This issue of Dialogues in Pediatric Urology focuses on the undescended testicle and in particular its surgical correction. Grahame Smith has assembled an expert team of contributors. Each of them brings a different expertise to the management of undescended testis. While hormonal therapy for undescended testis remains an option, it is hampered by variable success rates in reported series. Additionally, only HCG is FDA approved, whereas LHRH analogs have been used in other countries with some success either independently or in combination with HCG.

Operative orchidopexies for the undescended testis, therefore, remains the mainstay of therapy in most pediatric surgical centers around the world. This issue covers the gamete of operative approaches from the prescrotal approach up to the laparoscopic approach for the intra-abdominal testis. Each surgical approach is very well delineated in a stepwise fashion. Each contributor vividly details the anatomy for each step.

I congratulate Grahame Smith and his contributors for an excellent contribution which will undoubtedly serve as a reference source for years to come.
When to Operate and When to Investigate

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In the 1950’s, orchidopexy was done on 10-15 year old boys, so that the testis would be in the scrotum for spermatogenesis. This was because the testis was not thought to be carrying out any important functions until the onset of pubertal spermatogenesis. In other words, it was believed that the testis was in “suspended animation” until puberty. In addition, 10-15 year old boys were effectively adult size, enabling similar surgical techniques to those used in adults. It was thought that early surgery might be dangerous because of the delicacy of tissues in young children.

By contrast, in 2004, we are recommending surgery at 3-6 months of age. Our current surgical plan, however, is still based on a number of assumptions. The first of these is that germ cell loss begins at 3-6 months in cryptorchid testes. Secondly, it is assumed that this germ cell loss can be prevented by correcting the position of the testis and hence the working temperature of the testis. The third assumption is that spontaneous descent no longer occurs after approximately 3 months of age in a term baby. The final assumption of our current operative strategy is that early surgery is safe, as long as the surgeon is adequately trained in baby surgery, and usually this means the use of magnification.

The history of the changes in the recommended age for orchidopexy is quite interesting, as the age for surgery has fallen progressively in the last 40 years, as new information on testicular biology has been found. As mentioned above, in the 1950’s surgery was done on 10-15 year old children of adult size. In the 1970’s the recommended age fell to 4-6 years when it was observed that testicular atrophy was observable clinically from then on. It was presumed that if surgery was done prior to this time that the atrophy could be prevented. In the 1980’s it was found that there were changes in the histology of tubules, and changes in the germ cell development and number which suggested that germ cells became depleted in undescended testes from about 2 years of age onwards. This lead to the recommended age for orchidopexy falling to from 1-2 years, always hoping that the timing of surgery would predate any irreversible damage. In the last 15 years, it has been appreciated by Dale Huff and colleagues that the first sign of abnormality in the germ cells occurs between 3 and 12 months of age when the neonatal gonocyte fails to transform into a type A spermatogonium.

By 52 weeks of gestational age the incidence of undescended testes has fallen to approximately 1 – 2% and it is now believed that spontaneous descent beyond this time is extremely rare.

In the last 20 years it has been gradually worked out that the germ cells of the postnatal testes undergo a series of slow but very important changes for subsequent spermatogenesis. The neonatal gonocyte, the germ cell present at birth, undergoes transformation into a Type A spermatogonium in the first year. This is first visible at approximately 3 months and is complete by approximately 12 months of age. The gonocyte is initially in the centre of the testicular tubule and the transformation is associated with movement of the germ cell to the basal layer of the tubule so that it is in contact with the basement membrane. Type A spermatogonia are normally found adherent to the basement membrane between the Sertoli cells. Following this there is then a further set of slow but deliberate changes into intermediate spermatogonia, Type B spermatogonia, and then finally by 3-4 years of age development of primary spermatocytes. The Type B spermatogonium is partly on the way back to the centre of the testicular tubule, and the primary spermatocyte is back in the centre of the tubule. In addition, the size of the cytoplasm and the characteristics of the nucleus change through the stages. Once primary spermatocytes have developed, the testis is much more in a resting phase until the onset of puberty.

Dale Huff and colleagues have now shown very clearly that the first germ cell abnormality in cryptorchid testes is failure of the gonocyte to transform into a Type A spermatogonium. The hormonal regulation of this is being proposed to be via the hypothalamic-pituitary-gonadal axis and androgens, but there is some contradictory evidence suggesting that non-androgenic or gonadotrophic hormones maybe involved, such as Mullerian Inhibiting Substance/AntiMullerian Hormone. Gonocytes that fail to transform in the first year of life may well persist, and under the influence of the abnormally high temperature in the inguinal region, could well mutate into cells that might ultimately lead to carcinoma-in-situ or invasive testicular tumours. In addition, the decreased number of Type A spermatogonia leads to inadequate stem cells for spermatogenesis and subsequent low sperm counts and infertility.

The evidence for whether the germ cell loss is a primary or secondary effect caused by the malposition and the secondary high temperature (35 – 37°C vs 33°C), is unknown. Surgery, however, is based on the assumption that the germ cell loss is secondary to the malposition and, hence, reversible by placement of the testis in the scrotum. Whether this assumption is valid remains to be seen. No long term follow-up studies have been performed on children operated on at such a young age because they have only been treated in recent years. Despite this, there are a few studies which are beginning to show some advantage if surgery is done early in infancy, but more time will be required before this will be resolved completely.

