RESULTS OF MICROSURGICAL ANASTOMOSIS IN MEN WITH SEMINAL TRACT OBSTRUCTION DUE TO INGUINAL HERNIORRHAPHY

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The incidence of vasal injury during inguinal herniorrhaphy is estimated at 0.5%. We sought to assess the patency rates and long-term fertility outcome after microsurgical repair of vasal obstruction related to prior inguinal herniorrhaphy.

METHODS: Twenty procedures were performed on 13 men diagnosed with infertility and vasal injury secondary to previous inguinal herniorrhaphy. Eight of these men had undergone bilateral and 5 unilateral inguinal herniorrhaphy. Twelve procedures were vasovasostomies, 3 were crossover vasovasostomies, 2 were vasoepididymostomies, and 3 were crossover vasoepididymostomies. Eight patients were azoospermic, 2 were severely oligospermic (<1 M/mL), 1 was oligospermic, and 2 were asthenospermic. Patency data was obtained on all 13 patients, and pregnancy data was available for 10 couples (77%), with a mean follow-up of 69.5 months.

RESULTS: The overall patency rate was 65%. In the vasovasostomy group, the patency rate was 60% (9/15), and in the vasoepididymostomy group it was 80% (4/5). Among the azoospermic patients, 13 procedures were performed. The patency rate was 42.9% for the vasovasostomy (3/7), and 100% for the vasoepididymostomy procedure (4/4). The overall pregnancy rate was 40%. Of the men who underwent vasoepididymostomy, 80% (4/5) established a pregnancy.

CONCLUSIONS: Microsurgical vasovasostomy after inguinal vas injury results in a reasonable patency rate but a lower pregnancy rate than that after vasectomy reversal. When microsurgical vasoepididymostomy was possible, it resulted in high patency and pregnancy rate. Crossover vasoepididymostomy, when appropriate, can be a useful alternative to inguinal vasovasostomy.

DESCRIPTORS: **Azoospermia. Herniorrhaphy. Infertility. Male. Vasoepididymostomy.**

Prior hernia repair is the most common cause of inadvertent vasal obstruction[1]. The estimated incidence of injury of the vas deferens is 0.3% for adults and 0.8 to 2.0% in the pediatric age group[2-4]. Vasal injury is not usually recognized at the time of hernia surgery. If the patient sustains only a unilateral vas deferens obstruction with a normal contralateral testicle and patent excurrent duct, the injury may forever go unnoticed. However, if there is bilateral injury, a congenital absence of the contralateral vas or an intrinsic abnormality associated with the contralateral testis, the patient will be rendered infertile[5,6].

Correction of these vasal injuries can be challenging. The obstruction is commonly associated with substantial scarring in the inguinal region, particularly if mesh had been used[1,5-9]. Successful reanastomosis after herniorrhaphy is dependent upon adequate mobilization of the ends of the vas, recognition and subsequent correction of a secondary epididymal obstruction, and adequate spermatogenesis. With the availability of gamete micromanipulation, one must question whether microsurgical reanastomosis of the vas deferens should be considered the primary treatment of choice[10,11]. To help answer this question, we retrospectively assessed patency rates and fertility outcome after microsurgical repair of vas deferens obstruction related to inguinal herniorrhaphy.

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From 1983 to 1998, the medical records of 13 patients who underwent a microsurgical reanastomosis of the seminal tract due to hernia repair were reviewed. Eight men had undergone bilateral and 5 unilateral inguinal herniorrhaphies. Ten patients underwent this surgery during childhood, 1 at age 15 years, and 2 during adulthood. None of the 13 men had ever fathered a child. A single urologist performed all of the microsurgical procedures. The indication for the reanastomosis was infertility in 12 and testicular pain in 1 man. The patient with testicular pain was asthenospermic.

Patients with less than 20 M/mL sperm in the ejaculate were considered oligospermic, those with less than 1 M/mL were considered to have severe oligospermia, and patients without sperm were considered azoospermic. Asthenospermia was defined as motility lower than 20%. Eight patients presented with azoospermia, 2 with severe oligospermia (<1 M/mL), 1 with oligospermia (5 M/mL), and 2 with asthenospermia. Four patients had a unilateral atrophic testis, 3 had unilateral congenital absence of the vas deferens, 1 had an orchiectomy due to an undescended testis, and 1 had an undescended testis. The mean patient age was 32 years (range: 26 to 41 years), and the mean obstructive interval was 25.4 years (range: 3 to 40 years) (Table 1). Patency was defined by the presence of long-tailed sperm in a postoperative semen analysis. Information regarding pregnancy rate was obtained via chart review or telephone interview of the couple or referring physician. Patency data was obtained for all patients. Pregnancy data was available for only 10 couples (77%), with a mean follow up of 69.5 months (range: 13 to 181 months).

