

Microsurgical vasectomy reversal : results and predictors of success

Gert R. DOHLE, Marij SMIT

Andrology unit, Department of Urology, Erasmus University Medical Centre, Rotterdam, The Netherlands

ABSTRACT

Microsurgical vasectomy reversal is a challenge for the physician but successful treatment depends on the experience and skills of the surgeon. Fertility can often be restored, thus avoiding the need for artificial reproductive techniques. Also, the surgical procedures can be combined with sperm aspiration and cryopreservation, to be used for Intracytoplasmic sperm injection (ICSI) in cases of surgical failure. We describe the results of 217 vasovasostomy procedures, with special emphasis on recent technical refinements and prognostic indicators.

Between 1998 and 2002 we performed 217 vasovasostomy-procedures in an outpatient clinic setting. Refertilisation was successful in 76.5%, spontaneous pregnancy occurred in 42% of the couples after a follow-up of at least 1 year. The main prognostic factors determining the outcome of the surgery was the interval between vasectomy and refertilisation and the age of the female partner: patency was 89% after an interval of less than 5 years and pregnancy occurred in 56% of these couples. After an interval of more than 10 years patency decreased to 75% and pregnancy results dropped to 24%. Epididymal dysfunction with poor motility score and secondary epididymal obstruction appeared to be common after a long interval. Furthermore, in men with partners older than 35 years of age pregnancy was only 21%, indicating limited ovarian reserve as an important factor in determining the final outcome.

In men with a long obstructive interval between vasectomy and reversal an obstruction of the epididymis can be found due to a blow-out of the epididymal tubule with subsequent leakage of semen in the organ and fibrosis. A vaso-epididymostomy procedure is needed to treat the obstruction. Recently, surgical refinements, such as the invagination technique, have been introduced for the vaso-epididymostomy procedure, showing promising first results. This simplified technique enables less experienced microsurgions to perform this difficult operation

successfully. The results of vasectomy reversal procedures can be improved substantially if the surgeon is able to perform a vaso-epididymostomy in cases of a secondary epididymal obstruction, occurring in about 25% of men with an interval of more than 10 years.

Key words : male infertility, microsurgery, vasectomy reversal, vasoepididymostomy

I. INTRODUCTION

Microsurgery in urology is mainly applied in obstructive male infertility and varicocele repair. Other indications are vascular erectile dysfunction and penile or testicular vascular trauma. Obstructions of the male genital tract represent 5-10% of the causes of male infertility and in 70-80% of these men surgical repair can be performed [11].

In Western Europe about 10-15% of the male population rely on the vasectomy procedure as a contraceptive method. Since divorce rates are increasing, the demand for vasectomy reversal is increasing : in 2-6.5% of the vasectomised men a vasovasostomy is currently being performed [7].

We have analysed the results of microsurgical vasectomy reversal procedures with special focus on the prognostic role of the interval between vasectomy and vasovasostomy (VVS) and the age of the female partner in determining the final outcome.

Correspondance :

Dr G.R. DOHLE, MD, Ph.D - Dept. Urology - Erasmus University Medical Centre Rotterdam, P.O. Box 2040, 3000 CA Rotterdam, The Netherlands
Email g.r.dohle@erasmusmc.nl

II. MATERIAL AND METHODS

A retrospective analysis was performed of 217 vasectomy reversal procedures, performed between 1998 and 2002.

In brief the operation was performed as follows: a high scrotal delivery of the testis was performed, allowing the surgeon to perform an anastomosis even in the lower inguinal region in case the site of the vasectomy is located here. A vertical incision is preferred because it can be extended into the inguinal region, if necessary. The site of the previous vasectomy was identified and both ends of the vas deferens were mobilised for a tension free anastomosis. Stripping of the vas was carefully avoided since this will cause circulatory problems and subsequent stenosis of the vas deferens. The patency of the distal (inguinal) part of the vas deferens was tested by flushing a small amount of saline through a 24-gauge angiocatheter into the lumen. Under the microscope all fibrotic tissue, which can be recognised by white scarring bands in the seromuscular layer of the vas deferens, was excised.

The proximal part of the vas deferens was cut in a similar fashion and any fluid from the testicular part of the vas deferens was examined with a light microscope for the presence of spermatozoa. The absence of fluid or spermatozoa was considered an indication for epididymal inspection : if the epididymis was dilated entirely, the dissection of the vas deferens was continued until good semen quality was found in a more proximal part. Otherwise, epididymal exploration with microsurgical epididymal sperm aspiration (MESA) was performed and motile spermatozoa were harvested for cryopreservation, to be used for IVF/ICSI if needed and a vaso-epididymostomy (VES) procedure was performed [9].

