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Surgical Approach to Bilateral Inguinal Hernia. A Case-Control Study

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Rezumat

Particularități tactice în hernia inghinală bilaterală. Studiu caz-control

Introducere: Tratamentul concomitent al herniei inghinale bilaterale poate fi realizată în siguranță, fie prin intervenție chirurgicală deschisă, fie prin abord minim invaziv, într-un regim electiv. Alegerea metodei chirurgicale depinde de starea pacientului, caracteristicile herniei, preferințele chirurgului şi ale pacientului. Vârstă este un subiect de dezbatere in contextul selecției dintre cele două abordări. Chiar dacă nu există un consens clar în ceea ce priveşte cea mai eficientă tehnică terapeutică în cazul hernioplastiei inghinale bilaterale, scopul acestei lucrări este de a efectua o analiză detaliată asupra abordului chirurgical electiv al pacienților cu hernie inghinală bilaterală.
Materiale şi Metode: Un studiu de tip caz-control s-a efectuat pentru a investiga legătura între adoptarea unei abordări clasice versus laparoscopice la pacienții cu hernie inghinală bilaterală. În analiza noastră retrospectivă, pacienții înrolați în studiu (23 de persoane) au suferit intervenții chirurgicale deschise pentru hernie, în timp ce subiecții din lotul de control (82 de persoane) au beneficiat de intervențiilor laparoscopice pentru hernie. Am analizat două seturi de variabile: în primul rând, variabile legate de caracteristicile pacientului (vârstă > 65 de ani, IMC > 30 kg/m^2, fumat, hipertensiune arterială, bronhopneumopatie cronică

obstructivă, diabet zaharat, utilizarea de anticoagulante, prezența unui status neoplazic) şi, în al doilea rând, variabile legate de caracteristicile herniei (hernie inghinală, hernie recurentă şi hernie complicată).
Rezultate: Vârsta medie a pacienților în studiu a fost de 73,26 (±12,99) ani, iar cea a subiecților de control a fost de 56,48 (±15,15) ani. Analiza univariată a evidențiat patru variabile cu semnificație statistică: vârsta >65 de ani, prezența herniei inghinoscrotale, statusul neoplazic şi utilizarea de anticoagulante. În analiza multivariată, s-a constatat că doar două variabile, vârsta >65 de ani (OR=4,183, IC 95% [1,289, 13,572], p=0,017) şi utilizarea de anticoagulante (OR=38,876, IC 95% [1,305, 1158,011], p=0,035), au prezentat semnificație statistică.
Concluzie: Studiul nostru demonstrează că, în ceea ce priveşte tratamentul chirurgical al herniei inghinale bilaterale, la pacienții cu vârsta >65 de ani probabilitatea de a fi supuşi unei intervenții chirurgicale deschise este de cel puțin patru ori mai mare decât pacienții cu vârsta <65 de ani. Mai mult, utilizarea de anticoagulante influ-ențează alegerea metodei chirurgicale: posibilitatea de intervenție chirurgicală deschisă este de 38 de ori mai mare decât în cazul intervenției minim invazive pentru aceeaşi grupă de vârstă. Într-un mod interesant, în studiul nostru, caracteristicile herniei nu au fost asociate cu intervenția chirurgicală deschisă şi cu vârsta >65 de ani. Aşadar, am constatat că vârsta >65 de ani este un factor important in decizia terapeutică. Este necesară realizarea unor studii suplimentare pentru a investiga impactul vârstei şi a factorilor de risc legați de vârstă asupra rezultatelor chirurgicale.

Cuvinte cheie: hernie inghinală, vârstă, bilateral, Rives, Stoppa, Lichtenstein, abord extra-peritoneal total (TEP)

