Management of Severe Incontinence in Children and Adolescents

FROM THE GUEST EDITOR

Henri B. Lottmann, M.D.

Most reports on management of severe incontinence in children, including my own, state that it is particularly challenging for the pediatric urologist to treat incontinence in patients with conditions such as neuropathic bladder sphincter dysfunction or the so called bladder exstrophy-epispadias complex. In fact, the challenge is not as much for us as for the boys and girls who struggle to construct their life wearing diapers and with the terrible social handicap of severe urinary incontinence, often associated with other handicaps, such as fecal incontinence, ambulatory limitations, intellectual deficiencies, and genito-sexual deformities. Their life revolves around many clinic visits and hospital stays for evaluations, successful (and/or not so successful) surgical procedures and complications whether or not dryness has been achieved. A life of struggle for as normal life as possible. From these children (then adolescents and adults), and their families, after almost twenty years of practice, I have received so many lessons of courage, perseverance and modesty, that I would like to dedicate this issue of Dialogues in Pediatric Urology to them.

I wish to warmly thank Anthony Caldamone for inviting me to be the Guest Editor of an issue on the management of severe incontinence in children and adolescents. I appreciate the honor and I am proud to share it with an exceptional and impressive panel of contributors (and friends) who kindly accepted to share with the reader their enormous and well recognized expertise in this field. I wish to warmly thank them too for their outstanding contribution. Stephen Koff, in his usual full of thoughts style, points out the lack of uniformity in the way the results of clinical research in the field of urinary incontinence are presented; however, validated tools do exist, such as home diaries, frequency volume charts and urodynamic evaluations. A consensus should be stimulated to standardize the clinical evaluation of incontinence in children. David Bloom, John Park and Julian Wan clearly define structural incontinence and list potential etiologies for such a condition in the pediatric population. They describe how it should be evaluated and with which tools. They particularly insist on urodynamic studies, and the information provided by the measurement of the Bladder Leak Point Pressure (BLPP) and the Valsalva Leak Point Pressure (VLPP). Pierre Mouriquand stresses that surgery can only achieve “dryness” by creating a passive increased outlet resistance, which implies that subsequently, the bladder reservoir must be regularly and completely emptied to avoid complications such as stones and infections and to preserve the lower and upper urinary tract from progressive deterioration. He then

FROM THE EDITOR

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There is hardly a more difficult area of pediatric urology to both evaluate, manage and compare data than urinary incontinence due to sphincteric incompetence. Whether it is structurally based on abnormalities such as the exstrophy-epispadias complex and cloacal anomalies, or functionally based as associated with spina bifida, the challenges remain the same. It is clear that the pediatric urologist must bring to these patients an armamentarium of options as the selection of the proper procedure for the given patient would yield the highest overall success rate. That must be coupled with experience with each of these techniques.

Henri Lottmann has put together an outstanding issue which addresses all of the options associated with dealing with incompetence of the bladder outlet from bulking procedures to artificial sphincters to slings and to bladder neck closure. Each of the contributors is a known international expert in the field and have made outstanding contributions to this problem. I applaud each of the contributors for the clarity of their presentations as well as sharing their personal experience. I also thank Henri Lottmann for orchestrating such an excellent issue.
FROM THE GUEST EDITOR  (continued from page one)

presents a review of the surgical options for increasing outlet resistance and the results achieved from his own experience as well as from an analysis of the literature in patients with incontinence of neuropathic origin and in the patients with the exstrophy-epispadias complex. In a questions and answers format, Richard Rink and Anthony Herndon share with us their impressive experience with the artificial urinary sphincter (AUS). They consider neuropathic patients with low urethral resistance who void and completely empty their bladder and those with isolated epispadias as excellent candidates for the procedure. The AUS is an excellent tool to achieve dryness, but only one third of the patients can void on long-term follow-up and almost one fourth of the devices had to be removed. They also point out that pre-operative urodynamic studies fail to identify those patients who will deteriorate their bladder over time. I was educated with the dogma that to be effective and safe a sling in patients with incontinence of neuropathic origin should be systematically associated with an augmentation. Warren Snodgrass revisited this dogma; he first mentions that reasons for enterocystoplasty during sling procedures in children have not always been stated. Then he demonstrates from his personal experience that a sling without augmentation can be safe and effective, although with a relatively short mean follow-up. Avoiding unnecessary augmentation is particularly important in the light of concerns recently raised by Richard Rink and his group regarding a malignancy rate associated with this procedure long-term. We should be indebted to Warren Snodgrass for reminding us that dogmas should always be reconsidered.

Bulking agents have a limited success rate long term, however, according to my experience as well as others and considering the simplicity of the procedure, if dryness can be achieved without compromising other treatment options, bulking agents have a place in the armamentarium of outlet procedures in incontinent patients. Most series are too short and heterogenous to define precisely the ideal candidate and the best injection technique. Finally, the ultimate option to achieve dryness is bladder neck closure. While this is very effective, it has very dangerous potential. After describing technical aspects and reporting excellent personal results and variable success rates from others, Piet Hoebeke wisely mentions the necessity of careful and close follow-up of these patients, particularly when they go through adolescence.

