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Does contraction of mesh following tension free hernioplasty effect testicular or femoral vessel blood flow?

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Abstract: Prosthetic mesh can contract by 20-75% of its original size within ten months after implantation. We set out to determine whether this contraction has any effect on testicular or femoral vessel blood flow following open or laparoscopic hernia repair.

Twenty patients who underwent mesh repair of a primary unilateral inguinal hernia repair by Open (10) or Laparoscopic (10) methods a median of 3 years previously were investigated by ultrasound to determine the haemodynamic characteristics of the testis and femoral vessels. There was no significant difference in testicular blood flow, volume or echogenicity between the different types of repair or the contralateral side. The vertical and transverse dimensions of the femoral artery and vein were similar in all groups as was blood flow.

Mesh contraction following inguinal hernioplasty does not adversely affect the testis or femoral vessels and can be used safely for both anterior and preperitoneal approaches.

Key words: Inguinal hernia — Prosthetic mesh — Ultrasound — Testicle — Blood vessel

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Tension-free mesh repair has become the repair of choice for most inguinal hernias. The use of polypropylene mesh was first described for hernia repair in 1962 [Usher 1962] and has been used with considerable success with a low rate of complications [Shulman 1992]. Polypropylene mesh is available in different structural (open or closed weave) and filament (mono, dual, or multi-filament) configurations. It produces a perimesh fibrosis resulting in contraction by up to 20% in a patch and 75% in a plug at 10 months after implantation [Amid 1997].

As the mesh is in close contact to surrounding structures such as the testicular and femoral vessels we set out to determine whether this contraction had any effect on testicular and femoral blood vessels following laparoscopic and open inguinal hernia repair.

Patients and methods

Twenty patients enrolled into a multicentre trial of laparoscopic hernia repair [Wright 1996] were recruited. Ten had undergone open tension-free mesh repair while 10 had a laparoscopic totally extraperitoneal (TEP) repair a minimum of 2 years previously to allow maximal fibrosis to have occurred.

All underwent examination by a Consultant Radiologist (GMB) with an interest in ultrasound who was blinded as to operation side and type. All were scanned with a 7.5 MHz linear array probe on an Acuson 128XP. All patients had repair of a primary unilateral hernia only and had not undergone any surgery on the contralateral side, which was scanned as the patients' own control.

Both testes were scanned in transverse and longitudinal planes. Testicular volume was calculated from the equation V=-/6 a b² where (a) is the length and (b) the breadth of the testis [Behre 1989, Fuse 1990]. Testicular echogenecity, extra and intra testicular flow and co-existing intrascrotal pathology were also recorded.

Similarly the common femoral vessel diameter was calculated in transverse and anteroposterior (AP) planes at the level of the inguinal ligament and the cross-sectional area calculated. The patient was also asked to perform a Valsalva manœuvre and repeat vein diameter measurements undertaken. The haemodynamic waveform and velocity (peak, minimum and mean) were also measured.

Statistical analysis

All values are expressed as median and inter-quartile range. Data analysis was performed using SPSS with significance assessed using the Wilcoxon Signed Ranks Test for non-parametric data. A p value of < 0.05 was considered significant.

Results

The laparoscopic and open groups were comparable with regards age, operation side, hernia type and the interval between their hernia repair and ultrasound scan (Table 1). Monofilament open-weave polypropylene mesh (Prolene, Ethicon, Edinburgh, UK) was used for all repairs.

Testicular volume

There was no difference in testicular volume in either of the groups with normal echogenicity and testicular blood flow. Three of the 20 patients were noted to have epididymal cysts (Table 2).

Femoral vessels

The vertical and transverse diameter of the femoral artery was not significantly effected by the presence of mesh whether this was placed anteriorally or preperitoneally (Table 3) Similarly there was no significant difference in waveform or blood velocity between the groups or the nonoperated side. Femoral vein measurements in the pre-Valsalva (Table 4) and post-Valsalva state were also not affected by the presence of mesh.

Discussion

This study demonstrates no significant effects on testicular volume, femoral artery or vein blood flow following open or laparoscopic mesh repair. The repair techniques studied here place the prosthetic material in different anatomical planes of the abdominal wall. The **open mesh technique** places the mesh anterior to the transversalis fascia, on the floor of the inguinal canal, and is partially split to encircle the spermatic cord thus forming a new internal ring. In the **totally-extraperitoneal repair** the mesh is placed in the pre-peritoneal plane behind the transversalis fascia and covers all potential hernial orifices as well as the vas deferens, external iliac and testicular vessels for a short distance.

