

Comparison of Intraoperative and Postoperative Outcomes of Sleeve and Dorsal Slit Technique of Circumcision: A Prospective Interventional Study

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ABSTRACT

Introduction: Circumcision is the excision of the foreskin of the penis. Adult circumcision, although less prevalent, produces more discomfort and carries a fair share of complications if not performed meticulously. The dorsal slit technique and sleeve technique are the most followed techniques, the dorsal slit being the conventional method.

Aim: To compare the intraoperative and postoperative outcomes of the dorsal slit technique and sleeve technique of circumcision.

Materials and Methods: A prospective interventional study was conducted at SRM Medical College Hospital and Research Centre, Chennai, Tamil Nadu, India from October 2022 to April 2024. Sixty patients diagnosed with phimosis, balanoposthitis, paraphimosis and patients who requested circumcision for religious reasons were randomly assigned to undergo either the sleeve technique (Group A) or the dorsal slit technique (Group B). Postoperatively, patients were followed-up on the 3rd, 7th, and 14th day. Data included variables such as intraoperative blood loss, postoperative complications, wound healing time, operative time, postoperative pain and surgeon's comfort. Categorical variables were presented in the form of

percentages. The association between categorical variables was tested using Chi-square tests and p-value <0.05 was considered statistically significant.

Results: A total of 27 patients had blood loss of more than 50 mL. A total 19 (63.3%) of the 27 patients belonged to Group B, while 8 (26.7%) patients were a part of Group A. Operative time was extended in sleeve technique as opposed to dorsal slit technique (58.84 min vs. 54.77 min, p-value=0.020). Complications were noted more in dorsal slit technique than in sleeve (33.3% vs. 10%, p-value=0.028). Moderate pain was more common after dorsal slit technique than after the sleeve technique (40% vs. 16.7%, p-value=0.045). Delayed wound healing was noted more in the patients subjected to dorsal slit technique (76.7% vs. 36.7%, p-value=0.002). The surgeon's comfort was found to be more in dorsal slit technique than with sleeve technique (10% vs. 56.7%, p-value=0.001).

Conclusion: The sleeve technique of circumcision showed lesser intraoperative bleeding, faster healing, lesser postoperative pain and complications as compared to the conventional dorsal slit technique.

Keywords: Bleeding, Foreskin, Healing, Pain, Penis, Phimosis, Paraphimosis

INTRODUCTION

Circumcision is the process of removing the foreskin that covers the glans penis. Around 25-33% of the male population undergoes circumcision, with infants being the more frequently encountered populace [1-3]. The prevalence worldwide has increased to 38%, notably in the United States, the Middle East and Africa. Medical organisations recommend higher circumcision rates in Africa to help prevent Human Immunodeficiency Virus (HIV)/Acquired Immunodeficiency Syndrome (AIDS) [4]. The highest rate of circumcision is seen in Morocco (99.9%) and Afghanistan (99.8%). 13.5% of Indians undergo circumcision [5]. In India, circumcision is inherently linked to minority religions of Islam and Judaism, practiced by Muslims and Jewish people, respectively [6]. Circumcised heterosexual males typically experience a 40 to 60% lower risk of acquiring HIV compared to their uncircumcised counterparts [7,8]. In addition, there is a lower occurrence of Human Papillomavirus (HPV) infection and a decreased probability of transmitting herpes simplex virus [9].

While adult circumcision is not as prevalent as in infants, the procedure becomes more intricate. The outcome and healing process is contingent on the specific method utilised [9-12]. Circumcision is arguably one of the oldest surgical procedures in history. The principles underlying circumcision include maintaining aseptic conditions, ensuring the thorough removal of both outer and inner preputial skin layer, achieving haemostasis, safeguarding the glans and urethra and focusing on cosmesis [13,14]. Meta-analyses

have shown that circumcision can decrease the prevalence of inflammatory conditions of the glans penis by 68% [15,16].

Despite being a minor procedure, complications may occur even in the most ideal circumstances, either intraoperatively or postoperatively. Commonly encountered ones include bleeding, inadequate excision leading to increased postoperative pain, delayed wound healing due to indistinct excision [17,18].