Abstract
Introduction: Bilateral inguinal hernia can be safely repaired simultaneously, open or minimally invasive, in an elective sce-nario. The choice of surgical approach depends on the patient's status, hernia characteristics, surgeons and patient preferences. Whether age criteria should be considered when selecting between the two approaches is still a matter of debate. Considering that there is no consensus regarding the best repair in bilateral inguinal herniorrhaphy, the aim of the study is to perform an analysis regarding elective surgical approach of patients with bilateral inguinal hernias.
Material and Methods: To study the relationship between exposure to an open versus laparoscopic approach in patients with bilateral inguinal hernia, we conducted a case-control study. In our retrospective analysis, cases (23 patients) were the open-approach hernia repair, and controls (82 patients) were laparoscopic hernia repair. We analyzed two sets of variables: first, related to patient characteristics (age>65 years, BMI>30 kg/m2, smoking habit, HTA status, COPD status, DM status, use of anticoagulants, presence of neoplastic status) and second, variables related to hernia features (inguinoscrotal hernia, recurrent hernia and complicated hernia).
Results: The mean age for cases was 73.26 (±12.99) years and that of controls, was 56.48 (±15.15) years. Univariate analysis demonstrated four variables with statistical significance: age>65 years, inguinoscrotal hernia, neo-plastic status, and anticoagulant use. When introduced into the multivariate analysis, we noted that only two variables, age > 65 years (OR=4.183, 95% CI [1.289, 13.572], p=0.017) and use of anticoagulants (OR=38.876, 95% CI [1.305, 1158.011], p=0.035) reached statistical significance.
Conclusion: This study demonstrates that when we refer to bilateral inguinal hernia repair, patients aged > 65 years are at risk of having an open procedure at least fourfold more than patients aged < 65 years. In addition, the use of anticoagulants increases the risk of open hernia repair 38 times more than that of minimally invasive repair for the same age group. Interestingly, in our study, hernia characteristics were not found to be associated with open hernia repair and age > 65

years. In our study we found that age > 65 years is associated with electing open hernia repair over minimally invasive repair, which can be linked to age-related risk factors. Further re-search is needed to investigate the impact of age and age-related risk factors on surgical outcomes of bilateral inguinal hernia repair.

Key words: inguinal hernia, age, bilateral, Rives, Stoppa, Lichtenstein, total extraperitoneal approach (TEP)

Introduction

The incidence of abdominal wall hernia in elderly patients is 13/1000, according to Rutkow et al. (1). For the bilateral inguinal hernias, it was reported approximately 8 % to 30% of inguinal hernias (2).

Simultaneous surgery for bilateral inguinal hernia is considered safe and effective, but some surgeons prefer sequential repair (3). The minimally invasive approach (either TAPP – laparoscopic transabdominal preperitoneal/ TEP-laparoscopic total extraperitoneal or robotic) has the advantage of repairing both hernias using the same ports. In addition, it has numerous advantages related to patient outcomes and surgeons (4). For the surgeon, we have improved vision and clear anatomy. For patients, the risks of postoperative chronic pain and SSI-related complications are minimal. The HerniaSurge Group recently updated the recommendation on bilateral primary inguinal hernia repair and stated that if there is surgeon expertise and sufficient resources available, laparoendoscopic repair is recommended (5). Similarly, the EAES guidelines concluded that, especially in bilateral groin hernia, an endoscopic approach is an excellent choice (level 1 B consensus, 96%) (6).

In patients with contraindications to general anesthesia, we must move to another approach. For open repair, local or spinal anesthesia is required. The Lichtenstein procedure is preferred (7), but it requires two incisions; the Stoppa surgery requires one median incision (8).

In addition, in patients aged > 65 years, where cardio-pulmonary diseases occur more often, some prefer an open approach over the minimally invasive approach. Therefore, should we reduce the problem of anesthesia (9)? Considering the current advancements in technology, general anesthesia is safe for the elderly. Correcting cardio-pulmonary disease preoperatively is an important step in elective hernia management.

Preparation and delayed surgery can significantly improve the prognosis of these patients and reduce morbidity (10). Comorbid conditions like COPD (chronic obstructive pulmonary disease), hypertension, diabetes, and anticoagulant/antiplatelet therapy can increase the rate of complications and mortality in elderly patients, but several studies have shown that elective hernia repair in these patients is safe (11-14). Therefore, the aim of the study is to perform a rigorous analysis regarding the choice of surgical approach in patients with bilateral inguinal hernias based on different parameters.