Up to 4-5% of boys may have testes out of the scrotum at birth when one includes premature infants. Following birth a significant number of these continue to descend, arriving in the scrotum within 12 weeks of term. By 52 weeks of total gestational age the incidence of undescended testes has fallen to approximately 1 – 2% and it is now believed that spontaneous descent beyond this time is extremely rare. The current recommended age for surgery, therefore is based on the fact that after 3 months spontaneous descent is unlikely and around this time germ cell development becomes important. As general anaesthesia is now recognised in most paediatric surgical centres to be safe at about this age, orchidopexy is currently done in Melbourne between 3-9 months of age. Six months of age is our current recommended age assuming good anaesthetic backup, adequately trained surgeons and adequate magnification.

Despite recommendations for surgery in early infancy, some children still present at 5 – 10 years of age. In the past this was assumed to be delayed diagnosis of congenital undescended testes. However, now it is more likely that these are actually acquired undescended testes. This concept of acquired or secondary undescended testes has gained gradual but progressive acceptance over the last 10 years. Our own studies on this phenomenon have documented that the spermatic cord must double in length from approximately 5cm in a baby to approximately 10cm in a 10 year old boy. It is our proposal that acquired undescended testes are caused by failure of elongation of the spermatic cord. Some of these children have been proposed to have a hyperactive cremaster muscle, and this is certainly true in children with cerebral palsy. However, most
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children without cerebral palsy appear to have an abnormal persistence of a fibrous remnant of the processes vaginalis. In the Children’s Hospital in Melbourne, where approximately 350 orchidopexies are done each year about half our patients appear to have acquired undescended testes. The biological effects on the undescended testes are slightly different from those seen in congenital cryptorchid testes, but the germ cell loss secondary to high temperature is likely to be similar. Our indication for surgery in these children is once the testis no longer can remain in the scrotum after manipulation. If the testis immediately retracts into the groin and cannot remain spontaneously in the scrotum then we recommend surgery. By contrast, testes that look high but are still within the scrotum itself need annual review rather than immediate surgery. Some of these will get progressively higher with age, while others will remain in the scrotum as the boy grows.

Whether risks for infertility and cancer in acquired undescended testes are the same as for those with congenital undescended testes remains uncertain. However, evidence now appearing in the literature suggests that the risk of cancer in acquired undescended testes might be low. This may be because germ cell transformation in the first year of life may have occurred normally, so that there are no abnormal gonocytes which might predispose to carcinoma-in-situ. However, there are well-documented follow-up studies showing that acquired ascending testes do carry a risk of decreased fertility. There is lots of controversy about whether hormone treatment should be used in undescended testes, and the best evidence for the effect of hormone treatment is in acquired cryptorchidism. In Melbourne, hormonal treatment is not currently in use very frequently, and most children would be offered scrotal orchidopexy as described by Bianchi.

When to Investigate?

Some children with undescended testes need formal investigation, particularly if there is unilateral or bilateral impalpable testis. A special group requiring immediate investigation are those associated with a bifid scrotum and/or hypospadias, where one of the forms of intersex can be predicted. Finally, there are some children with general evidence of dysmorphism where a syndrome may be suspected. A good example of this are those children with hypotonia in infancy and poor feeding who subsequently present with obesity and cryptorchidism and are found to have Prader-Willi syndrome.

In children with bilateral impalpable undescended testes a karyotype is necessary to confirm male gender. Serum Müllerian Inhibiting Substance/Anti-Müllerian Hormone (MIS/AMH) levels are also useful if this test is available, as this hormone is produced throughout childhood and can be measured at anytime without the need for a gonadotropin stimulation test.

Unusual anatomy found at operation is another of the trigger for investigation. Rare abnormalities include two testes on the one side indicating transverse ectopia, or the presence of a fallopian tube, indicating persistent Mullerian duct syndrome. In this circumstance it is wise to deliver the abdominal contents through the inguinal canal to confirm the anatomy. The diagnosis is made by normal male external genitalia, and normal male karyotype and normal male androgen levels with or without an abnormality in serum MIS/AMH levels or its receptor. Adrenal rests are occasionally identified at surgery and if these are larger than a few millimetres in diameter, then investigation postoperatively to exclude male versions of Congenital Adrenal Hyperplasia would be worthwhile. Two other rare anatomical variants might trigger investigation including the presence of splenic tissue suggesting lienogonadal fusion, or absence of the vas deferens. Confirmation of the absence of the vas deferens can be made by examination of the intra-abdominal path of the vas where it can be demonstrated that is was not cut accidentally during mobilisation of the processus vaginalis. The contralateral side should be palpated to determine whether the vas is present on that side or not. If the vas is present on the contralateral side then an ultrasound should be done to determine whether or not the child has unilateral renal agenesis consistent with a male version of Rokitsansky syndrome. Bilateral absence of the vas deferens needs to be investigated for mutations of the cystic fibrosis gene.

Completely impalpable testes should be investigated by laparoscopy with or without preoperative ultrasound. The presence of compensatory hypertrophy of the remaining contralateral testis in the scrotum is an indication of possible vanishing testis, presumably secondary to peritubal torsion of the testis. On very rare occasions bilaterally impalpable testis in an otherwise normal phenotypic male might be the presentation of a very severe case of congenital adrenal hyperplasia. In such instances a rectal examination will identify the presence of a uterus, triggering chromosomal analysis, 17-hydroxyprogesterone analysis and urgent serum electrolytes. In children with a bifid scrotum plus hypospadias and an apparently undescended testis consideration of intersex conditions such as true hermaphroditism or mixed gonadal dysgenesis should be immediately made. In children with a bifid scrotum but symmetrically undescended testes various forms of gonadal dysgenesis and/or androgen deficiency or resistance should be considered.

