

Microsurgery and Andrology

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Pregnancy after Vasovasostomy for Vasectomy Reversal

FACTORS AFFECTING LONG-TERM RETURN OF FERTILITY IN 282 PATIENTS FOLLOWED FOR 10 YEARS

Vasectomy is the most popular method of birth control in the world today.²² More than a half million vasectomies are performed in the United States each year. Because of changing views about family life in the western world, increasing prevalence of divorce and remarriage, and fear of child death, a large number of men now are requesting reversal of vasectomy. For many years the pregnancy rate after surgical reanastomosis of the vas had been very low, and a variety of explanations had been offered for the relatively poor success in reversing vasectomy.^{9, 10, 23, 25, 31} With the advent of microsurgical techniques pregnancy rates improved considerably, suggesting that purely micro-mechanical factors were associated with the low success rates, but long-term follow-up on large numbers of patients were not available and the matter remains somewhat controversial.^{36, 38} Theories for the consistently poor results with vasectomy reversal have included development of sperm antibodies, damage to the deferential nerve, and testicular damage.^{4, 8, 12, 19, 21, 24, 28, 30} Yet some investigators questioned any correlation between sperm antibodies in the serum and subsequent fertility after vasovasostomy.³² The effect, if any, of vasectomy on the testis in humans and animals has also been very controversial.⁴⁰ Segregating the various studies by species has not cleared up the confusion. If any testicular damage occurs, the generally agreed upon mechanisms would be either autoimmune or pressure related.^{1, 6, 7, 18, 30, 40}

The pressure increase subsequent to vasectomy has been well-established as has the effect of this pressure on epididymal dilatation, perforation, and sperm inspissation in the epididymis, causing secondary epidid-

ymal obstruction.^{38, 41, 42} We found that the incidence of this confounding secondary epididymal blockage increased with the duration of time since vasectomy. Blockage never occurred if there was a sperm granuloma at the vasectomy site.^{36, 37, 40} Despite the disappointing finding of no sperm in the vas fluid in patients with secondary epididymal blockage, the testicle biopsy specimen always appeared normal.^{41, 47} This apparent effect of pressure increase after vasectomy led to the suggestion that the testicular end of the vas not sealed at the time of vasectomy, in order to lessen pressure build-up and possibly to increase the ease of reversibility (notwithstanding the potentially damaging immunological consequences).^{2, 34, 37} We wished to determine with the present study what the fertility rate would be for this favorable group of patients who had no epididymal damage as evidenced by sperm being present in the vas fluid.

We have carefully studied for 9 to 10 years a large group of patients who have undergone microsurgical vasovasostomy with no evidence of pressure-induced secondary epididymal blockage. We attempted to determine in these patients the presence or absence of varicocele, postoperative semen analyses, preoperative sperm antibody titers, and quantitative evaluation of testicular biopsy to the chance for pregnancy. In this study we are reviewing the results in patients who w

Table 1. OVERALL LONG-TERM PREGNANCY RATES IN PATIENTS UNDERGOING VASOVASOSTOMY 10-YEAR FOLLOW-UP (SPERM SEEN IN VAS FLUID)

	Combined 1975 and 1976-1977 Series	Original 1975 Series
Total Patients	282 (100%)	42 (100%)
Total Pregnant	228 (81%)	32 (76%)
Azoospermic	24 (9%)	5 (12%)

Table 2. PREGNANCY RATE ACCORDING TO DISTRIBUTION OF MOTILE SPERM COUNT IN MEN WITH SPERM PATENCY FOLLOWING VASOVASOSTOMY (10-YEAR FOLLOW-UP)

Total Motile Sperm Count (per ejaculate)	Total Patients	Pregnant	Not Pregnant
0-10,000,000	32 (12%)	25 (78%)	7
10-20,000,000	31 (12%)	27 (87%)	4
20-40,000,000	32 (12%)	30 (93%)	2
40-80,000,000	79 (31%)	68 (86%)	11
80,000,000	84 (33%)	78 (92%)	6
Totals	258 (100%)	228 (88%)	30

thought to have no epididymal blockage. Patients with no sperm in the vas fluid, all of whom exhibited secondary epididymal obstruction, are the subject of another study.