Material and Methods

Data Collection

We retrospectively examined the data of patients who underwent laparoscopic/open inguinal hernia repair between January 1, 2019, and March 1, 2023, in the surgical departments of two hospitals: Saint John Hospital and Victoria Center Hospital. The sampling was consecutive and exhaustive after obtaining institutional authorization and ethical committee approval to conduct the study, Approval code: 9089, Date of approval: 12.04.2023.

The inclusion criteria were bilateral inguinal hernia surgery as the primary procedure. The operated hernias were symptomatic, bilateral groin hernias. We excluded strangulated hernias and patients having occult hernias [asymptomatic hernias not detectable by physical examination, according to HerniaSurge Group (5)]. A total of 105 patients were enrolled. The cases group comprised 23 patients who underwent open hernia surgery. The control group was comprised of 82 patients who underwent laparoscopic surgery. Patients with incomplete clinical records were excluded.

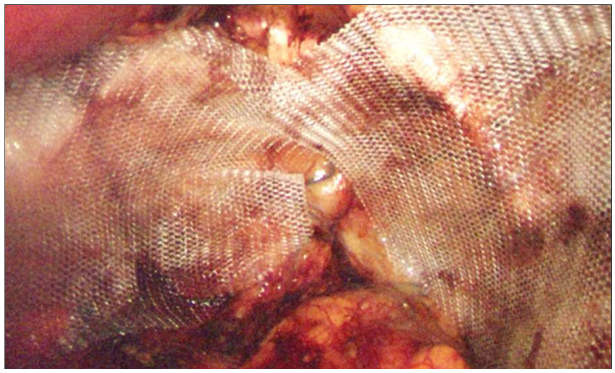

Figure 1. Intraoperative aspect – bilateral inguinal hernia repair in TEP procedure. The two meshes placed in each myopectineal orifice overlapping in the middle.

Surgical Technique

Open surgery for bilateral inguinal hernia can be done either anteriorly or posteriorly. Anterior repair is usually performed using Lichtenstein's or Rives' technique, and posterior repair (preperitoneal) Stoppas' procedure (15,16) – references to the procedures performed: Lichtenstein and Rives/Stoppa. In our study, the open procedures involved three subgroups according to the technique used: O-L (open bilateral Lichtenstein), O-RS (open Stoppas' procedure, treating both hernias preperitoneal) and O-LR (open Lichtenstein' for one side and/or Rives' technique for the other). The distributions are listed in *Table 1*. We noted a predominance of bilateral O-L technique (78.26%). Spinal or local anesthesia was used for open procedures.

In the laparoscopic group, TEP (total extraperitoneal) surgery was performed under general anesthesia. For all cases analyzed, a mesh was used (Bard 3D, Ultralight, and monofilament polypropylene). *Fig. 1* presents an intraoperative appearance using monofilament polypropylene mesh.

The repairs were performed by surgeons with experience in both techniques to avoid bias from the learning curve. The decision to perform either a TEP or open repair was made by the surgeon responsible for each patient.

Statistical Analysis

Statistical analyses were performed using SPSS version 23.0. Risk factors were compared between cases and controls using a multivariate logistic regression analysis. Relative risks for cases compared to controls were estimated by calculating odds ratios (OR) with 95% confidence intervals (CI).

The association between the risk factors was determined using the chi-squared test. Statistical significance was defined as a p-value of less than 0.05. The strength of the association between the variables was determined using the OR expressed with a 95% confidence interval.

Results

The age distribution of the cases and controls is listed in *Table 2*. The age range for the cases ranged from 47 to 97 years, with a mean age

Table 1. Open hernia repair options for the cases group.

Type of open surgery	no cases (%)
O-L	18 (78.26)
O-RS	3 (13.04)
O-LR	2 (8.70)

Table 2. Age distribution of patients with bilateral hernia in cases and controls (p-value <0.05).