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The objective in performing an orchiopexy is to bring the testis into a scrotal position without tension and without iatrogenic atrophy occurring. The majority of testes are present either in the inguinal canal or in the prepubic space (suprapubic or infrapubic) and thus the inguinal orchiopexy becomes the workhorse with respect to surgical approach. The overall success rate one achieves is dependent upon the preoperative testicular position and the technique employed. An understanding of the underlying anatomy becomes critical to the success in performing such an inguinal orchiopexy. The testis and cord structures are covered with various fascial layers that require dissection in order to separate the cord structures from the processus vaginalis and ultimately allow for adequate length in order to bring the testis into a scrotal position. A review of The Children's Hospital of Philadelphia experience with 447 boys with impalpable undescended testes found that 91 testes were intraabdominal. The overall success rate was 97% for a standard inguinal orchiopexy, 74% for Fowler-Stephens orchiopexy, and 80% for a two-stage orchiopexy. The overall success with inguinal orchiopexy, particularly for intraabdominal testes, is higher than reported in the literature and may be due to the anatomical approach to retroperitoneal dissection.

An appreciation of the retroperitoneal fascial layers is the key to understanding surgery of the retroperitoneum. Dr. Redman’s description of the anatomy of the retroperitoneal connective tissue is a key element to being able to successfully accomplish an inguinal orchiopexy. The layers surrounding the testis are representative of the layers comprising the anterior abdominal wall since the testis descends into the scrotum through the abdominal wall and carries with it its laminated layers. The external spermatic fascia is a continuation of the external oblique layer. The cremaster muscle and cremaster fascia is an extension of the internal oblique as well as transversus abdominis muscles. The internal spermatic fascia is an extension of the transversalis fascia and is also known as the endo-abdominal fascia or lateral spermatic fascia or lateral bands of Denis Browne. It is this layer which is the investing fascia that holds the hernial sac, vas, vessels and cremasteric fibers together. The testis that stops short of the scrotum in its course of descent may in fact not be foreshortened by the vas and the vessels but by the investing fascia that adheres to these structures.

The primary goal of cryptorchid surgery is freeing the vas and the vessels from their attachments within the inguinal canal and retroperitoneum. A step by step description of the inguinal orchiopexy will help illustrate these points.

Initially a transverse inguinal incision is made and dissection continued through Camper’s and Scarpa’s fascia until the external oblique layer is identified (Figure 1). A small nick is made in the external oblique fascia which is then extended through the external ring and proximally towards the internal ring. Pushing down both lateral and medial to this area will allow for elevation of the cord structures. The cremaster fibers are then swept free of the cord structures so that it can be adequately elevated. The dissection continues distally so that the gubernacular attachments are identified. Care is taken to tease the gubernacular attachments apart so that a long looping vas is not inadvertently injured in the dissection (Figure 2). Following division of the gubernacular attachments the cord structures are elevated which allows for a dissection of the inferior cremasteric fibers to the level of the internal ring. Two retractors are placed at the level of the internal ring, both medially and laterally which then allows for further dissection into the retroperitoneum. Gentle traction is placed on the testis and cord structures in order to facilitate this dissection. In order to free the remaining anterior and medial attachments of the vas and vessels to the endo-pelvic fascia the cord must then be freed from the overlying peritoneum. The internal spermatic fascia may be carefully opened in order to identify the plane of dissection between the processus vaginalis and the vas and vessels (Figure 5). As the processus is carefully grasped, the vas and the vessels are then swept laterally away from the processus in order to sepa-
rate these structures (Figure 6). Once the vas and vessels are completely freed from the processus vaginalis, an Allis clamp may be placed around the vas and vessels to provide for gentle retraction. Hemostats are then carefully placed across the processus vaginalis and this is then divided. The processus is brought medially as the vas and vessels are held laterally in order to further dissect these structures away from one another (Figure 3). Finally, the processus vaginalis is ligated with suture. Following ligation, retractors are then placed beneath the internal oblique layer in order to continue the dissection into the retroperitoneum. The peritoneum is then retracted anteriorly which facilitates dissecting the bands of endo-pelvic fascia from the vessels. If deeper exposure to the retroperitoneum is required, a narrow Deaver retractor may then be placed in order to optimize exposure. Rarely it is necessary to divide the internal oblique muscle for more extended exposure. In utilizing this technique in infants and young boys, it is then possible to free the spermatic vessels from the enveloping retroperitoneal fascia to the level of the renal vessels on the left and to the aorta on the right side. Further dissection cephalad into the retroperitoneum allows for dissection of the lateral condensations of the endo-pelvic fascia including the lateral ligaments of Browne, lateral spermatic fascia and the lateral spermatic ligament of Prentiss (Figure 4). With this dissection, there should be adequate length obtained in order to be able to bring the testis down into the scrotum. A sub-dartos pouch is then created and the testis is then carefully brought down into the sub-dartos pouch (Figure 7 A, B, C). Formal fixation of the testis can be accomplished in several different ways. I prefer placing two 5-0 prolene sutures between the septum of the scrotum and the mesorchium which is the confluence of the tunica vaginalis’s visceral and parietal layers along the medial aspect of the testis. Closure of the scrotum is performed with a subcuticular suture as is the closure of the inguinal incision.

Occasionally mobilization of the testis fails to provide an adequate length in order to bring the testis into the scrotum. In such a situation, division of the transversalis fascia can be accomplished and the testis and cord structures can be brought beneath the inferior epigastric vessels in order to further straighten the path down to the scrotum (Prentiss maneuver). Alternatively laparoscopic mobilization of the vessels can be accomplished at this point as well, if adequate length has not been achieved.