CONCLUSIONS

We wished to determine the eventual fertility of those vasectomy reversal patients who have no pressure-induced secondary epididymal blockage. These patients underwent simple vasovasostomy because at the time of the reversal surgery, sperm were present in large numbers in the vas fluid. If no sperm were in the vas fluid, the patients were excluded from the vasovasostomy series, and instead underwent vasoepididymostomy (see next section). We were able to obtain long-term follow-up on 282 patients with sperm in the vas fluid who underwent vasectomy reversal 8 to 10 years ago. These patients were studied for pregnancy rate, postoperative semen parameters, duration of time since vasectomy, preoperative serum antisperm antibody titers, influence of varicocele, and quantitative evaluation of testicular biopsy. All of the

Table 3. PREGNANCY RATE ACCORDING TO PERCENT SPERM MOTILITY IN MEN WITH SPERM PATENCY FOLLOWING VASOVASOSTOMY (10-YEAR FOLLOW-UP)

Motility	Total Patients	Pregnant	Not Pregnant
0-20	24	18 (75%)	6
20-40	70	66 (94%)	4
40-60	82	71 (86%)	11
60-80	62	55 (88%)	7
80	20	18 (90%)	2
Totals	258 (100%)	228 (88%)	30 (100%)

Table 4. LACK OF EFFECT OF VARICOCELE (NOT OPERATED ON) ON PREGNANCY RATE FOLLOWING VASOVASOSTOMY

	Number of Patients	Patients With Varicocele	Patients Without Varicocele
Pregnant	228 (80.9%)	33 (78.5%)	195 (81.2%)
Not Pregnant	54 (19.1%)	9 (21.4%)	45 (18.8%)
Totals	282 (100%)	42 (14.8%)	240 (85.2%)

44 patients with no sperm in the vas fluid who underwent vasovasostomy 10 years ago remained azoospermic. Of the 282 patients with sperm in the vas fluid, 228 (81 percent) eventually impregnated their wives. Patients with sperm in the vas fluid (24, 9 percent) were azoospermic and did not impregnate their wives. Of the 258 patients who had sperm patency, the pregnancy rate was 88 percent (Tables 1 to 5).

The number of mature spermatids per tubule in the testis correlated closely with the postoperative sperm count in patent cases. Quantitative evaluation of the testicular biopsy specimen revealed normal spermatogenesis even in patients with azoospermia or severe oligospermia postoperatively. Failures were thus found to be due to either blockage at the vasovasostomy site or epididymal blockage unrecognized at the time of vasovasostomy. Sperm count had a minimal impact on the likelihood of pregnancy so long as there was patency; no discrepancy was noted between sperm count and actual testicular sperm production as determined by testicular biopsy.⁴⁷ Pregnancy was not related to presence or absence of a varicocele, preoperative serum sperm antibody levels, or testicular biopsy findings.

Table 5. RELATIONSHIP OF SERUM SPERM ANTIBODY TITERS TO PREGNANCY RATE AFTER VASOVASOSTOMY

	Total Studied	Immobilizing		Agglutinating	
		Titer 2	(Isojima) 10	Titer 0	(Kibrick) 20
Husband Not Azoospermic					
Wife Pregnant	75	29 (39%)	18 (24%)	42 (56%)	30 (40%)
Wife Not Pregnant	11	1 (36%)	2 (16%)	6 (54%)	6 (54%)
Husband Azoospermic					
Wife Pregnant	12	5 (42%)	3 (25%)	7 (58%)	5 (42%)
Entire Group Studied	98	38 (39%)	23 (24%)	56 (57%)	41 (42%)

Results of Microsurgical Vasoepididymostomy

ROLE OF EPIDIDYMIS IN SPERM MATURATION

A total of 190 early patients with obstructive azoospermia caused by bilateral epididymal blockage have been followed for 6 years or longer after undergoing "specific tubule" vasoepididymostomy. At that time, we always attempted to perform the epididymal anastomosis as distally as possible so as to allow the greatest amount of epididymal length for sperm maturation. Thus the cases of vasoepididymostomy to the caput were more severely diseased and had a greater number of blockages than the more common cases of vasoepididymostomy to the corpus (Tables 6 to 15).

