20th Anniversary of TIP Repair

FROM THE GUEST EDITOR

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“As time goes by....”

In the midst of the tail end of a hurricane, in the fall of 1992, the final session of the South Central Section of the AUA, a session on pediatric urology was taking place in Galveston, TX. I was chairing the abruptly shortened session, given the weather. In addition to me, there was a captivated audience of four - the four presenters. I was intrigued by a presentation by a contemporary who I had not known from Lubbock, TX, Warren Snodgrass. Warren delivered his “slide” presentation.

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Lessons Learned From 20 Years of TIP Repair

Warren Snodgrass, MD
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FROM THE EDITOR

Elizabeth B. Yerkes, MD

I knew that I would enjoy Marty Koyle’s enthusiasm and words from an insider to tell the early TIP stories. The photo of the group was an excellent find as well.

TIP was beginning to spread during my fellowship, so my first TIP exposure was at that time. The unknown gets a cautious embrace but is now widely accepted. Every type of procedure we perform causes us to recall words of our mentors or other colleagues—a nice tribute to our small urologic family whether we do things exactly the same or have drifted in small ways over the years. I remember Mark Cain advising me during my clinical year of fellowship that it would take about 5 years in practice to feel that I was doing a (very) good job with hypospadias. I hope that this has been sage wisdom passed along to him but perhaps it was tailored for me. He was probably about right but some cases still make me wonder if I have arrived.

Certainly there is always room for technical and cosmetic improvements if we hon-
tion describing his experience with a new hypospadias technique that he called the incised urethral plate. It made sense to me that he was hinging the urethral plate as Mark Rich had described while working with John Duckett, and combined it with a Thiersch-Duplay urethroplasty, similar to the GAP (glanular apposition procedure). I returned to Denver and tried it a few times before showing it to my senior colleague, Ron Pfister, who suggested that “it just won’t work”, and that it would take years before we really knew the outcomes. He remains correct about the latter.

My mentor and former colleague, Rick Ehrlich invited me back to UCLA in 1993, where I was able to perform the TIPU, and he and Rick Hurwitz, both thought that it was worth trying. Tony Caldamone, an annual visitor to Denver in those days, was game to try it, too. Starting in 1992, I began an annual visit to Leicester, UK which allowed me to not only interact with many influential colleagues, but also have an opportunity to operate with one another. I think that is where I did the first TIPU outside of North America. I also met an eloquent plastic surgeon, Aivor Bracka, and learned a 2-stage technique that he was touting where, like Warren’s procedure, the urethral plate was incised but an inlay graft (at that time post-auricular skin) was placed in the first stage. We debated one another as to whether this graft and a second stage were “always” necessary in the raw bed of the incised urethral plate. I have no doubt that he thoroughly trounced me in that debate.

Tony Manzoni would later invite me to his annual meeting to Varese, Italy where many urologists and pediatric surgeons, on a televised circuit, were able to see this new technique introduced. As experience was gained with the procedure, I collated my data with that from Hurwitz, Ehrlich, Manzoni, and Caldamone and it was evident that our short-term results were very similar and reproducible. With deep embarrassment, I had to go back through the program from the 1992 South Central meeting, as I had forgotten Warren’s name and really didn’t know how to title the TIPU. In my operative reports, I was calling it the hinged glanular apposition procedure. Finally, I called Warren and informed him of the results. He graciously offered me the opportunity to write up the data that I had collected and we agreed that he should be the responsible author and use his and our data in combination describing the TIPU for distal hypospadias repair.

Later, we would all collaborate on another joint paper describing our results with proximal repair. This was all pre-internet days, with no smart phones, and we were sending information back and forth via fax, occasional emails, occasional snail mails, and lots of land line telephone calls. Somehow we got it done. Warren, and now Nicol Bush, deserve so much credit for pioneering a technique, engaging stakeholders, and for reporting their data in an evidence-based manner. “As time goes by”, congratulations to Warren, on a quarter of a century of success, “The Snodgrass” repair.

From the Editor

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testly critique our own work, and being willing to consider learning small changes from others keeps us fresh and more nimble. We have to give Warren and Nicol credit for looking at their results so carefully and sharing lessons learned from their own hands. Nearly 10 years ago I attended the AUA hypospadias course moderated by Doug Canning. After multiple attempts to get Warren to admit that there is some sort of plate that cannot or should not be incised, I reluctantly surrendered. I still don’t really agree, but what I most remember from that panel was Warren’s statement that “the body has to be responsible for something.” This was not in reference to the incised urethral plate but rather to allowing the meatus and glans to find each other without being directed by sutures. It was a great point that made sense for me and is an ‘-ism’ I will continue to credit to him when working with our residents and fellows.

