VARICOCELE LIGATION WITH IMPROVED FERTILITY*

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Summary. Seminal changes following fifty-five high ligations of different sizes of varicocele have been compared with those following ligation of the spermatic vein in the absence of a varicocele.

The criteria for selection of cases for operation have been discussed and it has been shown that even very small varicoceles are worthy of ligation.

An initial depression of the sperm count is generally followed by a gradual increase for as long as 15 months after operation.

Depressed sperm motility associated with an adequate sperm count is a strong indication for operation but good results can also be anticipated when there is complete necrostermia.

Approximately 75 % of cases with low sperm counts can be expected to return to normal levels.

Congenital or pathological changes in the testes — other than those produced by a varicocele — are a contra-indication to operation.

In a previous communication (Scott, 1958), the results of seminal and histological studies in patients with different sizes of varicocele were presented and it was noted that all grades of varicocele appeared to play a definite part in the production of male subfertility. That particular study was undertaken to make possible the more accurate selection of cases for operation; the present study sets out to justify these criteria for elective surgery based on the seminal changes following ligation of the different sizes of varicocele.

MATERIALS AND METHODS

CLINICAL MATERIAL

In the past 4 years, over a hundred subfertile men have had their varicoceles ligated by Mr W. S. Mack or myself at the Male Infertility Clinic of the Western Infirmary, Glasgow. This study covers fifty-five consecutive cases in which the author carried out both the operation and the clinical assessment of the size of the varicocele. Fifty-three of these cases had left-sided varicoceles of varying sizes and two had large right-sided varicoceles. To serve as 'controls',

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four subfertile men who had no varicocele voluntarily submitted themselves to the identical operative procedure.

METHOD OF STUDY

In order to compare the effect of ligation of the different sizes of varicocele with that of the 'controls', and with cases that had other complicating factors, all varicoceles were assessed by the method described by Scott (1958). In both the pre- and post-operative analyses, the seminal specimens were collected by coitus interruptus after 4 days' abstinence from intercourse and the findings given represent an average of two or more analyses. Once again, the arbitrary dividing line between a 'normal' and a 'low' sperm count was taken to mean above or below 20 million/ml; motility was considered 'normal' provided 50 % of the sperms still showed active progressive movement across a warmed slide 4 hr after ejaculation. Necrostermia was taken to mean a complete absence of sperm movement in two or more seminal specimens. Post-operative seminal analyses were carried out at intervals between 1 and 24 months, but all figures referred to in the following tables represent readings taken at 6 months.

OPERATIVE TECHNIQUE

Varicocele ligation at, or above, the deep inguinal ring does not harm the testicular blood supply provided care is taken to leave an adequate collateral circulation. The main bulk of the pampiniform plexus ascends in the spermatic cord but, as a rule, the tortuous dilated veins unite into one single vein shortly before entering the deep inguinal ring (Pl. 1, Fig. 1).

Basing their operative technique on the anatomical studies which Harrison (1949) carried out on testicular blood supply, many surgeons favour retroperitoneal section of the spermatic vein *above* the deep inguinal ring but I have found no advantage from this procedure and, in the majority of my cases, ligation and division of the single vessel formed by union of the pampiniform veins were easily and safely carried out immediately *below* the deep inguinal ring through the usual inguinal hernia exposure (Pl. 1, Fig. 1). This exposure also allows ligation and division of accessory veins communicating with the thigh and pubis which would be missed with the retroperitoneal exposure. The patients are allowed out of bed 24 hr later and are able to resume light work as soon as their skin sutures are removed on the seventh post-operative day.

OBSERVATIONS

For convenience of analysis the cases have been divided into five study groups:

Group 1: Cases with low sperm counts. This group consisted of twenty-three cases (Table 1), of which fourteen had large varicoceles, four were moderate and five were small.

Group 2: Cases with poor motility and normal sperm counts. This group consisted of twenty-six cases (Table 2), of which eight had large varicoceles, ten were moderate and eight were small.

FIG. 1. Venoogram showing union of the tortuous pampiniform veins into one single vein in the inguinal canal; the point of section and ligation is indicated by the arrow.

TABLE I

EFFECT OF LIGATION ON A LOW SPERM COUNT

Size of varicocele	Before operation		After operation						
	Count in millions/ml	No. of cases	Sperm count in millions/ml						
			Under 1	1 to 10	11 to 20	21 to 40	41 to 60	61 to 100	Over 100
Large	Under 1	4	2	—	1	1	—	—	—
	1 to 10	6	—	1	—	1	2	1	1
	11 to 20	4	—	—	—	1	—	—	3
Moderate	Under 1	1	—	1	—	—	—	—	—
	1 to 10	1	—	—	—	—	—	1	—
	11 to 20	2	—	—	1	—	—	—	1
Small	Under 1	1	1	—	—	—	—	—	—
	1 to 10	2*	—	—	1	—	—	—	—
	11 to 20	2	—	—	—	—	—	2	—

* One patient, whose wife became pregnant after his operation, refused to produce a post-operative specimen.

