



# THE THAI JOURNAL OF SURGERY

Official Publication of The Royal College of Surgeons of Thailand

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# The THAI Journal of SURGERY

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The Thai Journal of Surgery is the official publication of The Royal College of Surgeons of Thailand and is issued quarterly.

The Thai Journal of Surgery invites concise original articles in clinical and experimental surgery, surgical education, surgical history, surgical techniques, and devices, as well as review articles in surgery and related fields. Papers in basic science and translational medicine related to surgery are also welcome.

### Aim & Scope

The Thai Journal of Surgery is dedicated to serving the needs of the members of The Royal College of Surgeons of Thailand, specifically the younger researchers and surgical trainees who wish to have an outlet for their research endeavors. The Royal College strives to encourage and help develop Thai Surgeons to become competent researchers in all their chosen fields. With an international outlook, The Thai Journal of Surgery welcomes submissions from outside of Thailand as well.

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- o Osler AG. *Complement: mechanisms and functions*. Englewood Cliffs: Prentice - Hall, 1976.

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- o Chirappapha P, Arunnart M, Lertsithichai P, et al. Evaluation the effect of preserving intercostobrachial nerve in axillary dissection for breast cancer patient. Gland Surg 2019;8:599-608. doi:10.21037/gs.2019.10.06.

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Use the common format. Emphasis is on clinician comprehension. The **Abstract** uses the same common structured format. In the **Main text**, the **Introduction**, in addition to the usual context setting and rationale, should also contain explanations and descriptions of basic science concepts at the level of the educated layman. The **Methods** section should still be concise with sufficient detail for others to replicate the experiment, but one or two paragraphs in between explaining basic processes in plain English would be helpful. In the **Results** section, similar conciseness is still the rule, but a brief simplified summary of the findings should be provided. In the **Discussion**, clinical implications should be clearly stated. The **Conclusion**, again, should answer the research question.

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We encourage publication of case series or case reports if a comprehensive review of the literature is included, with the aim of helping the clinician manage rare and challenging diseases or conditions based on best available evidence in conjunction with practical, local experience. For the Thai Journal of Surgery, this implies that the case report format differs somewhat from that of the common format for research articles.

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*Editorial*

**Kusuma Chinaronchai, MD, FRCST, FACS**

*Editor of The Thai Journal of Surgery*

Dear Colleagues and Readers,

It is with great pleasure that I welcome you to the first issue of 2026, marking the beginning of Volume 47 of the Thai Journal of Surgery. As we step into another year of academic excellence, this issue reflects the dynamic and evolving nature of surgical practice in Thailand, spanning high-volume single-center experiences to the complex management of rare pathologies.

*The Editorial Board would also like to inform all readers that, starting with this issue, The Thai Journal of Surgery will be published exclusively online, with the print edition discontinued.* This transition is intended to enhance accessibility, broaden dissemination, and align the journal with contemporary academic publishing standards.

This issue presents five original articles reflecting diverse areas of surgical practice. We begin with a real-world retrospective study **comparing five-year oncological outcomes of locally advanced rectal cancer patients treated with and without radiotherapy**. This is followed by **a case series on rectal foreign bodies**, providing practical insights into emergency management. **A retrospective review of open-heart surgery in Buriram Hospital** highlights the expansion of regional

cardiac surgical services in Thailand. We also report **a large single-surgeon experience of 2,790 elective groin hernia repairs under local anesthesia**, demonstrating safety and efficiency in high-volume practice. Finally, **a time-based analysis of appendicitis rupture risk** emphasizes the importance of timely diagnosis in acute care.

This issue also includes two rare and clinically challenging case reports, **colonic hypoganglionosis in an adult and vascular pythiosis with intra-abdominal arterial involvement**, emphasizing the importance of clinical vigilance and multidisciplinary management.

Finally, we feature **a comprehensive narrative review on the current surgical management of complicated left-sided colonic diverticulitis**, offering updated guidance to support clinical decision-making in these complex cases.

I would like to extend my sincere gratitude to all the authors for their valuable contributions and to our reviewers for their dedication to maintaining the scientific integrity of this journal. We hope this issue provides you with actionable knowledge and inspiration for your daily practice.

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Original Article

## Comparison of 5-Year Oncological Outcomes of Locally Advanced Rectal Cancer Patients Treated with Radiotherapy versus Without Radiotherapy: A Real-World Single-Center Retrospective Study

**Mookda Nivaarrarsuwonnakul, MD**

Division of Surgery, Trang Hospital, Trang, Thailand

### Abstract

**Background and Objective:** Most oncologists treat rectal cancer following NCCN guidelines. Chemoradiotherapy (RT) is preferred for patients with suspected or proven T3-4 disease and/or regional node involvement. RT may result in tumor shrinking, reduce risk of local recurrence in the pelvis, and has been standard of care in North America for locally advanced rectal cancer. Because access to radiation is limited in Thailand, half of the patients deny being referred to radiation centers due to long waiting times and expenses. A transabdominal resection without radiotherapy (RT) was inevitable, but it observed favorable results. This study aimed to compare the long-term oncological outcomes of locally advanced rectal cancer patients who received RT with those who did not receive RT.

**Materials and Methods:** This retrospective study reviewed data of patients with clinical stage T3-4 rectal cancer who underwent curative resection, received RT, and those without RT from 1 January 2014 to 31 December 2019 in Trang Hospital. The survival and disease status of patients were updated as of 31 July 2024.

**Results:** Of 54 rectal cancer patients who underwent curative transabdominal resection (mean age  $61.57 \pm 10.8$  years, male 51.9%), 26 patients (48.1%) received RT, and 28 patients (51.9%) did not receive RT. The median follow-up time was 68.5 months (range, 5-113 months). There was no statistical difference between the RT group and the no RT group in 5-year disease-free survival (72.1% vs. 88.5%;  $P = 0.320$ ) and 5-year overall survival rates (68.8% vs. 82.1%;  $P = 0.242$ ). The 5-year local recurrence rate was higher in the RT group, but there was no statistically significant difference (21.7% vs. 4.0%;  $P = 0.147$ ).

**Conclusion:** In rectal cancer patients who were eligible for curative transabdominal resection, receiving or not receiving RT offered comparable long-term oncological outcomes. Omitting RT is an option when radiotherapy is unavailable.

**Keywords:** Rectal cancer, Omission of radiotherapy, Long-term outcome

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## INTRODUCTION

Colorectal cancer is the third most frequently diagnosed cancer in Thailand<sup>1</sup> and globally,<sup>2</sup> with rectal cancer accounting for approximately 31% of cases. 5-10% of rectal cancer patients present with locally advanced disease at the time of diagnosis.<sup>2</sup> The treatment of locally advanced rectal cancer (LARC) is challenging, requiring multimodality approaches and varying across countries. Most oncologists in Thailand treat rectal cancer by following the guidelines of the National Comprehensive Cancer Network (NCCN). Neoadjuvant chemoradiotherapy (CRT) is preferred for patients with suspected or proven T3-4 disease and/or regional node involvement and has been the standard of care in North America for LARC.<sup>3,4</sup> The use of RT or Short-course preoperative radiotherapy (SCPRT) aims to result in tumor shrinking, downstaging, and reducing the risk of local recurrence (LR) in the pelvis.<sup>3-5</sup>

On the other hand, in Scandinavian countries, these patients underwent surgery without any neoadjuvant therapy.<sup>6</sup> Consistent with some paraphrase in the European Society for Medical Oncology (ESMO) guideline, it is stated that standard total mesorectal excision (TME) should achieve a curative resection, and downsizing is not necessary if the surgeon routinely carries out good-quality TME and removes the mesorectal nodes en bloc.<sup>7</sup> The introduction of the TME technique is the most important in the surgical management of rectal cancer. The TME led to a significant reduction in local recurrence rates and a significant improvement in survival outcomes of rectal cancer patients.<sup>8,9</sup>

In Thailand, where access to radiotherapy is limited, approximately half of the patients in the study region declined referral to a radiation center because of several individual reasons, including the desire to stay in their local area, concerns about family separation, financial issues related to travel and living expenses in another province, and long waiting times at the radiation center, etc. For these patients, performing a transabdominal resection with the TME technique without the standard treatment of RT was an inevitable issue. However, favorable outcomes were observed in real-world clinical practice; however, there was no report of the long-term oncological outcomes of LARC patients who omit RT in real-world situations. This study aimed to compare the long-term oncological outcomes of locally advanced rectal cancer patients who received RT with those who did not receive RT.

## MATERIALS AND METHODS

This retrospective study reviewed the data of patients with clinical stage T3-4 rectal cancer at Trang Hospital from January 1, 2014, to December 31, 2019. The inclusion criteria were patients who underwent curative resection at Trang Hospital. Tumor histology was confirmed through preoperative endoscopic biopsies. The patients underwent preoperative staging with contrast-enhanced CT imaging. The rectal MRI was not conducted due to limited resources and financial issues. The exclusion criteria were patients who underwent palliative resection (stage IV disease), emergency surgery, rectosigmoid lesion, malignant lesions arising on a polyp, and those denied surgery.

The patients were divided into two groups: those treated with RT and those without RT. The decision to exclude radiation therapy from the standard treatment protocol was purely dependent on the individual patient's reasons since the beginning of the treatment planning. The patients who accepted to undergo treatment with RT were referred to receive RT at Songklanagarind University Hospital and were subsequently referred back for surgery at Trang Hospital. The patients who denied RT undergo standard total mesorectal excision (TME) at Trang Hospital. The postoperative adjuvant chemotherapy (FOLFOX4) was recommended for all patients who denied RT. However, the decision to receive chemotherapy was based on the patient's own decision.

The characteristic, pathological, and oncological data were retrieved for analysis. The survival and disease status of the patients were followed up until July 31, 2024. The follow-up period was defined as the time, in months, from the date of surgery to the last healthcare interaction or time of death. The long-term outcomes were 5-year disease-free survival (DFS), 5-year overall survival (OS), and local recurrence rate (LR). DFS was defined as survival free from disease recurrence or death from any cause. OS was defined as survival free from death from any cause. LRs were identified based on their location in the pelvis, regardless of the mode of detection.

The data were summarized as counts, frequencies (%), and means  $\pm$  standard deviations (SD). The population characteristics were compared using the chi-square test, Fisher's exact test, or t-test, as appropriate. The outcomes of both groups were evaluated using the chi-square and Fisher's exact test for categorical variables and the t-test for continuous variables. Survival was analyzed

using the Kaplan-Meier method and compared with the log-rank test. The Cox proportional-hazards model was used to calculate hazard ratios (HR) and 95% confidence intervals (CI). Statistical significance was attributed to a  $p$ -value  $< 0.05$ . The statistical software SPSS v.26.0 (IBM, New York, USA) was used for statistical analyses. Institutional Review Board approval was obtained for this study.

## RESULTS

From 1 January 2014 to 31 December 2019, A total of 121 patients underwent rectal cancer surgery at Trang Hospital during this period. Of the 54 eligible clinical T3-T4 rectal cancer patients who underwent curative transabdominal resection were included in the final analysis. The mean age of all patients was  $61.57 \pm 10.8$  years. There were 26 patients (48.1%) who received RT and 28 patients (51.9%) underwent surgery without re-

ceiving RT. 18 patients (64.3%) of the without RT group received post-operative FOLFOX regimen as adjuvant chemotherapy. Most of the tumors were located at 5-10 cm from the anal verge (70.4%). 51.9% of patients were male, and no statistically significant difference between genders. The received RT group had better prognostic factors than the non-received RT group, as younger age, smaller tumor size, lower T stage, but tumor location closer to the anal verge, as shown in Table 1. Most of the histological tumor type was well-differentiated adenocarcinoma, which was found in 44 of all 54 patients (81.5%). The other surgical and pathological outcomes are in Table 2.

The overall median follow-up time for the entire study was 68.5 months (range, 5-113 months). The mean follow-up period was  $66.9 \pm 26.2$  months. There was no statistical difference in LR and distant metastasis between the groups, as shown in Table 3.

**Table 1** Characteristics of rectal cancer patients

Characteristic	Receive RT Group (N = 26)	Not receive RT Group (N = 28)	$p$ -value
<b>Age: years, Mean <math>\pm</math> SD</b>	58.42 $\pm$ 10.8	64.5 $\pm$ 10.2	0.038
<b>Gender: n (%)</b>			0.586
Male	12 (46.2)	16 (57.1)	
Female	14 (53.8)	12 (42.9)	
<b>Tumor distance from anal verge; cm</b>			
Mean $\pm$ SD	5.32 $\pm$ 2.5	8.14 $\pm$ 2.3	$< 0.000$
<b>Rectal tumor location, n (%)</b>			0.040
$< 5$ cm from the anal verge	8 (30.8)	2 (7.1)	
5-10 cm from the anal verge	17 (65.4)	21 (75.0)	
$> 10$ cm from the anal verge	1 (3.8)	5 (17.9)	
<b>Clinical T category, n (%)</b>			0.024
T3	22 (84.6)	18 (64.3)	
T4	4 (15.4)	10 (35.7)	
<b>Diameter of tumor: cm, Mean <math>\pm</math> SD</b>	3.6 $\pm$ 2.7	5.3 $\pm$ 1.8	0.008

**Table 2** Surgical and pathological outcomes

Characteristic	Receive RT group (N= 26)	Not receive RT group (N=28)	p-value
<b>Type of surgery, n (%)</b>			0.02
Abdominal perineal resection	6 (23.1)	1 (3.6)	
Low anterior resection	18 (69.2)	17 (60.7)	
Laparoscopic low anterior resection	2 (7.7)	7 (25.0)	
High anterior resection	0	3 (10.7)	
<b>Tumor Histological Type, n (%)</b>			1.000
Well differentiated	22 (84.6)	22 (78.6)	
Moderately differentiated	4 (15.4)	5 (17.9)	
Mucinous carcinoma	0	1 (3.6)	
<b>Pathological T category, n (%)</b>			0.045
pT0	3 (11.5)	0	
pT1	2 (7.7)	0	
pT2	5 (19.2)	4 (14.3)	
pT3	13 (50.0)	14 (50.0)	
pT4	3 (11.5)	10 (35.7)	
<b>Pathological Ncategory, n (%)</b>			0.243
N0	16 (61.5)	17 (60.7)	
N1	6 (23.1)	10 (35.7)	
N2	4 (15.4)	1 (3.6)	
<b>Lymphovascular invasion, n (%)</b>			0.298
Yes	3 (11.5)	7 (25.0)	
No	23 (88.5)	21 (75.0)	
<b>Circumferential Resection Margin positive, n (%)</b>	0	0	

**Table 3** Oncological outcomes of patients

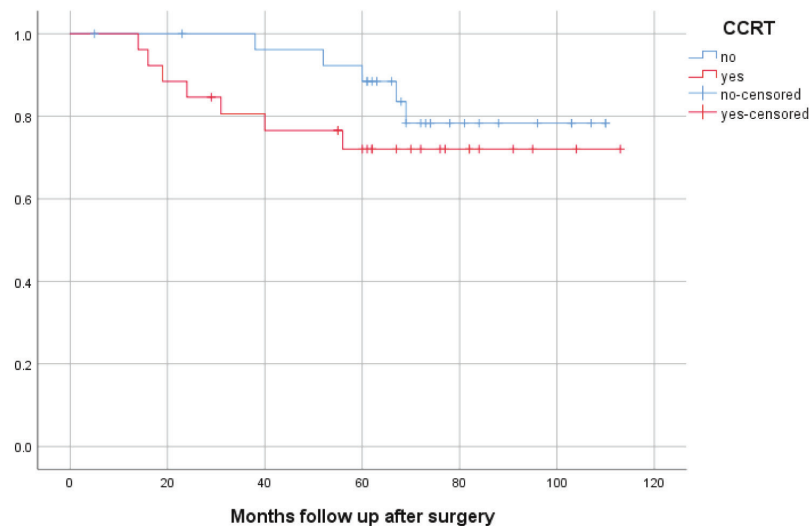
Characteristic	Receive RT group (N = 26)	Not receive RT group (N = 28)	p-value
<b>Location of Recurrence, n (%)</b>			0.246
Liver	1 (4.0)	0	
Lung	0	2 (7.7)	
Lung and liver	1	0	
<b>Local recurrence</b>	5 (19.2)	2 (7.1)	0.243
Lung and local recurrence	3 (12.0)	0	
Liver and local recurrence	1 (4.0)	1 (3.8)	
<b>Follow-up, months</b>			0.138
Mean ± SD	61.4 ± 27.3	72.0 ± 24.5	

For long-term oncological outcomes, the 5-year disease-free survival (DFS) rate was 72.1% (95% CI, 0.545-0.897) in the RT group and 88.5% (95% CI, 0.761-1.000) in the group without RT. Although there was no statistically significant difference in 5-year DFS between the two groups ( $P = 0.320$ ), the HR of 1.78 (95% CI, 0.563-5.617) indicates a numerically higher risk of disease recurrence in the RT group.

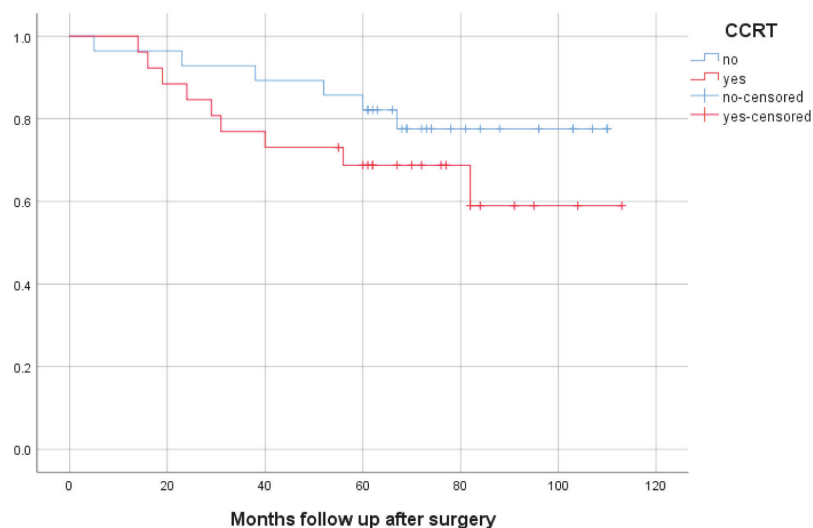
The 5-year overall survival (OS) rate was 68.8% (95% CI, 0.508-0.868) in the RT group and 82.1% (95% CI, 0.680-0.962) in the group without RT. There was no statistically significant difference in 5-year OS rates between the two groups ( $P = 0.242$ ). The HR for death in

the RT group, compared with the group without RT, was 1.84 (95% CI, 0.653-5.169). There was no statistically significant difference in mortality rates between the two groups.

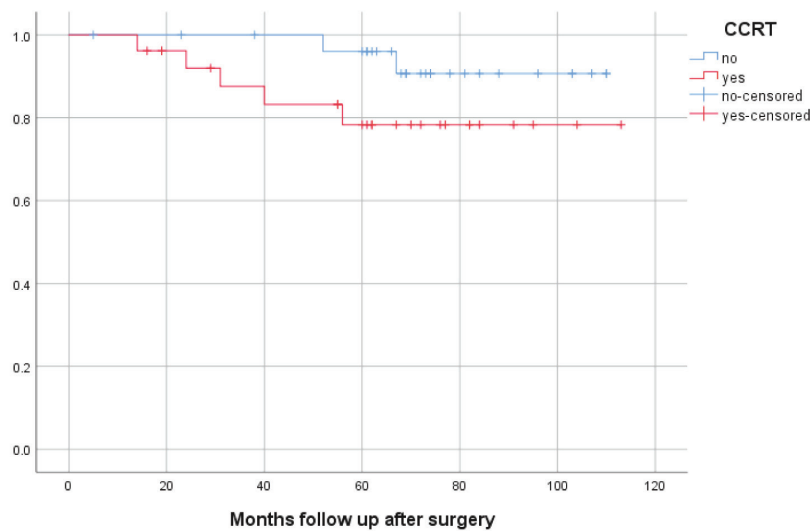
The 5-year local recurrence (LR) rate was 21.7% (95% CI, 0.047-0.387) in the RT group and 4.0% (95% CI, 0.000-0.116) in the without RT group. This difference was not statistically significant ( $P = 0.147$ ). Although there was a numerically higher risk of local recurrence in the RT group, the HR was 3.16 (95% CI, 0.612-16.329), indicating no statistically significant difference in risk between the two groups. All survival curves are demonstrated in Figures 1, 2, and 3.



**Figure 1** Kaplan-Meier curves show disease-free survival; differences between the RT group and the without RT group were assessed with the log-rank test ( $p = 0.320$ ).



**Figure 2** Kaplan-Meier curves show overall survival; differences between the RT group and the without RT group were assessed with the log-rank test ( $p = 0.242$ ).



**Figure 3** Kaplan-Meier curves show freedom from local recurrence; differences between the RT group and the without RT group were assessed with the log-rank test ( $p = 0.147$ ).

## DISCUSSION

The management of LARC in high-volume hospitals in Thailand, particularly for T3-4 disease and/or regional node involvement, has been standardized by guidelines such as those from the National Comprehensive Cancer Network (NCCN), which advocate for neoadjuvant chemoradiotherapy (nCRT) followed by curative resection.<sup>3</sup> This approach aims to achieve tumor downstaging, reduce local recurrence, and improve overall oncological outcomes.<sup>3,5</sup>

However, the optimal sequencing and necessity of each component, especially RT, are increasingly being re-evaluated globally, often driven by the desire to mitigate treatment-related morbidities and improve patient quality of life.<sup>7,10</sup> The effect of RT can damage the bowel, bone, sexual function, and fertility. This is associated with short-term and long-term toxic effects.<sup>11-14</sup> The omission of RT could improve patients' quality of life by reducing the temporary ostomy and side effects of RT, including the preservation of fertility, sexual function, bowel function, bone marrow resilience, and more.

Another important reason for investigating the outcome of skipping RT is the issue of healthcare access disparities. The global applicability of these guidelines is often challenged by real-world constraints, especially in this resource-limited study setting. And mainly in Thailand, where accessing comprehensive cancer care, particularly specialized treatments such as RT, is a significant challenge.<sup>15,16</sup>

This retrospective analysis reveals no statistically significant differences in the 5-year disease-free survival (DFS) and the 5-year overall survival (OS) between the two groups. The 5-year DFS was 72.1% in the RT group and 88.5% in the group without RT ( $P = 0.320$ ), and the 5-year OS rates were 68.8% in the RT group and 82.1% in the group without RT ( $P = 0.242$ ). The HR for death in the RT group, compared with the group without RT, was 1.84 (95% CI, 0.653-5.169). This result indicates a numerically higher risk of disease recurrence in the RT group but no statistically significant difference in risk between the groups.

