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Operative Duration, Postoperative Morbidity, and Failure Rates in No-Scalpel Versus Conventional Vasectomy: Evidence from Combined Retrospective and Prospective Analysis

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Abstract | **Original Research Article**

Background: Vasectomy is a reliable and effective method of permanent male sterilization. Conventional vasectomy is widely practiced but is associated with postoperative complications such as pain, hematoma, and infection. No-scalpel vasectomy has emerged as a minimally invasive alternative with improved postoperative outcomes. ***Aim:*** To compare operative duration, postoperative morbidity, and failure rates between no-scalpel vasectomy and conventional vasectomy. ***Materials and Methods:*** This hospital-based comparative observational study with retrospective and prospective analysis was conducted in the Department of surgery at a tertiary care hospital India over a period of 12 months. A total of 156 patients undergoing vasectomy were included, with 78 patients each in the no-scalpel vasectomy and conventional vasectomy groups. Outcome measures included operative duration, postoperative pain, hematoma, sepsis, failure rate, and semen analysis findings. Statistical analysis was performed using SPSS version 27.0 and GraphPad Prism version 5, with $p < 0.05$ considered statistically significant. ***Results:*** The mean operative duration was significantly lower in the no-scalpel vasectomy group (11.8 ± 2.4 minutes) compared to the conventional vasectomy group (19.6 ± 3.1 minutes) ($p < 0.001$). Mild postoperative pain was more common in the no-scalpel group, while moderate and severe pain were predominantly observed in the conventional group ($p < 0.001$). Postoperative complications such as hematoma, sepsis, and scrotal edema were significantly lower in the no-scalpel vasectomy group. Failure rates were low in both groups, with no statistically significant difference. Higher rates of azoospermia were observed in the no-scalpel vasectomy group. ***Conclusion:*** No-scalpel vasectomy is associated with shorter operative duration, lower postoperative morbidity, and comparable effectiveness when compared with conventional vasectomy, making it a preferable technique for permanent male sterilization.

Keywords: No-scalpel vasectomy; Conventional vasectomy; Male sterilization; Postoperative morbidity; Failure rate; Semen analysis.

INTRODUCTION

Vasectomy is one of the most effective, safe, and economical methods of permanent male contraception practiced worldwide. It is a minor surgical procedure intended to achieve sterility by interrupting the vas deferens, thereby preventing the transport of sperm into the ejaculate. Over the past few decades, vasectomy has gained recognition as a reliable family planning method because of its simplicity, low complication rate, and high success rate.[1] Despite these advantages, the acceptance of vasectomy remains relatively low in many developing countries due to social stigma, misconceptions regarding masculinity, fear of complications, and lack of awareness.[2] In countries with rapidly increasing populations, promotion of male sterilization remains an important public health strategy to reduce unintended pregnancies and improve reproductive health outcomes.

Conventional vasectomy (CV) has traditionally been performed using scalpel incisions to expose and ligate the vas deferens. Although effective, this method is associated with certain postoperative complications such as pain, bleeding, hematoma formation, wound infection, and delayed recovery.[3] To overcome these limitations, the no-scalpel vasectomy (NSV) technique

was introduced by Li Shunqiang in China in the 1970s and later popularized globally due to its minimally invasive nature.[4] Instead of making a skin incision, NSV utilizes a sharp dissecting forceps to puncture the scrotal skin, allowing delivery and occlusion of the vas deferens through a tiny opening. This approach minimizes tissue trauma, reduces operative bleeding, shortens procedural duration, and enhances postoperative recovery.[5]

Several studies have demonstrated that NSV is associated with lower postoperative morbidity compared to the conventional technique. Complications such as scrotal edema, infection, hematoma, and postoperative discomfort are significantly reduced in patients undergoing NSV.[6] Furthermore, the smaller puncture wound generally heals rapidly without the need for suturing, resulting in improved patient satisfaction and earlier return to daily activities.[7] However, despite the growing popularity of NSV, concerns regarding failure rates, recanalization, and technical expertise continue to influence the choice of procedure among surgeons and patients.[8]

