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ROLE OF LEVEL OF EPIDIDYMAL ANASTOMOSIS AND SURGICAL TECHNIQUES IN PREDICTING PATENCY FOLLOWING MICROSURGICAL VASOEPIDIDYMOSTOMY IN OBSTRUCTIVE AZOOSPERMIA

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ABSTRACT

Background: Microsurgical vasoepididymostomy (VEA) is the preferred treatment for epididymal obstructive azoospermia. However, the influence of intraoperative technical factors on postoperative patency remains unclear. The aim is to evaluate the impact of four intraoperative technical variables - anatomical level of epididymal anastomosis, VEA technique, suture material, and surgeon's intraoperative assessment - on postoperative patency following microsurgical VEA.

Materials and Methods: A prospective observational study included 27 men with obstructive azoospermia undergoing microsurgical VEA. One patient was lost to follow-up, leaving 26 patients for analysis. Four intraoperative technical variables were recorded prospectively. Postoperative patency was assessed by serial semen analyses, and associations were analyzed.

Results: Postoperative patency was achieved in 6 of 26 patients (23.1%). The anatomical level of epididymal anastomosis was significantly associated with patency ($p = 0.004$), with corpus anastomosis showing better outcomes than head anastomosis. The type of VEA technique, suture material, and surgeon's intraoperative assessment were not significantly associated with postoperative patency.

Conclusion: The anatomical level of epididymal anastomosis was the only technical factor significantly associated with postoperative patency. Careful selection of the epididymal tubule appears to be more important than variations in surgical technique, suture material, or subjective technical assessment.

Keywords: Obstructive azoospermia, vasoepididymostomy, patency, epididymal anastomosis, microsurgery, male infertility.

INTRODUCTION

Obstructive azoospermia (OA) accounts for approximately 15–20% of male infertility and represents one of the few surgically correctable causes of azoospermia.[1,2] In appropriately selected patients with normal spermatogenesis, microsurgical reconstruction offers the possibility of restoring physiological sperm transport and achieving natural conception without reliance on assisted reproductive techniques (ART).[2,3] Microsurgical vasoepididymostomy (VEA) remains the procedure of choice for men with epididymal obstruction.[3]

During the last four decades, several modifications of VEA have been introduced to improve surgical outcomes. Conventional end-to-side anastomosis has largely been replaced by intussusception techniques, including two-stitch and three-stitch longitudinal intussusception, which facilitate accurate mucosa-to-mucosa approximation while minimizing leakage from the anastomotic site.[4-6] Likewise, advances in microsurgical instrumentation and suture materials have enhanced precision during reconstruction. Despite these developments, reported patency rates continue to vary widely among institutions, reflecting

differences in patient selection, anatomical characteristics of the epididymis, surgeon experience, and operative technique.[6,9,10]

Among the numerous factors influencing surgical outcome, several intraoperative technical variables may directly affect the quality of reconstruction. The anatomical level of epididymal anastomosis determines the diameter and structural integrity of the epididymal tubule, thereby influencing the ease of microsurgical approximation.[8-10] The reconstructive technique employed may affect anastomotic watertightness and healing, while the choice of microsurgical suture material can influence handling characteristics and tissue trauma.[4-6] In addition, surgeons frequently form a subjective intraoperative impression regarding the quality of reconstruction; however, the prognostic value of this assessment has not been adequately evaluated.[6,10]

The present prospective study was undertaken to evaluate four intraoperative technical variables - the anatomical level of epididymal anastomosis, type of vasoepididymostomy technique, type of microsurgical suture material, and the surgeon's intraoperative technical assessment and determine their association with postoperative patency following microsurgical vasoepididymostomy in men with obstructive azoospermia.

MATERIALS AND METHODS

Study Design and Patient Selection: This prospective observational study was conducted at the Andrology Outpatient Department of Tertiary Care Hospital and Research Centre. Male partners of infertile couples presenting with suspected obstructive azoospermia (OA) were evaluated through a detailed clinical history, physical examination, and genital examination. Patients diagnosed with obstructive azoospermia and considered suitable candidates for microsurgical vasoepididymostomy (VEA) were prospectively enrolled.