The concept of the Fowler-Stephens orchiopexy is predicated on a testis with a long-looping vas deferens. The anatomy of such a testis needs to be appreciated initially in order to optimize the results of the Fowler-Stephens orchiopexy. Key elements of such an approach are that it involves an intraabdominal exploration, there is mobilization of the testicle on a broad vas-peritoneal pedicle, there is high division of the spermatic vessels, a new more medial internal ring is created next to the pubic tubercle, and finally a sub-dartos pouch is created. Essential surgical points include no dissection of the cord or testicle, no retro-

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One might ask why an orchiopexy is performed. The rationales are to potentially improve fertility, prevent malignancy, correct the associated hernia, prevent testicular torsion, and ultimately to provide for a normal genital appearance. With ongoing clinical research in cryptorchism, it is clear that reducing the risk of cancer and potentially enhancing fertility require more than simply successful surgery. We have come to appreciate that the testis contains primordial germ cells that are converted to gonocytes in utero. These gonocytes are then transformed into fetal spermatogonia and ultimately into Ad spermatogonia at two months of age (Figure 8). A second transformation occurs at approximately four or five years in which the Ad spermatogonia and Ap spermatogonia are converted to primary spermatocytes. In our review of the histology of cryptorchid testes, we have come to appreciate that many undescended testes have more gonocytes and no Ad spermatogonia noted in them. Thus cryptorchid boys may have a blunted response at two months of age which then leads to a decrease in the Ad spermatogonia which may impact fertility and are left with an increased number of gonocytes in their testes which may be a predisposing factor in the development of malignancy in the future. Thus our ability to modulate these maturational events may be critical in terms of improving the outcome for boys with cryptorchidism. Thus better assays are necessary to understand the development of the cryptorchid testes which in the future will involve understanding some of the molecular signaling that is occurring at critical times in the development of these testes.

**Figure 8 - Maturation process of spermatogenesis**

A Primordial germ cell to gonocytes occurs in utero
B Fetal spermatogonia to Ad spermatogonia at 2 months postnatally
C Ad spermatogonia to primary spermatocyte at 4-5 years
D Mature sperm at puberty

**References**


**FROM THE SECRETARY**

This will be my last letter in *Dialogues in Pediatric Urology* as Secretary of the Society for Pediatric Urology. I must say that it has been an enormous honor to be involved with the growth and changes that our Society has experienced over the last three years. It has been a privilege to work with a very supportive Executive Council and with three great Presidents, Anthony Caldamone, MD, Marty Koyle, MD, and David Joseph, MD, whose insight and advice have been invaluable. I leave the secretariat of the SPU in the very able hands of Doug Hussman, MD and look forward to working with him over the next year. The management team headed by Aurelie Alger will continue to provide superb and efficient, supportive technical and organizational assistance.

Having been immersed in the inner workings of the world of Pediatric Urology, I would also like to share some thoughts about the current state of our specialty. Pediatric urology has, beyond any doubt, come into its own. In Europe, the establishment of a European Academy of Pediatric Urology and of the *Journal of Pediatric Urology* and, in the United States, the recognition of a Certificate of Added Qualification by the American Board of Urology have enhanced its recognition. The education and training of young pediatric urologists has become more codified and but in the United States the fellowship match is only attracting between 12 to 18 candidates a year despite a growing number of unfilled positions. A small number of centers are training physician scientists who, with their work in both clinical and basic science research, will help advance the field. Pediatric urology has attracted the attention of the NIH and funding for research in pediatric urology is poised to grow. A recent poll of the SPU membership, however, reveals significant clouds in the horizon. In the USA, reimbursement for pediatric urology has remained stagnant. The number of large reconstructive cases seems to have decreased over the last 5 years with a concomitant rise in office visits for non-operative conditions such as voiding dysfunction and enuresis. There remains a significant overlap in the case mix with pediatric surgery in areas of oncology and fetal medicine. This and economic factors will significantly impact the overall market share for pediatric urologists. It may well be that pediatric urology may be forced to better define itself, aggressively protect its area of specialty care and maybe explore new areas for patient care. This can be done in several ways: (1) by increasing and fostering basic and clinical research, (2) by focusing on outcomes research and evidence based medicine, (3) by encouraging funding for long-term, large scale clinical projects, (4) by providing practice guidelines that will promote high quality, efficient health care, (5) by creating joint training and education programs, (6) by reaching out to physicians in Third World Countries. Pediatric Urology must therefore present itself as a vibrant, active and strong surgical specialty backed by quality clinical and laboratory research in order to attract the best and the brightest medical students and residents. Finally, pediatric urology needs to continue to position itself globally. Joint international meetings such as the combined AAP-ESPU meetings in Tours, France and Uppsala, Sweden serve to showcase our specialty. A World Congress of Pediatric Urology planned for 2010 would consecrate these global expectations.

In closing, I want to thank the SPU members throughout the world for their continued support and participation at our Annual Meeting. This has enabled the SPU to grow and thrive in these changing times. I look forward to serving you all as President of the SPU in the coming year.
High scrotal orchiopexy

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The standard orchiopexy involves 2 incisions and follows 3 principles:

i) Stripping of the cremasteric fibers and internal spermatic fascia,
ii) High ligation of the processus vaginalis (hernia sac),
iii) Tension-free placement of the testis in the scrotum, often with a “straightening” of the cord using the Prentiss maneuver.

Over the past 2 decades, laparoscopy has been incorporated into our armamentarium when the testis is palpable. However >80% of testes are palpable, the bulk of which are located distal to the external inguinal ring. As John Hutson has pointed out in this issue of Dialogues, we are seeing 2 peaks in age of presentation of the undescended testes, the congenital variety identified and treated in the first year of life, and those presenting at a mean age of 4-5 years of age with the secondary or ascending or gliding cryptorchid testis. It has been our observation that in the majority of these cases, regardless of the age of presentation, that there indeed is a patent processus vaginalis, but rarely is there a frank hernia. Thus it poses the questions:

i) Are all undescended testes created equal?
ii) Can orchiopexy be “tailored” to the individual patient/testis, rather than “doing it the same way every time”?

iii) Can we comply with the standard principles of orchiopexy utilizing a minimally invasive approach? This basically asks whether the external oblique needs to be opened in every case.

