Research Article

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Accidental Gallbladder Perforation During Laparoscopic Cholecystectomy

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Abstract

Laparoscopic cholecystectomy is the gold standard treatment of choice for gallstone diseases. One of the most common complications of laparoscopic cholecystectomy is iatrogenic gallbladder perforation. Iatrogenic gallbladder perforation during laparoscopic cholecystectomy remains a poorly understood phenomenon. The literature is limited, and there is a need for further research to elucidate the risk factors, mechanisms, and outcomes of this complication. All patients undergoing laparoscopic cholecystectomy at Lotus Hospital in Erode will be subjected to clinical assessment, alongside routine and radiological investigations. The study aims to identify the various perioperative predisposing factors contributing to gallbladder perforation and to evaluate the complication rates associated with gallbladder perforation during laparoscopic cholecystectomy. The study was conducted from May 2023 to December 2024, encompassing a duration of twenty months. The occurrence of iatrogenic gallbladder perforation does not appear to significantly elevate the risk of surgical site infection or postoperative collections; however, it is correlated with prolonged operative times and extended hospital admissions. The prompt retrieval of stones, adequate peritoneal irrigation, and the administration of prophylactic antibiotics may positively influence patient outcomes. Further research involving a larger sample size is warranted to substantiate these findings and to enhance surgical techniques.

Keywords: Laparoscopic cholecystectomy, Gallbladder perforation, surgical complications.

Introduction

Laparoscopic cholecystectomy is the gold standard treatment for gallstone diseases (Zinner, 1997). Having benefits of reduced postoperative pain, shorter hospital stays and faster postoperative recovery. However, like any other surgical procedure laparoscopic cholecystectomy is not without risk. One of the most common complications of laparoscopic cholecystectomy is iatrogenic gallbladder perforation. Iatrogenic gallbladder perforation during laparoscopic cholecystectomy can lead to serious consequences, including biliary peritonitis, abscess formation, and even death some cases (Hanely, 1992). The incidence of iatrogenic gallbladder perforation during laparoscopic cholecystectomy varies widely, ranging from 0.25% to 10% in different studies (Johannsen et al., 1989). Despite its significance, iatrogenic gallbladder perforation during laparoscopic cholecystectomy remains a poorly understood phenomenon. The literature is limited, and there is a need for further research to elucidate the risk factors, mechanisms, and outcomes of this complication. This thesis aims to investigate iatrogenic gallbladder perforation during laparoscopic cholecystectomy, with a focus on preoperative risk factors associated with iatrogenic gallbladder perforation and its postoperative outcome. By exploring this important topic, this research contributes to the existing body of knowledge and ultimately improves patient outcomes and safety in laparoscopic surgery.

Key Objectives

1. To determine the incidence of iatrogenic gallbladder perforation during laparoscopic cholecystectomy in a secondary care hospital in urban background.
2. To identify the risk factors associated with iatrogenic gallbladder perforation during laparoscopic cholecystectomy.
3. To describe the outcomes and management strategies for patients who experience iatrogenic gallbladder perforation during laparoscopic cholecystectomy.
4. To explore the impact of iatrogenic gallbladder perforation on patient outcomes, including morbidity, mortality, and quality of life.

Aim of Study

The study aims to identify the various perioperative predisposing factors contributing to gallbladder perforation and to evaluate the complication rates associated with gallbladder perforation during laparoscopic cholecystectomy.

Objectives

To find out preoperative risk factor that increases the risk of gallbladder perforation during laparoscopic cholecystectomy.
To find out most common intraoperative perforation site and instrument causing the perforation.

To find out the complications because of iatrogenic perforation which is compared with the no perforation group.

Methods and Materials

Study Design : Prospective Observational study
Study Centre : Lotus Hospital, Erode.
Study Duration : 20 months
Period of Study : May 2023 to December 2024
Samples Size : 82

Inclusion Criteria

All patients who underwent laparoscopic cholecystectomy included both emergency and elective surgeries.

