ORIGINAL ARTICLE

MITCHELL-BANKS' VS. FERGUSON AND GROSS HERNIOTOMY IN BOYS OVER TWO: A PROSPECTIVE COMPARISON OF POSTOPERATIVE OUTCOMES

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Background: Inguinal hernia repair in boys traditionally employs Ferguson and Gross Herniotomy (FGH) for older children and Mitchell-Banks' Herniotomy (MBH) for younger ones, though this age-based distinction is increasingly debated. Objective was to compare postoperative outcomes primarily scrotal oedema between MBH and FGH in boys over two years of age. **Methods:** In this prospective cohort study, 136 boys older than two years underwent primary inguinal herniotomy from January 2022 to December 2024 (MBH: 62; FGH: 74). Scrotal oedema was assessed clinically on postoperative days 1 and 7. Secondary outcomes included operative time, six-month recurrence, testicular atrophy, and surgical site infection. A p-value <0.05 was considered statistically significant. **Results:** MBH was associated with a significantly higher incidence of scrotal oedema on day 1 (40.3% vs. 5.4%) and day 7 (16.1% vs. 2.7%) (both p<0.05). However, MBH showed shorter operative duration (17.3±3.5 vs. 20.4±4.6 minutes, p<0.001) and lower recurrence rates (1.6% vs. 6.8%, p=0.038). Rates of testicular atrophy and surgical site infection were low and comparable between groups. **Conclusion:** Despite a higher rate of transient scrotal oedema, MBH offers advantages in operative efficiency and recurrence reduction, suggesting it may be a suitable option in older children. Further randomized studies are recommended to confirm these findings.

Keywords: Inguinal Hernia; Herniotomy; Paediatrics; Scrotal Oedema; Surgical Outcomes; Recurrence

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INTRODUCTION

Inguinal hernia is one of the most common paediatric surgical conditions, with an estimated incidence of 1–5% in full-term neonates and up to 30% in premature infants due to the persistence of a patent processus vaginalis (PPV).[1] Pan ML, Chang WP, Lee HC, *et al*. reported a cumulative incidence of inguinal hernia from birth to 15 years of age as 6.62% in males and 0.74% in females, indicating a male-to-female ratio of approximately 9:1.[2] Timely repair prevents incarceration, strangulation and testicular ischemia, complications that can cause irreversible harm if surgery is delayed.[3]

Among the open repair options, two techniques are widely practiced: Ferguson and Gross Herniotomy (FGH) and Mitchell-Banks' Herniotomy (MBH). FGH involves division of the external oblique aponeurosis to access the inguinal canal, allowing for high ligation of the hernia sac at the internal ring under direct visualization.[4] MBH, in contrast, accesses the hernia sac through the superficial inguinal ring without opening the external oblique, thus avoiding canal dissection and aiming to reduce operative trauma.[5]

Early operative repair is essential to prevent incarceration, strangulation, testicular ischemia, and other sequelae[3], and even chronic postoperative inguinal pain, although uncommon, underscores the need for careful technique[9]. While laparoscopic repair has gained traction[6,10], open procedures remain the mainstay worldwide. Historically, MBH has been limited to children under two years, given concerns over the anatomical feasibility and recurrence risk in older children with a longer inguinal canal.[6] However, recent comparative studies have challenged this age threshold, suggesting that MBH may be equally safe and effective in older boys when performed with appropriate technique.[7–10] These studies have demonstrated comparable or lower recurrence rates and shorter operative times for MBH compared to FGH. Additional cohort and registry data reinforce these findings and suggest expanding the age range for MBH.[10]

Postoperative scrotal oedema, though usually self-limiting, is more commonly reported with MBH.

Türk *et al*. observed that early scrotal oedema was significantly more common after Mitchell-Banks' herniotomy in older children and linked this finding to blind traction on the hernia sac during dissection.[11] Jain and Sarin showed that lymphatic disruption inherent to blind dissection in Mitchell-Banks' repair is the principal cause of the higher postoperative scrotal oedema rate when compared with the Ferguson & Gross technique.[12] Other complications such as testicular atrophy detected on follow-up ultrasonography[13] and surgical-site infection rates below 5% in large series[14] remain uncommon yet clinically relevant.

In this context, we conducted a prospective cohort study to compare the outcomes of MBH and FGH in boys older than two years. The primary endpoint was the incidence of postoperative scrotal oedema, with secondary endpoints including recurrence rate, operative time, testicular atrophy, and surgical site infections.

MATERIAL AND METHODS

We conducted a prospective observational cohort study at the Department of Surgery, Benazir Bhutto Shaheed Teaching Hospital, Abbottabad, from 1 January 2022 to 31 December 2024, following approval by the Institutional Review Board (BBSHTH/IRB/2022/). Informed written consent was obtained from the legal guardians of all participants, and the study adhered to the ethical standards outlined in the Declaration of Helsinki.