	Cases	Controls
age≤65	7 (30.43%)	50 (60.975%)
age>65	16 (69.57%)	32 (39.025%)

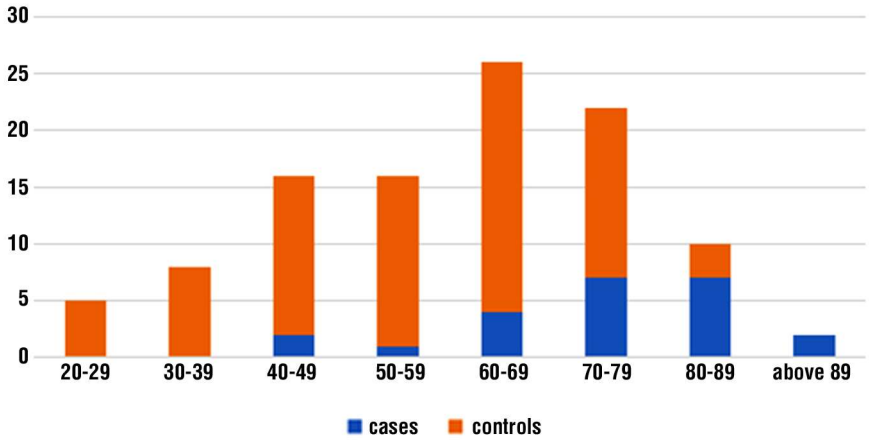

Figure 2. Distribution of age among cases and controls. The vertical axis represents the number of patients and the horizontal axis represents intervals of age.

of 73.26 (SD=12.99). For the controls, the age ranged from 21 to 88 years, with a mean age of 56.48 (SD=15.15). This distribution of age is shown in *Fig. 2*.

There was a predominance of male patients in both cases and control groups (96% and 97%, respectively). The distribution of sex among cases and controls is listed in *Fig. 3*. Our data are consistent with the literature (17).

The data recorded included two types of variables - assessed risk factors - a group (A) comprised of general risk factors (related to patients' status/characteristics) and another group (B) with particular risk factors (related to hernia):

Group A: age (we defined two subgroups: age > 65 and age ≤ 65), body mass index (BMI: subjects with BMI > 30 were considered obese), smoking habit (smoking/no smoking), presence or absence of chronic cough/COPD, use of anticoagulants, presence or absence of hypertension, neoplastic status (present or not), history of acute myocardial infarction (present or absent), presence or absence of diabetes mellitus; neoplastic status implies the presence of neoplasia.

Group B: recurrence or hernia (present or absent), inguinoscrotal hernia (present or absent), presence or absence of complicated hernia. We defined a complicated hernia as an irreducible hernia.

The distribution of these variables is listed in *Tables 3, 4*.

Age>65 years, anticoagulant use, and neo-

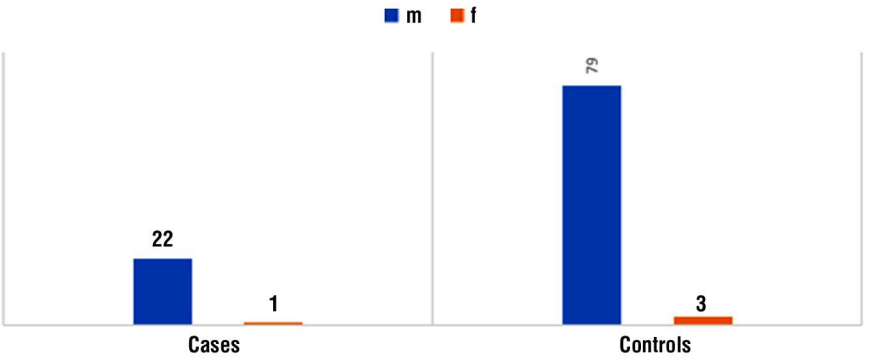

Figure 3. Distribution of sex among cases and controls (m-male, f-female).

Table 3. Distribution of risk factors for bilateral hernia among subjects and controls – general variables.

