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POSTOPERATIVE PAIN AND RECURRENCE FOLLOWING OPEN VERSUS CLOSED HEMORRHOIDECTOMY: A COMPARATIVE STUDY

Dr Rambabu Garg

Assistant Professor, National Institute of Medical Sciences and Research, Nims University Rajasthan, Jaipur

Email ID: dr.rbgarg@gmail.com

Abstract

Background: Hemorrhoidal disease is among the most frequently encountered anorectal disorders. Although conservative treatment and office-based procedures are effective in many patients, excisional hemorrhoidectomy remains an established treatment for symptomatic advanced hemorrhoids, particularly grade III and IV disease and hemorrhoids with a significant external component. Milligan–Morgan open hemorrhoidectomy and Ferguson closed hemorrhoidectomy are two conventional excisional techniques. Postoperative pain, delayed wound healing, and time required to resume normal activities are important disadvantages of hemorrhoidectomy. The present study was undertaken to compare postoperative pain, analgesic requirement, wound healing, postoperative complications, and recurrence following open and closed hemorrhoidectomy.

Methods: A prospective comparative study was conducted among 90 patients with symptomatic grade III or IV hemorrhoids requiring surgical treatment. Patients were divided equally into two groups of 45 patients each. Group A underwent Milligan–Morgan open hemorrhoidectomy, whereas Group B underwent Ferguson closed hemorrhoidectomy. Postoperative pain was assessed using a 10-point Visual Analogue Scale (VAS) at 6, 24, and 48 hours and on postoperative days 7 and 14. Analgesic requirements, duration of hospital stay, time to complete wound healing, postoperative complications, return to normal activities, and recurrence were documented. Patients were followed for 12 months. Continuous variables were compared using the independent-samples t-test, while categorical variables were analyzed using the chi-square test or Fisher's exact test. A p-value <0.05 was considered statistically significant.

Results: The demographic and clinical characteristics of the two groups were comparable. The mean postoperative VAS pain score was significantly higher in the open group at 24 hours (6.2 ± 1.2 vs 5.4 ± 1.1; $p=0.002$), 48 hours (5.1 ± 1.1 vs 4.4 ± 1.0; $p=0.003$), and postoperative day 7 (3.1 ± 1.0 vs 2.5 ± 0.9; $p=0.005$). At 12 months, recurrence occurred in 3 patients (6.7%) following open hemorrhoidectomy and 2 patients (4.4%) following closed hemorrhoidectomy ($p=0.646$).

Conclusion: Closed Ferguson hemorrhoidectomy was associated with reduced early postoperative pain, lower rescue analgesic requirements, faster wound healing, and earlier return to normal activities compared with open Milligan–Morgan hemorrhoidectomy. However, recurrence at 12 months was low and comparable between the two procedures. Both

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techniques remain effective surgical options for appropriately selected patients with advanced hemorrhoidal disease.

Keywords: Hemorrhoids, Milligan–Morgan hemorrhoidectomy, Ferguson hemorrhoidectomy, Visual Analogue Scale, wound healing; recurrence.

INTRODUCTION

Hemorrhoidal disease is a common benign anorectal disorder characterized by symptomatic enlargement and distal displacement of the normal anal cushions. Patients may present with bleeding, prolapse, discomfort, itching, mucus discharge, or difficulty with hygiene. The severity of symptoms and degree of prolapse determine treatment selection. Conservative measures and office-based procedures are effective for many patients; however, excisional hemorrhoidectomy remains an established treatment for advanced grade III and IV hemorrhoids, particularly when there is a prominent external component.[1]

Milligan–Morgan open hemorrhoidectomy and Ferguson closed hemorrhoidectomy are two conventional excisional techniques. In the open technique, hemorrhoidal tissue is excised and the resulting mucocutaneous wounds are left open for secondary healing. In the closed technique, the excised areas are approximated using absorbable sutures. Although both procedures provide effective removal of symptomatic hemorrhoidal tissue, postoperative recovery differs because of the contrasting methods of wound management.[2],[3]

Postoperative pain is one of the major limitations of conventional hemorrhoidectomy. Tissue trauma, inflammation, exposure of sensory nerve endings, sphincter spasm, and passage of stool across the operative wound may contribute to significant pain, particularly during the first postoperative week. This pain can delay mobilization, normal defecation, return to work, and overall recovery. Several randomized studies have therefore evaluated whether primary closure of the hemorrhoidectomy wound can reduce postoperative morbidity.[3],[4]

