

Cumulative Results of Corrective Surgery for Obstructive Azoospermia

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During the past 18 years (1964~1981), I have performed 775 corrective surgeries for the patients with azoospermias due to post-vasectomy obstruction and due to post-inflammatory epididymal obstruction at my department. Now I report the cumulative results of 584 vasovasostomies (vasovasostomy group) and those of 191 epididymovasostomies (epididymovasostomy group) and compare the success rates of 441 macro-surgical anastomosis techniques with those of 334 microsurgical anastomosis techniques in the hope of improving the outcome of these corrective surgeries.

MATERIALS

Vasovasostomy:

Over 680,000 vasectomies were carried out in Korea during the period from 1962 to 1981. This number corresponds to 1.8% of total population (38 million), 3.5% of male population (19 million), and 11% of eligible couples (6 million). This increasing popularity of vasectomy led to increased demands for reversal of the procedure (Lee, 1982). It is estimated that 1 reversal operation per 500 to 750 vasectomies in Korea (Lee, 1980). In a total of 584 patients who were operated for reversal of post-vasectomy azoospermias, 329 patients were operated by

conventional or macrosurgical technique and the remaining 255 patients were done by microsurgical technique (Table 1). An age of patients ranged from 19 to 49 with the mean of 33. Duration of obstruction ranged from 1 day to 16 years with the mean of 4.2 years (Table 2).

Reasons for requesting reversal operation were: remarriage in 225 patients, death of children, 222 patients, change of attitude, 108 patients, and psychological problems, 29 patients (Table 3).

Epididymovasostomy:

A total of 174 patients with azoospermias due to epididymal obstruction excluding 17 patients with vas agenesis were surgically treated (Table 1). Sixty-two patients out of the 174 were operated under a surgical microscope and the remaining patients were done by a conventional technique. An age of the patients ranged from 20 to 53 with the mean of 33, and that of their sexual partners, from 22 to 42 with the mean of 29. Marital life ranged from 10 years to 30 years with the mean of 5 years, and duration of obstruction, from 1 year to 23 years with the mean of 5 years (Table 4).

Suspective causes of epididymal obstruction were: non-tuberculous epididymitis in 104 patients, tuberculous epididymitis in 61 patients, injuries of scrotal contents in 9 patients and bilateral agenesis of vas deferens in 17 patients (Table 5).

METHODS

Vasovasostomy:

Under spinal or general anesthesia, the fibrous

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Table 1. Number of vasectomized men under Government Free-Service Programme and numbers of vasovasostomies and epididymovasostomies done by Lee, H.Y.

Year	Vasectomy		Vasovasostomy		Epididymo-vasostomy	
	Cases	%	Cases	%	Cases	%
1962	3,413	100.0				
1963	19,866	86.4				
1969	26,256	92.8	6	1.0	3	1.6
1965	12,855	85.7	9	1.5	2	1.0
1966	19,942	99.7	11	1.9	3	1.6
1967	19,677	91.6	12	2.1	3	1.6
1968	15,938	88.8	14	2.4	6	3.0
1969	15,457	77.3	14	2.4	8	4.2
1970	17,321	86.6	19	3.3	9	4.7
1971	18,581	93.0	27	4.6	10	5.2
1972	16,396	82.0	32	5.5	12	6.3
1973	19,696	98.5	24	4.1	10	5.2
1974	32,020	86.5	17	2.9	12	6.3
1975	43,056	92.4	25	4.3	12	6.3
1976	44,481	88.2	23	4.0	7	3.7
1977	53,781	98.8	30	5.1	15	7.9
1978	36,922	92.3	65	11.3	12	6.3
1979	25,863	86.2	91	15.6	16	8.4
1980	28,036	93.5	82	14.0	20	10.5
1981	31,320	104.4	82	14.0	31	16.2
Total	500,927*	91.6**	584	100.0	191***	100.0

* Besides these, it is estimated that more than 180,000 men underwent the vasectomy through private practitioners for the same period.