Exclusion Criteria

Patient who converted into open surgery because of severe adhesion or not tolerate general anesthesia.

Methods of Sampling

Consecutive sampling

Data Management and Statistical Tests Used for Drawing Inferences

The data is entered and cleaned in MS Excel software and the analysis of data was done in Jamovi software. (version: 2.5.7). Quantitative data is expressed in mean and standard deviation after checking for normality through Shapiro Wilk test. Qualitative data is expressed in frequency and percentage. The Chi-square / Fischer Exact test is used for the comparison of association between two qualitative variables. Independent sample t-test was used for the comparison of the mean difference between two quantitative variables. P value <0.05 is considered as statistically significant.

Data Collection

The patients with clinical features of cholecystitis or any gallbladder pathology (other than malignancy) presenting to general outpatient department and emergency department in lotus hospital erode, will be included in this study.

Relevant history, examination, biochemical and radiological investigation done. Preoperative factors like age, sex, BMI, with or without cholecystitis, emergency or elective procedure, wall thickness, size of gall bladder, number of stones, size of the stones, and associated CBD stone are noted in all patients who underwent laparoscopic cholecystectomy.

Intraoperative factors like difficulty of surgery (as per Cuscheri scale) (Farkas et al., 2012).

Grade 1: Easy or uncomplicated procedure
Grade 2: Medium difficulty either mild cholecystitis; cystic duct or artery obscured by adhesions or fatty tissue; mucocele may be present.
Grade 3: Difficult cholecystectomy either chronic cholecystitis; shrunken fibrotic gallbladder; severe cholecystitis; Hartmann's pouch adherent to the common hepatic duct; or cases in which the cystic duct or artery are difficult to dissect.
Grade 4: Conversion to open procedure is required such as in cases of Mirizzi's syndrome; gangrenous gallbladder; gallbladder or liver densely adherent to the duodenum or transverse colon.

Experience of the also included as an intraoperative risk factor. Instrumental cause of gallbladder perforation included.

Sites of perforation, duration of surgery, and usage of drain are included.
Postoperatively assess the hospitalization days, and any complications noted.

And patient was followed up for 6 months to look for any delayed onset complications.

Results

Analysis of Demographic Variables

Table 1: Distribution of study participants as per the Clinical presentation

Clinical Presentation	Number (n)	Percentage (%)
Acute calculous cholecystitis	24	29.26
Acute acalculous cholecystitis	3	3.66
Chronic acalculous cholecystitis	9	10.98
Cholelithiasis	31	37.80
Cholelithiasis + choledocholithiasis	10	12.20
Symptomatic gall stones	5	6.10
Total	82	100.00

From the above table it is evident that majority of study participants presented with cholelithiasis (38%) as the main clinical presentation followed by acute calculous cholecystitis (16%) as the presentation.

Table 2: Distribution of study participants according to occurrence of Perforation

Occurrence of perforation	Number (n)	Percentage (%)
Yes	18	21.95
No	64	78.05
Total	82	100.00

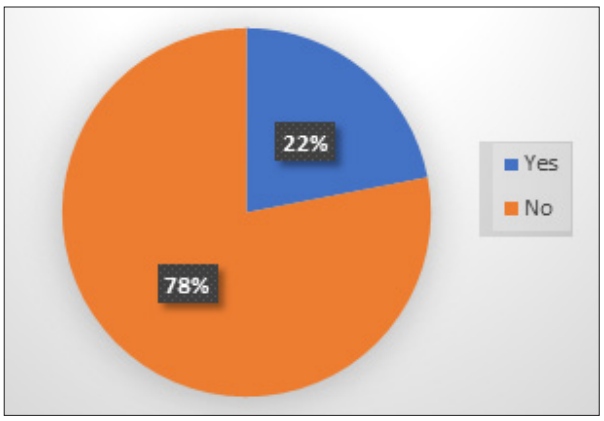

Figure 1: Distribution of study participants according to occurrence of perforation after surgery

From the above table it is evident that the occurrence of perforation in the patients was 18(21.95%) while most patients 64(78.05%) had no occurrence of perforation.

