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Research Article

Treatment of perforation after endoscopic retrograd cholangiopancreatography

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ABSTRACT

Introduction: Endoscopic retrograde cholangiopancreatography (ERCP) is a frequently performed invasive procedure associated with serious complications. While the rate of ERCP-related perforation is approximately 1%, the associated mortality rate can be as high as 8%. These perforations are categorized based on the Stapfer classification. Type I refers to duodenal perforations, Type II to periampullary perforations, Type III to perforations of the biliary system or pancreatic duct, and Type IV to the presence of retroperitoneal free air.

Methods: In our retrospective study, we analyzed patients who were consulted for post-ERCP perforation at our clinic over a five-year period. Treatment decisions were made jointly by the performing gastroenterologist and an experienced hepatobiliary surgeon. Conservative management included nil per os (NPO), close monitoring of laboratory and physical examination findings, and administration of intravenous fluids and antibiotics.

Results: A total of 35 patients were included in the study. The mean follow-up period was 12.7 days. Six patients who were clinically and biochemically unstable underwent surgery; two of these had Type I perforations and four had Type II perforations. Of the 29 patients managed conservatively, 26 were discharged in good health.

Conclusion: The necessity for surgical intervention in patients with post-ERCP perforation is a critical determinant of prognosis. The requirement for surgery and the subsequent high rates of mortality and morbidity in Type I and Type II perforations indicate the need for a more aggressive treatment strategy for these types. Conversely, conservative treatment appears to yield successful outcomes in patients with Type III and Type IV perforations. Therefore, an approach based on the Stapfer classification plays a significant role in the management of these patients.

Keywords: ercp, perforation, stapfer, endoscopy

Introduction

Endoscopic retrograde cholangiopancreatography (ERCP) is a procedure associated with significant complications, including pancreatitis, hemorrhage, cholangitis, and duodenal perforation. The perforation rate is reported to range from 0.095% to 1.676%, with modern data indicating a mortality rate of up to 8%. ERCP perforations are associated with factors such as sphincterotomy, prolonged procedure duration, advanced age, and a history of repeated procedures. It has been

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observed that patients do not follow a uniform clinical course and present with heterogeneous findings. While intraperitoneal perforations are an indication for surgery, the management of retroperitoneal perforations remains a subject of debate (1). Mortality is often linked to delays in diagnosis and treatment (2).

In our study, we analyzed patients who developed post-ERCP perforations and compared their clinical status with findings reported in the literature.

Materials and Methods

In this retrospective study, patients who were consulted at the general surgery clinic of our hospital between 2018 and 2023 for post-ERCP perforation were evaluated. All patients who developed post-ERCP perforation and were consulted by the general surgery department during the study period were included. No patients were excluded due to being followed up in isolation by the gastroenterology department or having incomplete records. The included patients were analyzed for demographic data such as age, gender, and comorbidities, as well as ERCP indications, perforation type (Stapfer classification Types I–IV), time and methods of diagnosis, imaging findings, clinical symptoms, applied treatment algorithms, and clinical outcomes. Data were collected from patient files and the hospital information system using a standardized form. Perforations were classified according to the description by Stapfer et al (3). Type I perforation refers to perforation of the medial or lateral duodenal wall caused by the endoscope; Type II perforations are periampullary perforations associated with sphincterotomy; Type III perforations involve the biliary tree or pancreatic duct; and Type IV perforations refer to retroperitoneal free air. Perforations were mostly detected post-procedurally. Patients who developed abdominal pain after ERCP and were suspected of having a perforation underwent intravenous contrast-enhanced abdominal computed tomography (CT). The diagnosis was established based on clinical and imaging findings. The treatment decision was made through a multidisciplinary approach by the performing gastroenterologist and an experienced hepatobiliary surgeon. The decision algorithm for surgical and conservative treatment is summarized in Table 1.

The treatment decision was made jointly by the performing gastroenterologist and an experienced hepatobiliary surgeon. Conservative management included nil per os (NPO), daily monitoring of laboratory values and physical examination, and administration of intravenous fluids and antibiotics.

The following clinical parameters were examined and recorded using standard forms:

- Time of Diagnosis: Intraoperative, early postoperative (<24 hours), and late (>24 hours)
- Diagnostic Methods: CT, plain radiography, endoscopic findings, clinical examination

Table 1. Decision algorithm for treatment approach

Parameter	Indication for Conservative Treatment	Indication for Surgical Treatment
Clinical Status	Hemodynamic stability, localized pain, no signs of peritonitis	Hemodynamic instability, generalized peritonitis, progression to sepsis
Laboratory	Stable or decreasing inflammatory markers (Leukocyte, CRP)	High and increasing inflammatory markers
Radiology (CT)	Minimal retroperitoneal air/fluid, no contrast extravasation	Widespread pneumoperitoneum, abscess/ collection, contrast extravasation
Perforation Type	Generally Type III and IV, selected Type II cases	Generally Type I, Type II cases unresponsive to conservative treatment

