International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2025: 7.089

Male Circumcision-Conventional Versus Circular Stapler: A Prospective Comparative Study

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Abstract: ***This review examines conventional male circumcision and the circular stapler method with emphasis on operative outcomes, safety, healing, and patient satisfaction. Conventional circumcision remains a widely practiced procedure because of its long clinical history and broad acceptance, yet it is often associated with longer operating time, greater blood loss, postoperative pain, and higher dependence on surgical skill. The circular stapler technique was introduced to simplify the procedure by combining cutting and wound closure in a single step, thereby improving consistency and reducing tissue trauma. Evidence from recent comparative studies shows that the stapler method generally offers shorter operative time, lower blood loss, less postoperative pain, faster recovery, and fewer complications than the conventional technique. Patient satisfaction and cosmetic outcomes are also reported to be better with device based procedures. However, the higher cost of the stapler and the occasional need for removal of residual staples remain important concerns. Overall, the available literature supports the circular stapler as a safe and effective alternative to conventional circumcision, while highlighting the need for further studies to evaluate long term outcomes, cost effectiveness, and wider applicability across different clinical settings.***

Keywords: Male circumcision, Circular stapler, Conventional circumcision, Postoperative complications, Patient satisfaction

1. Introduction

Male circumcision, the surgical removal of the foreskin of the penis, is one of the most common surgical procedures performed worldwide. It is practiced for various cultural, religious, and medical reasons[1]. Traditionally, male circumcision has been performed using conventional surgical techniques, which involve a scalpel or scissors to excise the foreskin, followed by suturing to achieve haemostasis and wound closure[2].

Despite its widespread practice, conventional circumcision is not without complications. Postoperative bleeding, infection, and prolonged healing times are some of the common issues associated with this method. Moreover, the skill of the surgeon plays a critical role in determining the outcome, making the procedure highly operator-dependent[3].

In recent years, technological advancements have introduced alternative methods for performing male circumcision, one of which is the use of a circular stapler. This device is designed to simplify the procedure by providing a consistent and uniform circumcision with minimal operator dependency. The circular stapler employs a ring-like apparatus that simultaneously cuts and staples the foreskin, thereby reducing operative time and potentially decreasing the risk of complications[4].

This thesis aims to compare the outcomes of conventional circumcision technique with those of the circular stapler method. A prospective comparative study will be conducted to evaluate various parameters, including operative time, intraoperative blood loss, postoperative pain levels, healing time and postoperative complications. The objective is to determine whether the circular stapler offers a superior alternative to conventional methods in terms of safety, efficacy, and overall patient experience[5].

By providing a comprehensive analysis of these two techniques, this study seeks to contribute valuable insights to the field of male circumcision. The findings may have significant implications for clinical practice, guiding healthcare professionals in choosing the most appropriate method for their patients and potentially improving the standard of care in male circumcision procedures.

2. Review of Literature

Brief Overview of Male Circumcision and Its Significance

Male circumcision, the surgical removal of the foreskin, is a practice with deep historical, cultural, and medical roots. Historically performed for religious and cultural reasons, it has been adopted for its medical benefits, including reduced risks of urinary tract infections, penile cancer, and sexually transmitted infections, including HIV[6]. The procedure is commonly performed in infancy, childhood, or adulthood, with varying techniques depending on the patient's age and the surgeon's expertise.

Introduction to the Conventional Method and the Circular Stapler Method

- **Conventional Method:** The traditional method of male circumcision involves the use of surgical instruments like scalpels or scissors to excise the foreskin, followed by suturing to control bleeding and facilitate healing. This technique requires skilled surgical intervention and is associated with risks such as bleeding, infection, and longer recovery times[7].

- **Circular Stapler Method:** The circular stapler method, a more recent innovation, employs a device that simultaneously cuts and staples the foreskin, aiming to simplify the procedure and reduce complications. This method promises quicker operation times, minimal bleeding, and uniform outcomes, making it an appealing alternative to conventional methods[8].

Purpose and Scope of the Literature Review

The purpose of this literature review is to comprehensively compare the conventional method of male circumcision with the circular stapler method. By examining a range of studies, clinical trials, and expert opinions, this review aims to:

- Evaluate the efficacy, safety, and outcomes of both methods.
- analyse the short-term and long-term complications associated with each technique.
- Assess patient satisfaction, healing times, and overall procedural efficiency.
- Provide a detailed cost-benefit analysis.
- Discuss ethical, social, and cultural implications of both methods[9].

The scope of this review includes recent studies and clinical trials conducted over the past decade, focusing on advancements in circumcision techniques and their impact on patient outcomes. This analysis will help inform clinical practices and guide future research in the field of male circumcision.

Historical Background of Male Circumcision

1) Evolution of Male Circumcision Practices Over Time

Male circumcision is one of the oldest surgical procedures, with evidence dating back to ancient Egypt around 2300 BCE. It has evolved significantly, from crude stone tools to sophisticated surgical instruments. In ancient cultures, it was often a rite of passage or a mark of social status. Over time, the practice spread across different regions, adapting to local customs and beliefs. The 19th and 20th centuries saw its medicalization, with an increased focus on hygiene and disease prevention.

2) Cultural, Religious, and Medical Reasons for Circumcision

- **Cultural Reasons:** In many societies, circumcision is a cultural norm, signifying a boy's transition to manhood. In some African and Indigenous Australian cultures, it is an essential ritual that integrates the individual into the community[4,5,6].
- **Religious Reasons:** Circumcision holds significant religious importance in Judaism and Islam[2]. In Judaism, it is performed on the eighth day after birth as a covenant with God. In Islam, it is a symbol of purity and adherence to the faith, usually performed during childhood or early adolescence.
- **Medical Reasons:** Medical reasons for circumcision include phimosis, balanitis xerotica obliterans, recurrent balanoposthitis, recurrent urinary tract infections, reducing the risk of penile cancer, and decreasing the transmission of sexually transmitted infections, including HIV[1,3,4,6,7,9]. The American Academy of Paediatrics and other health organizations have acknowledged these potential health benefits, though the practice remains controversial in some medical and ethical discussions.

By understanding the historical, cultural, religious, and medical contexts of male circumcision, we can better appreciate the diversity of practices and the reasons behind them. This background sets the stage for comparing the conventional and circular stapler methods in modern clinical settings.

Conventional Male Circumcision

1) Description of Traditional Techniques

Conventional male circumcision typically involves the following steps:

a) **Anaesthesia**: Local anaesthesia is administered to minimize pain.
b) **Foreskin Preparation**: The foreskin is pulled forward and secured.
c) **Incision and Excision**: A scalpel or surgical scissors are used to make an incision and remove the foreskin.
d) **Haemostasis**: Bleeding is controlled using sutures or cauterization.
e) **Closure**: The edges of the incision are sutured to facilitate healing.

2) Advantages and Disadvantages

a) Advantages:

- Well-established procedure with a long history.
- Wide availability and familiarity among surgeons.
- Can be performed at various ages, from infancy to adulthood.

b) Disadvantages:

- Higher variability in outcomes depending on the surgeon's skill.
- Longer operative time compared to modern techniques.
- Increased risk of postoperative complications such as bleeding and infection.
- Longer healing time and potential for more pain during recovery.

3) Common Complications and Their Management

a) Complications:

Bleeding:

- Can occur during or after the procedure.
- Managed by suturing or applying pressure.

Infection

- Risk of infection at the surgical site.
- Prevented and treated with proper antiseptic techniques and antibiotics.

Excessive Skin Removal

- Can lead to cosmetic issues and functional problems.
- Managed by careful surgical planning and technique.

Adhesions and Skin Bridges

- May form during healing.
- Prevented by ensuring proper wound care and follow-up.

Pain
- Common postoperatively.
- Managed with analgesics and proper postoperative care.

b) Circular Stapler Method

Development and Introduction of the Circular Stapler for Circumcision

The circular stapler method for male circumcision is a relatively recent innovation developed to address the limitations of conventional surgical techniques. Its development was driven by the need for a more efficient, less painful, and uniform procedure that reduces operative time and complications. The device was introduced in clinical practice after rigorous testing and trials that demonstrated its effectiveness and safety.

4) Mechanism of Action and Procedural Steps

Mechanism of Action: The circular stapler is designed to simultaneously cut and staple the foreskin, providing a uniform and consistent outcome. The device includes a ring-like apparatus that encircles the foreskin, which is then cut and stapled in a single action, minimizing tissue trauma and bleeding.

Procedural Steps:
1) **Preparation**: The patient is prepped, and local anaesthesia is administered.
2) **Device Placement**: The circular stapler is placed over the foreskin, with a protective bell inside the foreskin to ensure safety.
3) **Cutting and Stapling**: The device is activated, cutting the foreskin and applying staples to close the wound simultaneously.
4) **Completion**: The device is removed, and the surgical site is inspected for haemostasis.

Initial Reception and Adaptation in Clinical Practice

The initial reception of the circular stapler method in clinical practice has been positive, particularly due to its potential to standardize the circumcision procedure and reduce operator dependency. Early adopters have reported benefits such as reduced operative time, lower rates of intraoperative bleeding, and quicker recovery times for patients. Studies like the one by Cocci et al. (2020) have provided preliminary evidence supporting these benefits, contributing to the method's growing acceptance among urologists and surgeons. As more data becomes available, the circular stapler method is likely to become a preferred technique for male circumcision in various clinical settings.

