

Loupe-Assisted High Inguinal Varicocelectomy for Sub-Fertile Men with Varicoceles

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Background: Microsurgical sub-inguinal varicocelectomy has been associated with extremely high success rates and minimal postoperative complications. The aim of this study was to report the techniques and outcomes of varicocelectomy using a modified microsurgical method, specifically a loupe-assisted high inguinal varicocelectomy instead of the usual microscope and sub-inguinal approach.

Methods: From 1997 through 2000, 116 patients underwent modified high inguinal varicocelectomy. All patients had at least a 1-year history of infertility with abnormal semen parameters and varicocele proven by physical examination and/or color Doppler ultrasound. Varicocelectomy was performed as an outpatient procedure. To facilitate the procedure, a x3.0 loupe was used during the spermatic cord dissection at the level of the internal inguinal ring. During dissection, the dilated veins were ligated and divided including vasal veins and external spermatic veins. All of the patients were followed postoperatively with semen analysis and physical examination every 3 months.

Results: A total of 96 patients were followed for more than 1 year, with at least two semen analyses being conducted. Moreover, 136 varicocelectomies were performed among the 96 patients. No intra-operative complications occurred. A temporary reactive hydrocele was noted in one patient, but subsequently completely resolved. In addition, recurrent or persistent varicocele was identified by physical examination and/or color Doppler in four patients (2.9%). Motile sperm concentration increased from $31.8 \pm 18.6\%$ to $47.5 \pm 16.9\%$ ($p=0.0004$) in the sample group, and the sperm concentration ($10^6/\text{cc}$) increased from 26.2 ± 18.7 to 42.8 ± 28.5 ($p=0.0002$).

Conclusion: Loupe-assisted high inguinal varicocelectomy is a safe, simple, and effective method for the treatment of sub-fertile men, especially in medical facilities without microscopic equipment. However, further study with control groups is needed to strengthen the evidence.

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Varicocelectomy is the accepted treatment for the varicoceles associated with infertility. The goal of varicocelectomy is the complete disruption of all venous drainage reflux to the testis while preserving the artery supply, vas deferens, spermatic cord, and the lymphatic system.⁽¹⁾ However, the method of varicocelectomy is still a matter of controversy owing to the complexity and variations of the testicular venous anatomy.⁽²⁻⁴⁾ Several methods have been used, such as open surgical ligation, retrograde or antegrade sclerotherapy, microsurgical, and laparoscopic surgical methods.⁽⁵⁻⁸⁾ Each approach or method has its own advantages and disadvantages, and the conflicting results have been obtained by different researchers.

Testicular venous drainage occurs mainly through the internal spermatic veins, but collateral channels such as external spermatic veins or vasa veins may also contribute to the failure of varicocele repair.^(9,10) External spermatic veins exit the spermatic cord distal to the internal inguinal ring, and are not accessible by retroperitoneal or laparoscopic approaches to varicocele repair. The inguinal approach has the advantage of rapid access to external spermatic veins and vasa veins. However, the inguinal approach is limited in that many branches of the internal spermatic veins are often present at this level, particularly at the level of the external inguinal ring. Consequently, completely ligating all of these veins without destroying the spermatic artery and lymphatic drainage may be difficult without magnification. Therefore, early results of simple varicocele repair have been disappointing due to the high incidence of persistent or recurrent varicocele following surgical repair and the high complication rate of hydrocele.⁽¹¹⁻¹³⁾ Microsurgical approaches have been developed to reduce the rates of complications and recurrence following surgical varicocele repair.^(14,15) Moreover, authors have reported improved results and significantly lower recurrence rates using microsurgical sub-inguinal varicocele repair.^(6,7) However, a high inguinal approach and the use of a loupe instead of an operating microscope may be more practical and easier to perform than microsurgical repair. Consequently, we present the results of varicocelectomy using this modified procedure in 116 consecutive sub-fertile patients. The modified loupe-assisted high inguinal technique is also described in detail.

