

COMPARISON OF MILLIGAN MORGAN (OPEN) VERSUS FERGUSON (CLOSED) HEMORRHOIDECTOMY IN TERMS OF POST-OPERATIVE COMPLICATIONS: A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Background: Excisional hemorrhoidectomy remains the gold standard surgical treatment for advanced hemorrhoidal disease; however, controversy persists regarding the comparative superiority of the Milligan–Morgan (open) and Ferguson (closed) techniques in terms of postoperative outcomes. Variations in postoperative pain, wound healing, and bleeding reported in international literature necessitate further regional evidence to guide surgical decision-making. **Objective:** To compare postoperative complications, specifically hemorrhage, wound dehiscence, and postoperative pain, between the Milligan–Morgan (open) and Ferguson (closed) hemorrhoidectomy techniques in patients with Grade III and Grade IV hemorrhoids. **Methods:** This single-center, parallel-group randomized controlled trial was conducted at the Department of Surgery, Khyber Teaching Hospital, Peshawar, from February 2023 to July 2023. A total of 168 patients aged 30–70 years with Grade III or Grade IV hemorrhoids were enrolled and randomly allocated in a 1:1 ratio to either Group A (Milligan–Morgan/open hemorrhoidectomy; n=84) or Group B (Ferguson/closed hemorrhoidectomy; n=84) using block randomization with allocation concealment. Postoperative pain assessment was performed by an independent blinded observer. Primary outcome measures included postoperative hemorrhage, wound dehiscence, and postoperative pain assessed using the Visual Analogue Scale (VAS). Data were analyzed using IBM SPSS Statistics version 25.0. **Results:** Baseline demographic and clinical characteristics were comparable between the two groups. Postoperative hemorrhage occurred in 20 patients (23.8%) in both the Milligan–Morgan and Ferguson groups, with no statistically significant difference observed ($p=0.999$). Wound dehiscence occurred in 20 patients (23.8%) in the open group and 17 patients (20.2%) in the closed group ($p=0.576$). The relative risk (RR) for wound dehiscence in the Milligan–Morgan group was 1.18 (95% CI: 0.66–2.08). The mean postoperative pain score on the first postoperative day was 4.11 ± 1.98 in the open group compared with 3.77 ± 1.53 in the closed group, with a mean difference of 0.34 (95% CI: -0.20 to 0.88 ; $p=0.224$). **Conclusion:** Both Milligan–Morgan (open) and Ferguson (closed) hemorrhoidectomy techniques demonstrated comparable safety profiles, with no statistically significant difference in postoperative hemorrhage, wound dehiscence, or postoperative pain. However, the Ferguson technique showed favorable clinical trends toward lower wound dehiscence rates and reduced postoperative pain, suggesting potential advantages in enhancing early postoperative recovery and patient comfort.

Keywords: Hemorrhoidectomy; Milligan–Morgan; Ferguson; postoperative complications; randomized controlled trial.

1. Introduction

Hemorrhoidal disease is one of the most common anorectal disorders worldwide and is characterized by symptomatic enlargement and distal displacement of the normal anal cushions. It represents a significant medical and socioeconomic burden and commonly presents with painless rectal bleeding, prolapse, pruritus, mucous discharge, and discomfort during defecation. While conservative management is effective for early-stage disease, surgical intervention remains the definitive treatment for advanced hemorrhoids, particularly Grade III and Grade IV disease. [1,2]

Excisional hemorrhoidectomy continues to be regarded as the gold standard surgical treatment for advanced hemorrhoidal disease because of its durable long-term outcomes and low recurrence rates. The updated 2024 American Society of Colon and Rectal Surgeons (ASCRS) Clinical Practice Guidelines strongly recommend excisional hemorrhoidectomy for patients with symptomatic Grade III and Grade IV hemorrhoids, especially those with combined internal and external disease. [3] The guidelines further emphasize that both open and closed hemorrhoidectomy remain acceptable operative approaches, although variations in postoperative pain, wound healing, and postoperative bleeding continue to be reported in comparative studies. [3]

Among the various excisional techniques, the Milligan–Morgan (open) hemorrhoidectomy and Ferguson (closed) hemorrhoidectomy are the two most widely practiced procedures globally. The Milligan–Morgan technique involves excision of hemorrhoidal tissue with wounds left open to heal by secondary intention, whereas the Ferguson technique utilizes primary closure of the mucosa and skin following excision of hemorrhoidal tissue. [4,5]

Despite decades of surgical experience, controversy persists regarding the comparative

superiority of these techniques. The open technique is considered technically straightforward and facilitates drainage, whereas the closed technique is purported to provide faster wound healing, reduced postoperative pain, and improved patient comfort. However, published literature demonstrates inconsistent findings regarding postoperative complications including hemorrhage, wound dehiscence, delayed healing, and postoperative pain. [6,7]

Several randomized controlled trials and meta-analyses have compared both procedures, yet variations in patient demographics, perioperative care, surgeon expertise, and healthcare settings limit the generalizability of these findings to local populations. Furthermore, there remains limited high-quality regional evidence comparing these techniques within the Pakistani population. [8,9] Therefore, this randomized controlled trial was conducted to compare Milligan–Morgan (open) and Ferguson (closed) hemorrhoidectomy in patients with Grade III and Grade IV hemorrhoids in terms of postoperative complications, specifically postoperative hemorrhage, wound dehiscence, and postoperative pain.

