Surgical Technique

Microscopic subinguinal varicocelectomy with video telescopic operating microscope (VITOM) telescope: outcome analysis

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Abstract: Conventional techniques of varicocele repair are associated with substantial risks of hydrocele formation, ligation of the testicular artery, and varicocele recurrence. The advantages of the microscopic approach to varicocele repairs are detailed identification and preservation of the vascular structures. In this study, our purpose is to review the outcome of all patients that underwent microscopic subinguinal varicocelectomy with the video telescopic operating microscope (VITOM). Hence, a retrospective review of 23 varicocele patients who underwent microscopic subinguinal varicocelectomy at the center from the year 2019 until 2021 was done. They, ranging between 18 to 58 years of age, comprising one case of right varicocele, fifteen cases of left varicocele, and seven cases of bilateral varicocele, were all having symptoms (pain and swelling) and clinically palpable varicocele. Ultrasounds were done to confirm the diagnosis and measure the testicular size. The surgery was performed by a single surgeon, under spinal anesthesia. The operation was performed using the VITOM telescope system, with an average operative time of one hour. The patients were followed-up at one month postoperatively to review the wound and symptoms. Phone call evaluations of all 23 patients were done to detect any recurrence or complications. All patients were discharged one day after surgery. Post-operative, all of them have a well-formed scar at the previous subinguinal region incision wound during the clinic visits. None of the 23 patients reported with varicocele recurrence, testicular pain, hydrocele formation or sexual dysfunction. The previous testicular pain or discomfort they encountered prior to the surgery was resolved as well. In conclusion, microscopic subinguinal varicocelectomy using the VITOM telescope is feasible and could achieve good outcomes.

Keywords: Microscopic subinguinal varicocelectomy; outcomes; postoperative surgery; varicocele; video telescopic operating microscope (VITOM)

Submitted Nov 16, 2023. Accepted for publication Feb 01, 2024. Published online Apr 17, 2024.
doi: 10.21037/tau-23-586
View this article at: https://dx.doi.org/10.21037/tau-23-586

Introduction

Varicocele is found in up to 22% of the adult male population, more commonly in men of infertile marriages, affecting 25–40% of those with an abnormal semen analysis. WHO data analysis indicates that varicocele is related to semen abnormalities, decreased testicular volume and a decline in Leydig cell function (1). Varicocele repair is a treatment option recommended by the European Association of

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Urology to adults having clinical varicocele with infertility or abnormal semen quality as well as adolescents with progressive failure in testicular development (2).

There are various treatment approaches for varicocele repair, including surgical ligation or percutaneous embolization. Surgical management of varicocele can be performed through inguinal, subinguinal, retroperitoneal or laparoscopic approaches (3). Conventional techniques are associated with substantial risks of complications such as hydrocele formation, ligation of the testicular artery, and varicocele recurrence. The postoperative recurrence rate in conventional techniques may reach up to 20% of patients with varicocele (4).

The use of microscopes has significantly improved the outcome of varicocelectomy. Despite having a longer operative time compared to conventional techniques, various studies have demonstrated that subinguinal microsurgical varicocelectomy offers the best outcome compared with open inguinal and laparoscopic varicocelectomy (5,6). For example, none of the patients in the subinguinal microscopic group had developed post-operative hydrocele, whereas post-operative hydrocele was observed in the open inguinal group (13%) and laparoscopic group (20%). Besides, only one patient in the subinguinal microscopic group experienced recurrence of one varicocele compared to 7 and 9 patients in the open and laparoscopic groups, respectively (5). Microscopic subinguinal varicocelectomy is capable of achieving small and aesthetic skin wounds with fewer complications compared to conventional non-microscope varicocelectomy (7). Following the advance in medical technology, the use of an exoscope equipped with high-definition digital camera system like that in the video telescopic operating microscope (VITOM) offers added advantage in microscopic subinguinal varicocelectomy procedure compared to standard operating microscope. The video exoscope system proved to be superior to standard operating microscope in terms of magnification, illumination and image quality when connected to ultra-high-definition monitors (8). In the setting of microscopic subinguinal varicocelectomy, the VITOM 2D and 3D model equipped with high-definition or 4K ultra-high-definition image quality and stereopsis-3D capability (magnification: < ×2, field of view: 50–150 mm, depth of field: 35–100 mm) provides excellent imaging and anatomical details, which allows for better identification of testicular artery necessary for the surgery (9).

