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INGUINAL EXTRACRURAL VARICOCELECTOMY UNDER LOCAL ANAESTHESIA: THREE STEPS PROCEDURE

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To prospectively compare and objectively assess the surgical outcome of the three-steps procedure (inguinal extracrural ligation of varicocele, evertion of the tunica and plication of the cremasteric muscle) and the suprainguinal varicocelectomy in subfertile men, forty six patients having primary varicocele were randomly classified into two groups. Group I (26 patients) underwent the three-steps procedure and Group II (20 patients) underwent the standard suprainguinal varicocelectomy. The semen quality improved in 73% of patients of group I and in 70% of group II. The conception rate was 38% in group I and 35% of group II. The surgical morbidity encountered was negligible in group I while in group II, seroma reported in 10%, hematoma in 5%, hydrocele in 25%, recurrence of varicocele in 30% and testicular artery ligation in 10%, but no testicular atrophy was recorded in either group. These results showed superiority of the three-steps procedure over the suprainguinal varicocelectomy with respect to hospital stay, analgesic requirements, return to work, cost and minimal morbidity. Further tangible benefit to the three steps procedure procedure rests on its simplicity and low risk.

Key words : Inguinal, Extracrural, Varicocele.

INTRODUCTION

Varicocele is potentially detrimental to the male reproductive state and is a common cause of male infertility[1]. Varicoceles have been noted in approximately 39% of infertile men and in 8% to 20% of the general population [2]. The mechanism by which varicocele impairs spermatogenesis remains elusive. The postulation that varicocele adversely affects spermatogenesis by elevation of the testicular temperature, reflux of adrenal corticosteroids and catecholamines or poor drainge of testicular metabolites remains an attractive but still unproven premise [3,4]. Surgical management has been the primary form of treatment of varicocele with several techniques used to ablate the dilated pampiniform plexus. These techinques include the traditional open surgical approach, namely, the scrotal, high suprainguinal, inguinal, and minimally invasive procedures, such as transvenous percutaneous embolization and laparoscopic varicocele ligation [5,6,7]. Adverse effects have been documented following the inguinal and suprainguinal approaches, such as hydrocele, recurrence or persistance of varicocele and testicular artery injury. We tried to minimize these morbidity by using the inguinal extracrural approach with evertion of the tunica and plication of the cremasteric muscle and compared the objective and subjective outcome of this approach with the suprainguinal one. This three steps approach is simple, low risk, cost-effective and controls all routes of possible venous collaterals.

MATERIALS AND METHODS

A random selection of 46 patients with bilateral varicocele were studied. They were 20-35 years of age(mean age, 26 years) 44 patients had primary infertility and two patients had off springs either earlier in their marriage or during a prior marriage. The duration of infertitity ranged from 1-8 years (mean, 3 years). Patients were divided into three clinical grades according to the size of varicocele: grade I, varicocele detecable during Valsalva's maneuver (6 patients); grade II, palpable varicocele (17 patients) (Fig 1); grade III, visible varicocele (23 patients) (Fig 2). Patients of grade I varicocele seemed to be retricted to the left side, however, doppler examination proved to be

bilateral. Patients with grade II and III had bilateral varicocele (40 patients). At least two semen analyses were performed on each patient, prior to surgery. Postoperative semen studies were requested at 3 - month intervals for one year. A sperm count of 20 million / ml, motility of 40%, grade 3 and normal forms of 60% were considered the minimal normal standards for acceptable semen. Varicocelectomy was not performed on any individual who had semen quality comparable to or better than this standard. Endocrine studies, including serum testosterone, luteinizing hormone, follicle stimulating hormone and serum prolactin assays were carried out in the majority of patients. Scrotal ultrasound was done for measurement of testicular size and detection of hydrocele. Color doppler ultrasound was carried out to evaluate the grade of venous reflux. The doppler examination was done with the patient standing and breathing quietly at room temperature. The doppler probe was applied to the skin of the scrotum above the testes. Further exploration with the doppler probe was made on both sides over the inguinal canal, the upper quadrant of the scrotum and the lower pole of the testis. Each patient was examined before surgery and then one month and 3 months postoperatively. Varicocele appears before surgery as multiple dilated tortuous veins in the supratesticular and peritesticular regions. The maximum vein diameter was 4.7 mm. These veins showed flow at rest that is augmented by Valsalva maneuver with flow reversal. The change of flow velocity after Valsalva maneuver reached 14.3 cm/sec. According to the scoring system of Chiou etal [8], most of the patients had a score of 9 and following varicocelectomy they got a score of 4 (Fig 3). The patients were randomly classified into two groups. Group I, 26 patients underwent varicocelectomy through inguinal extracrural approach with plication of the cremasteric muscle and evertion of the tunica vaginalis under local anaesthesia. Group II, 20 patients underwent high ligation of internal spermatic venous system, superior to internal inguinal ring in the extraperitoneal space.