2. Materials and Methods

2.1 Study Design and Setting

This study was conducted as a single-center, parallel-group randomized controlled trial at the Department of Surgery, Khyber Teaching Hospital, Peshawar. The study was performed over a period of six months from 1st February 2023 to 31st July 2023 after obtaining approval from the Institutional Research and Ethical Review Board of Khyber Teaching Hospital.

2.2 Sample Size

The sample size was calculated using the WHO sample size calculator for comparison of two proportions. The calculation was based on the anticipated difference in postoperative wound dehiscence between open and closed hemorrhoidectomy techniques reported by

Majeed et al.[10], where postoperative wound dehiscence was observed in 18.24% of patients undergoing Milligan–Morgan hemorrhoidectomy compared to 3.69% in patients undergoing Ferguson hemorrhoidectomy. Using a 95% confidence level, 80% study power, and a 5% level of significance, the minimum required sample size was calculated to be 168 patients, with 84 participants allocated to each group.

2.3 Study Population

Patients aged between 30 and 70 years of either gender presenting with Grade III or Grade IV hemorrhoids according to Goligher's classification were assessed for eligibility and enrolled in the study.

2.3.1 Inclusion and Exclusion Criteria

Patients were selected based on the following inclusion criteria:

- Patients aged 30–70 years.
- Both male and female patients.
- Clinically diagnosed Grade III or Grade IV hemorrhoids.
- Patients willing to participate and provide informed written consent.

The exclusion criteria comprised:

- Patients with coagulopathy or severe bleeding disorders.
- Patients with previous anorectal surgery or hemorrhoidectomy.
- Patients with immunocompromised status.
- Patients with associated anorectal conditions including fistula-in-ano, anal fissure, malignancy, or thrombosed external hemorrhoids.
- Patients unwilling to participate in the study.

2.4 Sampling and Randomization

A non-probability consecutive sampling technique was used for patient recruitment. Eligible patients fulfilling the inclusion criteria

were enrolled after obtaining written informed consent.

Participants were randomly allocated in a 1:1 ratio into either Group A (Milligan–Morgan/open hemorrhoidectomy) or Group B (Ferguson/closed hemorrhoidectomy) using block randomization. The random allocation sequence was generated using **computer-generated random numbers** prior to patient enrollment. Allocation concealment was maintained using sequentially numbered opaque sealed envelopes, which were opened immediately before the surgical procedure.

● **Group A:** Patients underwent Milligan–Morgan (open) hemorrhoidectomy.

● **Group B:** Patients underwent Ferguson (closed) hemorrhoidectomy.

Due to the nature of the surgical interventions, blinding of the operating surgeons and participants was not feasible. However, postoperative pain assessment was performed by an independent blinded observer to minimize assessment bias. Selection bias was minimized through random allocation of participants, while assessment bias was reduced by utilizing predefined outcome measures and blinded postoperative pain assessment.

Patient recruitment, randomization, allocation, follow-up, and analysis were summarized using a CONSORT flow diagram. Figure.1

2.5 Surgical Procedure

All procedures were performed under spinal or general anesthesia with the patient in lithotomy position. Preoperative bowel preparation was carried out using rectal enemas administered the night before and the morning of surgery.

Milligan–Morgan (Open) Hemorrhoidectomy

In Group A, hemorrhoidal tissue was excised using the conventional Milligan–Morgan technique under standardized operative conditions. The vascular pedicle was transfixed using 2/0 polyglactin sutures, and the resulting

wounds were left open to heal by secondary intention.

Ferguson (Closed) Hemorrhoidectomy

In Group B, Ferguson hemorrhoidectomy was performed by excision of the hemorrhoidal tissue followed by high ligation of the vascular pedicle using 2/0 polyglactin sutures. The mucosa and perianal skin were subsequently approximated with absorbable 3/0 polyglactin sutures to achieve primary wound closure.

Standard postoperative care, including analgesia, antibiotics, dietary advice, and sitz baths, was provided uniformly to all patients.

2.6 Outcome Measures

Postoperative outcomes were assessed using predefined operational criteria during the postoperative follow-up period.