Table 3: Distribution of study participants according to site of perforation

Site of Gall Bladder perforation	Number (n)	Percentage (%)
During adhesion release	4	22.22
Extension from abdominal cavity	1	5.56
Liver bed dissection	6	33.33
Traction of gall bladder	6	33.33
Cystic duct slippage	1	5.56
Traction of gall bladder + Adhesion release	1	5.56
Total	18	100.00

Table 4 : Distribution of study participants according to reason for Gall Bladder Perforation

Reason for Gall Bladder perforation	Number (n)	Percentage (%)
Endo bag tear	1	5.56
Toothed gasper for retraction	7	38.89
Clip slippage	1	5.56
Dense adhesion releasing time	1	5.56
Diathermy lateral spread	4	22.22
Diathermy lateral spread + Dense adhesion releasing time	1	5.56
Sharp instrument	2	11.11
Sharp instrument+ dense adhesion release time	1	5.56
Total	18	100.00

Inferential Statistics

Table 5: Comparison of duration of surgery in participants with perforation and without perforation

Parameter	Group of participants	Mean±SD	Mean difference	T statistics	df	95% CI	P value*
Duration of surgery	With perforation	72.8±22.4	21.4	5.43	80	13.5 to 29.2	<0.001 significant
	Without perforation	51.4±11.8					

Table 6: Association between experience of surgeon and occurrence of perforation among study participants

Experience of surgeon	Perforation		X^2 Df P value
	Yes	No	**0.62** **1** **0.42** **Not significant**
<10 years	12	36	
>= 10 years	6	28	
Total	18(100.00)	64(100.00)	

Table 7: Comparison of duration of hospital stay after surgery among the study participants

Parameter	Group of participants	Mean±SD	Mean difference	T statistics	df	95% CI	P value*
Duration of hospital stay	With perforation	2.67±0.59	0.920	3.584	80	0.4092 to 1.4308	0.0006 significant
	Without perforation	1.75±1.04					

Table 8: Association between drain placement and occurrence of perforation among study participants

Drain placement	Perforation		X^2 Df P value
	Yes	No	24.34 1 0.0000 Significant
Yes	14	11	
No	4	53	
Total	18(100.00)	64(100.00)	

Table 9: Association between size of gall bladder and occurrence of perforation among study participants

Size of gall bladder	Perforation		X^2 Df P value
	Yes	No	6.257 2 0.04 significant
Normal	2	22	
Distended	14	31	
Contracted	1	11	
Total	18(100.00)	64(100.00)	

Discussion

This unicentric prospective observational study was conducted after approval from the institutional ethics committee. The study included 82 patients from the Department of General Surgery at Lotus Hospital, Erode, and focused on "accidental gallbladder perforation during laparoscopic cholecystectomy" from May 2023 to December 2024.

Demographics

In our study, there were 39 male patients and 43 female patients. Accidental gallbladder perforation during laparoscopic cholecystectomy was found to be more common in males than females, with male patients accounting for 72.23% and female patients accounting for 27.77% (male-to-female ratio: 2.5:1). This correlates with Suh et al. (2012) study, which showed a male-to-female ratio of 2.7:1, and (Hui et al., 1999)'s study, which showed a male-to-female ratio of 2:1. The most common age group in our study was 50-60 years (37.80%), followed by 40-50 years (20.73%), >60 years (18.29%), and 30-40 years (14.63%). This correlates with Akmoosh et al. (2019)'s study, which found that gallbladder perforation was most common in patients aged 40-60 years (Akmoosh et al., 2019).

BMI

Patients with gallbladder perforation had a mean BMI of 25.39 ± 3.71, while patients without gallbladder perforation had a mean BMI of 24.84 ± 2.69. The mean difference was 0.545, and the P-value was 0.489, which was statistically insignificant. This correlates with Farkas et al. (2012) study, which found that BMI was not a risk factor for gallbladder perforation.