In that spirit of memorable ‘-isms’ and pearls, this Edition’s As Above, See Below feature includes solicited comments from both new and mid-career surgeons. With many ‘-isms’ we can never be certain of the true creator and it may morph over time due to incomplete recall. Some can only be appreciated locally or as an institutional memory. Mentors will be proud to know that the pearls shared by their mid-career mentees are largely still held dear today!
Lessons Learned From 20 Years of TIP Repair

Warren Snodgrass, MD and Nicol Bush, MD
PARC Urology, Dallas

2014 marks 20 years of the “Snodgrass repair”, and this is the first, and last, time I will ever refer to it by that name! In 1994, I reported a new operation to correct distal hypospadias in a small series of boys, none of whom happened to develop a complication. Figure 2 in that article showed the urethral plate before and after dorsal midline incision (Figure 1), prompting one reviewer to ask if they were photographs from the same patient! Marty Koyle had seen me present the technique at the 1992 South Central AUA meeting, and subsequently recommended it to others. In 1996, he, Tony Manzoni, Rick Hurwitz, Tony Caldamone and Rick Ehrlich, combined their initial experience using TIP repair with mine to publish outcomes in a larger patient cohort. This report caught the attention of surgeons around the world who knew them and so decided to try the new operation. Another two years passed and I left my private practice in Lubbock and moved to Dallas to begin an academic career focused on testing the limits of TIP repair.

I brought patient charts from Lubbock, but discovered they did not easily mesh into the filing system at Children’s Medical Center. Realizing information from my first cases was about to be lost, I started an Excel spreadsheet to preserve it. Then, recognizing the spreadsheet could provide accurate and up-to-date numbers of operations and their complications, I added data from new patients when they were operated and returned for follow up.

In 2008, Nicol Bush laboriously reworked this descriptive database, dummy coding nearly a thousand entries to enable SAS and multivariable logistic regression - which began a collaboration that has since yielded new insights into both TIP and hypospadias repair in general. Based on these observations, indications and contraindications for TIP were established from evidence, and technical modifications were made which reduced complications. Now 20 years after that first article on TIP this issue of the Dialogues highlights lessons learned on this journey.

Distal TIP

As other centers began reporting TIP outcomes, I realized few mentioned glans dehiscence that I found occurring in a persistent number of boys. I easily determined the prevalence of this complication in my practice from reviewing the database. At first I thought dehiscence might relate to the chronic sutures I continued using after training to approximate glans wings, when I learned other surgeons preferred vicryl or PDS. So I began using vicryl in consecutive patients and recorded that change in the database.

Meanwhile, the most frequent question I heard at various meetings was how to avoid meatal stenosis and still manage to create the neomeatus at the tip of the glans. Again I turned to the database and confirmed there was no stenosis. I routinely performed postoperative calibration, a practice I began in Lubbock to reassure a pediatrician that normal, asymptomatic, 4 year olds he sent me when the meatus looked small did not have anatomic obstruction. When patients returned for a 6 month visit after hypospadias repair I similarly passed a sound through the neourethra demonstrating there was no stenosis – and the first TIP article stated all 16 boys calibrated to >10Fr.

Consequently, I suspected technical errors caused the stenosis others encountered. Discussions with these surgeons led to the conclusion they were likely tubularizing the urethral plate further distally than I did in order to sew the glans wings directly to the urethral plate and create a neomeatus at the very tip of the glans. In contrast, I began urethral plate tubularization at about the mid-glands a few mm below the end of the plate specifically to avoid a tight opening, and then separately approximated the glans wings at the mid-glands level, relying on spontaneous healing to resolve the gap between the urethral plate and glans openings (Figure 2).

Some beginning to tubularize the urethral plate thought it necessary to define those suitable for TIP versus others better managed by other procedures, following the example of decision-making between MAGPI and Mathieu based on variations in the subcoronal meatus. Influenced from training with Dave Gibbons and Edmond Gonzales when they were studying this anatomy, I started recording the plate groove as “flat”, “cleft”, or “deep” in keeping with other surgeons’ similar descriptions. Subsequently, Holland and Smith, Sarhan et al, and I each reported outcomes after distal TIP based on this characterization, finding they were the same – in other words, there was no contraindication to TIP based on depth of the urethral plate groove before midline plate incision.