TABLE 2

EFFECT OF LIGATION ON SPERM MOTILITY IN THE PRESENCE OF AN ALREADY ADEQUATE SPERM COUNT

Size of varicocele	Before operation		After operation				
	Sperm motility %	No. of cases	Nil	1 to 10%	11 to 40%	50 to 75%	Over 75%
Large	Nil	1	—	—	—	—	1
	1 to 10	3	—	1	—	1	1
	11 to 40	4	—	—	—	1	3
Moderate	Nil	5	—	1	—	2	2
	1 to 10	5	—	—	1	—	4
	11 to 40	—	—	—	—	—	—
Small	Nil	3	—	1	1	—	1
	1 to 10	4	—	1	—	2	1
	11 to 40	1	—	—	—	—	1

TABLE 3

SEMINAL CHANGES FOLLOWING LIGATION OF RIGHT-SIDED VARICOCELES

Before operation		After operation	
Sperm count in millions/ml	Motility %	Sperm count in millions/ml	Motility %
21	30	20	50
30	10	11	10

Group 3: Right-sided varicoceles. This group consisted of only two cases (Table 3), both of which had large varicoceles.

Group 4: Varicoceles with complicating factors. This group consisted of four cases (Table 4), three of which were large varicoceles and one was moderate.

TABLE 4
SEMINAL CHANGES FOLLOWING LIGATION OF VARICOCELES COMPLICATED BY OTHER FACTORS

Before operation		After operation		Complicating factor
Sperm count in millions/ml	Motility %	Sperm count in millions/ml	Motility %	
9	5	7	50	Maldescent
2	Nil	8	90	Maldescent
Under 1	10	Under 1	10	Maldescent
Under 1	50	Under 1	Nil	Mumps orchitis

Group 5: Cases with no varicocele. This small group of four volunteers was included to act as a form of control (Table 5); two of the cases had normal sperm counts associated with poor motility and two had faults in both factors. As soon as it became obvious that no improvement was likely to follow operation, no further cases were submitted to ligation even although some patients requested the operation after having heard of the post-operative improvement from friends who had had their varicoceles ligated.

TABLE 5
SEMINAL CHANGES FOLLOWING LIGATION OF A NORMAL PAMPINIFORM PLEXUS

Before operation		After operation	
Sperm count in millions/ml	Motility %	Sperm count in millions/ml	Motility %
68	Nil	72	Nil
50	Nil	48	Nil
11	10	11	10
Under 1	Nil	2	50

Effect on the Sperm Count

If one accepts a sperm count of 20 million/ml and an active motility of 50 % (at 4 hr) as being 'fertile', then it is reasonable to assume that 10 million *actively motile sperms* per ml should similarly be classed as 'fertile'. For the purpose of the present study this figure has been raised by 50 % to 15 million actively motile sperms per ml of semen in order to be on the safe side. Basing the results on this latter figure and excluding right-sided varicoceles and cases with other complicating factors, the operation must be considered eminently successful in over 70 % of all cases (Table 6). The overall effect on 'fertility' is most gratifying when compared with the results obtained by any form of drug therapy.

Six cases started with a virtual azoospermia (Table 1). Two of these had

maturation arrest proved by biopsy and one had severe bilateral hypospermatogenesis; none of these three cases showed any improvement but, of the remaining three, one improved to 35 million, one to 15 million and one to 5 million. In the group of nine cases with sperm counts between 1 million and 10 million/ml, six became 'fertile', one achieved a pregnancy within 3 months of operation but declined further seminal analysis, one improved to 13 million and there was only one failure. Seven of the remaining eight cases with pre-operative counts between 11 million and 20 million/ml became 'fertile' within 6 months of operation; the remaining case improved from 13 million to 20 million/ml. Although all sizes of varicocele contributed to the general improvement, appreciably greater increases in the sperm count were demonstrated after ligation of moderate and large varicoceles compared with the small ones. From the prolonged follow-up which continued, in some cases, for as long as 2 years after operation, there appeared to be a general pattern whereby the count dropped below pre-operative levels for 4 to 6 weeks after ligation and then

