

Evaluation of risk factors for necrotic tissue resections in elderly patients with groin hernia



Ann Ital Chir, 2023 94, 5: 472-477
pii: S0003469X23039246
free reading: www.annitalchir.com

Turgay Karatas*, Engin Burak Selcuk**, Mehmet Karatas***, Ibrahim Nuvit Tahtali****, Atila Yildirim*****, Ahmet Kadir Arslan*****

*Inonu University Medical Faculty Department of Anatomy, Malatya, Turkey

**Inonu University Medical Faculty Department of Family Medicine, Turkey

***Inonu University Medical Faculty Department of Medical History and Ethics, Malatya, Turkey

****Malatya Training and Research Hospital Urology Clinic, Malatya, Turkey

*****Malatya Training and Research Hospital General Surgery Clinic, Malatya, Turkey

*****Inonu University Medical Faculty Department of Biostatistics and Medical Informatics, Malatya, Turkey

Evaluation of risk factors for necrotic tissue resections in elderly patients with groin hernia

AIM: To reveal the relationships between patient findings and tissue resection in elderly patients.

MATERIALS AND METHODS: Between September 2020 and September 2022 three hundred eighty four patients over the age of 60 who were operated with the diagnosis of groin hernia were retrospectively analyzed. Gender, age, height, weight and body mass index value, groin and inguinal hernia types, hernia sides, primary or recurrent cases, hernia sac content, incarceration, tissue necrosis and resection presence, and accompanying pathologies were recorded. These findings were compared and evaluated in order to determine the relationships between patient findings and tissue resection, and the findings at risk for tissue resection.

RESULTS: Of the patients in the study, 352 (91.7%) were male and 32 (8.3%) were female. The mean age, height, weight and BMI were 67.48 ± 5.893 years, 169.27 ± 6.113 cm, 73.28 ± 7.878 kg and $25,566 \pm 2.3518$ kg/m², respectively. There were 369 inguinal, 15 femoral, 285 indirect, 84 direct, 312 primary, and 72 recurrent hernias. Incarceration was present in 65 (16.9%) patients, 19 (4.9%) of these patients underwent resection due to tissue necrosis (twelve omentum and seven small intestine). Tissue resection was 3.1% in male, 25% in female, 4.3% in inguinal, 20% in femoral, 5.6% in indirect, 0% in direct, 3.5% in primary and 11.1% in recurrent hernias. Tissue resections were significantly higher in females, femoral hernias, indirect inguinal hernias and recurrent cases ($p < 0.05$).

CONCLUSIONS: We can say that female gender, femoral, indirect and recurrent hernias are important risk factors for tissue resection in elderly patients.

KEY WORDS: Elderly Patients, Emergency Surgery, Groin Hernia, Incarceration, Tissue Resection

Introduction

Groin hernia repair is one of the most common surgeries in the world. More than 20 million groin hernia surgeries are performed annually in the world. Groin her-

nia are caused by weakening of the muscles in the lower abdominal wall¹. Groin hernias consist of inguinal and femoral hernias. Most of the groin hernias consist of inguinal hernias².

Groin hernia repair is one of the common surgical procedures with low morbidity and good results. Groin hernia is more common in the elderly than in younger patients due to the loss of strength of the abdominal wall and conditions that increase intra-abdominal pressure³. The risk of groin hernia increases with age. The frequency of groin hernia repair, which replaces the prevalence of hernia, increases from 0.25% at the age of 18 to 4.2% at the age of 75-80⁴.

