Chirurgia (2026) 121: 70-76
No. 1, January - February

http://dx.doi.org/10.21614/chirurgia.3255

Evolution of Inguinal Hernia Management in a Romanian Emergency County Hospital: A Single-Centre Experience

Vlad-Olimpiu Butiurca[1], Marian Botoncea[1]*, Catalin Dumitru Cosma[2], Ioulia Assmann[3], Calin Molnar[2]

[1]George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Targu Mures, ME2 Department, Targu-Mures, Mures County, Romania
[2]George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Targu Mures, M3 Department, Targu-Mures, Mures County, Romania
[3]DRK-Kinderklinik, Paediatric Surgery, Siegen, Germany

***Corresponding author:**
Botoncea Marian, MD
George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Targu Mures, ME2 Department, Targu-Mures
Mures County, Romania
E-mail: botonceam@gmail.com

Received: 25.11.2025
Accepted: 22.01.2026

Rezumat

Evoluția abordării terapeutice a herniei inghinale într-un Spital Județean de Urgență din România: experiența unui centru

Introducere: Cura herniei inghinale reprezintă una dintre cele mai frecvente intervenții din chirurgia generală. În ultimul deceniu, utilizarea pe scară largă a chirurgiei deschise cu utilizarea mesh-urilor şi introducerea procedurilor laparoscopice TEP/TAPP au modificat treptat practica, în timp ce pandemia de COVID-19 a redus temporar chirurgia electivă şi a crescut ponderea cazurilor de urgență.
Material şi Metodă: Am realizat un studiu retrospectiv, longitudinal, monocentric, care a inclus 1.760 de pacienți adulți (≥18 ani) internați cu diagnosticul de hernie inghinală în Clinica de Chirurgie Generală I, Spitalul Clinic Județean de Urgență Târgu Mureş, între iulie 2013 şi decembrie 2021. Au fost analizate date demografice, tipul de internare (electiv/urgență), prezența încarcerării, abordul chirurgical, tipul de anestezie şi durata spitalizării.
Rezultate: Pacienții de sex masculin reprezentat majoritatea (91,8%), cu vârsta medie de 61 de ani. Internările elective au reprezentat 77,7% din cazuri, iar urgențele 22,3%. Intervențiile laparoscopice pentru hernii inghinale au crescut de la 0,9% în 2013 la aproape 30% în 2018–2019, apoi au scăzut la aproximativ 20% în perioada COVID-19. Abordul deschis a rămas predominant (84,9%). Durata medie de spitalizare a fost de 3,31 zile şi a fost semnificativ mai mare la cazurile de urgență față de cele elective (3,98 vs 3,12 zile), la intervențiile deschise față de cele laparoscopice (3,52 vs 2,19 zile) şi la herniile încarcerate față de cele reductibile (4,13 vs 3,22 zile).
Concluzii: Clinica noastră a urmat tendința internațională de trecere de la tehnici deschise fără plasă la reparații cu plasă şi abord laparoscopic. Internarea în urgență, încarcerarea şi abordul deschis s-au asociat fiecare cu o durată mai lungă de spitalizare, în timp ce pandemia de COVID-19 a redus temporar volumul intervențiilor elective şi al reparațiilor laparoscopice.

Cuvinte cheie: hernie inghinală, reparație laparoscopică, Lichtenstein, TEP, TAPP, încarcerare, chirurgie electivă, COVID-19