Assessment of operative duration, postoperative morbidity, and failure rates is essential to determine the overall effectiveness and safety of vasectomy techniques. Comparative evaluation of these parameters can provide valuable evidence for clinicians and policymakers in selecting the most appropriate approach for large-scale family planning programs. Retrospective studies offer insights from previously treated patients, whereas prospective analyses allow detailed monitoring of outcomes and complications in real time. Combining both methodologies can therefore improve the reliability and comprehensiveness of clinical findings.[9]

The present study was undertaken to compare no-scalpel vasectomy and conventional vasectomy with respect to operative duration, postoperative morbidity, and failure rates using a combined retrospective and prospective analytical approach. The study aims to generate evidence regarding the relative advantages and limitations of both procedures, thereby contributing to improved surgical practice and enhanced acceptance of male sterilization as a dependable contraceptive option.[10]

The present study aims to compare no-scalpel vasectomy and conventional vasectomy in terms of operative duration, postoperative morbidity, and failure rates. The objectives are to evaluate surgical efficiency, assess postoperative complications such as pain, hematoma, and infection, and determine the overall effectiveness and safety of both vasectomy techniques.

MATERIALS AND METHODS

Study Design: Hospital-based comparative observational study with retrospective and prospective analysis.

Study Population: Male patients undergoing vasectomy for permanent sterilization.

Sample Size:

- Total sample size: 156 patients.
- No-Scalpel Vasectomy group: 78 patients.
- Conventional Vasectomy group: 78 patients.

Study Duration: 12 Months

Study Place: Department of Surgery, Tertiary Care Hospital.

Inclusion Criteria:

- Male patients willing for vasectomy.
- Patients fit for surgery under local anesthesia.
- Patients giving informed consent.

Exclusion Criteria:

- Patients with genital infection or bleeding disorders.
- Previous scrotal surgery/pathology.
- Patients unwilling for follow-up or semen analysis.

Outcome Measures:

- Operative duration.
- Postoperative pain.
- Haematoma.
- Sepsis.
- Failure rate.
- Semen analysis findings.

Statistical Analysis:

We put the data into Microsoft Excel and then used SPSS software version 27.0 (SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5 to look at it. Mean ± standard deviation was used to show continuous variables, and frequencies and percentages were used to show categorical variables. The unpaired t-test was utilized to examine continuous variables between independent groups, whereas the paired t-test was employed for comparisons within the same group. The Chi-square test or Fisher's exact test was used to look at categorical variables, depending on which one was better. A p-value of less than 0.05 was seen to be statistically important.

RESULT

Table 1: Distribution of Age Group among Study Participants

Age Group (Years)	No-Scalpel Vasectomy n (%)	Conventional Vasectomy n (%)	Total n (%)	p-value
21–30	12 (15.4%)	10 (12.8%)	22 (14.1%)	0.641
31–40	28 (35.9%)	30 (38.5%)	58 (37.2%)	
41–50	26 (33.3%)	24 (30.8%)	50 (32.1%)	
>50	12 (15.4%)	14 (17.9%)	26 (16.7%)	
Total	**78 (100%)**	**78 (100%)**	**156 (100%)**	

Table 2: Comparison of Mean Operative Duration between Study Groups

Operative Duration (Minutes)	No-Scalpel Vasectomy	Conventional Vasectomy	p-value
Mean ± SD	11.8 ± 2.4	19.6 ± 3.1	<0.001
Minimum	8	14	
Maximum	18	28	

Table 3: Comparison of Postoperative Pain between Study Groups

Postoperative Pain	No-Scalpel Vasectomy n (%)	Conventional Vasectomy n (%)	Total n (%)	p-value
Mild	58 (74.4%)	32 (41.0%)	90 (57.7%)	<0.001
Moderate	18 (23.1%)	36 (46.2%)	54 (34.6%)	
Severe	2 (2.5%)	10 (12.8%)	12 (7.7%)	
Total	**78 (100%)**	**78 (100%)**	**156 (100%)**	

Table 4: Comparison of Postoperative Complications between Study Groups

Complications	No-Scalpel Vasectomy n (%)	Conventional Vasectomy n (%)	Total n (%)	p-value
Hematoma	3 (3.8%)	11 (14.1%)	14 (9.0%)	0.028
Sepsis/Infection	2 (2.6%)	9 (11.5%)	11 (7.1%)	0.031
Scrotal Edema	5 (6.4%)	15 (19.2%)	20 (12.8%)	0.017
No Complications	68 (87.2%)	43 (55.2%)	111 (71.1%)	<0.001