Figure 1. Photographs from the first TIP article
The original caption read: A, urethral plate separated from glans. B, note generous mobility of urethral plate in patient after deep incision, allowing subsequent tubularization.

Figure 2. Independent closure of glans wings, separate from tubularization of the urethral plate
The neomeatus is created by approximating the glans wings (top arrow) separate from the opening in the tubularized urethral plate (bottom arrow). This key step minimizes risk for meatal stenosis, and both should begin approximately mid-glands

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However, both Holland and Smith and Sarhan et al. stated urethral plate width less than 8mm before incision increased postoperative complications. I read their reports and thought these complications more likely developed from not incising the plate sufficiently deep – to the surface of the underlying corpora – and/or tubularizing it too far distally. After watching our 2014 Live Surgery Webinar, Smith emailed that he agreed, it was not the pre-incision plate width but rather these technical issues accounting for the increased complications he found. Meanwhile, Bush and I have been measuring plate width in consecutive patients with distal hypospadias and found over 85% are less than 8mm before incision. However, multiple logistic regression analysis proved this width did not correlate with subsequent urethroplasty complications.7

I have not used any other surgical technique for distal hypospadias repair since the 1994 TIP report. Bush and I reviewed the reconfigured database after my first decade working in Dallas, analyzing 551 consecutive patients with distal hypospadias. Since only TIP was done there was no selection bias based on any subjective impression or objective measure of urethral plate groove, width, general appearance, suppleness or other characterization. Potential urethroplasty complications included fistula, glans dehiscence, meatal stenosis, urethral stricture, and/or diverticulum, which overall occurred in 4% and were not correlated with the urethral plate groove. We found no contraindication to distal TIP in this large series of consecutive patients.6

It has been said hypospadiologists should not force an operation on a patient, but the evidence just reviewed suggests TIP can be reliably adapted to the varying phenotype of distal hypospadias. Given its relative simplicity, versatility, reliable cosmetic results and expected complication rate less than 10%, TIP has reportedly become the most common operation done worldwide for distal hypospadias repair. Nevertheless, we recently polled US pediatric urology fellows and learned 40% were still taught to select from various options based on urethral plate anatomy.

Because TIP does not use skin flaps it is ideal for foreskin reconstruction in patients whose families do not want circumcision. I learned prepuceplasty during a visiting professorship in Uppsala from Gören Lackgren, and incorporated the technique into my Dallas practice. We do not evaluate any aspect of the foreskin preoperatively, but simply ask caregivers if it was their plan to have the boy circumcised at birth or not, and then follow that wish. We reported there was no difference in urethroplasty complications or skin revision rates related to circumcision versus prepuceplasty, which was requested by 20% of caregivers in a series of 428 consecutive repairs.8 A ventral dartos flap provides neourethral coverage. Every year we are contacted by families who want the foreskin reconstructed rather than removed but were told it is not advised. Our data generated without selection bias demonstrates otherwise, and so this simple variation can be offered when requested.

Proximal TIP

My first proximal TIPs had greater than 50% complications, mostly fistulas.9 Again continuing methods learned in training, I tubularized the longer neourethra with a single running epithelial chromic suture and covered the repair with a dorsal dartos flap. When caregivers of those initial patients asked about potential complication rates I quoted them 33%, extrapolating from prepuceplasty operations. In Lubbock I only did an average of 6 hypospadias repairs annually, and given a ratio of 10:1 distal to proximal hypospadias, there were long periods between proximal operations. Even when my volume greatly increased in Dallas, I did not realize my complication rate was so high since proximal cases were still uncommon.

During my fellowship year between leaving Lubbock and reaching Dallas, Mike Mitchell advised me to suture the urethral plate in 2 subepithelial layers. But not knowing the number of fistulas I was creating, I continued the faster single layer closure. When I created the database and reviewed outcomes from the initial 15 cases, I was shocked to learn my fistula rate was 33% (versus 2% after distal TIP)! So I changed from 1-layer chromic epithelial to 2-layer vicryl and PDS subepithelial suturing, and added spongioplasty before covering the neourethra with a dorsal dartos flap in the next 20 patients. Fistulas decreased by more than half to 10%.9 In the last published series of 24 boys, the dartos flap was replaced with tunica vaginalis and the overall complication rate was 13% - with no fistulas.10 The prospective database helped to first identify the problem, and then to prove technical modifications effectively decreased complications.