Abstract

Background: Inguinal hernia repair is one of the most frequently performed procedures in general surgery. During the last decade, wider use of mesh-based open techniques and the introduction of laparoscopic TEP/TAPP have progressively changed practice, while the COVID-19 pandemic temporarily shifted case-mix toward emergencies.
Material and Method: We conducted a retrospective, longitudinal, single-center study of 1,760 adult patients (≥18 years) admitted for inguinal hernia to Surgical Clinic No. I, Emergency County Hospital Târgu Mureş, between July 2013 and December 2021. Demographic data, admission type, incarceration, surgical approach, anesthesia and length of stay (LOS) were analyzed. Descriptive statistics and Welch t-tests were used for comparisons, and a multivariable logistic regression model was fitted to identify independent predictors of prolonged length of stay.
Results: Male patients predominated (91.8%), with a median age of 61 years. Elective admissions accounted for 77.7% of cases, while 22.3% were emergencies. Laparoscopic repairs increased from 0.9% in 2013 to almost 30% in 2018-2019, then decreased to ~20% during the COVID-19 period. Open repair remained dominant (84.9%). Mean LOS was 3.31 days and was significantly longer in emergency versus elective cases (3.98 vs 3.12 days), open versus laparoscopic repairs (3.52 vs 2.19 days) and incarcerated versus non-incarcerated hernias (4.13 vs 3.22 days) (all $p<0.001$).
Conclusions: Our clinic followed the international trend from non-mesh open to mesh and laparoscopic techniques. Emergency presentation, incarceration and open surgery were each associated with prolonged hospitalization, while the COVID-19 pandemic temporarily reduced elective and laparoscopic repairs.

Keywords: inguinal hernia, laparoscopic hernia repair, Lichtenstein, incarceration, COVID-19, elective vs emergency

Introduction

Inguinal hernia remains the most frequent abdominal wall defect requiring surgical correction, with a lifetime risk of 27% for men and 3% for women, and a clear male preponderance reported in European series (1). In Romania the recorded incidence of groin hernia (inguinal and femoral) in 2018 was estimated between 140 and 240 per 100,000 inhabitants (2). Current European Hernia Society (EHS) guidelines favor a tension-free mesh repair as the standard, with laparo-endoscopic approaches (TEP/TAPP) recommended especially for bilateral and recurrent hernias and in centers with adequate expertise (3). Romanian centers, including county emergency hospitals, have traditionally relied on open repair (Bassini, Postempski, McVay and, later, Lichtenstein), with adoption of laparoscopy coming later and often dependent on staff training, equipment availability, and case-mix (4,5). An additional perturbing factor was the COVID-19 pandemic, which forced postponement of elective benign surgery and increased the proportion of emergencies.

The present study aims to offer a complete picture of how one surgical clinic evolved over 9 years (2013-2021) in terms of inguinal hernia management, using a complete dataset (1,760 cases), and to identify which variables were most strongly associated with prolonged hospitalization.

Materials and Methods

Study Design and Setting

Retrospective, observational, longitudinal study conducted in Surgical Clinic No. I, Emergency County Hospital Târgu Mureş over a period of 9 years between July 2013 – December 2021 (the first 6 months of 2013 were not fully digitized and not available). Early postoperative complications (e.g. hematoma, seroma, wound infection, urinary retention) were extracted from the discharge summaries when available and analyzed descriptively.

Inclusion criteria

All adult patients admitted for a diagnosis of inguinal (groin) hernia that underwent evaluation and/or repair during the study period.

Exclusion criteria

Patients <18 years; cases without sufficient operative or discharge data, patients admitted for different main diagnoses who also had groin hernia. Final study cohort: 1,760 patients

Data Source and Variables

Data were extracted from digital hospital records and organized in an Excel spreadsheet with the following variables considered:

1. Demographic: sex (M/F); age on admission (years); residence: U = urban, R = rural.
2. Clinical/presentation:
   - o admission type: elective / emergency;
   - o incarceration at the time of admission;
   - o uni- or bilateral hernia;
   - o EHS elements: L or M, size group (1–3), first occurrence vs recurrence.
3. Operative:
   - o Anesthesia type (general anesthesia / rachianesthesia);
   - o Open or laparoscopic surgery.
4. Outcome: length of stay (0-23 days) and recurrence. Recurrence was defined as any reoperation for inguinal hernia recorded in the electronic hospital system during the study period; recurrences treated conservatively or in other hospitals were not captured.

