REVIEW ARTICLE

# Impact of microscopic intermediate sub inguinal varicocelectomy on varicocele and infertility

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**Abstract**

Varicocele is primarily tortuous dilation of the internal spermatic veins [ISV] and pampiniform plexus in the scrotum. It is the most common correctable cause of infertility. It has a higher prevalence in primary and secondary infertile in men. In this article, we reviewed the advantages and disadvantages of microscopic intermediate sub inguinal [MISV] varicocelectomies over conventional surgical methods. Although various mechanisms are postulated for pathogenesis, increased venous reflux is accepted as the predominant cause. Varicocelectomy is done to ligate the veins and reduce venous reflux without affecting the arteries, vas deferens and lymphatics. Open, laparoscopic and microscopic varicocelectomies are the different surgical approaches of varicocele. Embolization is another treatment option. MISV is a relatively novel technique and considered superior to the conventional treatment approaches because of increased spontaneous pregnancy rates, reduced recurrence, increased seminal parameters and fewer postoperative complications, as evidenced by many studies. Microscopic visualization and usage of micro-doppler in surgery improves safety. Absolute indications for varicocelectomy are documented infertility, clinically palpable varicocele abnormal seminal parameters and potentially treatable female infertility or normal fertility. Persistent pain, discrepancies in the testicular volume of more than 20% and hypogonadism are considered as relative indications for varicocelectomies. MISV should be regarded as the gold standard treatment method for varicocele.

## Introduction

Varicocele is abnormal tortuous dilation of pampiniform plexus and internal spermatic veins [ISV] of the scrotum [1–3] and is closely related to abnormal seminal parameters and infertility evidenced by previous studies. [1,2,4,5] Prevalence of varicocele in the normal healthy male population is 10-15% [6] Increased prevalence of varicocele [40-70%] is noted in men with primary and secondary infertility [7–9]. Though the varicocele was observed in patients with infertility, most people with varicocele [75%] have normal fertility rates [1,2,10]. Despite many research articles claiming the cause and effect relationship between infertility and varicocele, it remains controversial to establish varicocele as a definite cause.

Varicocelectomy is the surgery to ligate the internal spermatic veins as much as possible without affecting the testicular arteries and testis [5]. Favourable outcomes of a varicocelectomy are spontaneous postoperative pregnancies, success in artificial conception methods, improvement in seminal parameters and reduction in postsurgical pain [8]. Varicocele recurrence, hydrocele, accidental testicular arterial damage, causing testicular hypotrophy, and persistent pain are unfavourable outcomes [11].

## Etiopathogenesis

There are few mechanisms postulated for infertility in varicocele. Increased hydrostatic pressure in ISV due to venous reflux, scrotal hyperthermia, generation of reactive oxygen species [ROS] leading to increased DNA damage and reduced antioxidant capacity of testicles are those mechanisms [6]. These explained mechanisms can lead to harmful consequences. Those are increased damage to the germinal epithelium by toxic metabolites, reduced sperm quality, reduced testosterone production and loss of germinal cells, and testicular hypertrophy [12–14]. Venous reflux into the ISV is considered a significant cause among postulated pathophysiological mechanisms for the detrimental consequences of varicocele.

Further various anatomical and physiological factors contribute to increased venous reflux in ISV. Those are long course and the perpendicular confluence of the left testicular vein and renal vein, reflux into significant collateral veins [cremasteric, external pudendal and gubernacular] due to incompetent valves in the internal spermatic vein and metabolites from renal and suprarenal glands [15, 16]. So, the goal of varicocelectomy is to reduce the venous stasis in the

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collaterals caused by venous reflux. This is achieved by ligation of ISV with collateral veins [16,17]. The most negative influence of varicocele is the progressive reduction of testicular function [17–21]. Intervening at the right time may be imperative and challenging in practice.

**Symptomatology and indications**

Most of the patients are asymptomatic, and they are found to have varicocele when they seek medical advice for infertility after multiple failed attempts of conception [6,9,15,16]. A minority of patients have dull aching pain [10%] in the scrotum or testis or lump or swelling in the scrotum. Absolute indications for all types of surgical methods for varicocele are as follows: clinically palpable varicocele in the presence of infertility, one or two abnormal seminal parameters with a treatable cause of infertility or normal fertility in a female partner [17]. Relative indications are longstanding pain, non-obstructive azoospermia, severe oligoazthenospermia, testicular volume discrepancy of more than 20% and hypogonadism [18].