In order to evaluate these questions, we began opening the skin of the groin but not the external oblique aponeurosis. Then the cremasteric fibers were stripped and the processus vaginalis separated from the cord, mobilized cranially and suture ligated. We then opened the aponeurosis and found that indeed we had performed a high ligation of the sac and suture in 6 of 6 cases was above the internal ring. This then led to our making only a single skin incision at the upper scrotal rugal fold to create a dartos pouch and also to access the inguinal canal. The technique worked well, however, Tony Caldamone pointed out that we had, as usual, “re-invented the wheel”. Adrian Bianchi from Manchester had described the technique in Pediatric Surgery International in 1989, and thus deserves credit for the technique1. Lais and Ferro in 1996 in European Urology reported on 50 boys who had undergone this technique of whom 3 required a conversion to 2 incisions, 3 developed scrotal hematomas, I had a recurrent UDT and 2 showed evidence of testicular hypotrophy2. Editorials by Hohenfellner and Passerini-Glazel recommended against using this approach. Of our first 42 boys who underwent this technique, 1 developed secondary re-ascent, another required conversion to a 2 incision orchiopexy, and a post-pubertal boy who had undergone 2 prior orchiopexies ended up infarcting his testis and had it removed.3,4 Subsequently, both Docimo and Russinko have published independent articles showing that this technique is highly successful when employed in the properly selected patient.5,6 Others have also reported success with this approach.7,8

Our most recent data looked at 100 consecutive boys who underwent the Bianchi approach, acknowledging that some patients will require a second inguinal incision in order to assure that adequate cord length is achieved by performing a high retroperitoneal dissection9.

In 6% of cases it was necessary to make a second incision, but by “tailoring” the approach by going trans-scrotally first, this means that 94/100 boys were spared a second incision. In 1 case there was re-ascent of the testis and this did require a second Bianchi approach which was successful. No testes were lost and on exam (no ultrasounds) there appeared to be no testicular atrophy. Of note is the group with trapped testes in whom 88% of testes reached the scrotum after performing the scrotal incision alone. From an operating perspective, we felt that it was safer to identify the testis distally and free the scar tissue from below in order to identify the cord structures. Although not statistically significant, the older the patient was, the more likely it was to require conversion. Some things we have learned along the way may be helpful to the surgeon attempting this approach the first time:

- The penis does get in the way. We use a stay suture in the penis to tack it out of harm’s way or use a steri-strip to tape it to the uninvolved side.
- The high scrotal incision gives you the most flexibility but we have used a raphe incision when the process is bilateral or the patient is younger. We have used the approach in 6 cases where boys have undergone penile surgery, to get adequate exposure after the penis has been de-gloved (Figures 9-11).
- Make your dartos pouch first and then make a separate subcutaneous incision to gain access to the sub-inguinal area.
- Your assistant is essential in giving you exposure. You can get exposure of the external inguinal ring readily and open the canal as necessary. Sometimes in the infants, it helps to excise some of the peri-pubic fat, if it gets in the way.
- Stripping of the cremasterics and high ligation of the processus vaginalis are mandatory, as in standard orchiopexy, in order to assure tension free placement of the testis within the pouch to minimize the risk of secondary re-ascent.
- It is not a crime to have to occasionally make an inguinal incision in order to gain more complete cord mobilization.

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I use a single package of 4-0 Monocryl suture for the entire case (sac ligation, a single figure of 8 subcutaneous stitch and a single subcuticular stitch) and use Dermabond only to complete the skin closure and act as a dressing.

We enforce no postoperative restrictions. Regardless of age immediate bathing and return to full activity is allowed. All patients are given a local anesthetic and a caudal block and given Toradol before they awaken. They go home on alternating doses of ibuprofen and acetaminophen. In older boys a prescription is given for a narcotic to be filled only if necessary. This is rarely required, and if it is, only a few doses are necessary in the majority.

The most common issue is that on palpation post-operatively the peri-testicular tissue becomes extremely indurated. We thus see our patients for a first follow-up at 3 months rather than our prior routine of 6 weeks.

The Bianchi approach to orchiopexy is a simple, effective option in dealing with the palpable undescended testes. It upholds the concepts of traditional orchiopexy with the benefit of allowing rapid return to activity with no scar in the long run. Like laparoscopy, this technique can be a valuable addition to our surgical war chest in patients with cryptorchidism. We feel that by doing so, the operation can be tailored to the patient rather than the patient to the operation.

References

Laparoscopic Orchidopexy

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One of the early advances in the utilisation of laparoscopy was its application as a diagnostic tool for the assessment of impalpable testes in children. Logically, with technical advances and greater experience, laparoscopic orchidopexy has become an accepted part of the armamentarium of the paediatric urologist.

Before applying laparoscopy in the clinical setting of an impalpable testis, one needs to consider whether the testis is present or absent, its probable position is in relation to the inguinal canal, deep and superficial inguinal rings, and whether there are any other and complicating anatomical abnormalities.

From combined multi-institutional experience of undescended testes in their various forms, one would expect approximately 80% to be palpable and 20% impalpable. Of the impalpable group, on average, four out of five have a testis present somewhere and 20% have monorchia or rarely anorchia. In this group, it seems that about two-thirds have a testicular remnant external to the external inguinal ring and one-third deeper within the canal or within the abdominal cavity (the vanishing testis).