Statistical Analysis

Descriptive statistics were reported as frequencies and percentages for categorical variables and as mean ± standard deviation or median (interquartile range) for continuous variables. Univariable comparisons of length of stay (LOS) between groups (elective vs emergency, open vs laparoscopic, incarcerated vs non-incarcerated) were performed using Welch's t-test. Laparoscopic proportions by year (2013–2021) were summarized descriptively.

In addition, a multivariable analysis was performed to identify independent predictors of prolonged LOS. Prolonged LOS was defined as a hospital stay above the median value (>3 days). Variables entered the logistic regression model were age, sex, admission type (elective vs emergency), incarceration status and surgical approach (open vs laparoscopic). Odds ratios (OR) with 95% confidence intervals (CI) were reported. Statistical analyses were performed using IBM SPSS Statistics, version 29.0 (IBM Corp., Armonk, NY, USA), with a two-sided significance level of 0.05.

Table 1. Demographic characteristics (n=1,760)

Variable	n (%) / Mean ± SD
Sex – Male	1,616 (91.8%)
Sex – Female	144 (8.2%)
Age, years – mean ± SD	57.9 ± 16.4
Age, median (IQR)	61 (47–70)
Age range	18–92
Residence – Rural (R)	903 (51.3%)
Residence – Urban (U)	857 (48.7%)

Ethics

The study was approved by the Ethics Committee of the Emergency County Hospital Târgu Mureș. The study complied with the principles of the Declaration of Helsinki.

Results

Demographic and baseline characteristics

A total of 1,760 adult patients with inguinal hernia were included in the analysis (*Table 1*). The vast majority were male (91.8%), with a median age of 61 years (IQR 47–70). The population had a near-equal distribution between rural and urban residence, although rural patients were slightly predominant (51.3%).

Mode of admission and clinical presentation

Elective admissions represented 77.7% of cases, while 22.3% presented as emergencies (*Table 2*). Incarceration was documented in 10.3% of patients, a finding strongly associated with emergency presentation and older age groups. Bilateral hernias accounted for approximately 8–9% of the cohort, and recurrent hernias for ~10%, consistent with prior regional reports (4,5). *Fig. 1* illustrates the distribution of elective and emergency cases by year, highlighting the substantial drop-in elective

Table 2. Admission type and acute status

Variable	n (%)
Elective (EL)	1,368 (77.7%)
Emergency (EM)	392 (22.3%)
Incarceration present	182 (≈10.3%)
Incarceration absent	1,570
Bilateral hernia	˜8–9%
Recurrent hernia	≈10%

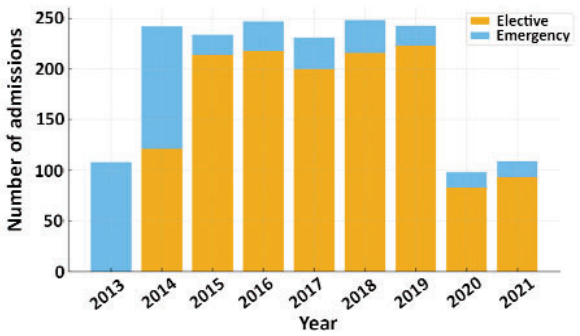

Figure 1. Elective and emergency cases by year

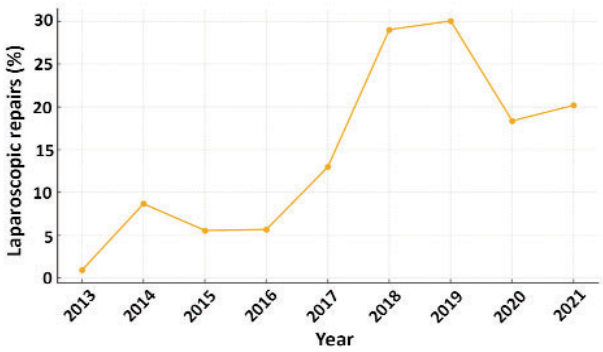

Figure 2. Proportion of laparoscopic inguinal hernia repairs / year

activity during 2020–2021 (COVID-19 period).