Pervenuto in Redazione Dicembre 2022. Accettato per la pubblicazione Gennaio 2023

Correspondence to: Asist. Prof. Dr.Turgay Karatas (MD, PhD), Department of Anatomy, Inonu University Medical School, Battalgazi, Malatya, Turkey (e-mail: drkaratas44@hotmail.com)

There is not enough information about the natural course of untreated groin hernias. Therefore, surgeons recommend surgery to the patient when a hernia is diagnosed. More positive results are obtained from elective repairs. However, many patients apply to the health unit in cases such as intestinal obstruction, incarceration and strangulation. Patients with complicated hernia who apply in this way must be operated on urgently. In such patients, some complications may occur during and after surgery, and morbidity and mortality may increase in patients ⁵. Patients with intestinal necrosis have longer hospital stays. In these patients, postoperative complications occur between 6% and 43% ⁶⁻⁹, and mortality rates are 1-7% ⁶⁻⁸.

In some studies, it has been shown that 40% of inguinal and femoral hernia repairs are performed due to incarceration or intestinal obstruction in patients over 65 years of age ¹⁰. Emergency operations for groin hernia carry a significant risk of death ¹¹. As mentioned in the literature, emergency tissue resections due to strangulation and tissue necrosis in elderly groin hernias have high morbidity and mortality rates. Therefore, it is very important to carefully evaluate the findings obtained from these patients, to determine the risk factors for tissue resection and to plan the necessary treatment considering these factors.

In this study, we aimed to identify patient findings such as gender, age, height, weight and BMI values, groin hernia types, inguinal hernia types, hernia sides, primary or recurrent cases in elderly groin hernias, and to determine the patient findings at risk for tissue resection.

Materials and Methods

The files of 384 patients over the age of 60 who were operated under emergency or elective conditions within 2 years (between September 2020 and September 2022) with the diagnosis of groin hernia were evaluated retrospectively.

This study was initiated after ethical approval was obtained from the Inonu University Health Sciences Non-Interventional Clinical Research Ethics Committee (Protocol number: 2022/3374).

Patient findings such as gender, age, height, weight, and BMI (Body-Mass-Index) value, groin hernia types (inguinal and femoral hernia), inguinal hernia types (indirect, direct hernia), hernia sides, primary or recurrent cases, hernia sac content, presence of incarceration, tissue necrosis and resection, and accompanying pathologies were recorded.

These findings were compared and evaluated in terms of tissue resection in order to determine the relationships between patient findings and tissue resection, and the findings at risk for tissue resection. In this study, tissue resections are omentum and small intestine resections.

STATISTICAL ANALYSIS

The variables examined in the study were summarized as arithmetic mean \pm standard deviation and number (percentage) according to measurement levels. The conformity of the numerical variables to the normal distribution was examined using the Shapiro-Wilk test. In the group comparisons in terms of numerical variables, t-test was used in independent groups. Ratio (percentage) comparisons of qualitative variables were made using the 2-sample test for equality of continuity-corrected ratios. In the analyses, $p \leq 0.05$ was accepted as statistical significance level. IBM SPSS Statistics 26.0 package program was used in the analysis.

Results

384 patients over 60 years of age who were operated on with the diagnosis of groin hernia were evaluated. Of these patients, 352 (91.7%) were male and 32 (8.3%) were female. Age, height, weight and BMI ranges were 60 to 92 years, 150 to 184 cm, 50 to 98 kg, and 19.7 to 31.6 kg/m², respectively. In addition, the mean age, height, weight and BMI were 67.48 ± 5.893 years, 169.27 ± 6.113 cm, 73.28 ± 7.878 kg and 25.566 ± 2.3518 kg/m², respectively.

The number and percentages of groin hernia types, hernia sides, primary or recurrent cases detected in patients operated for groin hernia are given in (Table I).

206 (53.6%) of these patients had an empty hernia sac, and 178 (46.4%) had an organ in the sac. The hernia sac content, incarceration, tissue necrosis and tissue resection numbers and percentages of patients who were operated for groin hernia are given in (Table II).

There was no concomitant pathology in 370 patients (96.4%). Cord cysts were detected in 2 patients (0.5%), hydrocele in 5 patients (1.3%), epigastric hernia in 5 patients (1.3%), and umbilical hernia in 2 patients (0.5%).

The patients who underwent tissue resection and those who did not were compared in terms of age, weight,

TABLE I - Number and percentage of groin hernia types, sides, and primary or recurrent cases.