The position of the intra-abdominal testis does have influence on what approach or technique best fits the ease of mobilization and placement of the testis into the scrotum. In particular, when is there a need to divide the vessels? A testis within 2 cm. of the internal inguinal ring seems likely to be deliverable to the scrotum without the need for gonadal vessel ligation.

Finally, we know there are certain anatomical obstacles that may make localization, exposure and subsequent manipulation of the testis difficult. Nonetheless the testis always has some peritoneal covering. Its attachment to the posterior abdominal wall varies between a long narrow stalk to a broad sessile attachment as seen with high intra-abdominal testes with complete epididymal dissociation. Previous lower abdominal and pelvic surgery as well as congenital abnormalities, such as gasterochisis, can produce extensive dense adhesions. Prune Belly Syndrome creates its own obstacles with a megacystis that can extend laterally and medially as a fold on the peritoneum retracting to the opposite side releasing the posterior inguinal wall.

Clinical examination may be helpful if one can confidently localize a testicular remnant as well as raise suspicions in the presence of “probable” contralateral testicular hypertrophy. The false negative rate of ultrasound, the radiation involved in CT and the need for sedation/anesthesia for CT/MRI makes these a less attractive option. I do not use preoperative imaging as it is clear that the child will require surgical testicular localisation in any case. I, therefore, rely on my clinical examination and examination under anaesthesia as my planning manoeuvres. I prepare the parents for all options before surgery.

Once the decision is made to proceed to laparoscopy, patient positioning is of utmost importance (Figure 15). In small children, I move the patient to the extreme head of the bed, moving the anaesthetic team to one or other side. Alternatively, cross table positioning with the legs in the frog position on sand bags is a more comfortable and ergonomically sound set up. I prefer alignment of surgeon, assistant and scrub nurse to one monitor (Figure 16). There is a short entry to target length, therefore, shorter instruments are preferable. Instruments are not required to be replaced and are usually 3 mm. in size. One may require a 5 mm. port if a stapler or advanced coagulation device such as a harmonic shears is required. Finally in a small and restricted space such as the infant abdomen and pelvis a 30 degree scope gives greater versatility.

The testis is not always in the pelvis. Therefore one needs to be prepared to move the ports accordingly. An initial open Hassan insertion of the visualisation port through the inferior or superior umbilical fold is made. The testis position, whether unilateral, bilateral low pelvic or high intraabdominal, will determine port positioning. I rely heavily on gravity control viscera with initially the head down at 30-45° with the ipsilateral side up or rolling side to side if it is bilateral.

The two techniques widely described assisting mobilization and placement of an intra-abdominal testis are laparoscopically assisted orchidopexy (single stage gonadal vessels in tact) and laparoscopic Fowler-Stephen’s orchidopexy (single or two stage, vessels divided).

Following positioning of the patient and establishing the pneumoperitoneum, the peritoneum lateral to the testis is incised, passing inferiordly towards the internal ring. The gubernaculum is grasped and delivered into the peritoneal cavity. The vas is followed carefully to ensure that it is not a “long-looping” variety. The gubernaculum is then divided, passing medially and releasing the peritoneum parallel to the vas into the pelvis. Superiorly, the peritoneum is again released along the same parallel plane. Finally, the testicular vessels and vas are lifted medially as a fold on the peritoneum retracting to the opposite side releasing any residual retroperitoneal adhesions to the pelvic wall. The peritoneum that overlies the gonadal leach superiorly is incised completing the peritoneal incisions. Alternatively, this manoeuvre can be delayed until the testis is under tension as it is passed into the scrotum. It is often easier in this position to maintain the necessary tension to allow the peritoneum to slide up the vessels.

The Fowler-Stephen’s orchidopexy applies itself beautifully to laparoscopy. Experience has shown that a one-stage procedure has an unacceptably high testicular atrophy range; therefore, it is recommended that a minimum of three months be left between stages to ensure ad-
Reoperative Orchiopexy

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A standard inguinal orchiopexy can be a challenge, particularly in the child less than a year of age. The internal spermatic vessels and vas deferens are small, the processus vaginalis delicate and the operative field limited. Reoperative orchiopexy, at times, can be a surgical tour de force. Although theoretically the term reoperative orchiopexy might be restricted to those procedures in which a prior attempt had been made to perform an orchiopexy, practically speaking, the term should be broadened to include any operation for orchiopexy in which a prior inguinal procedure has been done. The essence and the difficulty of the procedure lie in the encirclement and complete dissection of the spermatic cord.

The most common reasons for reoperative orchiopexy are three: a prior attempt at orchiopexy in which the testis does not completely reside within the confines of the scrotum, a prior inguinal operation in which the testis was extracted from the scrotum and not returned (iatrogenic cryptorchidism), or a prior hernia repair in which an associated undescended testis was not recognized.

Two generic operations for reoperative orchiopexy have been described: an operation in which the dissection is begun distal to the malpositioned testis and a procedure in which the dissection is begun at the cord level at a virginal site. An operation that begins distal to the undescended testis was described in 1993 by Cartwright and Snyder. They based the procedure on three observations: that most of the previously operated testis were located at the level of the external ring, that fibrosis was diminished distal to the testis and that much of the fibrosis was located between the ventral surface of the spermatic cord and the overlying external oblique aponeurosis. In short, they advocated an inguinal incision down to and exposing the external oblique aponeurosis. They then palpated the testis and began their dissection at its caudal aspect, continuing until the testis was completely mobile. Parallel incisions were made in the external oblique aponeurosis after ascertaining the position of the spermatic cord. The dissection was then carried dorsal to the cord until the level of the medial aspect of internal inguinal ring was reached. The parallel incisions were connected and the spermatic cord was encircled. They further recommended opening the peritoneum cranial to the site of the prior ligation of the hernia sac before dissecting the sac from the cord. They then continued the retroperitoneal dissection of the cord from that point cranially.

