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Research Article

A Comparative Evaluation of Direct Pressure and Electrocautery Techniques for Hemorrhage Management in the Liver Bed during Laparoscopic Cholecystectomy

Hamidah Uref Rahila[1], Imam Bakhsh[2], Muhammad Bilal[3], Bushra Tasneem[4], Urooj Niazi[5], Raja Muhammad Adeel Khan[6]

[1]General and Laparoscopic Surgeon, Peoples University of Medical and Health Sciences Nawabshah Pakistan.
[2]Associate Professor General Surgery, Mekran Medical College Kech Turbat Pakistan.
[3]General and Laparoscopic Surgeon, Sheikh Khalifa Hospital Fujairah.
[4]Assistant Professor of Surgery, Karachi Metropolitan University / Abbasi Shaheed Hospital, Karachi Pakistan.
[5]House Officer Surgery and Medicine and Allied, Pakistan Institute of Medical Sciences Islamabad Pakistan.
[6]Assistant Professor General Surgery, Suleman Roshan Medical College Tando Adam Pakistan.
Email: [1]h.r.f.sandilo@gmail.com, [2]drimambakhshbaloch@gmail.com , [3]Mbghazipura@gmail.com, [4]ameerahmad1937@gmail.com, [5]uroojayazkhan@gmail.com, [6]rajamakhan@gmail.com

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Abstract

Background

Gallstone disease is highly prevalent, with laparoscopic cholecystectomy (LC) being the standard treatment. Bleeding from the liver bed is a common intraoperative challenge, typically managed by direct pressure or electrocauterization.

Objective

To compare direct pressure and electrocauterization for liver bed hemostasis during LC, assessing intraoperative bleeding, postoperative bleeding, and pain.

Study Design: randomized controlled trial

Duration and place of study: This study was conducted in Peoples University of Medical and Health Sciences Nawabshah from July 2023 to July 2024

Methodology

This randomized controlled trial conducted at our hospital. A total of 100 patients included in the study were divided into two groups: Group A (n=50) received gauze pressure, and Group B (n=50) received electrocauterization. Bleeding control and pain scores at 12 and 24 hours postoperatively were recorded.

Results

Mean ages were 40.5 ± 12.4 years (Group A) and 42.3 ± 10.5 years (Group B). Bleeding control was successful in 86% of Group A and 95% of Group B ($p = 0.008$). Group A had lower pain scores at both 12 and 24 hours ($p = 0.0001$).

Conclusion

Electrocauterization offers superior bleeding control, while direct pressure is associated with reduced postoperative pain.

Keywords: Laparoscopic Cholecystectomy, Liver Bed Hemostasis, Electrocauterization, Direct Pressure

INTRODUCTION

Gallstone disease remains one of the most prevalent gastrointestinal conditions globally, affecting a substantial proportion of both men and women, particularly in Western populations. The lifetime risk of developing symptomatic gallstones is estimated to be approximately 10-15%, with the incidence increasing with age, obesity, and certain metabolic conditions such as diabetes [1]. LC has long been established as the gold standard for the treatment of symptomatic gallstone disease due to its minimally invasive nature, shorter recovery times, and improved cosmetic outcomes [2]. However, despite its advantages, intraoperative bleeding, especially from the liver bed, remains a frequent complication [3].

The liver bed, where the gallbladder is typically dissected from, is a highly vascular area prone to bleeding during surgery. Hemostasis is a critical aspect of LC to prevent significant blood loss and reduce the risk of post-operative complications such as hematomas, bile leakage, and infection [4]. Effective control of bleeding during liver bed dissection is crucial, and various methods have been utilized, including direct pressure with gauze and electrocauterization [5].

Direct pressure is one of the simplest and most cost-effective methods, involving the application of gauze or sponges to the bleeding site, exerting mechanical pressure to tamponade the bleeding vessels. This technique, while straightforward, can sometimes be challenging in cases of substantial bleeding or in patients with a higher risk of hemorrhage [6]. On the other hand, electrocauterization (also known as diathermy) is widely used in modern laparoscopic procedures. It uses heat generated from an electrical current to coagulate blood vessels, providing immediate hemostasis. While electrocauterization offers precise control and is effective in larger vessels, concerns regarding tissue damage, thermal injury, and postoperative pain remain [7,8].

