

Impact of intra-operative doppler ultrasound assistance during microsurgical varicocelectomy on operative outcome and sperm parameters

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Abstract

Background: Varicoceles are important cause for primary infertility. This study was mainly undertaken to study the importance of vascular Doppler assistance in microscopic Varicocelectomy in comparison with microscopic Varicocelectomy alone. **Material and Methods:** A randomized controlled study was conducted in a tertiary care centre among 60 patients who were divided equally in to two groups. First group undergone microscopic Varicocelectomy alone and second group had undergone intra operative vascular Doppler assisted microscopic Varicocelectomy. The baseline characteristics, operative time, number of veins ligated, number of arteries and lymphatics spared, Duration of hospital stay and return to work, pregnancy rates and sperm parameters were recorded during the time of follow up. **Results:** There was a significant difference in duration of the operation bilaterally. More number of arteries and lymphatics were spared in IVDU – MV group. There was no significant change in the sperm morphology during follow up between the two groups. The sperm motility improved significantly in IVDU – MV group during post operative follow up. The a + b grade of the sperm also increased significantly in IVDU – MV group than MV group. The rate of pregnancy was little higher in Doppler assisted group than the MV group which was not statistically significant. **Conclusion:** The use of Intra operative vascular Doppler helps in preservation of more number of testicular arteries and removal of more number of veins to help the improvement in spermatogenesis.

Keywords: Primary infertility, Varicocelectomy, Doppler Ultrasound, Sperm morphology, Sperm motility

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Introduction

Varicoceles is an important risk factor for the male infertility accounting to 35 – 50% in men with primary and up to 81% in secondary infertility [1,2]. The varicocelectomy is the surgery for the varicoceles which has shown to improve the semen parameters, increase the spontaneous pregnancy rates, and effectively resolve the testicular pain [3,4]. Complete disruption of the retrograde backflow from abdomen to pampiniform plexus is the main goal of varicocelectomy which has shown to preserve the internal spermatic arteries, vas deference, spermatic cord and the lymphatics [5]. But there is controversy over the procedure since the varicocele may not affect spermatogenesis but increased intrascrotal temperature may result in harmful effect. Also the studies are scant to prove the beneficial role of the surgery [6]. Many studies including a meta-analysis had shown that the Microscopic Varicocelectomy (MV) is most effective and least morbid method. It has shown to improve the spontaneous pregnancy rates and reduces complications [7,8]. The literature available shows that MV can be performed by using two approaches i.e. sub-inguinal and inguinal approaches. The sub-inguinal approach has been shown to spare more structures including internal spermatic arteries and veins in comparison with the inguinal approach. The inguinal approach had shown to increase the difficulty in surgery and also have the risk of arterial injury [9]. The spermatic artery can be easily appreciated by its pulsatile movement or evidence of antegrade flow during sub inguinal approach, but anatomic variations and fluctuations in the blood pressure may make difficult differentiate spermatic artery from

veins. Manipulation of arteries in an aggressive form may result in spasm even though papaverine drops are used to augment the pulsation of the artery. The arteries tend to be buried in the venous plexus makes difficulty in dissection of them warrants a method to differentiate the artery and veins. Till date only few randomized controlled trials have used Intra-operative Doppler ultrasound assisted MV. The identification of arteries and veins by using Doppler ultrasound can help in preservation of arteries to improve the blood supply to the testis. The long term outcomes and complications of Doppler assisted MV have elucidated by few studies. This made us to take up the study to assess the use of Intra operative Doppler in Microscopic Varicocelectomy.

Material And Methods

Selection of patients

During the study period of 4 years, 74 patients reported to the Department of Urology with varicocele and infertility. After excluding 14 patients, half of the patients (30 patients) were treated with sub inguinal microscopic Varicocelectomy without assistance of intra operative Doppler ultrasound and half (30 patients) were treated with Intra-operative Doppler assisted microscopic Varicocelectomy. Ethics committee approval and informed consent was obtained before enrolling the patients in to the study. Patients aged between 20 – 45 years, with primary infertility for more than 1 year with clinically palpable varicocele, impaired semen parameters as per fifth edited WHO criteria, normal level of serum follicle stimulating hormone (FSH), leutinizing hormone, thyroid hormones and prolactin and patient's spouse healthy and has normal reproductive functions were included. The patients with subclinical, recurrent varicocele, normal varicocele, female partner older than 35 years, abnormal serum hormones and female factor infertility were excluded from the study.

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The patients were randomly assigned to two groups by random allocation sequence by computer generated random numbers. Only surgeon and assistants knew the surgery and investigator was blinded. The varicocele was classified in to three categories before subjecting the patients for surgery as proposed by Duin and Amelar[10].