Variables (A)	Cases N=23 (%)	Controls N=82 (%)	OR (95% CI)	P-value
Age				
age ≤ 65	7 (30.4)	50 (61.0)	3.57 (1.32-9.64)	0.012
Age>65	16 (69.6)	32 (39.0)		
BMI>30				
Yes	4 (17.4)	14 (17.07)	1.03 (0.30-3.47)	0.9715
No	19 (82.6)	68 (82.93)		
Anticoagulants				
Yes	6 (26.09)	4 (4.88)	4.58 (1.75-27.07)	0.0058
No	17 (73.91)	78 (95.12)		
Arterial hypertension				
Yes	10 (43.48)	21 (25.61)	2.234 (0.85-5.85)	0,1014
No	13 (56.52)	61 (74.39)		
IMA				
Yes	7 (30.4)	11 (13.41)	2.82 (0.95-8.42)	0,0624
No	16 (69.6)	71 (86.59)		
Neoplastic status				
Yes	6 (26.09)	1 (1.22)	28,59 (3,23-253,07)	0,0026
No	17 (73.91)	81 (98.78)		
Smoking status				
Yes	5 (21.74)	29 (35.37)	0.51 (0.17-1.51)	0,2226
No	18 (78.26)	53 (64.63)		
Diabetes mellitus				
Yes	2 (8.69)	8 (9.76)	0.88 (0.17-4.47)	0.8784
No	21 (91.31)	74 (90.24)		
COPD				
Yes	2 (8.70)	2 (2.44)	3.81 (0.51-28.66)	0.1939
No	21 (91.30)	80 (97.56)		

plastic status were significantly associated with open bilateral hernia repair. In our study, the presence of myocardial infarction increased the risk (OR=2.82) of open hernia repair, but this was not statistically significant (p=0.06).

When neoplastic status was implied, we found a risk of open hernia surgery multiplied by 28.59, as shown in *Table 2*.

The Group B variables are listed in *Table 3*. For cases, we found 30.434 % of the recurrent hernias compared to 14.634% in controls. Complicated hernias were found in 30.769% of cases and 10.975% of controls. Inguinoscrotal was 34.782% and 7.84% in the cases and controls, respectively.

In the analysis of these hernia characteristics, we found that recurrent hernia, complicated hernia, or scrotal hernia increased the risk of open hernia repair, but only inguinoscrotal hernia characteristics were statistically significant (OR=6.76 C.I. 2.046-22.309, p=0.0017).

In the multivariate analysis, we included

Table 4. Distribution of risk factors for bilateral hernia among subjects and controls – particular variables.

Variables (B)	Cases N=23 (%)	Controls N=82 (%)	OR (95% CI)	P-value
Recurrent hernias				
Yes	7	12	2.55 (0.86-7.51)	0.0887
No	16	70		
Complicated				
Yes	4	9	1.71 (0.47-6.15)	0.4131
No	9	73		
Inguinoscrotal				
Yes	8	6	6.76 (2.046-22.309)	0.0017
No	15	76		

Table 5. Multivariate analysis of selected variables. Cox & Snell R Square – 0.250, Nagelkerke R Square – 0.385, aOR- adjusted Odds Ratio.

	Wald	Sig.	aOR	95% C.I.for aOR	
				Lower	Upper
Age>65 years	5.678	.017	4.183	1.289	13.572
Inguinoscrotal	12.546	.000	.041	.007	.240
Neoplastic status	3.714	.054	.133	.017	1.035
Anticoagulants	4.468	.035	38.876	1.305	1158.011
Constant	9.036	.003	3.104		

four statistically significant variables (p<0.05): age > 65 years, presence of inguinoscrotal hernia, presence of neoplastic status, and anticoagulant use.

The results of the adjusted model adjusted odds ratio (aOR) are listed in *Table. 5* - it appears that for patients over 65 years of age, it is at least four times more probable (p=0.017) to have an open hernia repair than a laparoscopic procedure. Furthermore, we found that anticoagulant use increased the risk of open hernia repair by at least 38 times (p=0.035). Neoplastic status did not reach statistical significance (p=0.054).

Discussion

Laparoscopic total extraperitoneal (TEP) repair has become an established, minimally invasive approach for inguinal hernias. In experienced hands, irreducible hernias can also be treated with TEP (18). The choice for the control group was based on the suggestion of opting for a laparoendoscopic technique for male patients with primary bilateral inguinal hernia because of lower postoperative pain incidence and reduced chronic pain incidence, provided that a surgeon with specific expertise and sufficient resources is available (19). A standardized technique can decrease the learning curve, as reported by Danson et al. (20).

A recent systematic review conducted by Hitman et al. (21) stated that there is no evidence to suggest a significant burden of morbidity between unilateral and bilateral TEP inguinal repair. Another review demonstrated that open or laparoscopic procedures are adequate for the repair of bilateral inguinal hernias, with no significant difference in recurrence and complication rates (22).