TABLE 6
OVERALL EFFECT OF LIGATION ON FERTILITY

Before operation Size of varicocele	No. of cases	Six months after operation			Success rate %
		Fertile	Improved	No change	
Large	22	16	2	4	72.7
Moderate	14	11	3	—	78.5
Small	13	8	2	3	61.5
Totals	49	35	7	7	71.4

continued to rise for the next 12 to 15 months. Several cases had higher seminal counts at 12 months than they did at 6 but, after 15 months, there was no evidence of further increase or decrease; two such cases are cited below as an illustration of this effect:

Case 1, aged 27 years, had a large left varicocele with a pre-operative sperm count of 7 million/ml. One month after ligation the count had fallen to 5 million/ml but, 6 months later, it had risen to 12 million and, 2 years after operation, it was 22 million/ml.

Case 2, aged 29 years, had a large left varicocele with a pre-operative sperm count of 5 million/ml. Nine months after ligation the count had risen to 21 million and, by the 13th month, it had risen to 126 million/ml.

Effect on Sperm Motility

In nine cases the operation was performed because an adequate sperm count was associated with persistent necrospemia (Table 2); of these, one showed no improvement at all, two increased to 5 %, one to 25 % and the remaining six increased to above the 'fertile' level. Seventeen cases had a normal sperm count associated with varying degrees of poor motility; of these, two showed no improvement and one increased to 30 % but the remaining fourteen cases showed such dramatic improvement — both qualitatively and quantitatively —

that the pre-operative sluggishness was transformed into teeming activity in the majority of the sperms.

Effect of Ligating Right-Sided Varicoceles

Both the right-sided operations were unsuccessful and both developed a post-operative hydrocele but no anatomical explanation for these failures has been forthcoming.

Effect Produced in the Presence of Complicating Factors

Three cases were associated with maldescent of the opposite testis; biopsies in each case revealed tubules lined only by Sertoli cells in the maldescented organs together with severe hypospermatogenesis on the side of the varicocele. The remaining case had a previous history of left-sided mumps orchitis with histological evidence of widespread tubular atrophy. Although the sperm motility was improved in some of these cases (Table 4), the sperm count was never significantly altered owing, no doubt, to the irreversible damage already done to the testes; such cases, together with right-sided varicoceles, are no longer accepted for operation.

Effect of Ligating the Spermatic Vein

In the absence of a varicocele, ligation of the spermatic vein produced no significant change in the fertility of any of the four 'control' cases.

Effect of Ligation on the Pregnancy Rate

In spite of the fact that this, in the eyes of the patient, is the supreme test of success or failure, there are so many different factors in the production of a pregnancy that one cannot appraise the value of the operation simply in the light of subsequent conception. Tietze (1956) has shown statistically that, excluding pregnancies resulting from pre-marital intercourse, 93 % of first pregnancies are conceived within 1 year of marriage. It is, therefore, gratifying — and perhaps significant — that, in my own cases, at least ten pregnancies occurred within 8 months of varicocele ligation although these same marriages had previously been barren for from 2 to 10 years. It is also significant that Davidson (1954), Tulloch (1955) and Young (1956) have, between them, reported fifty-two varicocele ligations of which 32 % subsequently achieved a pregnancy; similar increases in the post-operative pregnancy rate have also been noted by Hanley (personal communication, 1959).

CONCLUSIONS

(1) Although retroperitoneal section of the vein would appear, on anatomical grounds, to be the operation of choice, excellent results — free from complication — follow ligation at the upper end of the inguinal canal.

(2) No change in fertility follows ligation of the spermatic vein in the absence of a varicocele.

(3) A return to 'fertile' levels in the semen can be anticipated within 6 months of operation in approximately three out of every four cases.

(4) An initial post-operative depression of the sperm count is generally followed by a gradual increase for as long as 15 months after operation.

(5) Virtual azoospermia is not a complete contra-indication to operation but good results cannot always be anticipated as many of these cases will show histological evidence of irreversible damage to the germinal epithelium.

(6) Complete necrostermia associated with a normal sperm count is a strong indication for ligation; an excellent response can be anticipated in 75 % of the cases.

(7) Low grade motility associated with an already adequate sperm count is one of the strongest indications for varicocele ligation.

(8) All sizes of varicocele contribute to the production of male subfertility and even small ones — which will be missed unless the patient is examined in an upright position — are worth ligating. Prospects are poor, however, when there is azoospermia as it is probable that some factor, other than a *small* varicocele, is present in such cases.

(9) A significant increase in the pregnancy rate follows within a few months of operation.

(10) Patients with small, soft testes or a history of testicular abnormality — either congenital or pathological — do not respond to varicocele ligation.

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