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ORIGINAL RESEARCH

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Transurethral resection of ejaculatory ducts (TURED) for the management of ejaculatory duct obstruction: a Saudi cohort

Hammam Mandourah[1,†], Mohammad Alghafees[2,*,†], Lama Aldosari[3], Omar Alfehaid[4], Abdulaziz Almujaydil[4], Said Kattan[4], Naif Alhathal[4]

[1]Urology, King Abdulaziz University Hospital, 22230 Jeddah, Saudi Arabia
[2]College of Medicine, King Saud bin Abdulaziz University for Health Sciences, 12211 Riyadh, Saudi Arabia
[3]Department of Urology, King Fahad University Hospital, 34217 Al-Khobar, Saudi Arabia
[4]Urology, King Faisal Specialist Hospital and Research Centre, 11211 Riyadh, Saudi Arabia

***Correspondence**
Alghafees687@ksau-hs.edu.sa
(Mohammad Alghafees)

[†] These authors contributed equally.

Abstract

This retrospective study aimed to investigate the clinical characteristics, changes in semen parameters, and outcomes of adult patients with ejaculatory duct obstruction (EDO) who underwent transurethral resection of ejaculatory ducts (TURED). The study included 25 patients diagnosed with EDO who underwent TURED at King Faisal Specialist Hospital & Research Center in Saudi Arabia between January 2015 and December 2021. The results showed that 68% of the patients had complete ED obstruction, while 32% had partial obstruction. Primary infertility was reported in 68% of the patients, with 4% experiencing secondary infertility. The analysis revealed a significant increase in semen volume greater than 0.6 after TURED, while there was a significant decrease in volumes ranging from 0.1 to 0.3 and from 0.4 to 0.6. Patients with partial ED obstruction demonstrated a significant improvement in semen parameters compared to those with complete ED obstruction. The findings suggest that TURED is a safe and effective treatment option for EDO, leading to significant improvements in semen parameters and potentially resulting in spontaneous pregnancy. However, further research is needed to identify specific patient subgroups that may benefit the most from TURED. While magnetic resonance imaging (MRI) with an endorectal coil has been proposed for more detailed evaluation, transrectal ultrasound (TRUS) has been suggested as the standard examination technique.

Keywords

Transurethral resection; Ejaculatory duct obstruction; Infertility; Azoospermia; Assisted reproductive technology

1. Introduction

Ejaculatory duct obstruction (EDO) is a rare cause of male infertility, accounting for 1–5% of cases; however, it can be corrected through surgical intervention. The etiology of EDO can be categorized into congenital and acquired causes. Congenital causes encompass cystic lesions such as Mullerian duct (utricular) or Wolffian duct (diverticular) cysts, as well as ejaculatory duct atresia or stenosis. Acquired causes include infection, inflammation, trauma or the presence of calculi. In addition to infertility, EDO can manifest with symptoms like hematospermia, perineal pain during ejaculation, pain in the testicles and dysuria.

The diagnosis of EDO typically involves semen analysis, which typically shows a low-volume ejaculate and azoospermia. Confirmatory imaging is then employed to confirm the diagnosis. While vasography was previously favored, transrectal ultrasound (TRUS) and magnetic resonance imaging (MRI) are now preferred due to the risks associated with vasal injury and stricture. TRUS and MRI enable accurate diagnosis. Recognizing EDO as an underlying cause of male infertility is crucial.

The standard diagnostic method for EDO is TRUS examination. A seminal vesicle width exceeding 1.5 cm or an ejaculatory duct diameter greater than 2.3 mm on TRUS confirms the diagnosis. However, for more comprehensive evaluation, T2-weighted pelvic MRI with an endorectal coil is recommended. The main treatment for EDO is transurethral resection of ejaculatory ducts (TURED), which was first described by Farley and Barnes in 1973. Several retrospective studies have reported improved semen parameters in 50–65% of infertility cases and a pregnancy rate of 20–30% following TURED [1]. Although TURED is endorsed as a treatment for EDO and performed by urologists for male fertility and oncologic cases [2, 3], its effectiveness is not well understood, and further research is necessary to ascertain the specific patient subgroups that will derive the most benefit from this procedure.

