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Surgical Research

Outcome for Gubernaculum Sparing Laparoscopic Assisted Orchidopexy for Bilateral Intra-abdominal Testes

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ABSTRACT

Background: *A minority of undescended testes are intra-abdominal. Controversy still exists over the optimal laparoscopic technique to mobilize these gonads. The gubernaculum sparing, laparoscopic assisted, staged Fowler Stephens (FS) approach, has been shown to be highly effective in restoring unilateral intra-abdominal testes (IAT) into the scrotum. Crucial to success is the preservation of an adequate arterial supply. The outcome of this technique for bilateral IAT has not previously been independently reported.*

Aim: *To assess the outcome of gubernaculum sparing laparoscopic assisted FS orchidopexy technique for bilateral intra-abdominal testes.*

Method: *Over a 13-year period (2005-18), 36 cases of impalpable testes subjected to laparoscopy under a single surgeon's care were prospectively recorded on an Excel spreadsheet. Six cases with bilateral intra-abdominal testicles were the focus of this study. Demographic details, operative findings, details of intervention and outcome were recorded. Follow up was for a period of at least a year.*

Results: *Six cases of mean age 3.4 years (range 1.1-10.4) underwent bilateral orchidopexy. Three cases had significant underlying comorbidities and were late referrals. All interventions aside from one with small bowel injury were day procedures. At follow up all patients had a successful outcome with palpable testes in the scrotum bilaterally.*

Conclusion: *This study confirms the effectiveness of a staged gubernaculum sparing, laparoscopic assisted FS procedure for bilateral intra-abdominal testes. The results match those of unilateral intra-abdominal testicles subjected to the same procedure. Preservation of collaterals in a gubernaculum-sparing approach may explain the excellent results seen in this and prior series.*

Keywords

Laparoscopic, Abdominal gonads, Testis.

Introduction

Controversy still exists over the optimum technique to deliver IAT into the scrotum. The laparoscopic Fowler-Stephen's approach has demonstrated greater success rates when compared with the open approach. A variant of this, namely, the gubernaculum sparing, laparoscopic assisted, staged Fowler Stephens (FS) technique has been shown to be highly successful in preserving an adequate arterial supply and delivering viable testes into the scrotum. Whilst effective for unilateral IAT, the procedure has not been reported in a series with bilateral intra-abdominal gonads.

Method

A prospective analysis was undertaken over a thirteen-year period (2005-18). Thirty six cases of impalpable testes subjected to laparoscopy under a single surgeons care within two tertiary pediatric surgical units were prospectively recorded on a Microsoft Excel spreadsheet. Six cases with bilateral IAT were the focus

of this study. Demographic details, operative findings, details of intervention and outcome were recorded. Post-operative follow up was for a period of at least one year.

Technique

Testes which, under general anesthesia, were impalpable bilaterally and found to be lying within the abdominal cavity at laparoscopy were recorded as intra-abdominal and subjected to a three staged Fowler Steven's procedure using a 3 port approach (5 mm umbilical-camera and two similar working ports in the right or left iliac fossa and suprapubic [midline]). The first stage involved high clipping and unilateral division of the spermatic vessels (Figure 1).

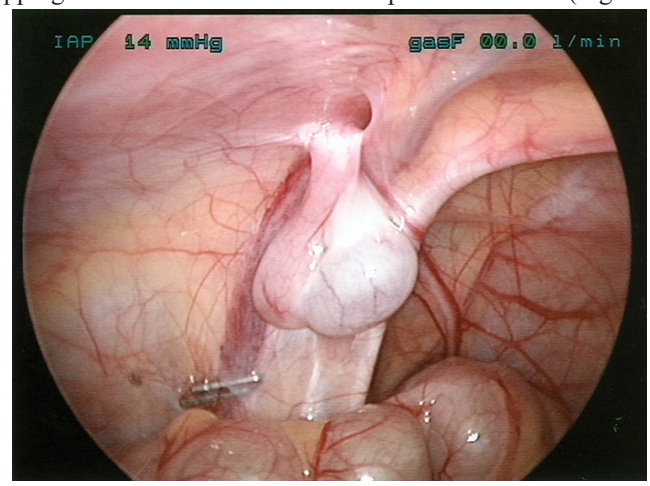

Figure 1: Intra-abdominal testes following first stage Fowler Stephens Procedure.