Hernia Features	N.	%
Inguinal hernia	369	96.1
*Indirect inguinal hernia	285	77.2
*Direct inguinal hernia	84	22.8
Femoral hernia	15	3.9
Right side	217	56.5
Left side	167	43.5
Primary cases	312	81.3
Recurrent cases	72	18.8

N: Count, %: Percentage, *: Types of inguinal hernia

TABLE II - Numbers and percentages of hernia sac contents, incarceration, tissue necrosis, omentum and small bowel resection.

	Omentum(n/%)	Small bowel (n/%)	Large bowel (n/%)	Bladder (n/%)	Total (n/%)
Hernia sac contents	144 (37.5)	24 (6.3)	8 (2.1)	2 (0.5)	178 (46.4)
Incarceration	48 (12.5)	16 (4.1)	1 (0.3)	0	65 (16.9)
Tissue necrosis and resection	12 (3.1)	7 (1.8)	0	0	19 (4.9)

n: Count, %: Percentage

TABLE III - Comparison of patients with and without tissue resection in terms of age, weight, height and BMI values.

	Age(year)	Weight (kg)	Height (cm)	BMI (kg/m ²)
Tissue Resection (+)	70,37±8,674	72,32±6,010	166,95±8,072	25,989±2,1602
Tissue Resection (-)	67,33±5,688	73,33±7,967	169,39±5,984	25,544±2,3620
P values	0.173	0.616	0.089	0.421

TABLE IV - Comparison of gender, groin hernia types, inguinal hernia types, sides and primary/recurrent cases in terms of tissue resection.

	Gender (n, %)	Groin Hernia Types (n, %)	Inguinal Hernia Types (n, %)	Sides (n, %)	Primary/Recurrent Cases (n, %)
	Male 11 (% 3.1)	Inguinal 16 (% 4.3)	Indirect 16 (% 5.6)	Right 14 (% 6.4)	Primary 11 (% 3.5)
	Female 8 (% 25)	Femoral 3 (% 20)	Direct 0 (%0)	Left 5 (% 2.9)	Recurrent 8) (% 11.1)
P values	0.0001	0.032	0.028	0.189	0.014

n: Count, %: Percentage

height and BMI values, and no significant difference was found between them (Table III).

A total of 65 patients underwent emergency surgery due to incarceration. Incarceration was seen in 48 male and 17 female patients. While the rate of incarceration in male was 13.6%, this rate in female was 53.1%. In addition, tissue resection rates in female were significantly higher than in male (Table IV). Six omentum and two small bowel resections were performed in female patients, and six omentum and five small bowel resections were performed in male patients. Small bowel resection was performed in 1.4% of male and 6.2% of female. Fourteen (73.7%) patients who underwent tissue resection were between 60 and 75 years of age, and the remaining five (26.3%) patients were over 75 years of age.

Tissue resection rates in femoral hernias were significantly higher than in inguinal hernias (Table IV). Tissue resections were ten omentum and six small intestine in inguinal hernias, and two omentum and one small bowel resection in femoral hernias. Small bowel resection was performed in 1.6% of inguinal hernias and 6.6% in femoral hernias.

A significant difference was found between tissue resection rates in indirect hernias and those in direct hernias, and resection rates in indirect hernias were significantly higher (Table IV). Ten omentum and six small bowel resections were performed in indirect hernias. There was no tissue resection in direct hernias. While small bowel resection was performed in 2.1% of indirect inguinal hernias, it was never performed in direct hernias.

There was no significant difference between tissue resection rates in right and left hernias (Table IV). Ten omentum and four small bowel resections were performed on the right side, and two omentum and three small bowel resections on the left side. Small bowel resection rates were 1.8% in right inguinal hernias and 1.7% in left inguinal hernias. A significant difference was found between tissue resection rates in primary and recurrent hernias, and tissue resection rates in recurrent hernias were significantly higher than primary hernias (Table IV). Nine omentum and two small bowel resections were performed in primary cases and three omentum and five small bowel resections in recurrent cases. Small bowel resection rates in recurrent and primary cases were 6.9% and 0.64%, respectively.