- Perforation Type: Stapfer classification (Type I: duodenal wall rupture; Type II: periampullary perforation; Type III: bile duct perforation; Type IV: retroperitoneal air)
- Imaging Findings: Pneumoretroperitoneum (PnRP), pneumoperitoneum (PnP), fluid collection (SE) on CT
- Clinical Findings: Abdominal pain, signs of peritonitis, fever, leukocytosis
- Treatment Methods: Conservative treatment, endoscopic clip/oversewing, emergency surgical intervention
- Criteria for Treatment Decision: Hemodynamic instability, generalized peritonitis, high inflammatory response

Analysis plan

- Data were analyzed using SPSS v26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (mean, standard deviation, frequency, and percentage) were presented to summarize the data.
- For intergroup comparisons, the Chi-square or Fisher's exact test was used for categorical variables, and the Student's t-test or Mann-Whitney U test was used for continuous variables. A p-value of < 0.05 was considered statistically significant.
- Age, gender, time of diagnosis, perforation type, treatment modality, and outcomes were compared between groups.
- The reasons for conversion to surgery, morbidity and mortality rates, with a particular focus on the high mortality rate in the surgical group (66.6%), were analyzed.

Results

Following a 5-year review, 35 patients, comprising 22 females (62.9%) and 13 males (37.1%), were analyzed for a preliminary diagnosis of post-ERCP perforation. The mean age was 65.97 ± 15.2 years. ERCP was performed for choledocholithiasis in 26 patients, distal common bile duct stenosis in 6, a mass at the head of the pancreas in 2, and hydatid cyst in 1. The mean follow-up period was 12.7 days (Table 2).

CT and clinical features

Patients presented with post-procedural abdominal pain and signs of peritonitis, for which they underwent intravenous contrast-enhanced abdominal imaging within the first 24 hours. Thirteen patients had air, 2 had fluid, and 16 had both air and fluid collections. The tomography scans of 4 patients were negative (Table 2).

Table 2. Demographic, Clinical, and Radiological Characteristics of Patients (n=35)

Feature	Type I (n=7)	Type II (n=19)	Type III (n=4)	Type IV (n=5)	Total (n=35)
Gender (Female/Male)	2/5	15/4	2/2	3/2	22/13
Mean Age (years)	61.4	69.0	56.0	68.8	65.9
ERCP Indication (n)					
Choledocholithiasis	5	14	3	4	26
Distal CBD Stenosis	2	3	1	0	6
Other	0	2	0	1	3
CT Finding (n)					
Air Only	2	7	3	1	13
Fluid Only	0	2	0	0	2
Air + Fluid	5	10	0	1	16
Negative	0	0	1	3	4

Table 3. Treatment Approach and Mortality by Perforation Type

Perforation Type	Conservative Treatment (n=29)	Surgical Treatment (n=6)	Total Mortality Rate (%)
	Number (Mortality)	Number (Mortality)	
Type I (n=7)	5 (1)	2 (1)	28.6
Type II (n=19)	15 (2)	4 (3)	26.3
Type III (n=4)	4 (0)	0 (0)	0
Type IV (n=5)	5 (0)	0 (0)	0

Treatment approach and criteria for conversion to surgery

Six patients (17.1%) who had concordant clinical and imaging findings and developed a systemic inflammatory response underwent surgery. Two of these patients had Type I perforations, and four had Type II perforations. Of the 6 patients who underwent surgical treatment, 4 (66.6%) died in the postoperative period. In the 29 patients for whom a decision for conservative management was made, there were 3 deaths (10.3%) (patients over 80 years of age with at least two comorbidities). The overall success rate in the conservative treatment group was calculated as 89.7%. Treatment outcomes and mortality rates are detailed in Table 3.

Discussion

The requirement for surgery in post-ERCP perforations is a decisive factor for prognosis. The rates of surgical intervention observed in Type I and Type II perforations, along with the accompanying high mortality, demonstrate that these two types require a more aggressive approach in clinical management, which is consistent with the literature. While Type I perforations are generally major duodenal injuries that lead to direct intraperitoneal leakage, Type II cases involve injuries adjacent to the papillary area and present with retroperitoneal air. In our study, a significant portion of Type I and Type II patients required surgical intervention, and the mortality rate in this group was found to be significantly high (3).

In contrast, Type III and IV perforations were observed to have a more limited tissue injury and fewer clinical signs, and thus could be successfully managed with conservative methods. This finding supports the validity of current management algorithms. Particularly, the fact that Type III perforations, being small perforations due to endoscopic sphincterotomy, do not require invasive intervention reinforces the importance of the type classification in the clinical decision-making process.