**MISV over conventional methods and its influence on the outcome**

Though the reasons for infertility remain unresolved, surgical correction positively impacts outcomes [2]. Thus, various surgical techniques are used in the treatment of varicocele. Those are the open approach, laparoscopic method, macroscopic and microscopic intermediate sub inguinal varicocelectomy [MISV]. Embolization is another method to correct varicocele. MISV recently gained popularity because of three factors; increased successful spontaneous pregnancies, fewer complications and low recurrence rates compared to conventional methods [6,16,19]. Evidence suggests MISV is preferred over traditional methods because of various advantages. Microscopic visualization discriminates small spermatic arteries and veins and avoids aggressive handling of arteries with a precise operative approach on testis [3,6,16,20,21]. Further introduction of intraoperative Doppler with papaverine helps identify arteries from veins. Evidence suggested that postoperative hydrocele and varicocele recurrence are significantly less than conventional methods.

**Technical aspects of surgery**

A transverse skin incision of 3 cm will be made immediately below the external ring, over the pubic ramus. The incision is further deepened and extended into scarpa fascia. Atraumatic babcock clamp will be used to mobilize the spermatic cord and vascular bundle carefully. Thereafter, these structures will be elevated into the surgical wound. Surrounding tissues of the spermatic cord and vessels are freely dissected and mobilized through the surgical wound. The spermatic cord will be kept carefully at this juncture by the retractor. Then, the microscope is brought inside the operative field to enhance visualization and magnification up to 8-15 times. External spermatic fascia is divided and examined with the help of a microscope. Vas deferens and surrounding vascular bundle, including lymphatic vessels, are identified and preserved.

At this point, a microvascular Doppler is used to examine vessels several times for the precise differentiation of arteries and veins by hearing the arterial pulsation. 20 MHz microvascular Doppler is commonly used. Further, it is used to preserve the testicular artery and careful dissection of dilated veins. Once the ligation of veins within the spermatic cord is done, the spermatic cord is reduced into vas deferens. Vascular bundle and vas again placed back in to place. The surgical wound will be closed with sutures.

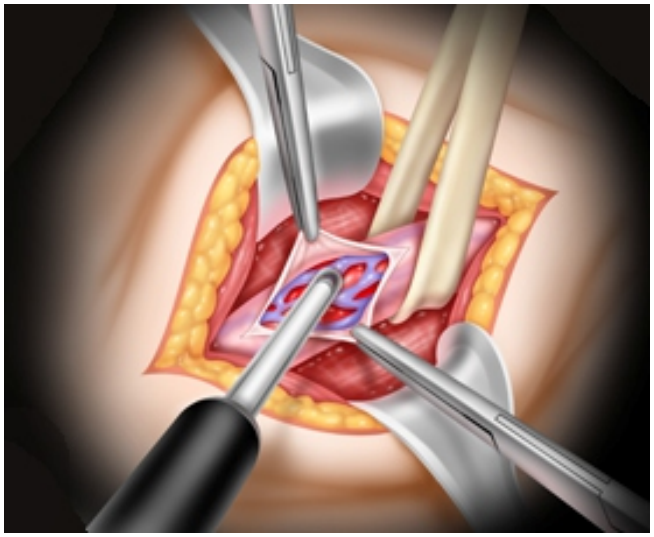

**Figure 1 A.** Microvascular doppler in subinguinal approach

**Figure 1 B.** Use of microdoppler during the procedure

**Methods of analysis**

All articles were searched electronically using Cochrane, EMBASE, PubMed, LILACS, SCOPUS and Google scholar databases. Keywords related to microscopic intermediate subinguinal varicocelectomy were searched in the title and abstract fields. Two investigators performed initial screening and eligibility based on titles, abstracts and keywords of citations from the electronic database. Of the articles that met the inclusion criteria, two investigators reviewed critical articles from systemic reviews, meta-analysis, prospective and retrospective cohorts by assessing full texts. All data pertaining to the advantages and disadvantages of MISV on infertility over conventional methods were extracted and categorized by the other two investigators. Finally, a narrative synthesis was performed by all four investigators. A systemic review was not performed due to the heterogeneity of the studies.