In this study, tissue resection due to necrosis was performed in a total of 19 patients, 12 (63.2%) of the omentum and 7 (36.8%) of the small bowel. Omentum resection rates were significantly higher than small bowel resection rates ($P=0.0001$). Concomitant pathology (epigastric hernia) was detected in only 1 (5.3%) patient who underwent tissue resection. Eighteen patients had no concomitant pathology.

Discussion

In this study, findings such as gender, age, weight, height, BMI values, hernia types, hernia side and primary-recurrence cases in elderly inguinal hernia patients who underwent tissue resection were evaluated. In the literature, small bowel resections are generally mentioned as tissue resection. While bowel resections increase morbidity and mortality, omentum resections can increase morbidity with intra-abdominal bleeding and adhesions. Therefore, small bowel resections and omental resections were included in tissue resections due to necrosis in our study. Incarceration is the inability of the organs in the hernia sac to be placed in the abdomen. Stangulation is the disruption of blood flow to the organs in the hernia sac. As a rule, organs and tissues necrosis due to strangulation should be resected and removed from this area before hernia repair.

Approximately 5-15% of adult hernia patients have incarceration, and intestinal necrosis requiring intestinal resection may develop in approximately 15% of these cases¹². A mortality rate of 3.4% was found in the post-operative period in incarcerated hernias. All of these patients who died were over the age of 65 and also had serious comorbidities¹³. We found incarceration in 16.9% of the elderly patients. We performed tissue resection due to strangulation and tissue necrosis in 29.2% of these incarcerated hernias (12 omentum and 7 small bowel resection). Tissue resection rates in our elderly patients were found to be higher than the values obtained from adult patients in the literature. We attribute the fact that our tissue resection rates are almost twice the adult resection rates in the literature, due to the addition of omental resections to small bowel resections. No mortality was observed in patients who underwent both small bowel and omental resection.

Inguinal hernias are more common in males. In the inguinal hernia series of 1655 cases, the majority were male patients, and 42 of these patients underwent emergency surgery due to incarceration or strangulation. Of the patients who underwent emergency surgery, 29 were male and 13 were female¹⁴. The risk of incarceration and strangulation is more common in female¹⁵⁻¹⁷. Especially female gender and femoral hernia type have significantly higher rates of incarceration and strangulation⁵. In our study, 352 of 384 patients were male and 65 of the patients underwent emergency surgery due to

incarceration. The rate of incarceration was 13.6% in male and 53.1% in female. These data were consistent with general literature findings.

In a study conducted in elderly patients, a total of 25 emergency surgical interventions were performed in 18 male and 7 female patients over 75 years of age, and small bowel resection was performed in 5 of these patients¹⁸. Azari et al. performed 14 small bowel resections in 142 patients over 60 years of age with strangulated hernia¹⁹. We performed emergency surgery on 65 patients due to incarceration, and 12 of these patients had omentum resection and 7 of them had small bowel resection. Small bowel resections in patients who underwent emergency surgery were lower than the resection values of elderly patients in the literature. Alvarez et al. reported that they performed small bowel resection in 12.9% of all patients in adults. Bowel resection was performed in 6 (7.8%) of male and 13 (18.6%) of female, and a significant difference was observed between male and female¹³. Tissue resection was performed in 4.9% of all our elderly patients, of which 3.1% had omental resection, 1.8% had small bowel resection. Small bowel resection was performed in 5 (1.4%) male and 2 (6.2%) female. The rate of small bowel resection in our elderly patients was also lower than the rate of resection in adults in the literature. The rate of bowel resection in our female patients was also higher than in male, as in the literature.