2. Materials and methods

2.1 Patient inclusion criteria and surgical technique

The study enrolled adult patients diagnosed with EDO who underwent TURED at King Faisal Specialist Hospital & Research Center in Riyadh, Saudi Arabia, between 01 January 2015 and 31 December 2021. Patients who had undergone the procedure for a different indication or at a different center but were currently being followed up at our center were excluded. The diagnosis of EDO was established based on TRUS or MRI findings. Semen analysis was performed at least twice for each patient. Semen samples were collected and evaluated in accordance with the current World Health Organization standards. The surgical procedure was conducted under spinal or general anesthesia, with the patients in the lithotomy position. Transurethral resection of the proximal verumontanum was performed using a standard 24-French transurethral resectoscope loop, following the technique described by Farley and Barnes [1]. Patients were followed up and post-operative parameters were recorded at 12 months after surgery.

2.2 Statistical analysis

Data analysis was carried out using RStudio (R version 4.1.1, Posit, Boston, MA, USA). Descriptive statistics were used to present categorical data in terms of frequencies and percentages. Temporal changes in semen parameters between preoperative and postoperative periods were assessed using the McNemar's test. The statistical differences in semen parameter outcomes among different categories of ejaculatory duct obstruction and congenital cysts were assessed using the Fisher's exact test. A p value of < 0.05 was considered statistically significant.

3. Results

3.1 Clinical characteristics

In the current study, Data from 25 patients who underwent transurethral resection of the ejaculatory duct (ED) were analyzed. Among the patients, 68.0% had complete ED obstruction, while 32.0% had partial ED obstruction. Primary and secondary infertility were reported among 68.0% and 4.0%, respectively. Sexually-transmitted were apparent among 4.0% of patients and urinary tract infections were observed in 20.0% of patients. One patient (4.0%) had an undescended testis, and another patient (4.0%) had necrospermia (Table 1).

3.2 Radiological assessment

The majority of patients (n = 20, 80.0%) underwent MRI, while more than a half of the sample (n = 14, 56.0%) underwent ultrasound. The most common abnormalities observed were congenital cysts (72.0%), followed by bilateral and unilateral dilatations of seminal vesicles (36% and 24%, respectively, Fig. 1).

TABLE 1. Clinical history of patients.

Parameter	Category	n (%)
Primary infertility		
	No	8 (32.0%)
	Yes	17 (68.0%)
Secondary infertility		
	No	24 (96.0%)
	Yes	1 (4.0%)
Sexually-transmitted infection		
	No	24 (96.0%)
	Yes	1 (4.0%)
Undescended testis		
	No	24 (96.0%)
	Yes	1 (4.0%)
Necrospermia		
	No	24 (96.0%)
	Yes	1 (4.0%)
Urinary tract infection		
	No	20 (80.0%)
	Yes	5 (20.0%)

3.3 Temporal changes in semen parameter

Significant changes in semen parameters were observed from the preoperative to postoperative period. The proportion of patients with a semen volume >0.6 increased significantly from 20.8% to 86.4% ($p = 0.001$), while the proportion of patients with a volume of 0.4 to 0.6 decreased from 37.5% to 4.5% ($p = 0.027$). Additionally, the proportion of patients with a volume of 0.1 to 0.3 decreased from 41.7% to 9.1% ($p = 0.027$). However, no significant differences were found in motility and count categories between the pre- and postoperative periods (Table 2).

3.4 Outcomes

Symptomatic improvement was observed in two patients who had symptoms at baseline (100.0%). Except for one patient (4.0%) who experienced persistent azoospermia, none of the patients were recorded with commonly observed complications, such as recurrent urinary tract infections (UTI's), epididymo-orchitis or fever. A total of eight pregnancies (32%) were noted, including two natural pregnancies and six pregnancies achieved through intracytoplasmic sperm injection (ICSI), resulting in a total of 11 children (Table 3). Volume improvement was reported in 64.0% of patients. Four patients (16.0%) experienced improvements in volume, count and motility. Additional outcomes of semen parameters are listed in Table 4. There was a significant difference in semen parameter improvement between patients with partial and complete ED obstruction. Patients with partial obstruction had a significantly higher proportion of improved semen volume and persistent normal count (42.9%) compared to patients with complete obstruction (0.0%) ($p = 0.023$). No other significant