5) Comparative Studies

Key Comparative Studies Between Conventional and Circular Stapler Methods

Several key studies have compared the conventional and circular stapler methods for male circumcision. These studies focus on operative time, safety, efficacy, pain levels, healing time, and patient satisfaction.

a) **A Prospective Randomized Clinical Trial (2023)**: This study found that the circular stapler method had a significantly shorter operative time compared to the conventional method. The stapler technique also showed fewer intraoperative complications and better overall safety[10].
b) **Meta-Analysis of Stapler vs. Conventional Circumcision (2024)**: This analysis aggregated data from multiple studies and concluded that the circular stapler method was associated with lower postoperative pain and faster healing times. The consistency and precision of the stapler technique contributed to these improved outcomes[11].
c) **Comparative Study of Surgical Outcomes (2023)**: This study evaluated patient satisfaction and cosmetic results, showing that patients who underwent the stapler method reported higher satisfaction rates and better cosmetic outcomes. The uniformity of the stapler cut resulted in more aesthetically pleasing results[12].

Analysis of Operative Time, Safety, and Efficacy

a) **Operative Time**: The circular stapler method consistently demonstrates a shorter operative time. The simultaneous cutting and stapling mechanism reduce the overall duration of the procedure[13].
b) **Safety**: The stapler method has shown a lower risk of postoperative complications, including reduced bleeding and infection rates. The precise and consistent nature of the stapler device contributes to its safety profile[14].
c) **Efficacy**: Both methods are effective for male circumcision, but the stapler method provides a more uniform and reliable outcome. The reduced variability in results makes it a preferable option for many clinicians[15].

Outcomes Related to Pain, Healing Time, and Patient Satisfaction

a) **Pain:** Patients undergoing the circular stapler method generally report lower pain levels postoperatively. The reduced tissue trauma and quicker procedure time contribute to decreased discomfort[16].
b) **Healing Time**: The stapler method often results in faster healing times. The immediate and uniform closure of the wound promotes quicker recovery and reduces the risk of infection[17].
c) **Patient Satisfaction**: Higher patient satisfaction rates are observed with the circular stapler method. Patients appreciate the reduced pain, faster recovery, and better cosmetic outcomes. The uniformity and precision of the stapler technique led to more aesthetically pleasing results[18].

These comparative studies highlight the advantages of the circular stapler method over the conventional technique in terms of operative efficiency, safety, pain management, and overall patient satisfaction. The evidence supports the adoption of the stapler method as a superior alternative for male circumcision in various clinical settings.

X D Jin et al (2015)[19] investigated the safety and efficacy of a new male circumcision technique involving the use of a circular stapler. In total, 879 consecutive adult male patients were randomly divided into 2 groups: 441 underwent stapler circumcision, and 438 underwent conventional circumcision. The operative time, pain score, blood loss volume, healing time, treatment costs, and postoperative complications were compared between the two groups. The

operative time and blood loss volume were significantly lower in the stapler group than in the conventional group (6.8 ± 3.1 *vs* 24.2 ± 3.2 min and 1.8 ± 1.8 *vs* 9.4 ± 1.5 mL, respectively; P<0.01 for both). The intraoperative and postoperative pain scores were significantly lower in the stapler group than in the conventional group (0.8 ± 0.5 *vs* 2.4 ± 0.8 and 4.0 ±0.9 *vs* 5.8 ± 1.0, respectively; P<0.01 for both). Additionally, the stapler group had significantly fewer complications than the conventional group (2.7% *vs* 7.8%, respectively; P<0.01). However, the treatment costs in the stapler group were much higher than those in the conventional group (US$356.60 ± 8.20 *vs* US$126.50 ± 7.00, respectively; P<0.01). Most patients (388/441, 88.0%) who underwent stapler circumcision required removal of residual staple nails. Overall, the study has shown that stapler circumcision is a time-efficient and safe male circumcision technique, although it requires further improvement.

Ameer Hohlfeld et al (2021)[20] assessed the effects of device-based circumcisions compared with standard surgical techniques in adolescent and adult males (10 years old and above).They included randomized controlled trials of device-based circumcisions (crush or ligature circumcision devices) compared to standard surgical dissection-based circumcision conducted by health professionals in a medical setting. Eighteen trials met the inclusion criteria. Trials were conducted in China, South Africa, Kenya and Zambia, Mozambique, Rwanda, Uganda and Zimbabwe. Primary outcomes Serious adverse events: there were no serious adverse events in either treatment arm (11 trials, 3472 participants). Moderate adverse events: there may be a slight increase in moderate adverse events when devices are used compared to standard surgical techniques (RR 1.31, 95% CI 0.55 to 3.10; I^2= 68%; 10 trials, 3370 participants; low-certainty evidence); this corresponds to 8 more (ranging from 15 fewer to 84 more) moderate adverse events per 1000 participants. They downgraded the certainty of the evidence for study limitations and imprecision. Secondary outcomes Mild adverse events: they were uncertain about the difference in mild adverse events between groups when devices were used compared to standard surgical techniques (RR 1.09, 95% CI 0.44 to 2.72; I^2 = 91%; 10 trials, 3370 participants; very low-certainty evidence). Operative time: operative time is probably about 17 minutes shorter when using a device rather than standard surgical techniques, which constitutes a clinically meaningful decrease in a procedure (MD -17.26 minutes, 95% CI -19.96 to -14.57; I^2 = 99%; 14 trials, 4812 participants; moderate-certainty evidence).

The standard surgical technique generally takes about 24 minutes. There may be less postoperative pain during the first 24 hours when circumcision devices are used compared to standard surgical techniques (measured using a visual analogue scale [VAS]; MD 1.30 cm lower, 95% CI 2.37 lower to 0.22 lower; I^2 = 99%; 9 trials, 3022 participants; low-certainty evidence). There may be little or no difference in postoperative pain experienced during the first seven days when compared with standard surgical techniques (measured using a VAS; MD 0.11 cm higher, 95% CI 0.89 lower to 1.11 higher; I^2 = 94%; 4 trials, 1430 participants; low-certainty evidence). A higher score on the VAS indicates greater pain. Participants may slightly prefer circumcision devices compared to standard surgical techniques (RR 1.19, 95% CI 1.04 to 1.37; I^2 = 97%; 15 trials, 4501 participants; low-certainty evidence). They recorded satisfaction as a dichotomous outcome. Higher rates reflected greater satisfaction.

Jadhav R M et al (2022)[21] assessed conventional and suture less circumcision. In this study majority of the study subjects belonged to the age group of 26 to 35 years (38.46% and 46.15% in either group), followed by 36 to 45 years (15.38% and 23.08% in either group.). Balanitis Xerotica Obliterans, Recurrent balanoposthitis was, Recurrent UTI, and Congenital phimosis were the commonest presentations of the patients. In the current study we assessed Sexual satisfaction among the study subjects. We observed that 53.85% subjects in first group and 61.54% subjects in second group had sexual satisfaction. Mean Operating time in Conventional group was 24.2 min and in suture less group was 6.8 min which was significantly lesser in suture less group. Mean Blood loss in Conventional group was 9.4 ml and in suture less group was 1.8 ml which was also significantly lesser in suture less group. Mean Pain score in Conventional group was 5.8 and in suture less group was 4 it was lesser in suture less group. Mean Healing time in Conventional group was 14.4 days and in suture less group was 12.5 days which was significantly lesser in suture less group. Mean Satisfaction in Conventional group was 90% and in Suture less group was 92% which was greater in suture less group. Post operative hospital stay Conventional group was 3.5 days and in suture less group was 2.2 days which was significantly lesser in suture less group. Among the commonest complications in the Conventional group: bleeding (15.38%), wound dehiscence (7.69%), oedema (23.08%), and infection (15.38%). Suture less group did not report any case of bleeding, oedema and infection.

Cheng Yue et al (2012)[22] investigated the safety and efficacy of Shang Ring™ male circumcision and conventional sleeve resection circumcision in a randomized study. During the same period, 479 cases of Shang Ring circumcision and 354 of sleeve resection circumcision were performed. Complete follow up data were evaluated on the 2 groups. Operative time, pain score, blood loss, postoperative complications, wound healing time and treatment costs were compared. There was no statistically significant difference in average age and foreskin status between the 2 groups preoperatively (p >0.05). Compared to the conventional group, there was shorter operative time, less blood loss and a lower intraoperative pain score in the ring group (p <0.05). In addition, ring male circumcision showed a lower complication rate than conventional circumcision (6.89% vs 13.28%, p = 0.002). However, wound healing time in the ring group was longer than in the conventional group (mean ± SD 19.86 ± 5.24 vs 13.42 ± 2.35 days, p <0.001).

Zheng Zhang et al (2016)[23] compared the surgical effects and postoperative complications and patient experience of two circumcision methods (novel disposable suture device and conventional suture approach) in Chinese excess foreskin or phimosis patients performed in Andrology

centre in a prospective non-randomized controlled study. A total of 520 cases of excess foreskin and 62 phimosis patients that underwent circumcision between June 2014 and June 2015 in a single centre using novel disposable device (n = 295; mean age 30.4 years, range 18-44 years) and conventional suture approach (n = 287; mean age 28.6 years, range 16-41 years) were documented. The main surgical outcomes (surgical time, intraoperative blood loss, incision healing time) and postoperative complications and patient experience (postoperative pain score, satisfaction rate of postoperative penile cosmetic appearance, recovery duration) were collected and analysed. A multivariate logistic regression with likelihood ratio test was also used to observe the possible determinants of oedema occurrence postoperatively. The novel disposable suture device group had shorter operation time, lower pain score and rapid recovery and a higher satisfaction rate of penile cosmetic appearance when compared to the conventional circumcision group. Besides, the incidence of complications (hematoma and incision bleeding and infection) was significantly lower in the novel disposable suture device group. A multivariate logistic regression with likelihood ratio test revealed that phimosis was the significant predictor of oedema occurrence postoperatively (Chi square of likelihood ratio = 9.88, df = 1, p = 0.025).