ASA Grading Association in the Perforated Groups

Our study found that 11 patients were classified as ASA 1, 6 patients as ASA 2, and 1 patient as ASA 3. The P-value was 0.193, indicating no significant association. This finding is consistent with Simone et al. (1999), who reported that BMI is not a preoperative risk factor for gallbladder perforation.

Emergency vs. Elective Laparoscopic Cholecystectomy

Our study included 33 emergency patients and 49 elective patients. Among the emergency patients, 14 experienced accidental gallbladder perforation, whereas 4 elective patients had perforation. The P-value was 0.0001, indicating a significant difference. Assaf et al. (2003) also reported that emergency cholecystectomy is associated with a higher risk of accidental gallbladder perforation.

Diabetes as a Comorbidity. In our study, 24 patients had diabetes, and 7 of these patients experienced perforation. Among the 59 patients without diabetes, 11 had perforation. The P-value was 0.2473, indicating no significant association. However, Luthra et al. (2022) reported that diabetes is an independent risk factor for iatrogenic gallbladder perforation. Other comorbidities with lesser incidence like hypertension in 6 patients, liver cirrhosis in 1 patient, and coronary artery disease in 2 patients. These factors did not affect the risk of iatrogenic gallbladder perforation and its outcome.

Regarding the size of the gallbladder, our study found that 24 patients had normal-sized gallbladders, 45 patients had distended gallbladders, and 12 patients had contracted gallbladders. Among these groups, 2 patients with normal-sized gallbladders, 14 patients with distended gallbladders, and 1 patient with a contracted gallbladder experienced perforation. These findings suggest that distended gallbladders are at higher risk of perforation (P-value = 0.04). This result is consistent with Zubair et al. (2010), who reported that distended gallbladders are a significant factor for intraoperative gallbladder perforation (P-value = 0.0001).

Our study examined the association between gallbladder wall thickness and perforation. We found that 49 patients had thick-walled gallbladders, of which 16 experienced perforations. In contrast, 33 patients had thin-walled gallbladders, of which 2 experienced perforation (P-value = 0.004). These results indicate that thick-walled gallbladders are at higher risk of perforation, likely due to increased inflammation and manipulation during surgery. This finding is supported by Hui et al. (1999), who identified the thickening of the gallbladder as a significant risk factor.

We investigated the relationship between the number of gallstones and gallbladder perforation. Our results showed that 22 patients had single stone disease, of which 4 experienced perforations. In contrast, 60 patients had multiple stones, of which 14 experienced perforation (P-value = 0.861). This result suggests that the number of gallstones is not significantly associated with the incidence of gallbladder perforation. Assaff et al. (2003) reported similar findings, indicating that the number of stones is not a significant risk factor for gallbladder perforation.

Regarding the size of gallstones, we divided the patients into two groups: those with stones less than 1 cm in size and those with stones greater than 1 cm in size. Among the 57 patients with stones less than 1 cm, 14 experienced perforations, whereas among the 25 patients with stones greater than 1 cm, 4 experienced perforations. The P-value was 0.8667, indicating no significant difference.

We assessed the level of difficulty of the surgery using the Cuschieri scale. Among the 52 patients in classes 1-3, perforation occurred in 23 patients. In class 2, 8 out of 23 patients experienced perforation, whereas in class 3, all 7 patients experienced perforation. The P-value was <0.00001, indicating a significant association.

The most common site of perforation was during traction of the gallbladder, particularly during fundal or body retraction with forceps, especially toothed forceps (6 patients). The same rate of incidence was observed during liver bed dissection of the gallbladder (6 patients). Additionally, 4 patients experienced perforation during omental adhesion release, 1 patient during cystic duct clip slippage, and 1 patient during specimen retrieval from the abdominal cavity. Hui et al. (1999) concluded that the most common causes of iatrogenic gallbladder perforation during laparoscopic cholecystectomy are primarily related to surgical techniques, with laceration caused by grasper traction being the most frequent mechanism (Hui et al., 1999). Similarly, Ahmed et al. (2022) identified gallbladder liver bed dissection as the most common site for gallbladder perforation during laparoscopic cholecystectomy, highlighting the need for careful surgical practices in this area (Ahmed et al., 2022).