** Per-cent of achievement from target.

*** Azoospermia due to post-inflammatory epididymal obstruction

nodule at the vasectomy site was exposed through a 2-cm bilateral scrotal incisions. In macroscopic anastomosis, end-to-end or side-to-side technique was adopted depending on the size of the nodule or level of the previous vasectomy. In microscopic anastomosis, full-thickness or two-layer end-to-end technique was utilized depending on the thickness of the proximal vasal wall using eye surgery instruments, vas approximating clips, grooved director needle and 9-0 to 10-0 dermalon suture materials. Particularly, for the two-layer anastomosis, the entire cut surface and the lumen of both vas ends were now faced directly the operator by rotating the approximating clips. Now 4 interrupted through mucosa-to-mucosa stitches of 10-0 nylon were placed and ends of the sutures were not tied and tagged with rubber-covered mosquito forceps for prevention of mucosal tears. Long ends of each suture were then tied separately in reverse order of 4 suture placements after straightening the vas ends. Eight to 10 stitches of 9-0 nylon were placed equidistantly on the outer muscular layer only and tied individually. The anastomosed part of the vas was then covered with neighbouring adventitial cremasteric fascia by applying 6-0 chromic catgut sutures.

Epididymovasostomy:

Under spinal or general anesthesia, a window was made in the epididymal head, upper-body or lower-body and the epididymal tubule was opened by removing small piece where milky

Table 2. Clinical history of patients of vasovasostomy group

Factors	Macrosurgery	Microsurgery	Total
Total patients operated upon (cases)	329	255	584
Number of patients followed-up (cases)	300	222	522
Average age of patients (ranges)	38 (19~57)	36 (24~56)	37 (19~57)
Average age of wives (ranges)	35 (21~49)	30 (21~50)	31 (21~50)
Average years of obstruction (ranges)	4.2 (1~16)	4.2 (1~16)	4.2 (1~16)
Number of children at vasectomy (m:f)	2.4 (1.3 : 1.1)	2.0 (0.9 : 1.1)	2.2 (1.1 : 1.1)
Number of children at vasovasostomy (m:f)	1.8 (0.8 : 1.0)	1.5 (0.5 : 1.0)	1.7 (0.5 : 1.0)

Table 3. Reasons for requesting vasovasostomy

Reasons	Macroscopy Cases(%)	Microsurgery Cases(%)	Total Cases(%)
Remarriage	128(39)	97(38)	225(39)
Death of children	120(36)	102(40)	222(38)
Change of attitude	56(17)	52(20)	108(18)
Psychological problems	25(8)	4(2)	29(5)
Total	329(100)	255(100)	584(100)

Table 4. Clinical history of patients of epididymovasostomy group

Factors	Macroscopy	Microsurgery	Total
Total patients operated upon (cases)	112	62	174
Number of patients followed-up (cases)	97	58	155
Average age of patients (ranges)	34(20~53)	32(27~46)	33(20~53)
Average age of wives (ranges)	30(22~42)	29(22~41)	29(22~42)
Average year of obstruction (ranges)	6(1~23)	24(1~19)	5(1~23)

Table 5. Causes of epididymal obstruction

Causes	Macroscopy Cases(%)	Microsurgery Cases(%)	Total Cases(%)
Non-tuberculous epididymitis	68(61)	36(58)	104(60)
Tuberculous epididymitis	37(33)	24(39)	61(35)
Injuries of scrotal contents	7(6)	2(3)	9(5)
Total	112(100)	62(100)	174(100)*

* Vas agenesis: 17 cases were excluded from a total of 191 patients

spermatic fluid leaked out. A longitudinal incision was made over the normal patent vas or the patent vas was divided and the cut end was opened longitudinally near the convoluted vas opposite the epididymal window. A short circuit operation was effected between the epididymal and vasal openings with a total of 10~15 stitches of 7-0 to 9-0 sizes of dermalon by side-to-side technique. In order to prevent later spontaneous closure of the opening of the epididymal tubule, I attempted end-to-end anastomosis between the mucosal layer of vas deferens and the original epididymal tubule which drained spermatic fluid continuously on 6 patients of the microsurgical anastomoses group. However, I could not satis-

factorily ascertain the original epididymal tubule end nor could I perfectly anastomose the epididymal tubule to the vasal lumen.