A testis biopsy was performed on all azoospermic patients to evaluate the degree of spermatogenesis. All patients underwent vasography to confirm the site of obstruction. All surgical anastomoses were performed using the operating microscope.

Surgical technique: If an inguinal vasovasostomy was to be performed, the incision was made in the inguinal region high enough to open the internal ring superiorly in order to identify the distal vas, which usually was to end in the retroperitoneum. Most of the patients had obstruction near the internal ring. These obstructions can often be palpated along the lateral wall of the retroperitoneum. After freeing the vas from the surrounding scar tissue, a 23-gauge angiocatheter was placed into the lumen, and contrast was injected to assure distal patency. Fluid from the proximal end of the vas (testicular) was examined by a light microscopy, noting gross appearance and whether sperm were present. Because of the marked disparity in luminal diameters between the 2 ends of the vas deferens, a modified single-layer microsurgical anastomosis with 9-0 nylon suture was performed.

When crossover or secondary vasoepididymostomy was performed, a 2-layer microsurgical end-to-side single tubule anastomosis was used at the level where sperm were identified[12]. If motile sperm were found, aspiration for cryopreservation was performed using a tuberculin syringe and 23-gauge angiocatheter. The lumen-to-lumen anastomosis between the vas deferens and the epididymis was performed using 4 to 6 interrupted 10-zero nylon sutures. The muscularis and adventitia were approximated to the epididymal tunic with 8 to 12 9-zero nylon sutures.

The technique of crossover vasovasostomy or crossover vasoepididymostomy involved isolating a sufficient length of normal vas on the contralateral side to tunnel through an opening in the scrotal septum, bringing it to the vas deferens (COVV) or epididymis (COVE).

Table 1 - Age, interval between herniorrhaphy and microsurgery, hernia procedure, and type of microsurgery procedure in 13 patients.

Patient	Age	Age at Hernia Repair	Interval	Hernia Procedure	First microsurgery procedure	Second microsurgery procedure
1	36	5	31	Unilateral	Right inguinal vasovasostomy	Right inguinal vasovasostomy
2	34	5	29	Bilateral	Left inguinal vasovasostomy	Left inguinal vasovasostomy
3	26	5	21	Unilateral	Left inguinal vasovasostomy	
4	31	2	29	Bilateral	Crossover vasovasostomy	Crossover vasovasostomy
5	35	5	30	Unilateral	Right inguinal vasovasostomy	
6	31	22	9	Bilateral	Left vasoepididymostomy, Right inguinal vasovasostomy	
7	41	1.5	40	Unilateral	Right inguinal vasovasostomy	
8	28	5	23	Bilateral	Right inguinal vasovasostomy	Right inguinal vasovasostomy
9	28	newborn	28	Bilateral	Right inguinal vasovasostomy	Right vasoepididymostomy
10	29	26	3	Bilateral	Right inguinal vasovasostomy	
11	37	2	35	Bilateral	Right inguinal vasovasostomy	Crossover vasoepididymostomy
12	31	5	26	Bilateral	Crossover vasoepididymostomy	
13	29	3	26	Unilateral	Crossover vasovasostomy	Crossover vasoepididymostomy

RESULTS

A total of 20 procedures were performed in 13 patients. Six patients underwent a second procedure due to primary inguinal vasovasostomy (VV) failure, and 1 patient underwent 2 procedures simultaneously. The semen analysis of these 6 men who underwent a second procedure revealed azoospermia in 3 and severe oligospermia in 3. Of the 20 procedures, 12 were VV, 3 crossover vasovasostomy (COVV), 2 vasoepididymostomy (VE), and 3 crossover vasoepididymostomy (COVE) (Table 2). All testis biopsies in the obstructed side revealed active spermatogenesis.

At the time of surgery, 35% (7/20) of the vasa or epididymides had clear fluid with motile sperm from the proximal end, 20% (4/20) had clear fluid with nonmotile sperm, 5% (1/20) had opaque fluid with motile sperm, 25% (5/20) had an opaque fluid with nonmotile sperm, 10% (2/20) had creamy fluid with nonmotile sperm, and 5% (1/20) had creamy fluid with no sperm in the vasal or epididymal fluid. We did not find a relationship between vasal or epididymal fluid and patency or pregnancy rates. After the 20 procedures, the overall patency rate was 65% (13/20). Of the men who underwent vasovasostomy alone, 60% (9/15) were patent, and 80% (4/5) of those who underwent a vasoepididymostomy demonstrated sperm in the ejaculate. The patient with testis pain (patient number 7) (Table 2) got better after the surgery.

Thirteen procedures (7 VV, 4 VE, and 1 simultaneous VE and 1 contralateral VV) were performed on the 8 azoospermic patients. The patency rate for this subset of patients was 42.9% (3/7) when VV was performed and 100% (4/4) when VE was indicated. The single azoospermic patient who underwent simultaneous VV and VE had a patent anastomosis on initial follow-up, but subsequently became azoospermic (Table 2).