Emergency admission was more common in:

- older age groups;
- rural patients;
- incarcerated hernias (85%+ of incarcerated hernias were admitted in an emergency setting).

Our database confirms the functional link between incarceration and emergency admission:

- mean LOS (length of stay) in incarcerated: 4.13 days;
- mean LOS in non-incarcerated: 3.22 days → $t=4.69$, $p = 5.1\times10^{-6}$ (statistically significant).

According to the EHS classification, among hernias with a clearly coded lateral/medial component, indirect (L) hernias predominated (≈72%) over direct (M) hernias (≈28%). In terms of defect size, most hernias were small (size group 1 ≈80%), while size groups 2 and 3 represented about 6% and 15% of cases, respectively, with both lateral and medial hernias being overwhelmingly classified as size 1.

Operative Management

Of the 1,760 admissions, 1,744 patients underwent operative repair (99.1%). Sixteen did not undergo surgery (comorbidities, death, refusal). Open repair remained the predominant technique throughout the study period (84.9% open vs 15.1% laparoscopic) (*Table 3*). Laparoscopic repairs - primarily TEP and TAPP - began to rise in 2014, peaked in 2018–2019 (reaching nearly 30% of all repairs), and subsequently decreased during the pandemic years (*Fig. 2*). Mesh use was standard in most open procedures (Lichtenstein technique), whereas a diverse range of mesh types were employed in laparoscopic repairs. Non-mesh repairs were seen mainly in emergencies or selected high-risk patients.

Table 3. Surgical approach and LOS

Variable	n (%) / Mean
Open approach (O)	1,480 (84.9%)
Laparoscopic (L)	264 (15.1%)
Days until discharge – Open	3.52 days
Days until discharge – Laparoscopic	2.19 days
Statistical comparison (Open vs Lap)	$t = 12.71$; $p = 1.13 \times 10^{-31}$

Anesthesia was predominantly general, with neuraxial regional techniques used in roughly one quarter of cases (404/1,744); local anesthesia was almost completely abandoned (2 cases), and virtually all laparoscopic repairs were performed under general anesthesia, with only a single case carried out under regional anesthesia.

Evolution in Time

Annual caseloads remained stable from 2014 to 2019 (230–250 cases/year), followed by a sharp decline during the pandemic:

- 2019: 243 cases
- 2020: 98 cases
- 2021: 109 cases

This represents a ~60% reduction in total admissions (*Fig. 4*). During the same period, the proportion of laparoscopic repairs fell from 30% pre-COVID to 18–20%, reflecting limited elective scheduling and prioritization of urgent open surgery during lockdown phases.

Hospitalization (Primary Outcome)

Overall mean LOS was 3.31 ± 1.91 days (range 0–23). Emergency cases had a significantly longer stay than elective cases (3.98 vs 3.12 days), open repairs than laparoscopic repairs (3.52 vs 2.19

Table 4. Length of stay according to key variables

Variable	n	Mean LOS (days)	p
Elective	1,368	3.12	
Emergency	392	3.98	$p = 2.0x10^{-10}$
Open	1,480	3.52	
Laparoscopic	264	2.19	$p = 1.1x10^{-31}$
Non-incarcerated	1,570	3.22	
Incarcerated	182	4.13	$p = 5.1x10^{-6}$

days) and incarcerated hernias than non-incarcerated hernias (4.13 vs 3.22 days; all p<0.001) (*Table 4*, *Fig. 3*).