Operative technique of inguinal extracrural approach.

The operation is started by local infiltration along the skin incision of a 50:50 mixture of 1% lidocaine and 0.5% bupivacaine. The therapeutic maximum dose of lidocaine is 300 mg and the dose is 175 mg for bupivacaine. The use of two different anaesthetic agents decreases the likelihood of exceeding the therapeutic maximum dose of each individual agent. This is particularly useful in the case of bilateral varicocelectomy. An average of 45 ml of this mixture usually is sufficient for each side.

The head of the operating table is raised by 5-10^{o} in order to fill the veins and demonstrate the anatomical abnormality. Two centimeters skin crease incision is made in the groin, 2-finger breadth above the pubic tubercle (Fig 4). The spermatic cord is picked up at its emergence of the external ring (Fig 5) and the inguinal canal is left intact. The fascial covering of the cord is opened and the pampiniform plexus of veins as well as the cremasteric plexuses are identified and separated from the vasal plexus that covers the vas deferens (Fig 6). In early cases, only the pampiniform veins are ligated and divided (Fig 7), carefully preserving the accompanying artery (Fig 8). In more advanced cases with secondary dilatation and varicosity of the cremasteric venous system, these veins are also ligated and divided, again taking care to preserve the artery. The upper pole of the testis is delivered into the groin incision by gentle traction on the spermatic cord assisted by scrotal upward pushing until the insertion of the cremasteric muscle into the tunica vaginalis is visualised (Fig 9). The tunica is divided, hydrocele fluid is evacuated (Fig 10), then the tunica is everted behind the testis without severing its connection to the scrotum (Fig 11). The cremasteric muscle is plicated by multiple series of stitches (Fig 12). The testis is replaced into the scrotum and the wound is closed in a single continuous layer.

RESULTS

(Table 1), discloses the semen quality in both groups before and after varicocelectomy. The semen volume remain unchanged. The sperm count and motility rose substantially and showed a significant difference, 3 months postoperatively, compared to the preoperative levels ($p<0.05$). The semen quality improved in a meaningful manner in 19 (73%) of group I and 14 (70%) of group II. Of the 26 subjects in group I, 10 had an average count of less than 10 million/ml. Of this more infertile group, 6 (60%) had significant improvement in semen quality, while 13 (81%) of the 16 with an average count of more than 10 million/ml fared in the same favorable manner. In group II, 5 patients of the 8 with count less than 10 million/ml showed significant improvement in semen quality and 9 of 12 patients with count more than 10 million/ml developed the same improvement following varicocelectomy (Table 2). Ten patients (38%) of group I and 7 (35%) of group II succeeded to impregnate their wives. The sperm count of these patients rose in a comparably impressive fashion, while the motility and morphology attained even better levels. The greater improvement in motility seen in the successful group was thought to be a major factor in the favorable outcome. In group I, inguinal extracrural ligation of varicocele together with plication of crematericmuscle and evertion of tunica was done in 26 patients (24 bilateral and 2 unilateral). The mean operative time was 15 minutes in unilateral cases and 25 minutes in bilateral cases. During evertion of the tunica, 6 patients showed mild hydrocele & 7 patients showed moderate hydrocele. Dilated engorged veins extending from the cremasteric plexus & spreading over the tunica was observed in most of the cases (Fig 13). Two patients showed calcifications in the hydrocele fluid (Fig 14). In most of the patients the cremasteric muscle fibers used to form a complete sheath around the cord at the external ring but