The results of this study are inconsistent with evidence from old randomized controlled trials, which demonstrated a clear benefit of preoperative chemoradiotherapy in reducing local recurrence.<sup>5,17</sup>

However, these findings are consistent with a recent study from Helsinki, which suggests that the omission of neoadjuvant short-course radiotherapy before surgery does not compromise the 5-year oncological outcome compared to no radiotherapy.<sup>6</sup> Moreover, an updated result of the Chinese FOWARC study after a median follow-up of 10 years found no significant difference in long-term survival outcomes between the LARC with RT and without RT groups.<sup>18</sup>

The 5-year DFS of patients without RT at Trang Hospital was higher than that reported in previous chemoradiotherapy treatments (DFS of 73.9-78.6%),<sup>4,19,20</sup> and the 5-year OS of patients without RT at Trang Hospital was in

the range of previous reports (OS of 75-90.2%).<sup>4,19,20</sup> Upon Kaplan-Meier survival analysis, omitting RT did not have a statistically significant effect on patient survival.

The major benefit of pelvic radiation therapy that has been shown is a decrease in the risk of pelvic recurrence.<sup>3,5</sup> The RAPIDO randomized trial used short-course RT, followed by neoadjuvant chemotherapy before surgery, compared with long-course CRT before surgery. This resulted in a reduction in disease-related treatment failure and metastasis. However, it is associated with an increased risk of LR (12% vs 8%) after 5 years.<sup>21</sup>

Peeters et al. found increased local control in irradiated patients, but no detectable improvement in overall survival. In their study, the 5-year LR risk of patients undergoing a complete local resection was 5.6% in the case of preoperative radiotherapy compared with 10.9% in patients undergoing TME alone ( $P < 0.001$ ). The 5-year OS rates were 64.2% and 63.5%, respectively ( $P = 0.902$ ).<sup>22</sup> Surprisingly, in contrast, the 5-year OS (82.1%) and LR (4.0%) in the group without RT of this study appear more favorable compared to the RT group of the previous literature (1.6% - 10%).<sup>4,9,19,21,22</sup>

The 5-year LR was numerically higher in the RT group (21.7%) compared to the group without RT (4.0%) in this study, although there was no statistical difference ( $P = 0.147$ ); the HR was 3.16 (95% CI, 0.612-16.329); however, there was no statistically significant difference in risk of LR between groups. This could be attributed to several limitations, such as the small sample size, which increases the likelihood of random variation; unmeasured confounders, where patients with a higher inherent local recurrence risk may prefer RT; long waiting times to surgery<sup>20</sup>; or adherence to protocols in a real-world setting. The tumor location being "closer to the anal verge" in the RT group is known as an adverse prognostic factor for local recurrence and sphincter preservation, which could have driven the decision for RT and contributed to the numerically higher LR despite treatment. The low recurrence rate and high OS in this study may be due to the predominance of well-differentiated adenocarcinoma (81.5% overall). This pathologic finding suggests a favorable tumor biology in this cohort, which might be less dependent on intensive multimodal therapy. Furthermore, this study showed acceptable surgical oncological clearance demonstrated by all negative circumferential resection margins (CRM) (Table 2), although it enrolled patients with high-risk tumors (T4) and limited MRI

staging, which are typically excluded from other trials.<sup>4-6</sup>

Additionally, the group without RT, where 64.3% received post-operative FOLFOX adjuvant chemotherapy, might have benefited from effective systemic therapy. This aggressive adjuvant chemotherapy could have compensated for the lack of RT, especially in a subset of patients with favorable tumor biology. This finding has recently been explored through the introduction of total neoadjuvant therapy (TNT), a novel approach for management in LARC.<sup>23,24</sup> The patients with locally advanced rectal cancer with tumors that respond to chemotherapy may safely omit radiation therapy before surgery, based on the findings of the PROSPECT trial and the study by Schrag et al. concluded that in locally advanced rectal cancer patients who were candidates for sphincter-sparing surgery, omission of the RT was noninferior to the current North American standard of neoadjuvant pelvic RT with similar outcomes in DFS and OS.<sup>4</sup>

While this study did not find a statistically significant difference in long-term oncological outcomes between the RT and without-RT groups, it's essential to interpret these findings in the context of the study's several limitations. The primary reason for the lack of statistical significance is likely due to low statistical power. The relatively small sample size may have prevented the detection of an actual difference between the groups, even if one exists in the larger population. This limitation is also reflected in the wide confidence intervals for the Hazard Ratios in this study. This broad range highlights a high degree of uncertainty surrounding our point estimate, indicating that the actual effect could be anywhere from protective to significantly harmful.

Another critical limitation to consider is selection bias, which is inherent in a retrospective study design. Patients who received RT and those who did not were not randomly assigned; instead, they were selected based on the patient's own decision in real-world situations. For example, patients who did not receive RT may have had less severe disease, a preference for upfront surgery, or limited access to radiotherapy due to geographic or financial constraints. This study did not conduct in-depth research to understand the rationale behind each patient's treatment decision. The unmeasured baseline differences could significantly influence the observed outcomes, confounding variables such as adjuvant chemotherapy or comorbidities, making a direct comparison between the groups challenging in real practice. It's crucial for future

research to address these limitations through larger, prospective studies or randomized controlled trials to provide a definitive answer on the role of RT in this patient cohort.

The accuracy of T staging was based on CT imaging alone, without a gold standard MRI, due to limited resources. Without an MRI, the accuracy of preoperative assessment of the CRM has always been a concern in real practice. The CRM is the surgical plane of the Total Mesorectal Excision (TME), and its involvement by the tumor is the most critical predictor of local failure. CT scans lack the soft-tissue resolution to visualize this fascial plane reliably. This diagnostic limitation may lead to a higher probability of incomplete surgical resection (an R1 resection) and, consequently, a higher incidence of local recurrence within the pelvis. However, this study demonstrated the surgical technique of R0 resection in all patients, without the need for MRI assessment.

Furthermore, being a single-center study, the generalizability of our findings to other institutions or broader patient populations with different healthcare systems, socioeconomic contexts, or treatment protocols is limited.

Despite these limitations, the study's findings provide valuable insights into the long-term oncological outcomes of LARC patients whose treatment decisions were influenced by these real-world practical limitations. They suggest that for some patients, perhaps those with more favorable biology, acceptable long-term oncological outcomes may still be achieved even in the absence of RT.

### CONCLUSION

In locally advanced rectal cancer patients eligible for curative transabdominal resection, omitting RT may not compromise long-term oncological outcomes. This study found comparable long-term oncological outcomes between patients who received RT and those who did not. These findings suggest that RT omission could be a viable consideration, particularly in clinical settings with limited access to radiotherapy.

### CONFLICTS OF INTEREST

The author declares that there is no conflict of interest.

### REFERENCES

1. Lohsiriwat V, Chaisomboon N, Pattana-Arun J. Current colorectal cancer in Thailand. *Ann Coloproctol.* 2020;36(2):78-82. doi: 10.3393/ac.2020.01.07.
2. Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2021;71(3):209-49. doi: 10.3322/caac.21660.
3. Benson AB, Venook AP, Al-Hawary MM, et al. Rectal Cancer, Version 2.2022, NCCN Clinical Practice Guidelines in Oncology. *J Natl Compr Canc Netw.* 2022;20(10):1139-67. doi: 10.6004/jnccn.2022.0051.
4. Schrag D, Shi Q, Weiser MR, et al. Preoperative Treatment of Locally Advanced Rectal Cancer. *N Engl J Med.* 2023;389(4):322-34. doi: 10.1056/NEJMoa2303269.
5. Sauer R, Becker H, Hohenberger W, et al. Preoperative versus postoperative chemoradiotherapy for rectal cancer. *N Engl J Med.* 2004;351(17):1731-40. doi: 10.1056/NEJMoa040694.
6. Marjasuo S, Koskenvuo L, Lepistö A. Comparison of oncological outcomes of T1-3 N1 rectal cancer patients treated with neoadjuvant radiotherapy versus no radiotherapy: A retrospective cohort study. *Scand J Surg.* 2025;114(2):202-9. doi: 10.1177/14574969251319201.
7. Glynne-Jones R, Wyrwicz L, Tiret E, et al. Rectal cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Ann Oncol.* 2017;28(suppl\_4):iv22-iv40. doi: 10.1093/annonc/mdx224.
8. Hill GL, Rafique M. Extrafascial excision of the rectum for rectal cancer. *Br J Surg.* 1998;85(6):809-12. doi: 10.1046/j.1365-2168.1998.00735.x.
9. Ross A, Rusnak C, Weinerman B, et al. Recurrence and survival after surgical management of rectal cancer. *Am J Surg.* 1999;177(5):392-5. doi: 10.1016/s0002-9610(99)00080-x.
10. García-Aguilar J, Patil S, Gollub MJ, et al. Organ preservation in patients with rectal adenocarcinoma treated with total neoadjuvant therapy. *J Clin Oncol.* 2022;40(23):2546-56. doi: 10.1200/JCO.22.00032.
11. Downing A, Glaser AW, Finan PJ, et al. Functional outcomes and health-related quality of life after curative treatment for rectal cancer: a population-level study in England. *Int J Radiat Oncol Biol Phys.* 2019;103(5):1132-42. doi: 10.1016/j.ijrobp.2018.12.005.
12. Baxter NN, Habermann EB, Tepper JE, et al. Risk of pelvic fractures in older women following pelvic irradiation. *JAMA.* 2005;294(20):2587-93. doi: 10.1001/jama.294.20.2587.
13. Joye I, Haustermans K. Early and late toxicity of radiotherapy for rectal cancer. *Recent Results Cancer Res.* 2014;203:189-201. doi: 10.1007/978-3-319-08060-4\_13.
14. Bruheim K, Tveit KM, Skovlund E, et al. Sexual function in females after radiotherapy for rectal cancer. *Acta Oncol.* 2010;49(6):826-32. doi: 10.3109/0284186X.2010.486411.
15. All.Can International. Cancer anywhere in Thailand [Internet]. c2025. [cited 2025 July 20] Available from: <https://www.all-can.org/efficiency-hub/cancer-anywhere-in-thailand/>.

16. Rittitit A, Promthet S, Suwanrungruang K, et al. Factors associated with time intervals for diagnosis of colorectal cancer: a hospital based study in Khon Kaen, Thailand. *Asian Pac J Cancer Prev*. 2020;21(6):1835-40. doi: 10.31557/APJCP.2020.21.6.1835.
17. Medical Research Council Rectal Cancer Working Party. Randomised trial of surgery alone versus radiotherapy followed by surgery for potentially operable locally advanced rectal cancer. *Lancet*. 1996;348(9042):1605-10.
18. Zhang J, Chi P, Shi L, et al. Neoadjuvant modified infusional fluorouracil, leucovorin, and oxaliplatin with or without radiation versus fluorouracil plus radiation for locally advanced rectal cancer: updated results of the FOWARC study after a median follow-up of 10 years. *J Clin Oncol*. 2025;43(6):633-40. doi: 10.1200/JCO-24-01676.
19. Wahba JF, Knight G, Husein M, et al. Preoperative Chemoradiotherapy for Locally Advanced Rectal Cancer: A Retrospective Analysis. *Cureus*. 2025;17(3):e81427. doi: 10.7759/cureus.81427.
20. Deidda S, Elmore U, Rosati R, et al. Association of delayed surgery with oncologic long-term outcomes in patients with locally advanced rectal cancer not responding to preoperative chemoradiation. *JAMA Surg*. 2021;156(12):1141-9. doi: 10.1001/jamasurg.2021.4566.
21. Dijkstra EA, Nilsson PJ, Hospers GAP, et al. Locoregional failure during and after short-course radiotherapy followed by chemotherapy and surgery compared with long-course chemoradiotherapy and surgery: a 5-year follow-up of the RAPIDO trial. *Ann Surg*. 2023;278(4):e766-e772. doi: 10.1097/SLA.0000000000005799.
22. Peeters KC, Marijnen CA, Nagtegaal ID, et al. The TME trial after a median follow-up of 6 years: increased local control but no survival benefit in irradiated patients with resectable rectal carcinoma. *Ann Surg*. 2007;246(5):693-701. doi: 10.1097/01.sla.0000257358.56863.ce.
23. Schrag D, Weiser MR, Goodman KA, et al. Neoadjuvant chemotherapy without routine use of radiation therapy for patients with locally advanced rectal cancer: a pilot trial. *J Clin Oncol*. 2014;32(6):513-8. doi: 10.1200/JCO.2013.51.7904.
24. Liu S, Jiang T, Xiao L, et al. Total Neoadjuvant Therapy (TNT) versus standard neoadjuvant chemoradiotherapy for locally advanced rectal cancer: a systematic review and meta-analysis. *Oncologist*. 2021;26(9):e1555-e1566. doi: 10.1002/onco.13824.

## Foreign Body in the Rectum: A Case Series of 20 Patients (2021–2025)

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### Abstract

**Background:** Rectal foreign bodies are uncommon presentations in surgical practice but have seen a steady rise due to changing social and sexual behaviors. Prompt diagnosis and proper management are essential to avoid serious complications.

**Objective:** To analyze clinical presentations, types of foreign bodies, management strategies, and outcomes in 20 patients treated for rectal foreign bodies between 2021 and 2025.

**Materials and Methods:** A retrospective analysis of 20 cases presenting to a tertiary care hospital was conducted. Clinical data, including demographics, type and cause of foreign body insertion, management approach, and outcomes, were recorded.

**Results:** The majority were males (90%) with a mean age of 36.5 years. Most insertions were self-induced for sexual gratification. Objects included bottles (30%), vegetables (25%), sex toys (20%), and metallic tools (10%). Manual removal under anesthesia was successful in 75% of cases, while 25% required surgical intervention. No mortality was recorded, but 10% had mucosal injuries.

**Conclusion:** Early recognition, non-judgmental patient handling, and an algorithmic approach help ensure safe extraction and avoid complications.

**Keywords:** Rectal foreign body, Emergency surgery, Sexual gratification, Colorectal injury, Case series

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### INTRODUCTION

Rectal foreign bodies are increasingly reported due to evolving sexual practices and psychological disorders. While many patients present early, others delay seeking care due to embarrassment, increasing the risk of complications such as perforation, bleeding, and sepsis. This case series aims to highlight the nature of these presentations and effective management strategies.

### MATERIALS AND METHODS

A retrospective observational study was conducted at K.D. Medical College, Mathura, Uttar Pradesh, India, from January 2021 to March 2025. Twenty patients who presented with rectal foreign body insertion were included. Demographics, presenting symptoms, imaging findings, type of object, removal method, and outcomes were reviewed.

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### Inclusion Criteria

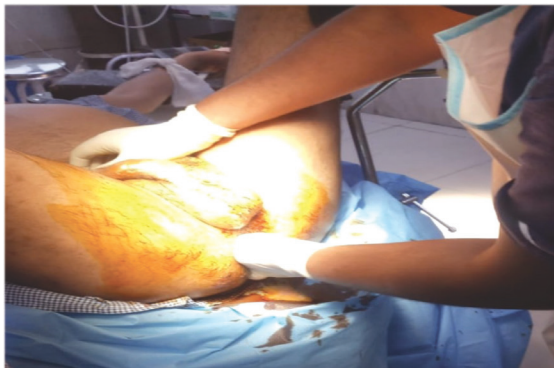
- Adults ( $\geq 18$  years) with confirmed rectal foreign body
- Time of presentation within 72 hours of insertion

### Exclusion Criteria

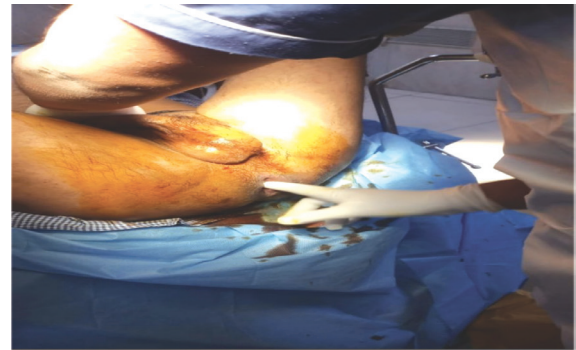
- Foreign body ingestion without rectal involvement
- Pediatric population

### Clinical Images

The following images illustrate one of the cases from our series, where a glass bottle was inserted rectally and retrieved under anesthesia in the operating room. The images highlight the clinical approach and successful extraction.



**Figure 1** Initial per-rectal examination under anesthesia with visible anal dilation



**Figure 2** Localization of the foreign body prior to removal



**Figure 3** Successful extraction of a glass bottle

### Master chart of 20 patients

**Table 1** The demographic, clinical, and management details of the 20 patients included in the case series

Patient No.	Age/Sex	Object Type	Reason for Insertion	Presenting Symptoms	Management	Outcome
1	34/M	Glass bottle	Sexual gratification	Pain, bleeding	Manual removal	Colostomy
2	41/M	Cucumber	Sexual gratification	Pain	Manual removal	Recovered
3	29/M	Sex toy	Sexual gratification	Distension	Surgical removal	Recovered
4	22/F	Wooden stick	Assault	Pain, bleeding	Manual removal	Recovered
5	38/M	Screwdriver	Psychiatric	Pain	Surgical removal	Recovered
6	45/M	Bottle	Sexual gratification	Pain	Manual removal	Recovered
7	33/M	Carrot	Sexual gratification	Pain, bleeding	Manual removal	Recovered
8	27/M	Glass bottle	Sexual gratification	Distension	Surgical removal	Recovered
9	36/M	Plastic toy	Sexual gratification	Pain	Manual removal	Recovered
10	50/M	Iron rod	Accidental	Bleeding	Surgical removal	Recovered
11	31/F	Vibrator	Sexual gratification	Pain	Manual removal	Recovered
12	28/M	Cucumber	Sexual gratification	Pain	Manual removal	Recovered
13	44/M	Glass bottle	Sexual gratification	Distension	Surgical removal	Colostomy
14	39/M	Wooden rod	Psychiatric	Pain	Manual removal	Recovered
15	24/M	Bottle	Sexual gratification	Pain, bleeding	Manual removal	Recovered
16	48/M	Sex toy	Sexual gratification	Distension	Surgical removal	Recovered
17	52/M	Glass bottle	Sexual gratification	Bleeding	Manual removal	Recovered
18	26/M	Vegetable	Sexual gratification	Pain	Manual removal	Recovered
19	40/M	Glass bottle	Sexual gratification	Distension	Surgical removal	Recovered
20	37/M	Toy car	Psychiatric	Pain	Manual removal	Recovered

## RESULTS

### Demographics

- Males: 18 (90%)
- Females: 2 (10%)
- Age Range: 21-58 years
- Mean Age: 36.5 years

### Reasons for insertion

- Sexual gratification (15, 75%)
- Psychiatric (3, 15%)
- Assault (1, 5%)
- Accidental (1, 5%)

**Table 2** Types of foreign bodies

Object Type	Number of Patients	Percentage
Glass bottles	6	30
Vegetables (e.g., cucumber, carrot)	5	25
Sex toys	4	20
Metal objects (tools)	2	10
Wooden items	2	10
Others (plastic)	1	5

### Presenting Complaints

- Rectal pain: 18 patients (90%)
- Bleeding per rectum: 6 patients (30%)
- Abdominal pain/distension: 4 patients (20%)

### Management

- Manual removal (13, 65%),
- Surgical removal (7, 35%),
- Other (2 colostomies post-surgery)

### Manual removal techniques under spinal/general anesthesia

Manual removal techniques employed in our series included:

**Manual suprapubic pressure** combined with **transanal one-hand extraction** to stabilize and guide the foreign body.

In selected cases, a **Foley catheter** was inserted beyond the foreign body, the balloon inflated, and gentle traction applied to facilitate removal.

**The pneumatic balloon suction technique** was also utilized in some cases. Here, inflation proximal to

the foreign body created a vacuum effect that prevented upward migration into the sigmoid colon during traction.

These techniques were particularly beneficial in avoiding laparotomy and reducing complications.

### Complications

- Rectal mucosal injury: 2 patients (10%)
- Perforation requiring colostomy: 2 patients (10%)
- Post-operative infection: 1 patient (5%)

### Hospital Stay

- Median duration: 3.5 days
- Longest stay: 10 days (post-laparotomy)

## DISCUSSION

The majority of patients with rectal foreign bodies are men and typically insert them for erotic purposes. Delayed presentation is common due to shame and fear of stigma, which complicates treatment. Glass bottles and organic items, such as vegetables, were the most common objects, similar to global trends.

Radiographic imaging (X-ray, CT) was useful in planning removal strategies. While most objects were successfully retrieved transanally, impaction or risk of perforation necessitated laparotomy in 25% of cases.

The strength of this case series lies in its being one of the few Indian experiences documenting rectal foreign body management in a structured manner. The weaknesses include its retrospective design, relatively small sample size, and single-center setting, which may limit generalizability.

Patient counseling and psychiatric evaluation were advised in cases of repeated behavior. The importance of maintaining a non-judgmental approach was emphasized to build trust and ensure timely intervention.

Several previous studies have highlighted similar strategies and challenges. Cologne and Ault emphasized evolving standards in the management of rectal foreign bodies.<sup>1</sup> Goldberg and Steele noted the predominance of sexual practices as an etiology and discussed operative versus nonoperative strategies.<sup>2</sup> Kurer et al. provided a systematic review of clinical outcomes and complications.<sup>3</sup> Lake et al. described predictors for surgical intervention,<sup>4</sup> while Coskun et al. and Ayantunde et al. reinforced the role of imaging and careful manual techniques.<sup>5,6</sup> Historical perspectives were given by Barone et al.,<sup>7</sup> and Rodríguez-Hermosa et al. presented a comparable 20-case series.<sup>8</sup> More recent literature, including

Kokemohr et al.<sup>9</sup> and Ploner et al.,<sup>10</sup> supports structured approaches and meta-analytical evidence to optimize outcomes.

### CONCLUSION

Rectal foreign bodies are challenging yet increasingly common surgical emergencies. A structured management protocol that combines clinical assessment, imaging, and appropriate surgical judgment is key to achieving good outcomes. Non-judgmental care and awareness can reduce the risk of complications and promote earlier presentation.

