Original Article

Clinical experience of vasoepididymostomy using a triangulation technique

HATSUKI HIBI,^{1*} TADASHI OHORI,¹ TOSHIYASU AMANO,² YOSHIAKI YAMADA,³ NOBUAKI HONDA,³ HIDETOSHI FUKATSU³ and YOSHIMASA ASADA⁴

Department of Urology, ¹Kyoritsu General Hospital, Nagoya, ²Nagano Red Cross Hospital, Nagano, ³Aichi Medical University School of Medicine, Nagakute and ⁴Fertility Center, Nakajima Clinic, Toyoyama, Japan

Background: Although the number of patients receiving vasoepididymostomies is gradually increasing, these individuals are limited in the recent advanced assisted reproductive technology (ART) era. A novel technique involving vasoepididymostomy with epididymal tubular invagination has been reported. We attempted to define the results of this method and to compare them with the conventional end-to-side technique in patients with suspected epididymal obstruction and no previous history of vasectomy.

Methods and Results: Eight eligible triangulation end-to-side vasoepididymostomy procedures performed on five azoospermic patients exhibiting either unilateral or bilateral epididymal obstruction are described. The overall patency rate following operation was 100% (five of five). Two pregnancies were achieved

by natural intercourse and one was accomplished via artificial insemination. A single pregnancy was obtained with an intracytoplasmic sperm injection using frozen-thawed sperm collected during the operation.

Conclusion: Vasoepididymostomy, using the triangulation technique for epididymal obstruction, resulted in an earlier patency in all patients. This method may afford advantages when compared with the conventional end-to-side approach; however, larger subject populations are required in order to assess further the efficacy of this procedure. In addition, long-term follow up is necessary. (Reprod Med Biol 2003; 2: 101–104)

Key words: obstructive azoospermia, triangulation technique, vasoepididymostomy.

INTRODUCTION

MICROSURGICAL REPAIR OF epididymal obstruction has improved following the development of microsurgical instruments and suture. However, these techniques require considerable microsurgical skills; moreover, any modification relating to organization and simplification of these procedures is desirable. Recently, simplified vasoepididymostomy using an invagination method in humans has been documented.^{1,2} These results were superior to those of end-to-side methodology, affording reduced operation time. The present investigation reports the outcome of vasoepididymostomy using the triangulation technique in men presenting with epididymal obstruction and no history of vasectomy. Findings were compared with our previous outcomes observed for the side-to-end approach.

MATERIALS AND METHODS

Patients

BETWEEN DECEMBER 2000 and August 2001, 22 azoospermic patients (nine patients displayed obstructive azoospermia, 12 subjects exhibited non-obstructive azoospermia, and a single individual presented with hypogonadotropic hypogonadism) visited our male infertility clinic of the Aichi Medical University Hospital. Seven patients were diagnosed with epididymal obstruction with no history of vasectomy. Five of these patients underwent a vasoepididymostomy. Post-epididymitis appeared to be the causative factor of epididymal obstruction in two cases, whereas in the remaining three cases, the cause was unknown. Five vasoepididymostomies were performed (three of which were bilateral and two of which were unilateral) because of the lack of sperm in epididymal fluid in any region of the unilateral epididymis.

The five patients were 26–35 years of age (mean, 31 years). Patient spouses were 23–38 years of age

*Correspondence: Dr Hatsuki Hibi, Department of Urology, Kyoritsu General Hospital, Goban-cho, Atsuta-ward, Nagoya 456-0057, Japan. Email: hibih@quartz.ocn.ne.jp

Received 18 June 2002; accepted 24 October 2002.

(mean, 32.2 years). The mean duration of infertility was 5.3 years (including a single subject exhibiting secondary infertility because of bilateral epididymitis). Testicular volume was 16–24 mL (mean, 17.6 mL) in the right testis and 14–24 mL (mean, 17.6 mL) in the left testis. Serum luteinizing hormone (LH), follicle stimulating hormone (FSH) and testosterone values were 1.7–4.4 mIU/mL (mean, 2.8 mIU/mL), 2.3–6.9 mIU/mL (mean, 4.1 mIU/mL) and 323–955 ng/dL (mean, 557 ng/dL), respectively. Medical charts of these patients were reviewed in order to compare the results with our previously reported vasoepididymostomy procedures using the end-to-side technique.³