When anastomosis was performed at the corpus epididymidis, the "patency" rate was 78 percent, and the overall pregnancy rate was 56 percent. The pregnancy rate for "patent" cases was 72 percent, indicating that a high fertility rate can be obtained with spermatozoa that have not transited the full length of the corpus epididymidis. By contrast, with vasoepididymostomy to the caput epididymidis there was a 73 percent "patency" rate, but the overall pregnancy rate was only 31 percent. The pregnancy rate for "patent" cases was 43 percent. Spermatozoa from the corpus epididymidis had a higher rate of fertility than spermatozoa from the caput epididymidis, but spermatozoa from proximal areas of the corpus have no less fertility than spermatozoa from the distal corpus epididymidis. The most remarkable observation was that in almost half the cases of caput anastomosis, spermatozoa that have never journeyed beyond the caput epididymidis were capable of causing pregnancy.

We now routinely perform all anastomoses at the caput for the following reasons. We do not yet have data on vasoepididymostomy performed routinely at the caput epididymis for *all* cases of epididymal obstruction, but we suspect no difference occurs in the fertilizing potential of sperm from anywhere along the epididymal tubule, if all other factors are equal. By performing all anastomoses at the caput we anticipate remarkable improvement in success rate. This expectation runs counter to current dogma and requires some explanation, which follows.

Epididymal Physiology: Is the Epididymis Just a Long Stupid Tube?

Because of advances in microsurgical techniques, it is now possible to bypass most cases of epididymal obstruction with a high incidence of technical success.^{38, 42, 43} The fertilizing capacity of spermatozoa that have not traversed all sections of the epididymis can ideally be studied with this human clinical model. In every animal that has been studied, spermatozoa from the caput epididymidis are only capable of weak circular

motion at most and are not able to fertilize.²⁷ Spermatozoa from the corpus epididymidis can occasionally fertilize but the pregnancy rate is low.

But few of these previous animal studies allowed the spermatozoa time to mature and thereby possibly develop fertilizing capacity. Spermatozoa were simply aspirated from specific regions of the epididymis and then promptly inseminated. In most studies in which the epididymis was ligated to determine if time alone could allow spermatozoa maturation, the obstructed environment was so pathological that no firm conclusions could be reached.^{13, 15, 29}

In 1969, Orgebin-Crist²⁷ pointed out that we still did not know with certainty from any of these animal studies whether the factors governing the maturation process of spermatozoa are intrinsic to the spermatozoa themselves and just require time, or whether spermatozoa must transit through most of the epididymis in order to mature. It was entirely possible that aging alone might mature the spermatozoa, and that spermatozoa might not need to pass through all of the epididymis in order to develop the capacity to fertilize. Yet because of the animal studies alluded to, and poor results in humans using nonmicrosurgical techniques, it has always been assumed that epididymal blockage carries a poor prognosis.^{3, 16, 17, 32}

As far back as 1931, however, Young's experiments in guinea pigs with ligation at various levels of the epididymis indicated to the contrary:⁶³ that the time consumed by spermatozoa in passing through the epididymis is necessary for a completion of their development, that the changes undergone during this period represent a continuation of changes, which start while the spermatozoa are still attached to the germinal epithelium, and are not conditioned by some specific epididymal secretion. In fact Young observed the same "inversion" of regions of sperm motility and nonmotility in the obstructed epididymis that we have observed in clinical obstructive azoospermia. The more distal regions have the poorest motility and the more proximal regions have the best motility. Young concluded that in an obstructed epididymis the more distal sperm are senescent, while the more proximal sperm have had time to mature despite having not traversed the epididymis.

Our clinical experience with specific tubule vasoepididymostomy supports Young's original thesis.

All vasoepididymostomies were performed with the "specific-tubule" technique we have described, which involves an end-to-end anastomosis of the inner lumen of the vas to the epididymal tubule, mucosa to mucosa in a leakproof fashion.^{39, 42, 43} Virtually all of the earlier related literature involved vasoepididymostomy with a longitudinal cut through the epididymal tunic and into the epididymal tubule that resulted in a random cutting of the epididymal tubule in many of its convolutions, which gives the appearance of many tubules leaking

Table 6. CORPUS EPIDIDYDIS: LACK OF RELATION OF POSTOPERATIVE SPERMATOZOA COUNT TO PREGNANCY RATE

Spermatozoa Count (per ml)	Pregnant	Not Pregnant
Azoospermic	0 (0%)	30
0 to 1×10^6	2 (67%)	1
1 to 5×10^6	5 (63%)	3
5 to 10×10^6	11 (65%)	6
10 to 20×10^6	6 (50%)	6
20 to 40×10^6	17 (81%)	4
40×10^6	32 (74%)	11
Unknown	5	0
	78 (56%)	61