Of the men who were followed more than 12 months, 40% (4/10) established a pregnancy. None of the 6 men who underwent vasovasostomy established a pregnancy. By contrast, of the 5 patients who underwent VE, 80% (4/5) established pregnancies (Table 2). The man who had LVE and RVV did not establish a pregnancy.

DISCUSSION

Herniorrhaphy is the most common cause of iatrogenic vasal obstruction[1]. The true incidence of vasal disruption related to herniorrhaphy is unknown due to the fact that a unilateral obstruction does not always affect fertility if the contralateral testicular function is normal. Patrick et al. evaluated 1,494 hernia sacs from 1,077 children (89% male) and found vas deferens in the pathology specimen in 0.2% (2/963) of the boys[2]. Tiryaki et al. reported a similar incidence (0.2%) in a review of 1,131 hernia repairs at their institution[3]. Matsuda reported that the incidence of unilateral vas deferens obstruction caused by inguinal herniorrhaphy was 26.7% among infertile patients with a history of herniorrhaphy during childhood[1].

Detection of a unilateral obstruc-

Table 2 - Semen analysis, quality of vasal or epididymal fluid, and pregnancy rates.

Patient	Total count pre*	Fluid *	Fluid †	Total count after*	Total count after†	Pregnancy
1	Severe Oligospermia	Clear, motile	Clear, motile	Oligospermia (5 million/mL)	Normospermia	Unknown
2	Azoospermia	Clear, motile	Clear, motile	Azoospermia	Azoospermia	No
3	Asthenospermia		Creamy, no sperm	Normospermia		No
4	Azoospermia	Opaque, nonmotile	Opaque, nonmotile	Severe Oligospermia	Oligospermia (8.3 million/mL)	No
5	Oligospermia (5.6 million/mL)		Creamy, nonmotile	Oligospermia (6 million/mL)		No
6	Azoospermia		R Creamy, nonmotile, L opaque, motile	Azoospermia		No
7	Asthenospermia		Opaque, nonmotile	Oligospermia (14 million/mL)		No
8	Azoospermia		Opaque, nonmotile	Oligospermia (16 million/mL)		Unknown
9	Azoospermia	Opaque, nonmotile	Opaque, nonmotile	Azoospermia	Oligospermia (14.5 million/mL)	Yes
10	Azoospermia		Clear, motile	Oligospermia (8.5 million/mL)		Unknown
11	Severe Oligospermia	Opaque, nonmotile	Opaque, nonmotile	Oligospermia (5 million/mL)	Oligospermia (12 million/mL)	Yes
12	Azoospermia		Opaque, nonmotile	Normospermia		Yes
13	Azoospermia	Clear, motile	Clear, motile	Azoospermia	Asthenospermia	Yes

* First microsurgery procedure; † second microsurgery procedure

tion of the seminal tract can be difficult because all patients do not present with azoospermia. Any man who presents with infertility and previous herniorrhaphy should be carefully evaluated to rule out an obstructed vas. When the vas is obstructed due to previous hernia repair, the epididymis may be thickened or indurated, and the vas is generally fuller and more convoluted when palpated. A testis biopsy can confirm spermatogenesis on the obstructed side.

The overall patency rate in our series was 65%, which is lower than those in reports of microsurgical vasectomy reversal[12,13]. It is well recognized that patency and pregnancy rates are inversely related to the time interval between vasectomy and reversal[13-15]. The mean obstructive interval in our patients was 25.4 years (range 3 to 40). Therefore, it is better to compare the patency rate in our study with those of patients who underwent a vasectomy reversal at least 15 years after vasectomy. In this case, our patency rate was slightly lower than the vasectomy reversal group (71%)[13]. Vasovasostomy in the inguinal region after herniorrhaphy is technically more difficult compared to routine vasectomy reversal[1,6,8,9]. In addition to the extensive scar tissue that may be present after the herniorrhaphy, some patients have had part of their vas deferens resected[6]. This can lead to a very challenging surgical procedure.

Silber reported that the prognosis for vasovasostomy performed 10 years or more after vasectomy was poor mainly because of the absence of sperm in the proximal fluid[16]. Patients who develop sperm granuloma after vasectomy are considered to have an improved prognosis at the time of vasectomy reversal[17]. The sperm granuloma is thought to form from sperm leakage after vasectomy. This leakage decreases intravasal pressure and subsequently reduces the likelihood of secondary epididymal obstruction. In patients with vasal obstruction due to childhood inguinal herniorrhaphy, no sperm granuloma is present because sperm is not produced until much later in life. This may result in a much higher likelihood of secondary epididymal obstruction and may also be responsible for the great differences in vasal diameter between the proximal and distal ends of the vas deferens.