A Modest Proposal to Standardize the Clinical Evaluation of Structural Urinary Incontinence in Children

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Accurately describing the results of surgery for urinary incontinence in children should not be difficult. Parents can easily make this determination; they can easily tell soon after surgery whether their child is completely dry, improved or still wet. So can other children, siblings and playmates tell if the child is still incontinent, cruelly so at times, as can teachers, nurses, family and friends. Why then do pediatric urologists who perform unique and innovative surgeries for urinary incontinence and who follow their patients so diligently after operation have so much trouble reporting their surgical results, simply and accurately, so that the reader or listener can tell how many achieve perfectly normal urinary control after surgery and how many do not?

This issue of the Dialogues deals with the surgical state of the art in managing structural causes of urinary incontinence in children and adolescents. It reflects years of innovative surgical contributions and epitomizes the art and practice of pediatric urology. Unfortunately it also reveals weaknesses; especially in the way we as a specialty perform clinical research to try to scientifically analyze the results of new surgical therapies. It is my opinion that in this area, our accomplishments are not stellar; because the methodologies for assessing surgical results and for comparing one therapy with another are below standard and in need of improvement; and to get back on track we need to initiate a true dialogue in pediatric urology.

There appear to be several areas where weakness in clinical research is evident. These include: 1) an absence of uniformly accepted and easily applied criteria for defining continence and incontinence in children with anatomic or neurogenic disease, 2) a lack of methodology for assessing whether a child is dry or wet, and if wet, to what degree, and 3) a need to improve clinical research study design to include more and better controlled observations.

(continued on the next page)
Because authors have tended to describe their results in different ways it has been difficult to compare the results of one surgical therapy with another even for exactly the same disease. Take bladder exstrophy for example. Some authors use simple and clear-cut criteria to distinguish a wet child from a dry one; a child who is totally continent during the day and night is considered to be dry while all the rest are wet. While these are unambiguous definitions to be sure and perhaps some would consider them the gold standard, how can we be confident that the authors’ assessment of post-operative continence is valid? Have we as readers been able to tell who actually made the determination of dryness or how it was made? Were the patients simply asked during their office visit to remember if they were wet or dry during the past week or month, did their subjective assessment agree with their caretaker’s or parent’s impression, or was there an objective 24-hour home diary used to document wetness and dryness?

Other authors use a dry-interval of 3 or even 2 hours to define continence and surgical success. In fact, a great body of urological literature reports successful surgical results after bladder neck reconstruction (BNR) in terms of dry-interval measurements. But we all know that children who have a dry interval of 3 hours are really wet. If they were not wet they would have a dry interval of 4 hours or an even longer interval. And it appears now, especially in young children, that a dry interval of say 2 or 3 hours after complete primary repair of bladder exstrophy is not a reliable sign of surgical success or even an accurate predictor of ultimate urinary continence. So why do we continue to use this pseudo-marker of continence, the dry interval, as a tool for post-operative continence assessment? Is it to provide wishful early encouragement that late occurring continence will follow, or because real, total continence is so rare and difficult to achieve in this condition? And if one does choose to use a dry interval to assess results in young children, how can the true time period between wettings be reliably assessed. Is simply asking the parents or caregiver “how many hours can your child go before he or she is wet” a scientifically valid approach?

Still others have developed their own often elaborate home-grown categories and gradations of incontinence such as: perfectly dry, dry, slightly moist, moist, damp, slightly wet, and soaked. While one can admire any author’s attempt to glean every last increment of post-operative success from the results, such grading schemes are ambiguous and in the past authors have typically neglected to indicate how the determinations were made and by whom. This makes it genuinely difficult to determine degree of benefit and compare results from different studies.

Another shortcoming is reflected in the methods of clinical research and perhaps best illustrated in evaluation of children with neuropathy whose incontinence typically has a dual bladder and sphincter etiology. In some series in which fascial slings or artificial sphincters have been used to achieve dryness the authors’ conclusions have been undermined by not controlling for (excluding) patients who had simultaneous bladder augmentation. By failing to analyze independently the sphincter tightening effects of sling or sphincter placement from the lowered intravesical pressures accompanying bladder augmentation, the authors have made it difficult if not impossible to determine whether and to what degree sling or sphincter placement was responsible for improved continence. Equally unclear are analyses of failure after therapy. Rare is the article indeed in which the cause of persisting incontinence after bladder neck therapy (BNR, sling, sphincter, or injection) is defined objectively. Is the patient still leaking because urethral resistance is too low, because bladder pressure is too high, or both? Simple urodynamic measurements can so easily clarify the nature of persisting incontinence; why are they not routinely obtained?