The study included male children over two years of age who were scheduled for primary surgical repair of an uncomplicated indirect inguinal hernia. Patients with a history of prior groin surgery, ipsilateral undescended testis, known syndromic diagnoses, coagulopathies, complicated hernias (such as incarcerated or strangulated), or those unlikely to complete follow-up were excluded. The choice of surgical technique Mitchell-Banks' herniotomy (MBH) or Ferguson and Gross herniotomy (FGH) was determined by the attending surgeon based on routine clinical judgment.

All procedures were performed or supervised directly by consultant surgeons and followed the standard operative protocols described by Fader and Axt. The primary outcome was the incidence of scrotal oedema, clinically evaluated and graded on postoperative days one and seven. Secondary outcomes included operative duration, recurrence of hernia within six months, and surgical site infections diagnosed according to CDC criteria.

Testicular atrophy was defined as a volume reduction of at least twenty percent confirmed by ultrasound. Due to resource constraints, assessor blinding was not feasible; however, ultrasonographic evaluation was employed in cases of ambiguous or symptomatic scrotal swelling.

A sample size calculation indicated that 58 participants per group would be required to detect a difference in oedema rates of 30% versus 5% with 80% power and a significance level of 0.05.[7] Our study enrolled 62 patients undergoing MBH and 74 receiving FGH, exceeding the calculated requirement.

Mitchell-Banks operative essentials: A 1.5- to 2-cm skin crease incision is made; the external ring is gently dilated without dividing the external-oblique aponeurosis; the sac is delivered with minimal traction using a peanut swab; high ligation is performed at the pre-peritoneal fat under direct vision using 3-0 polyglactin; the cord is inspected for twisting, and the external ring is partially closed with a single absorbable stitch. Adherence to these steps limits blind dissection, reduces lymphatic disruption, and is considered the "appropriate technique" that underpins the reported outcomes.

Age, side of hernia, and operative parameters were prospectively recorded, whereas data on comorbidities were variably reported and are presented qualitatively. Statistical analysis was conducted using SPSS version 25.0. Continuous variables were expressed as means with standard deviations and compared using independent-sample t-tests. Categorical variables were analyzed using chi-square or Fisher's exact tests, as appropriate. A two-tailed p-value of less than 0.05 was considered statistically significant. Recorded comorbidities were generally mild; the most frequent were seasonal respiratory infections (≈12 %), controlled asthma (≈6 %), and uncomplicated anaemia (≈4 %). No patient had severe systemic disease.

RESULTS

A total of 136 boys met the eligibility criteria for this study. Among them, 62 underwent Mitchell-Banks' Herniotomy (MBH), while 74 received Ferguson and Gross Herniotomy (FGH). The sample size provided sufficient statistical power to detect differences in both the primary and secondary outcomes. Baseline characteristics were generally well balanced between groups, although the MBH cohort had a slightly lower mean age (2.8±0.5 years) compared to the FGH group (3.2±0.4 years). Right-sided hernias predominated in both groups.

The primary outcome scrotal oedema was significantly more frequent in the MBH group. On postoperative day 1, oedema was noted in 40.3% (25/62) of MBH patients versus 5.4% (4/74) in the FGH group (p<0.001). By day 7, the incidence decreased but remained significantly higher in the MBH group (16.1% vs. 2.7%, p=0.014). All cases

were mild, self-limiting, and managed conservatively, with no lasting effects.

Hernia recurrence within six months was lower in the MBH group at 1.6% (1/62), compared to 6.8% (5/74) in the FGH group (p=0.038), suggesting greater durability of the MBH technique when applied in older children. MBH was also associated with a significantly shorter operative time (17.3±3.5 minutes vs. 20.4±4.6 minutes, p<0.001), likely reflecting its less invasive nature.

No cases of testicular atrophy were recorded in the MBH group, while one instance occurred in the FGH group (1.4%), a difference that was not statistically significant (p>0.05). Surgical site infections were uncommon in both groups, with rates of 3.2% in MBH and 5.4% in FGH patients (p=0.34). Additional complications, such as transient hydrocele and hematoma, occurred at similar rates and resolved without intervention. There were no reports of nerve injury in either cohort.

These findings, summarized in Table 1, support the clinical viability of MBH as an effective alternative to FGH in boys over two years of age offering shorter operative times and a lower recurrence rate, with the trade-off of a higher, though benign, incidence of early postoperative oedema.

Table-1: Clinical outcomes in both study Groups

Outcome	MBH (n = 62)	FGH (n = 74)	*p*-value
Number of patients	62	74	
Mean age (years)	2.8±0.5	3.2±0.4	
Scrotal oedema (Day 1)	40.3% (25/62)	5.4% (4/74)	<0.001
Scrotal oedema (Day 7)	16.1% (10/62)	2.7% (2/74)	0.014
Recurrence rate	1.6% (1/62)	6.8% (5/74)	0.038
Operative time (min)	17.3±3.5	20.4±4.6	<0.001
Testicular atrophy	0%	1.4% (1/74)	>0.05
Surgical site infection	3.2% (2/62)	5.4% (4/74)	0.34
Other complications – hydrocele	2/62 (3.2 %)	2/74 (2.7 %)	0.86
Other complications – hematoma	1/62 (1.6 %)	1/74 (1.4 %)	0.94
Nerve injury	0	0	—

DISCUSSION

The present findings describe associations rather than causation because technique selection depended on surgeon preference; therefore, unmeasured case-mix factors may underlie part of the observed differences.