The major contraindication to proximal TIP is ventral curvature leading to urethral plate transection. Urethroplasty options without a urethral plate include 1-stage tubed prepuceplasty, or 2-stage flaps or grafts. I decided to test 2-stage repairs, beginning with Byars flaps. But when my first series had 100% complications, mostly diverticulum in the absence of distal obstruction, I decided the operation might be inherently flawed – at least the way I was doing it – and changed to a 2-stage graft technique, similar to the repair I was using for complex reoperations when the urethral plate was scarred or absent. To reduce the length of graft needed, I began dissecting the formed urethra off the corpora to deep within the scrotum after transecting the plate, and then gently stretching it back distally to gain an additional 1cm.

Amilal Bhat presented his idea to dissect the formed urethra proximally with the urethral plate still intact, at the ESPU in Athens, reporting this maneuver actually resolved ventral curvature in most cases.10 I adopted this variation as a modification that might preserve the plate in some cases for 1-stage repair. However, unlike Bhat, most my patients still had curvature >30° after this dissection, requiring ventral corporotomies to straighten the penis. Nevertheless, when bending was corrected preserving the urethral plate I found it could still be incised and tubularized for single stage TIP.11

Most these patients did well, but approximately 20% developed symptomatic focal strictures of the neourethra resulting in urinary retention in all and febrile UTI in several. Bush analyzed this outcome comparing proximal TIP with and without urethral plate / proximal urethra mobilization, finding the incidence of strictures was statisti-
Glans Dehiscence

As mentioned above, I changed glansplasty suture from chronic to vicryl to reduce glans dehiscence, but subsequent review showed this made no difference. However, dehiscence occurred significantly more often after proximal than distal TIP, despite using the same operative technique and sutures\textsuperscript{13}, leading us to question if proximal cases had a smaller glans size which might explain the increased risk.

To determine if our hypothesis was true, Bush and I began measuring the glans. First we had to agree what to measure, given the varying shapes of glans, and then how to relate findings to normal boys and patients. Others had reported glans circumference, which we thought would be difficult to reliably obtain, so we began recording diameter at the widest point in all patients undergoing hypospadias repair (Figure 3) and compared those to width in newborns undergoing circumcision as controls. We found the mean glans diameter in normal newborns a median of 1 month old was 14mm, versus 15mm in patients with distal, but only 12.7mm with proximal hypospadias at 8 months of age.\textsuperscript{14}

While the difference in glans diameter was statistically significant, that did not mean size was an independent risk factor, separate from proximal meatal location, for glans dehiscence. Such critical thinking was the central theme of the clinical sciences curriculum that Bush learned while earning a Master’s degree after fellowship. Using consistent data from consecutive patients, she applied multivariable logistic regression analysis to determine the importance of glans size as we measured it.

Bush confirmed that each mm in glans diameter impacted risk not only for glans dehiscence, but for urethroplasty complications overall. To make this observation clinically applicable, she decided to use 14mm as the reference point, and found the odds for complications was 3.5x greater when glans width was less, regardless of meatal location. In other words, glans diameter is an independent risk factor for urethroplasty complications such that risk is increased in boys with either distal or proximal hypospadias when it is smaller.\textsuperscript{15}

Then, knowing androgens increase glans size, we next decided to use preoperative testosterone injections when the diameter was <14mm with the goal to reach ≥15mm before surgery. We first gave 2 or 3 injections of 2mg/kg as commonly recommended, but found some boys achieved the desired width after a single injection, while two-thirds of proximal patients did not reach it with 3. So we changed the protocol, still beginning with 2mg/kg, but then re-measuring 1 month later and increasing the dose to 4mg/kg if the target size was not achieved. Another month later the glans was measured again and 8 mg/kg given if it was still below the desired diameter. This process continued until the glans width was ≥15mm.\textsuperscript{16}

While we successfully increased glans diameter with preoperative testosterone injection, the goal of therapy was to reduce complications. Outcomes in those patients requiring testosterone to reach glans width ≥15mm were compared to similar patients who naturally had that diameter without testosterone treatment, finding complications remained significantly greater in the treated boys.\textsuperscript{17} Consequently, we stopped preoperative androgen therapy as it poses an independent risk for urethroplasty complications, along with proximal meatal location and glans size.