they spread apart beyond it to from two parallel bundles leaving an anterior gap (Fig 15). Immediate postoperative mobilization was the rule. The mean hospital stay was 1-2 hours and resumption of daily activity was within 2 days. None of the patients reported severe postoperative pain but minimal discomfort that required a single shot of analgesia. None of the patients developed hydrocele, recurrence of varicocele or reduction in the testicular size. Postoperative doppler did not reveal inadvertent testicular artery ligation in any of the patients. One patient showed high positioning of the testicles in the scrotum 3 months postoperatively (Fig 16) that returned to the normal position by the 7th month. Ten patients (38%) of group I succeeded to impregnate their wives. Those patients with a count of less than 10 million/ml achieved a pregnancy rate of 30%, whereas those with count more than 10 million/ml achieved a 43% conception rate. In group II, the suprainguinal varicocelectomy under general or spinal anaesthesia was done bilaterally for 20 patients. The mean operative time was 50 minutes. The postoperative ambulation was 4 hours in case general anaesthesia was used and 12 hours in case spinal anaesthesia was used. The mean hospital stay was 18 hours and resumption of daily activity was within one week. The postoperative morbidity in group II compared to group I is outlined in table 3. Wound discomfort was experienced in 50% of the patients that required several shots of analgesia. Two patients developed subcutaneous seroma and one patient showed subcutaneous hematoma but no infection was recorded. Five patients developed hydrocele (Fig 17), of these one get improved but the rest resisted the conservative measures over 18 months. Recurrence of varicocele was proved in 6 patients. Two patients showed testicular artery ligation but did not develop a significant reduction of testicular size. Six patients (30%) of group II got their wives pregnant. Two of them (25%) have had sperm count less than 10 million/ml and 4 (33%) used to have sperm count more than 10 million/ml (Table 4).

Statistical analysis

Postoperative parameters were analyzed by using Wilcoxon's rank sum test.

Table (1): ***Semen quality before and after varicocelectomy in both groups.***

	Group I		*Group II*	
	Before	After	Before	After
Volume	3.1	3.3	3.2	3.4
Sperm count 10^6/ ml	9.1	44.2	11.6	37.2
motility index*	90.2%	107.6%	48.3%	104%
Abnormal forms	35%	27%	30%	31.6

*The motility index is obtained by multiplying the percentage of active sperms by the quality of forward progression.

Table (2)*: .Semen quality following varicocelectomy in men with counts Less than and more than 10 million / ml.*

	Group I		*Group II*	
	$<10^6$/ml	$>10^6$/ml	$<10^6$/ml	$>10^6$/ml
No.of patients	10	16	8	12
No. improved	6 (60%)	13 (81%)	5(62%)	9 (75%)

Table (3). ***Postoperative morbidity in patients following varicocelectomy***

	Morbidity	*Group I*	*Group II*
		(n=26)	(n=20).
Seroma		--	2
Hematoma		--	1
Infection		--	--
Hydrocele		--	5
Recurrence		--	6
Testicular artery ligation		--	2
Testicular atrophy		--	--

Table (4). ***Pregnancy rate following varicocelectomy in both groups***

	Group I (n=26)		Group II (n=20)	
	$<10^6$ / ml	$>10^6$ / ml	$<10^6$ / ml	$>10^6$ / ml
No. of patients	10	16	8	12
No. of pregnancies	3	7	2	4

Fig (1): Grade II, palpable varicocele

Fig (2). Grade III, visible varicocele

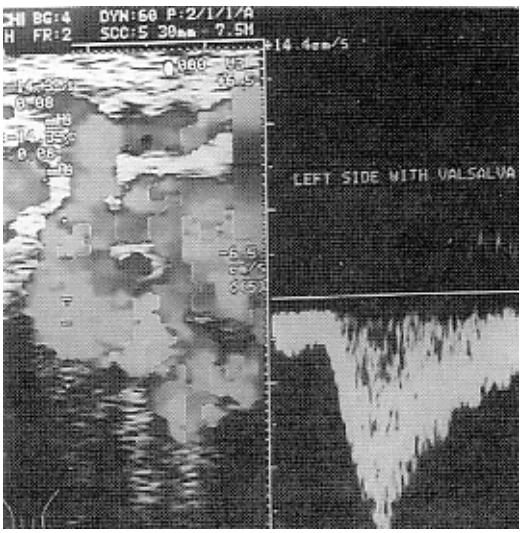

Fig (3a): Doppler examination of varicocele, score of 9 before surgery.