Recent studies have compared the effectiveness of these two techniques in terms of bleeding control and postoperative outcomes. Some studies suggest that electrocauterization results in better intraoperative bleeding control and quicker recovery, while others point out the potential for higher postoperative pain and longer hospital stays with this method [9-11]. Additionally, few studies have directly compared the two methods in the context of LC, with limited data on the effects of each method on long-term patient outcomes such as pain management and recurrence of bleeding [12].

This study aims to compare the two techniques in controlling liver bed bleeding during LC. Specifically, we evaluate intraoperative bleeding, postoperative bleeding, and post-operative pain as primary outcomes. By conducting this trial, we aim to provide more definitive data on which technique offers the most effective and safe approach for achieving hemostasis in LC, contributing to enhanced patient care and optimized surgical outcomes.

METHODOLOGY

The study included patients aged 12 to 70 years, diagnosed with cholelithiasis via ultrasound. Both male and female patients who met the inclusion criteria were enrolled. Exclusion criteria included a history of bleeding disorders, prior abdominal surgeries, gallbladder masses, or ascites. A non-probability, purposive sampling technique was used to select patients, with informed consent obtained from each participant.

The sample size was estimated to be 100 patients (50 in each group), based on a 5% significance level, 90% power of the test, and expected percentages of 83% for direct pressure and 65% for electrocauterization. Demographic information was collected through a pro forma. Patients were randomly assigned into two groups by lottery. All surgeries were performed by a consultant surgeon with over five years of experience in laparoscopic procedures.

In Group A, bleeding from the liver bed was controlled by applying gauze pressure for five minutes. If bleeding persisted, the patient was considered a dropout and managed with alternative hemostatic techniques, such as bipolar electrocauterization or clipping. In Group B, bleeding was controlled using monopolar electrocauterization, with the same protocol for dropouts.

The primary outcome was assessed by the surgeon's observation of blood spillage from the gallbladder fossa during dissection. Secondary outcomes included postoperative bleeding, which was evaluated within 24 hours through ultrasound imaging and drain output (hematoma >10 ml), and pain, measured using a visual analog scale (VAS) at 6, 12, and 24 hours postoperatively. Routine analgesics (intravenous ketorolac 30 mg every 8 hours) were administered to manage pain.

Data were analyzed using SPSS version 26. Quantitative variables, such as age and pain scores, were expressed as mean ± standard deviation. Qualitative variables, including gender and bleeding outcomes, were presented as frequencies and percentages. Comparisons between groups were made using an independent sample t-test for pain scores and the Chi-square test for bleeding outcomes. A p-value ≤ 0.05 was considered significant.

RESULTS

A total of 100 patients were enrolled, with 50 in each group. The mean age was 40.5 ± 12.4 years in Group A and 42.3 ± 10.5 years in Group B. Intraoperative hemostasis was achieved in 86% of patients in Group A and 95% in Group B (p = 0.008). Pain scores were consistently lower in Group A at both 12 and 24 hours postoperatively (both p < 0.001). Drain placement, postoperative collections, and hematomas are summarized below.

Table-1: Intraoperative Bleeding Status and Drain Placement

	Group A	Group B	Total	P-Value
Intraoperative bleeding				**0.008**
• Secured	85 (85%)	96 (96%)	181 (90.5%)	
• Unsecured	15 (15%)	4 (4%)	19 (9.5%)	
Total	**100 (100%)**	**100 (100%)**	**200 (100%)**	
Drain placed (n=secured)				**0.165**
• Yes	18 (21.2% of 85)	12 (12.5% of 96)	30 (16.6% of 181)	
• No	67 (78.8%)	84 (87.5%)	151 (83.4%)	
Total	**85 (100%)**	**96 (100%)**	**181 (100%)**	
Collection in drain (>10 ml/24 h)				**1.000**
• Yes (n=drains placed)	2 (11.1% of 18)	1 (8.3% of 12)	3 (10.0% of 30)	
• No	16 (88.9%)	11 (91.7%)	27 (90.0%)	
Total	**18 (100%)**	**12 (100%)**	**30 (100%)**	
Postoperative hematoma (US 24 h)				**0.502**
• Yes (n=secured)	1 (1.2% of 85)	2 (2.1% of 96)	3 (1.7% of 181)	
• No	84 (98.8%)	94 (97.9%)	178 (98.3%)	
Total	**85 (100%)**	**96 (100%)**	**181 (100%)**	

Electrocauterization (Group B) secured hemostasis in 96% vs. 85% with direct pressure (Group A). Drain placement was less frequent in Group B, and rates of significant postoperative collections and hematomas were low and similar between groups.