The dorsal slit technique was the standard procedure for circumcision, while the sleeve technique was later introduced to refine the process. The dorsal slit technique involves an approximate excision of the foreskin of the penis, sleeve technique involves a precise excision of the preputial layers [19]. Newer techniques such as laser circumcision, have also been introduced to further reduce the time taken and postoperative complications [20].

This study aimed to evaluate the intraoperative and postoperative differences between dorsal slit technique and sleeve technique of circumcision. The primary parameters taken into consideration were intraoperative blood loss, the pace of wound healing and postoperative complications. Secondary parameters include operative time, postoperative pain and surgeon's comfort during the procedure.

MATERIALS AND METHODS

This prospective interventional study was conducted within the Department of Surgery at SRM Medical College Hospital and Research Centre, Chennai, Tamil Nadu, India, from October 2022 to April 2024, after obtaining approval from the Human Ethics Committee of the Institute (SRMIEC-ST0722-52).

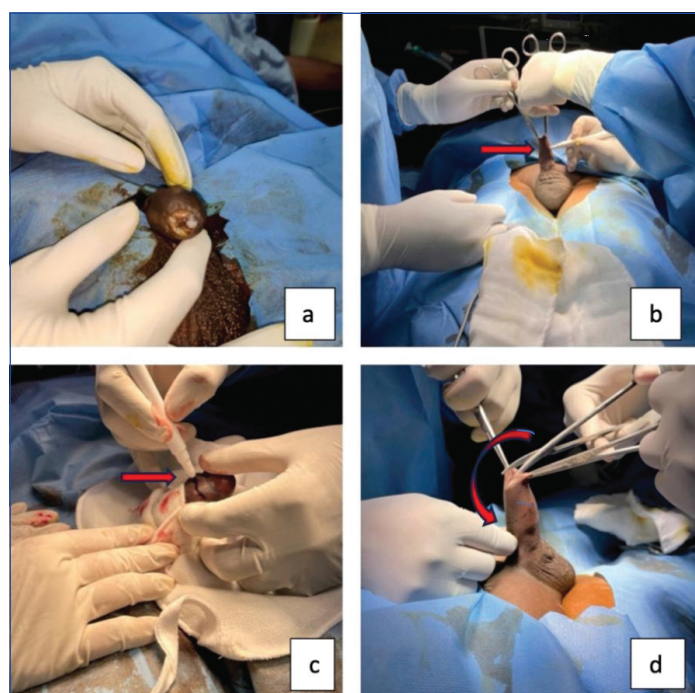
Inclusion criteria: Patients aged more than 18 years and diagnosed with phimosis, paraphimosis, balanoposthitis, and patients who requested the procedure for religious reasons were included in the study.

Exclusion criteria: Patients with hypospadias, bleeding disorders, buried penis, uncontrolled diabetes mellitus, uncontrolled hypertension, and unwillingness to participate were excluded from the study. Hypospadias and buried penis were contraindications, as reconstruction procedures might require the presence of foreskin. Uncontrolled diabetes mellitus and hypertension were avoided due to their effects on intraoperative bleeding, wound healing, and postoperative complications.

Sample size: A sample size of 60, with 30 patients in each group, was calculated, and the patients were randomly assigned to either Group A (sleeve technique) or Group B (dorsal slit technique) using a computer-generated randomisation sequence (1:1 ratio). Taking reference of Patel H and Kadia R with these assumptions, a study with a significance level (α) of 0.05 and a power (β) of 0.2, minimum sample size required was 30 in each group [21].

The procedure was done under spinal anaesthesia to avoid discomfort to the patient in case of prolonged duration. Preputial adhesions were released, and adequate exposure of glans was achieved.

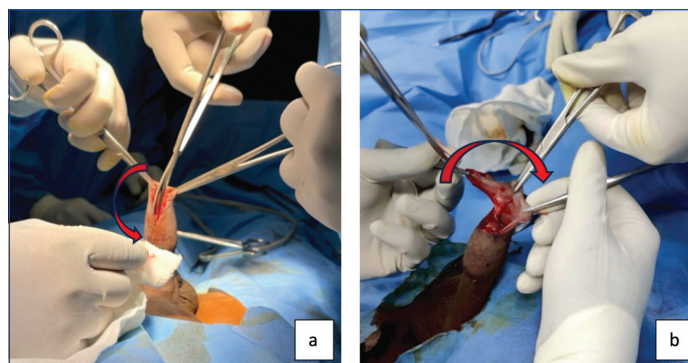
In Group A, the sleeve technique involved the individual marking of both the inner and outer preputial layers. A longitudinal slit was made, and excision of the foreskin was done along the line of marking [Table/Fig-1].