3. Aims & Objectives

Aims

To evaluate the safety and efficacy of circular stapler with that of conventional technique in adult male circumcision

Objectives

1) To compare the operative time between conventional and stapler circumcision
2) To compare the pain score between conventional and stapler circumcision
3) To compare blood loss volume between conventional and stapler circumcision
4) To compare healing time between conventional and stapler circumcision
5) To compare postoperative complications between conventional and stapler circumcision

4. Material & Methods

Study period

June, 2022 - May, 2024

Study design

Prospective Comparative study

Study place

- South Eastern Railway Central Hospital
- Department of General Surgery

Study population

- Adult male patients admitted in the General Surgery ward, between June, 2022 and May, 2024 for Circumcision .

Inclusion criteria

- All the adult male patients between 18 to 70 years of age
- Phimosis
- Balanitis xerotica obliterans
- Balanoposthitis
- Recurrent urinary tract infection

Exclusion criteria

- The adult male patients not willing to participate in the study,
- Hypospadias
- Concealed penis
- Sexually transmitted diseases
- Paraphimosis

5. Methodology

- Patients will be randomly assigned to conventional or stapler circumcision groups using slip system.
- Those assigned will be electively admitted.
- Detailed history will be obtained, and thorough clinical examination will be done.
- Relevant blood investigations will be done.
- The procedures will be done under the dorsal penile nerve block with lignocaine and bupivacaine(1:1) at a dose of 2mg/kg body weight.
- All surgeries will be done by a single surgeon.
- All patients will be discharged on post op day 1 and followed up on post op day 7, day 15 and day 30.

Definitions

- Conventional male circumcision mentioned here indicates sleeve resection technique.
- Clonmed disposable circumcision staplers marketed by Jupiter Health Care will be used here. Size of the stapler will be determined by measuring the penis just below the glans. Generally, 30 mm sized staplers are used for adults.
- 3-0 Rapide Vicryl by Ethicon (Polyglactin) will be used in conventional suturing.
- Operative time will be determined from first incision to last suture in conventional circumcision and from application of stapler to removal in stapler circumcision.
- For pain score visual analogue scale is used (Annexure III) at 3hr, 6hr, 12hr, 24hr and 48hr.
- For blood loss volume the number of soaked standard sized gauze (30cm x 30cm) will be counted. This type of gauze will soak about 10 mL of blood.

Figure 1: Disposable Circumcision Circular Stapler

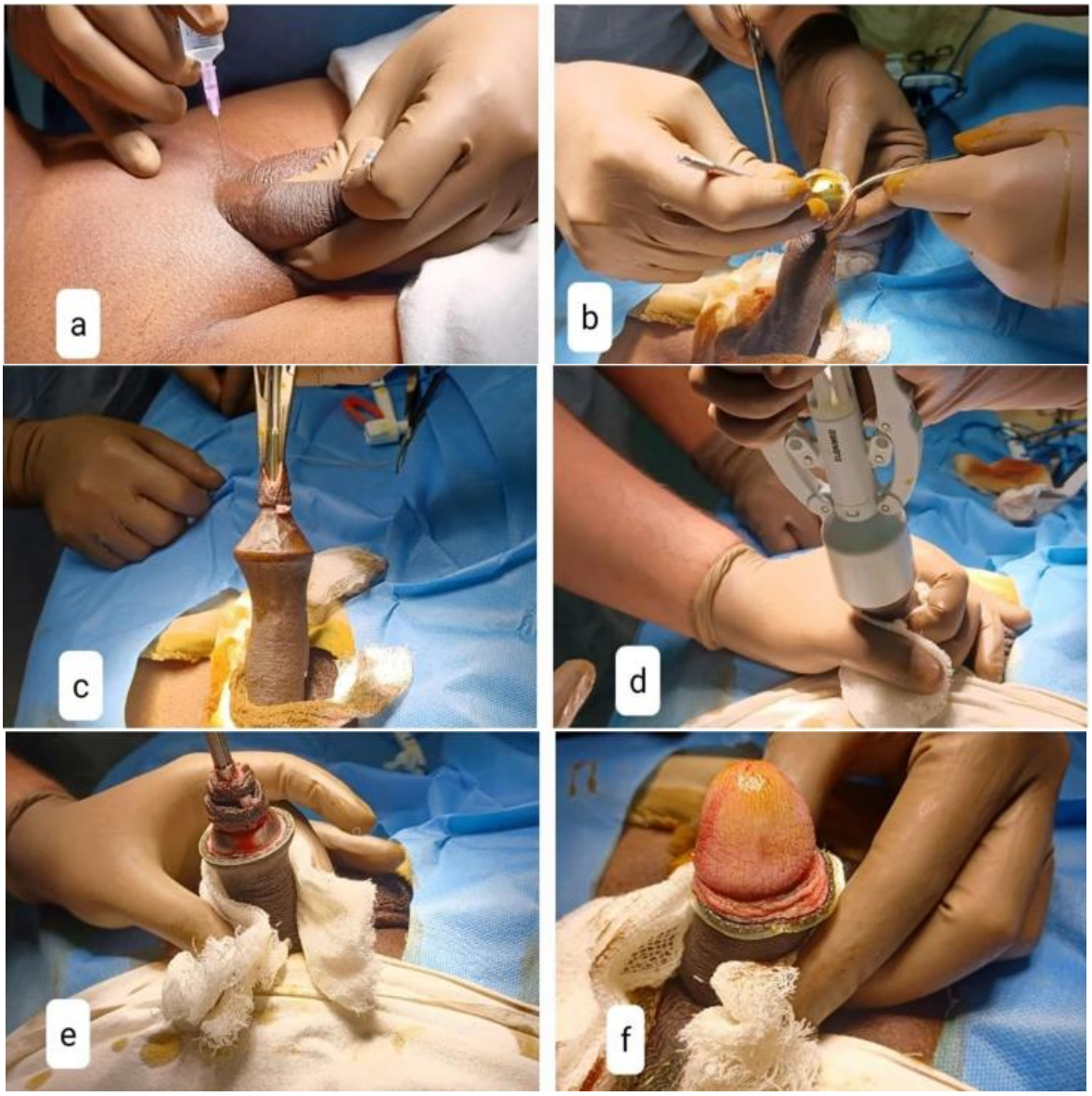


Figure 2: Circular stapler technique

a) Dorsal penile block is done.
b) Inner bell is placed inside the foreskin to cover the glans; the edge of the bell is at the level of the coronal sulcus. If the patient has severe phimosis, a dorsal slit should be made to correctly position the inner bell.
c) Foreskin is tied above the inner bell.
d) Outer bell is placed over the inner bell. The frenulum should be kept intact. The safety bolt is then removed. The screw is

rotated clockwise to sandwich the foreskin tightly. The handles are triggered to cut the foreskin and the wound is closed by staples at the same time.

e) Both the outer and inner bells are removed one by one.
f) Immediate post operative.

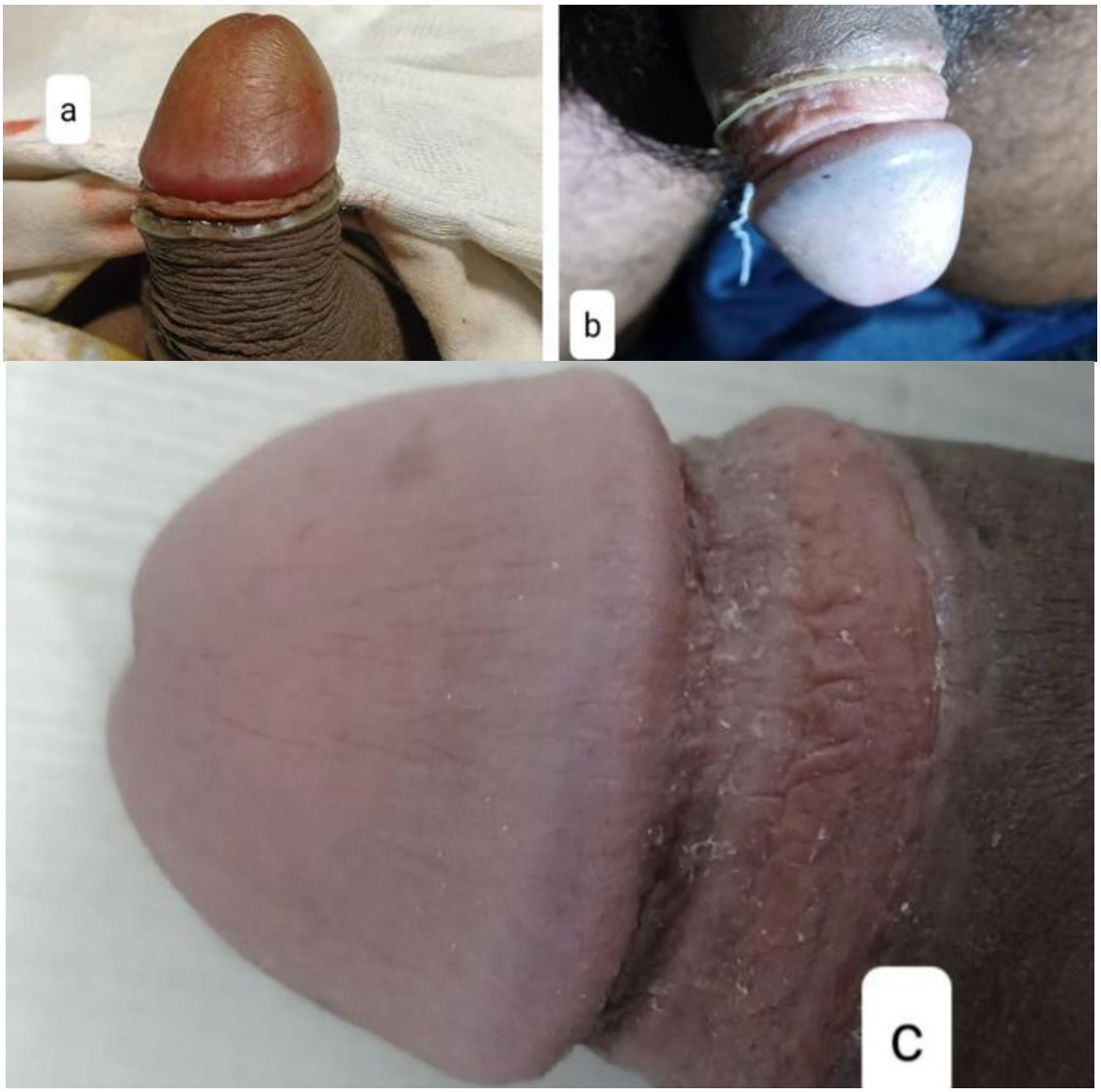


Figure 3: Typical recovery after stapler circumcision

a) Immediate post operative period.
b) Post operative day 7.
c) post operative day 15