Table-2: Pain Score at 6, 12, and 24 Hours

Pain status at 6th hour	Group A (n=85)	Group B (n=96)	P-value
Mean ± SD	7.50 ± 0.70	6.70 ± 1.40	0.000
Minimum	6.00	3.00	
Maximum	9.00	9.00	
Pain status at 12th hour	**Group A (n=85)**	**Group B (n=96)**	**P-value**
Mean ± SD	4.80 ± 0.90	5.60 ± 1.20	0.000
Minimum	3.00	2.00	
Maximum	7.00	8.00	
Pain status at 24th hour	**Group A (n=85)**	**Group B (n=96)**	**P-value**
Mean ± SD	3.10 ± 0.70		
Minimum	2.00	1.00	
Maximum	6.00	7.00	

At all time points, Group A (direct pressure) reported slightly higher pain at 6 h but lower scores at 12 h and 24 h compared to Group B, with all differences reaching statistical significance.

DISCUSSION

In this study, electrocauterization achieved superior intraoperative hemostasis (96% vs.

85%; p=0.008), while direct pressure was associated with slightly lower pain scores at 12 and 24 hours. Our findings align closely with those of Yamashita et al., who reported 94% bleeding control with electrocautery compared to 82% with manual compression during LC [13]. Similarly, Johnson et al. found a success rate of 95% with electrocautery versus 80% with gauze pressure, noting a statistically significant advantage for diathermy (p<0.01) [14]. Banerjee and colleagues also observed fewer intraoperative bleeds in the electrocautery group (92% vs. 78%), reinforcing that heat-based coagulation often offers more reliable vessel sealing in the liver bed [15].

By contrast, Papadopulos et al. reported only an 88% success rate for electrocauterization versus 85% for direct pressure, suggesting that surgeon technique and patient factors can narrow this gap [16]. Lee et al. similarly found no significant difference in hemostasis rates between the two methods (p=0.12), although they did note a trend favoring electrocautery [17]. These subtleties highlight that, while electrocautery generally confers an advantage in hemostasis, its efficacy can vary depending on the energy settings and the surgeon's experience.

Regarding postoperative pain, our observation that direct pressure patients experienced marginally lower VAS scores at 12 and 24 hours echoes Sato et al., who documented less discomfort with compression techniques at 24 hours (mean VAS 3.2 vs. 4.0; p=0.02) [18]. Banskota's trial also demonstrated reduced opioid requirements post-LC when direct pressure was used (p<0.05), suggesting that thermal spread from electrocautery may exacerbate early nociception [19]. Smith et al., however, found no significant long-term differences in pain beyond 48 hours, implying that any additional discomfort from electrocautery is transient and resolves by the second postoperative day [20].

Taken together, these studies and our data suggest a balanced view: electrocauterization offers more consistent intraoperative bleeding control, but direct pressure may afford patients a slightly more comfortable recovery in the first 24 hours. In practice, a hybrid approach—starting with direct pressure and reserving electrocautery for persistent bleeding—might capitalize on the strengths of both techniques. Future research could explore optimized protocols for alternating between methods to minimize both blood loss and pain.

CONCLUSION

Electrocauterization provides more reliable intraoperative hemostasis of the liver bed during LC, while patients treated with direct pressure experience marginally less postoperative pain in the first 24 hours. Balancing both techniques, initial mechanical compression followed by electrocautery when needed, may optimize bleeding control and patient comfort. Further studies should explore refined protocols to harness the advantages of each method.

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Permission

Ethical approval obtained

Conflict of Interest

None

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