[Table/Fig-1]: Sleeve technique (Group A). a) Phimosis; b) Marking the exterior border; c) Marking the interior at the same level after removing adhesions; d) Excision of the foreskin.

In Group B, during the dorsal slit or conventional circumcision, an initial dorsal slit was made, and a circumferential excision of the foreskin was done [Table/Fig-2]. A figure of '8' stitch was applied at the site of the frenular artery, with or without its injury.

A patient proforma was made and data were documented from screening to discharge and during follow-up visits on day 7, day 14, and day 21. Key data included intraoperative blood loss in milliliters, operating time in minutes, postoperative complications such as oedema, seroma and haematoma, postoperative pain according to visual pain analogue scale (scale of 1-10), complete wound healing time and surgeon's comfort [22] based on a comfort scale as shown in [Table/Fig-3].



[Table/Fig-2]: Dorsal slit technique/conventional technique (Group B). a) Dorsal slit made after removing adhesions between foreskin and glans; b) Excision of foreskin.

Score	Pain	Surgeon's comfort
0	No discomfort	Extremely comfortable
1	Mild discomfort	Mild movements/squeezing
2	Mild pain	Moderate discomfort (significant ocular movements/squeezing/Bell's phenomenon)
3	Moderate pain	Severe discomfort hampering surgical maneuvering
4	Unbearable pain	Unable to perform surgery

[Table/Fig-3]: Surgeon's comfort scale [22].

STATISTICAL ANALYSIS

Data was entered in Microsoft Excel 2019 and exported to Statistical Package for the Social Sciences (SPSS) version 27.0 for analysis. Associations between categorical variables were tested using Chi-square tests. The significance level was set at $p < 0.05$.

RESULTS

The average age of patients who underwent dorsal slit technique was 41 ± 15.68 years, while those who underwent sleeve technique were 44 ± 17.01 years. Among the patients who required surgery in this study, 30% had phimosis, 30% had balanoposthitis, 21.7% had paraphimosis, and 18.3% wanted surgical intervention for religious reasons. These parameters did not significantly affect the procedure followed.

A total of 27 patients had blood loss of more than 50 mL. A total of 19 (63.3%) of the 27 patients belonged to Group B, while 8 (26.7%) patients were a part of Group [Table/Fig-4].

			Blood loss		Total
			≤50 mL	>50 mL	
Procedure	Group A	Count	22	8	30
		% within procedure	73.3%	26.7%	100.0%
	Group B	Count	11	19	30
		% within procedure	36.7%	63.3%	100.0%
Total		Count	33	27	60
		% within procedure	55.0%	45.0%	100.0%

[Table/Fig-4]: Comparison of amount of intraoperative blood loss in patients in Group A vs Group B.

*Chi-square value: 8.148; p-value: 0.004

A total of 27 patients underwent the procedure for more than 30 minutes among whom 18 (60%) of the patients underwent procedure in Group A and the rest 9 (30%) of them belonged to Group B [Table/Fig-5].

In total, 13 patients had complications amongst whom 3 (10%) in Group A and the rest 10 (33.3%) in Group B [Table/Fig-6]. oedema was the most common complication noted, occurring in eight patients [Table/Fig-7]. Complications were managed with appropriate antibiotic therapy and sterile daily dressing. In the case of the haematoma, bedside removal of a suture, drainage

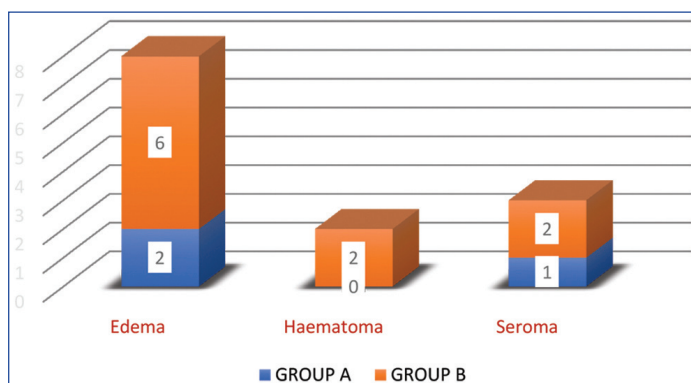
of collection, and regular sterile dressing was done with antibiotic coverage.