Around this time in 2012 I flew to Japan to observe the 1-stage tubularized prepubial graft repair done by Saburo Tanakazi and Kaoru Yoshino. I was surprised by the greater extent of glans wings mobilization they did, which Yoshino stated resulted in a <1% dehiscence rate even though mean glans width in their proximal cases was also 12mm, and preoperative testosterone was not routinely used.

For the past 2 years Bush and I have used their glans wings dissection when the width is <14mm, which involves first mobilizing them laterally along the surface of the corporea to 3 and 9 o’clock, and then distally another 4mm off the corpora on both sides (Figure 4). While this is done specifically for smaller glans, we also realize our dissection of the glans wings in general is more extensive than before. Bush recently analyzed our data since making this technical change and found the rate of urethroplasty complications, including glans dehiscence, has significantly decreased (unpublished data).

### Logistic Regression Analysis

Our database recording factors including age, meatal location, glans diameter, type of repair (TIP, inlay, or 2-stage graft), primary or re-operative urethroplasty, type of glansplasty (regular or extended), barrier layer (dartos, tunica vaginalis), circumcision versus prepuccioplasty, and complications - all recorded at the time of service - facilitates multiple logistic regression analysis to isolate those which impact outcomes.

Of these, proximal meatal location, reoperation, preoperative testosterone, and glans width <14mm each are independent risk factors increasing likelihood for urethroplasty complications. While surgeons cannot change the meatal location or the fact of reoperation in a given patient, measuring glans width at the beginning of every surgery guides our glansplasty, as just discussed.

This same data showed no difference in outcomes based on age at surgery, glans suture type, surgeon (WTS or NCB), or circumcision vs.

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Our most recent analysis since glansplasty modification found no difference in results of proximal TIP versus 2-stage graft operations, each having 15% complications.

Additional advantages of the database are the easy identification of problems, such as the initially high fistula rates in proximal TIP and glans dehiscence in the small glans, and follow-up analysis of the changes undertaken to address those problems. The modifications we made in proximal TIP urethroplasty and in glansplasty for small glans were successful, whereas the change from chromic to vicryl glans suturing and preoperative testosterone therapy were not.

Collecting information prospectively takes little time and makes patient assessments and treatments more uniform. It also facilitates periodic review of outcomes, which in my experience—not only with hypospadias, but also for neurogenic bladder outlet procedures and laparoscopic hernia repair—inevitably have shown results to be less favorable than I thought! Sometimes surgeons are resistant to change, believing their results are as good or better than others, just like I believed it unnecessary to do 2-layer urethroplasty until learning my fistula rate was so high. A multicenter national Dutch registry recently found wide variation in techniques chosen for distal hypospadias repair—complications rates varying from 10% to 70% among the surgeons.19 I suspect those with higher rates did not know they had so many complications, but now with this information will make practice changes to improve.

As I found example after example of results that could be improved in my own practice, I grew concerned, as an academic surgeon, that I might unintentionally teach residents and fellows technical errors they would then repeat in their own patients, multiplying their negative impact. These “3Ps” of prospective data collection, periodic outcomes review and subsequent practice change helped ensure I taught our trainees the best operative steps.

Reporting Results

As Bush and I analyzed our results and compared them to other publications, we realized there are no standardized definitions of the urethroplasty complications that occur after hypospadias repair. While fistulas and strictures would likely be similarly diagnosed by different surgeons, greater variability in identifying other complications including meatal stenosis, glans dehiscence, and diverticulum almost certainly exists. For example, we have given second opinions to a number of patients told there was postoperative meatal stenosis based on small appearance in boys without symptoms whose meatus calibrates to $\geq 8\text{Fr}$, which is the minimum normal size in children.20 Conversely, most the patients we have encountered with glans dehiscence after repair by other surgeons were not told this complication, which impacts not only the appearance but can result in urine spraying.

We suggest meatal stenosis be diagnosed by the combination of symptoms, including stranguria, UTI and or dysuria, plus calibrating <8Fr. Most often glans dehiscence results in complete separation of the wings and a coronal meatus. Sometimes the separated wings are connected with a band of tissue creating a pseudo-glanular meatus, but these patients also have dehiscence and may spray during voiding (Figure 5). Diverticulum are visible out-pouchings of the neourethra during voiding, but our experience with prepuce flap repairs that more likely result in them is not sufficient to define when enlargement during voiding of the neourethra lacking spongiosum crosses the threshold to become a diverticulum.