Inclusion Criteria

Patients fulfilling all of the following criteria were included:

1. At least two semen analyses demonstrating fructose-positive azoospermia with semen volume greater than 2 mL.
2. Bilaterally palpable vas deferens.
3. Clinically palpable and distended epididymis.
4. Normal spermatogenesis confirmed by diagnostic testicular biopsy.

Exclusion Criteria

Patients were excluded if they had:

1. Clinical evidence of non-obstructive azoospermia.
2. Absence of spermatozoa in epididymal fluid during surgical exploration.
3. Previous inguinal hernia repair or previous vasoepididymostomy.

A total of 27 men with primary infertility fulfilling the inclusion criteria underwent microsurgical vasoepididymostomy during the study period.

Preoperative Assessment: All patients underwent detailed preoperative evaluation including duration of infertility, previous reproductive history, history of vasectomy, inguinal or scrotal surgery, varicocele surgery, assisted reproductive procedures, genital trauma, and genitourinary infections. Obstructive azoospermia was considered idiopathic when no identifiable cause of obstruction was evident from the clinical history.

A comprehensive genital examination was performed in all patients, documenting testicular size, epididymal fullness, presence of the vas deferens, and clinical evidence of varicocele.

Surgical Procedure: Microsurgical vasoepididymostomy was performed under an operating microscope (OPMI-1, Carl Zeiss, Oberkochen, Germany) providing 6× to 25× magnification. Depending on intraoperative findings, unilateral or bilateral reconstruction was performed.

A high vertical scrotal incision of approximately 6 cm was made. The spermatic cord was mobilized, and the vas deferens was carefully dissected free from the cord structures. Adequate vasal length was mobilized to permit a tension-free anastomosis. The vas deferens was transected near its convoluted portion, and distal vasal patency was confirmed by irrigation with Ringer's lactate using a 24-gauge angiocatheter. The testis was delivered into the operative field, and the epididymis was examined for turgidity and scarring. The most distal epididymal tubule considered suitable for reconstruction was identified. After incising the epididymal tunic, the selected tubule was opened with a 26-gauge needle, and the epididymal fluid was examined immediately under light microscopy for the presence of spermatozoa.

If spermatozoa were identified, vasoepididymostomy was performed at that level. In the absence of sperm or when the epididymal tubule was collapsed without fluid, progressively more proximal epididymal tubules were explored. The procedure was abandoned if repeated exploration of the epididymal tail, corpus, and head failed to demonstrate spermatozoa.

Assessment of Intraoperative Technical Variables

The present study specifically evaluated four intraoperative technical variables as potential determinants of postoperative patency.

1. Anatomical Level of Epididymal Anastomosis

The site selected for vasoepididymostomy was recorded according to the anatomical location of the epididymal tubule as:

- Epididymal head
- Epididymal corpus
- Epididymal tail

2. Type of Microsurgical Vasoepididymostomy

The reconstructive technique was selected according to the intraoperative anatomical findings and quality of the epididymal tubule. Three techniques were employed:

- Two-stitch longitudinal intussusception vasoepididymostomy
- Three-stitch intussusception vasoepididymostomy
- Conventional vasoepididymal fistula

The conventional fistula technique was reserved for poor-quality or collapsed epididymal tubules, particularly at the epididymal head, where intussusception could not be performed.

3. Suture Material

The vasal muscularis and tunica adventitia were approximated using 8-0 nylon sutures. Epididymal tubules were anastomosed to the vasal lumen using 10-0 nylon sutures with either:

- Ethicon 3313 double-armed 240-µm needle, or
- Sharp Point 2507 double-armed 70-µm microneedle.