Summary—

Patency rate (78%)

Overall pregnancy rate (56%)

Pregnancy rate in "patent" cases (72%)

Table 7. CORPUS EPIDIDYDIS: RELATION OF PERCENT DIRECTIONAL SPERMATOZOA MOTILITY TO PREGNANCY RATE IN "PATENT" CASES

Directional Motility (%)	Pregnant	Not Pregnant
0-19	13 (48%)	14
20-39	18 (75%)	6
40-60	19 (76%)	6
60	22 (81%)	5

Table 8. CORPUS EPIDIDYDIS: LACK OF RELATION OF AGE OF WIFE TO PREGNANCY RATE IN "PATENT" CASES

Age Of Wife (years)	Pregnant	Not Pregnant
25	14 (78%)	4
25-29	30 (68%)	14
30-35	30 (75%)	10
35	4 (67%)	2

Table 9. CORPUS EPIDIDYDIS: LACK OF RELATION OF LEVEL OF CORPUS EPIDIDYMAL ANASTOMOSIS TO PREGNANCY RATE IN "PATENT" CASES

	Pregnant	Not Pregnant
Proximal corpus	7 (88%)	1
Mid corpus	17 (74%)	6
Distal corpus	54 (71%)	22

Table 10. CORPUS EPIDIDYDIS: PERCENT PREGNANT AT VARYING INTERVALS POSTOPERATIVE IN RELATION TO SPERM COUNT IN "PATENT" CASES

Sperm Count ($\times 10^6$ per ml)	6 Months	12 Months	18 Months	24 Months	>24 Months
1-5	56%	22%	22%		
5-10	63%	25%		13%	
10-20	17%	49%		17%	17%
20-40	44%	28%	11%	11%	6%
40	34%	28%	6%	9%	22%
100%	41%	29%	8%	10%	12%

Table 11. CORPUS EPIDIDYDIS: LACK OF RELATION OF SPERM COUNT TO MEAN TIME TILL PREGNANCY IN "PATENT" CASES

Sperm Count ($\times 10^6$ per ml)	Mean Time Till Pregnancy (months)
1-5	6.7
5-10	6.0
10-20	10.5
20-40	4.3
40	6.4

Table 12. HEAD OF EPIDIDYDIS: RELATION OF PREGNANCY TO SPERM MOTILITY IN 37 CASES WITH PATENCY

Sperm Motility (%)	Pregnancy Rate (%)	Pregnant	Not Pregnant
0-20	15	2 (13%)	11 (52%)
20	58	14 (87%)	10 (48%)
Totals	43	16 (100%)	21 (100%)

Table 13. HEAD OF EPIDIDYDIS: RELATION OF AGE OF WIFE TO PREGNANCY RATE IN CASES WITH PATENCY

Age of Wife (years)	Pregnancy Rate (%)	Pregnant	Not Pregnant
25-30	67	12 (75%)	6 (29%)
30	21	4 (25%)	15 (71%)
Totals	43	16 (100%)	21 (100%)

Table 14. HEAD OF EPIDIDYDIS: LACK OF RELATION OF LEVEL OF SUCCESSFUL VASOEPIDIDYMOSTOMY TO PREVIOUS FAILURE

	Pregnant	Not Pregnant
Redo after previous failure	6 (38%)	10
Virgin case	10 (29%)	25

Table 15. HEAD OF EPIDIDYDIS: RELATION OF POSTOPERATIVE "PATENCY" TO AREA OF ANASTOMOSIS AT HEAD OF EPIDIDYDIS

	Proximal Caput	Mid Caput or Mixed	Distal Caput
"Patent"	9 (53%)	10 (71%)	17 (89%)
Nonpatent (Azoospermia)	8 (47%)	4 (29%)	2 (11%)

spermatozoa. The vas is sutured to that outer epididymal tunic in the hope that a fistula would form. Because of the high rate of technical failure with that methodology, reliable data on the fertility of spermatozoa from the epididymis in the past have been difficult to obtain.