Due to the progressive loss of tissue strength with aging, the incidence of inguinal hernia is higher in the elderly²⁰. Small bowel resections and intensive care admissions were more common in patients over 60 years of age compared to younger patients, 19.6% and 32.7% versus 1.7% and 0%, respectively¹⁹. Of course, these conditions increase morbidity and mortality in elderly patients.

Therefore, it is necessary to approach elderly inguinal hernias more carefully, to evaluate the patient's findings well, to determine the risk factors and to take the necessary precautions. In this study, the relationships between patient findings and tissue resection were investigated and the results were evaluated.

Low body mass index is among the risk factors responsible for the formation of groin hernia²¹. Obesity, on the other hand, reduces the risk of groin hernia by 43% compared to normal weight²². However, obesity and increased BMI values increase the risk of incarceration and strangulation in groin hernias²³. In the study of Pierides et al, the mean BMI was reported as 24.6 kg/m² (16.7-32.2) in patients with inguinal hernia over the age of 65²⁴. The mean BMI in elderly groin hernias in our study was $25,566 \pm 2.3518$ kg/m², which was higher than the BMI values of inguinal hernias in the literature. It is mentioned that the risk of incarceration and strangulation increases with high BMI values in the literature. However, in our study, there was no significant difference in BMI values between the patients who under-

went tissue resection due to strangulation and those who did not.

In the study of Akıncı et al, it was reported that 200 inguinal (93 direct, 107 indirect), 12 femoral hernias, 28 direct+indirect hernias were found in patients over 60 years of age, and incarceration and strangulation were more common in femoral hernias⁵. Alvarez et al. also reported that bowel resection is mostly performed in femoral hernias¹³. In our study, the majority of hernias were inguinal hernias (96.1%), consistent with the literature. Likewise, tissue resections were mostly performed in femoral hernias (20%). In addition, the rate of small bowel resection was 6.6% in femoral hernias and 1.6% in inguinal hernias.

In the 200 case strangulated groin hernia study of Azeri et al, there were 60 indirect, 49 direct, and 31 femoral hernias in patients over 60 years of age. Bowel resection was performed in 15 patients and one of these patients was under the age of 60 and the others were over the age of 60. The type of inguinal hernia of the patients who underwent resection was not specified¹⁹. In our case, the majority of inguinal hernias were indirect hernias (77.2%). We found that tissue resection rates due to strangulation were significantly higher in indirect hernias than in direct hernias. Small bowel resection was performed in 2.1% of indirect inguinal hernias, but not in direct hernias.

Kulah et al. performed emergency surgery for 93 right, 46 left and 7 bilateral inguinal hernias in elderly patients due to incarceration²⁵. B.J. Ge et al. reported 16 (14.2%) small bowel resections in 112 right-sided and 12 (17.1%) small bowel resections in 70 left-sided⁶. The majority of hernias (56.5%) in our patients were right-sided hernias. Tissue resection was performed in 6.4% of the right side and 2.9% of the left side. There was no significant difference between the tissue resection rates of the right and left-sided hernias we obtained. Small bowel resection rates were also similar in right inguinal hernias (1.8%) and left inguinal hernias (1.7%). We could not find any study in the literature showing the rates of tissue resection due to strangulation in primary and recurrent cases. However, we found significantly higher tissue resection rates in recurrent hernias. Small bowel resection performed in recurrent cases (6.9%) was also found to be higher than primary cases (0.64%).

Conclusions

There was no difference in age, weight, height and BMI values between the patients who underwent tissue resection due to tissue necrosis and those who did not. However, tissue resection rates were found to be significantly higher in female gender, femoral hernias, indirect inguinal hernias and recurrent cases. From this point of view, we can say that female gender, femoral hernias,

indirect inguinal hernias and recurrent cases are important risk factors for tissue resection in elderly patients.

Riassunto

OBIETTIVO: Rivelare le relazioni tra i risultati del paziente e la resezione tissutale nei pazienti anziani.