			Operative time		Total
			≤30 min	>30 min	
Procedure	Group A	Count	12	18	30
		% within procedure	40.0%	60.0%	100.0%
	Group B	Count	21	9	30
		% within procedure	70.0%	30.0%	100.0%
Total		Count	33	27	60
		% within procedure	55.0%	45.0%	100.0%

[Table/Fig-5]: Comparing operative time in patients belonging to Group A vs Group B.
*Chi-square value: 5.455; p-value: 0.020

			Postoperative complications		Total
			Yes	No	
Procedure	Group A	Count	3	27	30
		% within procedure	10.0%	90.0%	100.0%
	Group B	Count	10	20	30
		% within procedure	33.3%	66.7%	100.0%
Total		Count	13	47	60
		% within procedure	21.7%	78.3%	100.0%

[Table/Fig-6]: Comparison of postoperative complications in patients belonging to Group A vs Group B.
*Chi-square Value: 4.812; p-value: 0.028



[Table/Fig-7]: Postoperative complications vs procedure.

Amongst the 60 patients, a total of 17 patients had a moderate level of pain (scored 4-6 on a scale of 10), which accounted for 28.3%. Of these, 12 (40%) belonged to Group B, while the remaining 5 (16.7%) patients were a part of Group A [Table/Fig-8].

			Pain scale		Total
			Mild (1-3/10)	Moderate (4-6/10)	
Procedure	Group A	Count	25	5	30
		% within procedure	83.3%	16.7%	100.0%
	Group B	Count	18	12	30
		% within procedure	60.0%	40.0%	100.0%
Total		Count	43	17	60
		% within procedure	71.7%	28.3%	100.0%

[Table/Fig-8]: Postoperative pain vs procedure.
*Chi-square value: 4.022; p-value: 0.045

Healing of the operated site in 34 patients i.e., 56.7%, took more than 14 days and among them 23 (76.7%) patients were subjected to Group B procedure in Group B and 11 (36.7%) patients were in Group A [Table/Fig-9].

The surgeon's comfort scale was found to be of Score 0 in 27 (90%) patients who were a part of Group B and in 13 (43.3%) patients in Group A [Table/Fig-10].

			Healing time		Total
			≤14 days	>14 days	
Procedure	Group A	Count	19	11	30
		% within procedure	63.3%	36.7%	100.0%
	Group B	Count	7	23	30
		% within procedure	23.3%	76.7%	100.0%
Total		Count	26	34	60
		% within procedure	43.3%	56.7%	100.0%

[Table/Fig-9]: Comparing the healing time in patients belonging to Group A and Group B.

*Chi-square value: 9.774; p-value: 0.002

			Surgeon comfort scale		Total
			0	1	
Procedure	Group A	Count	13	17	30
		% within procedure	43.3%	56.7%	100.0%
	Group B	Count	27	3	30
		% within procedure	90.0%	10.0%	100.0%
Total		Count	40	20	60
		% within procedure	66.7%	33.3%	100.0%

[Table/Fig-10]: Comparing the level of surgeon's comfort in patients belonging to Group A vs Group B.

*Chi-square value: 14.700; p-value: 0.001

DISCUSSION

Circumcision is the surgical removal of the foreskin. Various methods have been introduced to increase efficiency and decrease complications post procedure. Two such methods are the dorsal slit (conventional method) and the later-introduced sleeve method. Bleeding during circumcision is one of the most common complications [17,18]. In this study, the sleeve technique was found to have less intraoperative bleeding compared to the conventional technique (p-value=0.004), as also observed in studies by Jaiswal S and Jangid D and Karakoyunlu N et al., [19,23]. This may be due to the procedure being performed under direct vision, which prevents inadvertent bleeding. Dorsal slit technique has dramatically less operative time owing to the approximate excision of the prepuce. In contrast, the sleeve technique involves marking the inner and outer incisions and precise excision of the foreskin to avoid any excessive or lesser removal of the foreskin and to prevent frenular artery injury.