METHODS

During a 3-year period, 116 sub-fertile patients with varicoceles and abnormal semen parameters underwent modified microsurgical high inguinal varicocelectomy as an outpatient procedure. All of the patients presented with infertility of at least 1 year. Varicoceles were diagnosed clinically and further confirmed using results of color Doppler ultrasound. At least two semen analyses were obtained preoperatively for each patient, being taken after 3 days of abstinence and at least 1 month apart. Patients were examined at 1 month, 3 months, 6 months, and 1 year postoperatively. Semen analyses were obtained at 3 months, 6 months, and 1 year postoperatively. Scrotal ultrasound, including color Doppler, was performed if persistent or recurrent varicoceles, or hydroceles were clinically suggested.

Under laryngeal mask general anesthesia, the spermatic cord was approached through a 2-4 cm skin incision over the inguinal canal. After the external oblique aponeurosis was opened, the ileoinguinal nerve and genital branches of the genitofemoral nerve were identified and the spermatic cord was delivered. All identifiable external spermatic veins were ligated and divided (Fig. 1). After opening the internal spermatic fascia of the spermatic cord, dissection was continued with the aid of a x3.0 loupe. To facilitate the complete ligation of the internal spermatic vein, the cord was dissected at the level of the internal ring, or even at the retroperitoneal level, where few branches of the internal spermatic vein will be encountered theoretically. At this level, the internal spermatic vein usually merges into 1 to 3 larger vessels that can be easily dissected free from the adjacent soft tissue and divided under loupe magnification (Fig. 2). The testicular artery was identified by visible pulsation if possible. When the artery was difficult to visualize, dilated internal spermatic veins were carefully dissected while preserving all of the soft tissue around the veins. After completing ligation of the internal spermatic veins, the vas deference was checked and all dilated veins surrounding the vas deference were also ligated. Finally, the spermatic cord was run over the index finger and inspected at the dissection level to ensure that all of the veins had been ligated and only the testicular artery, lymphatic system, and vas deference and its vessels remained. Statistical analysis of pre-opera-

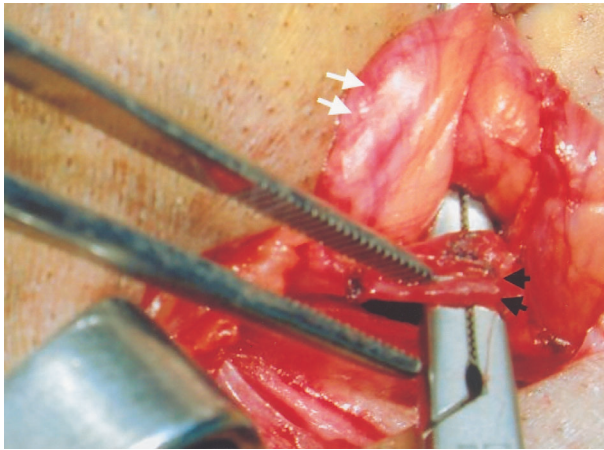


Fig. 1 All identifiable external spermatic veins (black arrows) were ligated and divided before opening the internal spermatic fascia (white arrows).

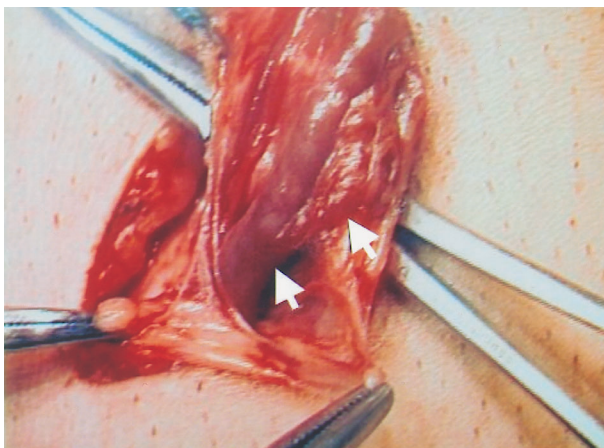


Fig. 2 The internal spermatic veins at high inguinal level usually merge into 1-3 larger vessels(white arrows) that can be easily dissected from the adjacent soft tissue and divided under loupe magnification.

tive and post-operative semen data was performed using the paired *t* test, which was considered significant at $p < 0.05$. The sperm parameter values are presented as mean \pm standard deviation (SD).

