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Clinical Approaches and Outcomes in Localized Gallbladder Perforation: A Comprehensive Review

Shazia Rizvi (Junior resident)[1], **Vijay V. Kanase (**Professor)[1] **and Vallepu Prashanth (**Senior resident)[2]
[1]Department of General Surgery, Krishna Institute Medical Sciences, KVV, Karad, Maharashtra, India.
Corresponding author: Shazia Rizvi (Junior resident)
Department of General Surgery, Krishna Institute Medical Sciences, KVV, Karad, Maharashtra, India.

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ABSTRACT:
Background: The ideal approach to handling localized gallbladder perforation, specifically Neimeier type II cases, remains uncertain [1], [2]. This systematic review was conducted with the objective of pinpointing factors linked to enhanced patient outcomes. **Methods:** Included in this systematic review were studies that detailed the management of Neimeier type II perforation, reported complications following the initial intervention, the need for additional interventions, resolution of the pathology, and the duration of hospitalization [3], [4]. **Results:** A total of 120 patients, with 52% beingmale, were included in the analysis. These patients were sourced from case reports, series, and cohorts. Among them, 54 (46%) underwent open cholecystectomy, while 46 (36%) underwent laparoscopic cholecystectomy. The overall risk of bias in the studies analyzed was determined to be moderate. Notably, the need for additional interventions was more frequent in the laparoscopic group (17 cases) compared to the open surgery group (5 cases), a statistically significant difference ($p < 0.001$). Similarly, the prevalence of complications was higher in the laparoscopic group (16 cases) in contrast to the open surgery group (4 cases), also demonstrating a significant difference ($p < 0.001$). **Conclusion:** Open cholecystectomy showed a reduced requirement for subsequent surgical interventions and experienced fewer postoperative complications compared to laparoscopic cholecystectomy. However, it was associated with an extended hospitalization period [5]. Notably, these outcomes remained consistent regardless of preoperative percutaneous drainage. Furthermore, the timing of cholecystectomy did not exert a significant influence on these outcomes.

I. INTRODUCTION

Spontaneous gallbladder perforation occurs in a range of 2-10% of patients diagnosed with acute cholecystitis. This condition is typically associated with various comorbidities such as diabetes, hypertension, severe atherosclerotic heart disease, and other chronic systemic illnesses. The fundusof the gallbladder is the most common site of perforation due to its inadequate vascular supply, which worsens with increased distension seen in unresolved cholecystitis [6]. This condition can manifest in patients with typical biliary pain, presenting with a spectrum of symptoms from gen- eral abdominal discomfort to acute widespread peritonitis. It's particularly important to consider in patients exhibiting fever, rapid clinical deterioration, leukocytosis, or alterationsin liver enzymes. The initial description of this pathology dates back to Niemeier in 1934, who categorized gallbladder perforation (GBP) into three primary types. Type I involves a chronic perforation characterized by a fistulous connection between the gall bladder and a neighboring organ. Type II represents a subacute perforation encased in an abscess, sequestered by adhesions, potentially extending into the liver. Type III encompasses generalized biliary peritonitis, result- ing from uncontained spillage of bile into the peritoneal cav-ity without protective adhesions. This classification provides a foundational framework for understanding and managing different manifestations of gallbladder perforation [7].Swift and accurate diagnosis, followed by prompt treatment, are pivotal in mitigating patient morbidity and mortality

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asso- ciated with gallbladder perforation. Emergency surgery is imperative for cases of generalized biliary peritonitis (type III). On the other hand, cholecystoenteric fistulae (type I) may be addressed through urgent or scheduled surgery based on the symptomatic condition of the patient. However, there remains a state of equipoise regarding the management of localized perforation (type II). The medical community en- gages in ongoing debates concerning conservative versus invasive approaches for type II perforations. Specifically, discussions encompass the optimal timing (early vs. interval cholecystectomy), the initial procedure (surgical intervention vs. drainage), and the technique employed for cholecys- tectomy (laparoscopic vs. open). These pivotal aspects of management for type II gallbladder perforation are yet to be definitively outlined. The objective of this systematic review is to compile evidence pertaining to the management of type II GBP, with a particular focus on the first intervention, timing, and surgical approach.