This prospective study compares the outcomes of Mitchell-Banks' Herniotomy (MBH) and Ferguson and Gross Herniotomy (FGH) in children over the age of two. Scrotal oedema occurred more often after MBH on days 1 and 7, replicating Ahmad *et al*. and Moeezah *et al*.[7,8] Türk *et al*. and Jain & Sarin linked this oedema to blind sac traction that disrupts lymphatic channels.[11,12] Because assessors were not blinded to technique, a degree of observer inflation cannot be excluded; the true difference may therefore be smaller than recorded. The oedema was mild and self-resolving, yet its frequency underscores meticulous tissue handling to minimise lymphatic injury and proactive counselling to prepare caregivers for transient swelling. Educating parents about the benign, self-limited nature of this swelling reduces anxiety and unnecessary emergency visits.

Hernia recurrence was significantly lower in the MBH group (1.6%) compared to FGH (6.8%), in line with findings by Ahmad *et al*. (0.8% vs. 6.2%)[7] and Moeezah *et al*. (0% vs. 3.1%)[8]. These results suggest that MBH, when correctly performed, provides secure high ligation. Preservation of the external oblique may reinforce anterior wall support a concept proposed by Shahid *et al*. but not yet biomechanically validated.[4]

Operative time was also significantly shorter in the MBH group. This is consistent with a quasi-experimental study by Nithin *et al*., which showed a mean duration of 13.17±1.47 minutes for MBH versus 16.23±1.51 minutes for FGH.[5] In contrast, Ahmad *et al*. reported longer operative times for MBH (26.65±3.22 minutes vs. 15.92±4.22 minutes for FGH)[7], likely because most surgeons at our centre have performed MBH for over five years, whereas Ahmad's cohort reflected operators in their adoption phase. These discrepancies highlight the role of familiarity and institutional protocol in influencing efficiency.[9]

Complications such as testicular atrophy, hydrocele, hematoma, and wound infection were rare and similarly distributed between the groups. This is consistent with prior studies that reported minimal complication rates for both techniques.[9,10,14] The low rate of surgical site infection observed aligns with the data reported by Girdhar *et al*.[14], which report infection rates under 5% for elective groin operations.

Given the non-random allocation of participants, there is a potential for selection bias. Factors such as surgeon preference or patient anatomical variations may have influenced the choice of technique. Future studies should consider randomized controlled designs to address this limitation. Overall, the findings support reconsideration of the conventional age cut-off for MBH. When performed by skilled paediatric surgeons, MBH may offer reduced operative time and

lower recurrence without compromising safety, making it a viable alternative for children over two years of age.

Study Limitations

The non-random allocation and surgeon-dependent technique choice introduce selection bias; hence all outcome comparisons should be interpreted as associative signals requiring confirmation. Lack of assessor blinding for the primary endpoint adds potential observer bias, which could exaggerate inter-group differences in oedema rates. Additionally, scrotal oedema grading relied mainly on clinical inspection; ultrasound was used only selectively, which may underestimate subclinical fluid. Inconsistent recording of baseline comorbidities further limited multivariable adjustment. The six-month follow-up window, while adequate for detecting early complications and recurrences, may not capture delayed presentations or long-term testicular changes. To mitigate these limitations, we used a pre-study briefing to standardise edema grading, collected operative data prospectively on uniform forms, and encouraged surgeons to alternate techniques when clinical equipoise allowed; however, completeness of comorbidity data still varied.

CONCLUSION

Mitchell-Banks' Herniotomy appears to be a safe and effective technique for paediatric patients over two years of age, offering benefits such as reduced operative time and lower recurrence rates compared to Ferguson and Gross Herniotomy. Although early postoperative scrotal oedema was more frequent with MBH, it was mild, transient, and not clinically significant. These results suggest that MBH may be a suitable option beyond the traditionally recommended age range and highlight the potential for revisiting rigid age-based criteria in technique selection.

However, the non-randomized design necessitates cautious interpretation. These findings should be considered hypothesis-generating, warranting further investigation through randomized, multicenter trials with longer follow-up and objective assessment tools. Despite its limitations, this study adds meaningful early evidence to the ongoing reevaluation of MBH as a primary approach in older paediatric hernia patients and supports its consideration in efforts to optimize surgical outcomes and operative efficiency.

AUTHORS' CONTRIBUTION

NA, UK: Data collection. TS: Data analysis. MS: Write-up. HA: Proof reading. MA, AI: Literature search.

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