RESULTS

Outpatient loupe-assisted high inguinal varicocelectomy was successfully accomplished in all 116 patients, with a mean operative time of 45 minutes for unilateral varicocelectomy and 68 minutes for bilateral. No intra-operative complications occurred.

More than 1 year of follow-up with at least two post-operative semen analyses was available for each of the 96 patients. The mean age of these 96 patients was 34.8 years (range, 29 to 43 years). Furthermore, the varicoceles were unilateral left in 54 cases, bilateral in 40 and unilateral right in two (namely, a total of 136 varicocelectomies were performed in the 96 patients with complete follow-up data).

Among the 136 varicocelectomies, dilated external spermatic veins posterior and lateral to the spermatic cord were found and ligated in 50 (36.8%) patients. Notably, the testicular artery could be identified in two thirds of these 136 varicocelectomies. Most of the 136 varicoceles had only one or two prominent internal spermatic veins when dissected at the internal ring level (Fig.2). A temporary reactive hydrocele, which subsequently completely resolved, was observed in one patient. Recurrent or persistent varicocele was identified using results of physical examination and/or color Doppler in four varicocelectomies (2.9%). No definite hydrocele or testicular atrophy was observed.

A statistical analysis of the semen data from the 96 qualified patients is shown in Table 1. Considerable changes were noted in sperm density ($26.2 \times 10^6/cc$ to $42.8 \times 10^6/cc$, $p < 0.001$) and percentage of motility (31% to 47%, $p < 0.001$), although no significant improvement was observed in percentage of normal sperm morphology (62.3% to 64.7%, $p = 0.58$).

Table 1. Pre-operative and Post-operative Semen Analysis Results in 96 Patients

Parameter	Mean \pm SD		<i>p</i>
	Preoperative	Postoperative	
Sperm concentration $\times 10^6/cc$	26.20 \pm 18.77	42.78 \pm 28.50	0.0002
% Motility	31.86 \pm 18.64	47.52 \pm 21.03	0.0004
% Normal forms	62.30 \pm 16.17	64.68 \pm 16.91	0.58

SD: standard deviation

DISCUSSION

Preservation of the artery and lymphatic system with complete ligation of the varix veins is key for successful varicocelectomy. During the past several decades, many different approaches or tools have been used for the treatment of varicocele with varying rates of success and complications. The high

retroperitoneal approach⁽¹⁷⁾ and laparoscopic approach⁽¹⁸⁾ can be performed for patients needing internal spermatic vein ligation, but not the external spermatic veins or vasal veins. Additionally, the inguinal and sub-inguinal approaches can be used to ligate the external spermatic and vasal veins.⁽¹⁶⁾ The best treatment modality for varicocele can be selected only after comparing the recurrence rate, increase in semen parameters, and complication rates of these approaches. Using the results of physical examination, color Doppler ultrasound, and venography, a wide difference in recurrence rates (0% to 45%) have been reported.^(11,12) Ross and Rupman reported no recurrences in 565 patients who were treated using the inguinal approach.⁽¹⁹⁾ However, from our previous practical experience, the postoperative outcome in high inguinal varicocelectomy without using magnification was unsatisfactory because of the difficulty in visualizing small branches of the internal spermatic vein, which has been proven with radiological evidence.⁽¹⁰⁾ With the microscope assisted technique, Marmar and Kim performed subinguinal varicocelectomy in 466 cases, revealing a palpable recurrence rate of 0.82% per procedure.⁽¹⁶⁾ Moreover, Kaye surveyed 50 patients who had undergone high inguinal microsurgical varicocelectomy, and found two recurrences (4%) using venography.⁽¹⁵⁾ In the patients who underwent loupe-assisted high inguinal varicocelectomy surveyed here, the recurrence rate as determined using results of physical examination and/or color Doppler ultrasound was 2.9%. The procedure was performed at the internal ring level of the inguinal channel, enabling the surgeon to minimize the number of veins and artery branches encountered. The use of loupe rather than microscope assistance may help simplify the operation and reduce the operating time. In fact, magnification by a x3.0 loupe is sufficient for visualization and dissection of small branches of the internal spermatic veins and vasal veins in this region, given that few vein branches are encountered in the first place.