Surgical procedure

The surgery was performed by the two surgeons in order to avoid subjective bias for each group. Both the surgeons were well experienced with requisite qualifications and fellowships. They operated in same hospital and used same techniques. Standard sub inguinal microsurgery approach was used in simple MV group. This approach involved a 2 cm horizontal incision one cm below the external inguinal ring was made. After opening the overlying fascia, spermatic cord was exposed which was subsequently grasped with the pusher and surrounded with Penrose drain. A standard operating microscope with 8 – 15 magnification was used for the operative field. The structures including vas deference, vassal veins and arteries were identified and preserved. Papaverine solution (1%) was used to elicit visual arterial pulsation. All identifiable external spermatic veins were ligated and divided, The spermatic fascia was opened and the counted arteries were dissected free from the veins

and lymphatics. The internal spermatic veins were counted and separated, ligated with 4-0 silk ties and divided. In Doppler ultrasound assisted group same procedure was followed by scanning all the spermatic vessels and arteries were carefully separated before ligation. During the surgery, the number of internal spermatic veins, spermatic arteries and lymphatics were carefully counted and recorded. The duration of operation was also recorded. The patients were assessed for scrotal pain, post operative hematoma and hydrocele, duration of hospital stay and time to return to normal activity were recorded. The patients were followed up at 1, 3, 6 and 12 months after surgery for sperm parameters including sperm count, sperm motility sperm morphology and the percentage of grade a + b sperm. The data obtained was compiled and analyzed. The data was expressed as mean with standard deviation. Independent sample T test was used to find out the difference between two groups if the data was normally distributed and Mann Whitney U test was used as non parametric test. Two way repeated measures Analysis of Variance (Holm – Sidak test) was used to evaluate changes in sperm parameters during different point of follow up with baseline. A p value of less than 0.05 was considered as statistically significant.

Results

Table 1: Comparison of baseline characteristics of the two groups

	Variables	MV(n=30)	IVDU – MV(n=30)	P value
Age	Patients	33.93 ± 5.43	34.27 ± 3.8	0.784, NS
	Partner	30.17 ± 3.96	31.1 ± 2.82	0.297, NS
Varicoceles	Unilateral	13 (43.3%)	12 (40.0%)	0.793, NS
	Bilateral	17 (56.7%)	18 (60.0%)	
Grade	II	25/47	22/48	0.606, NS
	III	22/47	26/48	

Comparison of baseline characteristics

The mean age of two groups was comparable between the MV and IVDU – MV groups since the difference was not statistically significant. The mean age of the partners in MV group was 30.17

years and IVDU – MV group was 31.1 years. More than half of the cases in both the groups had bilateral varicocele. About 25 patients in MV group grade II and 26 patients in IVDU – MV group had grade III varicocele.

Table 2. Comparison of intra operative characteristics between the two groups

	Variables	MV(n=30)	IVDU – MV(n=30)	P value
Duration of operation (mins)	Bilateral	83.07 ± 11.32	66.08 ± 12.5	0.002, Sig
	Unilateral	52.76 ± 10.0	48.72 ± 9.43	0.228, NS
Number of veins ligated		6.87 ± 1.8	7.33 ± 1.69	0.307, NS
Number of arteries preserved		1.53 ± 0.63	2.1 ± 0.68	0.001, Sig
Number of lymphatics spared		2.5 ± 0.97	2.6 ± 0.85	0.674, NS
Hospital stay (d)		4.47 ± 0.86	4.47 ± 0.81	1.0, NS
Days required for returning to normal activity		8.5 ± 1.38	8.4 ± 1.77	0.808, NS
Post operative hydrocele		1	0	0.313, NS
Recurrent varicocele		1	1	1.0, NS
Testicular atrophy		0	0	1.0, NS
Pregnancy		14 (46.7)	16 (53.3)	0.606, NS

Comparison of intra operative characteristics

There was a significant difference in duration of the operation bilaterally but there was no significant difference in duration of operation in unilateral varicoceles. About 6.87 veins were ligated in microscopic Varicolectomy group and 7.33 veins were ligated in IVDU – MV group, more number of arteries and lymphatics were spared in IVDU – MV group. The hospital stay was almost equal

between the two groups. The days required to return to the normal activity was 8.5 days in MV and 8.4 days in IVDU – MV groups. Post operative hydrocele and recurrent varicocele was found in one case MV group and post operative hydrocele was the complication in one case in OVDU – MV group. The rate of pregnancy after surgery in MV group was 46.7% and IVDU – MV group was 53.3% which was not statistically significant.