4. Surgeon's Intraoperative Technical Assessment

At the completion of each procedure, the operating surgeon assigned an overall technical grade based on the ease and quality of the microsurgical anastomosis:

- Grade A: Technically excellent reconstruction
- Grade B: Good reconstruction
- Grade C: Technically difficult reconstruction with poor overall satisfaction

Follow-up

Postoperative semen analyses were performed at three-month intervals for at least one year or until spermatozoa appeared in the ejaculate or pregnancy was achieved.

Patients were categorized according to postoperative semen analysis as follows:

- Patent group (P): Presence of spermatozoa in postoperative semen analysis.
- Non-patent group (NP): Persistent azoospermia throughout the available follow-up period.

Statistical Analysis: The association between each intraoperative technical variable and postoperative patency was evaluated by comparing the Patent and Non-patent groups. Categorical variables were expressed as frequencies and percentages. Statistical analysis was performed using the Chi-square test, and a p value of less than 0.05 was considered statistically significant.

RESULTS

Twenty-seven patients with obstructive azoospermia underwent microsurgical vasoepididymostomy during the study period. One patient was lost to follow-up, leaving twenty-six patients available for final analysis. Postoperative semen analysis demonstrated restoration of sperm in the ejaculate in six patients (23.1%), whereas twenty patients (76.9%) remained azoospermic during the follow-up period [Table 1].

Table 1: Baseline Characteristics of Patients Undergoing Microsurgical Vasoepididymostomy

Characteristic	No. of patients (%)
Total patients operated	27
Patients analysed	26
Mean age (years)	35 (23–45)
Mean follow-up (months)	11.5 (3–24)
Unilateral VEA	22 (84.6%)
Bilateral VEA	4 (15.4%)
Patent group	6 (23.1%)
Non-patent group	20 (76.9%)

Anatomical Level of Anastomosis

The anatomical level of epididymal anastomosis showed a statistically significant association with postoperative patency (p = 0.004). Five of the six patients (83.3%) in the patent group underwent anastomosis at the epididymal corpus, whereas sixteen of the twenty patients (80%) in the non-patent group required reconstruction at the epididymal head. No anastomosis was performed at the epididymal tail. These findings indicate that corpus anastomosis was associated with a substantially higher likelihood of postoperative patency than head anastomosis.

Type of Vasoepididymostomy Technique

Three microsurgical techniques were employed during reconstruction. The two-stitch longitudinal intussusception technique was used in twenty-three patients (88.5%) and represented the predominant operative method. Five of the six patients (83.3%) in the patent group and eighteen of the twenty patients (90%) in the non-patent group underwent this technique. One patient underwent conventional vasoepididymal fistula in each group, while only one patient underwent three-stitch intussusception. Because of the limited number of patients undergoing alternative techniques, no statistically significant difference was observed between the various reconstructive methods.

Type of Suture Material

Ethicon 3313 double-armed 240-µm needles were used in the majority of procedures. Five of the six patients (83.3%) in the patent group and nineteen of the twenty patients (95%) in the non-patent group underwent reconstruction using this suture material. Statistical analysis demonstrated no significant association between the type of suture material and postoperative patency (p = 0.347).

Surgeon's Intraoperative Assessment

At the completion of surgery, the operating surgeon assigned an overall technical grade based on intraoperative assessment of the anastomosis. Although Grade A procedures were more frequent among successful cases, the distribution of technical grades did not differ significantly between the patent and non-patent groups (p = 0.094). Thus, the surgeon's subjective assessment was not found to be an independent predictor of postoperative patency.

Table 2: Association Between Intraoperative Technical Variables and Postoperative Patency Following Microsurgical Vasoepididymostomy (n = 26)

Variable	Patent (n = 6)	Non-patent (n = 20)	P value
Level of epididymal anastomosis			0.004
Epididymal head	1 (16.7%)	16 (80.0%)	
Epididymal corpus	5 (83.3%)	4 (20.0%)	
Epididymal tail	0	0	
Type of VEA technique			NS
Two-stitch intussusception	5 (83.3%)	18 (90.0%)	
Three-stitch intussusception	0	1 (5.0%)	
Conventional fistula	1 (16.7%)	1 (5.0%)	
Type of suture material			0.347
Ethicon 3313	5 (83.3%)	19 (95.0%)	
Sharp Point 2507	1 (16.7%)	1 (5.0%)	
Surgeon's intraoperative assessment			0.094
Grade A	3 (50.0%)	14 (70.0%)	
Grade B	2 (33.3%)	5 (25.0%)	
Grade C	1 (16.7%)	1 (5.0%)	