Our results are comparable to a recent report when we evaluated the overall patency and pregnancy rates[6]. However, we observed a better patency and pregnancy rate in the group who underwent a crossover vasoepididymostomy. Of the 20 procedures, 15 were VV and 5 were VE. We observed that both patency and pregnancy rates were higher in the VE group than in the VV group. All 3 of the patients who underwent a COVE fathered children. In these 3 cases, we bypassed the obstructed region and performed the anastomosis on the contralateral side. These 3 patients had a normal vas deferens associated with an atrophic testis on the contralateral side to the herniorrhaphy. The high pregnancy rate in the group who underwent a crossover vasoepididymostomy is comparable to a previous report from Japan[5]. None of the 6 patients who had undergone only VV achieved a pregnancy, despite the 60% patency rate. These disappointing results may in part be due to a partial obstruction, insufficient mobilization of the abdominal vas with its blood supply, or inadequate vasal motility due to the time of obstruction.

Advances in assisted reproductive techniques (ART), particularly intracytoplasmic sperm injection (ICSI), have made another treatment modality available for men with obstructive azoospermia[10,11,18,19]. Assisted reproductive techniques subject a healthy woman to invasive and expensive procedures and may also result in a higher rate of multiple births. Our pregnancy rate is similar to the results obtained with ICSI. However, it is important to note that in these patients, the microsurgical procedure is covered by insurance and ICSI is never covered by insurance. In our opinion, microsurgical reanastomosis with, if possible, sperm cryopreservation is an appropriate approach for men with inguinal vasal obstruction, particularly if the contralateral normal vas may be available for a crossover procedure.

In conclusion, patients who have inguinal vasal obstruction were obstructed for a longer period of time, and the procedure is more demanding than vasectomy reversal. Therefore, these patients do not experience the same success rate for vasovasostomy as those men who have had a previous vasectomy for purposeful sterilization. Crossover vasovasostomy or crossover vasoepididymostomy may be the procedure of choice if spermatogenesis is compromised on the contralateral side and the ductal system is intact. The results in this setting are reasonable, and it is appropriate to offer microsurgical reconstruction to these couples interested in establishing a pregnancy.

RESUMO

PASQUALOTTO FF e col. - Resultados de anastomose microcirúrgica em homens com obstrução do trato seminal devido à herniorrafia inguinal. **Rev. Hosp. Clín. Fac. Med. S. Paulo 58**(6):305-309, 2003.

A incidência de trauma dos vasos deferentes durante uma herniorafia inguinal é estimada em 0.5%. Nós ava-

liamos as taxas de permeabilidade e o prognóstico da fertilidade a longo-prazo após o reparo microcirúrgico da obstrução dos vasos deferentes relacionados com herniorrafia inguinal prévia

MÉTODOS: Vinte procedimentos foram realizados em 13 homens diagnosticados com infertilidade e trauma nos vasos deferentes secundário à herniorrafia inguinal prévia. Oito destes homens foram submetidos à herniorrafia inguinal bilateral e 5 à herniorrafia inguinal unilateral. Doze procedimentos foram vasovasostomias, 3 vasovasostomias cruzadas, 2 vasoepididimostomias e 3 vasoepididimostomias cruzadas. Oito pacientes estavam azoospérmicos, 2 com oligozosspermia grave (< 1 milhão/mL) 1 oligozoospérmico e 2 astenozoospérmicos. Dados de permeabilidade foram obtidos em 13 pacientes e dados de gravidez estavam disponíveis em 10 casais (77%) com um seguimento médio de 69,5 meses.

RESULTADOS: A taxa de permeabilidade foi de 65%. No grupo de vasovasostomia, a taxa de permeabilidade foi de 60% (9/15) e no grupo de vasoepididimostomia foi de 80% (4/5). Entre os pacientes azoospérmicos, 13 procedimentos foram realizados. As taxas de permeabilidade foram de 42,9% para a vasovasostomia (3/7), e 100% para o procedimento de vasoepididimostomia (4/4). As taxas globais foram de 40%. Quatro de 5 (80%) homens que foram submetidos à vasoepididimostomia estabeleceram gravidez.

CONCLUSÕES: Vasovasostomia microcirúrgica após trauma inguinal nos vasos deferentes resultam em taxas de permeabilidade razoáveis, mas uma taxa de gravidez baixa comparada à reversão de vasectomia. Quando a vasoepididimostomia microcirúrgica foi possível, ela resultou em altas taxas de permeabilidade e gravidez. A vasoepididimostomia cruzada, quando apropriada, pode ser uma alternativa útil à vasovasostomia inguinal.

DESCRITORES: **Azoospermia. Herniorrafia. Infertilidade. Homem. Vasoepididimostomia.**

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