Multivariable analysis of prolonged length of stay. Prolonged LOS, defined as a hospital stay of more than 3 days, was observed in 611 of 1,752 patients with complete data (34.9%). In the multivariable logistic regression model including age, sex, admission type, incarceration status and surgical approach, older age (OR 1.03 per year increase, 95% CI 1.03–1.04; p<0.001), emergency admission (OR 1.57, 95% CI 1.18–2.09; p=0.002) and open surgery (laparoscopic repair: OR 0.10, 95% CI 0.05–0.18; p<0.001) were independently associated with prolonged LOS. Female sex showed a non-significant trend towards higher odds of prolonged stay (OR 1.41, 95% CI 0.97-2.06; p=0.075), while incarceration did not remain significantly associated with prolonged LOS after adjustment (OR 1.06, 95% CI 0.72-1.55; p=0.776).

Elective vs emergency

- Elective: 3.12 days (n=1,368);
- Emergency: 3.98 days (n=392);
- Welch t-test: t = −6.49; $p = 2.06\times10^{-10}$
- Interpretation: emergencies stay about 0.8-0.9 days longer.

Open vs laparoscopic

- Open: 3.52 days (n=1,480);
- Laparoscopic: 2.19 days (n=264);
- Welch t-test: t = 12.71; $p = 1.13\times10^{-31}$;
- Interpretation: laparoscopy is associated with ~1.3 days shorter stay.

Incarcerated vs non-incarcerated

- Incarcerated: 4.13 days (n=182);
- Non-incarcerated: 3.22 days (n=1,570);
- Welch t-test: t = 4.69; $p = 5.10\times10^{-6}$;
- Interpretation: incarceration adds ~0.9 days.

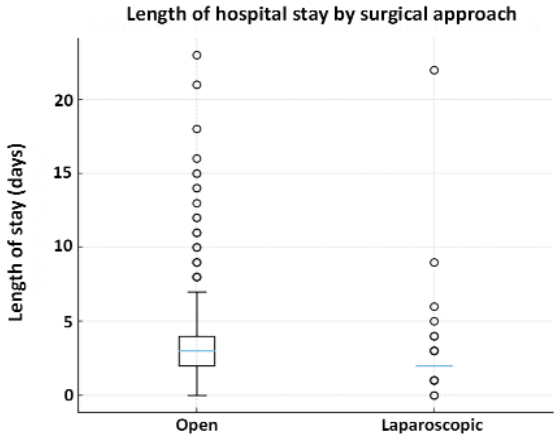

Figure 3. Box-plot of LOS by surgical approach (Open vs Laparoscopic)

Effect of COVID-19 (2020–2021)

Annual admissions remained stable between 2014 and 2019 (234–248 cases per year), then dropped to 98 cases in 2020 and partially recovered to 109 cases in 2021, representing an almost 60% reduction in total volume compared to 2019 (*Fig. 4*).

Discussion

This single-center Romanian experience over the 2013–2021 period confirms several findings already reported in European and regional series, and it also illustrates the pace at which a county emergency hospital can adopt minimally invasive inguinal hernia surgery (3,6). The epidemiological profile of our cohort (male sex >90%, median age around 60 years, slight predominance of rural patients and approximately 10% recurrent

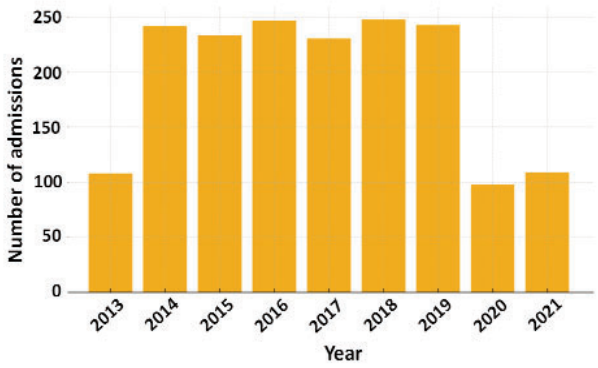

Figure 4. Total annual admissions for inguinal hernia (2013–2021)

hernias) is highly consistent with large national and registry-based data, in which men account for about 89–91% of inguinal hernia repairs and the typical age cluster is in the sixth decade of life (4,6–9). This suggests that our caseload is representative of a standard Eastern-European emergency hospital.