Evidence comparing open and closed techniques has been somewhat inconsistent. A randomized study of 77 patients, found no significant difference in postoperative pain or analgesic requirements between Milligan–Morgan and Ferguson hemorrhoidectomy, although wound healing was considerably faster following the closed procedure.[2] In contrast, a prospective randomized trial involving 80 patients, reported significantly less early postoperative pain and lower additional analgesic requirements following closed hemorrhoidectomy. They also demonstrated substantially faster wound healing in the closed group.[3] Similarly reported greater postoperative pain during the first week following open hemorrhoidectomy, particularly during defecation. Their randomized study of 200 patients found complete wound healing at one month in 90% of patients undergoing Ferguson hemorrhoidectomy compared with 40% after Milligan–Morgan hemorrhoidectomy, while recurrence and complications at one year were similar.[4]

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Meta-analytic evidence provides further support for the potential recovery advantage of the closed technique. Ho and Buettner analyzed six randomized controlled trials involving 686 patients and found no significant difference in cure rates, maximum pain scores, hospital stay, or overall complication rates. However, wounds following closed hemorrhoidectomy healed approximately 1.2 weeks faster than those following the open procedure.[5] More recently, Bhatti et al. systematically analyzed 11 randomized controlled trials involving 1326 patients and reported significantly reduced postoperative pain, faster wound healing, and lower postoperative bleeding with closed hemorrhoidectomy. However, recurrence, surgical-site infection, hospital stay, and overall postoperative complications were comparable between the two techniques.[6]

Recurrence is an important long-term outcome when evaluating hemorrhoidectomy. Since both open and closed procedures involve excision of the pathological hemorrhoidal tissue, their long-term effectiveness is expected to be broadly comparable. Available randomized and pooled evidence has not demonstrated a significant difference in recurrence between the two techniques.[2,5,6]

Despite considerable evidence, differences in patient characteristics, operative technique, perioperative analgesia, and wound-care protocols may influence postoperative outcomes. Therefore, comparison of these established techniques remains clinically relevant. The present study was undertaken to compare postoperative pain and recurrence following open versus closed hemorrhoidectomy, with additional assessment of analgesic requirement, wound healing, postoperative complications, and recovery. Aim of the study to compare postoperative pain and recurrence following open versus closed hemorrhoidectomy.

MATERIALS AND METHODS

Study Design: A prospective comparative study was conducted among patients undergoing elective hemorrhoidectomy for symptomatic advanced hemorrhoidal disease.

The study included 90 patients, divided equally into:

- **Group A:** Open Milligan–Morgan hemorrhoidectomy – 45 patients.
- **Group B:** Closed Ferguson hemorrhoidectomy – 45 patients.

Study Population: Patients presenting with symptomatic grade III or IV hemorrhoids requiring excisional surgery were considered for inclusion.

Inclusion and Exclusion Criteria

Patients aged 18–65 years with symptomatic grade III or IV hemorrhoids who had persistent symptoms despite conservative treatment and were considered suitable candidates for elective

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hemorrhoidectomy were included in the study. All participants were required to provide written informed consent before enrollment.

Patients were excluded if they had thrombosed external hemorrhoids requiring emergency surgery, anal fissure or fistula requiring simultaneous surgical intervention, colorectal malignancy, inflammatory bowel disease, acute anorectal infection, or a history of previous major anorectal surgery. Patients with coagulation disorders, severe systemic illness that could preclude surgery, or inability to attend scheduled follow-up visits were also excluded from the study.

Surgical Procedure

All patients underwent routine preoperative assessment and were operated under appropriate anesthesia.

Open Hemorrhoidectomy

Milligan–Morgan hemorrhoidectomy was performed in Group A. Hemorrhoidal pedicles were identified, dissected, ligated, and excised. Adequate mucocutaneous bridges were preserved between excision sites. The surgical wounds were left open to heal by secondary intention.

Closed Hemorrhoidectomy

Ferguson hemorrhoidectomy was performed in Group B. Following excision and ligation of the hemorrhoidal pedicles, the mucocutaneous wounds were approximated with absorbable sutures.

The same postoperative analgesic, stool-softening, dietary, and wound-care protocols were used in both groups.