Sample size

- Assuming p value <0.05 to be significant and considering effect to be two sided, we get Zα =1.96; assuming power of study to be 90% we get Z1-β = 1.28; considering an effect size (Difference in Wound healing time) of 6.44 to be statistically significant we get n > $2(Z\alpha + Z1-\beta)^2 \times SD^2/d^2$ we get n = 33. Hence minimum 33 patients will be taken in each group. Hence Total Sample Size will be 66.
- zα (the Value of the standard normal variate at 5% error) =1.96
- z1-β (the Value of the standard normal variate at 90% power) =1.28
- Wound healing time Group 1 = 19.86
- Wound healing time Group 2 = 13.42
- d=Effect Size = (19.86-13.42) = 6.44
- SD = Pooled Standard Deviation Assumed to be 8
- n > $2(Z\alpha + Z1-\beta)^2 \times SD^2/d^2 = 2(1.96 + 1.28)^2 \times 8^2/(6.44)^2 = 32.43 \sim= 33$.
- Considering 10% attrition the total sample size will be around 80.
- So, we will be taking 40 samples in each arm.

Statistical analysis

- Categorical variables will be expressed as Number of patients and percentage of patients and compared across the 2 groups Pearson's Chi Square test for Independence of Attributes/ Fisher's Exact Test as appropriate.
- Continuous variables will be expressed as Mean ± Standard Deviation and compared across the 2 groups

using unpaired t test if the data follows normal distribution and Mann-Whitney U test if the data does not follow normal distribution
- The statistical software SPSS version 25 will be used for the analysis.
- An alpha level of 5% has been taken, i.e. if any p value is less than 0.05 it will be considered as significant.

Ethical Clearance

The protocol will be submitted before the ethical committee for approval. After due approval from the Ethics Committee, the study will be initiated in the institution. Also, before including any patient for the participation in the study, a voluntary written consent for participation will be obtained from the patient. This consent will be taken in addition to the other consents that are obtained as per the laid down rules of the institution.

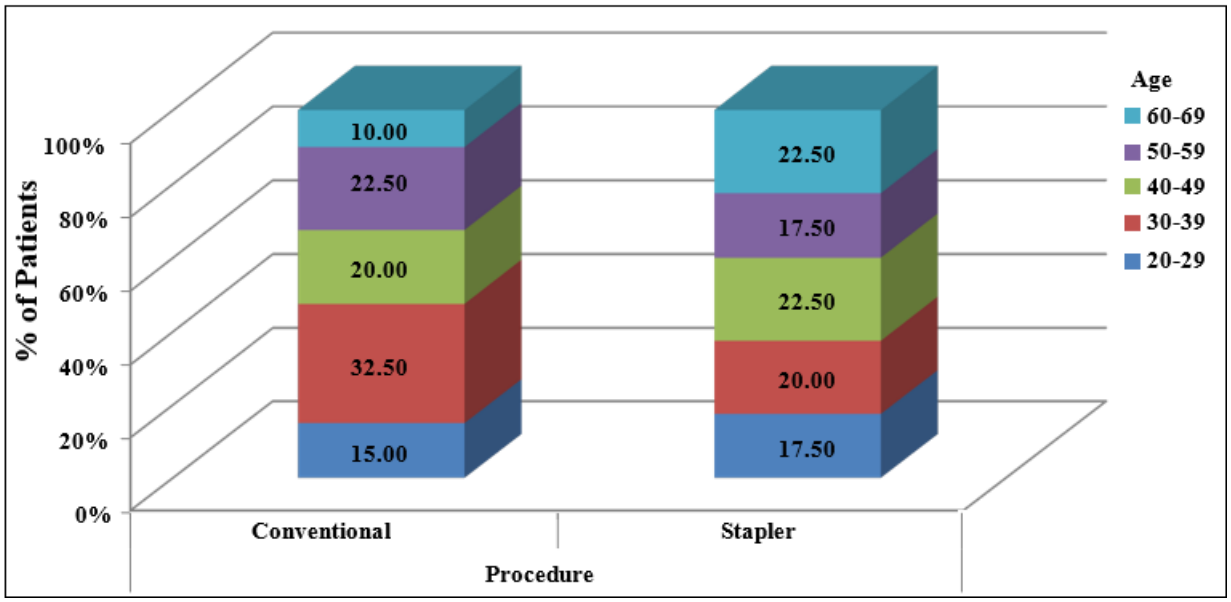
6. Results

Table 1: Age Distribution of Patients

Age	Procedure		Total	p Value	Significance
	Conventional	Stapler			
20-29	6 (15)	7 (17.5)	13 (16.25)	0.478	Not Significant
30-39	13 (32.5)	8 (20)	21 (26.25)		
40-49	8 (20)	9 (22.5)	17 (21.25)		
50-59	9 (22.5)	7 (17.5)	16 (20)		
60-69	4 (10)	9 (22.5)	13 (16.25)		
Total	40 (100)	40 (100)	80 (100)		

The table shows that the distribution of patients across different age groups is fairly similar between the conventional and stapler procedure groups. The highest percentage of patients falls within the 30-39 years age group in the conventional procedure (32.5%) and the 40-49 years age group in the stapler procedure (22.5%).

The p-value of 0.478 indicates that there is no statistically significant difference in the age distribution between patients undergoing the conventional procedure and those undergoing the stapler procedure. This suggests that age is evenly distributed across both groups, and age is not a confounding factor in comparing the outcomes of the two procedures.



Graph 1: Age Distribution of Patients

The graph shows that:
- For the conventional procedure, the largest age group is 30-39 years (32.5%), followed by 50-59 years (22.5%) and 40-49 years (20%).
- For the stapler procedure, the largest age group is 40-49 years (22.5%), followed by 60-69 years (22.5%) and 30-39 years (20%).

The distribution of patients is fairly similar between the two procedures, with no significant differences in the age groups. This supports the statistical finding that age distribution is not significantly different between the two groups (p-value = 0.478).

Table 2: Age Statistics of Patients

	Procedure						p Value	Significance
	Conventional			Stapler				
	Mean	Median	Std. Deviation	Mean	Median	Std. Deviation		
Age	43.00	42.00	13.31	45.25	47.00	13.99	0.391	Not Significant

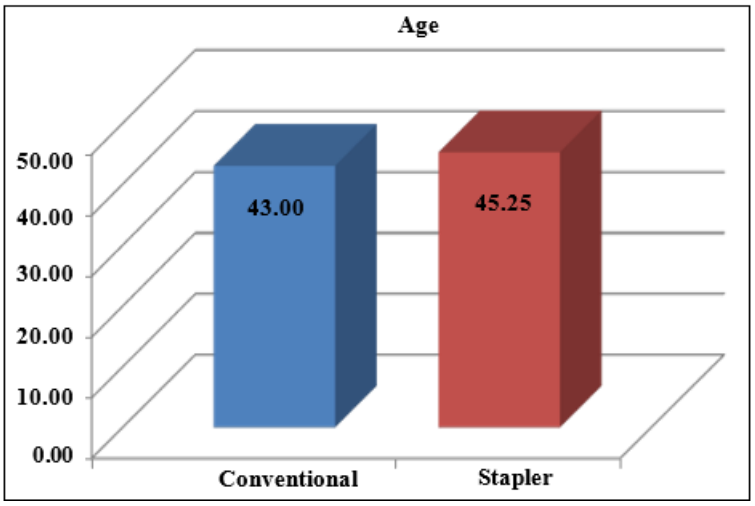
- The **mean age** of patients in the conventional group is 43.00 years, while in the stapler group, it is slightly higher at 45.25 years.
- The **median age** also follows a similar trend, with the conventional group having a median age of 42.00 years, and the stapler group having a median age of 47.00

years.

- The **standard deviation** indicates the spread of ages around the mean. Both groups have similar standard deviations (13.31 for conventional and 13.99 for stapler), suggesting comparable variability in patient ages within each group.

The **p-value** of 0.391 indicates that the difference in age between the two groups is not statistically significant. Therefore, age does not significantly differ between the conventional and stapler procedure groups.

The statistical summary shows that age distribution is similar across both groups, making it a non-confounding variable when comparing the outcomes of the two procedures.



Graph 2: Age Statistics of Patients

The bar chart displaying the age distribution in both groups highlights that there are no significant age differences, supporting the table's findings.