From a technical standpoint, our results document the clear evolution of operative practice. In the early years of the study (2013–2014), a substantial proportion of open procedures were still performed without mesh, which is understandable in a setting where the learning curves, mesh availability and surgeon preference all play a role. By 2016, open mesh repair (Lichtenstein-type) had become the dominant technique, in line with current international guidelines for primary unilateral hernias (3,4). After 2017, we observed a real increase in laparo-endoscopic repair, with TEP/TAPP accounting for almost one-third of all repairs in 2018–2019. This change is most likely related to the accumulation of laparoscopic expertise in the surgical team and to improved access to state-of-the-art equipment and tailored meshes in our public hospital.

Length of stay (LOS) emerged as a sensitive marker for both operative strategy and case-mix. In univariable analyses, emergency admission, incarceration and open surgery were each associated with almost one additional day of hospitalization, whereas laparoscopic repair reduced LOS by more than one day. In the multivariable model, older age, emergency admission and open surgery remained independent predictors of prolonged LOS, while incarceration lost statistical significance, suggesting that its effect is largely mediated through the higher proportion of emergency cases and open procedures. These findings are in line with other reports showing that minimally invasive repair and elective timing of surgery are key determinants of shorter hospital stay and more efficient use of hospital resources (10,11). From a practical point of view, these results support a policy of early elective repair, particularly in elderly rural patients, who in our cohort contributed disproportionately to the burden of incarcerated hernias.

The COVID-19 pandemic acted as an exogenous shock rather than a true change in surgical philosophy. During 2020–2021, total annual admissions for inguinal hernia decreased by almost 60% compared with 2019, with a parallel reduction in the proportion of laparoscopic repairs. As in other countries, the restriction of elective benign surgery led to a relative increase in emergencies and incarcerated hernias and forced a temporary shift back toward open surgery (2,5,12). Once operating room capacity and elective programs are fully restored, it will be important to consolidate the minimally invasive pathway and to avoid a persistent "COVID-era" pattern of delayed presentation and higher emergency rates.

Beyond the clinical implications, our findings also have relevant economic and organizational consequences for an emergency county hospital. Each additional day of hospitalization translates into increased bed occupancy, nursing workload and indirect costs. In our cohort, emergency admission, incarceration and open surgery were all associated with almost one extra day of hospital stay, whereas laparoscopic repair reduced LOS by more than one day. At the level of hundreds of inguinal hernia cases per year, these differences amount to a substantial number of bed-days and may influence the capacity to admit other surgical emergencies. In this context, policies that encourage timely referral and early elective repair, as well as the consolidation of minimally invasive hernia pathways, are likely to improve not only patient outcomes but also the efficiency of resource utilization in our institution.

Limitations

- Retrospective, single center.
- Recurrence rate is clearly underestimated because only re-operations recorded in our clinic were captured; Romania currently lacks a national patient registry, which prevents us from identifying recurrences treated in other hospitals.
- Standardization – data collection began in 2013, when European Hernia Society guidelines were still being developed and had not yet been widely adopted. Furthermore, Romanian surgeons tend to classify groin hernias simply on their anatomical appearance (external oblique / internal oblique) and did not adopt the indirect / direct classification or the EHS classifications until later
- "Symptoms" variable has many missing values → we did not perform symptom-based outcome analysis.
- Pediatric and femoral hernias were not included.
- The present analysis represents the first part of a broader research program on inguinal hernia management in our clinic. Since the

completion of the 2013–2021 retrospective database, our data acquisition system has been updated to include more detailed patient variables and systematic EHS-based classification for each inguinal hernia. A subsequent, prospective study using these enhanced records is already planned and will reassess current practice patterns and outcomes in a contemporary cohort.