Despite being a minor procedure, circumcision may be associated with numerous complications such as bleeding, infection, and recurrent inflammatory conditions due to inadequate excision of foreskin [24]. In this study, oedema, seroma, and haematoma were the complications observed. Sleeve technique showed lesser postoperative complications than dorsal slit technique (p-value=0.028). Similar to this study, sleeve technique had lesser complications when compared to dorsal slit technique, in accordance with studies conducted by Jaiswal S and Jangid D, where 30% of patients who underwent the sleeve technique had oedema, while 45% of them underwent dorsal slit technique apart from which Pain and blood loss were the other complications faced [19]. In a study by Karakoyunlu N et al., where postoperative pain was the main complication [23]. In another study by Hohlfeld A et al., oedema was the complication noted [25].

Postoperative pain was observed in all the patients, as adult circumcision is always associated with pain. However, discomfort was pronounced in patients who had undergone Dorsal slit technique of circumcision (p-value=0.045). A study performed by Jaiswal S and Jangid D showed the mean VAS score in patients who underwent the sleeve technique to be 2.39, vs 2.86 in dorsal slit patients [19]. Karakoyunlu N et al., performed a study where

Study	Present study	Jaiswal S and Jangid D [19]	Karakoyunlu, N et al., [23]	Jiang ZL et al., [26]	Lukong CS [27]
Sample size	60	40	60	93	100
Study place and year	October 2022- April 2024, Chennai, India	2021, Rajasthan, India	January- July 2013, Turkey	May 2015-March 2017, China	2012
Blood loss	63.3% of patients had blood loss >50 mL in Dorsal slit technique vs 26.7% in Sleeve technique	Mean gauze pieces used in sleeve technique were 1.64 and dorsal slit technique were 2.08 pieces	Preserving frenular artery reduces blood loss	Intraoperative bleed was 12.5 mL in tissue sparing technique vs 5.96 mL in conventional technique	1/100 patient had reactionary haemorrhage
Operative time	Mean operative time 58.84 min in sleeve technique vs 54.77 min in Dorsal slit technique	Mean operative time was 25.60 min for sleeve technique and 24.47 min for dorsal slit technique		Mean operative time for tissue sparing technique is 58.93 min vs 44.5 min for conventional technique	
Postoperative pain	Moderate pain (4-6/10) was noted in 40% patients post dorsal slit technique vs 16.7% patients post sleeve technique	Mean visual analogue score in sleeve technique 2.39 as opposed to 2.86 in Dorsal slit	40% of patients who underwent sleeve technique required no additional anaesthesia		
Postoperative complications	Complications was noted in 33.3% patients post dorsal slit technique vs 10% patients post sleeve technique	6 patients had oedema post Sleeve technique while 9 patients post dorsal slit had oedema			
Healing time	Delayed healing time noted in 76.7% patients post dorsal slit technique vs 36.7% patients post sleeve technique	Mean healing time was 15.38 days post sleeve technique and 16.22 days post dorsal slit technique		Mean healing time was 7.1 in tissue sparing technique and 10.8 in conventional technique	

[Table/Fig-11]: Comparison of results of similar studies and present study [19,23,26,27].

six patients were given two doses of analgesic post dorsal slit technique, while none of the patients who underwent the sleeve technique received second dose of analgesic [23]. This may be due to the lesser amount of intraoperative bleeding and postoperative complications. A summary of the findings of similar published studies is presented in [Table/Fig-11] [19,23,26,27].

These findings suggest that the sleeve technique of circumcision is a finer technique as compared to dorsal slit technique, with better patient responses, and it can be introduced into regular practice. A future multicentre study that includes the sleeve technique in cases of emergency intervention is recommended to validate these findings across diverse patient populations and to assess long-term outcomes comprehensively.

Limitation(s)

The limitations of this study include a single-centre design, modest sample size, short-term follow-up, lack of blinding, exclusion of emergencies and uncontrolled co-morbid conditions were the limitations.

CONCLUSION(S)

Sleeve technique of circumcision was found to be a better technique owing to its precision. It yielded lesser intraoperative blood loss, lesser postoperative pain, quicker wound healing and lesser postoperative complications. These findings suggest that Sleeve technique of circumcision is a finer technique as compared to Dorsal slit technique, with better patient responses.

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