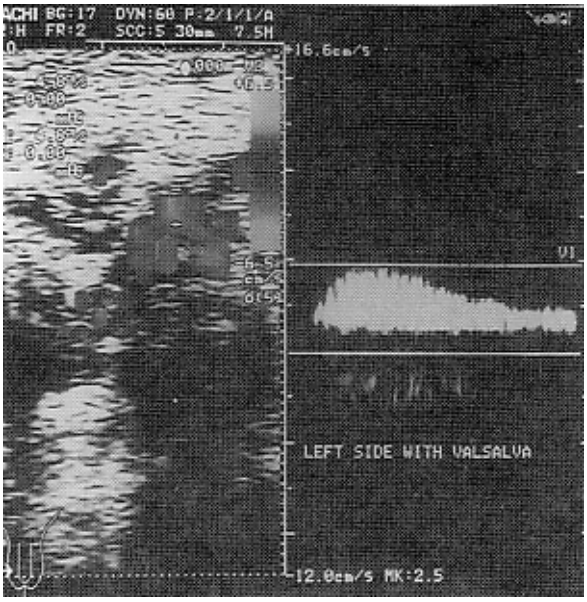

Fig (3b): Doppler examination with score of 4 after varicocelectomy

Fig (4): Two centimeter skin incision, 2 finger breadth above the pubic tubercle.

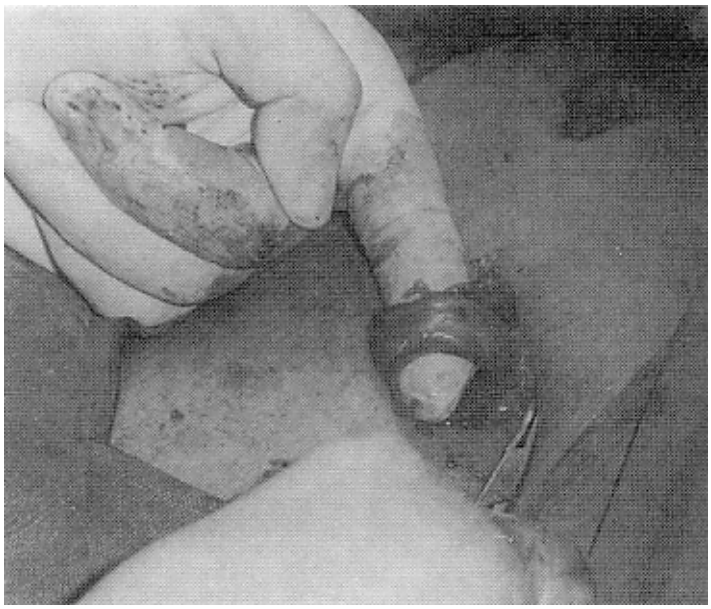

Fig (5): The spermatic cord picked up at the external ring

Fig (6a). Splitting of the fascial coverings of the cord and identification of the pampiniform plexus.

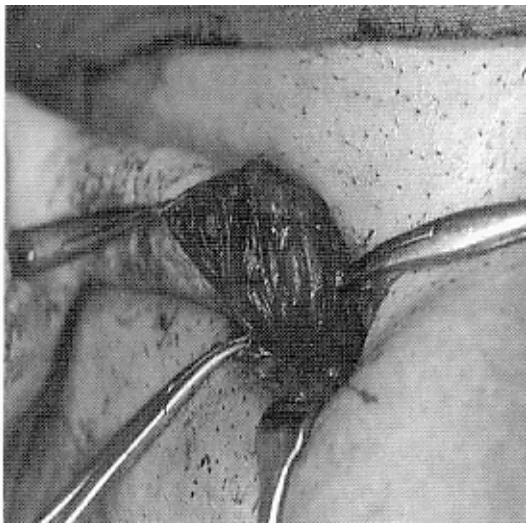

Fig (6b): Identification of the cremasteric plexus.

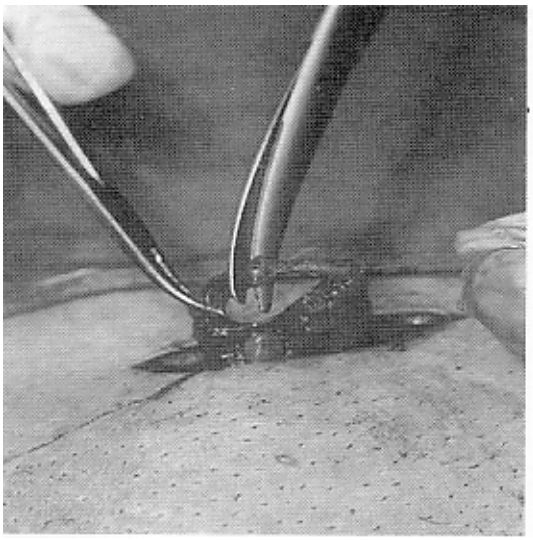

Fig (7a): Division of the pampiniform plexus between two ligatures.