Criteria of Evaluation:

Post-operative semen analyses were carried out 4 weeks after the operation and monthly thereafter for more than 6 months. The results of the operation were judged by the three criteria: anatomical success or patency rate defines as the appearance of normal viable sperm in counts of more than 10×10^6 /ml; and functional success or pregnancy rate, the occurrence of pregnancy (first pregnancy only) in both groups; and psychological success, the abatement of psychological problems in vasovasostomy

Table 6. Success rates associated with various factors in macroscopic and microscopic vasovasostomies

Factors	Semen examined Cases			Sperm positive Cases(%)			Pregnancy positive Cases(%)		
	Macro	Micro	Total	Macro	Micro	Total	Macro	Micro	Total
Interval(Years)	Age*								
1(-)	24	19	43	22(92)	17(89)	39(91)	14(58)	9(47)	23(53)
1~2	85	50	135	76(89)	46(92)	122(90)	38(45)	25(50)	63(47)
3~4	91	76	167	79(87)	70(92)	149(89)	31(34)	39(51)	70(42)
5~6	43	40	83	35(81)	36(90)	71(86)	11(26)	16(40)	27(33)
7~8	31	15	46	24(77)	12(80)	36(78)	7(23)	6(40)	13(28)
9~10	15	12	27	10(67)	10(83)	20(74)	2(13)	4(33)	6(22)
11(+)	11	10	21	6(55)	8(80)	14(67)	2(18)	3(30)	5(24)
Level of anastomosis									
Bilateral straight vas-to-straight vas	238	147	385	205(86)	135(92)	340(88)	87(37)	68(46)	155(40)
Straight vas-to-straight vas and straight vas-to-convoluted vas	47	29	76	37(79)	24(83)	61(80)	14(30)	14(48)	28(37)
Bilateral straight vas-to-convoluted vas	15	46	61	10(67)	40(87)	50(82)	4(27)	20(43)	24(39)
Anastomosis techniques									
End-to-end	226		226	191(85)		191(85)	80(35)		80(35)
Side-to-side	74		74	61(82)		61(82)	25(34)		25(34)
Two-layer		120	120		108(90)	108(90)		57(48)	57(48)
Full-thickness		102	102		91(89)	91(89)		45(44)	45(44)
Leakage of spermatic fluid									
Bilateral leakages	122	34	156	110(90)	32(94)	142(91)	49(40)	16(47)	65(42)
Unilateral leakage	61	83	144	53(87)	75(90)	128(89)	20(33)	41(49)	61(42)
No leakage	117	105	222	89(76)	92(88)	181(82)	36(31)	45(43)	81(36)
Total-Average	300	222	522	252(84)	199(90)	451(86)	105(35)	102(46)	207(40)

* Mean (macroscopy/microsurgery)

group.

RESULTS

Vasovasostomy:

The results of 584 vasovasostomies were evaluated with respect to the following various factors. Five-hundred and 22 patients out of the 584 could be followed-up for more than 1 year after the operation (Table 6).

Due to the interval of obstruction, both anatomical and functional success rates declined as duration of obstruction increased, particularly, in patients with vasectomy of longer than 9 years.

Due to the level of anastomosis, the results of bilateral straight vas-to-straight vas anastomosis appeared superior both anatomically and functionally to those of bilateral straight vas-to-convoluted vas anastomosis.

Due to the anastomosis technique, end-to-end technique was similar to side-to-side technique in macroscopic anastomosis series and two-layer technique was superior to full-thickness techni-

que in microscopic anastomosis series.