The most common cause of iatrogenic gallbladder perforation was the use of toothed graspers for retraction (38.8%), followed by electrocautery dissection, especially using monopolar (22.2%), and sharp instrumental causes (11.1%). This finding is consistent with (Hui et al. (1999); Salih (2020)), who reported that the most common causes of gallbladder perforation during laparoscopic cholecystectomy are: (Zinner, 1997) laceration due to grasper traction (55% of cases), and (Johannsen, 1989) electrocautery dissection (40% of cases).

Our study found a significant increase in operative time for patients with gallbladder perforation compared to those without perforation. The mean operative time for patients with perforation was 72.8 ± 22.4 minutes, whereas for patients without perforation, it was 51.4 ± 11.8 minutes (P-value < 0.0001). This finding is consistent with Evans et al. (2022), who reported that iatrogenic gallbladder perforation (IGP) resulted in significantly longer operative times, with a mean difference of 10.28 minutes (95% CI 7.40-13.16, P < 0.00001) compared to cases without perforation.

We observed a significant increase in drain usage in the perforated group compared to the non-perforated group. Among the 18 patients in the perforation group, 14 required drain placements, whereas among the 64 patients in the non-perforation group, only 11 required drain placement (P-value = 0.000). This finding is consistent with Altuntal et al. (2017), who reported that increased drain usage following iatrogenic gallbladder perforation (GP) was observed, with 45.8% of patients in the GP group requiring drains compared to 25% in the non-GP group, indicating a significant difference (P = 0.000) in drain utilization.

Postoperatively, patients in the perforated group had increased hospital admission days compared to the non-perforated group. The mean hospitalization days for patients with perforation were 2.67 ± 0.59 days, whereas for patients without perforation, they were 1.75 ± 1.04 days. The mean difference was 0.920 days (P-value = 0.0006), indicating a significant difference. This finding is consistent with Sams et al. (2022), who reported an increased length of hospital stay, with a mean difference of 0.51 days (95% CI 0.15-0.87, P = 0.005), compared to cases without perforation.

Postoperative complications occurred in only two patients who had gallbladder perforation, while there were no complications postoperatively in patients without intraoperative gallbladder perforation. The proportion of complications was 11.11% among the 18 patients with intraoperative gallbladder perforation. Both patients with postoperative wound-related complications belonged to the perforated group. One patient developed port-site cellulitis, which was clinically manifested after one month of surgery and was treated conservatively with wound care. There was no further recurrent infection. Another patient developed an abdominal lateral parietal wall abscess collection (3 cm × 2 cm), which was treated conservatively with antibiotics and completely resolved. Both patients were followed up, and no recurrent complications were observed until the 6-month follow-up. This finding correlates with the Indian Journal of Forensic Medicine and Toxicology, which summarizes postoperative complications following iatrogenic gallbladder perforation, including increased pyrexia (18% vs. 9%) and a higher risk of intra-abdominal abscesses, with 2.9% of patients experiencing abscesses when both bile and gallstones were spilled (P < 0.001). Additionally, most infective-related complications are manifested after months to years (Sams et al., 2022).

Conclusion

Iatrogenic gallbladder perforation during laparoscopic cholecystectomy is a significant complication that can lead to increased operative time, hospital stay, and postoperative complications.

This study aimed to investigate the incidence, risk factors, and outcomes of iatrogenic gallbladder perforation during laparoscopic cholecystectomy. The results of this study demonstrate that iatrogenic gallbladder perforation occurs in approximately 22% of patients undergoing laparoscopic cholecystectomy.

The most common causes of perforation were found to be the use of toothed graspers for retraction, electrocautery dissection, and sharp instrumental causes. Additionally, the study

identified several risk factors associated with an increased risk of perforation, including distended gallbladders, thick-walled gallbladders, and emergency surgery.