Table 3: Distribution of Patients' Comorbidities

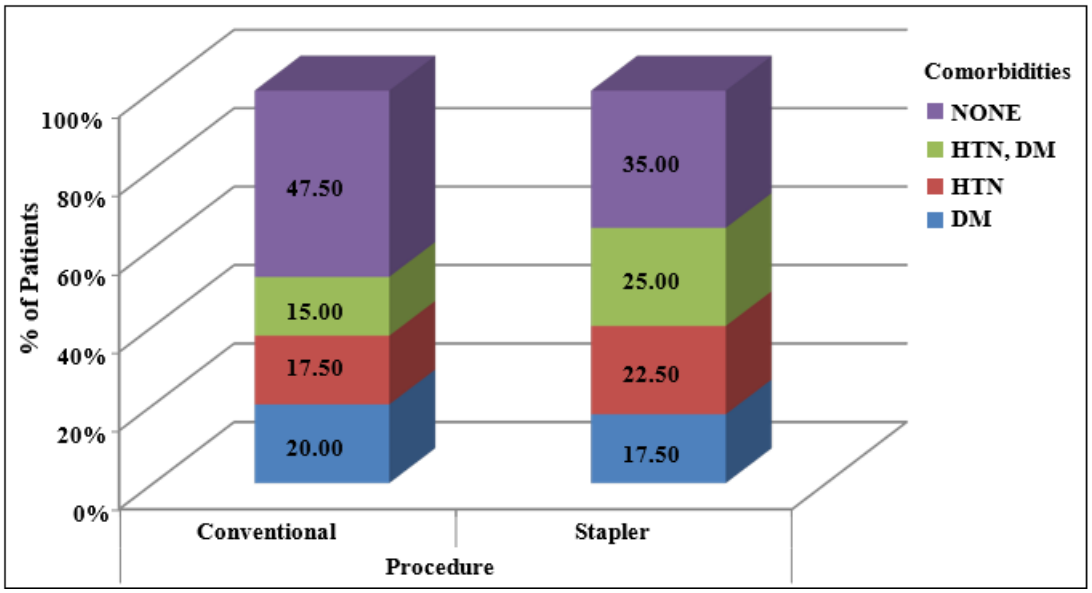
Comorbidities	Procedure		Total	p Value	Significance
	Conventional	Stapler			
DM	8(20)	7 (17.5)	15 (18.75)	0.557	Not Significant
HTN	7(17.5)	9 (22.5)	16 (20)		
BOTH	6(15)	10 (25)	16 (20)		
NIL	19(47.5)	14 (35)	33 (41.25)		
Total	40(100)	40 (100)	80 (100)		

The table shows that the distribution of comorbidities is quite similar between the conventional and stapler groups.

- Diabetes Mellitus (DM) is present in 20% of the conventional group and 17.5% of the stapler group.
- Hypertension (HTN) is observed in 17.5% of the conventional group and 22.5% of the stapler group.
- Patients with both HTN and DM are 15% in the conventional group and 25% in the stapler group.
- The majority of patients in both groups had no comorbidities, with 47.5% in the conventional group and 35% in the stapler group.

The p-value of 0.557 indicates that there is no statistically significant difference in the distribution of comorbidities between the two groups. This means that the presence of comorbidities does not differ significantly between patients undergoing the conventional procedure and those undergoing the stapler procedure.

This information helps to ensure that any differences in outcomes between the two procedures are not due to differences in patient comorbidities.



Graph 3: Distribution of Patients' Comorbidities

- The graph shows that a significant proportion of patients in both groups had no comorbidities, with 47.5% in the conventional group and 35% in the stapler group.
- The presence of both hypertension and diabetes (HTN, DM) is higher in the stapler group (25%) compared to the conventional group (15%).
- The distribution of patients with only hypertension (HTN) is slightly higher in the stapler group (22.5%) than in the conventional group (17.5%).
- The distribution of patients with only diabetes (DM) is similar in both groups, with 20% in the conventional group and 17.5% in the stapler group.

The chart visually confirms that the distribution of comorbidities is quite similar between the two procedure groups. The differences are not statistically significant, as indicated by the p-value of 0.557, which suggests that the comorbidity profiles are comparable between the groups. This supports the conclusion that comorbidities do not significantly influence the comparison of outcomes between the conventional and stapler procedures.

Table 4: Distribution of Surgical Indications

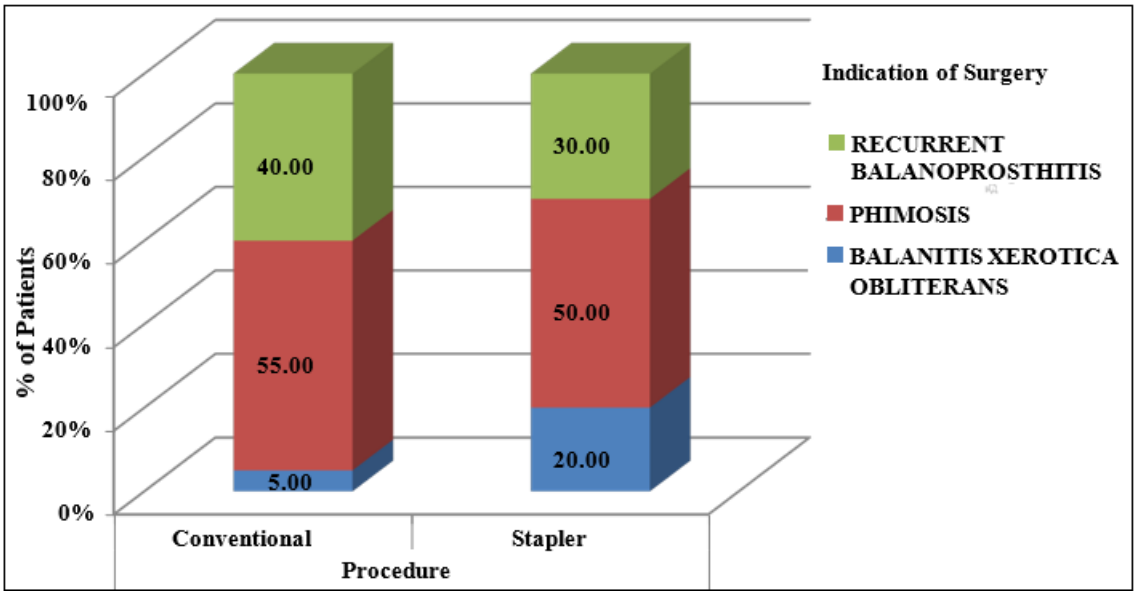
Indication of Surgery	Procedure		Total	p Value	Significance
	Conventional	Stapler			
Balanitis Xerotica Obliterans	2 (5)	8 (20)	10 (12.5)	0.118	Not Significant
Phimosis	22 (55)	20 (50)	42 (52.5)		
Recurrent Balanoposthitis	16 (40)	12 (30)	28 (35)		
Total	40 (100)	40 (100)	80 (100)		

The table shows the primary reasons for surgery in both groups, indicating that:

- **Balanitis Xerotica Obliterans** is an indication for a higher proportion of patients in the stapler group (20%) compared to the conventional group (5%).
- **Phimosis** is the most common indication in both groups, with 55% in the conventional group and 50% in the stapler group.
- **Recurrent Balanoposthitis** accounts for 40% of cases in the conventional group and 30% in the stapler group.

The **p-value** of 0.118 suggests that there is no statistically significant difference in the distribution of surgical indications between the two groups. This means the reasons for surgery are similarly distributed across both groups, indicating that the type of surgery performed (conventional vs. stapler) does not depend on the indication for surgery.

This distribution helps ensure that any differences in surgical outcomes between the two procedures are not due to differing surgical indications.



Graph 4: Distribution of Surgical Indications

- The graph shows that Phimosis is the most common indication for surgery in both groups, accounting for 55% of the conventional group and 50% of the stapler group.
- Balanitis Xerotica Obliterans is more prevalent in the stapler group (20%) compared to the conventional group (5%).
- Recurrent Balanoposthitis is more common in the conventional group (40%) than in the stapler group (30%).

The distribution of surgical indications is similar between the two groups, with no significant differences, as indicated by the p-value of 0.118. This suggests that the reasons for undergoing surgery are not significantly different between patients who had the conventional procedure and those who had the stapler procedure. This supports the conclusion that surgical indication does not significantly influence the comparison of outcomes between the two procedures.

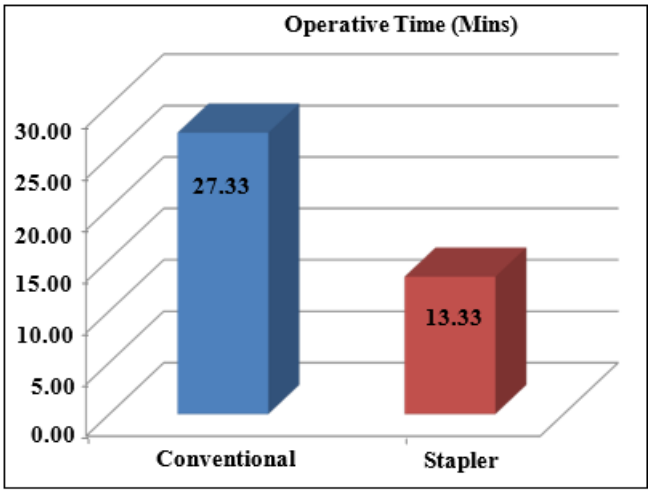
Table 5: Statistics of Operative Time

	Procedure						p Value	Significance
	Conventional			Stapler				
	Mean	Median	Std. Deviation	Mean	Median	Std. Deviation		
Operative Time (Mins)	27.33	26.00	4.41	13.33	13.00	1.99	<0.001	Significant

- The **mean operative time** for the conventional procedure is significantly longer (27.33 minutes) compared to the stapler procedure (13.33 minutes).
- The **median operative time** also shows that the stapler procedure (13.00 minutes) is quicker than the conventional procedure (26.00 minutes).
- The **standard deviation** indicates that there is more variability in the operative time for the conventional procedure (4.41) compared to the stapler procedure (1.99).