MATERIALI E METODI: Tra settembre 2020 e settembre 2022 sono stati analizzati retrospettivamente trecentotantaquattro pazienti di età superiore ai 60 anni operati con diagnosi di ernia inguinale. Sono stati registrati sesso, età, altezza, peso e valore dell'indice di massa corporea, tipi di ernia inguinale e inguinale, fianchi di ernia, casi primari o ricorrenti, contenuto del sacco erniario, incarcerazione, presenza di necrosi tissutale e resezione e patologie associate. Questi risultati sono stati confrontati e valutati al fine di determinare le relazioni tra i risultati del paziente e la resezione tissutale e i risultati rischiosi per la resezione tissutale.

RISULTATI: Dei pazienti inclusi nello studio, 352 (91,7%) erano maschi e 32 (8,3%) erano femmine. L'età media, l'altezza, il peso e il BMI erano rispettivamente di 67,48±5,893 anni, 169,27±6,13 cm, 73,28±7,878 kg e 25,566±2,3518 kg/m². C'erano 369 ernie inguinali, 15 femorali, 285 indirette, 84 dirette, 312 primarie e 72 ricorrenti. L'incarcerazione era presente in 65 (16,9%) pazienti, 19 (4,9%) di questi pazienti sono stati sottoposti a resezione per necrosi tissutale (dodici omento e sette intestino tenue). I pazienti sottoposti a resezione tissutale e quelli che non lo hanno fatto sono stati confrontati in termini di età, peso, altezza e valori di BMI e non è stata riscontrata alcuna differenza significativa tra di loro. La resezione tissutale è stata del 3,1% negli uomini, del 25% nelle donne, del 4,3% nell'inguine, del 20% nel femorale, del 5,6% nell'indiretta, dello 0% nella diretta, del 3,5% nella primaria e dell'11,1% nelle recidive. Le resezioni tissutali erano significativamente più elevate nelle donne, nelle ernie femorali, nelle ernie inguinali indirette e nei casi di recidiva (p<0,05).

CONCLUSIONE: È stato rivelato che i risultati dei pazienti come età, peso, altezza e valori di BMI non erano un importante fattore di rischio per la resezione tissutale a causa della necrosi tissutale. Tuttavia, il sesso femminile, l'ernia femorale, l'ernia indiretta e l'ernia ricorrente sono importanti fattori di rischio per la resezione tissutale nei pazienti anziani.

References

1. van Veenendaal N, Simons MP, Bonjer HJ: *Summary for patients: International guidelines for groin hernia management*. *Hernia*, 2018; 22(1):167-68, doi: 10.1007/s10029-018-1729-9.
2. Burcharth J, Pedersen M, Bisgaard T, et al: *Nationwide prevalence of groin hernia repair*. *Plos One*, 2013; 8(1): e54367, doi: 10.1371/journal.pone.0054367.