Surgical technique

Triangulation end-to-side vasoepididymostomy was performed under general anesthesia using the method created by Berger.¹ Vasotomy, for preparation of the vas and opening of the tunica vaginalis, was effected. Distal patency of the vas was confirmed with an injection of 5 mL of 1:1 methylene blue lactated Ringer's solution and observation of blue-colored urine through a Foley catheter. Fixation of vas deferens and vasal lumen in close approximation to the selected epididymal tubule was accomplished with 9–0 nylon sutures on the posterior lip of the vasal adventitia to the epididymal tunic. Three double-armed 10–0 nylon sutures were passed through a dilated selected epididymal tubule in triangulation fashion at the 11–1, 3–5 and 7–9 o'clock positions. The incision was made with a microknife followed by microscissors to open the epididymal tubule between the sutures; epididymal fluid was then examined (Figs 1, 2). When no sperm was found, the procedure was repeated more proximally in the epididymis. When sperm could be identified in the epididymal fluid, each needle was passed into the vas lumen and out through the muscularis of the vas cut end. Sutures were tied, followed by invagination of the epididymal tubule into the vas lumen to complete a watertight closure with six points of fixation. The adventitia of the vas was approximated to the cut edge of the epididymal tunic with six to eight sutures of 9–0 nylon. A drain was unnecessary. The patient was required to rest in bed with scrotal support for 1 week. Cryopreservation of sperm during surgery was also conducted in all cases.

RESULTS

TWO OF FIVE patients received unilateral vasoepididymostomy because of the lack of sperm in any

Figure 1 Three double-armed 10–0 nylon sutures were passed through a dilated selected epididymal tubule in a triangulation fashion. The incision was made under the traction of two sutures.

Figure 2 Each needle was passed into the vas lumen and out through the muscularis of the vas cut end.

portion of the epididymis; the remaining three patients underwent a bilateral procedure. Thus, eight vasoepididymostomies were evaluated. Anastomotic sites were cauda and capu in six and two cases, respectively. All patients demonstrated normal motile sperm in their epididymal fluid. Operation time was 255–300 min (mean, 278 min).

All patients, with the exception of one subject who did not undergo semen analysis until 5 months post-surgery, described sperm in their semen at 3 weeks. Six months later, semen analysis revealed normal quality in three patients. Details are presented in Table 1. Two pregnancies were achieved by natural intercourse and normal healthy deliveries were obtained. One patient

Table 1 Semen analysis after surgery (sperm count $\times$ million/mL and motility)

Case no.	3 weeks	3 months	5 months	6 months	Pregnancy
1	0.8 (0)	3.0 (0)	–	30 (70)	Yes
2	–	–	14 (54)	–	Yes
3	0.1 (0)	165 (27)	–	111 (54)	Yes (AIH)
4	1.0 (5)	2.0 (0)	–	40 (0)	No
5	0.2 (0)	–	–	–	Yes (Cryopreserved ICSI)

Data in parentheses are percentages. AIH, artificial insemination by husband; ICSI, intracytoplasmic sperm injection. (–), not done.

showing a normal quality achieved pregnancy via artificial insemination. Another patient desired the use of cryopreserved sperm for intracytoplasmic sperm injection (ICSI) because of the age of his wife (38 years of age); furthermore, pregnancy was achieved by using ICSI with frozen-thawed sperm. Thus, four pregnancies and two healthy babies occurred in the present series.

We previously described the outcome of 24 end-to-side vasoe epididymostomies.³ The average duration of surgery was 259 min; additionally, the patency rate was 54%. Duration of sperm appearance was 2–15 months (mean, 9.6 months). Consequently, a high-patency rate and earlier sperm appearance were observed with the triangulation technique in comparison to the end-to-side procedure conducted by the same surgeon (HH).

DISCUSSION

ALTHOUGH VARIOUS VASOEPIPIDIDYMOSTOMY results have been reported, the majority of causes are considered to be secondary epididymal obstruction such as postvasectomy. The prognosis is good for men presenting with epididymal obstruction caused by a vasectomy; in contrast, men with idiopathic epididymal obstruction exhibit a poorer outcome.^{4,5} The patency rate following vasoe epididymostomy in vasectomized men was 85%, whereas idiopathic epididymal obstruction was approximately 60%.^{6–8}

The conventional microscopic vasoe epididymostomy technique involves suture of a single epididymal tubule directly to the vas mucosa by either an end-to-end or end-to-side anastomosis. Although the results associated with these procedures are improved relative to former fistula methods, these approaches require considerable microsurgical skills; moreover, any modifications that organize and simplify these procedures are desirable.

The concept of tubular invagination vasoe epididymostomy was originally described in a rat model by Stefanovic *et al.*⁹ Only two sutures were used to pull

and secure the epididymal tubule into the vas lumen. Patency was confirmed at 97%; moreover, a histological examination revealed resorption of the invaginated portion of the epididymal tubule. Thus, invagination of the epididymal tubule into the vas deferens may help prevent sperm leakage and subsequent scarring at the site.