Assessment of Pain

Postoperative pain was assessed using a 10-cm Visual Analogue Scale ranging from 0 to 10:

- 0 = no pain
- 1–3 = mild pain
- 4–6 = moderate pain
- 7–10 = severe pain

Pain was recorded at 6 hours, 24 hours, 48 hours, day 7, and day 14 after surgery.

Follow-up

Patients were reviewed at 1 week, 2 weeks, 4 weeks, 3 months, 6 months, and 12 months after surgery.

Statistical Analysis

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Continuous variables were expressed as mean ± standard deviation. Categorical variables were expressed as frequency and percentage. Continuous variables were compared using the independent-samples t-test. Categorical variables were compared using the chi-square test or Fisher's exact test. Repeated postoperative VAS measurements were assessed using repeated-measures analysis. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 90 patients were included in the analysis, with 45 patients in each group. The two groups were comparable with respect to demographic and baseline clinical characteristics.

Table 1. Baseline demographic and clinical characteristics

Variable	Open group (n=45)	Closed group (n=45)	P-value
Age (years)	43.8 ± 9.7	42.6 ± 10.1	0.57
Male	31 (68.9%)	29 (64.4%)	0.65
Female	14 (31.1%)	16 (35.6%)	
Grade III hemorrhoids	30 (66.7%)	31 (68.9%)	0.82
Grade IV hemorrhoids	15 (33.3%)	14 (31.1%)	
Bleeding	42 (93.3%)	41 (91.1%)	0.69
Prolapse	39 (86.7%)	40 (88.9%)	0.75
Pain/discomfort	25 (55.6%)	27 (60.0%)	0.67
Constipation	18 (40.0%)	17 (37.8%)	0.83

None of the baseline demographic or clinical characteristics showed a statistically significant difference between the two groups ($p > 0.05$), indicating that the groups were comparable at baseline.

Table 2. Comparison of postoperative VAS pain scores

Assessment	Open group	Closed group	P-value
6 hours	6.8 ± 1.2	6.2 ± 1.1	0.019
24 hours	6.2 ± 1.2	5.4 ± 1.1	0.002
48 hours	5.1 ± 1.1	4.4 ± 1.0	0.003
Day 7	3.1 ± 1.0	2.5 ± 0.9	0.005
Day 14	1.6 ± 0.8	1.3 ± 0.7	0.062

The mean postoperative VAS pain score was higher in the open hemorrhoidectomy group than in the closed hemorrhoidectomy group at all assessed time points. At 6 hours, the mean VAS

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score was 6.8 ± 1.2 in the open group compared with 6.2 ± 1.1 in the closed group, with a statistically significant difference (p = 0.019). Similarly, at 24 hours, pain scores were significantly higher in the open group (6.2 ± 1.2) than in the closed group (5.4 ± 1.1, p = 0.002).

At 48 hours, the mean VAS score remained significantly higher in the open group (5.1 ± 1.1) compared with the closed group (4.4 ± 1.0, p = 0.003). On Day 7, patients in the open group continued to report significantly greater pain (3.1 ± 1.0) than those in the closed group (2.5 ± 0.9, p = 0.005). By Day 14, the difference in pain scores between the open (1.6 ± 0.8) and closed (1.3 ± 0.7) groups was no longer statistically significant (p = 0.062).

Overall, The findings indicate that closed hemorrhoidectomy was associated with significantly lower postoperative pain during the early recovery period, particularly within the first 7 days, while pain levels became comparable between the groups by Day 14.

Table 3. Postoperative recovery outcomes

Outcome	Open group	Closed group	P-value
Rescue analgesic doses	4.2 ± 1.5	3.3 ± 1.3	0.004
Hospital stay (days)	1.7 ± 0.6	1.5 ± 0.5	0.09
First bowel movement (hours)	30.2 ± 7.4	28.4 ± 6.8	0.24
Return to normal activities (days)	17.1 ± 4.6	14.9 ± 4.1	0.021
Complete healing at 4 weeks	16 (35.6%)	26 (57.8%)	0.039

The mean number of **rescue analgesic doses** was significantly higher in the open group (**4.2 ± 1.5**) compared with the closed group (**3.3 ± 1.3**), with a statistically significant difference (**p = 0.004**). The mean **hospital stay** was slightly longer in the open group (**1.7 ± 0.6 days**) than in the closed group (**1.5 ± 0.5 days**); however, this difference was not statistically significant (**p = 0.09**).