The second stage is undertaken 6 months later utilizing a laparoscopic assisted technique. The gonad on the contralateral side has its spermatic vessels clipped and divided. The gonad clipped at initial laparoscopy is then mobilized on the pedicle of the vas deferens taking a 1cm peritoneal margin down to the bladder base using principally sharp dissection. Peritoneal division is continued superiorly around the testicle and includes the margin of the internal ring effectively freeing up the gonad. Thereafter, a groin incision, division of the external oblique aponeurosis and laying open of the inguinal canal is performed. The testis is then retrieved through the internal ring by traction on the gubernaculum. Remaining attachments of the testicle to the margins of the internal ring are freed by blunt and sharp dissection. A rich network of vessels passing between the gubernaculum and the vas is apparent on distracting these structures (Figure 2). The testis is then placed in the Dartos pouch in conventional fashion with care taken to preserve the alignment of the gubernacular vessels (Figure 3). The length of the gubernacular and deferential pedicle is usually sufficient to permit fixation in the scrotum. No attempt is made to achieve peritoneal closure at the internal ring although closure of the anterior wall of the inguinal canal is performed.

Finally, 6 months later, following confirmation of an adequate result on the completed side, the contralateral side is subjected to a 2nd stage, laparoscopic assisted FS procedure. Paramount, again, is preservation of the gubernacular vessels in situ.

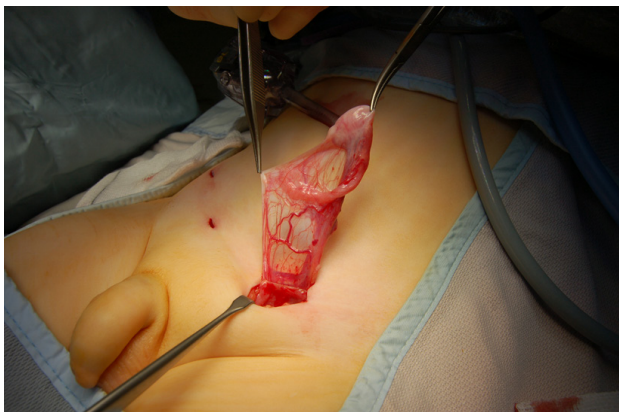

Figure 2: Testis delivered into the groin with robust collateralization between spermatic arterial stump, cremasteric and gubernacular vessels.

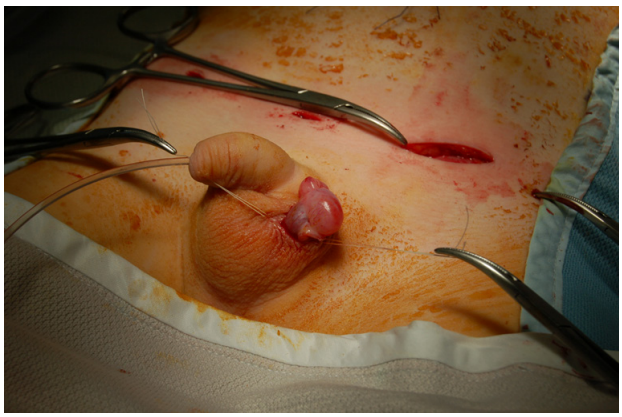

Figure 3: Testis delivered into scrotum and prior to fixation in Dartos pouch.

Result

Six cases of mean age 3.4 years (Range 1.1-10) underwent bilateral orchidopexy in a series of 36 cases with IAT. All except one case with a complication (see below) were managed as day cases.

Three cases had significant underlying comorbidities, two patients with cerebral palsy and one with Rubenstein Taybee syndrome. The high percentage of co-morbidities reflects the case mix of one of the institutions which handles mainly, highly complex cases, from the west of Saudi Arabia.

Two complication were recorded; an injury to the small bowel in the patient with Rubenstein Taybee syndrome who had undergone previous laparoscopic fundoplication with gastrostomy placement and a hematoma of the anterior wall secondary to inferior epigastric artery injury from port placement presenting 48 hours post discharge. The former was recognized at the time of Hassan approach for camera port placement and repaired with two intra-corporeal knots. He was resumed on feeding and discharged the following day. The latter was managed expectantly.

All patients subjected to a staged Fowler-Stephens procedure had successful surgery with all testes palpable within the scrotum at

post-operative assessment. Cases were reviewed in the outpatient clinic at 3, 6 month and yearly intervals, by the consultant who performed the procedure. All testes were equivalent in volume to the contra-lateral gonad (Figure 4), except one, where a hypoplastic intra-abdominal testicle remained unchanged in size. Follow up was for at least a year and no patients were observed to have suffered indirect inguinal hernia despite the internal ring having been left unsutured.

Figure 4: Post-operative outcome demonstrating both testes of adequate volume and well located within the scrotum.