However, due to the relatively new technology in the field, not many research are available on the use of VITOM in the setting of microscopic subinguinal varicocelectomy. Previous research related to the topic mainly focuses on the usage of conventional operating microscope. Therefore, in this study, we sought to review the outcome of subinguinal microscopic varicocelectomy surgery done with a VITOM microscope at our center. approach. We present this article in accordance with the SUPER reporting checklist (available at https://tau.amegroups.com/article/view/10.21037/tau-23-586/rc).

Highlight box

Surgical highlights

- Microscopic subinguinal varicocelectomy using the video telescopic operating microscope (VITOM) telescope is feasible and could achieve good outcomes.

What is conventional and what is novel/modified?

- Conventional techniques are associated with substantial risks of complications such as hydrocele formation, ligation of the testicular artery, and varicocele recurrence.
- Microscopic approach using VITOM for subinguinal varicocelectomy can provided detailed identification and preservation of the vascular structures, thus increase the outcome of the surgery.

What is the implication, and what should change now?

- Most of the patients did not report any postoperative pain and swelling.

Preoperative preparations and requirements

Site settings and material

This study was conducted at Universiti Kebangsaan Malaysia Medical Centre (UKMMC). The surgery was performed at the operating theatre of our centre. The ultrasound was done to confirm the diagnosis and determine the testicular size before the procedure. The surgical equipment used consist of microsurgical instruments and A VITOM HOPKINS Straight Forward 0° Telescope (microscope).

Patients

Patients with at least grade two varicocele (clinically palpable varicocele) with scrotal swelling or pain presented to our outpatient clinic and who had given their consent were included in the study. While patients who did not give their consent were excluded. When they were

initially presented to the outpatient clinic with scrotal swelling or pain, they were assessed by a single surgeon (correspondence) clinically. They were examined in a standing position for at least three minutes and the presence of varicocele with its grade was recorded. The patients were then assessed with color Doppler ultrasonography (US) of the scrotum to help establish the diagnosis.

The indications for varicocelectomy for all patients included testicular pain, testicular hypotrophy, scrotal swelling and scrotal pain. They consented and proceeded with microscopic subinguinal varicocelectomy. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patients prior to the surgery.

Step-by-step description

The microscopic subinguinal varicocelectomy operative procedures were explained to the patients prior to surgery. The operations were done under spinal anesthesia and were performed by the same surgeon (correspondence). Surgery was initiated with 2.5–3.0 cm subinguinal incision at the external inguinal ring. The spermatic cord was mobilized. Vas deferens was identified, dissected, and preserved. A Farabeuf retractor was placed underneath the cord for proper visualization. The testicles remain untouched within the scrotum. A VITOM HOPKINS Straight Forward 0° Telescope (microscope) was placed around 25 cm above the operative field with ×16 magnification to obtain detailed visualization over the monitor screen. Testicular arteries were carefully identified via its pulsation that was magnified and preserved. The dilated spermatic veins were cut and ligated with 4/0 Polyglactin suture. Hemostasis was secured to any bleeding area, followed by the closure of the wound in layers.

Postoperative considerations and tasks

After surgery, the patients were followed-up at one month and six months postoperatively. Symptom review and physical examination of the scrotum and testis were performed by the same surgeon during each clinic follow-up visit.

Statistical analysis was conducted in this study. Patient demographics and clinical observations such as age, ethnicity, presentation of varicocele, varicocele grading, symptoms, duration of operation and postoperative observations were recorded. Continuous data were presented in mean ± standard deviation (SD), while descriptive data were expressed in number and percentage (%). Pearson chi-square analysis was performed using SPSS (version 28.0) (IBM Corp. Released 2021. IBM SPSS Statistics for Windows, Version 28.0., Armonk, NY, USA) to identify the association between the variables. The association was considered significant if the P value <0.05.