Semen analysis was performed twice after the operation at three months and 6 months. Couples were interviewed at least one year after the procedure for the occurrence of spontaneous pregnancy and artificial reproductive techniques (ART).

III. RESULTS

We performed of 217 vasectomy reversal procedures between 1998 and 2002. Mean male age was 46 years, and mean female partners age was 31 years. The average interval between vasectomy and vasovasostomy was 9.3 years. Complications were recorded in 24 men (11%), mainly hae-

matomas and wound infections. No major complications occurred. Refertilisation was successful in 76.5%, spontaneous pregnancy occurred in 42% of the couples after a follow-up of at least 1 year. Azoospermia occurred in 46/217 (21%) men, in 34 men directly after the operation at the first semen analysis, in 7 cases within one year, and in another 5 after a longer follow-up.

1. The role of the interval

In a series of 217 vasovasostomy procedures, 118 men had an interval of more than 10 years. Figure 1 shows the results of the patency and pregnancy rates at different interval periods between vasectomy and VVS: patency was 89% after an interval of less than 5 years and pregnancy occurred in 56% of these couples. After an interval of more than 10 years patency decreased to 75% and pregnancy results dropped to 24%.

Table 1 shows the results of semen analysis after 217 VVS procedures. Sperm motility was significantly lower in patients with an obstructive interval between vasectomy and VVS of more than 10 years. The results of the postoperative sperm count and antisperm antibody binding were not significantly different between men with a short interval and a long interval.

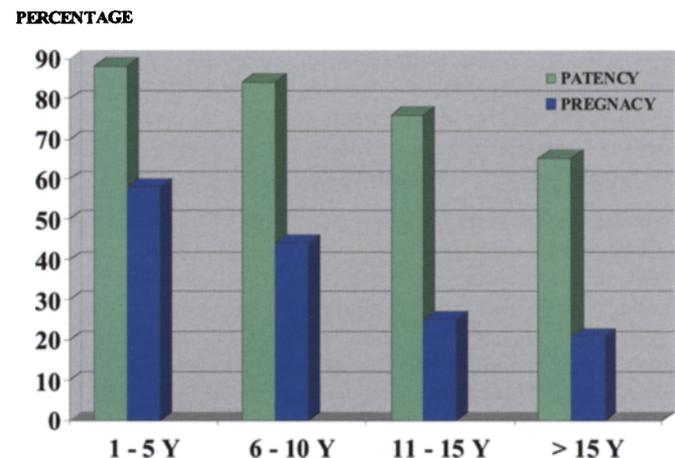


Figure 1 : Patency and pregnancy rates after vasovasostomy at different intervals (Y = Years) between vasectomy and reversal.

Table 1 : Results of the sperm count, sperm progressive motility and antisperm antibody (MAR) test according to the length of the obstructive interval between vasectomy and reversal.

SPERM COUNT	< 1.0 mil./ml (%)	1.0-20 mil./ml (%)	> 20 mil./ml (%)	< 10% Motility (%)	MAR-TEST Positive (%)
OBSTRUCTIVE INTERVAL < 10 YEARS	8/62 (12.9)	34/62 (54.8)	20/62 (32.3)	9/30 (30.0)	29/41 (70.7)
OBSTRUCTIVE INTERVAL > 10 YEARS	14/77 (18.2)	42/77 (54.5)	21/77 (27.3)	25/46 (54.3)	18/31 (58.1)
Student's T-test (P-value)	N.S.	N.S.	N.S.	P = 0.025	N.S. (P=0.49)

N.S. = non significant

2. The role of the partners age

In the series of 217 patients 30 men had a female partner older than 35 years. The mean age of these women was 38.5 years (range 36-43 y). Sixteen women had already conceived in a previous relationship. The mean interval between vasectomy and reversal in these couples was 12.0 years. The post-operative semen analysis showed oligozoospermia in 19/30 (63.3%) and a normospermia in only 4 couples. Patency rate was 76.6%, spontaneous pregnancies occurred in 6/30 (20.0%).

IV. DISCUSSION

Microsurgical repair after vasectomy can be a very successful procedure, since both patency and pregnancy results are high under good surgical conditions and after a short interval. The advantage of microsurgery is that it enables the surgeon to perform a delicate and exact alignment between the proximal and distal part of the dissected vas deferens [9].