Due to leakage of spermatic fluid from the proximal vas end, both anatomical and functional success rates were higher in patients with bilateral leakage than in patients with no leakage in both macroscopy and microsurgery series.

The summarized results of total vasovasostomies revealed that viable sperm were present in the 252 (84%) of the 300 patients in macroscopic vasovasostomies and also the 199 (90%) of the 222 patients in microscopic vasovasostomies. Pregnancy occurred in 105 patients (35%) of macroscopic anastomosis and also in 102 patients (46%) of microscopic anastomosis. About 60% of the husbands of the successful anastomoses impregnated their wives within one year after the operation (Table 7).

An average spermogramme of the 451 anatomically successful patients was: volume, 3.0ml; count, $40 \times 10^6/\text{ml}$; motility, 49% and normal morphology, 77%. There were no significant difference in spermogramme between macroscopic and microscopic anastomosis patients (Table 8).

Later stricture of anastomosed site due to

Table 7. Results of total vasovasostomies

Factors	Macroscopy Cases(%)	Microsurgery Cases(%)	Total Cases(%)
Total operations	329	255	584
Semen examined	300(100)	222(100)	522(100)
Sperm appeared (Anatomical success)	252(84)	199(90)	451(86)
Pregnancy occurred (Functional success)	105(35)	102(46)	207(40)
Psychological problems disappeared	19/25(76)	3/4(75)	22/29(76)

Table 8. Spermogramme of patent patients after vasovasostomy

Parameters	Macroscopy	Microsurgery	Total
No. of patients	252	199	451
Volume(ml)	2.9(0.8~7)*	3.2(0.7~8)	3.0(0.7~8)
Counts($10^6/\text{ml}$)	39(10~210)	41(10~250)	40(10~250)
Motility(%)	49(10~75)	48(10~76)	49(10~76)
Normal shape(%)	77(69~90)	76(66~90)	77(66~90)

* range

Table 9. Success rates associated with various factors in macroscopic and microscopic epididymovasostomies

Interval(Years)	Semen examined Cases			Sperm positive Cases(%)			Pregnancy positive Cases(%)		
	Macro	Micro	Total	Macro	Micro	Total	Macro	Micro	Total
	1~2	3	2	5	1(33)	1(50)	2(40)	0(0)	0(0)
3~4	22	18	40	7(32)	7(39)	14(35)	3(14)	5(28)	8(20)
5~6	42	22	64	14(33)	8(36)	22(34)	6(14)	6(27)	12(19)
7~8	17	9	26	5(29)	3(33)	8(31)	2(12)	1(11)	3(12)
9~10	10	5	15	2(20)	1(20)	3(20)	1(10)	0(0)	1(7)
11(+)	3	2	5	1(33)	1(50)	2(40)	0(0)	0(0)	0(0)
Age groups									
20~35	4	0	4	1(25)	0(0)	0(0)	0(0)	0(0)	0(0)
26~30	25	17	42	8(32)	7(41)	15(36)	4(16)	5(29)	9(21)
31~35	36	32	68	13(36)	10(31)	23(34)	6(17)	6(19)	12(18)
36~40	21	4	25	5(24)	2(50)	7(28)	1(5)	1(25)	2(8)
41~45	8	3	11	2(25)	1(33)	3(27)	1(13)	0(0)	1(9)
46~50	2	2	4	1(50)	1(50)	2(50)	0(0)	0(0)	0(0)
51(+)	1	0	1	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Causes, bilateral									
Non-tuberculous epididymitis	59	34	93	22(37)	16(47)	38(41)	10(17)	10(29)	20(22)
Tuberculous epididymitis	33	22	55	7(21)	5(23)	12(22)	2(6)	2(9)	4(7)
Trauma of scrotal contents	5	2	7	1(20)	0(0)	1(14)	0(0)	0(0)	0(0)
Anastomosis site									
Vas-to-epididymis, bilateral	82	52	134	27(33)	20(38)	47(35)	11(13)	12(23)	23(17)
Vas-to-epididymis, unilateral	10	5	15	3(30)	1(20)	4(27)	1(10)	0(0)	1(7)
Vas-to-testis, bilateral	5	1	6	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Level of epididymal window									
Head	46	32	78	15(33)	12(38)	27(35)	6(13)	7(22)	13(17)
Upper-body	35	22	57	11(31)	8(36)	19(33)	4(11)	4(18)	8(14)
Lower-body	11	3	14	4(36)	1(33)	5(36)	2(18)	1(33)	3(21)
Testis(implantation)	5	1	6	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Total-Average	97	58	155	30(31)	21(36)	51(33)	12(12)	12(21)	24(15)