Overall, a total of 23 male patients who fulfilled the inclusion and exclusion criteria were recruited for the study. The mean age of the patients was 32.3±9.34 years, with the youngest patient being 18 years old and the oldest patient 58 years old. Chinese patients were the highest with 12 (52.2%), followed by Malay 10 (43.5%) and Indian 1 (4.3%). Left varicocele accounted for the majority of the cases with 15 (65.2%), followed by bilateral varicocele 7 (30.4%) and right varicocele 1 (4.3%). 14 (60.9%) of the cases were Grade Two varicocele whereas 9 (39.1%) of them were Grade Three. Patients reported symptoms of scrotal swelling (n=5; 21.7%), scrotal pain (n=5; 21.7%) or both (n=13; 56.5%). The mean duration of operation for all the patients was 1.17±0.39 hours.

In terms of clinical observation, all patients showed surgical complication Grade I according to the Clavien-Dindo Complication Scale, whereby all the complications were deviation from normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions (10). Twenty-two patients (95.7%) claimed they had not experienced any pain after the surgery whereas only one patient (4.3%) claimed to experience postoperative pain, but the pain had reduced compared to before surgery. The majority of 19 patients (82.6%) did not show testicular swelling postoperatively. Only four patients reported testicular swelling postoperatively which has been resolved during subsequent follow up. None of the patients who underwent the microscopic subinguinal varicocelectomy experienced unwanted postoperative complications, including a reduction in the number of sperms, sexual dysfunction or loss of libido and the presence of lower urinary tract symptoms (LUTS). All patients were discharged a day after the surgery. Well-formed scars were observed at the site of previous subinguinal region incision wounds for one month and six months follow-up visits for all patients. Detailed information on the patients was presented in *Table 1*.

As shown in *Table 2*, Pearson chi-square analysis showed no significant association between ethnicity, presentation

Table 1 Demographic and clinical characteristics of patients

Variables	Value
Total number of patients (n)	23
Age, years, mean ± SD [range]	32.30±9.34 [18–58]
Ethnicity, n (%)	
Malay	10 (43.5)
Chinese	12 (52.2)
Indian	1 (4.3)
Presentation of varicocele, n (%)	
Left varicocele	15 (65.2)
Right varicocele	1 (4.3)
Bilateral varicocele	7 (30.4)
Varicocele grading, n (%)	
Grade 2	14 (60.9)
Grade 3	9 (39.1)
Symptoms, n (%)	
Scrotal swelling	5 (21.7)
Scrotal pain	5 (21.7)
Scrotal swelling and pain	13 (56.5)
Duration of operation (h) (mean ± SD)	1.17±0.39
Clavien-Dindo Complication Scale grade I, n (%)	
Postoperative pain	
No	22 (95.7)
Yes	1 (4.3)
Postoperative swelling	
No	19 (82.6)
Yes	4 (17.4)
Postoperative recurrence	
No	23 (100.0)
Yes	0 (0)
Postoperative hydrocele	
No	23 (100.0)
Yes	0 (0)
Postoperative reduction of sperms	
No	23 (100.0)
Yes	0 (0)
Postoperative sexual dysfunction	
No	23 (100.0)
Yes	0 (0)
Postoperative LUTS	
No	23 (100.0)
Yes	0 (0)

SD, standard deviation; LUTS, lower urinary tract symptoms.

of varicocele and symptoms with a duration of operation, postoperative pain and postoperative swelling. There was also no significant association between the varicocele grading with duration of operation and postoperative pain. However, a significant association was observed between the varicocele grading with the postoperative swelling (χ^2=7.53; P=0.006).

The varicocele grading had a large effect size on postoperative swelling with the Cramer's value recorded at 0.57 (P=0.006). The postoperative swelling for patients with grade 3 is more compared (n=4) to swelling in grade 2 (n=0) (*Table 3*).

Tips and pearls

The most important tip for this study is to assess the location of the arteries and veins using appropriate ultrasound probe to avoid any accidental injury to the testicular arteries during microscopic subinguinal varicocelectomy.