A novel vasoe epididymostomy technique involving epididymal tubular invagination for human application has been documented.^{1,2} These modifications appeared to be helpful with respect to the organization and simplification of several aspects of the procedure; furthermore, the results were improved compared with other techniques. The use of fewer sutures, as in the case of the invagination protocol, reduces operative time and facilitates the procedure. The triangulation technique involves three double-armed sutures, which were passed through an epididymal tubule in a triangular fashion. Following tubulotomy between sutures, each needle was passed into the vas lumen. When these sutures were tied, the epididymal tubule was invaginated into the vas lumen to complete a watertight closure with six points of fixation. Thus, triangulation sutures are roughly equivalent to six individual sutures between the vas deferens.¹

In contrast, Marmar emphasized that after placement of the first needle in the epididymal tubule, profound leakage and tubular collapse were often observed, which caused the placement of additional sutures to be more difficult.² He reported a more simplified invagination technique using only two sutures; moreover, operation time was reduced by approximately 35–45 min per procedure. Simultaneous double-needle placement may reduce tubular collapse.²

Although simultaneous double-needle placement appeared to be a simple technique, several technical difficulties were noted. When effecting a simultaneous double-needle placement to the epididymal tubule, the direction of needles should not be changed in a parallel fashion. Moreover, the removal of simultaneously passed

needles should maintain the parallel arrangement. Holding of two needles simultaneously may reduce a precise sense to avoid tubular injury. Although this simplified technique is of great interest, this procedure requires rather precise needle holders and greater surgical skill.

We attempted to compare the results of the triangulation technique with the conventional end-to-side protocol in previously reported patients with suspected epididymal obstruction and no previous history of vasectomy.³ Patient background such as age, endocrine profile, testicular volume, and etiology were not different; the only difference was the age of spouses (32.2 years in the present result, and 26.9 in the previous). Sperm appearance in the semen was observed in all patients undergoing the triangulation procedure, whereas it was approximately 54% with the end-to-side method. The duration of sperm appearance was 3 weeks, with the exception of one subject who did not receive a semen analysis until 5 months after surgery involving the triangulation technique; duration averaged 9.6 months (range, 2–15 months) with the end-to-side approach.^{3,10} Earlier sperm appearance was observed and the patency rate was obviously improved with the triangulation method. Unfortunately, the operation time was not reduced (278 vs 259 min).

A considerable problem associated with this procedure involves the inability to confirm the presence of sperm in the selected epididymal tubule passed by 10–0 nylon sutures until the structure is opened. In the present series, we could not identify the presence of sperm in any portion of the epididymis in two cases, which may have been related to prolonged operation time. Tubulotomy was often difficult within the triangle; additionally, in several instances, a suture was inadvertently cut intra-operatively. We had no experience regarding such complications; consequently, great care is recommended.

In conclusion, vasoepididymostomy involving the triangulation method for epididymal obstruction, where no previous history of vasectomy exists, afforded satisfactory, earlier patency. Although this technique for epididymal obstruction appeared promising in comparison with the previously reported end-to-side approach, a larger sample of patients and long-term follow up is necessary.

REFERENCES

- ¹ Berger RE. Triangulation end-to-side vasoepididymostomy. *J Urol* 1998; **159**: 1951–1953.
- ² Marmar JL. Modified vasoepididymostomy with simultaneous double needle placement, tubulotomy and tubular invagination. *J Urol* 2000; **163**: 483–486.
- ³ Hibi H, Yamada Y, Honda N *et al.* Microsurgical vasoepididymostomy with sperm cryopreservation for future assisted reproduction. *Int J Urol* 2000; **7**: 435–439.
- ⁴ Belker AM. Evaluation of partial anastomotic obstruction after vasovasostomy and predictors of success after vasoepididymostomy. *J Urol* 1998; **159**: 835–836.
- ⁵ Berardinucci D, Zini A, Jarvi K. Outcome of microsurgical reconstruction in men with suspected epididymal obstruction. *J Urol* 1998; **159**: 831–834.
- ⁶ Matsuda T, Iwamoto T, Ito N *et al.* Outcome of seminal tract reanastomosis for obstructive azoospermia: a multi-institutional study. *Jpn J Fertil Steril* 2000; **45**: 143–149.
- ⁷ Matthews GJ, McGee KM, Goldstein M. Microsurgical reconstruction following failed vasectomy reversal. *J Urol* 1997; **157**: 844–846.
- ⁸ Kolettis PN, Thomas J Jr. Vasoepididymostomy for vasectomy reversal: a critical assessment in the era of intracytoplasmic sperm injection. *J Urol* 1997; **158**: 467–470.
- ⁹ Stefanovic KB, Clark SA, Buncke HJ. Microsurgical epididymovasostomy by tubule intussusception: a new technique in rat model. *Fertil Steril* 1991; **55**: 189–193.
- ¹⁰ Amano T, Hibi, Takamizawa A, Takemae K. A case of achieved pregnancy and delivery following vasoepididymostomy using triangulation technique. *Med J Nagano Red Cross Hospital* 2001; **15**: 81–84.