It is important that these complications be described the same way between surgeons so that results can be compared. Of the various domains of hypospadias outcomes, including urinary function, sexual function and cosmetic appearance, urethroplasty complications are the easiest to quantify and so are most often quoted by surgeons explaining their preferences for various operative techniques. Nonetheless, surgical reports listing only fistula rates are quite different from those also reporting glans dehiscence, diverticulum, strictures and meatal stenosis. And a report that defines meatal stenosis as a small-appearing meatus may be very different from one with calibration or uroflow data. Agreeing on standardized definitions as a specialty will help alleviate these problems.

It is important that these complications be described the same way between surgeons so that results can be compared.... But until definitions are standardized, it is important that reviewers and editors insist that authors clearly state how they determined complications when articles are considered for publication.

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Figure 4. “Extended” glansplasty

A. standard glansplasty, in which glans wings are separated off the corpora laterally to 3 and 9 o’clock before their subsequent approximation

B. “extended” glansplasty, with additional dissection of the wings from the corpora distally another approximately 4mm on each side. Note the resulting horizontal orientation of the wings in contrast to the standard glansplasty dissection

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But until definitions are standardized, it is important that reviewers and editors insist that authors clearly state how they determined complications when articles are considered for publication. Otherwise readers cannot apply the experiences of the authors to their own practices.

And in addition to surgeon-reported results such as urethroplasty complications, additional work is needed to determine if these are the outcomes that matter most to patients, and, if not, then what does! Our work in conjunction with Melise Keays using a pilot patient-centered outcome questionnaire administered pre- and post-operatively reminds us that a significant portion of hypospadias patients are very concerned about cosmesis, body image, and urinary function.

Comparing Observations Worldwide

I described above learning from Japanese colleagues how to improve glansplasty. This occurred more than a year after we published an article on glans dehiscence, which included description of our operative technique, and after some glasses of sake I mentioned they never contacted me with their solution!

During that same visit I watched 4 scrotal hypospadias repairs in boys who all had ventral curvature >30° after degloving. I was surprised their bending completely straightened by transecting the urethral plate at the corona and then dissecting it from the corpora to the native meatus – which is not our experience in which 85% of patients still have curvature >30° leading to ventral lengthening by corporotomies (unpublished data). John Duckett similarly found that excising the urethral plate did not straighten the penis.21 We were intrigued by this apparent difference in the etiology of bending in Japanese boys versus our mixed population mostly of western European descent, so I asked other Asians and was told in both Hong Kong and in India that neither dorsal plication nor ventral lengthening were usually needed in their proximal repairs.

This could explain why Bhat reported urethral plate and proximal urethra mobilization usually straightened the penis, whereas our patients nearly always additionally need ventral corporotomies. When I asked one Asian surgeon why they did not comment on this difference at international meetings, he responded they were concerned the North Americans and Europeans would conclude Asians did not know how to properly assess curvature!

Bush is now working to create a network of surgeons in various corners of the world to systematically assess phenotypic differences in patients with hypospadias. Using this data, we can tabulate the prevalence and extent of ventral curvature, and hopefully identify the optimal means to correct it. By using standardized pre- and intra-op measurements and standardized definitions for complications along with prospective data collection, we can also determine if complication rates vary by geography and help address potential issues such as nutrition which may impact results.

Live Surgery

Given the lack of uniform reporting and these possible variations in hypospadias phenotype among different populations, the need for surgeons to observe other surgeons operating is apparent. Hypospadias repair is a demanding task in which dissection just 1mm off the correct plane can result in complications. It is difficult to thoroughly and clearly describe such precise details in articles or textbook chapters, and impossible to do so in abstracts at national meetings. Even edited videos may not convey needed information, since a step important to improving someone’s results might not be included in the final 8 minute version.

Every year there are multiple live surgery workshops held around the world demonstrating hypospadias repair, attesting to the technical demands of the operation and the desire of many surgeons to do better. But it is sometimes not convenient, and in some cases may be impossible, for surgeons to travel to these workshops. For this reason we decided to offer a live surgery demonstration 4 years ago, which is now shown by webinar worldwide.

In our practice we are exploring other means for post-graduate education, including private webinars for surgeons referring unusual or difficult cases, and visits to assist in cases chosen by host surgeons that they find challenging. We noticed fellows may not fully comprehend the technical nuances of hypospadias surgery during training, until they have to perform these operations on their own and realize they may have missed a few details while working with their mentors!