II. METHODS

This review encompassed studies that fulfilled the subsequent criteria: (1) observational studies, including cohorts and case reports, that examined drainage or surgical intervention as the initial treatment for Neimeier type II gallbladder perforation;

(2) provided information on complications (unwanted effects arising from the procedure) of the primary intervention, the need for subsequent interventions, resolution of the proce- dure, and the duration of hospitalization; (3) presented the data in the English language.The process of selecting studies was meticulously carried out in two phases, and each phase included a pilot study to ensure that the agreement between three independent reviewers was of high reliability, indicated by a Cohen's kappa coefficient exceeding 0.7. If this level of agreement was not initially achieved, an additional pilot study was conducted after addressing and resolving disagree-ments among the reviewers to attain the desired kappa level. Prior to commencing the screening of titles and abstracts, duplicates were removed, and a pilot study involving the screening of titles and abstracts from 20 randomly selected studies was conducted to achieve a kappa level above 0.78, [9]. Subsequently, the remaining studies were assessed for eligibility. Following the title and abstract screening phase, another pilot study was performed to assess kappa agreement during the full-text screening. Once the desired level of agreement was attained (after two pilot phases), the review- ers proceeded with the full-text screening. Throughout each screening phase, any discrepancies or disagreements between reviewers were resolved through consensus. In cases where consensus could not be reached, an independent reviewer was consulted for further discussion and resolution [10]. This rigorous process was implemented to ensure the robustness and reliability of the study selection.Studies that met the established eligibility criteria were selected for qualitative analysis. Patients from cohort studies and case series/reports, which recorded the outcomes of interest, were categorized into four groups for comparison: open cholecystectomy vs. laparoscopic cholecystectomy, with or without preoperative percutaneous drainage. To compare the proportions of pre- specified post-intervention outcomes, a chi-square test was conducted. This statistical analysis was employed to as-sess the significance of any differences observed among the groups in terms of these specific outcomes.

III. RESULTS

In the assessment of retrospective observational cohort stud-ies, all of them were placed in the category of having an overall moderate risk of bias [11], [12]. A critical risk of bias was identified in the domain of confounding factors. However, they demonstrated a low risk of bias in domains re- lated to deviations from intended interventions, missing data, and the measurement of outcomes (as detailed in Supplement Table 1). For the case reports included in the systematic review and subsequent statistical analyses, they all exhibited a sufficient level of quality for publication [13], [14]. Among these reports, eleven were deemed as "a valuable contribution to the literature," while eight were approached with some caution, advising readers to be mindful of their validity and clinical significance. There was one case series that was classified as "insufficient quality for publication" due to a high risk of bias and consequently was excluded from the statistical analyses.The results obtained from cohort studies and case series/reports reveal significant differences when comparing open cholecystectomy (with or without percuta- neous drainage) to laparoscopic cholecystectomy (with or without percutaneous

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drainage). Specifically, the open chole- cystectomy group exhibited lower proportions of patients requiring another intervention (5 cases) in contrast to the laparoscopic cholecystectomy group (17 cases), with a highly significant difference ($p < 0.001$) [15]. Similarly, the open cholecystectomy group experienced fewer complications (4 cases) compared to the laparoscopic cholecystectomy group (16 cases), again with a highly significant difference ($p < 0.001$).Furthermore, the open cholecystectomy group had a higher proportion of patients who successfully resolved the gallbladder perforation without the need for additional intervention or hospitalization following their initial inter- vention. This was observed in 100% of patients in the open cholecystectomy group compared to 93% in the laparoscopic cholecystectomy group, with a statistically significant differ-ence ($p = 0.048$).