**Studies regarding MISV**

There are many studies stating the advantage of MISV over conventional methods. Maguid et al conducted a study on MISV for men with infertility on 162 patients [22]. Improved motility of sperm, increased sperm count and increased pregnancy rates with reduced complications were noted in their study. Phan et al conducted a study on the same topic in 86 patients [23]. They also found similar findings as to the previous study. In another study on MISV outcomes in 100 patients, Kumar et al [24] concluded that MISV is a safe surgical option for varicocele related infertility with improved pregnancy rates and seminal parameters. Jungwirth et al [n=272 CI-95%] conducted a study on clinical outcomes of MISV in infertile men [25]. Increased pregnancy rates and improved parameters of sperm were noted in their patients.

In a study by Kandari et al [26]on MISV in 100 patients, increased pregnancy rate and reduced hydrocele formation were noted in patients who had undergone MISV in their study. A meta-analysis was performed by Majzoub et al impact of MISV on male infertility in 452 oligospermic patients [27]. Increased sperm counts and motility with increased pregnancy rates were found following MISV in their study. Guptha et al carried out a study on outcomes following MISV in patients with oligospermia in 56 patients [28]. Improved pregnancy rates were observed in patients with severe oligoasthenospermia. A retrospective study was performed by Kadigolu et al on the impact of MISV in 92 patients with infertility [29]. Increased sperm count with improved quality of sperm was noted in their study.

**Table 1.** Summary of studies on microscopic intermediate subinguinal varicocelectomy

| Author and Study type | Outcomes |
|---|---|
| Jungwirth et al [25] [1990-1998] Retrospective study [n=272] | Increased quality of sperm and pregnancy rates with low post-operative complications after MISV. |
| Maguid et al [2010] [22] Prospective study [n=162] | Increased motility of sperm and pregnancy rates with reduced post-operative hydrocele and recurrence following MISV over conventional surgical methods for varicocele. |
| Phan et al [23] [2021] Prospective study [n=86] | Increased pregnancy rates and reduced post-operative complications following MISV. |
| Kumar R et al [24] [2003] Prospective study [n=100] | Increased sperm count and quality with increased pregnancy rates. MISV is a safe surgery for varicocele. |
| Kandari et al [26] [2010-2015] Prospective study [n=100] | Reduced recurrence of varicocele and hydrocele and increased pregnancy rate following MISV. |
| Majzoub et al [27] [2021] Meta-analysis [n=452] | Increased sperm count, motility of sperm and pregnancy rate after MISV. |
| Gupta et al [28] [2018] Retrospective study [n=56] | Increased pregnancy outcomes in patients with severe oligospermia following MISV |
| Kadioglu et al [29] [2014] Retrospective study [n=92] | Increased sperm count with improved quality following MISV in patients with varicocele. |
| Guo et al [30] [2015] Prospective study [n=87] | Improved parameters of sperm with increased conception rate following MISV |
| Jun Wang et al [31] [1996-2013] Meta-analysis [n=2042] | Increased pregnancy rates with reduced complications following MISV |
| Chia-FengLee [32] [2010] Prospective study [n=224] | Incread quality of sperm and reduced scrotal discomfort following MISV and Its safe and minimally invasive surgery for varicocele. |

Confidence interval 95 %; MISV- microscopic intermediate subinguinal varicocelectomy

Guo et al conducted a randomized controlled trial on outcomes of MISV with the use of a doppler scan in 86 patients [30]. Increased conception rates with increased sperm counts were noted in their study. There was a meta-analysis by Jun wang et al on outcomes of subinguinal varicocelectomy in 2042 patients [31]. Increased pregnancy rates with improved seminal parameters and reduced post-operative complications were noted in the study. Another prospective study was carried out by Chia-Feng lee et al on MISV outcomes in 224 patients [32]. Increased quality of sperm with reduced scrotal discomfort following MISV was noted in their study.

## Conclusion

Varicocele remains one of the correctable causes of male infertility. Varicocelectomy is indicated in an infertile male with a clinically palpable varicocelewith two abnormal seminal parameters and when the female partner has normal fertility or a treatable cause of infertility. Physical examination and vascular doppler help in the diagnosis [10]. MISV increases spontaneous postoperative pregnancy rates and the success of artificial conception methods and improves seminal parameters [3,33–35]. It has reduced the percentage of recurrence, hydrocele formation and postoperative pain compared to other conventional surgical procedures [36–38]. MISV has to be considered as the gold standard for varicocele repair over conventional surgical methods, as evidenced by many studies

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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