With the specific-tubule technique used in this series, the epididymis is transected proximally until the point is reached where many spermatozoa are found (Fig. 1). Fluid at every level is examined under a phase contrast microscope in the operating room for the presence of and quality of spermatozoa. The anastomosis of the vas to the epididymis is performed at the transition point from no spermatozoa to the point with an abundant amount of spermatozoa in the fluid coming from the epididymal tubule (Fig. 2).

The fact that when a technically successful anastomosis to anywhere along the corpus epididymidis is achieved, almost 72 percent of the wives get pregnant, with a mean time to conception of 6 months, clarifies the issue that spermatozoa do not necessarily have to traverse the entire corpus or cauda epididymidis to achieve fertilizing capacity.

The lower pregnancy rates in previous clinical series most probably relate to a number of factors. We performed a specific tubule anastomosis rather than create a fistula, which could lead to lower "patency" rates and even poorer spermatozoa motility in the cases that are "patent."^{3, 32} Newer microsurgical techniques have thus clearly improved the quality of spermatozoa in the ejaculate postoperatively.

It is fascinating that the spermatozoa count had no impact on pregnancy rate but spermatozoa motility did. This finding agrees with many clinical studies that demonstrate low spermatozoa counts in a high percentage of normal fertile males.^{35, 46, 49, 54}

If the oligospermia is caused by partial obstruction (or epididymal dilatation) poor motility would result and fertility may be compromised. But if a patient's

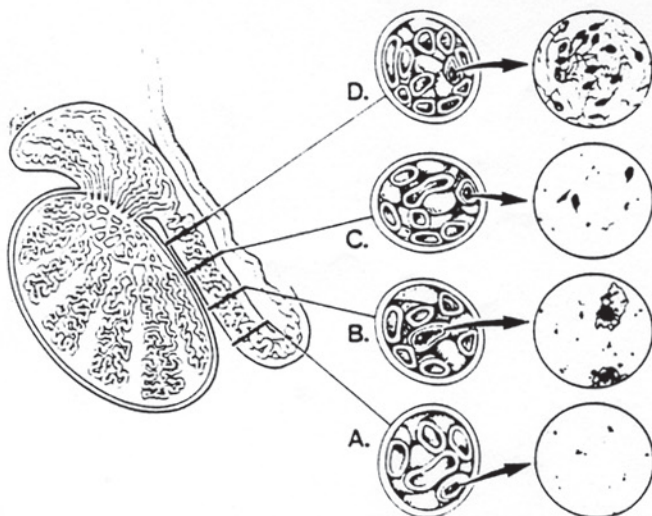


Figure 1. Serial sectioning of epididymis until the site of the proximal-most obstruction is bypassed.

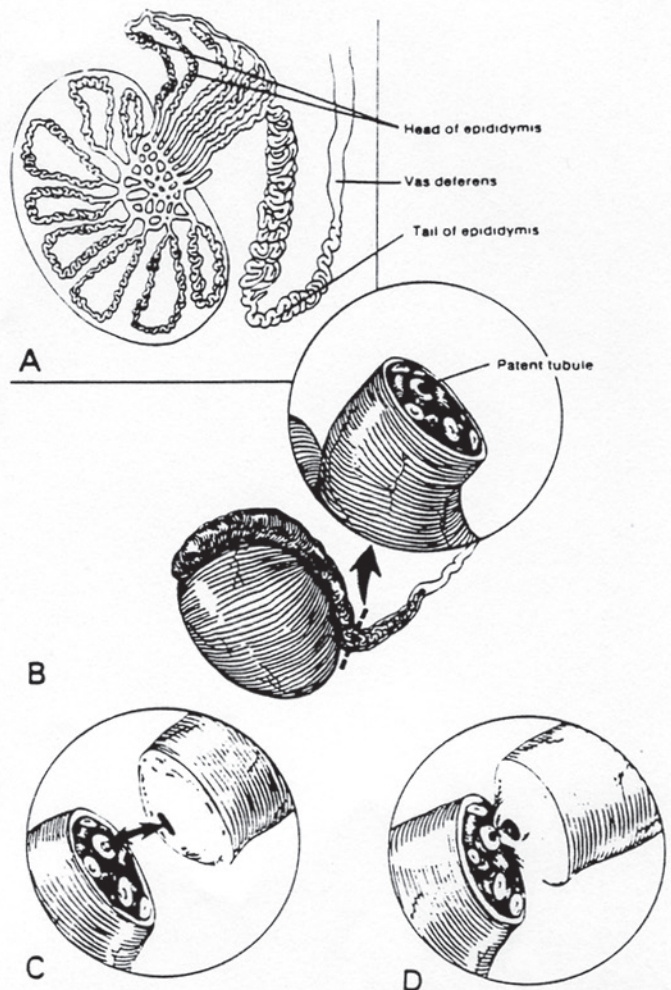


Figure 2. "Specific-tubule" anastomosis of vas lumen to the epididymis proximal to the site of obstruction.