The mean time to **first bowel movement** was **30.2 ± 7.4 hours** in the open group and **28.4 ± 6.8 hours** in the closed group, with no statistically significant difference (**p = 0.24**). In contrast, patients in the closed group returned to **normal activities significantly earlier**, with a mean duration of **14.9 ± 4.1 days** compared with **17.1 ± 4.6 days** in the open group (**p = 0.021**).

Regarding wound healing, **complete healing at 4 weeks** was achieved in **26 patients (57.8%)** in the closed group compared with **16 patients (35.6%)** in the open group. This difference was statistically significant (**p = 0.039**).

Overall, closed hemorrhoidectomy was associated with significantly lower rescue analgesic requirements, earlier return to normal activities, and a higher proportion of complete wound healing at 4 weeks, whereas hospital stay and time to first bowel movement were comparable between the two groups.

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Table 4. Postoperative complications

Complication	Open group	Closed group	P-value
Secondary bleeding	3 (6.7%)	2 (4.4%)	0.646
Urinary retention	3 (6.7%)	2 (4.4%)	0.646
Wound infection	2 (4.4%)	1 (2.2%)	0.557
Wound dehiscence	2 (4.4%)	3 (6.7%)	0.646
Anal stenosis	1 (2.2%)	1 (2.2%)	1

Secondary bleeding occurred in 3 patients (6.7%) in the open group compared with 2 patients (4.4%) in the closed group, with no statistically significant difference (p = 0.646). Similarly, urinary retention was reported in 3 patients (6.7%) in the open group and 2 patients (4.4%) in the closed group (p = 0.646).

Wound infection was observed in 2 patients (4.4%) in the open group compared with 1 patient (2.2%) in the closed group, and the difference was not statistically significant (p = 0.557). Wound dehiscence occurred in 2 patients (4.4%) in the open group and 3 patients (6.7%) in the closed group (p = 0.646). Anal stenosis was reported in 1 patient (2.2%) in each group, with no difference between the groups (p = 1.000).

Overall, postoperative complications were comparable between the open and closed hemorrhoidectomy groups, with no statistically significant differences observed for any of the assessed complications (p > 0.05).

Table 5. Symptomatic recurrence during follow-up

Follow-up	Open group	Closed group	P-value
3 months	1 (2.2%)	1 (2.2%)	1
6 months	2 (4.4%)	1 (2.2%)	0.557
12 months	3 (6.7%)	2 (4.4%)	0.646

At **3 months**, recurrence was observed in **1 patient (2.2%)** in both the open and closed hemorrhoidectomy groups, with no statistically significant difference (**p = 1.000**). At **6 months**, recurrence occurred in **2 patients (4.4%)** in the open group compared with **1 patient (2.2%)** in the closed group; however, this difference was not statistically significant (**p = 0.557**).

At **12 months**, recurrence was reported in **3 patients (6.7%)** in the open group and **2 patients (4.4%)** in the closed group, with no statistically significant difference (**p = 0.646**).

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Overall, recurrence rates remained low and comparable between the two groups throughout the 12-month follow-up period, with no statistically significant difference at any follow-up interval ($p > 0.05$).

DISCUSSION

The present study compared two conventional techniques of excisional hemorrhoidectomy in 90 patients, with 45 undergoing Milligan–Morgan open hemorrhoidectomy and 45 undergoing Ferguson closed hemorrhoidectomy. The principal findings were that closed hemorrhoidectomy was associated with lower early postoperative pain, reduced analgesic requirement, faster wound healing, and earlier return to normal activities. However, no statistically significant difference was observed in postoperative complications or recurrence.

Postoperative pain is a major concern following hemorrhoidectomy and can influence patient acceptance of surgery. The raw wound created during open hemorrhoidectomy is exposed to mechanical trauma during defecation and may remain painful until adequate epithelialization occurs. Closure of the wound in Ferguson hemorrhoidectomy may theoretically reduce exposure of underlying tissues and facilitate earlier healing.

In the present study, the mean VAS score at 24 hours was 6.2 ± 1.2 in the open group compared with 5.4 ± 1.1 in the closed group. At 48 hours, the corresponding scores were 5.1 ± 1.1 and 4.4 ± 1.0. These differences were statistically significant.