This retrospective case series was conducted in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments. Approval for the study was obtained from the Institutional Ethics Committee of K.D. Medical College, Mathura, Uttar Pradesh, India.

Informed consent for participation and publication was obtained from all individual patients included in the study. Patient identity has been anonymized to ensure privacy.

### REFERENCES

1. Cologne KG, Ault GT. Rectal foreign bodies: what is the current standard? *Clin Colon Rectal Surg.* 2012;25(4):214-8. doi: 10.1055/s-0032-1329392.
2. Goldberg JE, Steele SR. Rectal foreign bodies. *Surg Clin North Am.* 2010;90(1):173-84. doi: 10.1016/j.suc.2009.10.004.
3. Kurer MA, Davey C, Khan S, et al. Colorectal foreign bodies: a systematic review. *Colorectal Dis.* 2010;12(9):851-61. doi: 10.1111/j.1463-1318.2009.02109.x.
4. Lake JP, Essani R, Petrone P, et al. Management of retained colorectal foreign bodies: predictors of operative intervention. *Dis Colon Rectum.* 2004;47(10):1694-8. doi: 10.1007/s10350-004-0676-4.
5. Coskun A, Erkan N, Yakan S, et al. Management of rectal foreign bodies. *World J Emerg Surg.* 2013;8(1):11. doi: 10.1186/1749-7922-8-11.
6. Ayantunde AA, Unluer Z. Increasing trend in retained rectal foreign bodies. *World J Gastrointest Surg.* 2016;8(10):679-84. doi: 10.4240/wjgs.v8.i10.679.
7. Barone JE, Yee J, Nealon TF Jr. Management of foreign bodies and trauma of the rectum. *Surg Gynecol Obstet.* 1983;156(4):453-7.
8. Rodríguez-Hermosa JI, Codina-Cazador A, Ruiz B, et al. Management of foreign bodies in the rectum. *Colorectal Dis.* 2007;9(6):543-8. doi: 10.1111/j.1463-1318.2006.01184.x.
9. Kokemohr P, Haeder L, Frömling FJ, et al. Surgical management of rectal foreign bodies: a 10-year single-center experience. *Innov Surg Sci.* 2017;2(2):89-95. doi: 10.1515/iss-2017-0021.
10. Ploner M, Gardetto A, Ploner F, et al. Foreign rectal body - Systematic review and meta-analysis. *Acta Gastroenterol Belg.* 2020;83(1):61-5.

# Retrospective Review on Open-Heart Surgery in Buriram Hospital Starting Now and Moving Forward to the Future

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## Abstract

**Background:** According to the First National Adult Cardiac Surgical Database Report, open-heart surgery from 2006-2008 included 16,017 patient records, with an in-hospital mortality rate of 6.7% and a 30-day mortality rate of 7.4%, compared to a worldwide 30-day mortality rate of 4.6%. For Buriram Hospital, the first open-heart surgery was performed on 31 May 2022.

**Objective:** This study conducted a retrospective review of patients undergoing open-heart surgery at Buriram Hospital to evaluate outcomes, morbidities, mortalities, and major postoperative complications, with the goal of improving surgical techniques, enhancing quality of life, and reducing mortality, morbidity, and hospitalization rates.

**Materials and Methods:** Retrospective reviews from 31 May 2022 to 31 December 2024 at the Division of Cardiothoracic Surgery, Department of Surgery, Buriram Hospital, focusing on patients who underwent open-heart surgeries, consisted of 164 patients.

**Results:** Of these, 131 were elective surgeries, 20 were urgent surgeries, and 13 were emergency surgeries. In total, 158 patients underwent heart-lung machine surgery with an average duration of  $154.49 \pm 63.24$  minutes. The average aortic cross-clamp time was  $104.64 \pm 47.33$  minutes. The average hospitalization duration was  $15.85 \pm 9.08$  days. The survival rate of postoperative patients was 96.11%. (156 survivors) with a mortality rate of 4.89% (8 deaths). In the patient group, the mean risk of death after heart surgery (EUROSCOREII) was  $4.27 \pm 7.66\%$ .

**Conclusions:** The results of open-heart surgery at Buriram Hospital were satisfactory compared to global and national results. Factors affecting hospitalization duration of patients were health status and the urgency of patients' conditions before surgery. The findings were empirical data to improve the efficiency of care for patients undergoing open-heart surgery at Buriram Hospital.

**Keywords:** Open-heart surgery, Buriram Hospital, Morbidities, Mortalities

## INTRODUCTION

The first closed-heart surgery in Thailand was performed by Professor Smarn Muntarbhorn at Chulalongkorn Hospital in November 1953. The first open-heart surgery in Thailand, using cardiopulmonary bypass, was performed on 28 October 1959.<sup>1</sup> Open-heart surgery had been performed in Thailand for more than 60 years.

At Buriram Hospital, the first open-heart surgery was performed on 31 May 2022 on a 78-year-old female patient, diagnosed with coronary artery disease. She had underlying conditions of hypertension, type II diabetes mellitus, and dyslipidemia. The patient underwent coronary artery bypass grafting (CABG).

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According to the First National Adult Cardiac Surgical Database Report, open-heart surgery from 2006 to 2008 included 21 hospitals and 16,017 patient records. The mean age for combined CABG with valve surgery was 65, 63 for isolated CABG, and 49 for isolated valve surgery. The mortality rate for combined CABG with valve, CABG with other surgery, and CABG with valve and other was higher than for either isolated CABG or isolated valve, with in-hospital mortality of 6.7% and 30-day mortality of 7.4%.<sup>2</sup>

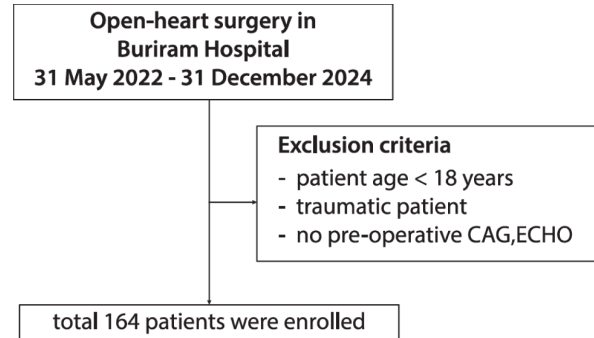
According to the EuroSCORE II global mortality rate, 30-day mortality among consecutive patients undergoing major cardiac surgery in 154 hospitals across 43 countries over a 12-week period (May–July 2010) was 4.6%.<sup>3</sup>

This retrospective review presented data on the characteristics of open-heart surgery in Buriram Hospital, outcomes, morbidities, mortalities, and other major post-operative complications.

**MATERIALS AND METHODS**

This retrospective review, conducted from 31 May 2022 to 31 December 2024 at the Division of Cardiotho-

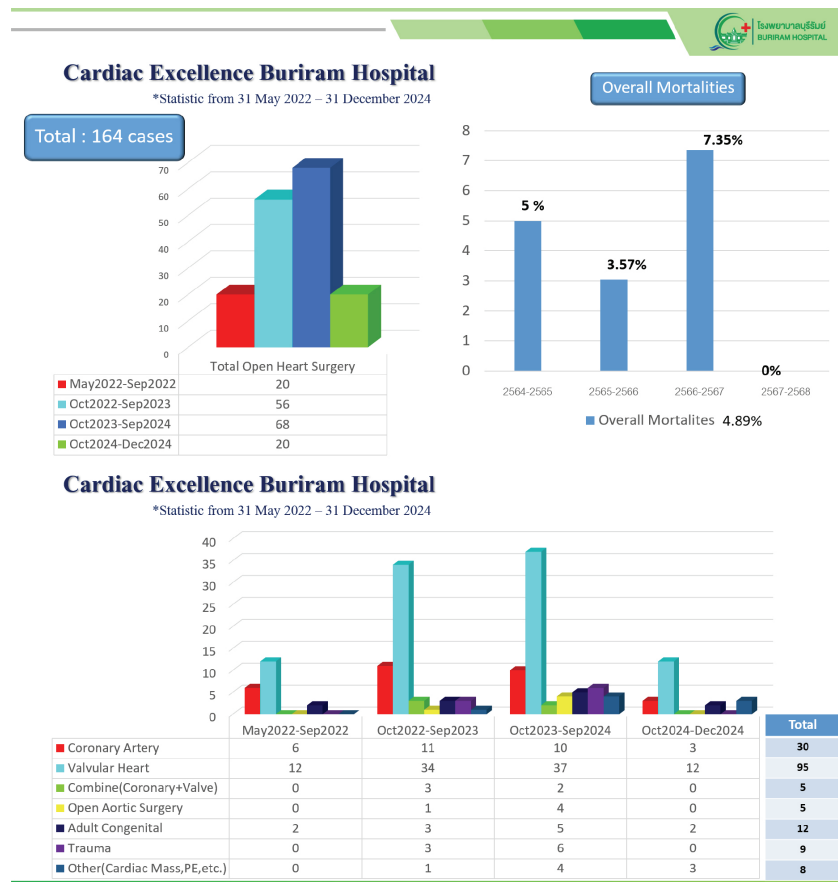
racic Surgery, Department of Surgery, Buriram Hospital, focused on patients who underwent open-heart surgeries (Figure 1).



**Figure 1** Study design

Following the selection of samples in accordance with the study criteria, the final sample comprised 164 patients: 30 CABG, 95 valvular surgery, 5 both CABG and valvular surgery, 5 aortic surgery, 8 other surgeries, 12 congenital, and 9 trauma conditions (Figure 2).

The study design was approved by the Human Research Ethics Office, Buriram Hospital.



**Figure 2** Data on open-heart surgery and mortalities

## RESULTS

The majority of patients were male (male = 96, female = 68) with an average age of  $52.98 \pm 15.30$  years (male =  $52.20 \pm 15.37$  years), (female =  $54.10 \pm 15.25$  years). Body mass index was  $22.58 \pm 4.49$  kg/m<sup>2</sup>, (male =  $21.88 \pm 3.85$  kg/m<sup>2</sup>), (female =  $23.57 \pm 5.12$  kg/m<sup>2</sup>).

Underlying conditions included diabetes mellitus in 50 patients (male = 24, female = 26), hypertension in 100 patients (male = 54, female = 46), dyslipidemia in 92 patients (male = 48, female = 44), and chronic kidney disease in 29 patients (male = 16, female = 13) (Table 1).

**Table 1** Demographics data

Demographics Data	Total	Male	Female
Sex	164	96	68
Age (years)*	$52.98 \pm 15.30$	$52.20 \pm 15.37$	$54.10 \pm 15.25$
Body mass index (kg/m <sup>2</sup> )*	$22.58 \pm 4.49$	$21.88 \pm 3.85$	$23.57 \pm 5.12$
Diabetes	50	24	26
Hypertension	100	54	46
Dyslipidemia	92	48	44
Chronic kidney disease (stage III+)	29	16	13

\*Data are presented as mean  $\pm$  S.D.

Of the 164 surgeries, 131 were elective, 20 were urgent, and 13 were emergency. Most patients have New York Heart Association (NYHA) Classification class II (NYHA class I in 10, NYHA class II = 108, NYHA class III = 29, NYHA class IV = 17) with left ventricular ejection fraction (LVEF) at  $57.41 \pm 12.37\%$  (male =  $55.28 \pm 12.56\%$ ), (female =  $60.43 \pm 11.53\%$ ). In total, 158 patients underwent heart-lung machine surgery with an average

duration of  $154.49 \pm 63.24$  minutes. The average aortic cross-clamp time was  $104.64 \pm 47.33$  minutes. The type of cardioplegia was blood cardioplegia in 63, crystalloid Custodiol® in 45, and modified Del Nido in 48. In the patient group, the mean risk of death after heart surgery according to EUROSCOREII was  $4.27 \pm 7.66\%$  (Table 2).

**Table 2** Perioperative data

**Total sample size = 164 (Elective n = 131, Urgent n = 20, Emergency n = 13)**

Perioperative Data	Total
<b>NYHA</b>	
Class I	10
Class II	108
Class III	29
Class IV	17
<b>Ejection fraction (%)*</b>	$57.41 \pm 12.37\%$ (male = $55.28 \pm 12.56\%$ , female = $60.43 \pm 11.53\%$ )
<b>Bypass time (mins) (n = 158)*</b>	$154.49 \pm 63.24$
<b>Cross clamp time (mins) (n = 156)*</b>	$104.64 \pm 47.33$
<b>Type of cardioplegia (n = 156)</b>	
Blood	63
Crystalloid Custodiol®	45
Modified Del Nido	48
<b>Euroscore II*</b>	$4.27 \pm 7.66\%$

NYHA = New York Heart Association functional classification for heart failure

\*Data are presented as mean  $\pm$  S.D.

The average hospitalization duration was  $15.85 \pm 9.08$  days. The survival rate of postoperative patients was 96.11%. (156 survivors), with a mortality rate of 4.89% (8 deaths). Morbidity of this patient's group was re-sternotomy 3, new post-op neurological complication 4 (stroke = 2, transient ischemia attack = 2), pulmonary

complication 7 (hospital acquire pneumonia = 3, pleural effusion = 3, pneumothorax = 1), renal failure needs dialysis 4, new heart failure 4, surgical site infection 4 (CABG graft site = 3, median sternotomy = 1), Heart heart block on permanent pacemaker = 3 (Table 3).

**Table 3** Post-operative data

Post-operative Data	Total
Length of hospital stay (day)*	15.85 ± 9.08
Mortality	8 (4.89%) (male = 5, female = 3)
Morbidity	
Re-sternotomy	3
New post-op neurological complication	4 (stroke = 2, TIA = 2)
Pulmonary complication	7 (HAP = 3, pleural effusion = 3, pneumothorax = 1)
Renal failure requiring dialysis	4
New heart failure	4
Surgical site infection	4 (CABG graft site = 3, median sternotomy = 1)
Heart block on PPM	3

CABG = Coronary artery bypass grafting, HAP = Hospital acquired pneumonia, PPM = Permanent pacemaker, TIA = Transient ischemic attack

\*Data are presented as mean ± S.D.

## DISCUSSION

When considering the in-depth data of patients who died after the surgery, it was found that they had a poor preoperative left ventricular ejection fraction, longer duration of cardiopulmonary bypass, and aortic cross-clamping than the expected surgical time. These factors caused acute heart failure after surgery, requiring the use of extracorporeal membrane oxygenation (ECMO). This resulted in other postoperative complications such as septic pneumonia, postoperative renal failure, and severe sepsis (Tables 3 and 4).

Factors affecting hospitalization duration included patients' health status, preoperative underlying diseases, and preoperative urgent conditions.

## CONCLUSION

The results of open-heart surgery at Buriram Hospital were satisfactory when compared to both global and national results. The primary factors affecting patients' postoperative mortality were acute heart failure, pneumonia infection, and postoperative renal failure.

Most patients who underwent surgery had underlying conditions such as high blood pressure, high cholesterol, diabetes, and chronic kidney disease (stage 3 or higher), respectively.

Factors affecting hospitalization duration of patients were health status and the urgency of patients' conditions before surgery. The findings were empirical data to improve the efficiency of care for patients undergoing open-heart surgery at Buriram Hospital.

## ACKNOWLEDGEMENTS

Since this thesis was the first report of the success of Buriram Hospital in performing heart surgery, the author team would like to thank all the advisors who had supported the Buriram surgical team throughout namely Phramongkutklo hospital, Rajavithi hospital, Sunpasitthiprasong hospital, Queen Sirikit Heart Center of the Northeast, Surin Hospital for the mentor of Buriram hospital, and all the supporters who helped the team overcome the obstacles that allowed the author's team to present the impressive work.

**Table 4** Mortality Cases

Gender	Age	Diagnosis	Operation	EURO II (%)	NYHA	LVEF (%)	CPB/Cross clamp time (mins)	Echo	Post-op	LOH (days)
Male	44	Severe MS, MR, AR	AVR, MVR	2.67	III	40	222/169	Poor LVEF	CRRT, ECMO, HAP	18
Female	69	Severe MR	MVR	3.25	IV	50	84/62	Poor LVEF	CRRT, ECMO	9
Male	61	Severe AR, MR, TR	AVR, MVR, TVA	2.63	III	48	319/262	Myocardial stunning	ECMO, CRRT, HAP	18
Male	76	DVD with LM, Severe MR	CABG x II with MVR	32.5	IV	30	182/112		AKI On CRRT, HAP	18
Male	81	Blunt chest with IVC tear	Post-cardiac arrest with intra-cardiac massage	38.28	I	30	Stand by	RV failure due to post-CPR		1
Female	61	TVD with Dissection at Proximal Anastomosis	CABG x III	12.94	II	42	418/97 (arrest time 40 mins)		IABP, ECMO	4
Female	66	Severe AS (Sudden cardiac arrest day 3)	AVR	3.61	III	59	195/126		ECMO	4
Male	65	Severe AR with TVD	AVR with CABG x III	9.51	III	40	398/226		IABP, ECMO	2

AKI = Acute Kidney Injury, AR = Aortic Regurgitation, AS = Aortic Stenosis, AVR = Aortic Valve Replacement, CABG = Coronary Artery Bypass Grafting, CPB = Cardiopulmonary Bypass, CPR = Cardiopulmonary Resuscitation, CRRT = Continuous Renal Replacement Therapy, DVD = Double Vessel Disease, ECHO = Echocardiogram, ECMO = Extracorporeal Membrane Oxygenation, EUROII = European System for Cardiac Operative Risk Evaluation II (EuroSCORE II), HAP = Hospital-Acquired Pneumonia, IVC = Inferior Vena Cava, LM = Left Main Coronary Artery, LOH = Length of Hospitalization, LVEF = Left Ventricular Ejection Fraction, MR = Mitral Regurgitation, MS = Mitral Stenosis, MVR = Mitral Valve Replacement, NYHA = New York Heart Association Functional Classification for Heart Failure, TR = Tricuspid Regurgitation, TVA = Tricuspid Valve Annuloplasty, TVD = Triple Vessel Disease

## REFERENCES

1. Chaiseri P. Development of coronary artery bypass graft (CABG) in Thailand. *Thai J Surg* 2019;31(2):39-42.
2. Sakornpant P, Kojaranjit V. First national adult cardiac surgical database report: demonstrating “practice of adult cardiac surgery in Thailand: measuring performance and outcome”. Thailand: The Society of Thoracic Surgeons of Thailand; 2011.
3. Nashef SA, Roques F, Sharples LD, et al. EuroSCORE II. *Eur J Cardiothorac Surg*. 2012;41(4):734-44; discussion 744-5. doi: 10.1093/ejcts/ezs043.

# Single-Surgeon Experience with 2,790 Consecutive Elective Groin Hernia Repairs Under Local Anesthesia: Outcomes and Technical Considerations

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## Abstract

**Objective:** This study presents the author's 34-year experience with groin hernia repair under local anesthesia, a technique adopted in 1989. It discusses the rationale, evolution, technical considerations, clinical benefits, and alignment with the 2023 International HerniaSurge Guidelines, which support local anesthesia in selected patients. This method is especially valuable for high-risk patients unsuitable for general or regional anesthesia.

**Materials and Methods:** This retrospective analysis draws from records from Chiangrai Prachanukroh Hospital. All procedures were performed or supervised by a single surgeon. Included were adult patients ( $\geq 18$  years) undergoing elective groin hernia repair; cases with acute complications were excluded. Data collected included demographics, hernia type, repair technique, operative time, hospital stay, and complications. Ethical approvals were obtained.

**Results:** From September 1989 to September 2023, 2,790 groin hernia repairs were performed under local anesthesia. Most patients were male (97%), with indirect inguinal hernia being the most common (77.8%). A tension-free repair with a modified Lichtenstein technique was used in 76% of cases. Intraoperative assessment included voluntary patient straining to confirm the integrity of the repair. A one-day surgery (ODS) approach was applied in 91.4% of cases. The overall complication rate was 5.28%, and the recurrence rate was notably low at 0.71%.

**Conclusion:** Groin hernia repair under local anesthesia is a safe, effective, and cost-efficient option, well-suited for one-day surgery. With excellent outcomes and reduced inpatient resource use, this approach supports broader adoption in Thailand's healthcare system. The author encourages wider use of local anesthesia in routine open groin hernia repairs.

**Keywords:** Groin hernia repair, Local anesthesia infiltration, One-day surgery (ODS)

## INTRODUCTION

Groin hernia repair represents one of the most performed surgical procedures worldwide.<sup>1</sup> Despite its prevalence, this operation receives disproportionately limited attention in surgical curricula, as academic institutions often prioritize more complex procedures. This educational gap results in inadequate training of surgical residents in proper hernia repair techniques, which may

lead to technical errors and potentially increase recurrence rates.<sup>2</sup> Such recurrences not only compromise patient outcomes but also significantly complicate subsequent repairs.<sup>3</sup> The author's experience with groin hernia repair under local anesthesia began at Chiangrai Prachanukroh Hospital in 1989. This work was inspired by early exposure to international literature demonstrating the efficacy of local anesthesia for groin hernia repair during surgical

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residency.<sup>4</sup> However, these publications notably lacked detailed technical descriptions of anesthetic infiltration techniques. Upon completing surgical training, the author systematically developed an optimized local anesthesia protocol through a comprehensive review of regional anesthesia textbooks. The first successful hernia repair under local anesthesia was performed in September 1989,<sup>5</sup> establishing the foundation for a sustained clinical practice that has spanned over three decades. Since 1989, the author has exclusively employed local anesthesia for groin hernia repairs in elective cases. Throughout three decades of surgical practice, the author has rarely performed groin hernia repair under general or spinal anesthesia, reserving these approaches exclusively for emergency cases. This report details the evolution and outcomes of this experience, which now encompasses more than 2,790 procedures.

## MATERIALS AND METHODS

This retrospective cohort study analyzed consecutive elective groin hernia cases treated at the Department of General Surgery, Chiangrai Prachanukroh Hospital. Data were extracted from institutional medical records, which were available from 2008 onward. However, additional patient records dating back to 1989 were obtained from a surgeon-maintained patient portfolio. All surgical procedures were performed or directly supervised by a single surgeon between September 1989 and September 2023, totaling 2,790 cases. Cases involving hernia-related complications, such as strangulation, were excluded. The inclusion criteria are detailed below.

### Inclusion criteria

1. Elective groin hernia repair candidates.
2. Age  $\geq$  18 years, both genders.
3. Absence of acute hernia complications (incarceration or strangulation).
4. Normal coagulation profile (no coagulopathy).
5. No uncontrolled comorbidities (hypertension or diabetes mellitus).
6. Willing and able to provide informed consent.