secondary fibrosis occurred more often in macroscopic anastomosis than in microscopic anastomosis.

In general, both anatomical and functional success rates of microscopic anastomosis were found to be slightly higher than those of macroscopic anastomosis.

Epididymovasostomy:

The results of 174 epididymovasostomies were summarized as follows. One-hundred and 55 patients out of the 174 were followed-up for more than 1 year after the operation (Table 9).

Due to duration of the obstruction and age groups, no significant differences were noted in both anatomical and functional success rates.

Due to causes of the obstruction, both anatomical and functional success rates were higher in patients with non-tuberculous epididymitis than patients with tuberculous epididymitis (patency=41%: 22%; pregnancy=22%:7%).

Due to the extent of post-inflammatory scar on the epididymis, success rates of bilateral vas-to-epididymal anastomosis group were better than those of unilateral vas-to-epididymal anastomosis groups (patency=38%:27%; pregnancy=17%:7%). No successful cases were found in bilateral vas implantation into top of testis group.

Due to the level of epididymal window, there were no significant differences were found in anatomical success rates among the vas-to-epididymal head anastomosis, vas-to-epididymal upper-body anastomosis, and vas-to-epididymal lower-body anastomosis group (patency=38%: 33%:36%; pregnancy=17%:14%:21%). Summarized results of present series revealed that viable sperm were obtained from 51 patients (33%) and pregnancy occurred in 24 patients (15%) out of the 155 following epididymovasostomy, even though the anatomical success

Table 10. Results of total epididymovasostomy

Factors	Macroscopy Cases(%)	Microsurgery Cases(%)	Total Cases(%)
Total operations	112	62	174
Semen examined	97(100)	58(100)	155(100)
Spermatozoa present (Anatomical success)	30(31)	21(36)	51(33)
Pregnancy occurred (Functional success)	12(12)	12(21)	24(15)

Table 11. Spermigramme of patent patients by age groups and by duration of obstruction after epididymovasostomy

Age groups	Total(Cases)			Volume(ml.)			Count(10 ⁶ /ml)			Motility(%)			Morphology(%)		
	Macro	Micro	Total	Macro	Micro	Total	Macro	Micro	Total	Macro	Micro	Total	Macro	Micro	Total
20~30	8	4	12	2.6	2.7	2.6	29	31	30	41	44	42	77	78	77
31~40	20	15	35	2.5	2.6	2.5	28	30	29	39	41	40	76	77	76
41~50	2	2	4	2.5	2.5	2.5	29	29	29	40	42	41	77	76	76
Interval(Years)															
1~ 2	1	1	2	3.0	3.1	3.0	33	34	33	44	41	43	77	78	77
3~ 4	7	7	14	2.6	2.7	2.6	32	33	32	43	42	42	75	77	76
5~ 6	14	8	22	2.5	2.6	2.5	28	29	28	40	42	41	76	77	76
7~ 8	5	3	8	2.5	2.6	2.5	27	27	27	38	40	39	76	76	76
9~10	3	2	5	2.4	2.5	2.5	26	27	26	37	39	38	75	77	76
Total-Average	30	21	51	2.5	2.6	2.5	28	30	29	40	42	41	76	77	76

rate averaged 35% and functional success rate, 15% according to the reported results by different authors (Table 10).