1. Postoperative Hemorrhage

○ Postoperative hemorrhage was defined as persistent and continuous bleeding resulting in soaking of more than five dressings within the first 24 hours after surgery.

2. Wound Dehiscence

○ Wound dehiscence was defined as visible gaping of the surgical wound, either within the anal canal or perianal skin, detected on clinical examination two weeks following surgery.

3. Postoperative Pain

○ Postoperative pain was assessed on the first postoperative day using the Visual Analogue Scale (VAS), ranging from 0 to 10, where 0 indicated no pain and 10 represented the worst imaginable pain. Pain assessment was performed by an **independent blinded observer**.

2.7 Data Collection Procedure

After admission through the outpatient department, eligible patients fulfilling the inclusion criteria were enrolled after obtaining informed written consent. Baseline demographic information including age, gender, body mass index (BMI), and duration of symptoms was recorded using a predesigned proforma.

All patients underwent the assigned surgical procedure and were subsequently followed during the postoperative period for assessment of study outcomes.

2.8 Statistical Analysis

Data were entered and analyzed using IBM SPSS version 25. Quantitative variables including age, BMI, duration of disease, and postoperative pain scores were expressed as mean $\pm$ standard deviation. Qualitative variables including gender, postoperative hemorrhage, and wound dehiscence were presented as frequencies and percentages.

Comparisons between groups were performed using the independent sample t-test for quantitative variables and Chi-square test for qualitative variables. A two-tailed p-value of <0.05 was considered statistically significant.

3. Results

3.1 Baseline Characteristics

A total of 168 patients were enrolled in the study and equally randomized into two groups, with 84 patients allocated to the Milligan–Morgan (open) hemorrhoidectomy group and 84 patients to the Ferguson (closed) hemorrhoidectomy group. Baseline demographic and clinical characteristics, including age, gender distribution, body mass index (BMI), and disease duration, were comparable between the two groups (Table 1).

Table 1: *Baseline Characteristics*

Variable	Group A (Open) (n=84)	Group B (Closed) (n=84)
Mean Age (years)	48.60 $\pm$ 10.94	46.50 $\pm$ 10.54
Male/Female	59/25	61/23
BMI (kg/m ²)	24.19 $\pm$ 2.55	24.47 $\pm$ 2.73
Disease Duration (months)	14.54 $\pm$ 4.23	13.42 $\pm$ 3.81

3.2 Postoperative Hemorrhage

Postoperative hemorrhage was observed in 20 patients (23.8%) in both the Milligan–Morgan and Ferguson groups, with no statistically significant difference between the two techniques

($p=0.999$). The relative risk (RR) of postoperative hemorrhage in the Milligan–Morgan group compared with the Ferguson group was 1.00 (95% CI: 0.58–1.72) (Table 2).

Table 2: *Comparison of Postoperative Hemorrhage*

Group	Frequency	Percentage (%)
Milligan–Morgan (Open)	20	23.8%
Ferguson (Closed)	20	23.8%

P-value : 0.999

3.3 Wound Dehiscence

Wound dehiscence occurred in 20 patients (23.8%) in the Milligan–Morgan group and 17 patients (20.2%) in the Ferguson group. Although the Ferguson group demonstrated a

lower frequency of wound dehiscence, the difference between the two groups was not statistically significant ($p=0.576$). The relative risk (RR) of wound dehiscence in the Milligan–Morgan group was 1.18 (95% CI: 0.66–2.08) compared with the Ferguson group (Table 3).

Table 3: *Comparison of Postoperative Wound Dehiscence*

Group	Frequency	Percentage (%)
Milligan–Morgan (Open)	20	23.8%
Ferguson (Closed)	17	20.2%

P-value : 0.576

3.4 Postoperative Pain

The mean postoperative pain score measured on the first postoperative day was 4.11 ± 1.98 in the Milligan–Morgan group and 3.77 ± 1.53 in the Ferguson group. The mean difference in

postoperative pain scores between the two groups was 0.34 (95% CI: -0.20 to 0.88). Although the Ferguson group demonstrated lower mean postoperative pain scores, the difference did not reach statistical significance ($p=0.224$) (Table 4).

Table 4: *Comparison of Mean Postoperative Pain Scores (VAS)*

Group	N	Mean Score $\pm$ SD
Milligan–Morgan (Open)	84	4.11 ± 1.98
Ferguson (Closed)	84	3.77 ± 1.53

P-value : 0.224

4. Discussion

The results of this randomized controlled trial indicate that there is no statistically significant difference between the Milligan Morgan (open) and Ferguson (closed) techniques regarding the incidence of post-operative hemorrhage, wound dehiscence, or pain. While the outcomes were statistically comparable, a clear clinical trend was observed favoring the Ferguson technique, which demonstrated lower mean pain scores and fewer instances of wound dehiscence. Both procedures remained similar in terms of safety, specifically

regarding the frequency of post-operative hemorrhage.