Table 5: Comparison of Failure Rate between Study Groups

Failure Rate	No-Scalpel Vasectomy n (%)	Conventional Vasectomy n (%)	Total n (%)	p-value
Failure Present	1 (1.3%)	4 (5.1%)	5 (3.2%)	0.169
No Failure	77 (98.7%)	74 (94.9%)	151 (96.8%)	
Total	**78 (100%)**	**78 (100%)**	**156 (100%)**	

Table 6: Semen Analysis Findings after Vasectomy

Semen Analysis Finding	No-Scalpel Vasectomy n (%)	Conventional Vasectomy n (%)	Total n (%)	p-value
Azoospermia Achieved	75 (96.2%)	70 (89.7%)	145 (92.9%)	0.118
Rare Non-motile Sperm	2 (2.5%)	5 (6.4%)	7 (4.5%)	
Persistent Motile Sperm	1 (1.3%)	3 (3.9%)	4 (2.6%)	
Total	**78 (100%)**	**78 (100%)**	**156 (100%)**	

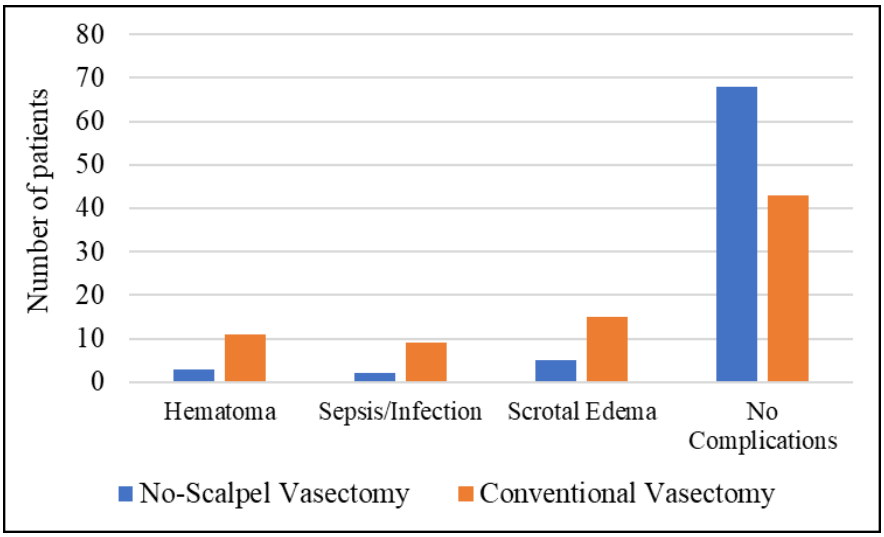

Figure 1: Comparison of Postoperative Complications between Study Groups

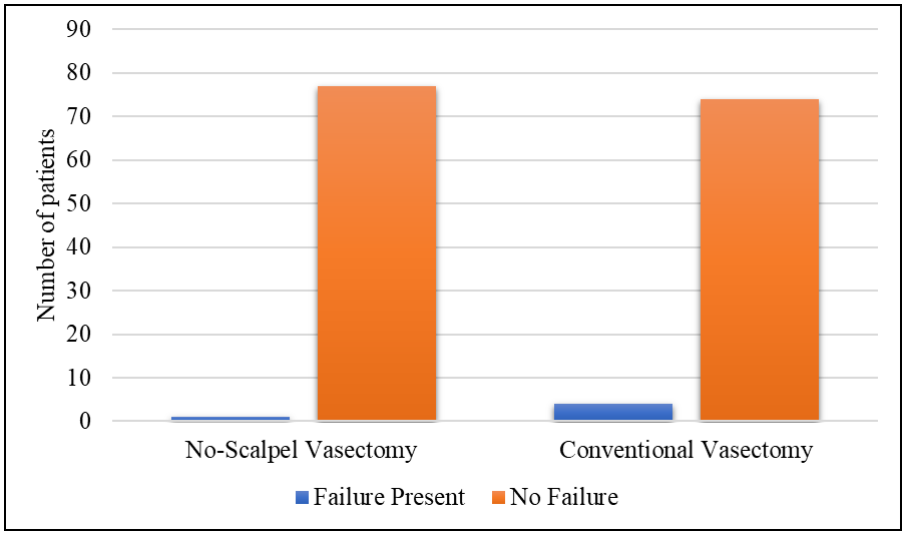

Figure 2: Comparison of Failure Rate between Study Groups

A total of 156 patients were included in the study, with 78 patients each in the no-scalpel vasectomy and conventional vasectomy groups. The majority of patients belonged to the 31–40 years age group, accounting for 58 (37.2%) cases, followed by the 41–50 years age group with 50 (32.1%) patients. In the no-scalpel vasectomy group, 28 (35.9%) patients were aged 31–40 years, whereas 30 (38.5%) patients in the conventional vasectomy group belonged to the same age category. The distribution of age between the two groups was comparable and statistically not significant ($p = 0.641$).

The mean operative duration was significantly lower in the no-scalpel vasectomy group compared to the conventional vasectomy group. Patients undergoing no-scalpel vasectomy had a mean operative duration of 11.8 ± 2.4 minutes, whereas the conventional vasectomy group required 19.6 ± 3.1 minutes on average. The difference was statistically highly significant ($p < 0.001$), indicating that the no-scalpel technique was associated with shorter surgical time.

Postoperative pain was significantly less severe among patients undergoing no-scalpel vasectomy. Mild postoperative pain was observed in 58 (74.4%) patients in the no-scalpel group compared to 32 (41.0%) patients in the conventional vasectomy group. Moderate pain was more common in the conventional vasectomy group, affecting 36 (46.2%) patients, while severe pain was reported in 10 (12.8%) patients undergoing conventional vasectomy compared to only 2 (2.5%) patients in the no-scalpel group. This difference was statistically significant ($p < 0.001$).