Discussion

Between 10 to 25% of patient with cryptorchidism will have bilateral undescended testes [1]. Intra-abdominal testes account for almost 30% of impalpable cases [2]. The presence of bilateral intra-abdominal testes in the absence of an intersex state is indeed rare. Restoration of these gonads into the scrotum allows for optimal development and facilitates monitoring for malignant change throughout life. The two stage FS procedure for unilateral intra-abdominal testes is a time tested technique which is widely utilized. Since 2005, we have exclusively adopted the two-stage laparoscopic assisted FS technique for intra-abdominal testes [3,4]. Preservation of the gubernaculum whether by an exclusive laparoscopic or a laparoscopic assisted technique has resulted in a significant improvement in testicular salvage rates [3-8].

The testis is supplied by the triad of; testicular artery, the deferential artery which originates in the inferior vesicle artery and the cremasteric artery which is a branch of the inferior epigastric artery [9]. Studies performed during surgical procedures and using intravascular repletion in cadavers show the existence of multiple anastomotic channels between these arteries [4,10,11]. Division of the testicular artery during a staged Fowler Stephens procedure leaves the gonad entirely dependent on the blood supply of the deferential and cremasteric vessels and the rich collateralization between these is critical to maintaining viability of the testes [4]. There is some evidence to suggest that less dissection results in an improved testicular survival [5]. Histologically, the gubernaculum, being relatively thick and well vascularized, has been reported in several studies to have a robust blood supply [6]. Thus preservation of the gubernacular collaterals in situ may offer an improved chance for testicular survival.

A two stage laparoscopic or laparoscopic assisted FS orchidopexy for the intra-abdominal testis can be performed utilizing a variety of modifications in technique. The laparoscopic assisted approach in particular focuses on maintaining the gubernacular and vas deferential collateral vasculature in situ. The second stage procedure is performed 6 months after the first stage as it is felt, in the absence of alternative evidence, to provide sufficient time for good collateral vascular growth. The same philosophy guides the timing of surgery for bilateral intraabdominal testes with second stage procedure on the one side combined with a first stage on the contralateral side. The second stage on the opposite side is completed a semester later making for total intervention time from initial to final procedure, of a year.

The optimum time for undertaking these procedures is between 1 to 2 years of age. The patients in the present series are a lot older on account of the associated co-morbidities and hence late referral. However this in itself did not appear to have impacted on the outcome. No groin hernias were observed post operatively despite the margins of the internal ring not being approximated following testicular retrieval from the abdominal cavity. This has been reported by other authors and it is likely that peritoneal division at the internal ring, leaving raw margins, results in rapid apposition and sealing of the defect averting hernia development [6]. The incisions, whether for port placement or for delivery of the testes are sited in the suprapubic fold and where possible are superimposed to improve the aesthetic outcome.

Previously described methods of totally laparoscopic gubernacular-sparing 2-stage orchidopexy which utilizes the retrograde retrieval of the testes (via the scrotum) whether through the patent processus vaginalis or medial to the inferior epigastric vessels, are not anatomical and the appropriate lie of the gubernacular vessels cannot be guaranteed [7,12,13]. The concern is that acute angulation and stretching of gubernacular collaterals may risk occlusion. Furthermore, injuries to the bladder have been reported [14]. Additional concerns are a tight squeeze at the new point of exit through the anterior abdominal wall and direct and excessive testicular handling by grasping forceps. All of these factors may impact on the final outcome.

Although a meta-analysis demonstrated higher success rates in a two-stage compared to a single staged FS orchidopexy (85 vs 80%), more recently, evidence supporting similar outcomes utilizing a single stage procedure are emerging [10,15,16]. If this approach were applied to patients with bilateral intra-abdominal testicles and if each side were done in turn then total intervention would be reduced from a year to six months. Additionally, this would spare the child an additional general anesthetic. If undertaken simultaneously then a single intervention would suffice.

The limitations of this study are two fold, firstly, that testicular

health following surgery was assessed clinically without the use of ultrasonography to more accurate measure size and vascularity. Secondly, that the true test of success, namely, fertility and hormonal function, were not age appropriate for this cohort and therefore outside the scope of this study. A hypothetical assumption that we make, is that preservation of size will translate into adequate endocrine and fertility function.

Conclusion: This study confirms the effectiveness of a staged gubernaculum sparing, laparoscopic assisted FS procedure for bilateral intra-abdominal testes. The results match those of unilateral intra-abdominal testicles subjected to the same procedure. Preservation of collaterals in a gubernaculum-sparing approach may explain the excellent results observed in this series.

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