The **p-value** is less than 0.001, indicating that the difference in operative times between the two procedures is **Statistically Significant**.

This significant difference in operative times highlights that the stapler procedure is much quicker than the conventional procedure, which could contribute to various clinical and logistical benefits, such as reduced anaesthesia time and increased operating room efficiency.



Graph 5: Statistics of Operative Time

The chart shows a significant difference in the mean operative times between the two procedures:

- The **Conventional procedure** has a significantly longer operative time, with a mean of 27.33 minutes.
- The **Stapler procedure** has a much shorter operative time, with a mean of 13.33 minutes.

The visual difference between the two bars clearly indicates the efficiency of the stapler procedure in reducing operative time.

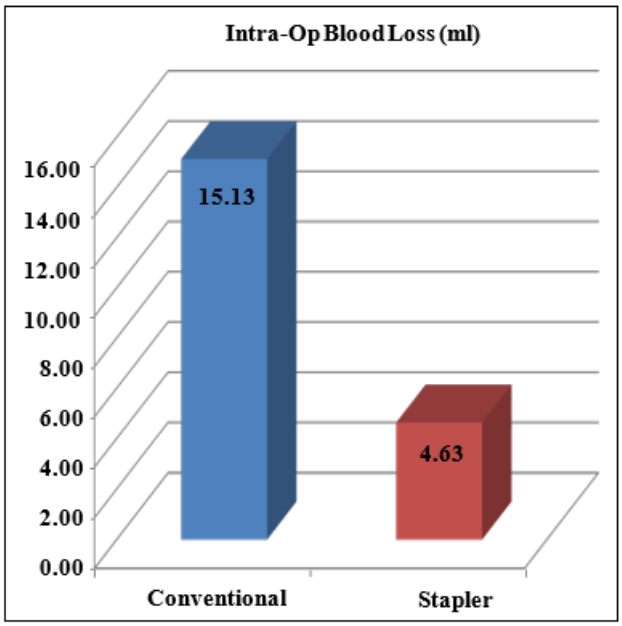
Table 6: Statistics of Intra-operative Blood Loss

	Procedure						p Value	Significance
	Conventional			Stapler				
	Mean	Median	Std. Deviation	Mean	Median	Std. Deviation		
Intra-Op Blood Loss (ml)	15.13	15.00	3.84	4.63	5.00	3.28	<0.001	Significant

- The **mean intra-operative blood loss** for the conventional procedure is significantly higher at 15.13 ml compared to the stapler procedure, which has a mean blood loss of
- 4.63 ml.
- The **median intra-operative blood loss** also indicates a greater blood loss in the conventional group (15.00 ml) compared to the stapler group (5.00 ml).
- The **standard deviation** shows the variability in blood loss for each procedure. Both groups have similar variability, with the conventional group at 3.84 and the stapler group at 3.28.

The **p-value** of less than 0.001 indicates that the difference in intra-operative blood loss between the two procedures is statistically significant.

This significant reduction in intra-operative blood loss with the stapler procedure suggests a clinical advantage, potentially leading to better patient outcomes and fewer complications related to blood loss.



Graph 6: Statistics of Intra-operative Blood Loss

The chart shows a significant difference in the mean intra-operative blood loss between the two procedures:

- The **Conventional procedure** has a significantly higher mean blood loss of 15.13 ml.
- The **Stapler procedure** has a much lower mean blood loss of 4.63 ml.

The visual difference between the two bars clearly indicates that the stapler procedure results in substantially less blood loss compared to the conventional procedure.

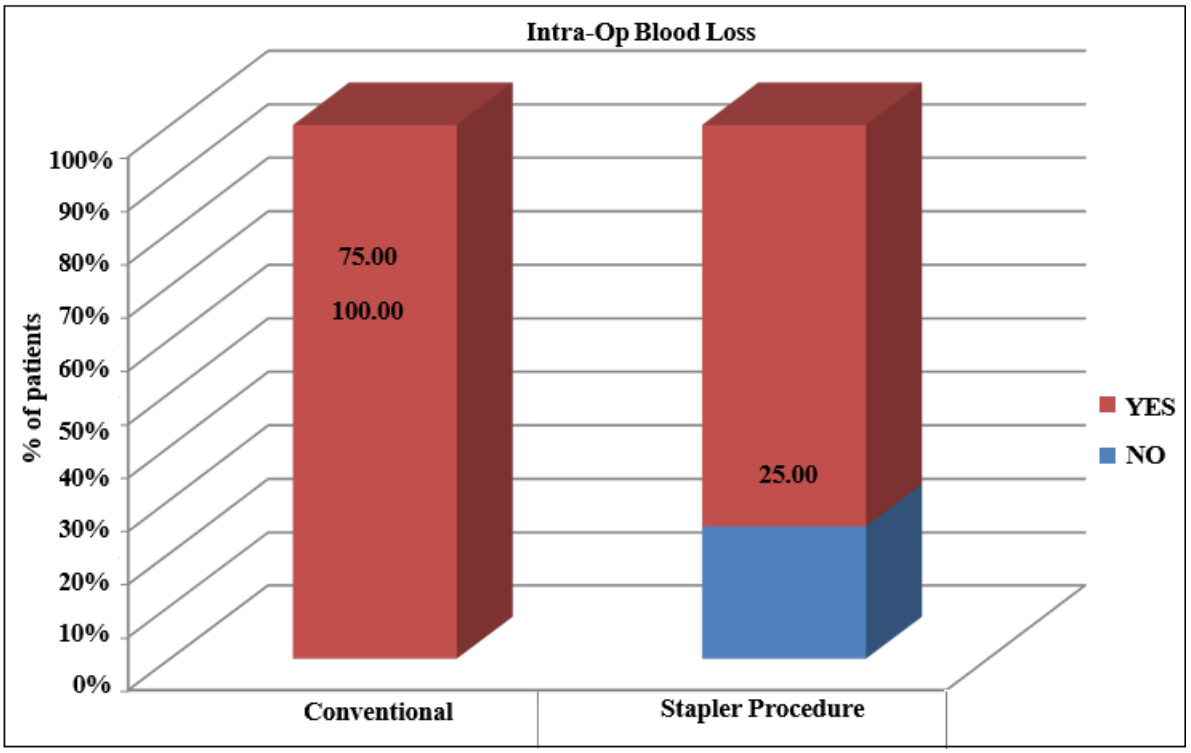
Table 7: Distribution of Presence of Intra-Operative Blood Loss

Intra-Op Blood Loss	Procedure		Total	P Value	Significance
	Conventional	Stapler			
No	0(0)	10(25)	10(12.5)	0.001	Significant
Yes	40(100)	30(75)	70(87.5)		
Total	40(100)	40(100)	80(100)		

The table shows a stark contrast in the presence of intra-operative blood loss between the two procedures:

- In the **Conventional procedure**, all patients (100%) experienced intra-operative blood loss.
- In the **Stapler procedure**, 25% of patients did not experience any intra-operative blood loss, while 75% did.

The **p-value** of 0.001 indicates that the difference in the presence of intra-operative blood loss between the two procedures is statistically significant. This suggests that the stapler procedure is more effective in minimizing or eliminating intra-operative blood loss in a significant number of cases compared to the conventional procedure.



Graph 7: Distribution of Presence of Intra-Operative Blood Loss

- The graph clearly shows that all patients (100%) undergoing the conventional procedure experienced intra-operative blood loss.
- In contrast, 25% of patients undergoing the stapler procedure did not experience any intra-operative blood loss, while 75% did.

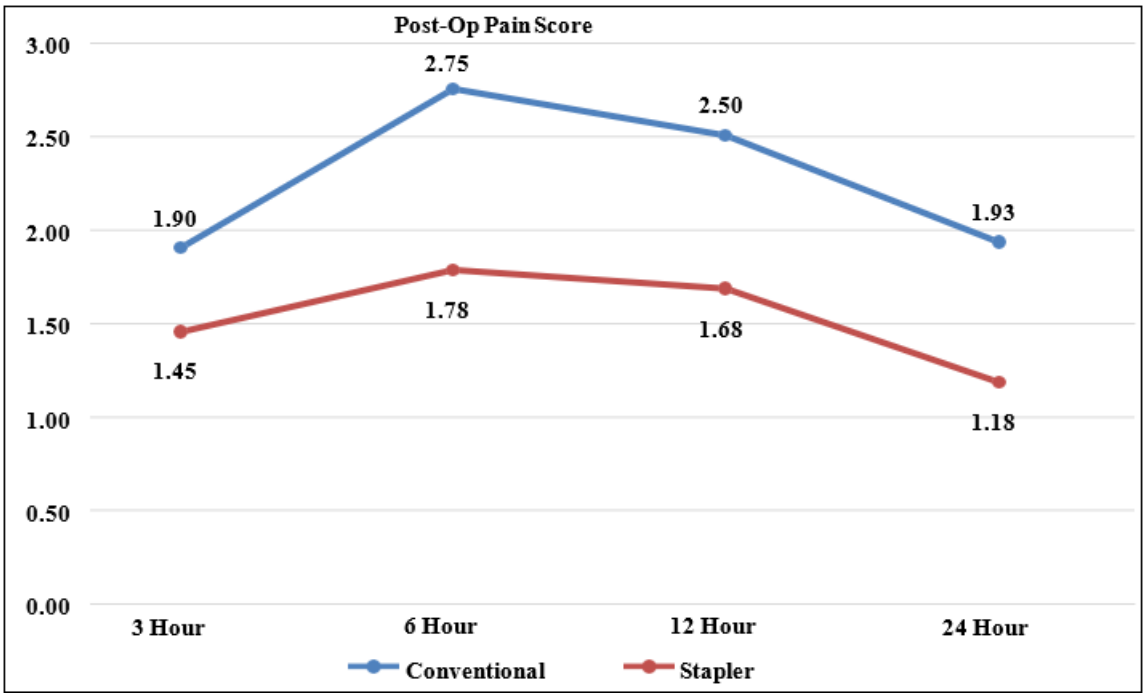
The visual difference between the two bars highlights the significant reduction in blood loss achieved with the stapler procedure compared to the conventional procedure.