Postoperative complications were comparatively lower in the no-scalpel vasectomy group. Hematoma formation occurred in 3 (3.8%) patients in the no-scalpel group and 11 (14.1%) patients in the conventional vasectomy group, which was statistically significant ($p = 0.028$). Sepsis or wound infection was noted in 2 (2.6%) patients in the no-scalpel group compared to 9 (11.5%) patients in the conventional group ($p = 0.031$). Scrotal edema was observed in 5 (6.4%) patients undergoing no-scalpel vasectomy and 15 (19.2%) patients undergoing conventional vasectomy ($p = 0.017$). Overall, absence of postoperative complications was significantly higher in the no-scalpel group (87.2%) than in the conventional vasectomy group (55.2%) ($p < 0.001$).

Failure rate following vasectomy was lower in the no-scalpel vasectomy group compared to the conventional vasectomy group. Failure was observed in 1 (1.3%) patient in the no-scalpel group and 4 (5.1%) patients in the conventional vasectomy group. However, the difference between the two groups was not statistically significant ($p = 0.169$). Successful vasectomy without failure was achieved in 77 (98.7%) patients in the no-scalpel group and 74 (94.9%) patients in the conventional group.

Semen analysis findings demonstrated a higher rate of azoospermia in the no-scalpel vasectomy group. Azoospermia was achieved in 75 (96.2%) patients undergoing no-scalpel vasectomy compared to 70 (89.7%) patients in the conventional vasectomy group. Rare non-motile sperm were identified in 2 (2.5%) patients in the no-scalpel group and 5 (6.4%) patients in the conventional group. Persistent motile sperm were observed in 1 (1.3%) patient in the no-scalpel group and 3 (3.9%) patients in the conventional group. Although the no-scalpel technique showed comparatively better semen analysis outcomes, the difference was not statistically significant ($p = 0.118$).

DISCUSSION

The present study compared no-scalpel vasectomy and conventional vasectomy with regard to operative duration, postoperative morbidity, failure rates, and semen analysis findings. The findings

demonstrated that the no-scalpel vasectomy technique was associated with shorter operative duration, reduced postoperative pain, fewer complications, and better postoperative recovery when compared with the conventional technique.

In the present study, the majority of patients belonged to the 31–40 years age group, followed by the 41–50 years age group. Similar age distribution patterns have been reported in previous vasectomy studies, where men in the economically productive and completed family size age groups were more likely to opt for permanent sterilization.[11] A study conducted by Kumar et al. observed that most vasectomy acceptors were between 30 and 45 years of age, which is consistent with the present findings.[12] This trend may reflect increased awareness regarding family planning and socioeconomic responsibilities among middle-aged men.