### The local anesthesia infiltration technique

#### Anesthetic Preparation and Instruments

1. Local anesthetic mixture
  - 30 mL of 1% lidocaine with epinephrine (1:100,000)

- 20 mL of 0.5% bupivacaine
- Mixed before administration (final volume 50 mL). The mixture was stored in a 50 mL sterile plastic syringe.

#### 2. Alkalinization

- 5 mL of 7.5% sodium bicarbonate was added to the above anesthetic mixture.

#### 3. Equipment

- 5 mL sterile syringes
- 25-gauge spinal needle

The local anesthesia site of infiltration and technique (Figure 1).

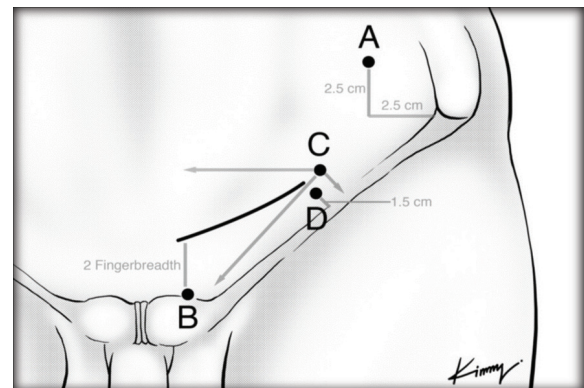


Figure 1 Anesthetic infiltration site<sup>5</sup>

#### Landmark A: Ilioinguinal Nerve Block

The injection site is located 2.5 cm medial and 2.5 cm superior to the anterior superior iliac spine (ASIS). Using a 25-gauge spinal needle inserted perpendicular to the skin, advance the needle until positioned just beneath the external oblique aponeurosis. Correct placement is confirmed by:

1. Tactile loss of resistance (LOR) upon penetrating the aponeurosis
2. Feeling fascial "popping" sensations during needle advance through

A single bolus of 5 mL of anesthetic mixture is deposited beneath the aponeurosis without using a fan-shaped distribution, as the volume of the mixture allows it to spread sufficiently to reach the target nerve beneath the external oblique aponeurosis.

#### Landmark B: Pubic Tubercle and Superficial Inguinal Ring Block

##### 1. Initial Injection (Pubic Tubercle)

Palpate the pubic tubercle and mark a point 2 cm laterally

The needle is inserted perpendicularly through the skin and then advanced at a 45-degree angle toward the tubercle. Subsequently, 2–3 mL of the anesthetic mixture is infiltrated around the periosteal interface.

## 2. Secondary Injection (Superficial Ring)

- Withdraw the needle tip to the subcutaneous level without exiting the skin
- Redirect inferiorly to target 1.5 cm below the pubic tubercle
- Deposit 2-3 mL of anesthetic mixture at the superficial inguinal ring

## Landmark C: Incision Site Block

### 1. Incision Planning

- A 5-6 cm skin incision is made along natural skin creases
- Positioned 2-3 cm (2 finger breadths) superior to the pubic tubercle

### 2. Anesthetic Technique

#### a) Initial infiltration

- Insert the needle 1.5-2 cm laterally from the planned incision
- Subcutaneous infiltration of anesthetic mixture along the incision line toward the midline (5 mL)

#### b) Multidirectional blocking (Figure 2)

- Withdraw the needle to the insertion point without exiting the skin
- Redirect the needle parallel to the inguinal ligament toward the superficial ring (5 mL)
- Repeat the redirection of the needle perpendicular to the inguinal ligament toward the midline (5 mL)
- Fan-shaped infiltration: complete the remaining area coverage (10 mL)
- Total volume used: 25-30 mL

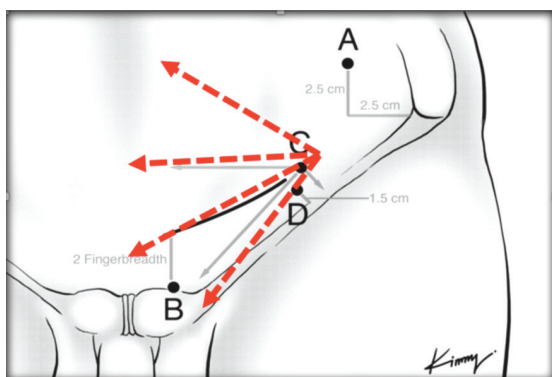


Figure 2 Direction of infiltration

## Landmark D: Hernia Sac Infiltration at Deep Inguinal Ring

1. Locate 1.5 cm superior to the midpoint of the inguinal ligament
2. Insert a 25-gauge spinal needle perpendicular to the skin
3. Advance the needle to penetrate the external oblique aponeurosis (EOA) (confirmed by a distinct "pop" sensation/LOR), then deepen the needle 0.5-1 cm, based on the patient's muscle thickness.
4. Aspirate the syringe before infiltration to exclude femoral vessel puncture; if any blood is present, stop this step.
5. Deposit 2-3 mL of the anesthetic mixture.
6. An alternative approach is first to incise the skin, followed by direct infiltration of the anesthetic mixture into the hernia sac near the deep inguinal ring during dissection.

Note: Before the incising of EOA, administer 2-3 mL of local anesthetic mixture beneath this layer to ensure direct blockade of the inguinal nerve.

## Sedation

Our technique of local anesthetic infiltration is associated with minimal procedural pain. Patients are thoroughly informed and guided through each step of the operating room process, which contributes to a significant reduction in perioperative anxiety. Notably, no sedation is administered in most cases.

## Analgesic medication during or post op period

No intraoperative analgesic injections were administered to any patients. If the patient complained of pain during the procedure, supplemental local anesthesia was administered at the site of discomfort. Postoperative pain management consisted of paracetamol 500 mg (1-2 tablets every 6 hours) and NSAIDs (ibuprofen 400 mg, one tablet three times daily after meals). Most patients received analgesia for 3 to 5 days. No narcotic medications were prescribed postoperatively.

## Follow up

Postoperatively, most patients will be advised to undergo suture removal at a local healthcare facility near their residence. They will receive detailed wound care instructions and guidance before discharge. In the event of complications, patients are instructed to return to our

institution for further evaluation. A scheduled follow-up visit at one month will include wound assessment, evaluation of postoperative symptoms, and counseling regarding potential complications. Additionally, patients are encouraged to seek prompt consultation if they have any concerns regarding surgical sequelae or postoperative issues.

## RESULTS

This retrospective study analyzed medical records from the Department of General Surgery at Chiangrai Prachanukroh Hospital. All procedures were performed or directly supervised by a single surgeon between September 1989 and September 2023, encompassing 2,790 cases. The cohort consisted predominantly of male patients (2,706 cases; 97%), with female patients accounting for 84 cases (3%). Patient age ranged from 15 to 92 years (mean: 56.8 years) (Table 1). Primary indirect inguinal hernias accounted for 77.8% of cases, while primary direct hernias represented 15.99% and bilateral inguinal hernias 1.05% (Table 2). Lichtenstein hernioplasty was performed in most cases (76.32%), with a minority undergoing tissue repair (Table 3), and the operative time ranged from 15 to 160 minutes (mean: 44.7 minutes) (Table 4). Anesthetic assistance was required for two patients due to inadequately controlled perioperative pain. Underlying comorbidities were present in some patients, with hypertension and diabetes being most prevalent (Table 5). A total of 2,558 patients (91.68%) were managed as one-day surgery cases, with an average postoperative unit stay of 2 hours (Table 6). The overall morbidity rate was 4.75% including 65 cases of ecchymosis, 39 cases of wound swelling, 12 cases of hematoma, 5 cases of transient femoral nerve paresis, 2 cases of local anesthesia failure, 5 cases of superficial wound infection, and 20 cases of hernia recurrence (Table 7)—no instances of local anesthetic allergy or systemic toxicity. No perioperative deaths occurred.

This retrospective study included consecutive patients from all risk categories, as stratified by standardized systems such as the American Society of Anesthesiologists (ASA) classification. Although the exact distribution of patients across ASA categories was not recorded, preoperative risk assessment was performed by anesthesiologists in all cases. The mean patient age was 56.8 years, with approximately half presenting with comorbidities such as hypertension or diabetes. Given this profile, the ASA risk distribution in this cohort is expected to align with standard population trends.

**Table 1** Age Distribution

Age (year)	Amount	Percent
15-20	78	2.79
21-30	270	9.64
31-40	380	13.57
41-50	355	12.68
51-60	862	30.79
61-70	701	25.04
71-80	101	3.61
> 80	53	1.89

**Table 2** Types of Hernia

Type of hernia	Side		Total	Percent
	Rt.	Lt.		
Indirect	1,344	938	2,282	77.80
Direct	222	249	471	15.99
Pantaloon	56	32	88	2.99
Bilateral	22	9	31	1.05
Femoral	22	15	37	1.26
Recurrent	18	9	27	0.92

**Table 3** Types of Hernia Repair

Age (year)	Amount	Percent
<b>Tissue repair</b>		
Bassini	197	7.04
Marcy	349	12.46
McVey	18	0.64
Femoral ring repair	20	0.71
Shouldice	66	2.36
<b>Tension Free</b>		
Lichtenstein	2,127	76.23
Plugging	13	0.46

**Table 4** Operation Time

Time (Minute)	Amount	Percent
0-15	35	1.25
16-30	740	26.43
31-45	1,201	42.89
46-60	730	26.07
> 60	94	3.36

**Table 5** Co-medical Diseases

Diseases	Amount	Percent
Hypertension	1,121	40.04
Diabetes	568	20.29
Hyperlipidemia	290	10.36
BPH	240	8.57
COPD, Asthma	132	4.71
Coronary artery disease	120	4.29
Chronic kidney disease	98	3.50
HIV positive	22	0.79

**Table 6** One Day Surgery

	Amount	Length of stay (day)
Inpatient	242	2.1
One Day Surgery	2,548	0

**Table 7** Complication

	Amount	Percent
Ecchymosis	65	2.32
Wound swelling	39	1.39
Hematoma	12	0.43
Femoral nerve paresis	5	0.18
Local anesthesia failure	2	0.07
Infection	5	0.18
Recurrence	20	0.71

## DISCUSSION

Groin hernias are among the most prevalent surgical conditions. Regardless of symptom presentation, surgical intervention remains the standard for treatment. Due to their high incidence, groin hernia repairs are frequently the first procedures taught to surgical residents during training. However, because open hernia repairs are considered technically straightforward, they may receive less emphasis in academic curricula compared to more complex procedures such as laparoscopic surgery, which requires advanced technical skills and specialized equipment.<sup>6</sup> While laparoscopic approaches often require general anesthesia, this preference may limit residents' exposure to open groin hernia repairs under local anesthesia—a technique that, when performed by experienced surgeons, yields comparable outcomes to laparoscopic

approaches.<sup>7</sup> Laparoscopic hernia repair offers several advantages over the open repair.<sup>8</sup> However, open groin hernia repair under local anesthesia remains a viable and effective option, particularly in resource-limited settings.<sup>9</sup> Notably, open surgery with local anesthesia avoids risks associated with general or spinal anesthesia while maintaining comparable outcomes when performed with proper technique.<sup>10,11</sup> The author contends that, in skilled hands, open groin hernia repair under local anesthesia can achieve results equivalent to laparoscopic repair, offering a cost-effective and accessible alternative without compromising efficacy.<sup>9,10</sup>

The author completed general surgery training in 1989. Interest in groin hernia repairs under local anesthesia began during surgical training and later evolved into a focused specialization. At the time, the author's idea that a major surgical procedure could be safely performed without the need for general or spinal anesthesia was both innovative and compelling. This technique could offer significant advantages in terms of patient safety, cost-effectiveness, and suitability for outpatient surgery. Over the decades, these benefits have been realized in clinical practice. Supporting this shift, the European Hernia Society has recommended, since 2009, avoiding spinal anesthesia in adult hernia open repair surgery and advised that when general anesthesia is used, it should be supplemented with local anesthesia to optimize patient outcomes.<sup>12</sup> While numerous medical journals, both international<sup>4</sup> and Thai,<sup>13</sup> had documented this approach's advantages, none provided detailed technical guidance on local anesthetic infiltration. Although not the first surgeon in Thailand to perform groin hernia repair under local anesthesia, the author noted that previous attempts by others were not sustained, and methodologies—particularly regarding anesthetic infiltration—were inadequately documented.<sup>13,14</sup> Motivated by this gap, the author developed a reliable infiltration technique after reviewing the Textbook of Regional Anesthesia. The first groin hernia repair under local anesthesia was performed in September 1989. Since 1989, the author has exclusively employed local anesthesia for groin hernia repairs in elective cases. After accumulating adequate cases, preliminary results were published in the Journal of the Department of Medical Services in October 1994, emphasizing the feasibility and technical approach to local anesthetic infiltration.<sup>5</sup> Throughout three decades of surgical practice, the author has rarely performed groin hernia repair under general or

spinal anesthesia, reserving these approaches exclusively for emergency cases. Contrary to the misconception that local anesthesia should be reserved exclusively for high-risk patients undergoing hernia repair, current evidence supports broader application. Specifically, the European Hernia Society strongly recommends (Grade A) the use of local anesthesia for open inguinal hernia surgery in all adult patients.<sup>12</sup>

Initially, this technique was unfamiliar to some Thai surgeons and met with skepticism. However, the author refined the approach, demonstrating that successful local anesthesia for groin hernia repair requires skill but is not time-consuming to master.<sup>15</sup> Early in the learning curve, two cases required conversion to general anesthesia due to intraoperative pain, underscoring the importance of experience in achieving consistent analgesia. The author maintains that groin hernia repair under local anesthesia is a safe, effective, and cost-efficient procedure. Its localized effect avoids systemic complications and reduces anesthetic requirements, particularly benefiting frail and elderly patients.<sup>16</sup> When the author began this work, no definitive guidelines existed for anesthetic techniques in inguinal hernia repair. Recently, however, international guidelines—including those from the HerniaSurge Group—have classified local anesthesia as a Grade A recommendation for open groin hernia repair.<sup>9</sup> The disadvantages of spinal anesthesia (e.g., complications) and general anesthesia (e.g., postoperative cognitive decline, increased mortality in elderly patients) further support local anesthesia's preference.<sup>17,18</sup> Given that a significant proportion of groin hernia patients are elderly (approximately 60% over age 50 and 18% over 65), local anesthesia provides a safer alternative for this high-risk group (Table 1).

In the author's early practice, mesh was not widely available, and tissue-based repairs were common. Currently, mesh repair accounts for 97% of cases, with the Shouldice technique reserved for select patients. Local anesthesia remains the cornerstone of the author's approach, adaptable to various surgical techniques based on the patient's condition and available resources (Tables 2 and 3).

Some patients initially express concerns about undergoing groin hernia repair under local anesthesia. The attending physician must clearly explain the safety and benefits.<sup>1</sup> The primary patient concern is **PAIN** during the procedure. To address this, the author has systemati-

cally refined the local anesthetic infiltration technique to enhance comfort. The following measures have been incorporated and optimized.

### *Optimized Local Anesthesia Techniques*

**1. Use of fine-gauge needles:**<sup>19</sup> A 25-gauge or smaller needle is employed to minimize insertion-related discomfort.

**2. Use of longer needles:**<sup>20</sup> A spinal needle is utilized to reduce the number of skin punctures required, thereby improving patient tolerance.

**3. Slow, pulsatile infiltration:**<sup>21</sup> This technique allows gradual diffusion of the anesthetic agent, reducing tissue pressure and associated pain.

**4. Warming of the anesthetic solution:**<sup>22</sup> The local anesthetic is pre-warmed up to 37 °C, which has been shown to decrease injection pain.

**5. Buffering the solution:**<sup>23</sup> To reduce the acidity of commonly used anesthetics and diminish infiltration pain, the solution is buffered with 5 mL of 7.5% sodium bicarbonate. This adjustment raises the pH to approximately 7.2-7.4, which clinical studies have shown significantly lowers patient-reported pain scores.

### *Postoperative Management and Complications*

During the initial 4-5 years of the author's experience performing groin hernia repair under local anesthesia, patients were managed as inpatients and remained hospitalized for postoperative recovery. Complications were infrequent and generally minor, with an average hospital stay of approximately 2.5 days.<sup>5</sup> Most patients demonstrated good self-care capabilities and did not require intensive nursing support. Postoperative pain was effectively managed using standard analgesics, such as paracetamol and non-steroidal anti-inflammatory drugs (NSAIDs). An important observation regarding the use of local anesthesia is that, in addition to providing immediate intraoperative analgesia, patients tend to experience less postoperative pain compared to those who undergo surgery under general or spinal anesthesia. This is evidenced by the reduced need for postoperative analgesics in patients receiving local anesthesia. A proposed mechanism underlying this benefit is the preemptive analgesic effect of local anesthetic infiltration, which may attenuate the release of pro-inflammatory mediators at the surgical site. This includes a reduction in polymorphonuclear (PMN) cell activity and the associated release of free radicals

and other local inflammatory mediators.<sup>24,25</sup> With growing confidence in the technique's safety and efficacy, the author transitioned to outpatient management in 1994. This shift was justified by: (1) equivalent care quality from attentive family members, and (2) reduced administrative burdens and more efficient hospital resource utilization.<sup>26</sup> Since 1994, > 90% of cases of groin hernia repairs under local anesthesia have been performed on an outpatient basis (Table 6). Only two patients required inpatient care during this period, both due to the absence of suitable caregivers at home. The author has not encountered any instances of local anesthetic allergy or systemic toxicity throughout the clinical experience. No perioperative deaths occurred.

#### **Complication Analysis (Total: 148 cases; 5.28%) (Table 7)**

1. Ecchymosis occurred in 65 cases and wound swelling in 39 cases, neither of which required further intervention.

Ecchymosis and wound swelling are the most frequent postoperative complications (3.71%), occurring despite meticulous hemostasis and vessel ligation.

The author hypothesizes that these complications may result from decreased tissue integrity, which is commonly observed in elderly patients.

2. Hematoma occurred in 12 cases, 5 of which necessitated surgical evacuation.

These complications occurred primarily during the initial phase of the author's experience. The predominant cause was inadequate ligation of superficial vessels. While the adrenaline in the anesthetic mixture induces transient vasoconstriction; however, this effect is temporary and may create an illusion of hemostatic control. Upon vasodilation, these vessels can lead to superficial hematoma formation. Therefore, meticulous ligation of these vessels remains essential to prevent postoperative bleeding.

3. Transient femoral nerve paresis was noted in 5 cases and resolved spontaneously without intervention.

Although these complications occur infrequently, they can cause patient anxiety. However, all cases resolved spontaneously within two hours, with patients regaining full mobility before discharge. These complications likely result from excessive volume and depth of anesthetic infiltration during the step of the landmark D-guided infiltration.

As an alternative approach, the skin may first be

incised, followed by direct infiltration of the anesthetic mixture near the deep inguinal ring during dissection.

4. Superficial wound infection occurred in 5 cases; they were successfully treated with wound opening and dressing.

These unpleasant complications not only provoke patient anxiety but also increase treatment costs and may lead to subsequent issues, including chronic pain and recurrence. Meticulous adherence to all steps of aseptic surgical technique is paramount. In accordance with international HerniaSurge guidelines for groin hernia management, the author routinely avoids prescribing prophylactic antibiotics.

5. Local anesthesia failure was found in 2 cases, which required conversion to general anesthesia due to inadequate intraoperative pain control.

These complications arose during the early phase of the authors' learning curve with the procedure. The authors were unable to determine whether the failure was attributable to the infiltration technique or to the pharmacologic agent itself. Local anesthesia infiltration for groin hernia repair is a specialized technique that requires dedicated practice to master. While the learning curve is relatively short,<sup>15</sup> structured training sessions under expert supervision significantly accelerate skill acquisition compared to independent trial-and-error approaches.

6. There were 20 cases of hernia recurrence:

- o 15 following tissue-based repair and
- o 5 following Lichtenstein hernioplasty.
- o Most of the patients with recurrence opted for reoperation, which was successfully performed under local anesthesia.

While the observed recurrence rate in this study was acceptably low (0.7%), the author acknowledges that the true rate may be underestimated. Although the follow-up period ranged from 5 to 20 years and may not capture very late recurrences, existing literature indicates that most recurrences occur within the first 2 years postoperatively, with the majority presenting within the first 5 years.<sup>27</sup> The majority of hernia recurrences in the author's experience occurred during the early adoption phase of both tissue-based repair and tension-free repair techniques. Published evidence indicates significantly higher recurrence rates with tissue-based repairs compared to tension-free techniques.<sup>11</sup> Therefore, tension-free repair techniques are used by the authors in the surgical treatment of over 97% of groin hernia repairs.

### LIMITATION

While this study offers robust clinical insights, several limitations must be acknowledged.

**1. Single-surgeon bias:** Outcomes reflect one practitioner's expertise, which may limit generalizability.

**2. Retrospective design:** Data were collected from medical records, potentially missing nuanced patient-reported outcomes.

**3. Evolving techniques:** Early cases used tissue-based repairs, while later cases predominantly employed mesh (97%), affecting long-term recurrence comparisons.

**4. Follow-up variability:** Although follow-up spanned 5-20 years, some very late recurrences may be underrepresented.

**5. Context-specific applicability:** Results may differ in settings lacking experienced surgeons or structured training programs.

Future directions could include prospective multicenter studies to validate these findings and further optimize anesthetic protocols.

### CONCLUSION

Groin hernia repair under local anesthesia is a safe, efficient, cost-effective, and technically straightforward surgical approach—particularly well-suited for one-day surgery settings. This ambulatory model holds strong potential for broader integration into Thailand's health-care system. Drawing on over three decades of experience and 2,790 cases, this study demonstrates that local anesthesia provides excellent perioperative analgesia, minimizes postoperative pain, and significantly reduces systemic complications. The approach optimizes resource utilization, lessens inpatient burden, and maintains excellent clinical outcomes. A low overall complication rate (5.28%) and an exceptionally low recurrence rate (0.71%) further support the effectiveness of this procedure when performed with meticulous technique. The author's refined local anesthetic protocol, including buffered, warmed solutions, fine-gauge needles, and pulsatile infiltration, has proven essential to these favorable results. These findings are consistent with international guidelines (e.g., HerniaSurge Group), which assign a Grade A recommendation to the use of local anesthesia for open groin hernia repair. Although laparoscopic inguinal hernia repair demonstrates favorable outcomes, it should be reserved for surgeons with substantial expertise in the technique. Comparative analyses have shown that open

repair under local anesthesia carries a similar short-term postoperative complication risk to laparoscopic repair but offers the advantage of reduced operative time.<sup>7</sup> The perceived benefits of laparoscopic versus open repair are significantly influenced by anesthesia modality, underscoring the necessity for Level I evidence directly comparing laparoscopic inguinal hernia repair with open repair performed under local anesthesia. Considering these outcomes, the author strongly encourages colleagues to adopt local anesthesia as a viable and advantageous standard for routine open groin hernia repair.