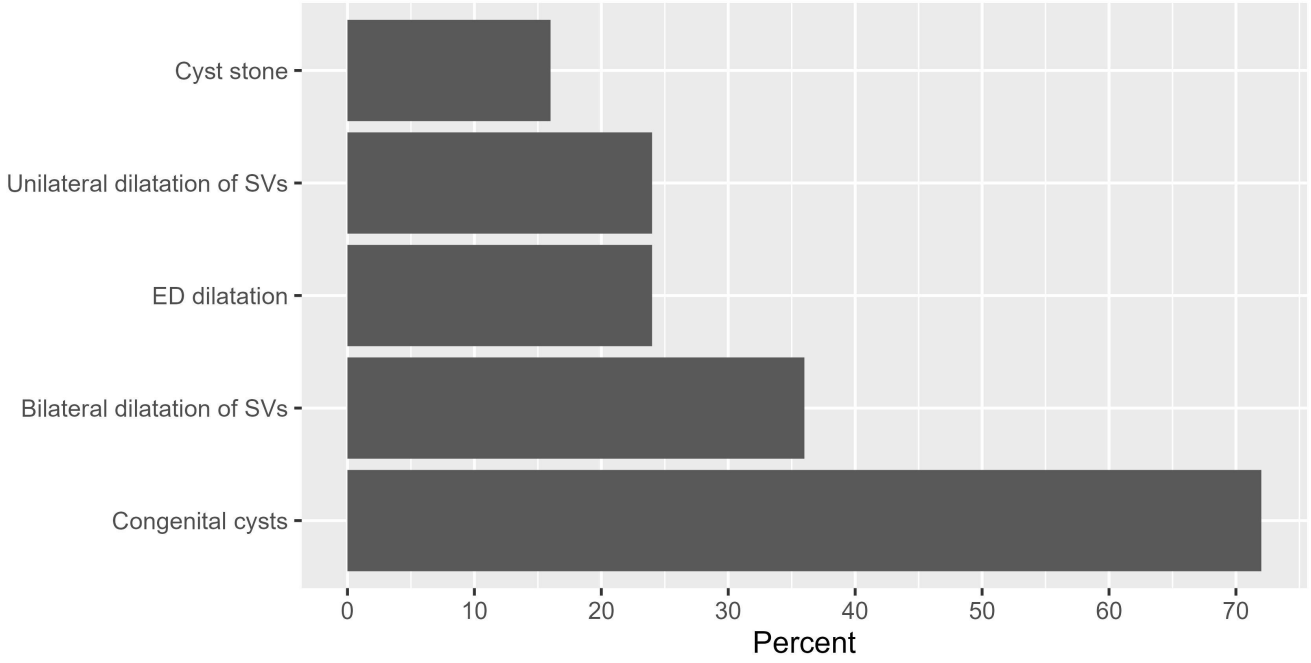

FIGURE 1. Imaging findings among patients suffering EDO. ED: ejaculatory duct; SVs: Seminal vesicles.

TABLE 2. Semen parameter in the pre and postoperative periods.

Parameter	Category	Preoperative	Postoperative	*p*
Volume				
	0.1–0.3	10 (41.7%)	2 (9.1%)	0.027
	0.4–0.6	9 (37.5%)	1 (4.5%)	0.027
	>0.6	5 (20.8%)	19 (86.4%)	0.001
	Missing	1 (4.0%)	3 (12.0%)	
Count				
	Azoospermia	16 (66.7%)	10 (43.5%)	0.114
	Oligospermia	1 (4.2%)	4 (17.4%)	0.371
	200–1000	1 (4.2%)	0 (0.0%)	0.999
	1100–5000	1 (4.2%)	0 (0.0%)	0.999
	5000–100,000	1 (4.2%)	0 (0.0%)	0.999
	>100,000	4 (16.7%)	9 (39.1%)	0.074
	Missing	1 (4.0%)	2 (8.0%)	
Motility				
	0 to 10	5 (62.5%)	1 (10.0%)	0.134
	10 to 20	1 (12.5%)	2 (20.0%)	0.074
	>20	2 (25.0%)	7 (70.0%)	0.999
	Missing	17 (68.0%)	15 (60.0%)	

TABLE 3. Outcomes of TURED surgeries.