The mean operative duration in the present study was significantly lower in the no-scalpel vasectomy group (11.8 ± 2.4 minutes) compared to the conventional vasectomy group (19.6 ± 3.1 minutes). This finding is comparable to the observations made by Nirapathpongporn *et al.,* who demonstrated that no-scalpel vasectomy required significantly less operative time because of minimal tissue dissection and easier vas delivery.[13] Similarly, Christensen and Maples reported that the no-scalpel technique reduced operative time and improved procedural efficiency in outpatient settings.[14] The shorter duration associated with no-scalpel vasectomy may contribute to improved patient turnover and greater acceptability in resource-limited healthcare settings.

Postoperative pain was significantly lower in the no-scalpel vasectomy group in the present study. Mild pain was predominantly observed in patients undergoing no-scalpel vasectomy, whereas moderate and severe pain were more frequent in the conventional vasectomy group. Similar results were reported by Sokal *et al.,* who found significantly reduced postoperative discomfort among patients treated with the no-scalpel approach.[15] Cook *et al.,* in a Cochrane review, also concluded that no-scalpel vasectomy was associated with less intraoperative and postoperative pain compared to conventional vasectomy.[16] Reduced tissue trauma, absence of scalpel incision, and minimal bleeding are likely responsible for the decreased pain levels observed with the no-scalpel technique.

The present study further demonstrated significantly fewer postoperative complications such as hematoma, sepsis, and scrotal edema in the no-scalpel vasectomy group. Hematoma formation was noted in only 3.8% of patients undergoing no-scalpel vasectomy compared to 14.1% in the conventional group. Similar findings were reported by Li *et al.,* who observed markedly lower complication rates following no-scalpel vasectomy due to limited vascular injury and minimal tissue handling.[17] A study by Philp et al. also showed higher rates of postoperative bleeding and infection among patients undergoing conventional vasectomy.[18] The reduced complication profile of no-scalpel vasectomy is clinically important because it improves patient satisfaction, decreases postoperative morbidity, and minimizes the need for additional medical intervention.

In the present study, the failure rate was lower in the no-scalpel vasectomy group, although the difference was not statistically significant. Comparable findings were noted by Labrecque *et al.,* who reported that both vasectomy techniques were highly effective, with only minimal differences in failure rates when appropriate occlusion techniques were used.[19] The low overall failure rate in both groups indicates that vasectomy remains a reliable method of permanent male contraception. Occasional failures may occur because of spontaneous recanalization, technical errors, or inadequate postoperative semen analysis compliance.

Semen analysis findings in the present study revealed a higher rate of azoospermia in the no-scalpel vasectomy group. Although the difference was not statistically significant, better semen clearance was observed among patients undergoing no-scalpel vasectomy. Similar findings were reported by Barone *et al.,* who found high azoospermia rates after no-scalpel vasectomy with proper follow-up.[20] Persistent motile sperm were uncommon in both groups, indicating high procedural success rates overall.

Overall, the findings of the present study support the growing body of evidence favoring no-scalpel vasectomy as a safer, faster, and less morbid alternative to conventional vasectomy. Reduced operative duration, lower postoperative pain, fewer complications, and comparable failure rates make no-scalpel vasectomy a preferable technique for male sterilization programs and family planning services.

CONCLUSION

The present study demonstrated that no-scalpel vasectomy is a safe, effective, and minimally invasive alternative to conventional vasectomy for permanent male sterilization. Patients undergoing no-scalpel vasectomy experienced significantly shorter operative duration, reduced postoperative pain, and fewer complications such as hematoma, sepsis, and scrotal edema compared to those undergoing the conventional technique. Although the difference in failure rates and semen analysis findings between the two groups was not statistically significant, the no-scalpel technique showed comparatively better outcomes with higher rates of azoospermia and lower incidence of persistent motile sperm. The minimally invasive nature of no-scalpel vasectomy contributes to faster recovery, improved patient comfort, and greater procedural acceptability. These findings support the wider adoption of no-scalpel

vasectomy in family planning programs and surgical practice. Increased awareness, proper counselling, and training of healthcare professionals may further improve acceptance and utilization of this reliable method of male contraception.

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