These findings are largely consistent with existing surgical literature and previous comparative studies. Similar outcomes were reported by Majeed et al., who also observed lower post-operative pain and reduced wound dehiscence in the closed group compared to the open group. [10]. Bhatti et al.'s meta-analysis found the closed technique significantly reduced postoperative pain, accelerated wound healing, and lowered bleeding risk compared to open (Milligan–Morgan) hemorrhoidectomy. [9]. Further, a meta-

analysis of six trials involving 686 patients similarly found no significant difference in overall complication rates or pain, though it did highlight that the closed technique (Ferguson) achieved complete wound healing significantly faster than the open method. [11] Balciscueta et al. reported that open hemorrhoidectomy produced the highest pain scores, whereas closing the wound (especially with a bipolar or ultrasonic device) significantly reduced post-op pain. [12] In contrast, earlier RCTs found minimal pain differences: Ho et al. (1997) showed virtually identical pain and analgesic needs, though open wounds healed significantly faster. [13] Arbman et al. likewise found pain scores comparable between techniques but noted that closed wounds healed more quickly and dehiscence was uncommon. [14]

The clinical advantage of the Ferguson technique can be attributed to its use of primary wound closure. [15] By performing high ligation of the vascular pedicle and suturing the mucosa and skin, the closed approach results in less exposed wound surface, which is theorized to reduce the inflammatory response and the subsequent intensity of post-operative pain. [16] This primary closure also provides immediate structural integrity to the surgical site, which explains the trend toward lower dehiscence rates compared to the Milligan Morgan technique, where wounds are intentionally left open for drainage. [17]

With regard to wound healing/dehiscence, most studies favor closed wounds for healing: for example, Khalil-ur-Rehman et al. observed 100% two-week healing in closed cases vs. ~50% in open ($p < 0.001$). [18] Open wounds frequently heal faster when they do heal but are prone to partial dehiscence (Ho et al. showed open heals reliably by ~5 weeks versus ~7 weeks for closed). [13] Bleeding complications were generally similar between groups in large trials [18,10]; however, the meta-analysis found a statistically lower bleeding risk with the closed method. [11]

In terms of clinical relevance, this study confirms that both Milligan Morgan and Ferguson techniques are safe and effective for managing Grade III and IV hemorrhoidal disease. Since surgical hemorrhoidectomy remains the gold standard for advanced cases, the choice between techniques may be guided by patient comfort and recovery speed. Given the trends toward reduced pain and improved wound integrity, the Ferguson technique may be the preferred approach for surgeons aiming to enhance early patient recovery and satisfaction. [11,12]

Despite these insights, several limitations must be acknowledged for future publication. This was a single-center study conducted at Khyber Teaching Hospital, Peshawar, which may limit the generalizability of the findings to broader populations. Additionally, the study utilized a short follow-up period, evaluating pain on the first post-operative day and wound dehiscence at two weeks. Finally, the scope of this research was limited to immediate post-operative complications and did not assess long-term outcomes, such as the rate of disease recurrence or anal stricture formation.

5. Conclusion

Both Milligan-Morgan (open) and Ferguson (closed) hemorrhoidectomy techniques demonstrated comparable safety profiles, with no statistically significant difference in postoperative hemorrhage, wound dehiscence, or postoperative pain. However, the Ferguson technique showed favorable clinical trends toward lower rates of wound dehiscence and reduced postoperative pain. These findings suggest that the closed hemorrhoidectomy approach may offer advantages in terms of early postoperative recovery and patient comfort in the management of Grade III and Grade IV hemorrhoidal disease.

6. Recommendations

Based on the findings of this randomized controlled trial and the current gaps identified in

the literature, the following recommendations are proposed:

- **Larger Multicenter Studies:**

Future multicenter randomized controlled trials involving larger sample sizes and diverse healthcare settings are recommended to further validate these findings and improve the generalizability of results within the local population.

- **Assessment of Long-Term Outcomes:**

The present study focused primarily on early postoperative outcomes. Future studies should incorporate longer follow-up periods to evaluate late postoperative complications such as anal stricture, delayed wound healing, and long-term functional outcomes.

- **Evaluation of Recurrence Rates:**

Further research should assess long-term recurrence rates following Milligan–Morgan and Ferguson hemorrhoidectomy techniques to determine the most durable surgical approach for advanced hemorrhoidal disease.

- **Inclusion of Patient-Centered Outcomes:**

Future studies may also evaluate additional patient-centered outcomes, including quality of life, duration of return to normal activity, patient satisfaction, and postoperative analgesic requirements.

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FIGURE 1 CONSORT FLOW DIAGRAM