IV. DISCUSSION

This systematic review has compiled findings on the treat- ment of individuals diagnosed with localized GBP (Niemeier type II). The analysis revealed that open cholecystectomy exhibits a reduced requirement for subsequent surgical inter- ventions and post-operative complications when compared to the laparoscopic approach. When considering the inclu- sion of preoperative percutaneous drainage, no statistically significant differences were observed [17], [18].In order to select the most suitable surgical approach, the surgeon needsto assess the pros and cons of various treatment options for each individual patient. Recent research and clinical guidelines predominantly advocate for minimally invasive surgical techniques, a trend that has persisted over the past decade. When considering overall outcomes, open chole- cystectomy appears to outperform laparoscopic procedures in terms of the necessity for additional surgeries and post- operative complications. Nevertheless, patients undergoing minimally invasive surgery generally experience shorter in- hospital stays [19].Nonetheless, when conducting laparo-scopic cholecystectomy, it is imperative for the surgeon to achieve a critical view of Calot's safety triangle. Failureto do so should prompt the surgeon to consider converting to an open cholecystectomy or opting for a subtotal chole- cystectomy. It's worth noting that the evaluation of open cholecystectomy with a mini-incision or subcostal muscle trans-section has not been explored in the context of GBP (presumably gallbladder pathology).Significant differences in terms of complications and the necessity for additional interventions were not observed between the early and de- layed cholecystectomy groups. However, it's important to note that the optimal timing for these procedures couldn't be comprehensively evaluated in this review. This limitationarose from a lack of detailed information in the majority of the studies, and most

TABLE 1: Outcome characteristics of open cholecystectomy vslaparoscopic cholecystectomy in patients from cohort and casereport/series studies

SurgicalApproach	N	Need of AnotherIntervention	p-value	Cx	p-value	Resolved the perforation	p-value
OpenChol	54	5	<0.001*	4	<0.001*	56	0.048*
LapChol	46	17		16		41	
OpenChol	48	2	0.001*	2	<0.001*	38	0.168
PCD+OpenChol	28	3		2		18	
LapChol	38	16		16		35	
PCD+LapChol	6	1		0		6	
Total(%)	100	22(22)		20(20)		97(97)	

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corresponding authors were unable to provide additional data. Similarly, there was a lack of data regarding pre-operative versus perioperative diagnosis. In all cases, the surgeon's primary consideration was patient safety. Notably, percutaneous drainage did not exhibit statistically significant differences between the open and laparoscopic approaches regarding the number of interventions or com- plications. However, it did result in an increase in the median number of hospitalization days, rising from 4.5 days (with a range of 2 to 12 days) in the laparoscopic group to 7 days (with a range of 7 to 30 days). Nonetheless, in order to conduct a comprehensive meta-analysis and establish a more robust evidence base for best practices, additional studies are required to evaluate the role of laparoscopy and percutaneous drainage (PCD). Furthermore, the authors strongly recom- mend that future publications incorporate essential details such as the preoperative diagnosis, the specific indications for each procedure performed, the time intervals between interventions, and in-depth information regarding complica- tions and their respective management strategies [20]. These additions will contribute to a more thorough understanding of these medical interventions and their outcomes.

V. CONCLUSION

Initiating treatment with an open cholecystectomy in cases of localized gallbladder perforation has demonstrated advan- tages such as reduced requirements for subsequent surgi- cal interventions and decreased postoperative complications. However, it is associated with a longer hospital stay. Interest- ingly, no statistically significant differences were observed in various other outcome measures when comparing open versus laparoscopic cholecystectomy, early versus delayed cholecystectomy, or the utilization of preoperative percuta- neous drainage.

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CONFLICTS OF INTEREST

The authors declared no conflict of interest.

AUTHORS' CONTRIBUTIONS

All authors equally contributed to preparing this article.

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