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### REFERENCES

1. Köckerling F, Simons MP. Current Concepts of Inguinal Hernia Repair. *Visc Med.* 2018;34(2):145-50. doi: 10.1159/000487278.
2. Robson AJ, Wallace CG, Sharma AK, et al. Effects of training and supervision on recurrence rate after inguinal hernia repair. *Br J Surg.* 2004;91(6):774-7. doi: 10.1002/bjs.4540.
3. Gopal SV, Warriar A. Recurrence after groin hernia repair-revisited. *Int J Surg.* 2013;11(5):374-7. doi: 10.1016/j.ijss.2013.03.012.
4. Flanagan L Jr, Bascom JU. Repair of the groin hernia. Out-patient approach with local anesthesia. *Surg Clin North Am.* 1984;64(2):257-67. doi: 10.1016/s0039-6109(16)43283-4.
5. Phongmanjit P. Inguinal hernia repair under local anesthesia (in Thai). *J Dept Med Serv.* 1994;19(3):371-5.
6. Neumayer L, Giobbie-Hurder A, Jonasson O, et al. Open mesh versus laparoscopic mesh repair of inguinal hernia. *N Engl J Med.* 2004;350(18):1819-27. doi: 10.1056/NEJMoa040093.
7. Meier J, Stevens A, Berger M, et al. Comparison of Postoperative Outcomes of Laparoscopic vs Open Inguinal Hernia Repair. *JAMA Surg.* 2023;158(2):172-80. doi: 10.1001/jamasurg.2022.6616.
8. Salvilla SA, Thusu S, Panesar SS. Analysing the benefits of laparoscopic hernia repair compared to open repair: A meta-analysis of observational studies. *J Minim Access Surg.* 2012;8(4):111-7. doi: 10.4103/0972-9941.103107.
9. Stabilini C, van Veenendaal N, Aasvang E, et al. Update of the international HerniaSurge guidelines for groin hernia management. *BJS Open.* 2023;7(5):zrad080. doi: 10.1093/bjsopen/zrad080.
10. Balentine CJ, Meier J, Berger M, et al. Using Local Anesthesia for Inguinal Hernia Repair Reduces Complications in Older Patients. *J Surg Res.* 2021;258:64-72. doi: 10.1016/j.jss.2020.08.054.
11. Balentine CJ, Meier J, Berger M, et al. Using local rather than general anesthesia for inguinal hernia repair is associated with

- shorter operative time and enhanced postoperative recovery. *Am J Surg.* 2021;221(5):902-7. doi: 10.1016/j.amjsurg.2020.08.024.
12. Simons MP, Aufenacker T, Bay-Nielsen M, et al. European Hernia Society guidelines on the treatment of inguinal hernia in adult patients. *Hernia.* 2009;13(4):343-403. doi: 10.1007/s10029-009-0529-7.
  13. Puriphoom J. Local anesthesia for inguinal hernia repair (in Thai). *J Dept Med Serv.* 1988;13(6):695-8.
  14. Nana-Nukoon S. Inguinal hernia repair under local anesthesia (in Thai). *J Dept Med Serv.* 1990;15(4):364-8.
  15. Kingsnorth AN, Britton BJ, Morris PJ. Recurrent inguinal hernia after local anaesthetic repair. *Br J Surg.* 1981;68(4):273-5. doi: 10.1002/bjs.1800680416.
  16. Meier J, Berger M, Hogan T, et al. Using local rather than general anesthesia for inguinal hernia repair may significantly reduce complications for frail Veterans. *Am J Surg.* 2021;222(3):619-24. doi: 10.1016/j.amjsurg.2021.01.026.
  17. Huerta S, Phung T, Tran N, et al. Predictors of long-term mortality in octogenarian veterans following inguinal hernia repair. *Hernia.* 2022;26(1):243-9. doi: 10.1007/s10029-021-02525-2.
  18. Mahanna-Gabrielli E, Schenning KJ, Eriksson LI, et al. State of the clinical science of perioperative brain health: report from the American Society of Anesthesiologists Brain Health Initiative Summit 2018. *Br J Anaesth.* 2019;123(4):464-78. doi: 10.1016/j.bja.2019.07.004.
  19. Arendt-Nielsen L, Egekvist H, Bjerring P. Pain following controlled cutaneous insertion of needles with different diameters. *Somatosens Mot Res.* 2006;23(1-2):37-43. doi: 10.1080/08990220600700925.
  20. Strazar AR, Leynes PG, Lalonde DH. Minimizing the pain of local anesthesia injection. *Plast Reconstr Surg.* 2013;132(3):675-84. doi: 10.1097/PRS.0b013e31829ad1e2.
  21. Zilinsky I, Bar-Meir E, Zaslansky R, et al. Ten commandments for minimal pain during administration of local anesthetics. *J Drugs Dermatol.* 2005;4(2):212-6.
  22. Hogan ME, vanderVaart S, Perampaladas K, et al. Systematic review and meta-analysis of the effect of warming local anesthetics on injection pain. *Ann Emerg Med.* 2011;58(1):86-98. doi: 10.1016/j.annemergmed.2010.12.001.
  23. Ball EL, Sanjay P, Woodward A. Comparison of buffered and unbuffered local anaesthesia for inguinal hernia repair: a prospective study. *Hernia.* 2006;10(2):175-8. doi: 10.1007/s10029-005-0058-y.
  24. Hollmann MW, Durieux ME. Local anesthetics and the inflammatory response: a new therapeutic indication? *Anesthesiology.* 2000;93(3):858-75. doi: 10.1097/00000542-200009000-00038.
  25. Ding Y, White PF. Post-herniorrhaphy pain in outpatients after pre-precision ilioinguinal-hypogastric nerve block during monitored anaesthesia care. *Can J Anaesth.* 1995;42(1):12-5. doi: 10.1007/BF03010564.
  26. Phongmanjit P, Cholvidapong P. Ambulatory inguinal hernia repair (in Thai). *J Dept Med Serv.* 1998;23(1):17-21.
  27. Lichtenstein IL, Shulman AG, Amid PK. The cause, prevention, and treatment of recurrent groin hernia. *Surg Clin North Am.* 1993;73(3):529-44. doi: 10.1016/s0039-6109(16)46035-4.

# The Critical Window for Appendicitis Diagnosis: A Time-Based Analysis of Rupture Risk

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## Abstract

**Background:** Risk of appendix rupture varies over time. It aims to identify factors contributing to treatment delays, potentially heightening rupture risk. Findings could help surgeons intervene more quickly, lowering rupture chances and improving outcomes. Insights could contribute to effective treatment guidelines, particularly benefiting regions with limited healthcare access.

**Objectives:** To understand how appendix rupture risk changes over time and to identify factors associated with rupture and treatment delays, facilitating prompt intervention and better outcomes.

**Materials and Methods:** A retrospective analysis of 800 acute appendicitis cases at Rajavithi Hospital (October 2019 - September 2022) assessed symptom onset time and initial clinical signs. Patients diagnosed and treated for acute appendicitis were included; prior cases or incomplete records were excluded. Symptom onset was patient-reported, and diagnoses were based on initial assessments. Rupture was confirmed intraoperatively. Statistical analysis used a significance level of  $p < 0.05$ .

**Results:** Participants' mean age was  $35.78 \pm 14.33$  years. Average time from symptom onset to hospital presentation was  $23.90 \pm 23.87$  hours, and door-to-surgery time was  $12.79 \pm 6.99$  hours. Univariate analysis showed significant associations between rupture and older age ( $p = 0.002$ ), higher temperature ( $p = 0.002$ ), increased heart rate ( $p < 0.001$ ), higher ASA class ( $p < 0.001$ ), and elevated WBC count ( $p < 0.001$ ). No significant association was found with gender, symptom onset-to-hospital time, or intra-hospital timeframes. Multivariate analysis confirmed older age ( $p = 0.011$ ), higher temperature ( $p = 0.019$ ), elevated pulse rate ( $p < 0.001$ ), higher ASA class ( $p = 0.038$ ), WBC count  $\geq 10,000$  ( $p = 0.002$ ), increased door-to-ATB time ( $p = 0.018$ ), and longer surgical consultation time ( $p = 0.039$ ) as rupture predictors.

**Conclusion:** Older age, elevated temperature, heart rate, WBC count, higher ASA classification, and delays (door-to-ATB time, surgical consultation time) are significant factors influencing appendicitis rupture. Addressing these could improve outcomes.

**Keywords:** Appendicitis, Rupture, Time-base analysis

## INTRODUCTION

Appendiceal rupture is a serious complication that can lead to peritonitis, sepsis, and even death.<sup>1,2</sup> While clinicians generally recognize that delayed diagnosis increases the likelihood of rupture, the precise relationship between symptom duration, in-hospital delays, and rupture risk remains unclear.<sup>1,3</sup> Most previous studies have compared ruptured and non-ruptured cases only at

the time of diagnosis or surgery, without quantifying how rupture risk evolves dynamically as time progresses.<sup>3,4</sup> This limitation leaves an important knowledge gap: clinicians lack evidence-based benchmarks on when rupture risk begins to escalate significantly, or which hospital-related time intervals most strongly contribute to rupture.

Understanding this time-dependent nature of rupture risk is crucial for improving outcomes.<sup>5</sup> Identifying

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not only patient-related factors but also specific process delays within the hospital (such as consultation time or door-to-antibiotic time) could provide actionable insights for optimizing care pathways. Unlike prior research that focused primarily on overall surgical timing, this study introduces a time-based analytical approach to evaluate rupture risk across both pre-hospital and intra-hospital intervals. By quantifying how risk changes over time and determining which delays have the greatest impact, we aim to clarify the “critical window” for appendicitis management.

This methodological focus distinguishes our study in two key ways. First, it shifts the perspective from a binary classification of ruptured versus non-ruptured appendicitis to a dynamic assessment of rupture risk as a function of time. Second, it highlights modifiable hospital workflow factors, particularly door-to-antibiotic administration and surgical consultation delays, that may be targeted for system improvement. These findings are expected to guide earlier interventions, reduce rupture incidence, and improve patient care. Moreover, the results have practical relevance for healthcare settings with limited resources, where optimizing time-sensitive processes is essential.

## MATERIALS AND METHODS

This study was a retrospective descriptive analysis focusing on October 1, 2019, and September 30, 2022. The researchers assessed the time of symptom onset and clinical signs at the patient's first medical contact by examining physician and nursing notes, physician examination documentation, and medication order forms.

The inclusion criteria for this study were patients diagnosed with acute appendicitis who received treatment at Rajavithi Hospital and had their data collected between October 1, 2019, and September 30, 2022. The exclusion criteria for this study were patients who had previously been treated for acute appendicitis and those with incomplete medical records.

The time of symptom onset was determined based on the patient's history during the first examination. Patients diagnosed with appendicitis or an acute abdomen with appendicitis as the primary diagnosis in the initial assessment note were categorized as having a diagnostic impression of appendicitis. Those with any other diagnoses were considered uncertain. The time of appendiceal rupture was defined as the time when the operation was performed, and the rupture was confirmed. Because determining the exact moment of rupture is not feasible,

the diagnosis was based on observations made during the operation.

## Definition

1. Symptom onset-to-hospital presentation represents the duration between the moment a patient experiences the initial symptoms and their arrival at the hospital for evaluation and treatment.

2. Management Patient at Emergency Room (ER) to Consult Surgery refers to the time period from the start of patient management in the Emergency Room (ER) to the moment when a consultation with a surgical specialist takes place.

3. Consulting Surgery to Surgical Diagnosis represents the duration between the initial consultation with a surgical specialist and the determination of a conclusive surgical diagnosis.

4. Surgical Diagnosis to Admission represents the time between the determination of a surgical diagnosis and the patient's subsequent admission to the hospital.

5. Door-to-ATB refers to the time interval between a patient's arrival at a healthcare facility (door) and the administration of appropriate antibiotic therapy (ATB).

6. Ward to the Operating Room refers to the time between a patient's transfer from the ward to the operating room.

7. Anesthesia Preparation refers to the time required to prepare the patient for anesthesia before surgery.

8. Door-to-surgery refers to the duration between a patient's arrival at the hospital (or emergency department) and the commencement of the surgical procedure.

### 9. Time from Symptom Onset to Surgery

The time of symptom onset was determined based on the patient's self-reported history at initial examination. We acknowledge that this method relies on patient recall and is therefore susceptible to recall bias, which may affect the accuracy of reported symptom duration.

At our institution, routine CT scanning is not performed for all suspected appendicitis cases. The initial diagnosis is primarily based on clinical assessment, physical examination, and laboratory findings (e.g., elevated WBC count). Ultrasound may be used as a first-line imaging modality in equivocal cases, particularly in female patients or those with atypical presentation. A CT scan is reserved for patients with inconclusive findings after clinical evaluation.

In this study, the sample size was calculated using the formula for comparing the proportions of two groups

(Bernard R, 2000). The sample size for each group,  $n$ , was determined using standard statistics and significance levels. Based on a previous study by Bickell et al. (2006),<sup>1</sup> the following rupturing rates were found.

A 3% rupture rate in the group receiving surgery within 36 hours ( $p_1 = 0.03$ ) and a 20% rupture rate in the group that received surgery after 36 hours ( $p_2 = 0.20$ ). The average complication rate from both surgical methods ( $p_{bar} = 0.13$ ). Using these values, the sample size is calculated to be 55 subjects per group. Considering that past statistics at Rajavithi Hospital show that approximately 10% of surgeries occur within 36 hours after onset, a total of 550 patients ( $55/0.1$ ) were needed for the study. Therefore, the researchers will collect data from all patients with acute appendicitis treated at Rajavithi Hospital between October 1, 2020, and Janu-

ary 31, 2023, which is expected to be no less than 550 patients. Data analysis was conducted using the following statistical methods. Descriptive statistics will be reported as the number and percentage for categorical data and mean and standard deviation for continuous data with a normal distribution. The median, minimum, and maximum values will be reported for continuous data with nonnormal distributions. Inferential statistics will involve the Chi-square test or Fisher's exact test for comparing categorical data, Student's  $t$ -test for comparing continuous data with normal distribution between two independent groups, Mann-Whitney U-test for comparing continuous data with non-normal distribution, binary logistic regression for analyzing related factors, reporting risks as odds ratios (OR) with 95% confidence intervals (CI), and a significance level of  $p < 0.05$ .

## RESULTS

**Table 1** Demographic and clinical characteristics of the study patients

Demographic	Total (n = 800) n (%)
<b>Gender</b>	
Male	408 (51.0)
Female	392 (49.0)
<b>Age</b>	35.78 ± 14.33
<b>ASA</b>	
Class 1	426 (53.3)
Class 2	330 (41.3)
Class 3	42 (5.3)
Class 4	2 (0.3)
<b>Temperature (°C)</b>	37.23 ± 0.82
BT ≥ 37.8 °C	407 (50.9)
BT < 37.8 °C	393 (49.1)
<b>WBC</b>	14.87 ± 5.02
WBC < 10,000	6 (0.8)
WBC ≥ 10,000	794 (99.3)
<b>Heart rate (BPM)</b>	93.67 ± 16.82
<b>Time (hr)</b>	
Symptom Onset to Hospital Presentation	23.90 ± 23.87
Management Patient at Emergency Room to Consult Surgery	4.86 ± 1.42
Consult Surgery to Surgical Diagnosis	3.95 ± 2.58
Door-to-ATB	8.96 ± 6.93
Surgical Diagnosis to Admission	2.58 ± 1.77
Ward to Operating Room	4.50 ± 3.90
Anesthesia Preparation	0.35 ± 0.12
Door-to-Surgery	12.79 ± 6.99
<b>Symptom Onset to Surgery</b>	36.68 ± 25.09
Less than 36 hrs	533 (66.6)
More than 36 hrs	267 (33.4)
<b>Length of stay (LOS)</b>	3.11 ± 2.90

Values are represented as n (%), mean ± SD, and median(min-max).

Demographic and clinical characteristics of 800 study patients (Table 1). The participants consisted of 51% males and 49% females, with an average age of 35.78 years. The majority of patients were ASA Class 1 (53.3%), followed by Class 2 (41.3%), Class 3 (5.3%), and Class 4 (0.3%). The average temperature was 37.23 °C, with 50.9% of patients having a temperature of 37.8 °C or higher. The average WBC count was 14.87, with 99.3% of the patients having a count equal to or above 10,000.

The study also provided data on the time elapsed during various stages of patient care. The average time from symptom onset to hospital presentation was 23.90 hours, and the average time from surgical diagnosis to admission was 2.58 hours. The overall door-to-surgery time was 12.79 hours, with 66.6% of patients having surgery within 36 hr of symptom onset. The average length of hospital stay (LOS) was 2.90 days. The factor associated with rupture is shown in Table 2.

**Table 2** Factors associated with Rupture

Characteristics	Acute (n = 722) n (%)	Rupture (n = 78) n (%)	p-value
<b>Gender</b>			0.138
Male	362 (88.7)	46 (11.3)	
Female	360 (91.8)	32 (8.2)	
<b>Age</b>			0.001*
< 60 years	669 (91.1)	65 (8.9)	
≥ 60 years	53 (77.9)	13 (22.1)	
<b>Temperature (°C)</b>			0.002*
BT < 37.8	380 (93.4)	27 (6.6)	
BT ≥ 37.8	342 (87.0)	51 (13.0)	
<b>Heart rate (BPM)</b>			< 0.001*
60-100	519 (93.5)	36 (6.5)	
> 100	203 (82.9)	42 (17.1)	
<b>ASA class</b>			< 0.001*
Class 1	403 (94.6)	23 (5.4)	
Class 2	286 (86.7)	44 (13.3)	
Class 3-4	33 (75.0)	11 (25.0)	
<b>WBC count</b>			< 0.001*
< 10,000	2 (33.3)	4 (66.7)	
≥ 10,000	720 (90.7)	74 (9.3)	
<b>Symptom onset to surgery</b>			0.608
≤ 36 hrs	481 (90.2)	52 (9.8)	
> 36 hrs	241 (90.3)	26 (9.7)	
<b>Door-to-ATB</b>			0.034*
≤ 8 hrs	400 (92.4)	33 (7.6)	
> 8 hrs	322 (88.0)	45 (12.0)	
<b>Consult surgery to diagnosis</b>			0.039*
≤ 4 hrs	500 (91.7)	45 (8.3)	
> 4 hrs	222 (87.1)	33 (12.9)	

\* significant at  $p < 0.05$ .

Factors associated with rupture in acute and ruptured cases. The study found that age ( $p = 0.002$ ), temperature ( $p = 0.002$ ), heart rate ( $p < 0.001$ ), ASA ( $p < 0.001$ ), and WBC count ( $p < 0.001$ ) were significantly associated with rupture. Specifically, patients with rupture had a higher average age (41.78 years), higher temperature ( $\geq 37.8^\circ\text{C}$ ), increased heart rate (100 BPM), higher ASA classes, and higher WBC count ( $\geq 10,000$ ).

No significant association was found between sex and rupture ( $p = 0.138$ ), and the time from symptom onset to surgery was not significantly different between acute

and rupture cases ( $p = 0.993$ ). Consultation time from surgery to surgical diagnosis ( $p = 0.039$ ) and door-to-ATB time ( $p = 0.034$ ) were significantly different between the two groups. Other variables, such as symptom onset to hospital presentation, management at the emergency room, surgical diagnosis to admission, ward to operating room, anesthesia preparation, door-to-surgery, and symptom onset to surgery, showed no significant association with rupture. The multivariate analysis factors associated with rupture are shown in Table 3.

**Table 3** Multivariate analysis of factors associated with Rupture

Factors	Adjusted OR	95% CI	$p$ -value
Age $\geq 60$ years	2.15	1.05 – 4.40	0.036*
Temperature $\geq 37.8^\circ\text{C}$	1.94	1.11 – 3.39	0.019*
Heart rate $> 100$ bpm	3.39	1.99 – 5.80	$< 0.001^*$
ASA Class 2	2.48	1.38 – 4.43	0.002*
ASA Class 3-4	3.26	1.18 – 9.03	0.023*
WBC $\geq 10,000$	6.12	1.52 – 24.64	0.011*
Door-to-ATB $> 8$ hrs	1.72	1.05 – 2.82	0.031*
Consult Surgery to Diagnosis $> 4$ hrs	1.58	0.95 – 2.64	0.078

\*Adjusted for age, temperature, heart rate, ASA class, WBC, door-to-ATB, and consultation time.

\*Significant at  $p < 0.05$

This study investigated the factors associated with rupture using multivariate analysis. The study identified several significant factors, including higher body temperature (BT  $\geq 37.8^\circ\text{C}$ ), elevated pulse rate ( $> 100/\text{min}$ ), higher ASA classes (Class 4, 3, and 2), WBC count  $\geq 10,000$ , older age, and increased time from door to ATB. The analysis was adjusted for factors such as age, temperature, pulse, ASA, WBC, time from ER to surgical diagnosis, and time from door to ATB. Results were considered significant at  $p < 0.05$ .