The main purpose of varicocelectomy is to improve the semen parameters and to achieve pregnancy. According to the study by Pryor and Howards 66% (range, 51% to 78%) of patients had some improvement in the sperm parameters postoperatively after 2266 varicocelectomies.⁽²⁰⁾ Specifically, motility improved in 70% of the cases, while sperm count and sperm morphology improved

in 51% and 44%, respectively. Pregnancy rates were between 24% and 53%. Comparing the results of microsurgical varicocelectomy from different studies, Goldstein et al. demonstrated a significant increase in sperm concentration ($36.97 \times 10^6/\text{cc}$ to $46.85 \times 10^6/\text{cc}$), sperm motility (39.2% to 45.66%) and normal form (48.42% to 52.1%), as well as a 43% pregnancy rate.⁽⁷⁾ Moreover, Cayan et al. reported a 42.8% pregnancy rate, improvement of sperm concentration from 29.7×10^6 to 36.62×10^6 and improvement of sperm motility from 25.6% to 43.47%.⁽²¹⁾ Finally, our present study also demonstrated a significant improvement in sperm density ($26.2 \times 10^6/\text{cc}$ to $42.8 \times 10^6/\text{cc}$) and percentage of motility (31% to 47%). However, we observed that the percentage of normal form did not significantly improve (from 62.3% to 64.7%). The normal baseline of the pre-operative data in this study may be the reason for the phenomenon mentioned above. Nevertheless, the present study still noted a 39.5% pregnancy rate (38/96) after 2 years of follow-up.

In summary, based on technical feasibility, recurrence rates, complication rates, and increase in semen parameters of the different approaches, the loupe-assisted high inguinal varicocelectomy is a reliable approach for sub-fertile men with varicoceles. The novel technique can be easily implemented to access not only the internal spermatic veins but also the external spermatic veins and dilated vasal veins at this level. The magnification provided by the loupe allows reliable identification of the testicular artery and lymphatic system, as well as small venous channels if present. Consequently, the postoperative development of hydrocele or recurrence of the varicocele can be prevented, and a significant improvement in semen parameters is achieved.

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放大眼鏡下施行高位腹股溝精索靜脈截除術

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背景： 低位腹股溝顯微精索靜脈曲張截除術有很高的手術成功率及低手術併發症，然而這個方法需要較昂貴的器具及時間花費。這裏我們報告，利用放大眼鏡幫忙下，經由較高位的次顯微精索靜脈曲張截除術之經驗、技術及其可行性。

方法： 從1997年到2000年之間，一共有116位病人施行這種改良手術法。所有病人都有一年以上的不孕史且有不正常的精液分析及理學檢查或超音波証實的精索靜脈曲張。以門診手術的方式、利用三倍放大眼鏡的幫忙，在接近內腹股溝環的位置，把所有曲張的靜脈，包括內、外精索靜脈及輸精管靜脈結紮而儘可能保留動脈、淋巴管及神經。所有的病人術後每三個月回診做精液分析及理學檢查。

結果： 一共有96位病人至少有超過一年的完全追蹤及至少二次以上的精液分析。手術中沒有任何併發症發生，術後有一位病人有短暫的陰囊水腫。有4位病人術後有復發或持續性的靜脈曲張 (2.9%)。術後精虫活動力從 $31.8 \pm 18.6\%$ 上升到 $47.5 \pm 16.9\%$ ($p=0.004$)，而精虫濃度則從 $26.2 \pm 18.7 \times 10^6/cc$ 增加到 $42.8 \pm 28.5 \times 10^6/cc$ ($p=0.0002$)。

結論： 放大眼鏡幫忙下，施行較高位腹股溝精索靜脈曲張截除術，是一個安全且技術上較為單純、容易而且有效的方式，尤其是對沒有顯微設備的地方。
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關鍵字： 精索靜脈曲張，不孕症，精索靜脈曲張截除術。

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