The operative success of the vasectomy reversal procedure depends on several factors :

- Gentle tissue handling, with careful preservation of the nutritional vessels of the vas deferens.
- Accurate mucosa to mucosa approximation.
- Tension free leak-proof anastomosis.
- Excision of fibrotic vasal tissue.
- The presence of spermatozoa in the proximal (testicular) vas deferens.
- A modified one-layer or two-layer microsurgical anastomosis of the vas deferens.
- Bipolar diathermia and non-absorbable 9-zero and 10-zero double-armed sutures.

Late stenosis of the anastomosis is reported in about 12-18% of the patients within one year [18]. Failure after a first VVS is usually caused by stricture of the anastomosis and epididymal blockage. Only in a few men an epididymal dysfunction or a testicular insufficiency is the cause of the failure.

1. Prognostic factors

Silber was the first to describe an inverse relationship between the duration of the obstructive interval and the patency and pregnancy rates. The pregnancy rate after VVS progressively decreases with the duration of the obstructive interval [24]. Although, even in men with an interval >15 years patency rate can be as high as 60-70%, pregnancy rate is only 20-30%, mainly due to loss of epididymal function [2, 14].

The age of the female partner is a strong predictive factor in the treatment of infertile couples [21]. The decline of ovarian function in aging woman results in a decrease in pregnancy rate, both spontaneous and with artificial reproductive techniques. From the results of ART in older woman it is esti-

ated that the fertility potential of a woman aged 35 is only 50% of the fertility of a woman aged 25 years ; by the age of 38 years this is further reduced to only 25%, and over the age of 40 years it is less than 5%. Kolettis *et al.* reported a dramatic decrease in delivery rates per ICSI cycle in women older than 36 years : the rate dropped from 34% in women aged 30-36 to 13% for women aged 37-39 and only to 4% in women 40 years and older [15].

It has been suggested that men with older female partners who seek treatment for post-vasectomy infertility should undergo sperm aspiration and ICSI rather than vasectomy reversal. Recently, Deck and Berger compared the results of vasectomy reversal in men with ovulating female partners older than 37 years to the results of sperm retrieval and ICSI for woman in the same age category [6]. Birth rate after a follow-up of at least one year was 17% after vasectomy reversal and 8% per cycle in the ICSI group. They concluded that vasectomy reversal is the treatment of choice in men with female partners older than 37 years, although pregnancy rates were low in both groups. Sperm retrieval and ICSI did not improve the final outcome of these couples. VVS appeared to be more cost-effective than MESA/ICSI.

In men with a long obstructive interval a decrease in both the sperm count and the progressive motility is seen (Table 1). The low number of motile spermatozoa can be the consequence of epididymal insufficiency, reactive oxygen species (ROS) and antisperm antibodies [22, 19].

The role of the epididymis is storage and maturation of spermatozoa, and passage through the organ is essential for normal fertilisation. Epididymal insufficiency can be seen after a long obstructive interval with dilatation of the epididymal tubule. ROS, generated by leukocytes, affect immature spermatozoa which highly susceptible to oxidation, since enzymes for neutralisation of ROS are absent in germ cells. Leukocytospermia can be the consequence of the epididymal obstruction and a low-grade infection of the genital tract [22]. Epididymal obstruction should be suspected during surgery if no fluid can be expressed from the proximal vas deferens or if the fluid contains no spermatozoa.

Antisperm antibodies are found in 20-50% of the ejaculates after the operation [19]. Antisperm antibodies may cause sperm agglutination and low motility. IgA antibodies on the cell surface of the spermatozoa are bound to anti-IgA in the cervical mucus, preventing further progression of the spermatozoa into the uterine cavity. Sperm washings and intra-uterine insemination are indicated in couples with major IgG and IgA binding and low motility.

Severe oligozoospermia with low sperm count and motility is usually the consequence of a stricture at the anastomosis due to imprecise microsurgical alignment of the vasal lumen, malnutrition of the vas deferens or leakage of seminal fluid causing granuloma and fibrosis [4]. These men should be treated by a repeat reversal procedure rather than ART, since both patency and pregnancy rates are acceptably high after a second procedure [8].

The repeat reversal procedure is indicated for men with

initial patency and late stenosis of the anastomosis resulting in severe oligozoospermia or azoospermia. Partial obstruction with oligozoospermia and azoospermia after an initial good semen analysis results occurs in 12-18% [18]. A second reversal procedure will result in patency rate of 50-80% and spontaneous pregnancies were reported in 20-50% [12]. Therefore, a repeat reversal with intraoperative sperm aspiration and cryopreservation appears to be the first treatment option in these couples.

