermore, our findings suggest that the delay in surgery caused by the use of imaging tests resulted in a higher length of hospital stay in Group 2.

Exploration is recommended in cases of groin hernias (GH) with incarcerated (IC) or strangulated (SG) hernias, even in cases of spontaneous reduction when intestinal viability is suspected [3]. The surgeon's experience and type of surgery determine the exploration technique. The available options comprise of open exploration via the groin, standard laparoscopy, hernia sac laparoscopy (hernioscopy) or laparotomy [24]. In our study 2 patients in each group underwent hernioscopy and laparotomy was performed only in patients requiring bowel resection. Routine laparoscopic exploration was not performed.

Performing emergent groin hernia surgery in a timely manner is crucial to prevent complications, irrespective of the hernia type (incarcerated or strangulated). For emergent hernia surgeries, mesh repair is generally considered the preferred technique for clean and clean-contaminated cases [25-27]. However, for infected and contaminated cases, suture repairs are typically preferred, although mesh repair may be appropriate for well-cleaned and protected surgical sites, while weighing the risks of infection. Therefore, it is important to carefully evaluate the benefits and potential risks of mesh repair in such cases [28, 29]. In our study, the majority of patients (73%) were classified as clean or clean-contaminated and underwent mesh repair. In our study 83.3% of the patients underwent mesh repair, while 16.7% underwent suture repair.

In conclusion; prompt surgical intervention is essential in cases of incarcerated or strangulated GH to prevent complications and minimize the risks of morbidity and mortality. Preoperative imaging should not be undertaken as it does not alter the type of surgical procedure and prolongs the time to surgery. Mesh repair is the optimal option for clean and clean-contaminated cases in emergent hernia surgery, while suture repair is preferred for contaminated and infected cases. In the latter cases, mesh repair should be cautiously considered after carefully evaluating the risk of infection. Exploration or hernioscopy ought to be conducted when doubts arise regarding intestinal viability subsequent to the spontaneous reduction of a hernia. Overall, early surgical intervention is necessary to avoid potential complications in cases of incarcerated and strangulated GH.

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#### **Authors' contributions to the article**

F.B. constructed the main idea and hypothesis of the study. H.B. developed the theory and arranged/edited the material and method section. M.S.O. has done the evaluation of the data in the results section. Discussion section of the article was written by M.A.A. and S.T. reviewed, corrected and approved. In addition, all authors discussed the entire study and approved the final version.