The study also found that patients who experienced iatrogenic gallbladder perforation had significantly longer operative times, hospital stays, and increased drain usage compared to those without perforation. Furthermore, the study reported a higher incidence of postoperative complications, including wound-related complications and intra-abdominal abscesses, in patients with perforation. The findings of this study have important implications for surgeons performing laparoscopic cholecystectomy.

To minimize the risk of iatrogenic gallbladder perforation, surgeons should exercise caution when using toothed graspers for retraction, employ careful electrocautery dissection techniques, and consider the use of alternative instruments. Additionally, surgeons should be aware of the potential risk factors associated with perforation and take steps to mitigate these risks.

In conclusion, this study provides valuable insights into the incidence, risk factors, and outcomes of iatrogenic gallbladder perforation during laparoscopic cholecystectomy. The findings of this study highlight the importance of careful surgical technique and awareness of potential risk factors to minimize the risk of this significant complication.

Limitations

The number of patients in this study was comparatively lower when compared with other study. The time period of my study was also limited. The variations in the study are due to these differences.

Recommendations

Improved Surgical Training

Provide comprehensive training for surgeons on laparoscopic cholecystectomy, including hands-on experience and simulation-based training.

Standardization of Surgical Techniques

Develop and implement standardized surgical techniques for laparoscopic cholecystectomy to reduce the risk of iatrogenic gallbladder perforation.

Use of Advanced Technologies

Consider using advanced technologies, such as robotic-assisted surgery or artificial intelligence-powered surgical systems, to improve visualization and reduce the risk of iatrogenic gallbladder perforation.

Postoperative Care

Develop and implement standardized postoperative care protocols to manage patients who had iatrogenic gallbladder perforation

Quality Improvement Initiatives

Implement quality improvement initiatives, such as regular audits and feedback sessions, to identify areas for improvement and reduce the incidence of iatrogenic gallbladder perforation.

Develop and implement criteria for selecting patients who are suitable for laparoscopic cholecystectomy, taking into account factors such as age, comorbidities, and previous surgical history.

Consider using a risk assessment tool to identify patients who are at high risk of iatrogenic gallbladder perforation.

References

1. Zinner, M. J. (1997). Maingot's Abdominal operation. Laparoscopic surgery, (10th edition). McGraw hill pub.https://www.amazon.in/Maingots-Abdominal-Operations-v-1-2/dp/0838561063
2. Hanely, E. S. (1992). Anesthesia for laparoscopic surgery. *Surg Clin North Am, 72*(5), 1013-9. DOI: https://doi.org/10.1016/s0039-6109(16)45828-7
3. Johannsen, G., Andersen, M., & Juhl, B. (1989). The effect of general anaesthesia on the haemodynamic events during laparoscopy with CO2 insufflation. *Act Anaesthesiol Scand, 33*(2), 132-6. DOI: https://doi.org/10.1111/j.1399-6576.1989.tb02875.x
4. Farkas, D. T., Moradi, D., Moaddel, D., Nagpal, K., & Cosgrove, J. M. (2012). The impact of body mass index on outcomes after laparoscopic cholecystectomy. *Surgical Endoscopy, 26*(4), 964-969. DOI: https://doi.org/10.1007/s00464-011-1978-5
5. Suh, S. W., Park, J. M., Lee, S. E., & Choi, Y. S. (2012). Accidental Gallbladder Perforation During Laparoscopic Cholecystectomy: Does It Have an Effect on the Clinical Outcomes?. *Journal of Laparoendoscopic & Advanced Surgical Techniques, 22*(1), 40-45. DOI: https://doi.org/10.1089/lap.2011.0219
6. Hui, T. T., Giurgiu, D. I., Margulies, D. R., Takagi, S., Iida, A., & Phillips, E. H. (1999). Iatrogenic gallbladder perforation during laparoscopic cholecystectomy: etiology and sequelae. *American Surgeon, 65*(10), 944-948. DOI: https://doi.org/10.1177/000313489906501010
7. Akmoosh, M. A. R., & Kandil, M. (2019). Clinical Outcomes of Gall Bladder Perforation During Laparoscopic Cholecystectomy. *Annals of Tropical Medicine and Public Health, 22*(12), 190-206. DOI: http://doi.org/10.36295/ASRO.2019.221220
8. Simone, P. D., Donadio, R., & Urbano, D. (1999). The risk of gallbladder perforation at laparoscopic cholecystectomy. *Surgical Endoscopy, 13*(11), 1099-1102. DOI: https://doi.org/10.1007/s004649901181
9. Assaff, Y., Matter, I., Sabo, E., Mogilner, J. G., Nash, E., Abrahamson, J., & Eldar, S. (2003). Laparoscopic Cholecystectomy for Acute Cholecystitis and the Consequences of Gallbladder Perforation, Bile Spillage, and "Loss" of Stones. *European Journal of Surgery, 164*(6), 425-431. DOI: https://doi.org/10.1080/11024159875004238