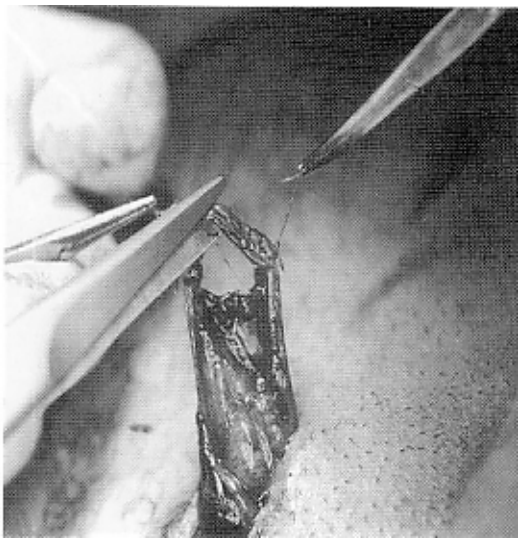

Fig (7b): Division of the cremasteric plexus

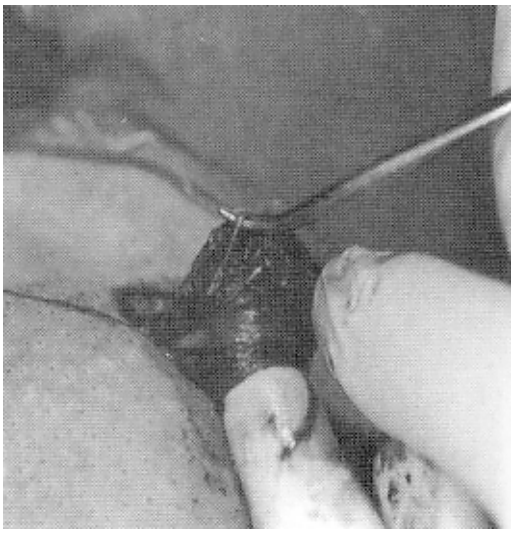

Fig (8): Isolation and preservation of the testicular artery.

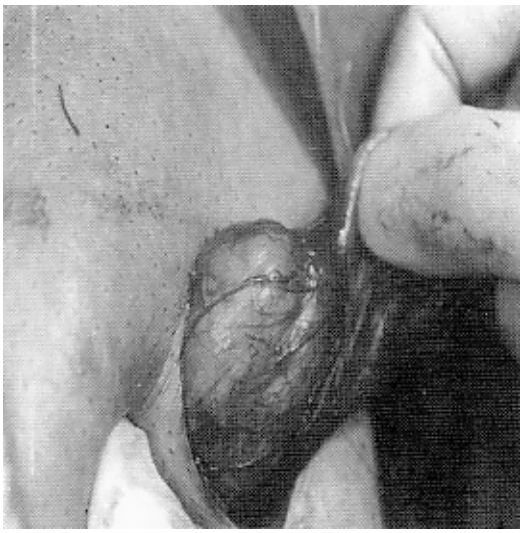

Fig (9): Delivery of the upper pole of the testis till the insertion of cremasteric muscle into the tunica is visualized.

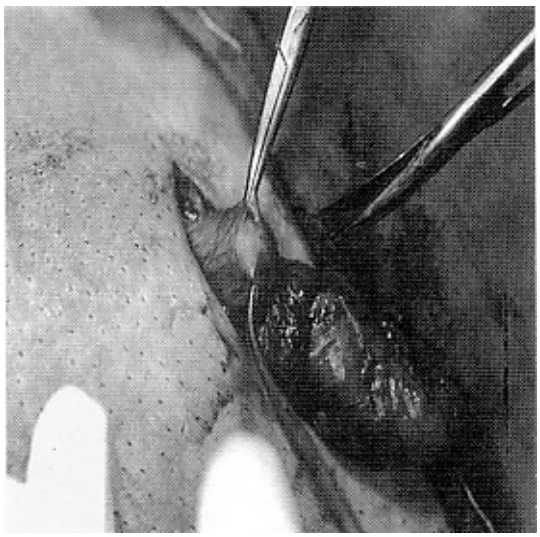

Fig (10a):. Opening of the tunica vaginalis.