Conclusion

In this retrospective study of 1,760 adult patients with inguinal hernia treated in a Romanian emergency county hospital between 2013 and 2021, we observed a stable epidemiological profile comparable with international data and a progressive transition from open/non-mesh to open/mesh techniques, followed by a significant adoption of laparoscopic TEP/TAPP after 2017, peaking at almost 30% of all repairs before the COVID-19 pandemic. Emergency admission, incarceration and open surgery were each associated with longer hospital stay, whereas laparo-endoscopic repair significantly reduced LOS. The COVID-19 period temporarily reduced the volume of elective repairs and the proportion of laparoscopic approaches. These findings support the promotion of early elective repair, particularly in rural and elderly patients - and the consolidation of minimally invasive hernia surgery to decrease the burden of incarcerated hernias and optimize use of hospital resources.

Author's Contributions

BVO conceived and designed the study. IA collected the data and managed the database. BM and BVO performed the statistical analysis. MC and BVO drafted the manuscript. All authors critically revised the text, approved the final version and agreed to be accountable for all aspects of the work.

Conflicts of Interest and Source of Funding

The authors declare no conflicts of interest. No external funding was received for this study.

References

1. Primatesta P, Goldacre MJ. Inguinal Hernia Repair: Incidence of Elective and Emergency Surgery, Readmission and Mortality. Int J Epidemiol. 1996; 25(4):835-839.
2. Garofil ND, Bratucu MN, Zurzu M, Paic V, Tigora A, Virgiliu Prunoiu 1, et al. Groin Hernia Repair during the COVID-19 Pandemic - A Romanian Nationwide Analysis. Medicina (Kaunas). 2023;59(5):970.
3. HerniaSurge Group. International guidelines for groin hernia management. Hernia. 2018;22(1):1–165.
4. Garofil ND, Zurzu M, Bratucu MN, Paic V, Tigora A, Vladescu C, et al. Laparoscopic vs. Open-Groin Hernia Repair in Romania - A Populational Study. J Clin Med. 2025;14(8):2834.
5. Feier CVI, Muntean C, Gaborean V, Vonica RC, Faur AM, Murariu MS, et al. Surgical Challenges During the COVID-19 Crisis: A Comparative Study of Inguinal Hernia Treatment in Romania. Medicina (Kaunas). 2024;60(11):1825.
6. Picciochi M, Barranquero AG. Disparities in minimally invasive surgery for elective inguinal hernia repair across Europe: secondary analysis of an international cohort study. BJS Open. 2025;9(6):zraf122.
7. Burcharth J, Pedersen M, Bisgaard T, Pedersen C, Rosenberg J. Nationwide prevalence of groin hernia repair. PLoS One. 2013;8(1):e54367.
8. Jacob DA, Hackl JA, Bittner R, Kraft B, Köckerling F. Perioperative outcome of unilateral versus bilateral inguinal hernia repairs in TAPP technique: analysis of 15,176 cases from the Herniamed Registry. Surg Endosc. 2015;29(12): 3733–3740.
9. Köckerling F, Krüger C, Gagarkin I, Kuthe A, Adolf D, Stechemesser B, et al. What is the outcome of re-recurrent vs recurrent inguinal hernia repairs? An analysis of 16,206 patients from the Herniamed Registry. Hernia. 2020;24(4):811–819.
10. Perez AJ, Strassle PD, Sadava EE, Gaber C, Schlottmann F. Nationwide Analysis of Inpatient Laparoscopic Versus Open Inguinal Hernia Repair. J Laparoendosc Adv Surg Tech A. 2020;30(3):292–298.
11. Yang C, Deng S. Laparoscopic versus open mesh repair for the treatment of recurrent inguinal hernia: a systematic review and meta-analysis. Ann Palliat Med. 2020;9(3):1164–1173.
12. de Leeuw RA, Burger NB, Ceccaroni M, Zhang J, Tuynman J, Mabrouk M, et al. COVID-19 and Laparoscopic Surgery: Scoping Review of Current Literature and Local Expertise. JMIR Public Health Surveill. 2020;6(2):e18928.