Subspecialization

There is growing evidence that complex operations have better outcomes when done by surgeons with larger volumes. Cardiac arterial bypass, pancreaticoectomy, and thyroidectomy are among many examples in which lower complications have been documented by high volume surgeons22, and a systematic review of literature on a variety of procedures further supports the concept.23

A prior survey of resident participation in hypospadias repair found they were allowed to do less than 50% of the overall operation, concluding both residents and their faculty believed specialized (fellowship) training was required to perform this surgery.24 But no determination of the minimum number of cases needed to achieve and then maintain competency has been made.

Self-reported case logs by pediatric urologists to the American Board of Urology showed the median number of distal repairs annually was 12, and for proximal surgery was only 2.25 Even if 12 cases is
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sufficient to reliably perform distal hypospadias repair with complications in <10%, it is very unlikely that optimal results can be obtained for the widely varying phenotype of proximal hypospadias, which includes ventral curvature >30° and glans diameter <14mm in over half the cases, doing only 2 a year. We reported that most the patients characterized as “cripples” based on combinations of persistent curvature >30°, obliterative stenosis, dehiscence, and/or hair in the neourethra originally had proximal hypospadias20 operated by fellowship-trained pediatric urologists.

Together these observations strongly support subspecialization of proximal hypospadias repair so that fewer surgeons can gain greater experience and develop expertise. We suggest that centers designate a single surgeon—even better, a team of 2 experienced surgeons—to perform proximal operations, as well as re-operations, which also ensures a senior surgeon can train a successor.

**Lessons Learned**

Our journey from distal to proximal TIP, and then to 2-stage grafts has taught us many lessons in hypospadias surgery. First, we have found that all cases can be reliably repaired using only 2 basic techniques: TIP (and related inlay grafts) and 2-stage grafts (using either prepuce or lower lip). There is no need to incorporate more procedures into the surgical algorithm, and given the low number of repairs done annually by most specialists, greater expertise likely can be achieved and maintained if fewer operative techniques are used.

Second, we and others have observed that surgeons, including us, sometimes assume their individual results are better than they actually are, but when they realize their true complication rates they change to improve. The best means to determine true outcomes and then monitor whether such changes are effective is prospective data collection. A simple spreadsheet recording only a patient identifier, meatal location, primary versus re-operative repair, surgical procedure done, and complications is sufficient to begin this personal quality review. During her fellowship with us, Melise Keays worked with the IT department and developed electronic forms that generate the spreadsheet automatically in Epic, minimizing workload.

Third, we have seen the power of reliable data to better understand both our surgeries and hypospadias in general. I could easily determine the number of distal or proximal or re-operative TIP procedures done, follow up afterwards, and complications diagnosed, from the spreadsheet, as well as simple chi square comparisons between patient groups to assess technical modifications made. But Bush is able to further mine this information to better understand the underlying factors that influence those results besides the surgical technique used for repair. Determining these factors through multivariable analyses then focuses surgical innovation to improve outcomes.

Fourth, proximal cases are uncommon and should be concentrated into the hands of designated subspecialists, who would then be held accountable to the group to improve results.

Finally, the world is filled with innovative surgeons making observations that can improve hypospadias surgery. One reward of our travel has been to learn from them. Hopefully our profession will embrace new means to share information and supplement traditional academic presentations and publications – all for the benefit of the boys we operate upon.

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"As Above, See Below......."

Other hypospadiasisms and pearls, shared from ‘round the small world of Pediatric Urology. Initially current fellows and recent grads were surveyed about the words of their mentors. When credit was assigned, it is included. The second group of pearls were solicited from colleagues who trained “around” the time that TIP was spreading.

“There is a snake under every bush.”
(translation: be wary of pitfalls because they are lurking everywhere) - Dr. Edmond Gonzales

“That dog will hunt.”
- attributed to one or more Texan/Texas-trained mentors

“Stuff in the brains.”
According to the source: “When closing the skin, the dartos may protrude out. So it became a saying to ‘stuff in the brains’ when tying down the skin stitches. Seemed funny at the time but maybe one has to be there.

“You can’t make chicken salad out of chicken s***.”
Heard from many but credited to Dr. Butch Noe: When doing a hypospadias with crummy tissue.

“Very much in the middle.”
One of Dr. Pippi Salle’s best lines in reference to incising the urethral plate, etc. The ‘very’ is usually drawn out a little bit - “Veeeeeery much in the middle.” Best appreciated in his Brazilian/Canadian/American accent.