Table 8: Statistics of Post-Operative Pain Scores at Various Intervals

	Procedure						p Value	Significance
	Conventional			Stapler				
	Mean	Median	Std. Deviation	Mean	Median	Std.Deviation		
Post-Op Pain Score - 3 Hr	1.9	2	0.67	1.45	1	0.55	0.002	Significant
Post-Op Pain Score - 6 Hr	2.75	3	0.93	1.78	2	0.58	<0.001	Significant
Post-Op Pain Score - 12 Hr	2.5	2	0.88	1.68	2	0.53	<0.001	Significant
Post-Op Pain Score - 24 Hr	1.93	2	1.12	1.18	1	0.38	<0.001	Significant

- **3 Hours Post-Op**: The stapler procedure results in significantly lower pain scores (mean: 1.45) compared to the conventional procedure (mean: 1.90), with a p-value of 0.002.
- **6 Hours Post-Op**: The stapler group continues to report lower pain scores (mean: 1.78) than the conventional group (mean: 2.75), with a highly significant p-value of less than 0.001.
- **12 Hours Post-Op**: Pain scores remain lower for the stapler procedure (mean: 1.68) compared to the conventional procedure (mean: 2.50), with a p-value of less than 0.001.
- **24 Hours Post-Op**: The stapler group reports significantly lower pain (mean: 1.18) compared to the conventional group (mean: 1.93), with a p-value of less than 0.001.

The consistent trend of lower pain scores in the stapler group across all time points indicates that the stapler procedure is associated with less post-operative pain compared to the conventional procedure.



Graph 8: Statistics of Post-Operative Pain Scores at Various Intervals

- **3 Hours Post-Op**: The stapler group reports a lower mean pain score of 1.45 compared to the conventional group at 1.90.
- **6 Hours Post-Op**: The stapler procedure results in significantly lower pain (mean score of 1.78) than the conventional procedure (mean score of 2.75).
- **12 Hours Post-Op**: The stapler group continues to report less pain (mean score of 1.68) compared to the conventional group (mean score of 2.50).
- **24 Hours Post-Op**: The stapler group maintains a lower pain score (mean of 1.18) than the conventional group (mean of 1.93).

This line graph effectively communicates the significant reduction in post-operative pain experienced by patients undergoing the stapler procedure compared to those undergoing the conventional procedure. The clear visual difference between the two lines underscores the stapler procedure's advantage in minimizing post-operative pain.

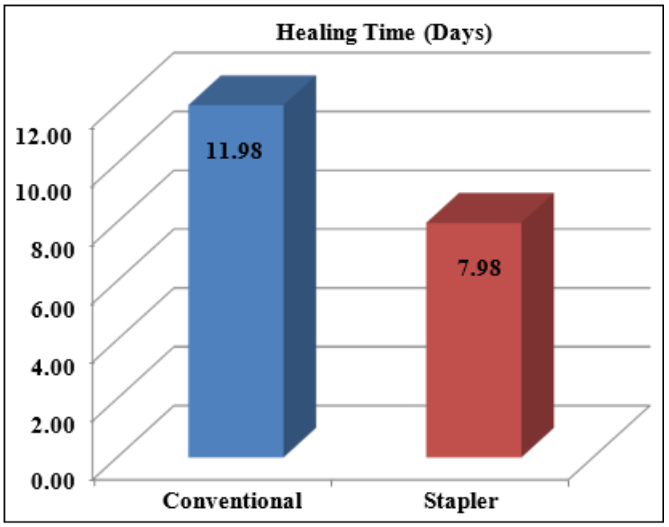
Table 9: Statistics of Healing Time

	Procedure						p Value	Significance
	Conventional			Stapler				
	Mean	Median	Std. Deviation	Mean	Median	Std. Deviation		
Healing Time (Days)	11.98	12	2.12	7.98	8	1.19	<0.001	Significant

- The **mean healing time** for the conventional procedure is significantly longer at 11.98 days compared to the stapler procedure, which has a mean healing time of 7.98 days.
- The **median healing time** also reflects a longer duration for the conventional group (12.00 days) compared to the stapler group (8.00 days).
- The **standard deviation** indicates the variability in healing times for each procedure, with the conventional group having a slightly higher variability (2.12) compared to the stapler group (1.19).

The **p-value** of less than 0.001 indicates that the difference in healing times between the two procedures is statistically significant.

This significant reduction in healing time with the stapler procedure suggests a clinical advantage, potentially leading to quicker recovery and reduced overall patient care time.



Graph 9: Statistics of Healing Time

The graph shows a significant difference in the mean healing times between the two procedures:

- The **Conventional procedure** has a significantly longer

mean healing time of 11.98 days.
- The **Stapler procedure** has a shorter mean healing time of 7.98 days.

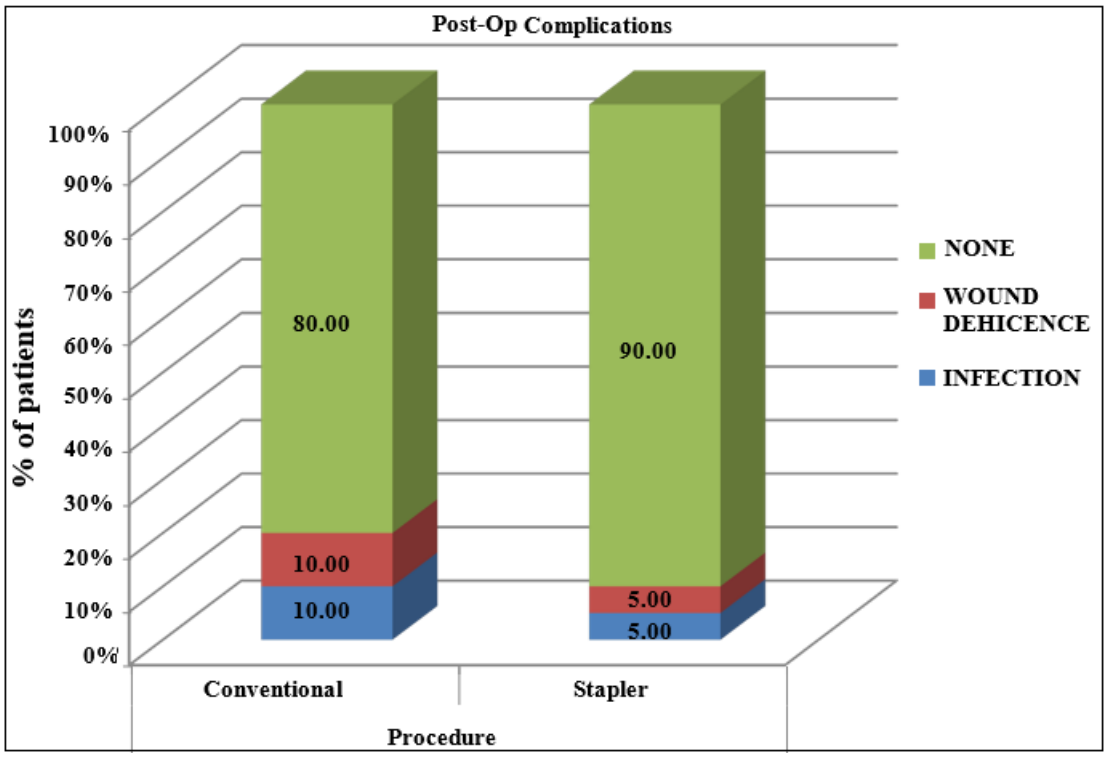
The visual difference between the two bars clearly indicates that patients who underwent the stapler procedure experienced a faster healing process compared to those who underwent the conventional procedure.

Table 10: Distribution of Post-Op Complications

Post-Op Complications	Procedure		Total	p Value	Significance
	Conventional	Stapler			
Infection	4 (10)	2 (5)	6 (7.5)	0.456	Not Significant
Wound Dehiscence	4 (10)	2 (5)	6 (7.5)		
None	32 (80)	36 (90)	68 (85)		
Total	40 (100)	40 (100)	80 (100)		

- **Infection**: The incidence of infection is slightly higher in the conventional group (10%) compared to the stapler group (5%), but this difference is not statistically significant (p-value = 0.456).
- **Wound Dehiscence**: Similarly, wound dehiscence occurs more in the conventional group (10%) than in the stapler group (5%), but the difference is not statistically significant.
- **None**: The majority of patients in both groups did not experience any post-operative complications, with a higher percentage in the stapler group (90%) compared to the conventional group (80%).

The **p-value** of 0.456 indicates that there is no statistically significant difference in the incidence of post-operative complications between the conventional and stapler procedures. This suggests that the type of procedure does not significantly affect the likelihood of post-operative complications.



Graph 10: Distribution of Post-Op Complications

- **Infection**: The chart shows that 10% of patients in the conventional group experienced an infection, compared to 5% in the stapler group.
- **Wound Dehiscence**: Similarly, 10% of patients in the conventional group experienced wound dehiscence, compared to 5% in the stapler group.
- **None**: A higher percentage of patients in the stapler group (90%) did not experience any complications compared to the conventional group (80%).