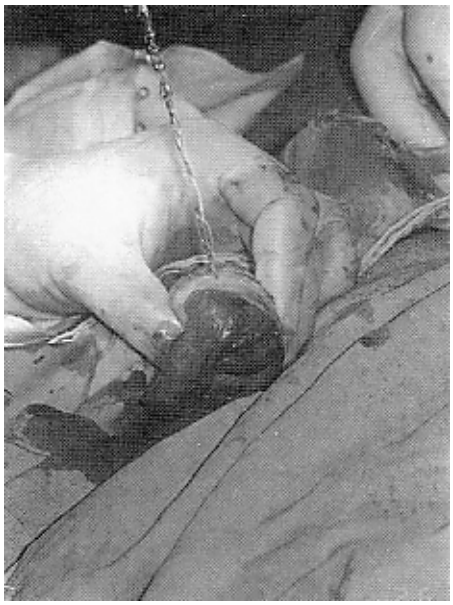

Fig (10b): Evacuation of hydrocele fluid

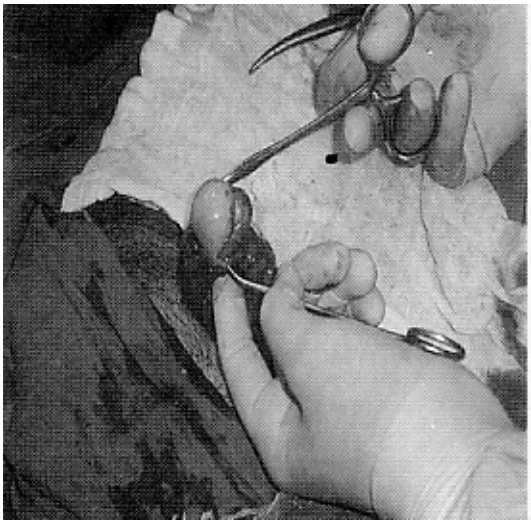

Fig (11a). Delivery of the testis out of tunica

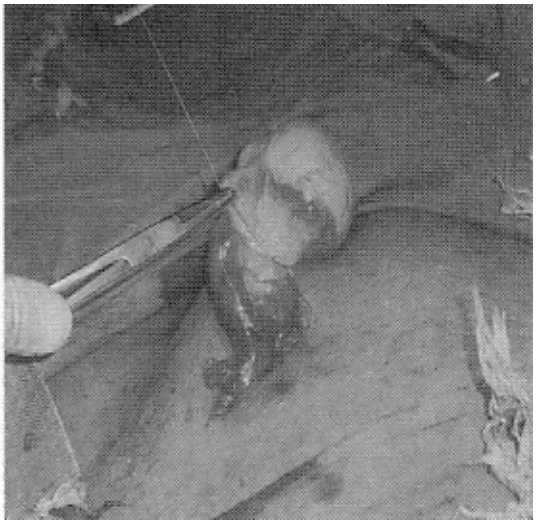

Fig (11b): Evertion of the tunica behind the the testis

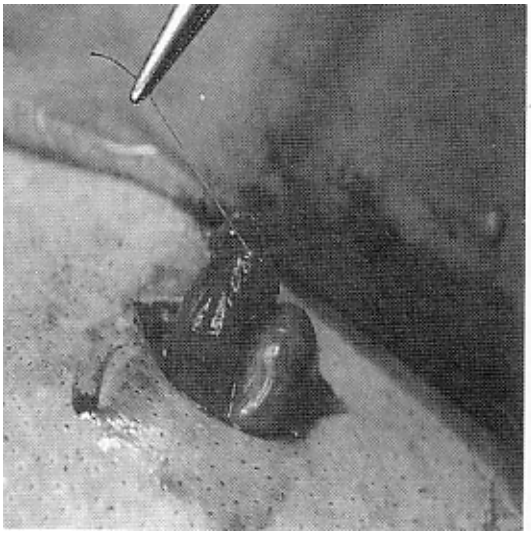

Fig (l2a): Plication of the cremasteric muscle around the cord.

Fig (l2b): Complete series of plicating sutures.

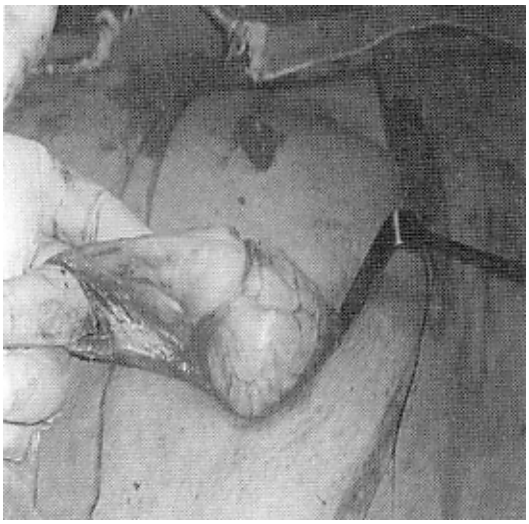

Fig (13): The cremasteric plexus spreading over the tunica.