The literature indicates that Type I perforations are generally associated with full-thickness injury of the duodenal wall and require prompt surgical intervention. In the literature, the rate of surgical decision for Type I perforations appears lower; however, the mortality rate is found to be similar (4). In this study, 2 of the 7 patients who had a Type I perforation underwent surgery, and the mortality rate in this group was 28.5%. Type II perforations involve the periampullary region and are mostly injuries associated with sphincterotomy. In these patients, the indication for surgery increases if the inflammatory response is severe. In our study, 4 of the 19 Type II patients were taken to surgery, and the total mortality of this group was found to be 15.8%. The predominance of Type II perforations as the most common form (54%) in our patient distribution is consistent with the general trend in the literature (5). As this type involves injuries adjacent to the periampullary region, it frequently presents with retroperitoneal air and fluid. Fifteen of our Type II perforation patients were followed in the conservative treatment group, and 14 were

discharged in good health. Our success rate with conservative treatment was 93.3%. According to similar publications, the success rate in patients with Type II perforations was relatively higher (6). In light of these evaluations, the fact that approximately 21% of these patients in our study required surgical intervention shows that conservative treatment can generally be successful in this type, but careful clinical observation is necessary.

In Type I perforations, the rate of surgical requirement is 28.6%, and this group also has the highest mortality rate. This supports the knowledge that this type generally presents with full-thickness duodenal rupture and quickly leads to intraperitoneal contamination. In our study, the prevalence of free air and fluid on CT in this group of patients was significant, and these findings supported the indication for surgery. The literature generally recommends prompt surgery for this group, and our findings confirm this (7).

Type III perforations were seen more rarely (11%), and no patient required surgical intervention. This is due to the fact that these types of perforations are generally small, limited injuries caused by an endoscopic wire or sphincterotomy. The patients were successfully managed conservatively with fluid replacement, antibiotic therapy, and close monitoring (8). In our study as well, the 4 patients with Type III perforation were treated conservatively, and no decision for surgery was made. In this respect, the success rate of conservative treatment in Type III perforations is high and parallels the data in the literature.

Type IV perforations (14%) were also a group that was managed entirely conservatively and had a good prognosis. In these patients, only retroperitoneal air was observed on CT, and there were no significant clinical symptoms or laboratory findings. This shows that Type IV is a form that generally has minimal clinical manifestation and often does not require treatment even if diagnosed. It is primarily attributed to the air administered to maintain lumen patency during the procedure and should not be considered a true perforation (9). The fact that our 5 patients evaluated as Type IV perforation were treated conservatively, did not develop a need for surgery, and had no mortality supports the literature data.

When CT findings are examined, the detection of widespread free air and/or fluid in all cases requiring surgery demonstrates the correlation between imaging and the clinical picture. Furthermore, the average age of patients requiring surgery was found to be higher. This suggests that age may be an indirect determinant of prognosis.

The high mortality rate (66.6%) observed in the surgical treatment group in our study is noteworthy. When the potential factors underlying this situation are examined, it was seen that the patients who went to surgery exhibited more severe clinical findings (widespread peritonitis, sepsis) at the time of diagnosis. In particular, the loss of three of the four patients with Type II perforation for whom a surgical decision was made suggests that the clinical condition at the time the decision for surgery was made was already quite severe and that surgery was performed as a "rescue" procedure. A delay in diagnosis or surgical decision may have led to the depletion of the patient's physiological reserves and a worsening of postoperative outcomes (10). This situation once again highlights the importance of early and aggressive management in patients with suspected perforation (11).

The mean length of hospital stay was found to be significantly longer in patients who underwent surgery (approximately 18.6 days), whereas this period was limited to 6-8 days in conservatively managed patients. This clearly demonstrates the impact of the management method on the use of healthcare resources and patient burden.

Mortality was seen only in the group that underwent surgical intervention and was calculated at a total rate of 8.6%. This rate suggests a poor prognosis that can be associated particularly with late surgery or delayed diagnosis.

CT findings have been an important guide in the clinical decision-making process. The detection of widespread free air and/or intraperitoneal fluid on CT in nearly all patients requiring surgery shows the correlation of imaging findings with clinical severity (12).

Conclusion

Post-ERCP perforation is a rare but serious complication carrying a high risk of morbidity and mortality. Particularly in Type I and II cases requiring surgery, delays in diagnosis and treatment can adversely affect patient prognosis. Therefore, rapid and accurate classification and early decision-making are of vital importance in determining appropriate management for these patients. In Type III and IV cases, successful outcomes are achieved with conservative treatment, making it possible to avoid unnecessary surgical interventions. Consequently, an approach based on the Stapfer classification plays a critical role in patient management.

Ethical approval

The study was approved by İzmir Katip Çelebi University Health Research Ethics Committee (date: 09.10.2025, number: 0597).

Author contribution

The authors confirm contribution to the paper as follows: Study conception and design: MY, FC, OND; data collection: KY, AA, SG; analysis and interpretation of results: MY, ÖG; draft manuscript preparation: MY, FC. All authors reviewed the results and approved the final version of the manuscript.

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Conflict of interest

The authors declare that there is no conflict of interest.

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