## DISCUSSION

In this study of 800 patients with acute appendicitis, we found that several clinical factors were significantly associated with rupture. On univariate analysis, older age, elevated temperature, tachycardia, higher ASA classification, and elevated WBC<sup>6-10</sup> count showed strong associations, whereas gender and overall symptom duration did not. Intra-hospital delays, specifically prolonged surgical consultation time and door-to-antibiotic time, were also

significantly related to rupture risk.<sup>11</sup> Multivariate analysis confirmed that age  $\geq 60$  years, fever ( $\geq 37.8^\circ\text{C}$ ), tachycardia ( $> 100$  bpm), ASA class  $\geq 2$ , WBC count  $\geq 10,000$ , and prolonged door-to-antibiotic time were independent predictors of rupture. These findings highlight that both patient-related risk factors and modifiable hospital workflow delays contribute to appendiceal rupture.<sup>12</sup>

Based on the research findings discussed above, the following strategies can be considered to ensure faster treatment for patients with conditions such as appendicitis, such as improving patient awareness.<sup>1</sup> Educate the public about the symptoms of appendicitis to encourage patients to seek medical attention sooner. Early recognition and presentation to healthcare facilities can speed up the diagnosis process and reduce the risk of complications, such as rupture. Enhance emergency department efficiency: Streamline processes within the emergency department to reduce the time it takes to diagnose and admit patients. For example, optimizing patient flow, enhancing communication between healthcare provid-

ers, and improving the efficiency of diagnostic tests can expedite patient care. Prioritize patients at a higher risk: Implementing an effective triage system to identify and prioritize patients with a higher risk of complications, such as those with elevated body temperature, increased pulse rate, higher ASA classes, or elevated WBC count. Prioritizing these patients can help ensure prompt treatment.<sup>3,5</sup> Improve surgical scheduling: Optimize surgical scheduling to minimize delays in patients who require surgery. This could include adjusting operating room availability, improving staff allocation, and coordinating surgery schedules to ensure prompt treatment for patients with time-sensitive conditions, such as appendicitis. Monitor performance metrics: Regularly review performance metrics, such as door-to-surgery times and door-to-antibiotic times, to identify areas for improvement. By continually assessing these metrics, healthcare facilities can identify potential bottlenecks and implement targeted interventions to reduce delays and improve patient care. Promote interdisciplinary collaboration: Encourage collaboration and communication between various healthcare professionals, such as emergency physicians, surgeons, anesthesiologists, and nurses, to ensure a seamless transition from diagnosis to treatment. Improved coordination between these professionals can lead to more efficient patient care and faster treatment.

This study has several strengths. First, it is based on a relatively large cohort of 800 consecutive appendicitis cases from a single tertiary referral center, which provides robust statistical power. Second, the study applied a time-based analytical approach, allowing us to assess not only patient-related clinical factors but also specific intra-hospital process delays, such as door-to-antibiotic time and surgical consultation time, which are modifiable in clinical practice. Third, by incorporating both univariate and multivariate analyses, our findings provide a more comprehensive understanding of independent predictors of rupture.

Although the research conducted above provided valuable insights into the factors associated with a higher risk of rupture in patients with appendicitis, there may be additional high-risk factors that were not recorded or considered in this study. These factors could potentially influence the decision-making process to treat patients faster. Some of these factors may include the following. This study did not specifically include generalized peritonitis in the lower abdomen in the analysis. While

peritonitis is an important clinical manifestation of rupture and may have prognostic implications, our dataset focused on time-related and readily measurable clinical factors. We acknowledge this as a limitation, and future studies should incorporate peritonitis as a variable to provide a more comprehensive risk model.

The selective use of CT scanning may have influenced diagnostic timelines. While CT can provide high diagnostic accuracy, waiting for imaging may prolong the time to definitive diagnosis and treatment, particularly in resource-limited or high-volume settings. In our cohort, we did not perform a formal subgroup analysis to quantify the impact of CT utilization on delayed diagnosis or rupture risk. This represents a limitation of the present study, and future prospective research should evaluate whether selective imaging strategies contribute to treatment delays and adverse outcomes.

A limitation of our analysis is the handling of continuous variables. While logistic regression can accept continuous predictors, categorization into clinically meaningful groups (e.g., age thresholds, timing cut-offs) may yield results that are easier to interpret in clinical practice. Future studies should explore both continuous and stratified approaches to enhance the applicability of statistical findings. Finally, as this was a single-center retrospective study, the findings may not be generalizable to other healthcare settings, especially those with different diagnostic protocols or resource availability.

Patient's medical history: Past medical history, such as previous episodes of abdominal pain and gastrointestinal disorders. Comorbidities: The presence of other medical conditions, such as diabetes, obesity, or immunosuppression, could potentially increase the risk of complications in patients with appendicitis. Severity of pain: The intensity and nature of the pain experienced by a patient may provide valuable information about the progression of the condition. Patients with severe worsening pain may require urgent treatment. Social determinants of health: Socioeconomic status, access to healthcare, and health literacy can influence a patient's ability to seek timely medical care. These factors may contribute to treatment delays and should be considered when assessing the urgency of care. Radiological findings: Advanced imaging techniques, such as ultrasound or computed tomography (CT), can provide more detailed information about the severity and progression of appendicitis. Incorporating these imaging findings into decision-making

## CONCLUSION

In summary, this study emphasizes the criticality of the prompt diagnosis and treatment of patients with appendicitis. Delays in treatment from symptom onset can significantly elevate the risk of a ruptured appendix, particularly in relation to the door-to-antibiotic (ATB) time.

## CONFLICT OF INTEREST

The authors declare that they have no affiliations with or involvement in any organization or entity with any financial interest in the subject matter or materials discussed in this manuscript.

## REFERENCES

1. Bickell NA, Aufses AH Jr, Rojas M, et al. How time affects the risk of rupture in appendicitis. *J Am Coll Surg*. 2006;202(3):401-6. doi: 10.1016/j.jamcollsurg.2005.11.016.
2. Elnaiem MAH, Alshammari AZB, Alanazi AOA, et al. Acute appendicitis neglected to rupture: review article. *Int J Pharm Phytopharm Res*. 2020;10(4):133-7.
3. Abou-Nukta F, Bakhos C, Arroyo K, et al. Effects of delaying appendectomy for acute appendicitis for 12 to 24 hours. *Arch Surg*. 2006;141(5):504-6. doi: 10.1001/archsurg.141.5.504.
4. Drake FT, Mottey NE, Farrokhi ET, et al. Time to appendectomy and risk of perforation in acute appendicitis. *JAMA Surg*. 2014;149(8):837-44. doi: 10.1001/jamasurg.2014.77.
5. Eko FN, Ryb GE, Drager L, et al. Ideal timing of surgery for acute uncomplicated appendicitis. *N Am J Med Sci*. 2013;5(1):22-7. doi: 10.4103/1947-2714.106186.
6. Chupaitoon D. Factors Associated with Ruptured Appendicitis in Patients at Pranburi Hospital (in Thai). *HuaHin Med J*. 2019;4(3):e0073.
7. Limmahakun P. The factors relating to the ruptured appendicitis at Phimai hospital. *Maharat Nakhon Ratchasima Hospital Journal (in Thai)*. 2016;38(1):35-40.
8. Atiksawedparit P, Sittichanbuncha Y. Associated factors of ruptured appendicitis in acute appendicitis patients at the emergency department, Ramathibodi Hospital (in Thai). *J Thammasat Univ Med Sch*. 2013;13(1): 36-42.
9. Punnanieth T, Laohawila S, Mongkhonsawa S. Outcomes of Treatment for Appendicitis by using Alvarado Score in Khon Kaen Hospital, Thailand. *Udonthani Hospital Medical Journal*. 2018;26(2):93-8.
10. Manositisak P. Incidence and associated factors of negative appendectomy in Kalasin Hospital (in Thai). *Srinagarind Med J*. 2010;25(3):223-7.
11. Mankhong Y, Kannikaphorn P. A study of pathology reports of appendixes specimens in patients with appendectomy at Mukdahan Hospital (in Thai). *Nakhonphanom Hosp J*. 2017;4(1):35-46.
12. Roongpiboonsopit P, A Factor that relates to an appendicitis diagnostic (in Thai) [Internet]. Kamphaeng Phet Hospital; 2016 [cited 2022 June 10]. Available from: <https://www.kph.go.th/index.php/การจัดการความรู้-km/39-ศิษย์กรรม/1121-ปัจจัยที่มีความสัมพันธ์ต่อการวินิจฉัยโรคไส้ติ่งอักเสบ-นพ-ประดิษฐ์-รุ่งพิบูลโสภณัฐ>

## Colonic Hypoganglionosis in an Adult Female: A Case Report

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### Abstract

Hypoganglionosis is a rare cause of intestinal obstruction characterized by a reduced number of ganglionic cells in the colon. Patients with this condition may present with constipation and acute intestinal obstruction. Based on the segment of the intestine affected, it can be classified into type one, in which the pathology is confined to a segment of the colon, and type two, in which the hypoganglionosis is widespread but less severe. In children, the condition can be isolated or associated with Hirschsprung's disease. Hypoganglionosis is extremely rare in adults and is not easy to diagnose. We present this 39-year-old female patient who presented with symptoms of acute intestinal obstruction and was initially managed medically. Still, she ultimately underwent a total colectomy, and the diagnosis of colonic hypoganglionosis was made on histopathological evaluation. Her recovery was uneventful, and she has been symptom-free.

**Keywords:** Hypoganglionosis, Constipation, Abdominal distension, Colectomy

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### INTRODUCTION

Hypoganglionosis is a rare disease that affects 5% of cases of neuronal intestinal malformation.<sup>1</sup> The clinical features of hypoganglionosis are like Hirschsprung's disease, where they present with chronic constipation or as acute pseudo-intestinal obstruction. Intestinal hypoganglionosis is divided into two subtypes: isolated hypoganglionosis and the Hirschsprung-associated form. Isolated hypoganglionosis is a distinct and rare disorder that has been proposed as a distinct entity, with two further subtypes: congenital isolated hypoganglionosis (CIHG) and acquired isolated hypoganglionosis (AIHG). In isolated hypoganglionosis, the submucosal nerve plexus is

normal, while a significant reduction in the myenteric ganglia is noted. In congenital hypoganglionosis, the number and size of ganglion cells are reduced at birth, and although their size increases with time, their number does not change. Acquired hypoganglionosis often occurs as a late-onset finding and is characterized by degeneration of ganglion cells and findings of gliosis on histopathological study.<sup>2,3</sup>

We report a case of hypoganglionosis in an adult woman who experienced turbulent years of worsening abdominal symptoms before receiving a definitive diagnosis. Her clinical journey highlights the importance of considering rare neuromuscular disorders in patients

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with stubborn constipation and underscores the role of full-thickness biopsies in confirming the diagnosis.

### CLINICAL PRESENTATION

A 39-year-old Chinese lady presented to the emergency department with complaints of progressive abdominal distension and intermittent abdominal pain for the last 3 days.

#### History of presenting illness

The patient reported progressive abdominal distension and intermittent episodic abdominal pain over the last 3 days. The pain was generalized, crampy, non-radiating, and partially relieved by passing flatus. She reported no passage of stools for 4 to 5 days but had been able to pass flatus. She denied nausea, vomiting, or fever.

She described a long-standing history of constipation since the age of 25, requiring laxatives or enemas 2–3 times per week. Her bowel habits had progressively worsened, and she passed stools with the help of these agents once a week. She had tried various dietary modifications and other forms of medications with limited relief. She gave a history of weight loss as reduced food intake due to her constipation. There were no previous surgeries or chronic illnesses. There was no history of weight loss, gastrointestinal bleeding, recent travel, or antibiotic use. She had no previous surgeries or known chronic illnesses.

#### Medical/Surgical history

The past medical history was significant in that during this period she had multiple CT scans and colonoscopies, but no definite diagnosis was made. An MRI defecography done in 2022 revealed moderate rectal prolapse and large rectoceles. A rectal mucosal intersectional colonic study done in the same year suggested colonic inertia. The patient had no other known comorbidities. Or any surgeries done. She had used over-the-counter laxatives and enemas frequently for her symptoms and has no known drug allergies on record.

#### Family history

Family history was insignificant, as no one in her family suffered from a similar problem, a history of Hirschsprung's disease. No history of GI malignancies or Inflammatory bowel disease was present.

#### Social

She is a non-smoker, though she takes an occasional

glass of alcohol. She is an accountant by profession. Her social life has been rather constricted due to her prevailing problems.

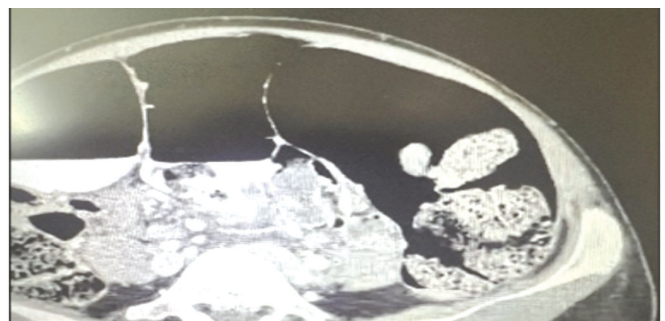
#### Clinical examination

On physical examination, she was mildly distressed due to her distension, but there was no pallor, and her hydration was adequate. Her vital signs were BP 118/80, PR 90/mt, temperature was within normal limits, and SpO<sub>2</sub> 98% on room air.

On examination of the abdomen, it was soft, distended, and non-tender or guarded. There was a non-tender palpable mass occupying the entire left flank. The abdomen was tympanic, and the bowel sounds were normal. Digital rectal examination showed an empty rectum with no feces or masses felt.

#### Investigations

Blood investigations, which included a full blood count, electrolytes, thyroid function, and serum calcium levels, were normal. A CT scan of the abdomen revealed a megacolon extending to the cecum, with greater dilation in the left descending colon (10 cm) and a large fecaloma (Figure 1).



**Figure 1** Computerized tomography of the abdomen, showing the dilated transverse colon

#### Management

Conservative management began with intravenous fluids, analgesics, and antibiotics. Although the therapy was continued, it was eventually discontinued due to a lack of improvement. It was then decided to proceed with surgical intervention, specifically an open laparotomy. Intraoperatively, as shown in the CT scan, there was a megacolon extending to the cecum, with more pronounced dilation over the left descending colon. The sigmoid colon was highly redundant. The colon was impacted with feces (Figures 2 and 3). The transition point was located at the upper rectum. Other organs appeared

normal. A total colectomy was performed, followed by a stapled side-to-end ileo-anal anastomosis and a covering loop ileostomy. Post-operative recovery was uneventful, and she was discharged.



**Figure 2** Specimen from a total colectomy (the arrow indicates the dilated segment)



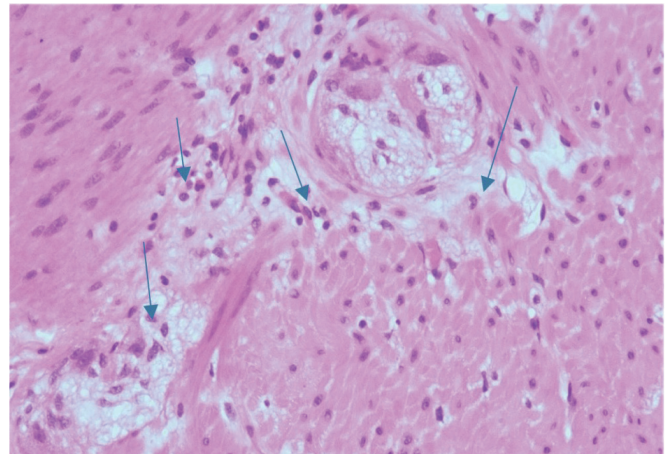
**Figure 3** The macroscopic specimen of the resected total colectomy specimen (the green arrows indicate the dilated segment)

### Histopathology

The histopathological reports (Histological slides, Figure 4) showed morphological features of hypoganglionosis. The mucosal layer shows ganglions, but the number of ganglion cells appears to be reduced and appears from the cecum to the sigmoid colon. The submucosal layer is normal.

### Follow-up

On follow-up, she was cheerful and coping well with the stoma. There was significant relief of abdominal symptoms with the stoma functioning well. She has also shown a gain in weight compared to her admission. Closure of the stoma is planned in the coming months with improvement in her function.



**Figure 4** The histological examination of the specimen highlights the features of hypoganglionosis with a reduced number of ganglionic cells. (The blue arrow indicates the reduced number of ganglionic cells)

### DISCUSSION

Intestinal hypoganglionosis is a disorder of intestinal innervation that is commonly seen in children. It is one of the rarest gastrointestinal neuromuscular disorders. It affects the submucosal and myenteric neural plexus of the rectal wall and involves a specific length of the intestine just above the rectum.<sup>4</sup> Hypoganglionosis is characterized by a reduced number of ganglia, with fewer than one ganglion per 10 mm or an average of fewer than 2 neurons per ganglion. The diagnosis is usually confirmed through histological examination of the full-thickness specimen, including two-thirds of the resected segment's circumference. Hematoxylin and eosin staining are used to verify the diagnosis of hypoganglionosis.<sup>5,6</sup> It can be classified into type one, which is focal with a transitional zone, and type two, which is diffuse without a transitional zone. The transitional zone in type one often shows fewer, or no ganglion cells compared to the proximal dilated segment of the colon.<sup>7</sup>

The clinical presentation of intestinal hypoganglionosis involves long-term constipation and may include acute intestinal obstruction, abdominal distension, and ongoing constipation. Gas retention in the abdomen can cause pain. Common imaging tests, such as abdominal x-ray and CT scans, often show signs of intestinal blockage.<sup>6</sup> A significantly enlarged proximal colon segment with a transitional zone and a narrow distal segment on CT in a patient with chronic, unresponsive constipation typically indicates hypoganglionosis. Barium enema images usually support these findings to confirm the diagnosis.<sup>8</sup>

The management of hypoganglionosis involves surgical resection, which may include either a segmental resection of the colon or a subtotal colectomy. The most common complications observed are frequent and loose stools, especially in patients who have undergone a subtotal colectomy, while other complications, such as anastomotic leaks and enterocutaneous fistulas, are noted as rare. The choice of surgical procedure depends on the patient's presentation and the affected segment of hypoganglionosis.<sup>9-11</sup> This case report highlights the importance of the role of hypoganglionosis in chronic constipation in adults. After performing radiological investigations, performing serial biopsies may be beneficial in these patients; however, these have to be full-thickness biopsies, which may hinder their use in preoperative investigations of these patients.<sup>12,13</sup>

### CONCLUSION

Hypoganglionosis of the colon is a rare cause of intestinal obstruction in adults, and it is crucial to establish the diagnosis for proper management and to prevent complications. These patients should be monitored for recurrent constipation to avoid issues like acute intestinal obstruction.

### CONFLICTS OF INTEREST

There is no conflict of interest.

### REFERENCES

1. Meier-Ruge W. Epidemiology of congenital innervation defects of the distal colon. *Virchows Arch A Pathol Anat Histopathol.* 1992;420(2):171-7. doi: 10.1007/BF02358809.
2. Dingemann J, Puri P. Isolated hypoganglionosis: systematic review of a rare intestinal innervation defect. *Pediatr Surg Int.* 2010;26(11):1111-5. doi: 10.1007/s00383-010-2693-3.
3. Lee A, Suhardja TS, Simpson I, et al. Rare case of adult intestinal hypoganglionosis and review of the literature. *Clin J Gastroenterol.* 2021;14(2):599-607. doi: 10.1007/s12328-021-01342-5.
4. Knowles CH, De Giorgio R, Kapur RP, et al. Gastrointestinal neuromuscular pathology: guidelines for histological techniques and reporting on behalf of the Gastro 2009 International Working Group. *Acta Neuropathol.* 2009;118(2):271-301. doi: 10.1007/s00401-009-0527-y.
5. Do MY, Myung SJ, Park HJ, et al. Novel classification and pathogenetic analysis of hypoganglionosis and adult-onset Hirschsprung's disease. *Dig Dis Sci.* 2011;56(6):1818-27. doi: 10.1007/s10620-010-1522-9.
6. Taguchi T, Masumoto K, Ieiri S, et al. New classification of hypoganglionosis: congenital and acquired hypoganglionosis. *J Pediatr Surg.* 2006;41(12):2046-51. doi: 10.1016/j.jpedsurg.2006.08.004.
7. Schärli AF, Sossai R. Hypoganglionosis. *Semin Pediatr Surg.* 1998;7(3):187-91. doi: 10.1016/s1055-8586(98)70016-2.
8. Kim HJ, Kim AY, Lee CW, et al. Hirschsprung disease and hypoganglionosis in adults: radiologic findings and differentiation. *Radiology.* 2008;247(2):428-34. doi: 10.1148/radiol.2472070182.
9. Zhang HY, Feng JX, Huang L, et al. Diagnosis and surgical treatment of isolated hypoganglionosis. *World J Pediatr.* 2008;4(4):295-300. doi: 10.1007/s12519-008-0053-3.
10. Kwok AM, Still AB, Hart K. Acquired segmental colonic hypoganglionosis in an adult Caucasian male: A case report. *World J Gastrointest Surg.* 2019;11(2):101-111. doi: 10.4240/wjgs.v11.i2.101.
11. Qadir I, Salick MM, Barakzai A, et al. Isolated adult hypoganglionosis presenting as sigmoid volvulus: a case report. *J Med Case Rep.* 2011;5:445. doi: 10.1186/1752-1947-5-445.
12. Crocker NL, Messmer JM. Adult Hirschsprung's disease. *Clin Radiol.* 1991;44(4):257-9. doi: 10.1016/s0009-9260(05)80191-6.
13. Wheatley MJ, Wesley JR, Coran AG, et al. Hirschsprung's disease in adolescents and adults. *Dis Colon Rectum.* 1990;33(7):622-9. doi: 10.1007/BF02052222.

# Progression of Vascular Pythiosis and Management of Intra-Abdominal Arterial Involvement

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## Abstract

Intra-abdominal vascular pythiosis is a rare, life- and limb-threatening infection caused by *Pythium insidiosum*. A 36-year-old Thai male with thalassemia presented with a chronic left leg ulcer that progressed despite debridement, leading to a below-knee amputation (BKA). Post-BKA, chronic osteomyelitis necessitated an above-knee amputation (AKA). The stump failed to heal, and intra-abdominal vascular pythiosis was diagnosed using PCR and computed tomography angiography (CTA), which revealed extensive arterial occlusion. Management included antifungal and antibacterial therapy, high AKA, and arterial resection. Over 36 months, the patient showed clinical improvement with stable inflammatory markers. Timely diagnosis of vascular pythiosis is essential for optimizing treatment outcomes, and radical surgical resection continues to serve as the cornerstone of effective therapy.

**Keywords:** Intra-abdominal vascular pythiosis, Antifungal agent, Antibacterial agent

## INTRODUCTION

Vascular pythiosis is a rare disease but serious life- and limb-threatening infection caused by *Pythium insidiosum*, a fungus-like organism endemic in Thailand. The clinical conditions are classified into four groups: cutaneous/subcutaneous, vascular, ocular, and disseminated.<sup>1</sup> In 1989, vascular pythiosis was reported.<sup>2</sup> Factors predisposing to the arteritis caused by *P. insidiosum* are not entirely identified, but arteritis occurs most often in patients with hemoglobinopathies, particularly thalassemia, which are relatively common in Thailand.<sup>3</sup> The current effective management is the combination of surgery and medication. Particularly, the surgical management must be a

radical amputation above the area of the arterial lesion.<sup>4</sup> Vascular pythiosis is typically located in the infrainguinal area. In contrast, intra-abdominal extension of the disease can influence the outcome and result in a higher mortality rate.<sup>5</sup> This case report demonstrates the progression of vascular pythiosis in the lower extremity and the management of intra-abdominal vascular pythiosis.