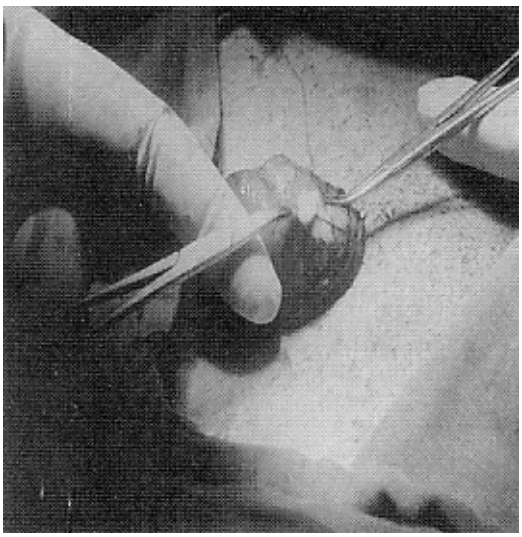

Fig (14): Calcification of hydrocele fluid.

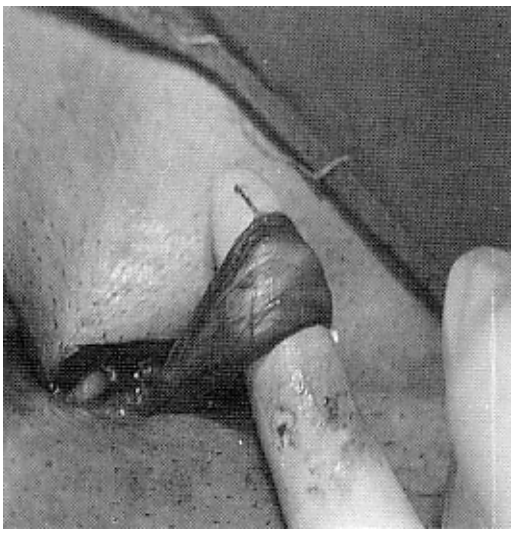

Fig (15): The cremasteric muscle spreading apart into two bundles leaving anterior gap.

Fig (16): Upward positioning of the testicles leaving redundant scrotal skin.