No significant differences were found in the spermogramme of patent cases by age groups or by duration of obstruction and also between macrosurgery and microsurgery groups (Table 11).

Generally speaking, both patency and pregnancy rates of microsurgical series were slightly better than those of macro-surgical series.

DISCUSSION

Vasovasostomy:

For the successful vasovasostomy, the most important factor in a meticulous and skillful anastomosis technique. By this technical perfection, an accurate anatomic approximation of the vas ends will be accomplished so as to create leakproof anastomosis without subsequent scarring down at the anastomosed site. For this, use of microsurgery using fine suture materials and instruments for eye surgery is recommended (Fernandes, 1968; Schmidt, 1975; Owen, 1977; Silber, 1978). For the microsurgical vasovasostomy, I am utilizing two different modified techniques, such as two-layer technique (mucosa-to-mucosa and muscularis-to-muscularis) and full-thickness or one-layer technique (through-and-through full-thickness and muscularis-to-muscularis). Major advantage of the two-layer technique (I prefer to call tripple-layer technique since 1st layer is mucosa-to-mucosa, 2nd layer, muscularis-to-muscularis, and 3rd layer, fascia-to-fascia) is that a better mucosa-to-mucosa approximation can be achieved by matching up the shrunken mucosa of the distal vas to the dilated mucosa of the proximal vas. This attains leakproof alignment and less subsequent stricture formation in the inner canal of the vas. Moreover, an adequate muscular layer suturing ensures a

leakproof approximation and neighbouring fascia covering allows normal conduction of powerful peristalsis of the vas essential for the propulsion of sperm from epididymis into the ejaculates since the contraction of the vas is controlled by the release of norepinephrine from the sympathetic nerve endings running through the fascia (Pabst, 1979). Therefore, this two-layer technique has been one of the most popular methods of vasovasostomy (Silber, 1978; Amelar, 1979; Belker, 1980; Lee, 1980). However, it is technically more difficult to place the accurate sutures on the mucosal layer of the thin wall of the dilated vas without tearing of the mucosa and to cut the ends of the sutures short enough to be buried in the muscular layer in this two-layer technique. Besides these, too many mucosal sutures of over 6 stitches may affect the formation of suture granulomas at the lumen of the anastomosed site. On the other hand, a meticulous and accurate approximation of full-thickness technique (I prefer to call double-layer technique since 1st layer is full layer-to-full layer with muscularis-to-muscularis and 2nd layer, fascia-to-fascia) anastomosed by full layer-to-full layer with muscularis-to-muscularis sutures effectively provides good approximation of the cut ends of the vas and prevents sperm leakage from the anastomosis site. And also, neighbouring fascia suturing allows normal and powerful peristalsis of the anastomosed part of the vas. Moreover, this technique is simpler than the two-layer technique. However, the full-thickness technique may result in a imperfect anatomical approximation of mucose-to-mucosa by muscle bridge formation between the two mucosal edges, so that sperm leakage and granuloma formation may occur. Consequently, I found that the anatomical success rate of two-layer technique is almost equal with that of the full-thickness technique but the functional success rate of the former is slightly better than that of the latter

in my series. Meanwhile, as compared the microsurgical results with the macrosurgical results obtained at my department, both anatomical and functional success rates of the microsurgical series appeared superior to the macrosurgical series, but the differences were not statistically significant (Bagshaw, 1980; Lee, 1980; Lee, 1980). However we have been utilizing the microsurgical anastomosis technique for vasovasostomy since 1978 and we believe that this microsurgical technique may provide better results in the future as it is quite true that the more experience with particular technique the surgeon has acquired, the better will be the results.