Some authors have suggested that simultaneous bilateral repair of inguinal hernia is as effective as sequential repair (23,24). One prospective study on open hernia repair concluded that bilateral simultaneous hernia repair can be performed with no greater morbidity than unilateral repair, and return to normal activity is as rapid; bilateral hernias should be repaired simultaneously rather than

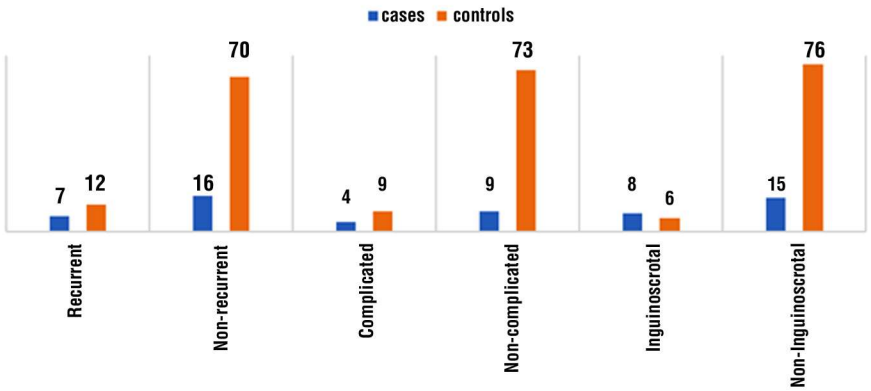

Figure 4. Distribution of hernia characteristics among cases and controls.

sequentially (24). As Doudakmanis et al. stated, a gold standard approach for bilateral inguinal hernia repair is yet to be established (25).

The incidence of elderly patients undergoing elective inguinal hernia repair is increasing; simultaneous bilateral inguinal hernia repair has benefits over sequential repair in elderly patients, and single hospitalization and surgery with single anesthesia can lower the associated morbidity (23). We concur with the recommendation of Gianetta et al. that elective hernia repair should be offered to the elderly to avoid the risk of emergent surgery (26). Why some prefer local anesthesia is probably related to age (elderly) and the association between pulmonary and neurovascular problems. A study by Chlebny et al. concluded that inguinal hernia surgery in the el-derly may be safe in an elective setting and if regional anesthesia is used (9). However, the long-term quality of life, as reported by Ielpo et al., is probably not influenced by repair alone (27).

One issue that should be addressed is occult hernias. Patients with occult or asymptomatic (according to the definition of the HerniaSurge group) hernias were excluded from our study. There is no consensus regarding this type of hernia, and there were discussions and polls related to this topic in the EHS Congress 2023 (Sitges, Spain) that concluded that it is not recommended to dissect on the other side to look for an occult hernia, especially when performing TEP. Some authors have demonstrated that early detection of occult hernias can improve prognoses, but this matter is debatable (28,29).

Our study demonstrates some aspects of bilateral inguinal hernia repair in the elderly population. In the uni-variate analysis, we found that age > 65 years was associated with a risk of open hernia repair at least 3-fold more than laparoscopic hernia repair (OR-3.57 (1.32-9.64), p=0.012). This is concurrent with studies that emphasize the association of age>65 years with the choice of open hernia repair and an increase in complications in this group (1,2).

One study from Spain showed that in a population of 21,795 cases, the main factor associated with the utilization of laparoscopy was the region of residence (30). Additionally, age < 65 years and recurrent inguinal hernia were independently associated with the choice of laparoscopy. The same study also observed that age>65 years is independently associated with perioperative complications.

Obesity was another studied variable, probably underappreciated as an age-related risk factor despite its potential to significantly impact morbidity in elective hernia repair (28). In obese patients (BMI>30 kg/m^2), our data showed no significant difference (p=0.9715) in terms of an open bilateral hernia repair (OHR) compared to laparoscopic hernia repair (LHR). It is considered that using an LHR in obese patients has the advantages of fewer deep surgical site infections (SSI), surgical site occurrence (SSO), and shorter hospitalization time compared to open surgery (31).