The author also described a technique in 1993 in which the spermatic cord is approached through the cremasteric fascia. The procedure was based on a previous finding that the spermatic cord is easily approached through the cremasteric fascia with an unobstructed visualization of the inguinal floor. A further premise was that most surgeons performing inguinal surgery for either hernia repair or orchiopexy have approached the spermatic cord through the ventral aspect of the cremasteric muscle, per se. Therefore, an approach through the cremasteric fascia along its insertion to the inguinal ligament would allow for an approach to the spermatic cord in a virtually virginal field. In addition, without exception, the internal ring had not been opened on its caudal aspect.

A requisite to reoperative orchiopexy is a thorough understanding of inguinal anatomy. A surgeon may have some success with inguinal surgery with a limited conceptual knowledge of anatomy, but if this is the extent of his or her knowledge, reoperative surgery should not be attempted. Magnification is a must and 3.5 mm. loupes are ideal. Not only are delicate structures better seen, but often while operating in fibrotic areas, clues to the structure being dissected are much more easily discerned, such as remnants of the cremasteric musculature or the edge of a patent processus vaginalis. Very important is strict, almost compulsive, attention to hemostasis. Although oozing frequently may occur, a virtually bloodless field can be maintained by immediately addressing even punctate bleeding points with a fine tipped cautery turned to a very low setting. It is important to enhance the opportunity to identify subtleties of structure. Self-retracting retractors, such as spring retractors provide an even, constant retraction in a limited space. This is an improvement over the ever shifting field that occurs with handheld retractors manned by assistants.

Sharp dissection should be chosen over blunt dissection, particularly in areas of fibrosis, which will greatly reduce inadvertent tearing of tissue and enhance the maintaining of planes of dissection. A most important admonition is that no cut should be made until the surgeon is absolutely sure of the identity of the structure being cut, regardless of how prolonged the procedures becomes. All tissues of the cord should be handled with care, as should the testis. Traction sutures placed into the testis should be avoided.

A surgeon may have some success with inguinal surgery with a limited conceptual knowledge of anatomy, but if this is the extent of his or her knowledge, reoperative surgery should not be attempted.

(continued on next page)
Pertinent Anatomic Points

The cremasteric muscle invests primarily the ventral aspect of the spermatic cord. When separated from the overlying external oblique aponeurosis, the muscle appears to form an arc. Bridging from the arc, per se, to the inguinal ligament is the cremasteric fascia. Paralleling the inguinal ligament, between the leaves of the cremasteric fascia, course the genital branch of the genitofemoral nerve and the cremasteric artery and vein, also known as the external spermatic vessels. Once incised, the incision in the cremasteric fascia may be extended laterally into the attachment of the cremasteric muscle or even further laterally into the attachment of the internal oblique muscle. Both maneuvers gain lateral access to the spermatic cord, far removed from most previous dissections. Beneath the cremasteric muscle and fascia lies the internal spermatic fascia, which invests the cord structures. A cleavage plane can easily be established between the internal spermatic fascia and the cremasteric fascia, which establishes a plane, which can be carried to the caudal aspects of the testis and to the level of the internal ring.

In regards to the anatomy of the internal ring, it has been said that the internal ring is a hole, but it is not a hole until the surgeon makes it a hole. Between the transversus abdominis arch and the spermatic cord is a circumferential sheet of transversus abdominis fascia covering the cord. A sharp incision into the sheet of transversalis fascia may be continued in a circumferential manner around the cord, thus opening the internal ring.

A final important aspect of anatomic knowledge is the anatomy of the relationships of the processus vaginalis and the spermatic cord. The processus vaginalis is located on the anteromedial aspect of the cord, though it may invest the cord entirely. The internal spermatic fascia surrounds the processus vaginalis and the cord structures. The internal spermatic vessels are usually embedded in yellow fat, contiguous with the intermediate stratum of retroperitoneal connective tissue. An incision in the internal spermatic fascia at the lateral edge of the processus vaginalis may be extended distally and proximally over the cord following which the cord structures may be dissected away from the processus vaginalis to such an extent that the peritoneal sac may be cross clamped and cut across without opening it.

An initial consideration is whether or not to secure and read the previous operative note. The fact is that frequently the language of the operative note will belie what is actually found at the reoperation; not that the initial surgeon meant to deceive. It was probably truly believed that what was recorded was fact. The date of the previous surgery is important, since reoperative surgery should not be attempted earlier than 6 months following the prior surgery.