oligospermia is simply a reflection of his low testicular sperm production, fertility may not be poor.

In 1969, Marie Claire Orgebin-Crist²⁷ asked whether factors governing the maturation process of spermatozoa are intrinsic to the spermatozoa, or whether they reside in the epididymis. Epididymal ligation experiments have not always been clear in answering this question because they cause dilatation and epithelial disruption that negatively affects the motility of spermatozoa so retained.^{13-15, 29, 53} Yet Young was able to draw a tentative conclusion in 1931 that indeed sperm maturation may be completely independent of epididymal transport. Others have made similar speculations regarding the corpus and cauda epididymidis.^{5, 33}

A vasoepididymostomy model such as ours, in which spermatozoa cannot traverse the full length of epididymis, would allow maturation to occur with time only in the vas deferens and help clarify this issue. The fact that spermatozoa which could not have travelled through any portion of the corpus or cauda epididymidis were capable of fertilization indicates that a full journey through the epididymis is certainly not required for maturation of spermatozoa sufficient to allow pregnancy. Because pregnancy occurred in the

wives of almost half of the men with patent cases to the caput indicates that transit beyond the head of the epididymis is not an absolute requirement for spermatozoa to attain fertilizing capacity.

None of these patients underwent any special treatments, such as in vitro fertilization or gamete intrafallopian transfer (GIFT), and these pregnancies all occurred simply with natural intercourse. In the next several years we may find out whether with in vitro techniques more than 43 percent of these patients with spermatozoa from the caput epididymidis will or will not be able to accomplish fertilization.

Further clinical cases have demonstrated that it is even possible in some circumstances for spermatozoa that have never traversed any length of epididymis to fertilize the human egg. In two cases reported of vasa

efferentia to vas deferens anastomoses, the postoperative ejaculate contained normally motile sperm, and the wives became pregnant.⁴⁴ In addition, pregnancy from aspiration of epididymal spermatozoa combined with in vitro fertilization and zygote intrafallopian transfer (ZIFT) in cases of unrepairable obstruction gives further evidence that transit through the epididymis is not a requirement for fertilization.^{45, 48} Newer studies of epididymal sperm transport in the human indicate that the epididymis is not a storage area, and indeed spermatozoa transit the entire epididymis very quickly, in a mere 2 days not 11 days as previously thought.²⁰ Thus it is possible that in humans, the epididymis may not be as essential to spermatozoa development and fertility as it appears to be in most other animals.

Pregnancy with Sperm Aspiration from the Proximal Head of the Epididymis

A NEW TREATMENT FOR CONGENITAL ABSENCE OF THE VAS DEFERENS

It has long been assumed that sperm must pass through a certain length of epididymis to mature, gain progressive motility, and become capable of fertilization. In every animal thus far studied, sperm from the nonobstructed proximal head of the epididymis exhibit only weak, circular swimming motions and are incapable of progressive motility or fertilization of the egg. It is thought that only when sperm have traversed through most of the corpus epididymis that they mature sufficiently to become progressively motile and are able to fertilize.²⁷ But our observations suggest that their journey through the epididymis may not be an absolute requirement and that sperm may need only a period of time to mature after leaving the testicle.

Congenital absence of the vas deferens accounts for 11 to 50 percent of cases of obstructive azoospermia and, heretofore, has been considered basically untreatable.¹¹ A large and frustrating group of patients have been shown on countless testicular biopsy specimens to have normal spermatogenesis and are, theoretically, making sperm quite capable of fertilizing an egg. Yet treatment up until the present time has been very dismal.⁵¹

Dr. Ricardo Asch with his team and our team have collaborated equally to develop a treatment protocol involving microsurgical aspiration of sperm from the proximal region of the epididymis, combined with in vitro fertilization and ZIFT, which now offers very good results in this previously frustrating group of couples.^{36, 45}

We now have a method for microsurgical sperm aspiration from the proximal-most region of the head of the epididymis, combined with in vitro fertilization,

with the first documentation of fertilization and pregnancy utilizing this approach for the treatment of congenital absence of the vas deferens.