The testis receives its main blood supply from the testicular artery supplemented at the deep ring by the artery to the vas (superior vesical artery) and the cremasteric artery (inferior epigastric artery). Distal to the superficial ring and in the scrotum the testicle receives collateral supply from scrotal, perineal branch of the inferior pudendal, inferior vesical and prostatic arteries [Fong 1992,

Table 1. Patient Characteristics

Group	[a]Age	[a]Time since Repair (yrs)	Operated side (R: L)
Laparoscopic	44 (30-57)	3 (2.0-4.1)	5: 5
Open	48 (37-73)	2.9 (2.1-3.8)	5: 5

[a] All values are medians and interquartile ranges

Table 2. Testicular Volume

Repair	Side	No	[a]Volume (cm³)	P value
Laparoscopic	Operated	10	18.8 (16.5-20)	
	Control	10	20.3 (16.4-22.4)	NS
Open	Operated	10	15.0 (13.6-23.6)	
	Control	10	16.1 (13.3-25.4)	NS

[a] All values are medians and interquartile ranges

Table 3. Common femoral artery measurements

Repair	Side	No	[a]Diameter (mm) Transverse	Vertical
Laparoscopic	Operated	10	9.5 (8.1-10.8)	10 (9.2-11.2)
	Control	10	8.8 (7.4-10)	9 (8.8-10)
Open	Operated	10	9.0 (7.6-10.9)	9.2 (8-11.4)
	Control	10	9.2 (7.7-10.2)	9.0 (8.4-10)

[a] All values are medians and interquartile ranges

Table 4. Common femoral vein measurements

Repair	Side	[a]Diameter (mm) Transverse	Vertical
Laparoscopic	Operated	9.0 (7.7-12.2)	11.5 (8.6-13.3)
	Control	9.7 (8-11.6)	10.6 (8.5-13.7)
Open	Operated	9.7 (7.3-10.4)	11.0 (9.5-14)
	Control	8.7 (7.5-10.6)	10.2 (8-12.8)

[a] All values are medians and interquartile ranges

Koontz 1965]. The venous drainage follows a similar pattern. Ninety-eight percent of the testicular mass is formed by the seminiferous tubules which are sensitive to disturbances in circulation. Any change therefore should be easily detectable by ultrasound which has been shown to be very accurate in estimating testicular size [Behre 1989] and intratesticular flow [Middleton 1989]. No previous study has examined for delayed testicular effects, most focusing on changes in the immediate post-operative period.

There is a wide variation in the reported rate of ischaemic orchitis and testicular atrophy following hernia repair in the literature. After primary repair ischaemic orchitis occurs in 0.7-1% of patients with 0.03-0.65% developing testicular atrophy [Fong 1992, Reid 1994]. The lower figures seem to occur where the spermatic cord and the collateral network are protected, by minimal dissection of cord, leaving the testicle and distal hernia sac in-situ, avoiding concurrent operations upon the testicle, and minimising diathermy of the cord. After recurrent hernia repair through an anterior approach, orchitis rises to 2% with atrophy in 1-5% [Wantz 1982].

It is believed that orchitis and atrophy has more to do with damage to the venous network than the arterial supply. If mesh fibrosis does gradually compress the testicular venous plexus at the deep ring then the distal collateral network should expand to accommodate any diverted flow. If there is increased reliance in the collateral network to support the testis then it is unlikely that this would cause any effect unless there was subsequent surgery disrupting the anastomotic network. It would seem therefore that instances of atrophy where care is taken at the hernia repair are due to a normal variation and deficiency in any collateral circulation.

A high incidence of inguinal hernia repair among men attending infertility clinics has been documented. Yavetz et al reported a 6.65% incidence of hernioplasty with or without subsequent testicular atrophy in 8500 patients [Yavetz 1991]. Hormonnai et al found that 14.4% of 131 infertile men who had undergone hernia repair had changes in their testicular size on the operated side [Hormonnai 1980]. Others have estimated that a quarter of sub-fertile patients with a history of childhood inguinal hernia repair have a unilateral vas deferens obstruction [Matsuda 1992]. Fong & Wantz on the other hand suggest that unilateral testicular atrophy will not have significant effects on fertility [Fong 1992, Wantz 1982].

Polypropylene mesh causes a disorganised dense perimesh fibrosis with dense fibrous tissue forming as quickly as 10 weeks over the surface of the mesh which can cause tension on surrounding tissue from scar contraction [Elliot 1979]. Given that the mesh is almost in direct contact with the vessels following laparoscopic repair it is surprising that some deformity was not observed. However it is reassuring to note that there was no significant effect on cross-sectional area or blood flow in this study.

Conclusion

Mesh contraction following open or laparoscopic inguinal hernia repair does not adversely affect the testis or femoral vessels and can be used safely for both anterior and preperitoneal approaches.

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