Parameter	Category	n (%)
Symptomatic improvement¥		
	Improved	2 (100.0%)
Complications		
	No	24 (96.0%)
	Still azoospermic	1 (4.0%)
Natural pregnancy		
	Yes	2 (8.3%)
	Missing	1 (4.0%)
ICSI with ejaculate		
	Yes	20 (83.3%)
	Missing	1 (4.0%)
Number of ICSI children*		
	None	14 (70.0%)
	One	3 (15.0%)
	Two	3 (15.0%)

**Descriptive statistics were based on 20 patients who underwent ICSI; ¥Descriptive statistics were based on 2 patients who had symptoms at baseline. TURED: transurethral resection of ejaculatory ducts; ICSI: intracytoplasmic sperm injection.*

TABLE 4. categories of ED obstruction and congenital cysts.

Parameter	Overall n = 22	Ejaculatory duct obstruction			Congenital cysts		
		Partial n = 7	Complete n = 15	*p*-value	No n = 6	Yes n = 16	*p*-value
No improvement in volume and count	2 (9.1%)	0 (0.0%)	2 (13.3%)	>0.999	0 (0.0%)	2 (12.5%)	>0.999
Volume improvement	16 (72.7%)	6 (85.7%)	10 (66.7%)	0.616	6 (100.0%)	10 (62.5%)	0.133
Improved volume only (persistence azoospermia)	7 (31.8%)	0 (0.0%)	7 (46.7%)	0.051	4 (66.7%)	3 (18.8%)	0.054
Improved volume only (persistence normal count)	3 (13.6%)	3 (42.9%)	0 (0.0%)	0.023	0 (0.0%)	3 (18.8%)	0.532
Improved volume and count	2 (9.1%)	1 (14.3%)	1 (6.7%)	>0.999	1 (16.7%)	1 (6.2%)	0.481
Improved count and motility	1 (4.5%)	1 (14.3%)	0 (0.0%)	0.318	0 (0.0%)	1 (6.2%)	>0.999
Improved volume and count and motility	4 (18.2%)	2 (28.6%)	2 (13.3%)	0.565	1 (16.7%)	3 (18.8%)	>0.999
Improve semen parameters only	3 (13.6%)	1 (14.3%)	2 (13.3%)	>0.999	0 (0.0%)	3 (18.8%)	0.532
Azoospermia to normospermia conversion	2 (9.1%)	0 (0.0%)	2 (13.3%)	>0.999	0 (0.0%)	2 (12.5%)	>0.999
Aspermia + retrograde ejaculation	1 (4.5%)	0 (0.0%)	0 (0.0%)	>0.999	0 (0.0%)	1 (6.2%)	>0.999

differences were observed in semen parameters. Furthermore, the presence of congenital cysts did not significantly affect the outcomes of semen parameters (Table 4).

4. Discussion

EDO remains a relatively rare yet significant cause of male infertility. In recent times, with the increased use of TRUS and MRI as diagnostic tools, it is now more frequently diagnosed. Our study aimed to evaluate TURED as a treatment for EDO. After TURED, all symptomatic patients experienced improvement. Volume improvement was reported in the majority of the patients who underwent the procedure, while motility and count did not show significant improvement. A total of eight pregnancies were achieved (two natural and six ICSI) resulting in 11 offspring. Patients with partial obstruction had a significantly higher proportion of improved semen volume and persistent normal count compared to those with complete obstruction. Furthermore, the outcomes of semen parameters did not differ significantly based on having congenital cysts.