10. Luthra, A., Behura, A., Behera, C. R., Mishra, A., Mohanty, S., & Panda, B. (2022). Intraoperative Findings of Elective Laparoscopic Cholecystectomy in Diabetics Versus Nondiabetics: A Comparative Study. *Cureus, 14*(1). DOI: https://doi.org/10.7759/cureus.20886
11. Zubair, M., Habib, L., Mirza, M. R., Channa, M. A., & Yousuf, M. (2010). Iatrogenic gall bladder perforations in laparoscopic cholecystectomy: an audit of 200 cases. *Mymensingh Medical Journal, 19*(3), 422-426. https://pubmed.ncbi.nlm.nih.gov/20639837/
12. Ahmed, Z., Khan, N. U., Ahmad, J., Saeed, S., Batool, S. F., Sami, A., Zafar, M., & Khawar, A. (2022). Incidence, Risk Factors and Outcome of Gallbladder Perforation during Laparoscopic Cholecystectomy. *Pakistan Journal of Medical and Health Sciences, 16*(12), 798-800. DOI: https://doi.org/10.53350/pjmhs20221612798
13. Salih, T. M. (2020). Complications of Laparoscopic Cholecystectomy in a Sample of Patients Admitted to Al-Ramadi Teaching Hospital, Anbar-Iraq. *Indian Journal of Forensic Medicine & Toxicology, 14*(2), 415–420. DOI: https://doi.org/10.37506/ijfmt.v14i2.2827
14. Evans, L., Hajibandeh, S., Hajibandeh, S., Sams, E., & Naguib, A. (2022). Iatrogenic gallbladder perforation during laparoscopic cholecystectomy and outcomes: a systematic review and meta-analysis. *Langenbeck's Archives of Surgery, 407*(3), 937–946. DOI: https://doi.org/10.1007/s00423-022-02439-2
15. Altuntas, Y. E., Oncel, M., Haksal, M., Kement, M., Gundogdu, E., Aksakal, N., & Gezen, F. C. (2017). Gallbladder perforation during elective laparoscopic cholecystectomy: Incidence, risk factors, and outcomes. *Northern clinics of Istanbul, 5*(1), 47-53. DOI: https://doi.org/10.14744/nci.2017.88155
16. Sams, E., Evans, L., Naguib, A., Hajibandeh, S., & Hajibandeh, S. (2022). SP8.1.4 Iatrogenic gallbladder perforation during laparoscopic cholecystectomy and outcomes: a systematic review and meta-analysis. *British Journal of Surgery, 109*(5). DOI: https://doi.org/10.1093/bjs/znac247.089
17. Hasnain, J. V., & Matjasko, M. J. (1991). Pratical anaesthesia for laparoscopic procedures. In K. A. Zucker (Ed.), Surgical Laparoscopic, (pp. 77-86) St Louis. MO: Quality Medical, https://www.ijsurgery.com/index.php/isj/article/view/915