## CASE REPORT

The patient is a 36-year-old Thai male with a history of thalassemia (HbH disease with HbCS). He was pierced by a stick on the medial side of his left lower leg while working in the field. One week after the accident,

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he noticed a small ulcer, pain, swelling, redness, and tenderness. He was diagnosed with cellulitis and treated with oral antibiotics at the community hospital.

One month later, the medial aspect of his left leg developed a larger wound with black edges, and the wound also extended to the lateral aspect of his left leg. He was referred to a tertiary hospital and admitted to the surgical ward. According to the physical examinations, he had a thalassemic facial appearance, a fever, and a wound on his left leg. His pulses were normal in all extremities except for the left posterior tibial artery, where the pulse was absent, though a biphasic Doppler signal was detected. He underwent debridement of the left leg (Tissue culture revealed *Staphylococcus aureus*). During his five-day hospital stay, he was treated with a combination of a third-generation cephalosporin and clindamycin. After discharge, he was prescribed oral antibiotics to continue at home for ten days.

Two months after debridement, the wound on the left leg showed progressive necrotic tissue with pus oozing from both the medial and lateral aspects. (Figure 1A) The surgeon decided to perform a below-knee amputation (BKA) due to an infection deep within the muscle. After the surgical intervention, the wound had completely healed.

One year after the BKA, he noticed swelling, redness, and a limited range of motion in his left knee. He went to a community hospital, where he was diagnosed with chronic osteomyelitis and septic arthritis of the left knee. He underwent a left knee arthrotomy. After two arthrotomies, his condition improved.

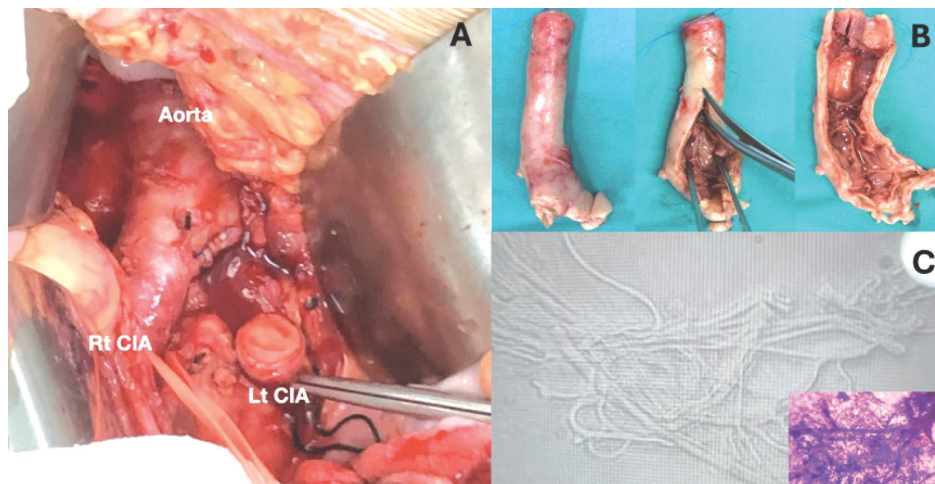
Seven months after arthrotomy, the left knee arthrotomy wound had pus with necrotic tissue again. (Figures 1B and 1C) He was again diagnosed with chronic osteomyelitis and septic arthritis in his left knee. The surgeon decided to perform an above-knee amputation (AKA) due to chronic osteomyelitis.



**Figure 1** Wound on the left leg after debridement (A), Seven months after arthrotomy, the left knee arthrotomy wound had pus with necrotic tissue. (B), and the X-ray shows osteomyelitis with air around the left knee joint (C).

One month after the AKA, the wound remained unhealed, and the AKA stump was infected. During the examination, the physical exam revealed an impalpable common femoral artery (CFA) pulse, prompting a consultation with a vascular surgeon. The vascular surgeon ordered a computed tomography angiography (CTA), which demonstrated total occlusion of the left common iliac artery (CIA), internal iliac artery (IIA), external iliac artery (EIA), down to the proximal superficial femoral artery (SFA). The affected segments showed character-

istic features of vascular pythiosis, including concentric mural thickening, perivascular soft-tissue infiltration, and the absence of arterial calcification (Figure 2A). After obtaining the CTA, a *Pythium* infection was suspected, so a polymerase chain reaction (PCR) test for *Pythium insidiosum* was ordered, and the result confirmed to be positive. The inflammatory markers showed a very high Erythrocyte sedimentation rate (ESR) of 120 ml/hr and C-reactive protein (CRP) of 111.4 mg/L.



**Figure 2** Aneurysmal changes and inflammation of the CIA and EIA (A). Gross pathology after CIA excision showed pus and inflammation (B). CIA pus: 10% Potassium Hydroxide (KOH) and Gram stain (C).

The patient's management included the prompt initiation of antifungal therapy with itraconazole (200 mg twice daily) and antibacterial treatment with doxycycline (100 mg twice daily) and azithromycin (250 mg twice daily), along with surgical eradication of infected tissue. Using a retroperitoneal approach, findings revealed aneurysmal changes and inflammation of CIA and EIA. Prompt removal of CIA and EIA, ligation of IIA, and a high above-knee amputation (AKA) were performed (Figure 3A).

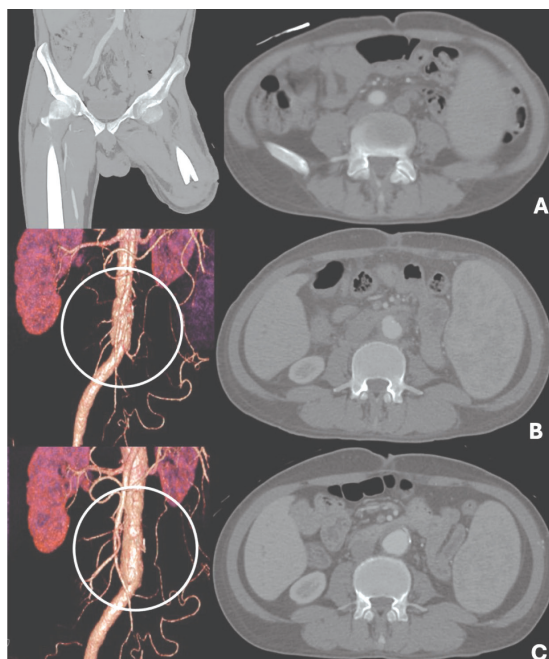
The pathological report showed no completely free margin of *Pythium* infection in CIA. Despite being advised to undergo reoperation, the patient declined.

Following surgical eradication, the patient's wound

healed well. Due to the surgical non-free margin for *Pythium* infection, lifelong treatment with itraconazole (antifungal), doxycycline, and azithromycin (antibacterials) was prescribed.<sup>6,7</sup>

After follow-up, the patient continued medical treatment. The inflammation markers, ESR and CRP, showed improvement. But CTA after 6 months showed dilatation of the abdominal aorta with suspected progression of vascular pythiosis (Figure 3B). We offered reoperation again, but he declined.

After 36 months of follow-up with lifelong medical treatment, CTA showed no progression of abdominal aortic aneurysm (Figure 3C), and both ESR and CRP were normal. The patient was still in good well-being.



**Figure 3** Preoperative CTA showed total occlusion of the left CIA, IIA, and EIA down to the proximal SFA (A). Postoperative CTA after 6 months showed dilatation of the abdominal aorta (B). Postoperative CTA after 36 months showed no progression of the abdominal aorta (C). Lifelong follow-up appointments, including clinical examinations and inflammatory marker tests such as ESR and CRP, were scheduled every 3 months, with a CTA scan at 3 months postoperatively and then every 6 months thereafter.

## DISCUSSION

In this case, although the presentation was typical of vascular pythiosis, early diagnosis was challenging because it resembled other soft-tissue infections, leading to a delayed diagnosis. This condition requires a high index of suspicion and is often recognized by vascular surgeons or clinicians familiar with this infection. For early diagnosis of vascular pythiosis, patients often present with a history of an underlying hematologic disease and a progressively worsening chronic wound with black edges, typically affecting the foot and ankle. In late-stage cases, pulses in the lower extremities may become impalpable. As a result, diagnosing this patient took up to 24 months from the initial medical consultation. Another helpful tool for diagnosis is CTA, which often reveals the crusty thrombosed arterial sign. This sign is characterized by diffuse thickening and irregular enhancement of the arterial wall along with long arterial thrombosis, without any skip lesions.<sup>8</sup>

In cases of suprainguinal pythiosis involvement, survival beyond 12 weeks post-diagnosis is rare. According to a literature review, effective management of suprainguinal pythiosis includes a combination of medical treatment and adequate surgical margins, which is associated with the highest likelihood of survival.<sup>6</sup>

In the operative technique, the non-infected common iliac artery was ligated proximally, and a short segment just distal to the arterial stump was sent for microscopic examination to confirm its freedom from pathogens. The arterial stump was then covered with noninfected adjacent tissue to protect it from potential contamination by pathogens.<sup>4</sup> This is similar to the surgery performed in this case. However, we did not send samples for intraoperative microscopic examination to confirm the margins. The surgical results for this case revealed that the pathological report indicated non-free margins of the proximal CIA. Inadequate assessment of the surgical-free margin at the time of surgery can lead to the progression of residual disease involving the proximal artery, such as the aorta, which may result in a poor prognosis.<sup>6</sup> Patients with CIA or aortic involvement who underwent aneurysmectomy with anatomical bypass grafting survived only a few months.<sup>9</sup> In our case, bypass grafting was not performed. Patients with disease involving the iliac vessels or the femoral artery may relapse, despite the negative surgical margin, given that the vessels are in the proximity of the aorta.<sup>7</sup> We recommended extra-anatomical bypass. Nevertheless, the patients in this report remained clinically

stable at 36 months post-diagnosis, likely due to the combination of antibacterial and antifungal agents they received. Given its effectiveness, this approach could serve as a promising strategy to combat this life-threatening disease and warrants further study.<sup>7,10</sup>

Diagnosis of vascular pythiosis relies on a combination of clinical suspicion, imaging findings, and confirmatory laboratory tests, as there are no universal guidelines due to its rarity. The disease should be suspected in patients with thalassemia or other hemoglobinopathies who present with chronic nonhealing ulcers or arterial occlusions unresponsive to standard therapy, particularly in endemic areas with water exposure. CTA typically demonstrates long-segment arterial occlusion with concentric mural thickening, perivascular soft tissue infiltration, and absence of calcification. Definitive diagnosis is achieved through histopathologic identification of broad, sparsely septate hyphae using GMS or PAS stains, culture or PCR detection of *Pythium insidiosum*, and supportive serologic testing such as immunodiffusion or ELISA. Surgical intervention to achieve organism-free margins of affected tissue, in combination with antibacterial and antifungal therapy, immunotherapy, remains the recommended treatment approach.<sup>1,5,8-10</sup>

Due to the lack of established follow-up guidelines, cases of vascular pythiosis at our center involve clinical and laboratory assessments, including monitoring inflammatory markers such as ESR and CRP every 3 months. Additionally, imaging with CTA is performed every 6 months to assess disease progression.

## CONCLUSION

In conclusion, the management of intra-abdominal vascular pythiosis requires a comprehensive approach. This includes optimized medical treatment, which is a combination of antibacterial and antifungal agents and immunotherapy with cytokine injections, as well as aggressive surgical removal of the infected artery. Additionally, continuous patient follow-up using inflammatory markers and imaging, such as CTA, is essential for improving survival outcomes.

Timely diagnosis of vascular pythiosis is essential for optimizing treatment outcomes, and radical surgical resection continues to serve as the cornerstone of effective therapy.

## CONFLICTS OF INTEREST

All authors have no conflicts of interest.

### ADDITIONAL NOTE

Patient consent for publication was obtained.

### AUTHOR CONTRIBUTIONS

**Study conception:** all authors

**Data collection:** all authors

**Writing:** all authors

**Critical review and revision:** all authors

**Final approval of the article:** all authors

**Accountability for all aspects of the work:** all authors

### REFERENCES

1. Krajaejun T, Sathapatayavongs B, Prachartam R, et al. Clinical and epidemiological analyses of human pythiosis in Thailand. *Clin Infect Dis.* 2006;43(5):569-76. doi: 10.1086/506353.
2. Sathapatayavongs B, Leelachaikul P, Prachaktam R, et al. Human pythiosis associated with thalassemia hemoglobinopathy syndrome. *J Infect Dis.* 1989;159(2):274-80. doi: 10.1093/infdis/159.2.274.
3. Laohapensang K, Rutherford RB, Supabandhu J, et al. Vascular pythiosis in a thalassemic patient. *Vascular.* 2009;17(4):234-8. doi: 10.2310/6670.2008.00073.
4. Hahtapornsawan S, Wongwanit C, Chinsakchai K, et al. Suprainguinal vascular pythiosis: effective long-term outcome of aggressive surgical eradication. *Ann Vasc Surg.* 2014;28(7):1797.e1-6. doi: 10.1016/j.avsg.2014.04.020.
5. Arworn S, Reanpang T, Apichartpiyakul P, et al. Retrospective review of management and overall survival rate of patients with vascular pythiosis of the lower extremity: 20 years experience. *Int J Low Extrem Wounds.* 2025;24(3):561-9. doi: 10.1177/15347346231214291.
6. Sermsathanasawadi N, Praditsuktavorn B, Hongku K, et al. Outcomes and factors influencing prognosis in patients with vascular pythiosis. *J Vasc Surg.* 2016;64(2):411-7. doi: 10.1016/j.jvs.2015.12.024.
7. Susaengrat N, Torvorapanit P, Plongla R, et al. Adjunctive antibacterial agents as a salvage therapy in relapsed vascular pythiosis patients. *Int J Infect Dis.* 2019;88:27-30. doi: 10.1016/j.ijid.2019.08.032.
8. Srisuwan T, Kattipatanapong T, Inmutto N, et al. Computed Tomography Finding of Crusty Thrombosed Arteries: An Appearance of Lower Extremity Vascular Pythiosis. *Int J Low Extrem Wounds.* 2024;15347346241266290. doi: 10.1177/15347346241266290.
9. Chitasombat MN, Jongkhajornpong P, Lekhanont K, et al. Recent update in diagnosis and treatment of human pythiosis. *PeerJ.* 2020;8:e8555. doi: 10.7717/peerj.8555.
10. Torvorapanit P, Chuleerarux N, Plongla R, et al. Clinical outcomes of radical surgery and antimicrobial agents in vascular pythiosis: a multicenter prospective study. *J Fungi (Basel).* 2021;7(2):114. doi: 10.3390/jof7020114.

# The Current Surgical Management of Complicated Left-Sided Colonic Diverticulitis: Narrative Review Article

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## Abstract

Acute left-sided diverticulitis represents the most prevalent form of acute diverticulitis and is categorized into two types: complicated and uncomplicated. The surgical intervention for complicated diverticulitis is classified into the Hartmann's procedure or sigmoid resection with anastomosis, accompanied by a protective ileostomy. Damage control surgery is indicated for patients with complicated left-sided diverticulitis who are hemodynamically unstable. Laparoscopic lavage serves as a bridging procedure in cases of complicated diverticulitis with purulent discharge or classified as Hinchey 3, aiming to stabilize the patient for subsequent definitive surgery. This review will examine the surgical management of complicated left-sided diverticulitis, with a focus on Hartmann's procedure and colonic resection with anastomosis. Additionally, we will explore the role of laparoscopic lavage in the context of complicated diverticulitis.

**Keywords:** Colonic diverticulitis, Hinchey classification, Laparoscopic lavage, Hartmann's procedure, Sigmoid colectomy, Sigmoid diverticulitis, Open surgery

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## INTRODUCTION

Diverticulitis is characterized by the inflammation of diverticula within the colon, with the sigmoid colon being the most affected region. It is classified into uncomplicated diverticulitis, marked by acute inflammation with or without phlegmon, and complicated diverticulitis, which involves diverticular inflammation accompanied by an abscess and perforation, with or without peritonitis. This condition is more prevalent in Western countries, with an incidence rate of 100 to 200 cases per 100,000 individuals. Left-sided colonic diverticulitis predominantly occurs in individuals over the age of 45 years and

exhibits an equal prevalence among males and females.<sup>1-4</sup> Risk factors for diverticulitis include a diet low in fiber, cigarette smoking, the use of medications such as steroids and non-steroidal anti-inflammatory drugs (NSAIDs), and obesity. Clinically, it presents as left-sided lower abdominal pain accompanied by fever, and laboratory investigations typically reveal leukocytosis and elevated C-reactive protein (CRP) levels. Computed tomography is the most employed imaging modality for confirming the diagnosis of diverticulitis.<sup>5</sup>

Diverticulitis is categorized according to the Hinchey classification system into four stages: Stage 1,

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characterized by a localized abscess; Stage 2, involving a pelvic, intra-abdominal, or retroperitoneal abscess; Stage 3, defined by purulent, generalized peritonitis; and Stage 4, marked by feculent, generalized peritonitis. The modified Hinchey classification subdivides Stage 1 into Stage 1a, which involves confined pericolic inflammation or phlegmon, and Stage 1b, characterized by a confined pericolic abscess within the sigmoid mesocolon.<sup>6</sup> Managing uncomplicated diverticulitis typically involves a low-fiber diet, analgesics, antipyretics, and the selective use of antibiotics. In contrast, the management of complicated diverticulitis is divided into medical treatment for small abscesses less than 5 cm, which involves the use of antibiotics. Surgical management of complicated diverticulitis may involve performing a Hartmann's procedure or a sigmoid resection with an anastomosis, with or without diversion, depending on the patient's presentation.<sup>7-12</sup>

Laparoscopic lavage can be employed as a bridging procedure for complicated diverticulitis with purulent discharge to stabilize the patient and perform a definitive sigmoid resection later. However, laparoscopic lavage is associated with a high recurrence rate, and the selection of patients for elective surgery later is essential.<sup>13</sup> Laparoscopic sigmoid resection for complicated sigmoid diverticulitis is feasible; however, further studies are needed to validate its use in the emergency management of left-sided diverticular disease. Laparoscopic sigmoid resection for complicated sigmoid diverticulitis is feasible; however, further studies are required to validate its use

in the emergency management of left-sided diverticular disease. Laparoscopic sigmoid resection and Hartmann's procedure are performed in selected patients and tertiary high-volume centers, but it is mainly indicated for elective surgical resection.<sup>14</sup>

The surgical management of left-sided colonic diverticulitis has undergone gradual evolution. Hartmann's procedure remains the predominant emergency surgical intervention performed. However, sigmoid resection with a protective ileostomy is increasingly being recognized as a viable option for the emergency management of left-sided colonic diverticulitis. This review article has been conducted to explore the surgical management strategies available for treating left-sided colonic diverticulitis. Additionally, the role of laparoscopic lavage in managing left-sided colonic diverticulitis has been examined. A comprehensive literature review was conducted using PUBMED, the Cochrane Database of Clinical Reviews, Semantic Scholar, and Google Scholar, focusing on clinical trials, observational studies, cohort studies, systematic reviews, and meta-analyses from 1990 to 2025. The search employed the following keywords: "Sigmoid diverticulitis," "Hinchey classification," "Colonic diverticulitis," "Hartmann's procedure," "Sigmoid colectomy," "Laparoscopic lavage," and "open surgery." All articles were restricted to the English language. Additional articles were identified through manual cross-referencing of the literature. Case reports, studies with fewer than 10 patients, and editorials were excluded. The study included adult male and female patients.

**Table 1** Showing the Hinchey and Modified Hinchey classification

Hinchey Classification	Modified Hinchey Classification
Stage 1-abscess less than 4 cm	Stage 1a-Confined pericolic inflammation Stage 1b-Confined pericolic abscess less than 4 cm, from the inflammation
Stage 2-abscess more than 4 cm	Stage 2-Diverticulitis with abscess distant from the primary inflammatory site (Intra-abdominal, retroperitoneal, or pelvic)
Stage 3-purulent peritonitis	Stage 3-Generalized purulent peritonitis
Stage 4-feculent peritonitis	Stage 4-Generalized feculent peritonitis

## DISCUSSION

### *The surgical management of complicated left-sided diverticular disease*

The World Society of Emergency Surgeons (WSES) has issued guidelines for the management of colonic di-

verticulitis in acute settings, recommending Hartmann's procedure for critically ill patients and those with multiple comorbidities. For stable patients without comorbidities, sigmoid resection with or without anastomosis is advised. Laparoscopic resection is suggested only if the necessary

equipment and expertise are available.<sup>15,16</sup> The American Society of Colon and Rectal Surgeons (ASCR) advocates for sigmoid resection in the emergency surgical management of acute left-sided colonic diverticulitis, with the choice between anastomosis or stoma being contingent upon patient-specific factors and the operating surgeon's discretion.<sup>17</sup> German guidelines recommend primary resection and anastomosis of the sigmoid colon with a protective ileostomy for patients with acute stable diverticular disease, reserving the Hartmann's procedure for unstable patients.<sup>18</sup> Similarly, the European Association of Emergency Surgeons (EAES) and the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) have provided evidence-based recommendations that align with these practices for the surgical management of acute left-sided diverticulitis.<sup>19</sup>

The surgical management of complicated left-sided colonic diverticulitis is contingent upon the patient's stability and the presence of peritonitis. Surgical interventions can be categorized into Hartmann's procedure or sigmoid resection with anastomosis, accompanied by a protective ileostomy. Traditionally, Hartmann's procedure has been the preferred emergency operation, while sigmoid resection is reserved for selected patients. The choice of procedures is typically determined by the operating surgeon.<sup>20,21</sup> A systematic review and meta-analysis conducted by Cirocchi et al. examined the treatment of Hinchey stages 3 and 4, incorporating fourteen studies with a total of 1,041 patients. The findings indicated that patients who underwent sigmoid resection experienced reduced mortality and shorter hospital stays compared to those who underwent Hartmann's procedure.<sup>22</sup> A similar systematic review and meta-analysis by Halim et al. also concluded that primary resection anastomosis was associated with reduced mortality.<sup>23</sup>

Ryan et al performed a systematic review and meta-analysis comparing primary resection and anastomosis versus Hartmann's procedure for the management of acute diverticulitis with generalized peritonitis. Twelve studies with 918 patients were included, of which 367 underwent primary resection and anastomosis, and 551 underwent Hartmann's procedure. There was no difference in the 30-day mortality rate, but the primary resection and anastomosis group was associated with a reduced morbidity and permanent stoma rate.<sup>24</sup> Acuna et al conducted a systematic review and meta-analysis on the operative strategies for perforated diverticulitis.