Induction of Follicular Development and Oocyte Retrieval

The female partners of men with azoospermia caused by congenital absence of the vas underwent induction of multiple follicular development with the following protocol: leuprolide acetate (Lupron, TAP Pharmaceuticals, North Chicago, IL), 1 mg subcutaneously, daily (8:00 a.m.) from day 1 of the menstrual cycle until the day of follicular aspiration. Patients received human follicle stimulating hormone (FSH) (Metrodin, Serono Laboratories, Inc., Randolph, MA) and human menopausal gonadotropins (hMG) (Pergonal, Serono), 150 IU intramuscularly (IM), daily (4:00 p.m.) from day 2 of the menstrual cycle until days 9 and 8 (patients 1 and 2), respectively. Human chorionic gonadotropin (hCG) (Profasi, Serono), 10,000 IU, was administered IM (9:00 p.m.) on days 9 and 10, respectively.

The patients underwent follicular aspiration, 36 hours after hCG administration, in the operating room under intravenous sedation with titrating doses of 0.1 to 0.25 mg of fentanyl (Sublimaze, Janssen Pharmaceutical, Inc., Piscataway, NJ) and 5 to 7 mg of midazolam HCl (Versed, Roche Laboratories, Nutley, NJ).

Follicular aspiration was performed using a transvaginal probe (GE H4222 TV) adapted to an ultrasound system (GE RT3000, General Electric Company, Milwaukee, WI) with a needle set for ovum aspiration and follicle flushing (Labotect, Bovenden-Göttingen, FRG) (no. 4060-2, length 300 mm, 1.4 mm

Two days after insemination embryos are transferred to the fallopian tubes of each patient, via minilaparotomy. A technique is used similar to the one for GIFT, via a Tomcat catheter (Monoject, St. Louis, MO), 2.5 cm inside the fimbrial ostium. The entire surgical procedure lasts approximately 30 minutes, and the patients are discharged the next day to undergo an uneventful postoperative recovery. Patients receive progesterone in oil, 25 mg/day, IM, 1 day after the embryo transfer.

RESULTS

At present, of 32 cases, ten pregnancies, two miscarriages, and eight ongoing or delivered live babies (25 percent) have resulted.

Pregnancies that have occurred readily after vasoepididymostomy to the caput epididymis (and even in some cases to the vasa efferentia) suggest that immature sperm that have not had a chance to transit the epididymis might mature on their own during storage in the vas deferens.⁴ If this theory were true, it might explain why we have been able to achieve success by aspirating more proximally, not being limited (because of theoretical considerations) to distal regions of the epididymis where the sperm are generally senescent and nonmotile in the obstructed state.

Other factors in the success of this technique, which may be equally important, are (1) obtaining large numbers of oocytes in order to increase the odds for fertilization, (2) incubating sperm outside of the milieu of the obstructed epididymis, and (3) transferring the embryos into the fallopian tube rather than into the uterus.

Although these results will have to be considered preliminary until greater numbers are obtained, for the moment it is safe to conclude: (1) sperm from the proximal-most caput epididymis are capable of fertilization of the human egg in vitro; (2) passage of time after emergence from the testicle may be adequate for sperm maturation without the absolute need for transit through the rest of the epididymis; and (3) an approach for achieving pregnancy in couples with a heretofore dismal condition, congenital absence of the vas deferens, now exists.

EDITORIAL COMMENT

Dr. Silber has remained a pioneer in microsurgery and andrology. He has had extensive experience particularly in vasoepididymostomy and has had more favorable results with this operation than most urologists. He makes the point that even anastomosis to the caput of the epididymis has been quite successful. This success runs contrary to some previous reports, but few have had Dr. Silber's great experience. We have had a few favorable results with vasoepididymal anastomoses into the body or lower portion of the caput of the epididymis. An end-to-side vasoepididymal anastomosis is preferred.

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OPERATIVE UROLOGY

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