As with any open surgical procedure, the proper placement of the incision frequently determines the ease of the remainder of the surgery. The question, therefore, arises, should the reoperative surgeon utilize the previous surgeon’s line of incision or should he or she utilize an incision that they normally would employ. The fact is that frequently the language of the previous surgeon’s line of incision was more cranial, the initial steps of the incision are placed just cranial and lateral to the pubic tubercle. Since in most cases the previous incision was more cranial, the initial steps of the incision will occur in virginal tissue. Indeed the external oblique aponeurosis will not have been incised. The fibers are usually seen clearly and so an incision can be made in the direction of the fibers and through the remnant of the external ring and frequently into the internal spermatic fascia. Once the external oblique aponeurosis is completely incised, the caudal leaf of the external oblique aponeurosis is grasped with forceps. Using a cotton-tipped applicator or Kuttner dissector, the cremasteric muscle and the cremasteric fascia are swept from it’s under surface. This plane is pursued to the level of the inguinal ligament, where upon the external spermatic vessels and genital branch of the genitofemoral nerve will be noted just beneath the cremasteric fascia, paralleling the inguinal ligament. The fascia is incised immediately cranial to the inguinal ligament, avoiding the cremasteric vessels. The incision is then carried proximally and then distally as far as it can be carried without encountering fibrosis. If fibrosis is encountered laterally, the incision is continued laterally, dividing the attachments of the cremasteric muscle or even the attachments of the medial border of the internal oblique muscle from the inguinal ligament. The intent is to gain a position lateral to the internal ring, which will give access to a virginal area of the spermatic cord. The cremasteric vessels should now be dissected from the underlying internal spermatic fascia covering the cord. The internal spermatic fascia is then grasped with forceps and with caudal and ventral traction, the cord structures will usually easily separate from the cremasteric muscle. Continuing this plane of dissection, the cord can be encircled. Sharp dissection may be required to facilitate the freeing of the ventral medial aspect of the cord, since this is usually the site of the previous ligation of the hernia sac. Once the cord is encircled, the plane of dissection between the cremasteric fascia and internal spermatic fascia is pursued carefully until the testis has been completely freed. Attention is then directed to the internal ring. An incision is made in the transversalis fascia at the caudal aspect of the emergence of the cord through the internal ring. The incision is carried circumferentially around the cord. The next step is to separate the processus vaginalis from the remaining cord structures. Although the original operative note may record a high ligation of the sac, the site of ligation will frequently be found in midcanal. The sac is dissected to a position cranial to the internal ring and ligated. The internal spermatic vessels and vas are now separated from the under surface of the peritoneum. The intermediate stratum of retroperitoneal connective tissue lateral to the cord is incised to affect a medial excursion of the cord. The condensation of the intermediate stratum of retroperitoneal connective tissue medial to the cord, the “secondary” internal ring, is then incised. If adequate length of the spermatic cord is not attained by this maneuver, the transversalis fascia is incised to the level of the pubic tubercle. Following this the outer limiting membrane of the intermediate stratum of retroperitoneal connective tissue (the continuity of the fascia incised when incising the “secondary” internal ring) is incised dorsal to the inferior epigastric vessels. The spermatic cord is then transposed medial to the epigastric vessels (the Prentiss maneuver). Any testicle that was located within the inguinal canal will now be ready to be placed without tension in a subdartos scrotal pouch.

References

It is often said, the strength of an organization doesn’t come from the individual acting as president, but from others in the administration. They are the ones truly responsibility for the organization’s success. That is keenly evident to me as this year comes to a close. I was fortunate to have Marc Cendron guide me through the tasks that needed to be addressed, and I thank him for that. Marc was in the difficult position of following in Tony Caldamone’s shoes and he did that admirably. The successes we’ve had this year are a reflection of his efforts. The future of the SPU is strong under Marc’s upcoming leadership as president, with Jack Elder primed as president-elect and Doug Husmann taking the reins of secretary.

The “new beginning” for the SPU can be dated to the vision of past secretaries particularly that of Bill Cromie, Tony Caldamone and continued by Marc. Their foresight recognized that the next step for growth of the SPU was seeking professional administrative assistance and financial guidance. We’ve been fortunate to have Aurelie Alger and associates from PRRI elevate the standard of the SPU, improving member services, increasing direct communication and adding utility to our website. Financially the times have changed and I know that I wouldn’t have come close to the success of past presidents assuring our financial well-being. The work of Jean Stasik has been outstanding and has served us well. It has provided us a solid foundation and allowed us to pursue activities such as this Dialogue and ability to support research grants.

For years we have discussed the desire to have Pediatric Urology recognized through certification. That dream will become reality in the not so distant future. There were several roads that could have been taken to accomplish certification. Our coordinating council under the direction of Gil Rushton, executive secretary, took the high road, working with the ABU and AUA not against them. They are congratulated for their efforts. The process for certification though didn’t begin with the coordinating council, many of you have contributed over the years and survived what at times was a painful experience. All of you are responsible for certification. But with a certificate of added qualification comes increased responsibility and I suspect an even greater effort will be needed to maintain respect and credibility particularly with our pediatric surgical colleagues, the ABU, AUA and internationally. There is bound to be some grumbling and ripples in the future but organized urology, especially the AUA, will be strengthened not factionated as Pediatric Urology becomes “legitimate”.

It seems like yesterday that a group of us (names not mentioned but you know who you are) were discussing the need to become more influential in the political makeup of pediatric urology. All of you have contributed and we now give way for the next generation. The stakes and responsibility for pediatric urology have become higher and the challenges greater. It is essential that we maintain the interest and eagerness of our younger associates and the new graduates and encourage their involvement. The importance of joining, participating and speaking out cannot be underestimated. Membership into the SPU, AAP, AAPU, SFU and corresponding membership in international societies are all complementary and essential. Each society has its own unique personality, strengths and goals. As we move forward we should recognize that the future existence of pediatric urology and the various societies may be limited by financial constraints; and enhanced by sharing responsibility, utilizing the particular strength of each society, combining resources when possible, limiting duplication and preventing competition. Due to the small number of pediatric urologists, all of the organizations are made up of similar memberships. Any success and achievement within one association benefits all of us. The coordinating council is in the position and has the ability to see these mutual alliances succeed.

It has been an honor for me to have served as the president this past year. I greatly appreciate having had this opportunity and your confidence. I look forward to seeing all of you in San Antonio. Warren Snodgrass has prepared an outstanding academic program (with CME approved credit) and Elizabeth Yerkes will definitely have us entertained at the Buckhorn Saloon & Museum. This is a meeting you won’t want to miss.