Volume improvement following TURED has been widely reported in multiple studies. For instance, Johnson *et al.* [4] reported an increase in seminal volume from 1.1 mL preoperatively up to 2.3 mL postoperatively. In contrast to our findings, they also noted an improvement in motility. However, despite our study having a larger number of participants, there were a high proportion of missing laboratorial analyses for motility, mainly due to patient non-compliance. Furthermore, in a systematic review of 29 studies involving 634 patients, Yurdakul *et al.* [5] reported volume improvement in 83.0% of patients (interquartile range (IQR): 37.5). In contrast to our study, they found that sperm motility and concentration improved in a median of 63.0% and 62.5% of patients, respectively. In addition, Kun-Long Lv and colleagues reported an improvement rate of 88.5% where semen appeared in 23 out of 25 cases within 3 months after surgery. The study also mentions that the sperm concentration and motility postoperatively at 6 months were higher than that at 3 months postoperatively [6]. Furthermore, Zheng *et al.* [7] reported a significant improvement in the ejaculate volume and sperm motility significantly improved postoperatively within the first 12 months. Moreover, Wang and colleagues reported an improvement of the semen volume, the sperm concentration and the motility after TURED. The study had a similar follow-up of one year. However, all of the 8 patients had an incomplete EDO [8].

The overall pregnancy rate in our cohort was 32% (two natural and six ICSI). In contrast, a Chinese cohort of 51 patients reported that 16 patients' wives (26.7%) achieved pregnancies despite an overall improvement of 85.0% in semen parameters, which is slightly higher than our improvement rate in all aspects of semen parameters (volume, count and motility) [9]. In an Egyptian cohort of 30 males, spontaneous pregnancies were achieved in 10 cases (33.3%) after short-term follow-up and in 8 cases (26.6%) after long-term follow-up. These success rates in spontaneous pregnancy are higher than natural pregnancy rates in our cohort (8%) [10]. It is worth noting that follow-up period our study was 12 months compared to the 7-year period in the aforementioned study. Furthermore, in Turkey, Yurdakul and colleagues reported a combined pregnancy rate (natural and ICSI) of 41.6% during a follow-up period of 12 (4–36) months [5]. In our case series, both symptomatic patients experienced improvement in their symptoms. This high improvement rate is consistent with the current literature. Sangster *et al.* [11] reported an improvement rate of 68% (22/33), while Popken *et al.* [12] observed a 100% improvement rate in all five patients included in their study.

The etiology of EDO has been found to play a role in the outcomes of TURED, both in terms of symptomatic relief and improvement in seminal parameters. Nelson and colleagues mentioned that complications in the congenital etiology group were minor, whereas 25% of the men in the acquired etiology group had significant impairment of seminal parameters after transurethral resection of the ejaculatory ducts [13]. Some studies, however, report a difference in the likelihood of complication occurrence. For instance, Mei and colleagues report an association between intraoperative calculus and recurrence of symptoms [14]. In our analysis, an association between etiology and complication could not have been calculated due to the low complication rate.

5. Conclusions

In crux, TURED is a safe and effective method for the treatment of EDO, with a very low complication rate. While, MRI with an endorectal coil has been proposed for more detailed evaluation, TRUS remains the suggested standard examination. After undergoing TURED, patients achieved significant improvements in semen parameters, symptom relief, and in some cases successful pregnancies. Additionally, TURED can enhance the outcomes of procedures such as ICSI. These results need to be interpreted with caution due to its small number of participants and having some missing variables. Further research is necessary to identify which patient subgroups are most likely to benefit from TURED to further tailor the indication for this procedure.

AVAILABILITY OF DATA AND MATERIALS

The data presented in this study are available on reasonable request from the corresponding author.

AUTHOR CONTRIBUTIONS

HM, MG and NH—conceptualized the study, designed the methods, validated the research and provided research materials. LD and OF—curated and analyzed the data, interpreted the results and presented them. AM and SK—wrote the original draft of the article. HM, MG and NH—critically reviewed and revised the original draft for important intellectual content, supervised and administered the project. All authors have approved the final draft and take responsibility for the accuracy and integrity of the work, including the similarity index of the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The Human Investigation Committee (IRB) and Research Ethics Committee of King Faisal Specialist Hospital and Research Center waived the need for consent due to the retrospective nature of the study, and all the procedures being performed were part of routine care.

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CONFLICT OF INTEREST

The authors declare no conflict of interest. Naif Alhathal is serving as one of the Editorial Board members of this journal. We declare that Naif Alhathal had no involvement in the peer review of this article and has no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to KSH.

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