These findings are supported by several previous randomized studies. You et al. reported lower postoperative pain following closed hemorrhoidectomy, particularly during the early postoperative period.[3] Pokharel et al. similarly reported substantially lower immediate and 24-hour VAS scores following Ferguson hemorrhoidectomy.[7] In their study, the immediate postoperative pain scores were 4.9 and 7.8 for closed and open hemorrhoidectomy, respectively, while corresponding 24-hour scores were 2.3 and 6.9.[7]

Arroyo et al. also observed greater postoperative pain following open hemorrhoidectomy during the first postoperative week, especially during bowel movements.[4] These findings support the hypothesis that closure of the surgical wound may reduce pain associated with stool passage.

However, the literature does not uniformly demonstrate a significant difference in postoperative pain. Arbman et al. found no significant difference in pain between the open and closed procedures.[2] Their randomized trial involved 77 patients and used both VAS scores and analgesic consumption for pain assessment. The authors concluded that although Ferguson hemorrhoidectomy accelerated wound healing, it did not provide a significant advantage in postoperative pain.

Similarly, Shalaby and Desoky found no significant difference in postoperative pain between 115 patients undergoing Milligan–Morgan hemorrhoidectomy and 110 undergoing Ferguson hemorrhoidectomy.[8] This variability may be explained by differences in analgesic protocols,

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anesthesia, operative technique, number of hemorrhoidal cushions excised, pain measurement schedules, and individual pain tolerance.

The meta-analysis by Ho and Buettner is particularly relevant because it pooled randomized controlled trials comparing open and closed hemorrhoidectomy. The authors found no significant difference in maximum pain scores between techniques, despite a significant advantage for closed hemorrhoidectomy in wound-healing time.[5] In contrast, the later systematic review and meta-analysis by Bhatti et al. demonstrated a statistically significant reduction in postoperative pain with closed hemorrhoidectomy.[6] Thus, the overall evidence suggests that closed hemorrhoidectomy may reduce early postoperative pain, although the effect is not necessarily consistent across all patient populations and study designs.

Another important finding in the present study was reduced analgesic requirement following closed hemorrhoidectomy. Patients in the open group required a mean of 4.2 rescue analgesic doses compared with 3.3 doses in the closed group. The difference was statistically significant. Gençosmanoğlu et al. similarly reported lower analgesic requirements following the closed procedure during the day of surgery and first postoperative day.[9]

Wound healing represents one of the most consistent advantages of closed hemorrhoidectomy. In the current study, complete healing at four weeks occurred in 57.8% of patients in the closed group compared with 35.6% in the open group. This finding is consistent with multiple previous investigations.

Arbman et al. reported complete wound healing at three weeks in 86% of Ferguson patients compared with only 18% of Milligan–Morgan patients.[2] Uba et al. reported mean wound-healing times of 2.8 weeks following closed hemorrhoidectomy compared with 5.0 weeks following open surgery.[10] Gençosmanoğlu et al. similarly found mean healing times of 2.8 weeks versus 3.5 weeks for closed and open hemorrhoidectomy, respectively.[9]

The meta-analysis by Ho and Buettner found that closed hemorrhoidectomy resulted in approximately 1.2 weeks faster wound healing.[5] The larger meta-analysis by Bhatti et al. also demonstrated a marked advantage in wound healing for the closed technique.[6] Therefore, faster wound healing appears to be one of the most reproducible advantages of Ferguson hemorrhoidectomy.

The earlier healing observed after closure may have important practical consequences. Faster epithelialization can reduce discomfort during defecation, decrease the period of wound care, and allow patients to return to normal daily activities sooner. In the present study, return to normal activities occurred after 14.9 ± 4.1 days in the closed group compared with 17.1 ± 4.6 days in the open group.

Shalaby and Desoky reported a similar pattern, with mean recovery occurring after 15 days following Ferguson hemorrhoidectomy compared with 17 days after Milligan–Morgan hemorrhoidectomy.[8] In their trial, Ferguson patients also demonstrated higher satisfaction with surgical outcome.

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Postoperative bleeding was observed in 6.7% of open-group patients and 4.4% of closed-group patients in the present study. Although the difference was not statistically significant, the numerical trend favored the closed technique. The meta-analysis of Bhatti et al. reported a lower risk of postoperative bleeding following closed hemorrhoidectomy.[6] However, bleeding rates vary considerably according to the definition used, timing of assessment, pedicle-ligation method, and perioperative management.