It is very difficult at present to attempt real comparisons with reported results of vasovasostomy since there has been no standardized and uniform criteria in reporting system of the results of the operation. However, overall success rates reported recently by some investigators ranged from 83% to 95% for the patency and from 33% to 53% for the pregnancy by conventional macrosurgical anastomosis and ranged from 90% to 98% for the patency and from 40% to 76% for the pregnancy by microsurgical anastomosis (Owen, 1977; Silber, 1978; Amelar, 1980; Lee, 1980). It is evident by these results that the microsurgical technique is undoubtedly superior to the conventional technique regardless of existing controversy regarding the best method of vasovasostomy.

Epididymovasostomy:

For the anastomosis level of the epididymis, it has been recommended that the higher epididymis level, the more patency rate and the lower epididymis level, the more pregnancy rate. Accordingly, the anatomical success rate should be highest when the vas is anastomosed near the epididymal head since a dozen of efferent ducts connect the 20-30 tubules of rete testis to the head of the epididymis so as to facilitate

the flow of spermatic fluid from the rete testis into the vas deferens. And the functional success rate should be theoretically the highest when the vas is anastomosed to epididymal lower-body since the spermatozoa tend to undergo maturation as they are transported through from epididymal head to tail (Schoysman, 1978). However, both anatomical and functional success rates were much the same in entire anastomosis groups of vas to epididymal head, vas to epididymal upper-body and vas to epididymal lower-body in my series (Lee, 1977; 1978).

The results of epididymovasostomy particularly on post-inflammatory obstruction were not much improved yet. And also the prognosis for the obstruction due to malformation or trauma was generally poor one. It has been considered that cases of post-tuberculous obstruction were no longer contraindicated to epididymovasostomy due to the success of modern anti-tuberculous chemotherapy. However, the success rate of corrective surgery after tuberculous epididymal obstruction was proved to be very poor in this series (Hanley, 1955; Handry, 1978).

Overall success rates of epididymovasostomy were not encouraging, even though the anatomical success rate averaged 35% (7~66%), and the functional success rate, 15% (0~44%) according to the reported results by different authors (Hanley, 1955; Smith, 1963; Schoysman, 1978; Kelami, 1978; Lee, 1978).

My observation on failed epididymovasostomy at reoperations revealed that there were marked fibrosis and scar formation with sperm and suture granulomas and blockage of the original epididymal tubular opening at the site of the previous anastomosis. It is, therefore, ideal to attempt direct anastomosis between the original epididymal tubule and the mucosal layer of vas deferens (Silber, 1978).

Causative Factors of the Failures:

Causes of anatomical failure are (1) mecha-

nical, that is, inadequate anastomosis technique and materials used, (2) infection leading to fibrosis, (3) formation of sperm and suture granulomas, (4) obstruction in the proximal vas and epididymis following vasectomy or epididymitis, (5) vasectomy in the convoluted tubule, (6) excision of too large a segment during vasectomy, (7) inadequate intravasal and epididymal splint, (8) longer period of obstruction (more than 10 years), (9) early ambulation after corrective surgery (less than two days), (10) persisting previous residual infection, etc.

Possible causes of functional failure are (1) poor semen quality after corrective surgery, (2) local changes in the testis and epididymis, (3) injury to the sympathetic nervous system, (4) later spontaneous closure of the opening of the original epididymal tubule, (5) sperm antibody formation, (6) low or pre-vasectomy or pre-epididymitis semen quality, (7) low fertility potential of partner, (8) incompatibility between husbands and wives, (9) other causes of male infertility, (10) inadequate follow-up, etc.

The discrepancy between anatomical success and functional success may be explained by the following two major factors: (1) Oligospermia persisted due to depressed sperm production and maturation, and sperm senescence resulted from testicular and epididymal environmental changes after vasectomy or epididymal obstruction. This resulted in poor sperm transfer through the anastomosis. (2) Initially good sperm counts after vasovasostomy or epididymovasostomy may subsequently fall. This is most likely due to scarring at the anastomosed site before the wife became pregnant (Lee, 1978).