Table 3: Comparison of sperm parameters between the two groups

Sperm count	MV× 10 ⁶ /mL	IVDU – MV× 10 ⁶ /mL	P value
Preoperative	17.53 ± 2.59	17.8 ± 2.64	0.695, NS
Postoperative – 3 months	22.43 ± 3.27	24.17 ± 3.15	0.041, Sig
Postoperative – 6 months	23.67 ± 3.21	26.6 ± 2.67	0.000, Sig
Postoperative – 12 months	24.73 ± 2.97	27.53 ± 2.55	0.000, Sig

Sperm morphology			
Preoperative	28.03 ± 2.41	28.77 ± 2.51	0.254, NS
Postoperative – 3 months	29.77 ± 2.3	30.0 ± 2.53	0.710, NS
Postoperative – 6 months	30.57 ± 2.04	30.83 ± 2.27	0.635, NS
Postoperative – 12 months	31.3 ± 2.2	31.53 ± 2.12	0.678, NS
Sperm Motility			
Preoperative	26.63 ± 1.95	26.5 ± 1.52	0.77, NS
Postoperative – 3 months	33.5 ± 2.84	36.33 ± 2.59	0.000, Sig
Postoperative – 6 months	33.9 ± 2.71	36.97 ± 2.35	0.000, Sig
Postoperative – 12 months	34.4 ± 2.6	37.67 ± 2.31	0.000, Sig
Grade a + b			
Preoperative	21.87 ± 2.44	22.23 ± 2.26	0.550, NS
Postoperative – 3 months	49.1 ± 4.96	54.3 ± 2.33	0.000, Sig
Postoperative – 6 months	51.13 ± 4.31	55.67 ± 2.48	0.000, Sig
Postoperative – 12 months	51.1 ± 3.85	56.4 ± 2.34	0.000, Sig

Comparison of sperm parameters

In this study semen parameters were measured during preoperative period, 3 months, 6 months and 12 months post operatively. The differences were evident and significant in sperm count at 3 months, 6 months and 12 months after surgery. But there was no significant change in the sperm morphology during follow up. The sperm motility improved significantly in IVDU – MV group during post operative follow up. The a + b grade of the sperm also increased significantly in IVDU – MV group than MV group. The rate of pregnancy was little higher in Doppler assisted group than the MV group which was not statistically significant.

Discussion

The varicoceles are often regarded as the important cause for the male related infertility. Varicocelectomy aims at interruption of the refluxing venous drainage to the testis by maintaining the arterial inflow and lymphatic drainage. An ideal procedure should have optimal results, less number of recurrence and complication rates. This study had shown that the age was comparable between the Microscopic Varicocelectomy (MV) and Intra operative Vascular Doppler assisted Microscopic Varicocelectomy (IVDU – MV) group. The number of spermatic arteries spared had a significant difference between the two groups but number of veins ligated and number of lymphatics spared had no difference. The duration of the hospital stay and return to normal activity was also not significantly different. The rate of complications was also comparable between MV and IVDU – MV groups. The rate of pregnancy was slightly higher in IVDU – MV group. The Sperm parameters had significant difference in sperm count, sperm motility and grade a+b.

Very few studies have compared the results between the microscopic Varicocelectomy and intra-operative vascular Doppler assisted Microscopic Varicocelectomy. A study by Guo et al reported that the microscopic procedure of sub inguinal Varicocelectomy requires more operative time and practical skills. The operative time is expected to be less with the use of intra operative vascular Doppler. This study had also note significant improvement in the sperm parameters including Sperm concentration, motility and a+ b grade sperm after surgery in both the groups[12]. A study of Varicocelectomy by loupe assisted Sub – Inguinal approach had shown that three sperm related parameters became normal within three months after surgery. The loupe assisted group had demonstrated increase in sperm concentration among the motile spermatozoa as well as reduction in the spermatozoa with abnormal morphology which was not statistically significant[13]. The microscopic Varicocelectomy is considered as gold standard to varicocele repair or by radiological embolization[14]. A number outcomes including increased pregnancy rate or improvement in one, two or all the three seminal parameters have used in evaluation of the success rate of the procedure[15]. A number of studies have demonstrated the importance of varicocele repair with respect to pregnancy rates[16,17]. The preservation of the testicular arteries is

still more controversial. The literature available suggests the preservation of the testicular arteries for inguinal and sub inguinal approaches[18,19]. As recommended by American Urological association, the Varicocelectomy must be performed with the optical magnification to preserve the testicular arteries since the arterial supply traverse through the spermatic cord[8]. The hypoxia due to surgery had been shown to impair the spermatogenesis. The preservation of testicle is most important in children or adolescents [20]. In this context intra operative vascular Doppler plays an important role in preservation of the testicular arteries than the traditional use of papaverine drops. This study results are also consistent with a study where Doppler ultrasound MV was performed[21]. Precise identification of smaller veins by Doppler ultrasound can help in preservation of arteries and lymphatics. Ligation of larger number of veins can help in prevention of the reflux from abdomen and diminishes the insult to the spermatogenesis.

Conclusion

This study finding demonstrates that the microscopic Varicocelectomy and Intraoperative vascular Doppler ultrasound assisted microscopic Varicocelectomy are efficacious in improving sperm related parameters. The Doppler assistance helps in ligations of more veins and preservation of the testicular arteries and lymphatics to improve the sperm parameters.

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