Comorbid conditions in our study were: hypertension, diabetes mellitus, myocardial infarction, and COPD. These conditions are recognized as age-related risk factors (32). Our data revealed that the presence of arterial hypertension increased the risk (OR=2.234 CI (0.85-5.85)) of OHR versus LHR, but the difference was not statistically significant (p=0.1014). Similar results were obtained for myocardial infarction (OR=2.82 CI (0.95-8.42), p=0.0624) and COPD (OR=3.81 CI (0.51-28.66), p=0.1939). Diabetes mellitus did not increase the risk of OBHR versus LHR (OR=0.88 CI (0.17-4.47), p=0.8784).

COPD is considered by some authors a contraindication for laparoscopic surgery, but low-pressure pneumoperitoneum can reduce complications and facilitate a minimally invasive approach (33). An analysis conducted by Fields et al. provided evidence of increased morbidity in hernia repair and emphasized the importance of preoperative optimization of the pulmonary status (34). Moreover, data from a comparative study on large groups of patients concluded that the use of regional anesthesia in patients with COPD had better outcomes than in general anesthesia (35).

In the elderly, cardiac failure is associated

with increased morbidity when hernia repair is indicated (36). Regarding a medical history of myocardial infarction or high blood pressure, our data showed an increased risk of having OHR, but this did not reach statistical significance. In laparoscopic surgery, there is evidence of pneumoperitoneum influence on blood pressure and heart rate, but transient and easily manageable intraoperatively; hence, we comply with the idea that these comorbid conditions are not contraindications to minimally invasive hernia repair (37).

Diabetes is a well-known risk factor for postoperative complications; however, there is insufficient evidence for groin hernia surgery. Diabetes did not increase the risk of developing OHR in our study. A recent study conducted by Hellspong et al. concluded that diabetes increases the risk of bleeding, wound dehiscence, wound infection, and overall complication rates in groin hernia surgery, but there was no difference between laparoscopic and open hernia surgery (38).

Smoking habits were also studied, but the data did not show statistical significance (OR= 0.51 CI (0.17-1.51), p=0.2226). Smoking cessation is a recommendation for elective hernia surgery (39), and it has been proven that preoperative smoking is associated with postoperative pneumonia (40); hence, there could be an advantage in using local/spinal anesthesia in these patients. However, a recent study concluded that smoking status was not associated with 30-day adverse outcomes after inguinal hernia repair. (41)

We studied the neoplastic status and anticoagulant use. The data for these two variables was statistically significant: for the neoplastic status, we found an increased risk (OR=28.59 CI (3.23-253.07), p=0.0026) and for anticoagulants use a more than fourfold risk (OR=4.58 CI (1.75-27.07), p=0.0058) of OHR. Neoplastic status is defined as the presence of neoplasia; in patients with neoplasia, there is delayed wound healing and worse quality of life, probably due to chemo/radiotherapy associated with cancer treatment (42). There has been an increase in cancer incidence in the elderly, but the relationship with hernia requires further research (43).

LHR requires general anesthesia, unlike OHR, which requires local/locoregional anesthesia. Some anesthetic agents can induce tumor development, but there is not enough data to validate this effect. Currently, available studies suggest that locoregional anesthesia seems to reduce perioperative immunosuppression and angiogenesis compared with general anesthesia, but the real link between these aspects remains to be elucidated (43).

Based on our results, the presence of neoplasia influenced the choice of herniorrhaphy (p=0.0026); however, to assess which hernia repair (open versus laparoscopic) is recommended in patients with neoplasia, prospective RCTs are needed to provide definitive arguments.

Elderly patients are often candidates for inguinal hernia repair, and it is not uncommon for them to receive anticoagulant therapy (44). Increased operative time due to bleeding risks and postoperative hemorrhage /thromboembolic episodes is associated with these patients (45). Studies suggest that laparoscopic hernia repair is safe in patients receiving anticoagulant/antiplatelet therapy, but others prefer open repair to effectively deal with bleeding problems during surgery (46,47). Our data were consistent with those of these studies.

Regarding the laparoscopic approach, a literature review showed that the rate of bleeding in TEP was as low as 0.41% (48). Although the bleeding risk is generally low, there is still concern about whether the extensive dissection of the preperitoneal space in patients taking antithrombotics or coagulopathy can lead to significant hemorrhage (45).