SUMMARY AND CONCLUSION

A total of 522 patients out of the 584 vasovasostomy patients were followed-up during the past 18 years. Better results were obtained in

shorter duration of obstruction, bilateral straight vas-to-straight vas anastomosis, bilateral leakages of spermatic fluids groups. Results of end-to-end technique were similar to side-to-side technique in macrosurgery but those of two-layer technique were superior to full-thickness technique in microsurgery. Success rates were 84% for patency and 35% for pregnancy in the 300 macrosurgeries and 90% for patency and 46% for pregnancy in the 222 microsurgeries. Failure of patency was mainly due to the scar formation with sperm and suture granulomas.

A total of 155 patients out of the 174 epididymovasostomy patients for post-inflammatory epididymal obstruction were followed-up during the past 18 years. Success rates were found to be higher in patients with non-tuberculous epididymitis than tuberculous epididymitis. There were no significant differences among the anastomosis levels of epididymal window. Success rates were 31% for patency, 12% for pregnancy in the 97 macrosurgeries and 36% for patency and 21% for pregnancy in the 58 microsurgeries. Causes of anatomical failures were scar formation at the anastomosed site and blockage of opening of the original epididymal tubule.

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—國文抄錄—

閉鎖性 無精子症에 대한 矯正手術의 綜合評價

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지난 18년(1964~1981) 동안에 서울대학교병원 비뇨기과에서 저자에 의해 시술된 睾丸後性 閉鎖性 無精子症에 대한 矯正手術 治驗例는 모두 775예가 된다. 이들은 584예의 精管切除術後의 精管精管吻合術과 191예의 副睾丸閉鎖後의 副睾丸精管吻合術로 구성된다. 이들중 441예는 肉眼的 在來式 手技로 시술했고, 나머지

334에는 顯微鏡의 微細式 手技로 시술하였다.

여기서는 이들 矯正手術의 開通率 혹은 解剖學的 成功率과 妊娠率 혹은 機能的 成功率을 각종 인자에 따라 분석하는 동시에 在來式과 微細式 手技를 비교 고찰하기로 한다.

精管精管吻合術群：

1. 정관절제술에서 복원수술까지의 폐쇄기간이 길수록 성공율이 떨어진다.

2. 직선정관에 직선정관을 이어 준 예에서 성공율이 높다.

3. 문합수기별로 볼 때 재래식에서는 단대단문합법과 측대측문합법사이에 별 차이가 없으나 미세식에서는 2층문합술이 전층문합술 보다 약간 좋은 것 같다.

4. 근위 정관단에서 나오는 정액의 유출이 있는 군에서 없는 군보다 성공율이 높다.

5. 술후의 정액검사치는 그 양이 3ml, 수가 40×10^6 ml, 운동성이 49%, 정상형이 77%가 된다.

6. 전반적으로 자가성적을 종합하면 재래식에서는 개통율이 84%에, 잉태율이 35%인데 비하여 미세식에서는 개통율이 89%에 잉태율이 46%가 된다.

따라서 현미경적 미세식이 육안적 재래식 문합술 보다 우수하다.

副睪丸精管吻合術群：

1. 부고환의 문합부위별로 볼 때 개통율에서나 잉태율에서 부고환 두부와 채부 사이에 이렇다 할 뜻 있는 차가 없다.

2. 결핵성 부고환염후의 폐쇄에서는 비결핵성 부고환염후의 폐쇄에서 보다 개통율이나 잉태율이 모두 떨어진다.

3. 술후의 정액검사치는 그 양이 2.5ml, 수가 29×10^6 /ml, 운동성이 41%, 정상형이 76%가 된다.

4. 전반적으로 자가성적을 종합하면 개통율이 33%에, 잉태율이 15%가 된다. 이들중 현미경적 미세식에서는 개통율이 36%에, 잉태율이 21%인데 비해 육안적 재래식에서는 개통율이 31%에, 잉태율이 12%가 된다.

따라서 여기서도 현미경적 문합술이 육안적 문합술 보다 우수하다는 것을 알 수 있다.

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