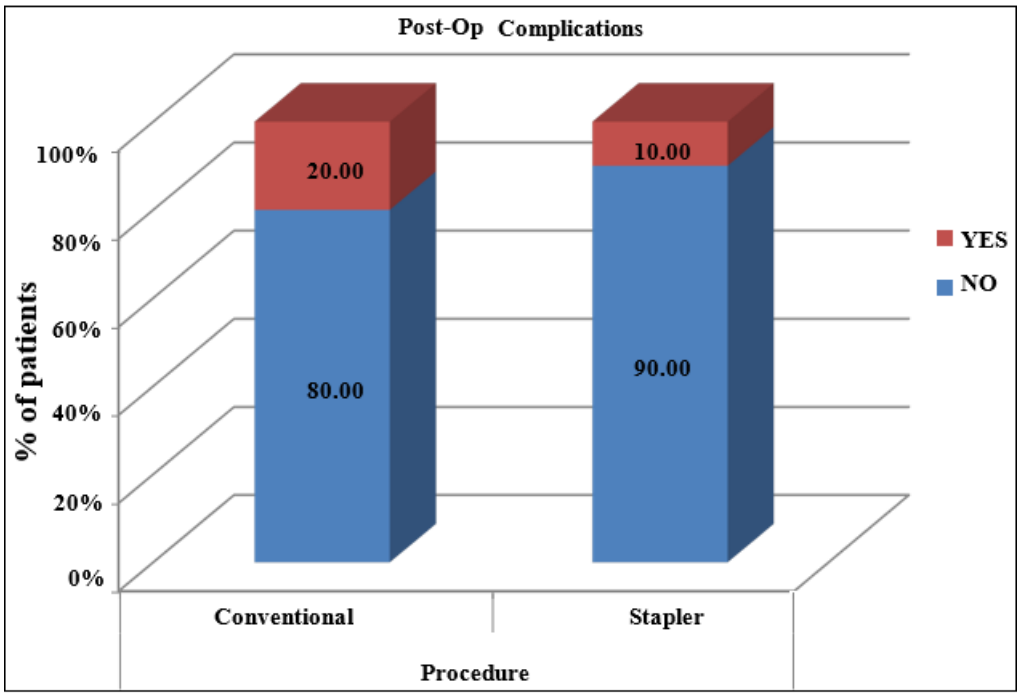
This graph effectively communicates the distribution of post-operative complications between the two procedures. The visual representation clearly shows that most patients in both groups did not experience any complications, and the rates of complications (infection and wound dehiscence) are slightly lower in the stapler group. This supports the conclusion that both procedures are safe with similar complication profiles.

Table 11: Distribution of Presence of Post-Operative Complications

Post-Op Complications	Procedure		Total	p Value	Significance
	Conventional	Stapler			
No	32(80)	36(90)	68(85)	0.210	Not Significant
Yes	8(20)	4(10)	12(15)		
Total	40(100)	40(100)	80(100)		

- No Complications (No): The majority of patients in both groups did not experience any post-operative complications, with 80% in the conventional group and 90% in the stapler group.
- Complications (Yes): A higher percentage of patients in the conventional group (20%) experienced post-operative complications compared to the stapler group (10%).

The p-value of 0.210 indicates that the difference in the overall incidence of post-operative complications between the two procedures is not statistically significant. This suggests that the likelihood of experiencing post-operative complications is similar for both the conventional and stapler procedures.



Graph 11: Distribution of Presence of Post-Operative Complications

- The chart shows that a higher percentage of patients in the stapler group (90%) did not experience any post-operative complications compared to the conventional group (80%).
- Conversely, 20% of patients in the conventional group experienced complications, compared to only 10% in the stapler group.

This graph effectively communicates the overall incidence of post-operative complications between the conventional and stapler procedures. The visual representation clearly shows that the majority of patients in both groups did not experience any complications, and the incidence of complications is slightly lower in the stapler group, supporting the conclusion that both procedures have similar safety profiles.

7. Discussion

This study compares the conventional method and the circular stapler method for male circumcision by examining several critical parameters, including operative time, intra-operative blood loss, postoperative pain, healing time, and complication rates. The results reveal significant differences between the two techniques, suggesting distinct advantages for the circular stapler method.

Operative Time

The circular stapler method demonstrates a markedly shorter operative time compared to the conventional method (mean operative time: 13.33 minutes for stapler vs. 27.33 minutes for conventional, $p < 0.001$). This finding is consistent with existing literature, such as the study by X D Jin et al. (2015), which also reported a significantly shorter operative time for the stapler method (6.8 ± 3.1 vs. 24.2 ± 3.2 minutes). The efficiency of the stapler method is primarily due to its simultaneous cutting and stapling mechanism, which reduces the procedural complexity and duration. Shorter operative times are beneficial as they minimize the patient's exposure to anaesthesia and reduce the overall time spent in the operating room, thereby enhancing throughput and resource utilization.

Intra-Operative Blood Loss

The circular stapler method results in significantly less intra-operative blood loss (mean blood loss: 4.63 ml) compared to

the conventional method (mean blood loss: 15.13 ml, $p < 0.001$). This reduction is corroborated by X D Jin et al. (2015), who found that blood loss was significantly lower in the stapler group (1.8 ± 1.8 ml) compared to the conventional group (9.4 ± 1.5 ml). The stapler's design, which includes immediate haemostasis through stapling, likely accounts for this reduction in blood loss, improving patient safety and reducing the risk of complications associated with excessive bleeding.

Postoperative Pain

Pain scores were consistently lower in the circular stapler group at various postoperative intervals (3 hours, 6 hours, 12 hours, and 24 hours). For example, at 24 hours post-operation, the mean pain score was 1.18 in the stapler group versus 1.93 in the conventional group ($p < 0.001$). Similar findings were reported by X D Jin et al. (2015), who noted significantly lower pain scores both intraoperatively and postoperatively in the stapler group. Reduced pain can be attributed to the minimally invasive nature of the stapler technique, which causes less tissue trauma compared to the conventional method.

Healing Time

The study found that the healing time was significantly shorter for the circular stapler method (mean healing time: 7.98 days) compared to the conventional method (mean healing time: 11.98 days, $p < 0.001$). This result is in line with Zheng Zhang et al. (2016), who reported faster recovery and a higher satisfaction rate of penile cosmetic appearance with a novel disposable suture device compared to conventional circumcision. Faster healing times reduce the duration of postoperative care and the risk of infection, facilitating a quicker return to normal activities for patients.

Complication Rates

While the overall rate of postoperative complications was not significantly different between the two groups (infection rates: 20% for conventional vs. 10% for stapler, $p = 0.456$), the trend favours the stapler method. The study by X D Jin et al. (2015) also found fewer complications in the stapler group (2.7% vs. 7.8%, $p < 0.01$). The stapler's precision and uniformity likely contribute to these reduced complication rates by ensuring consistent and secure wound closures.

8. Summary & Conclusion

8.1 Background and Objectives

Male circumcision, a common surgical procedure performed for cultural, religious, and medical reasons, traditionally involves conventional surgical techniques. These methods, while effective, are often associated with significant operative time, blood loss, and postoperative complications. In recent years, the circular stapler method has emerged as an alternative, promising greater efficiency and safety. This thesis aims to compare the conventional and circular stapler methods for male circumcision, focusing on operative time, blood loss, postoperative pain, healing time, and complication rates to determine the more effective and patient-friendly technique.

8.2 Methods

The study employed a prospective comparative design, including 80 patients divided equally between the conventional and circular stapler methods. Key variables such as age, comorbidities, and indications for surgery were recorded to ensure comparable groups. Statistical analysis was conducted using SPSS version 25, with Pearson's Chi-Square test and unpaired t-test employed to compare categorical and continuous variables, respectively. Significant findings were identified at an alpha level of 5%.

8.3 Results

The findings indicate that the circular stapler method significantly reduces operative time (mean 13.33 minutes vs. 27.33 minutes, $p < 0.001$) and intra-operative blood loss (mean 4.63 ml vs. 15.13 ml, $p < 0.001$) compared to the conventional method. Postoperative pain scores were consistently lower in the stapler group across various time points, with significant differences observed at 3, 6, 12, and 24 hours (all $p < 0.001$). Additionally, the stapler method resulted in faster healing times (mean 7.98 days vs. 11.98 days, $p < 0.001$). While complication rates were generally lower in the stapler group, the differences were not statistically significant for infection and wound dehiscence.

8.4 Conclusion

The study concludes that the circular stapler method for male circumcision offers significant advantages over the conventional method, including reduced operative time, less intra-operative blood loss, lower postoperative pain, and faster healing. These findings suggest that the stapler method enhances patient safety and satisfaction, making it a superior alternative for male circumcision. The results support the broader adoption of the circular stapler technique in clinical practice, provided that further research continues to confirm its long-term benefits and cost-effectiveness.

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Annexure I Study Proforma

Thesis Topic:
Male Circumcision - Conventional versus Circular Stapler: A Prospective Comparative Study

Patient Particulars
S. No.: Date:
Name: Age: Sex:
Date of Admission: IPD Regn. No.
Date of Surgery:
Date of Discharge:
Chief Complaints:

History Taking

Past Medical History:

Past Surgical History:

Allergic History: General Survey: Penile Examination:

Systemic Examination:

Name of the Procedure:

Outcome of Surgery:

Time Taken for Operation: Intra-Operative Blood Loss:

Operative Period Clinical Examination

Post-Operative Period

Time Passed since Procedure: Post-Operative Pain Score:	03 Hr	06 Hr	12 Hr	24 Hr	48 Hr
Healing Time (Days):					
Complications in Follow-Up Period: Wound Infection		Day 1	Day 7	Day 15	Day 30
Urinary Retention					
Urinary Tract Infection					
Penile Edema					
Haemorrhage/Haematoma					
Chronic Pain					
Delayed Wound Healing					
Duration of Hospital Stay:				Remarks:	