“There’s only one great opportunity to repair a hypospadias - the first time - so take your time and do it right the first time!”
- Dr. Armando J. Lorenzo

“He is going to love it! And god made him like this!”
- Dr. Glenn Cannon

“No wrinkles of my penises!”
- Dr. Heidi Stephany

“That’s a fistula.”
(in reference to less than perfect suture placement)
- Dr. Mark Cain

“We’re going to talk to the penis.”
- Dr. Max Maizels

Pearls retained by colleagues who trained “around” the time TIP became widespread and therefore familiar with pre-TIP pearls:

One of the keys for preventing hypospadias complications is using “lots of tiny stitches.”
- From mentee of Dr. Mark Burns

The reason hypospadias re-operative surgery fails is “not doing enough”: using local tissue for fistula repair or dilating or incising for structure or metal stenosis will lead to failure.
–From mentee of Dr. Mike Mitchell

Design the repair to fit the glans, since a small flat glans needs a different incision than a large deeply clefted glans. The difficult part is not so much the performance of the hypospadias repair, but knowing where to put the marks on the glans, because once you’ve made the incisions, the final cosmetic outcome is set.
–From mentee of Dr. Howard Snyder

“If you plan on a two stage operation the child will get a minimum of two operations.” This was usually preceded or followed up by the explanation that even if the complication rate is 50% for a proximal one stage operation, that means half of the children will only require one operation.
- Anonymous, but perhaps familiar

“If the glans falls apart the entire operation is ruined.”

“The only way to avoid suture sinuses is to not traverse the epithelium with a suture- this is why we put in subcuticular sutures for skin closure.”

“The margin of error in this operation is 1 mm”...
Sometimes followed by: “If you cut too much off I can’t put it back.”

“Dr. XX (senior partner) teaches you how to do this operation the right way, I’m going to teach you how to be pragmatic.”

“I’ve seen hypospadias repairs by very reputable pediatric urologists that look terrible because they didn’t pay attention to the skin fit.”

“Dr. Snodgrass has taught us that this will heal by secondary intent.”

“I’m concerned that in 15-20 years we’re going to be redoing a lot of these TIPU operations because of stricture.”

(continued on page 9)
Pearls from Dr. John Wiener, reflecting on advances since training:

#1: Experienced pediatric urologists learned long ago that closing penile skin in infants with through and through chromic sutures would lead to skin bridges (aka, suture tracks.) This is because the infant skin grows so fast that it grows around the chromic suture before it dissolves. It doesn’t matter whether one is doing a circumcision or a complex hypospadias. During my training, the solution to prevent skin bridges was to close the skin with interrupted subcuticular 6-0 chromic sutures. This could take an hour, particularly if one was teaching a resident to work with fine suture and instruments. Needless to say, I was delighted to learn around the year 2000 that the new Monocryl (Ethicon) or Biosyn (Covidien) sutures wouldn’t lead to skin bridges when placed through and through the skin (at least, very rarely). This technologic innovation has saved me a great deal of time (and frustration as a surgical mentor) over the past 15 year.

#2 - Hypospadiologists long sought a reliable penile dressing that could apply gentle pressure to the healing penis. The younger audience is not aware of the time and energy spent on developing the optimal dressing to minimal post-operative swelling. Urologists used Dixie cups or rolled x-rays to fashion molds in which to pour hardening liquids in order to create a soft cast around the penis. In the 1990’s, flexible adhesive clear dressings (Tegaderm, OpSite, etc.) were introduced and provided more reliable and infinitely simpler dressings for hypospadias repairs. Barry Belman once said that it was the biggest advancement in hypospadias surgery over the preceding decade.

#3 - I was a fellow in Houston when a young private practice urologist in a small city in west Texas named Warren Snodgrass began promoting the tubularized incision plate (TIP) urethroplasty. (As an aside, Warren told me back then how much time that he spent coming up with the catchy acronym TIP and was frustrated that everyone just called it a Snodgrass repair.) My mentor Edmond Gonzales, who had been one of Warren’s mentors, as well as other giants in the field, felt that this technique was heresy. They continued to do substitution urethroplasties such as flip-flaps (Mathieu) or transverse island preputial flaps (Duckett) because they worried that creating a scar in the urethra both dorsally (urethral plate incision) and ventrally (the urethroplasty closure) would invariably lead to stricture. Warren went to great lengths to assuage these fears and showed videos of urethoscopies of his repairs when indicated. Although no repair is reliable in all situations, time has shown the TIP repair to be reliable in a large proportion of cases without stricture development. Warren is to be applauded for his persistence to modify his technique and share his modifications to optimize results.