3. Amato B, Compagna R, Fappiano F, et al: *Day-surgery inguinal hernia repair in the elderly: Single centre experience*. BMC Surg, 2013;13 (Suppl 2):S28, doi: 10.1186/1471-2482-13-S2-S28.
4. Itani KMF, Fitzgibbons R: *Approach to groin hernias*. JAMA Surg, 2019; 154(6): 551-552, PMID: 30865244, doi: 10.1001/jamasurg.2018.5564.
5. Akinci M, Ergül Z, Kulah B, et al: *Risk factors related with unfavorable outcomes in groin hernia repairs*. Hernia, 2010; 14:489-493, doi: 10.1007/s10029-010-0683-y.
6. Ge BJ, Huang Q, Liu LM, et al: *Risk factors for bowel resection and outcome in patients with incarcerated groin hernias*. Hernia, 2010; 14:259-64, doi:10.1007/s10029-009-0602-2.
7. Koizumi M, Sata N, Kaneda Y et al: *Optimal timeline for emergency surgery in patients with strangulated groin hernias*. Hernia, 2014; 18: 845-8, doi:10.1007/s10029-014-1219-7.
8. Kurt N, Oncel M, Ozkan Z, et al: *Risk and outcome of bowel resection in patients with incarcerated groin hernias: Retrospective study*. World J Surg, 2003; 27:741-3, doi:10.1007/s00268-003-6826-x.
9. Tanaka N, Uchida N, Ogihara H, et al: *Clinical study of inguinal and femoral incarcerated hernias*. Surg Today, 2010; 40:1144-7, doi:10.1007/s00595-009-4193-4.
10. Latifi R: *Surgical decision making in geriatrics*. In: Gogna S, Choi J K, Latifi R (ed): *Inguinal hernia repair in the elderly*. First edition, Springer Nature Switzerland AG, 2020; 211-17, doi: 10.1007/978-3-030-47963-3_16.
11. Nilsson H, Stylianidis G, Haapameaki M, et al: *Mortality after groin hernia surgery*. Ann Surg, 2007; 245(4):656-60, doi: 10.1097/01.sla.0000251364.32698.4b.
12. Chen P, Huang L, Yang W, et al: *Risk factors for bowel resection among patients with incarcerated groin hernias: A meta-analysis*. American Journal of Emergency Medicine, 2020; 38(2):376-83, doi: 10.1016/j.ajem.2019.09.023.
13. Alvarez JA, Baldonado RF, Bear IG, et al: *Incarcerated groin hernias in adults: Presentation and outcome*. Hernia, 2004; 8(2):121-6, doi: 10.1007/s10029-003-0186-1.
14. Tosun S, Leblebici M, Yener O, et al: *Factors affecting the time of surgery in emergent groin hernia cases*. International Journal of Surgery Research, 2020; 2(1):5-8.
15. Read RC: *The contributions of usher and others to the elimination of tension from groin herniorrhaphy*. Hernia, 2005; 9(3):208-11, doi: 10.1007/s10029-005-0322-1.
16. Köckerling F, Koch A, Lorenz R: *Groin hernias in women: A review of the literature*. Front Surg, 2019; 6:4, doi: 10.3389/fsurg.2019.00004.
17. Schoots IG, van Dijkman B, Butzelaar RM, et al: *Inguinal hernia repair in the Amsterdam region 1994-1996*. Hernia, 2001; 5(1):37-40, doi: 10.1007/bf01576163.
18. Compagna R, Rossi R, Fappiano F, et al: *Emergency groin hernia repair: Implications in elderly*. BMC Surgery, 2013; 13 Suppl 2:S29, doi: 10.1186/1471-2482-13-S2-S29.
19. Azari Y, Perry Z, Kirshtein B: *Strangulated groin hernia in octogenarians*. Hernia, 2015; 19:443-47, doi: 10.1007/s10029-013-1205-5.
20. Pallati PK, Gupta PK, Bichala S, et al: *Short-term outcomes of inguinal hernia repair in octogenarians and nonagenarians*. Hernia, 2013; 17(6):723-27, doi: 10.1007/s10029-012-1040-0.
21. Ruhl CE, Everhart JE: *Risk factors for inguinal hernia among adults in the US population*. Am J Epidemiol, 2007; 165(10): 1154-61, doi: 10.1093/aje/kwm011.
22. Rosemar A, Angeräs U, Rosengren A: *Body mass index and groin hernia a 34-year follow-up study in swedish men*. Ann Surg, 2008; 247(6):1064-68, doi: 10.1097/SLA.0b013e31816b4399.
23. Ravanbakhsh S, Batech M, Tejirian T: *Increasing body mass index is inversely related to groin hernias*. Am Surg, 2015; 81(10): 1043-6.
24. Pierides G, Mattila K, Vironen J: *Quality of life change in elderly patients undergoing open inguinal hernia repair*. Hernia, 2013; 17:729-36, doi:10.1007/s10029-013-1171-y.
25. Kulah B, Duzgun AP, Moran M, et al: *Emergency hernia repairs in elderly patients*. The American Journal of Surgery, 2001; 182(5):455-9, doi: 10.1016/s0002-9610(01)00765-6.