2. ART or surgery ?

Sperm retrieval and ICSI has been advocated as the treatment of choice for obstructive male infertility, regardless the etiology. However, the results of microsurgical treatment of obstructive azoospermia as compared to IVF/ICSI results are much in favour for surgical treatment [10]. Pregnancy rates of 44-65% after vasectomy reversal are better than the ongoing pregnancy rate after MESA/ICSI of 29%. In addition, even the less successful VES procedure still results in a spontaneous pregnancy rate of 31-56%. Furthermore, the cost per delivery after microsurgery and after MESA/ICSI is much in favour of surgical treatment [13].

With surgical treatment several complications and disadvantages of *in vitro* reproductive techniques can be avoided, like hormonal treatment of the partner, transvaginal ovum pick-up and embryo transfer and the higher risk for offspring with a (sex-) chromosomal abnormality after ICSI procedures [16]. Therefore, epididymal sperm aspiration and intracytoplasmic sperm injection should be reserved for couples not amenable to microsurgical reconstruction of obstructive azoospermia.

3. Vaso-epididymostomy

A vasovasostomy procedure is indicated if sperm are found in the proximal part of the vas deferens during surgery. Sperm can usually be found in clear or white seminal fluid, creamy thick "tooth-paste" like fluid usually does not contain spermatozoa and is often seen in cases of epididymal blockage [1]. The absence of fluid or spermatozoa is an indication for epididymal inspection with microsurgical epididymal sperm aspiration (MESA) and vaso-epididymostomy. Epididymal obstructions appear more frequently after a long interval between vasectomy and reversal and are caused by a blow-out of the epididymal tubule with semen leakage and subsequent fibrosis and stenosis of the organ.

VES is a technically demanding procedure that requires advanced microsurgical skills. The end-to-side vasotubulostomy was popularised by Silber [23]. The reported patency rates after the procedure range from 64-78%, spontaneous pregnancies occur in 31-56% [18]. Passage through a substantial portion of the epididymis is essential for the fertilising capacity of the spermatozoa. An anastomosis between the vas deferens and the head of the epididymis usually does not result in spontaneous pregnancy. MESA/ICSI procedures are indicated for these couples.

Recently, Berger introduced an invagination technique

modification to facilitate the anastomosis between the epididymal tubule and the lumen of the vas deferens, with high initial patency results [3]. The dilated epididymal tubule is exposed through a small incision in the tunica vaginalis and slight pressure of the epididymis by the thumb and the index finger is applied. Three double-armed 10-zero nylon sutures are placed through the anterior wall of the tubule before opening the lumen and fixated insight-out to the mucosa of the vasal lumen in a triangular fashion. A tubulotomy is performed in the middle of the three sutures and the seminal fluid is examined for spermatozoa. The anastomosis is created by this invagination method at six sites for mucosal adaptation, using only 3 double-armed sutures. The procedure has recently been modified by Marmar, using only 2 double-armed 10-zero sutures [17]. Others have also shown the advantages of invagination techniques in an animal model [20] : it is easier to learn than the end-to-side procedure and has shown to be equally effective. In small series the patency was as high as 90% and already established 3 months after the operation [3]. For optimal results the surgeon performing the reversal should be able to perform a VES in case of secondary epididymal blockage, occurring more frequently in men with a long interval between vasectomy and reversal [5].

V. SUMMARY

Microsurgical repair of obstructive male infertility is a challenge for the physician, but training and experience are mandatory for good results. Fertility can often be restored or improved, thus avoiding the need for artificial reproductive techniques [24]. The procedures can be combined with sperm aspiration and cryopreservation, to be used for ICSI in cases of failed microsurgery. Comparing microsurgery to MESA/ICSI, both the results and the costs are much in favour of surgery. Urologist with an interest in Andrology should be encouraged to learn microsurgery as a part of their surgical training. The operations are best performed in centres for reproductive medicine, allowing different options to be performed for selective cases.