Discussion

The microsurgical approach to varicocelectomy was first described in 1992 by Goldstein *et al.* (11). Optical magnification of the microscope allows detailed evaluation of the spermatic cord structures including the veins, arteries and lymphatics during dissection. This allows selective ligation of the small spermatic veins while preserving the arteries supplying the testis, epididymis and vas deferens.

The testicular artery, vassal artery and cremasteric artery are the three main sources of arterial supply to the testis (12). The testicular artery, which is the largest caliber arterial vessel among the three provides most of the blood flow to the testis. The diameter of the testicular artery is equal to or greater than the sum of the vasal and cremasteric arteries combined in most of the human spermatic cords.

Preservation of the testicular arteries is important for optimal testicular blood flow, as ligation of it will cause testicular ischemia and subsequently lead to testicular atrophy. There is also evidence showing that ligation of the testicular artery causes deleterious effects on germinal epithelium and spermatogenesis in both human and animal models (13). Hence, the use of the microscope is recommended in varicocelectomy to potentiate the possibility to preserve the testicular artery.

Table 2 Pearson chi-square analysis of the variables

Variables	Duration of operation	Postoperative pain	Postoperative swelling
Ethnicity	0.26 (0.87)	0.96 (0.61)	5.14 (0.07)
Presentation of varicocele	4.57 (0.10)	0.56 (0.75)	2.58 (0.27)
Varicocele grading	0.406 (0.52)	1.63 (0.20)	7.53 (0.006*)
Symptoms	2.87 (0.23)	0.80 (0.66)	3.73 (0.15)

Data are χ^2 (P value). *, P value less than 0.05.

Table 3 Relationship between the varicocele grading and postoperative swelling

Varicocele grading	Postoperative swelling	
	Yes	No
Grade 2		
Observed	14	0
Expected	11.6	2.4
%	100.0	0.0
Grade 3		
Observed	5	4
Expected	7.4	1.6
%	55.6	44.4

Cramer's V =0.572 (P=0.006).

The external pudendal vein and internal spermatic vein are the two principal sources of venous drainage of the testis (14). The cremasteric and vasal veins are smaller collaterals forming the pampiniform plexus with the testicular veins forming. A varicocele develops due to the reversal of blood flow within the internal spermatic and cremasteric veins which leads to its dilatation. It seems crucial to ligate both the external and internal spermatic veins in order to prevent the recurrence of varicocele (5). Ligation of the larger veins during varicocelectomy while missing the smaller veins may lead to the recurrence of varicocele.

Recurrence after varicocele repair is one of the most variable complications, varying from 0–35% (15). It depends largely on the technique used, the method of approach, and the use of magnification during surgery. In conventional (non-microscopic) varicocelectomy, postoperative varicocele recurrence is found in 5–20% of men (5), with a lower recurrence rate for the inguinal approach compared to the retroperitoneal approach. This is believed due to the conventional varicocelectomy technique that may miss smaller internal spermatic veins that may dilate in the future and cause recurrence (16).

In contrast, in one series, a microsurgical approach was associated with recurrence rates of <1% (17). The use of ×7 magnification in the VITOM system facilitates the identification and ligation of many small spermatic veins while preserving small arteries and lymphatics. In that way, surgical field magnification and illumination can be enhanced through high definition 2D or 3D screen imaging. As such, the VITOM system offers high-resolution imaging, a more precise focusing and a more extensive depth of field than conventional operating microscope, which allows for better identification of smaller anatomical structures like veins and arteries (18). This explains the superiority of microscopic varicocelectomy in minimizing varicocele recurrence. As supported by the current study results, most patients did not report any pain or swelling postoperatively. For those who did, the pain and swelling were mild and markedly reduced compared to before surgery. Moreover, the microscopic varicocelectomy procedure did not cause any undesirable postoperative complications such as a reduction in the number of sperms, sexual dysfunction and occurrence of LUTS, as shown in the results.