DISCUSSION

Microsurgical vasoepididymostomy remains the definitive reconstructive procedure for men with epididymal obstructive azoospermia seeking natural conception.[2,3,9] The success of this technically demanding operation depends on meticulous microsurgical execution as well as favourable intraoperative findings. The present study specifically evaluated four technical variables encountered during surgery and demonstrated that only the anatomical level of epididymal anastomosis was significantly associated with postoperative patency, whereas the type of VEA technique, suture material, and surgeon's subjective intraoperative assessment were not.

Among all technical variables examined, the anatomical level of anastomosis emerged as the most important determinant of postoperative success. Patients undergoing corpus anastomosis achieved significantly better patency than those requiring reconstruction at the epididymal head. Anatomically, corpus tubules are generally larger in diameter, possess thicker walls, and are easier to manipulate under high magnification, allowing more accurate mucosal approximation and reduced risk of anastomotic leakage. In contrast, tubules in the epididymal head are smaller, more fragile, and often reflect a more proximal level of obstruction, thereby increasing technical difficulty and reducing the likelihood of successful reconstruction.[8] Similar observations have been reported in recent systematic reviews and meta-analyses, which identified distal epididymal anastomosis as a favourable predictor of postoperative patency.[9,10]

The reconstructive technique itself did not significantly influence postoperative outcome in the present series. Although modern intussusception techniques have largely replaced conventional end-to-side anastomosis and are associated with excellent patency rates in experienced centres,[4-7] nearly 90% of patients in the present study underwent the two-stitch longitudinal intussusception technique. Consequently, meaningful comparison between different techniques was limited by the small number of patients treated with alternative methods. Previous studies have likewise suggested that when microsurgical principles are meticulously followed, differences among currently accepted intussusception techniques are relatively modest, with surgeon experience and case selection exerting greater influence on outcome than the specific reconstructive method employed.[5,6,9]

Similarly, the choice of microsurgical suture material was not associated with postoperative patency. Ethicon 3313 double-armed sutures were used in most procedures because of their favourable handling characteristics and widespread availability during the study period. Although advances in microsurgical needles have facilitated increasingly precise anastomoses, current evidence does not indicate that one suture material independently improves patency when meticulous surgical technique is maintained.[5,6] The findings of the present study therefore support the concept that tissue handling and accurate mucosal approximation are more important than the particular suture employed.

The surgeon's intraoperative technical assessment also failed to predict postoperative outcome. Subjective grading is inevitably influenced by individual experience and perception and may not accurately reflect biological factors affecting healing and long-term patency. Objective anatomical findings, particularly the level of anastomosis, appear to provide more reliable prognostic information than the surgeon's overall impression of operative difficulty.[6,10] Routine documentation of objective intraoperative variables may therefore be more valuable than subjective technical scoring for postoperative counselling.

Limitations of the study: The present study has several limitations. The sample size was relatively small, and most procedures were performed using a single reconstructive technique, limiting statistical comparison among techniques. Pregnancy outcomes were not analysed because they are influenced by female partner characteristics. Nevertheless, the prospective evaluation of intraoperative technical variables provides useful information regarding

operative decision-making in microsurgical reconstruction.

CONCLUSION

In conclusion, the anatomical level of epididymal anastomosis was the only technical intraoperative variable significantly associated with postoperative patency. Neither the reconstructive technique, type of microsurgical suture material, nor the surgeon's subjective intraoperative assessment independently predicted surgical success. These findings suggest that appropriate selection of the epididymal tubule may be more important than technical modifications of the anastomosis itself and should be considered an essential component of intraoperative decision-making.

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