REFERENCES

1. ANGER J.T., GOLDSTEIN M. : Intravasal "toothpaste" in men with obstructive azoospermia is derived from vasal epithelium, not sperm. J. Urol., 2004, 172 : 634-636.
2. BELKER A.M., THOMAS A.J., FUCHS E.F., KONNAK J.W., SHARLIP I.D. : Results of 1469 microsurgical vasectomy reversals by the vasovasostomy group. J. Urol., 1991, 145 : 505-511.
3. BERGER R.E. : Triangulation end-to side vasoepididymostomy. J. Urol., 1998, 159 : 1951-1953.
4. CARBONE D.J., SHAH A., THOMAS A.J., AGARWAL A. : Partial obstruction, not antisperm antibodies, causing infertility after vasovasostomy. J. Urol., 1998, 159 : 827-830.
5. CHAWLA A., O'BRIEN J., LISI M., ZINI A., JARVI K. : Should all urologists performing vasectomy reversals be able to perform vasoepididymostomies if required ? J. Urol., 2004, 172 : 1048-1050.
6. DECK A.J., BERGER R.E. : Should vasectomy reversal be per-

- formed in men with older female partners ? J. Urol., 2000,163: 105-106.
7. ENGELMANN U.H., SCHRAMEK P., TOMAMICHEL G., DEINDL F., SENGE T. : Vasectomy reversal in central Europe: results of questionnaire of urologists in Austria, Germany and Switzerland. J. Urol., 1990, 143 : 64-67.
 8. FOX M. : Failed vasectomy reversal : is a further attempt worthwhile using microsurgery ? Eur. Urol., 1997, 31 : 436-440.
 9. GOLDSTEIN M. : Microsurgical vasovasostomy : Surgical approach, decision-making, and multilayer microdot technique. In : Goldstein M. ed. Surgery of male infertility. London, The Saunders Company, 1995, vol. 1 : 46-60.
 10. HEIDENREICH A., ALTMANN P., ENGELMANN U.H. : Microsurgical vasovasostomy versus microsurgical epididymal sperm aspiration/testicular extraction of sperm combined with intracytoplasmic sperm injection. Eur. Urol., 2000, 37 : 609-614.
 11. HENDRY W.F. : Azoospermia and surgery for testicular obstruction. In : Hargreave T.B. ed. Male infertility. London, Springer Verlag, 1994 : 337-363.
 12. HERNANDEZ J., SABANEHGH E.S. : Repeat vasectomy reversal after initial failure : overall results and predictors for success. J. Urol., 1999, 161 : 1153-1153.
 13. KOLETTIS P.N., THOMAS A.J. : Vasoepididymostomy for vasectomy reversal : a critical assessment in the era of intracytoplasmic sperm injection. J. Urol., 1997, 158 : 467-470.
 14. KOLETTIS P.N., SABANEHGH E.S., D'AMICO A.M., BOX L., SEBESTA.M., BURNS J.R.. : Outcomes for vasectomy reversal performed after obstructive intervals of at least 10 years. Urology, 2002, 60 : 885-888.
 15. KOLETTIS P.N., SABANEHGH E.S., NALESNIK J.G., D'AMICO A.M., BOX L.C., BURNS J.R. : Pregnancy outcomes after vasectomy reversal for female partners 35 years old or older. J. Urol., 2003, 169 : 2250-2252.
 16. KURINCZUK J.J : Safety issues in assisted reproduction technology. From theory to reality-just what are the data telling us about ICSI offspring health and future fertility and should we be concerned ? Hum. Reprod., 2003, 18 : 925-931.
 17. MARMAR J.L. : Modified vasoepididymostomy with simultaneous double needle placement, tubulotomy and tubular invagination. J. Urol., 2000,163 : 483-486.
 18. MATTHEWS G.J., SCHLEGEL P.N., GOLDSTEIN M. : Patency following microsurgical vasoepididymostomy and vasovasostomy : temporal considerations. J. Urol., 1995, 154 : 2070-2073.
 19. MEINERTZ H., LINNET L., FOGH-ANDERSEN P., HJORT T. : Antisperm antibodies and fertility after vasovasostomy : a follow-up study of 216 men. Fert. Steril., 1990, 54 : 315-321.
 20. POPKEN G., WETTERAUER U., SCHULTZE-SEEMANN W. : Microsurgical epididymovasostomy in the rat : comparison of end-to-side and two invagination techniques. Urol. Res., 1999, 27 : 214-218.
 21. ROSENWAKS Z., DAVIS O., DAMARIO M. : The role of maternal age in assisted reproduction. Hum. Reprod., 1995, 10 : 165-173.
 22. SHARMA R., AGARWAL A. : Role of reactive oxygen species in male infertility. Urology, 1996, 48 : 835-850.
 23. SILBER S.J. : Results of microsurgical vasoepididymostomy : role of the epididymis in sperm maturation. Hum. Reprod., 1989, 4 : 298-303.
 24. SILBER S.J., GROTTJAN H.E. : Microscopic vasectomy reversal 30 years later : a summary of 4010 cases by the same surgeon. J. Androl., 2004, 25 : 845-859.

Received January 2005 ; accepted February 2005.