In the matter of surgical technique, the subinguinal approach is associated with more rapid recovery time and less pain compared to the inguinal approach (17). The subinguinal approach isolates the cord by dissection at the level just inferior to the external inguinal ring, without opening the external oblique aponeurosis. In comparison to the inguinal approach, the subinguinal approach is associated with more internal spermatic veins and arteries per dissection (19). As compared to the laparoscopic approach, the potential complications of laparoscopic varicocelectomy such as injury to the bowel, vessels or viscera, air embolism, and peritonitis were also prevented. Hence, we chose the subinguinal approach for all our 23 patients who went for microscopic varicocelectomy. The

short average duration of the procedure as observed in the results was another added advantage, which proved the simplicity and convenience of the procedure.

Hydrocele formation is another commonly reported complication of varicocelectomy in all methods of approaches and varies between 3% and 33% (average incidence 7%) (17). Hydrocele is the most frequent side effect following internal spermatic mass ligation in the retroperitoneal approach, occurring in up to 25% of cases (20), while incidence of postoperative hydrocele formation varies from 3% to 15% in the conventional inguinal approach (6). Microscopic approaches have shown the result that the incidence rate of postoperative hydrocele may drop up to 0.07% (17). As in our case, none of the 23 patients was reported to have postoperative hydrocele during our clinic follow-up. Lymphatic obstruction is believed to be the cause of postoperative hydrocele formation (16). It was also reported that poor lymphatic drainage causing interstitial oedema also impairs testicular function which affects fertility (21). Distinguishing tiny veins from lymphatic vessels remains a challenging task, which may contribute to the comparatively elevated incidence of hydroceles. However, the use of magnification in VITOM to identify and preserve lymphatics in microsurgical improves fertility outcome. Not just magnification, VITOM provides the surgeons with a broader visual perspective instead of confining to an eyepiece like that in conventional operating microscope. This creates a more ergonomic work environment for surgeons by eliminating the need to confine vision to an eyepiece. This flexibility will help to improve the outcome of microscopic subinguinal varicocelectomy (18).

Nowadays, the 'gold standard' method for treating varicocele in adults and adolescents is microsurgical subinguinal varicocelectomy because of the generally better results and lower rates of postoperative complication and recurrence (22). The result was similarly found in our study when we performed the surgery using a VITOM telescope in which most of the patients did not report any postoperative pain and swelling. There is a notable correlation between the patient's varicocele grading and the occurrence of postoperative swelling. It is important to highlight that the swelling reported by all four patients was temporary and resolved during subsequent follow-up. A previous study which evaluated VITOM technology mentioned that VITOM enhanced surgeons' ability to perform their job and improved the surgical process through an improvement in work ergonomic without having to strain their eyes to a single eyepiece (18). The technology was also easy to use and could improve operation visualization and identification during the surgery, especially for small anatomical structures like testicular arteries and veins, which helped to improve their understanding and enhance the teaching and learning experience (23,24). From our experiences in this study, using VITOM during varicocelectomy procedures provides sufficient magnification (×16) to identify the testicular artery. VITOM improves the learning curve of microsurgical varicocelectomy with excellent video image quality, compared to the microscopic view from the microscope. As microscopic urology operation is very limited, most urologists require more training and learning processes to operate under the microscope. Video image also offers a more efficient learning process to the trainees.

Conclusions

Microscopic subinguinal varicocelectomy with the VITOM telescope is feasible and could achieve good outcomes. VITOM telescope could be used for microscopic subinguinal varicocelectomy if the tool is available.

Acknowledgments

Funding: None.

Footnote

Reporting Checklist: The authors have completed the SUPER reporting checklist. Available at https://tau.amegroups.com/article/view/10.21037/tau-23-586/rc

Peer Review File: Available at https://tau.amegroups.com/article/view/10.21037/tau-23-586/prf

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://tau.amegroups.com/article/view/10.21037/tau-23-586/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research

committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patients prior to the surgery.

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Cite this article as: Mohd Hashim MH, Fam XI, Azizi MH, Khoo HC, Shukor S. Microscopic subinguinal varicocelectomy with video telescopic operating microscope (VITOM) telescope: outcome analysis. Transl Androl Urol 2024;13(4):560-567. doi: 10.21037/tau-23-586