Fig (17): Bilateral postoperative hydrocele in patients of group II

DISCUSSION

Ample evidence exists that a varicocele is not merely an associated finding in infertile men but may be the cause of the infertility as well. Not only do varicoceles occur more commonly in the male partner of infertile couples but they are also associated with reduced sperm concentrations [9,10] Two thirds of infertile men with a varicocele will have an abnormality in sperm morphology; primarily tapered forms are found, but immature spermatids may also be present. Marked depression in sperm motility is also a common finding. Despite its strong association with infertility, the mechanism by which a varicocele causes infertility is still unknown. An abnormally high scrotal temperature secondary to increased venous blood flow [11,12], and retrograde venous flow into the scrotal circulation of adrenal substances toxic to spermatogenesis have been proposed, although evidence for an excess concentration of such substances is generally lacking [10]. The varicocele in itself is not likely to be directly responsible for the impairment but may be only one manifestation of a more basic pathologic process which can produce oligospermia and the presence of varicocele enables the examiner to identify the existence of this abnormal state [13]. In the present study peripheral plasma concentration of FSH, LH, and testosterone were normal in patients with varicocele which is consistent with other studies[14] and their measurements was not helpful in distinguishing which patient should undergo surgery [15]. The rationale for surgical ligation of a varicocele is that retrograde venous flow into the spermatic vein is prevented. Reverse flow may occur with total absence or incompetence of valves in the spermatic vein[16]. There are various surgical techniques to correct a varicocele. Ligation of the pampiniform plexus via a scrotal incision is associated with high recurrence rate due to the presence of unligated collateral vessels and development of postoperative hydrocele[17]. Most surgeons perform a "high ligation" of the spermatic vein through an incision in the inguinal canal or flank. With either incision, hydrocele is uncommon, as is ligation of the testicular artery [18]. In the present study we used local anaesthesia, in group I, with its known advantages of being safe, simple, effective, and economical, without postanaesthesia side effects. Furthermore, local anaesthesia administered before the incision produces longer postoperative analgesia because local infiltration inhibits build-up of local nociceptive molecules and, therefore, there is better pain control in the postoperative period. Obesity has not been a problem in using local anaesthetic. Even morbidly obese patients do not have as much adipose tissue in the groin area as in the abdominal wall region. Administration of sedative drugs by an anaesthesiologist as "monitored anaesthesia care" for intraoperative infusion of rapid short-acting amensic and an anxiolytic agents reduces the patient's situational anxiety especially at the time of delivery of the testis. Furthermore, it decreases the required amount of local anaesthetic agents [19,20]. In group I, 97% of patients did not need analgesia and regained immediate postoperative ambulation. The mean operative time, hospital stay and resumption of activity were shorter in group I compared to group II. This could be the result of using local anaesthesia with its known analgesic effect, minimal surgical trauma where no muscle splitting or peritoneal stripping. Moreover, the postoperative outcome was favorable for group I patients without morbidity compared to group II patients where seroma developed in 2 patients and hematoma in one patient. This could be related to the muscle splitting incision. Hydrocele developed in 5 patients of group II but in none of group I and is attributable to failure to preserve the lymphatics which course in close proximity to the veins. This incidence of hydrocele coincides with that reported by Szabo and Kessler [21] . Evertion of the tunica, as a part of the procedure in patients of group I allowed the detection of variable degrees of hydrocele in 50% of the patients. The observation that patients who developed hydrocele postoperatively in group II, failed to impregnate their wives, raises the possibility that the fluid accumulated in the tunica may add to the problem of suppression of spermatogenesis either by keeping a higher temperature arround the testis that is transmitted from the veins spreading over the tunica, or stretching the dartos muscle and interfering with its thermoregulatory mechanism or acting as a reservoir for unrecognized oxygen free radicals diffused to the fluid through the static blood in the surrounding veins leading to impairment of the epididymal environment. It is well known that spermatozoa continue maturation during their passage through the epididymis. The medium transit time has been determined to be 12 days, minimum 1 day and maximum 21 days [22]. Since most of the varicosity is localized in the supratesticular region at the dome of the epididymis with the hydrocele fluid surrounding it, it may produce environmental changes of the testis and epididymis. This may appear in all degrees of varicocele and probably affects mainly motility [23]. In group I, we had no failure rate for varicocelectomy, defining failure in terms of recurrent or residually dilated scrotal veins. On the other hand, 6 recurrences occurred in patients of group II, being detected both clinically and by doppler. Although a lower incidence of recurrence following the suprainguinal ligation was reported by Brown [24] and Nilsson et al [25], however, they used the clinical evaluation as the sole method for detection of persistence or recurrence but did not use the doppler that is more precise and accurate[8]. Ralph et al, reported 17.9% recurrence following suprainguinal varicocelectomy and related this to the missed ligation of external spermatic vein draining the cremasteric plexus [26] The observation that none of the

patients in group I had recurrence or persistence of varcocele could be explained by 1-Division of the pampiniform and the cremasteric veins as well as the venous channels commonly found underneath the cord impeded in the surrounding fat.[2] Plication of the cremasteric muscle thus correcting its subluxation and providing support of the remaining cord venous plexuses, preventing their dilatation and improving the pumping mechanism effeciency [27]. We observed that varicocelectomy improved sperm count and motility in 73% of patients in group I and 70% in patients of group II. This is consistent with the results of Dubin [18] but higher than those of Glezerman et al [23]. We reported a conception rate of 38% which is in line with that reached by others [18,24] Although the number of men with improved sperm counts and motility was higher among those who subsequently became fathers, there were no factors that could distinguish these patients from men who had improved counts but did not subsequently impregnate their wives. Difficulties in these correlations may reflect unexplained infertility factors in the wives, the timing and the number of postoperative semen analyses, and the presence of other confounding factors in the male.

In conclusion, the inguinal extracrural varicocelectomry with evertion of the tunica and plication of the cremasteric muscle served to reduce the postoperative pain, recovery time and the cost. Postoperative complications are relatively few, attesting to the benign nature of the operation. No hydrocele, recurrence or testicular artery ligation were reported in this approach due to evertion of the tunica, better visualization and non-missing of the cremasteric plexus. This approach also yields greater improvement in spermatogenesis and conception rate which is the factor most detrimental of the success of varicocelectomy. The patient who has a good anatomical result but no improvement in semen quality after varicocele ligation has either suffered irreversible damage from the varicocele or has another cause for his subfertility.

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