Recent studies have revealed that in patients undergoing antithrombotic therapy, TEP hernia repair can be safely performed during the discontinuation of antithrombotics with or without heparin bridging therapy (49,50).

The choice of the open versus laparoscopic approach can also be influenced by the

characteristics of the hernia. We have chosen three of these: a recurrent hernia, an inguinoscrotal hernia, and a complicated hernia (irreducible hernia). Analysis of hernia characteristics revealed that having an inguinoscrotal hernia had a 6.7-fold higher risk of having OHR than LHR [6.76 (2.046-22.309), p=0.0017] and these data were statistically significant. Inguinoscrotal herniorrhaphy can be challenging, but good preoperative evaluation and the following technical guidelines can provide the best outcomes for these patients (51,52).

Further analyses of variables with statistical significance were performed. Multivariate analysis included: age > 65 years, neoplastic status, use of anticoagulants, and inguinoscrotal hernia status. The Adjusted Odds Ratio (aOR) showed that patients aged > 65 years had a risk of at least fourfold to have OBHR (aOR=4.183 CI (1.289,13.572), p=0.017). Anticoagulant use was found to be associated with an increased risk of OHR (aOR=38.876 CI (1.305, 1158.011), p=0.035). These two variables were statistically significant.

Our study was conducted using data collected from two hospitals: a public hospital and a private hospital. Consequently, we suggest that open inguinal hernia repair under local anesthesia can reduce healthcare costs, probably leading to biased decision-making (53).

Finally, we stress the importance of the informed consent process and eventually adhere to the idea that patient preference guides the surgeon to choose the best approach, based on presenting the outcomes of each choice (54,55).

Conclusion

Elective hernia repair should be offered to the elderly, as it is considered safe, in contrast to emergent repair. Bilateral hernia repair can be open or minimally invasive. In bilateral inguinal herniorrhaphy, there is no consensus regarding the best repair; therefore, surgeons should approach each patient individually and tailor their approach according to patient risk factors and preferences.

Our data suggest that age over 65 is associated with electing open hernia repair over minimally invasive repair, which can be linked to age-related risk factors. Moreover, anticoagulant use, a common occurence in the elderly, was a risk factor for open repair in contrast to minimally invasive. Neoplastic status was found to influence the decision of the surgeon in our study, and this can open new lines of study on whether patients with neoplasia should be operated on open or minimally invasive. Further research is needed to investigate the impact of age and age-related risk factors on surgical outcomes of bilateral inguinal hernia repair.

Limitations and Biases

There are several limitations to this study. First, the number of cases was small. This is due to inclusion criteria: bilateral symptomatic inguinal hernias. In their studies, many surgeons introduced bilateral hernias that were not symptomatic. The effect of occult hernias is detailed in the Discussion section. Second, patient selection can also be considered biased because age as a risk factor is debatable and age groups cannot be differentiated. However, having two different surgical centers and surgeons can be considered a strong point. Another limitation is related to the type of study (case-control); however, bilateral hernias are not as frequent as other types of hernias. Another bias is probably related to surgeons' and patients' preferences. Some patients prefer open surgery; similarly, some surgeons feel more comfortable with the open approach. In many surgical centers, surgeons consider TAPP better than TEP and use it more often, but our experience has proven otherwise. Hence, we consider the TEP approach for the control group as appropriate. Even if there is a potential for confounding bias, examining multiple risk factors (age and anticoagulant use) can be considered an advantage and the conclusions can encourage future studies on this topic.

Author's Contributions

Conceptualization, C.-O.U. Data curation, C.-O.U, N.I.; Investigation, S.F. and V.-T.G., V.I.; Project administration, N.I., D.E.G. and O.G.; Resources, D.-A.C.; Supervision, N.I., R.I.; Visualization, C.-O.U. and R.I; Writing - original draft, C.-O.U. and O.G.; Writing - review and editing, C.-O.U., D.E.G., V.I., O.G. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interests

The authors have no conflicts of interest or financial ties to disclose.

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Informed Consent Statement

Due to the retrospective nature of the study, signed informed consent of the patients was waived.

Data Availability Statement

The data supporting the findings of this study are available per request.

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