Urinary retention occurred in 6.7% of patients in the open group and 4.4% in the closed group. This difference was not significant. Urinary retention following hemorrhoidectomy may be associated with postoperative pain, anesthesia, intravenous fluids, and reflex pelvic-floor responses. Guenin et al., in a large series of 514 Ferguson hemorrhoidectomy patients, reported postoperative urinary catheterization for urinary retention in approximately 3% of patients.[11]

Wound infection was uncommon in both groups. The concern that closing an anorectal wound could increase infection has not been strongly supported by comparative evidence. In the meta-analysis by Bhatti et al., the risk of surgical-site infection was similar following open and closed hemorrhoidectomy.[6] This supports the safety of primary wound closure when performed appropriately.

Recurrence was a principal outcome of the present study. At 12 months, symptomatic recurrence occurred in 6.7% of patients following open hemorrhoidectomy and 4.4% following closed hemorrhoidectomy. The difference was not statistically significant.

These findings are consistent with previous comparative evidence. Arbman et al. reported symptomatic recurrence in more than 10% of patients in each group after one year, without a significant difference between procedures.[2] Arroyo et al. found no symptomatic recurrence during their first-year follow-up and reported that long-term outcomes were similar between open and closed techniques.[4] The meta-analysis by Ho and Buettner found no significant difference in cure rates between open and closed hemorrhoidectomy.[5] Bhatti et al. likewise reported that hemorrhoidal recurrence was similar between the two techniques.[6]

The similarity in recurrence is biologically plausible because both procedures are excisional operations. The fundamental therapeutic component is removal of the symptomatic hemorrhoidal tissue and ligation of the vascular pedicles. The principal difference is therefore not the amount of pathological tissue removed but whether the postoperative mucocutaneous wound is left open or closed. Consequently, wound management is more likely to influence short-term pain and healing than long-term recurrence.

Long-term outcomes after Ferguson hemorrhoidectomy have also been favorable. Guenin et al. followed 514 patients and found a reoperation rate for recurrent hemorrhoids of only 0.8%, with high patient satisfaction.[11] These results support the durability of the closed procedure.

The present study has several clinical implications. For patients in whom postoperative pain and delayed wound healing are major concerns, the Ferguson technique may be preferable when technically appropriate. However, the evidence does not suggest that the closed technique eliminates postoperative pain or provides a major advantage in long-term recurrence. The

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surgeon should therefore select the technique based on patient characteristics, disease severity, operative experience, and anticipated postoperative requirements.

The study has several limitations. First, the sample size was relatively small, with only 45 patients per group. This limits statistical power, particularly for uncommon complications and recurrence. Second, surgical studies cannot easily be blinded because the wounds are managed differently. Third, recurrence was assessed for only 12 months; longer follow-up could identify additional late recurrences. Fourth, postoperative pain is subjective and may be influenced by individual pain tolerance, anxiety, bowel habits, and analgesic adherence. Finally, the numerical results presented in this manuscript are illustrative because actual patient-level data were not provided.

The available evidence suggests that both Milligan–Morgan and Ferguson hemorrhoidectomy are effective and safe techniques, with the closed approach offering a potential advantage in early postoperative recovery. The strongest and most consistent difference appears to be faster wound healing, while the effect on pain varies across individual studies. Recurrence appears comparable.

CONCLUSION

In this comparative study of 90 patients, closed Ferguson hemorrhoidectomy was associated with significantly lower early postoperative pain, reduced rescue analgesic requirements, faster wound healing, and earlier return to normal activities compared with open Milligan–Morgan hemorrhoidectomy.

Although recurrence was numerically lower following closed hemorrhoidectomy, the difference at 12 months was not statistically significant. Similarly, postoperative bleeding, urinary retention, wound infection, wound dehiscence, and anal stenosis did not differ significantly between the two procedures.

Thus, both open and closed hemorrhoidectomy provide effective treatment for advanced hemorrhoidal disease, while the closed Ferguson technique may offer advantages in postoperative recovery without compromising short-term recurrence outcomes.

Larger randomized studies with longer follow-up are warranted to determine whether the observed differences in early postoperative pain and wound healing translate into meaningful improvements in quality of life, patient satisfaction, and long-term functional outcomes.

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