Six studies involving 626 patients were included in this analysis, and the mortality rate between the Hartmann's procedure and primary resection and anastomosis was similar. However, the morbidity and stoma reversal rates were better in the primary resection group.<sup>25</sup> Another systematic review and meta-analysis comparing resection with primary anastomosis vs non-restorative resection for perforated diverticulitis with peritonitis, which was conducted by Gachabayov et al., also concluded that the mortality rate was similar between both groups.<sup>26</sup>

A systematic review on emergency surgery in acute diverticulitis was conducted by Beyer-Berjot et al. The review included seventy-one studies, revealing that patients who underwent Hartmann's procedure experienced poorer long-term outcomes and a higher rate of non-stoma reversal.<sup>27</sup> A prospective, randomized, multicenter trial (DIVERTI) was conducted by Bridoux et al., comparing the Hartmann's procedure with primary resection for generalized peritonitis due to perforated diverticulitis. This study included 102 patients and found that morbidity and mortality rates were similar between the two groups; however, the rate of stoma reversal was 96% in the primary resection group compared to 65% in the Hartmann's group.<sup>28</sup> The long-term outcomes from the prospective multicenter randomized trial (DIVERTI) comparing the Hartmann's procedure and primary resection for perforated peritonitis were examined by Loire et al. Seventy-eight of the one hundred and two patients were followed up for nine years, and the overall survival rate was 76%, with an incisional hernia rate of 52% in the Hartmann's group and 29% in the primary resection group. This study concluded that primary resection did not affect the long-term survival rate.<sup>29</sup> A multivariate logistic regression analysis of the long-term outcomes of primary anastomosis versus Hartmann's procedure for Hinchey 3 and 4 that was conducted by Facile et al also reported the same conclusions.<sup>30</sup>

A systematic review and meta-analysis conducted by Shaban et al. examined the outcomes of perforated diverticulitis with or without anastomosis. The study encompassed a total of 765 patients, of whom 482 underwent the Hartmann's procedure, while 283 underwent primary resection anastomosis. The mortality rate was observed to be 10.6% in the primary resection group, compared to 20.7% in the Hartmann's procedure group. Additionally, the morbidity rate was 41.8% for the primary resection group and 51.2% for those who underwent the Hartmann's

procedure. The study concluded that primary resection anastomosis is a feasible and safe approach for managing perforated diverticulitis.<sup>31</sup>

### *Minimally invasive surgical management of complicated left-sided diverticulitis*

The minimally invasive surgical management of complicated diverticulitis can be categorized into laparoscopic primary resection, anastomosis, and Hartmann's procedure. However, their application in cases of complicated diverticulitis is advised only when the requisite expertise is available. Laparoscopic lavage represents another minimally invasive technique, primarily employed in patients with Hinchey grade 3. It serves mainly as a bridging procedure to stabilize patients, allowing for an elective procedure once their clinical condition has improved.<sup>32</sup> The laparoscopic approach for complicated diverticulitis has been associated with reduced morbidity and mortality compared to the open procedure. Additionally, patients who underwent the laparoscopic approach experienced better outcomes in terms of analgesia use and early ambulation.<sup>33,34</sup>

Laparoscopic lavage drainage was a minimally invasive procedure for patients with Hinchey grade 3 diverticulitis. It involves draining the purulent material in the left iliac fossa and pelvis, performing an abdominal lavage, and placing a drain in the abdomen to allow subsequent drainage of all purulent material. It was used as a bridging procedure to stabilize the patient and perform an elective sigmoid resection later.<sup>35-37</sup> Laparoscopic lavage is associated with reduced morbidity and mortality, but it is associated with a risk of missing sealed perforation, fecal peritonitis, and underlying sigmoid malignancy.<sup>38</sup> The Diverticulitis-laparoscopic lavage versus resection (Hartmann's procedure) or DILALA randomized clinical trial compared laparoscopic lavage with resection for the treatment of perforated diverticulitis by Kohl et al. Eighty-three patients were randomized to forty-three for laparoscopic lavage, and forty underwent the Hartmann's procedure. The patients in the lavage group had a 45% reduced risk of reoperation when compared to the Hartmann's procedure group, and there was no difference in mortality between the groups.<sup>39</sup>

The Scandinavian Diverticulitis trial (SCANDIV) was a multicenter randomized controlled trial conducted

across several hospitals in Norway and Sweden. A total of 199 patients were randomized, with 101 undergoing laparoscopic lavage and 98 undergoing colonic resections. The one-year results indicated no significant difference in mortality between the groups; however, laparoscopic lavage was associated with higher rates of deeper surgical site infections and reoperations compared to the surgical resection group.<sup>40</sup> The three-year follow-up of these patients revealed minimal differences in major complication rates, yet the recurrence rate was 21% in the lavage group compared to 4% in the resection group. This trial demonstrated that laparoscopic lavage was associated with a higher recurrence rate.<sup>41</sup>

The Laparoscopic Peritoneal Lavage or Sigmoidectomy for Perforated Diverticulitis with Purulent Peritonitis (LOLA) multicenter randomized trial was conducted in 42 hospitals across Europe. A total of 90 patients were randomized to undergo laparoscopic lavage and sigmoid resection, but due to the high mortality in both the lavage groups, this trial was terminated.<sup>42</sup> A three-year follow-up of 77 patients from the original randomized group, the cumulative morbidity and mortality between both groups were similar, and the reoperation rate was lower in the laparoscopic lavage group. This study concluded that laparoscopic lavage was associated with reduced reoperation rate and stoma formation.<sup>43</sup>

Shaikh et al. conducted a systematic review and meta-analysis to compare laparoscopic peritoneal lavage with surgical resection for the treatment of perforated sigmoid diverticulitis. This study incorporated three studies involving a total of 372 patients. The findings indicated that laparoscopic lavage was associated with a higher incidence of postoperative abscesses, although the mortality rate was comparable between the two groups.<sup>44</sup> Similarly, Cirocchi et al. performed a systematic review and meta-analysis on the same comparison, including three studies with 540 patients. Their results also demonstrated a higher postoperative abscess rate in the laparoscopic lavage group, with no significant difference in mortality rates between the lavage and surgical resection groups.<sup>45</sup> Additionally, a systematic review focusing on laparoscopic lavage for managing Hinchey grade 3 diverticulitis concluded that the recurrence rate was elevated in the laparoscopic lavage group.<sup>46</sup>

**Table 2** Shows the complication rates between laparoscopic peritoneal lavage (LPL) and surgical resection for the SCANDIV and DILALA trials.

Study	Study type	Year	N = numbers (%)	Mortality Rate Rate (%)	Complication Rate (%)	Recurrence Rate (%)
Diverticulitis-laparoscopic lavage versus resection (Hartmann's procedure)-DILALA trial-Schultz et al.	Randomized controlled trial	2018	83-total Patients 43-laparoscopic peritoneal lavage (LPL) 40-Hartmann's procedure (HP)	LPL-12 HP-11	LPL-27 HP-20	LPL-28 HP-29
Scandinavian diverticulitis trial (SCANDIV)-Azhar et al.	Randomized controlled trial	2020	199 total patients 101-laparoscopic peritoneal lavage (LPL) 98-Colon Resection (CR)	LPL-32 CR-25	LPL-29 CR-25	LPL-21 CR-4

### Damage control surgery for complicated left-sided diverticulitis

Damage control surgery is a multistep procedure employed for patients with complex left-sided diverticular disease who are hemodynamically unstable. This procedure entails the resection of the perforated colon, the creation of stapled-off stumps, and peritoneal lavage. The abdomen is temporarily closed, and the management of sepsis and fluid resuscitation is conducted in the intensive care unit for a period of 24 to 48 hours. Subsequently, the patient is returned to the operating theatre for either anastomosis or stoma formation.<sup>47,48</sup> Sohn et al. analyzed the application of damage control surgery in the treatment of perforated diverticulitis with generalized peritonitis, concluding that it is a safe procedure associated with a reduced morbidity rate.<sup>49</sup>

A systematic review and meta-analysis conducted by Cirocchi et al. examined the role of damage control surgery in the management of perforated colonic diverticulitis. This study incorporated nine studies encompassing a total of 318 patients. The most prevalent category was Hinchey 3, accounting for 68.3% of cases, while Hinchey 4 constituted 28.9%. Resection with primary anastomosis was successfully performed in 62.1% of cases, with a major anastomotic leak rate of 4.7% and a mortality rate of 9.2%. The findings indicate that damage control surgery is a feasible option for managing complicated diverticular disease in hemodynamically unstable patients; however, further research is necessary to assess its efficacy comprehensively.<sup>50</sup>

### CONCLUSION

Complicated left-sided diverticular disease presents a significant clinical challenge, particularly when perforation is involved. The most frequently performed surgical intervention is Hartmann's procedure, which is relatively straightforward for the operating surgeon. However, due to the high rate of non-reversibility associated with the stoma, there is an increasing preference for sigmoid resection and anastomosis with a protective ileostomy. Laparoscopic lavage serves as a crucial interim procedure, facilitating patient stabilization and enabling subsequent resection and anastomosis once stabilization is achieved. Damage control surgery is a viable option only in facilities equipped with robust intensive care unit support. Ultimately, the decision regarding the appropriate surgical approach rests with the operating surgeon.

### CONFLICTS OF INTEREST

There is no conflict of interest.

### REFERENCES

1. Peery AF. Management of colonic diverticulitis. *BMJ*. 2021;372:n72. doi: 10.1136/bmj.n72.
2. Ambrosetti P, Gervaz P. Management of sigmoid diverticulitis: an update. *Updates Surg*. 2016;68(1):25-35. doi: 10.1007/s13304-016-0365-0.
3. Kaise M, Nagata N, Ishii N, et al. Epidemiology of colonic diverticula and recent advances in the management of colonic diverticular bleeding. *Dig Endosc*. 2020;32(2):240-50. doi: 10.1111/den.13547.
4. Bhatia M, Mattoo A. Diverticulosis and diverticulitis: epidemiology, pathophysiology, and current treatment trends. *Cureus*. 2023;15(8):e43158. doi: 10.7759/cureus.43158.

5. Hanna MH, Kaiser AM. Update on the management of sigmoid diverticulitis. *World J Gastroenterol.* 2021;27(9):760-81. doi: 10.3748/wjg.v27.i9.760.
6. Hawkins AT, Wise PE, Chan T, et al. Diverticulitis: an update from the age old paradigm. *Curr Probl Surg.* 2020;57(10):100862. doi: 10.1016/j.cpsurg.2020.100862.
7. You H, Sweeny A, Cooper ML, et al. The management of diverticulitis: a review of the guidelines. *Med J Aust.* 2019;211(9):421-7. doi: 10.5694/mja2.50276.
8. Horesh N, Wasserberg N, Zbar AP, et al. Changing paradigms in the management of diverticulitis. *Int J Surg.* 2016;33 Pt A:146-50. doi: 10.1016/j.ijsu.2016.07.072.
9. Nally DM, Kavanagh DO. Current Controversies in the Management of Diverticulitis: A Review. *Dig Surg.* 2019;36(3):195-205. doi: 10.1159/000488216.
10. Lumpkin ST, Chaumont N. Management of Freely Perforated Diverticulitis. *Dis Colon Rectum.* 2019;62(10):1153-6. doi: 10.1097/DCR.0000000000001457.
11. Stocchi L. Current indications and role of surgery in the management of sigmoid diverticulitis. *World J Gastroenterol.* 2010;16(7):804-17. doi: 10.3748/wjg.v16.i7.804.
12. Koprowski MA, Affleck A, Tsikitis VL. Emerging evidence and recent controversies in diverticulitis: a 5-year review. *Ann Gastroenterol.* 2022;35(1):8-16. doi: 10.20524/aog.2021.0677.
13. Deery SE, Hodin RA. Management of diverticulitis in 2017. *J Gastrointest Surg.* 2017;21(10):1732-41. doi: 10.1007/s11605-017-3404-3.
14. Collins D, Winter DC. Laparoscopy in diverticular disease: Controversies. *Best Pract Res Clin Gastroenterol.* 2014;28(1):175-82. doi: 10.1016/j.bpg.2013.11.014.
15. Sartelli M, Catena R, Ansaloni L, et al. WSES Guidelines for the management of acute left sided colonic diverticulitis in the emergency setting. *World J Emerg Surg.* 2016;11:37. doi:10.1186/s13017-016-0095-0.
16. Sartelli M, Weber DG, Kluger Y, et al. 2020 update of the WSES guidelines for the management of acute colonic diverticulitis in the emergency setting. *World J Emerg Surg.* 2020;15(1):32. doi:10.1186/s13017-020-00313-4.
17. Hall J, Hardiman K, Lee S, et al. The American Society of Colon and Rectal Surgeons clinical practice guidelines for the treatment of left-sided colonic diverticulitis. *Dis Colon Rectum.* 2020;63(6):728-47. doi:10.1097/DCR.0000000000001679.
18. Kruis W, Germer CT, Böhm S, et al. German guideline diverticular disease/diverticulitis: Part II: Conservative, interventional and surgical management. *United European Gastroenterol J.* 2022;10(9):940-957. doi:10.1002/ueg2.12313.
19. Francis NK, Sylla P, Abou-Khalil M, et al. EAES and SAGES 2018 consensus conference on acute diverticulitis management: evidence-based recommendations for clinical practice. *Surg Endosc.* 2019;33(9):2726-41. doi:10.1007/s00464-019-06882-z.
20. Meara MP, Alexander CM. Emergency presentations of diverticulitis. *Surg Clin North Am.* 2018;98(5):1025-46. doi:10.1016/j.suc.2018.06.006.
21. Khan A, Hawkins AT. Challenging Surgical Dogma: Controversies in Diverticulitis. *Surg Clin North Am.* 2021;101(6):967-980. doi:10.1016/j.suc.2021.05.024.
22. Cirocchi R, Trastulli S, Desiderio J, et al. Treatment of Hinchey stage III-IV diverticulitis: a systematic review and meta-analysis. *Int J Colorectal Dis.* 2013;28(4):447-457. doi:10.1007/s00384-012-1622-4.
23. Halim H, Askari A, Nunn R, et al. Primary resection anastomosis versus Hartmann's procedure in Hinchey III and IV diverticulitis. *World J Emerg Surg.* 2019;14:32. doi:10.1186/s13017-019-0251-4.
24. Ryan OK, Ryan ÉJ, Creavin B, et al. Systematic review and meta-analysis comparing primary resection and anastomosis versus Hartmann's procedure for the management of acute perforated diverticulitis with generalised peritonitis. *Tech Coloproctol.* 2020;24(6):527-43. doi:10.1007/s10151-020-02172-2.
25. Acuna SA, Wood T, Chesney TR, et al. Operative strategies for perforated diverticulitis: a systematic review and meta-analysis. *Dis Colon Rectum.* 2018;61(12):1442-53. doi:10.1097/DCR.0000000000001149.
26. Gachabayov M, Oberkofler CE, Tuech JJ, et al. Resection with primary anastomosis vs nonrestorative resection for perforated diverticulitis with peritonitis: a systematic review and meta-analysis. *Colorectal Dis.* 2018;20(9):753-770. doi:10.1111/codi.14237.
27. Beyer-Berjot L, Maggiori L, Loiseau D, et al. Emergency Surgery in Acute Diverticulitis: A Systematic Review. *Dis Colon Rectum.* 2020;63(3):397-405. doi:10.1097/DCR.0000000000001327.
28. Bridoux V, Regimbeau JM, Ouaiissi M, et al. Hartmann's Procedure or Primary Anastomosis for Generalized Peritonitis due to Perforated Diverticulitis: A Prospective Multicenter Randomized Trial (DIVERTI). *J Am Coll Surg.* 2017;225(6):798-805. doi:10.1016/j.jamcollsurg.2017.09.004.
29. Loire M, Bridoux V, Mege D, et al. Long-term outcomes of Hartmann's procedure versus primary anastomosis for generalized peritonitis due to perforated diverticulitis: follow-up of a prospective multicenter randomized trial (DIVERTI). *Int J Colorectal Dis.* 2021;36(10):2159-64. doi:10.1007/s00384-021-03962-2.
30. Facile I, Galli R, Dinter P, et al. Short- and long-term outcomes for primary anastomosis versus Hartmann's procedure in Hinchey III and IV diverticulitis: a multivariate logistic regression analysis of risk factors. *Langenbecks Arch Surg.* 2021;406(1):121-9. doi:10.1007/s00423-020-02015-6.
31. Shaban F, Carney K, McGarry K. Perforated diverticulitis: To anastomose or not to anastomose? A systematic review and meta-analysis. *Int J Surg.* 2018;58:11-21. doi:10.1016/j.ijsu.2018.08.009.
32. McDermott FD, Collins D, Heeney A, Winter DC. Minimally invasive and surgical management strategies tailored to the severity of acute diverticulitis. *Br J Surg.* 2014;101(1):e90-e99. doi:10.1002/bjs.9359.
33. Mbadiwe T, Obirize AC, Cornwell EE 3rd, et al. Surgical management of complicated diverticulitis: a comparison of the laparoscopic and open approaches. *J Am Coll Surg.* 2013;216(4):782-8. doi:10.1016/j.jamcollsurg.2013.02.003.
34. Desai GS, Narkhede R, Pande P, et al. An outcome analysis of laparoscopic management of diverticulitis. *Indian J Gastroenterol.* 2018;37(5):430-8. doi:10.1007/s12664-018-0907-0.
35. Daher R, Barouki E, Chouillard E. Laparoscopic treatment of complicated colonic diverticular disease: A review. *World J Gastrointest Surg.* 2016;8(2):134-42. doi:10.4240/wjgs.v8.i2.134.

36. Biffi WL, Moore FA, Moore EE. What is the current role of laparoscopic lavage in perforated diverticulitis? *J Trauma Acute Care Surg.* 2017;82(4):810-3. doi:10.1097/TA.0000000000001390.
37. Papagrorgoriadis S, Charalampopoulos A. Surgery for diverticular peritonitis. *Front Med (Lausanne).* 2025;12:1501734. doi:10.3389/fmed.2025.1501734.
38. Kiely MX, Yao M, Chen L. Laparoscopic Lavage in the Management of Hinchey III/IV Diverticulitis. *Clin Colon Rectal Surg.* 2021;34(2):104-12. doi:10.1055/s-0040-1716702.
39. Kohl A, Rosenberg J, Bock D, et al. Two-year results of the randomized clinical trial DILALA comparing laparoscopic lavage with resection as treatment for perforated diverticulitis. *Br J Surg.* 2018;105(9):1128-34. doi:10.1002/bjs.10839.
40. Schultz JK, Wallon C, Bleic L, et al. One-year results of the SCANDIV randomized clinical trial of laparoscopic lavage versus primary resection for acute perforated diverticulitis. *Br J Surg.* 2017;104(10):1382-1392. doi:10.1002/bjs.10567.
41. Azhar N, Johanssen A, Sundström T, et al; SCANDIV Study Group. Laparoscopic Lavage vs Primary Resection for Acute Perforated Diverticulitis: Long-term Outcomes From the Scandinavian Diverticulitis (SCANDIV) Randomized Clinical Trial. *JAMA Surg.* 2021;156(2):121-7. doi:10.1001/jamasurg.2020.5618.
42. Vennix S, Musters GD, Mulder IM, et al. Laparoscopic peritoneal lavage or sigmoidectomy for perforated diverticulitis with purulent peritonitis: a multicentre, parallel-group, randomised, open-label trial. *Lancet.* 2015;386(10000):1269-77. doi:10.1016/S0140-6736(15)61168-0.
43. Hoek VT, Edomskis PP, Stark PW, Lambrichts DPV, Draaisma WA, Consten ECJ, et al; LADIES trial collaborators. Laparoscopic peritoneal lavage versus sigmoidectomy for perforated diverticulitis with purulent peritonitis: three-year follow-up of the randomised LOLA trial. *Surg Endosc.* 2022 Oct;36(10):7764-7774. doi: 10.1007/s00464-022-09326-3. Epub 2022 May 23. PMID: 35606544; PMCID: PMC9485102.
44. Shaikh FM, Stewart PM, Walsh SR, et al. Laparoscopic peritoneal lavage or surgical resection for acute perforated sigmoid diverticulitis: A systematic review and meta-analysis. *Int J Surg.* 2017;38:130-7. doi:10.1016/j.ijso.2017.01.020.
45. Cirocchi R, Di Saverio S, Weber DG, et al. Laparoscopic lavage versus surgical resection for acute diverticulitis with generalised peritonitis: a systematic review and meta-analysis. *Tech Coloproctol.* 2017;21(2):93-110. doi:10.1007/s10151-017-1585-0.
46. Marshall JR, Buchwald PL, Gandhi J, et al. Laparoscopic Lavage in the Management of Hinchey Grade III Diverticulitis: A Systematic Review. *Ann Surg.* 2017;265(4):670-6. doi:10.1097/SLA.0000000000002005.
47. Cirocchi R, Sapienza P, Anania G, et al. State-of-the-art surgery for sigmoid diverticulitis. *Langenbecks Arch Surg.* 2022;407(1):1-14. doi:10.1007/s00423-021-02288-5.
48. Cirocchi R, Arezzo A, Vettoretto N, et al. Role of damage control surgery in the treatment of Hinchey III and IV sigmoid diverticulitis: a tailored strategy. *Medicine (Baltimore).* 2014;93(25):e184. doi:10.1097/MD.0000000000000184.
49. Sohn M, Agha A, Heitland W, et al. Damage control strategy for the treatment of perforated diverticulitis with generalized peritonitis. *Tech Coloproctol.* 2016;20(8):577-83. doi:10.1007/s10151-016-1506-7.
50. Cirocchi R, Popivanov G, Konaktchieva M, et al. The role of damage control surgery in the treatment of perforated colonic diverticulitis: a systematic review and meta-analysis. *Int J Colorectal Dis.* 2021;36(5):867-79. doi:10.1007/s00384-020-03784-8.