If successful management and cure of anatomic and neuropathic urinary incontinence in children is our goal, then we as pediatric urologists cannot afford to allow the value of exceptional surgical techniques and important clinical contributions to be eroded by imperfections in standardization of criteria and definitions and blemishes in clinical research lest we see their clinical significance placed in jeopardy and their validity questioned. Whether you agree or do not agree that a problem exists which affects accuracy in reporting the results of urinary incontinence surgery I encourage you to join a dialogue in pediatric urology to examine these issues in greater detail. The objective should be to improve the quality of clinical research in this area and our goals should include the development of: 1) simple, easily applied and widely acceptable criteria to define continence and describe degrees of incontinence in children with anatomic and neurogenic handicaps, and 2) minimal reporting standards that allow surgical results to be clearly measured and accurately compared.

Fortunately a lot of preliminary work has already been done, and we can build upon it. An ICCS subcommittee recognized that an accurate assessment of urinary incontinence requires objectivity and quantification, and that simple validated tools already exist. Diaries to record wetting times, pad or diaper weighing to measure leakage volumes, and frequency volume charts to assess functional bladder capacity are all available as are urodynamic studies which will readily distinguish sphincteric from bladder causes of incontinence pre-operatively and allow the mechanism(s) for persisting post-operative leakage to be defined. Agreed upon implementation of these and other tools is an obvious next step.

As we read the Dialogues today about innovative alternative therapies now available to treat structural incontinence in children, I can think of no better time to begin to work together to ensure that when results are reported they accurately reflect outcomes and allow future therapies to be accurately compared.

References

The Evaluation of Structural Incontinence

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Introduction

The evaluation of structural incontinence in children seems similar to the process for other medical conditions. The history and physical exam have recognized symptoms, signs and findings which are pathognomonic. A differential diagnosis list consists of common and not-so-common diagnoses. Specialized terminology and investigative procedures are helpful in confirming or clarifying the diagnosis. What makes this process for structural incontinence different from other evaluations is that the usual sequence of evaluation and therapy is typically rearranged. Often the patients will present with a known diagnosis or come for evaluation only as a result of having had treatment. This inversion of the normal order of the standard medical paradigm of diagnosis, prognosis, and therapy is an under-appreciated point by non-specialists, family... (continued on the next page)
lies and patients and can be a source of many practical problems. The following discussion aims to highlight some of the considerations which the authors hope the reader will find to be of practical value when facing this challenging situation.

**What is Structural Incontinence?**

Medical terminology developed as a concise and precise method of communication. We refer to the extent of neoplasms by their clinical or pathological stage and not by a vague notion of severity. Distinct definitions exist for each stage and these do not just accurately describe the extent of disease but also help us understand natural history, prognosis and treatment options. For other conditions, such as infectious and inflammatory disorders which can have a confusing array of overlapping symptoms and signs we try to gather them into groups by their causative agents. Bacterial pneumonias are segregated from viral pneumonias and environmental inhalation bronchitis. Amoebic enteritis is separated from ulcerative colitis and gluten enteropathy. Unfortunately we cannot always be so precise and utilitarian in this process with incontinence. While there have been attempts to standardize terminology there is not a widely accepted vocabulary to characterize the severity of incontinence and even what constitutes incontinence is not universally defined. Some papers regard a limited degree of incontinence as being “functionally dry” and regard their outcome as a “cure”. Others propose that only complete continence as would be expected by the lay public should be defined as a “cure”. This looseness in terminology is not insurmountable; it merely requires that our communications with the patients, families, and our colleagues are clear and unambiguous. For the purposes of this discussion we could consider functional incontinence to include such disorders such as idiopathic detrusor overactivity (also known as detrusor instability), whereas structural incontinence could be due to sphincteric incompetence (also known as intrinsic sphincter deficiency) or a very small capacity bladder (poor compliance bladder) or some other condition with an anatomical defect.

Incontinence is messy literally and figuratively and cannot be neatly divided into clear distinct pure forms. Often there is a mixed phenomenon involving both structure and function. For example, a spina bifida patient may be incontinent when transferring from her wheel chair and at first glance would seem to have just a form of stress incontinence due to an incompetent bladder neck. Upon further investigation she may be found to have detrusor instability and a small bladder capacity. Structure and function in daily clinical practice form an inseparable pair; one cannot exist without the other. It is therefore unlikely to have purely structural or functional problems. We are now well into the 3rd century wherein the conceptual basis of organized medicine is based on reproducible data as well as exclusionary and inclusionary terminology. The language of our profession is important as the Sapir-Whorf hypothesis tells us – the words we use shape the world we see. Thus we will define structural urinary incontinence as urinary leakage due to a correctable structural problem. This definition includes common adult diagnoses such as vesicovaginal fistula in addition to the more typical pediatric urologic disorders such as extrophy, epispadias, bilateral ectopic ureters with a small bladder, duplication with an ectopic ureter, neuropathic bladder of myelomeningocele, urogenital sinus and cloacal anomalies. For the subsequent discussion we will exclude conditions such as vesicovaginal fistula and ectopic ureter with a duplicated system because evaluation of these does not require assessment of the efficacy of bladder storage or the bladder neck and sphincter.

Some conditions do not present with incontinence as a primary symptom, because, these congenital anomalies only manifest incontinence as a consequence of corrective therapy. Well known examples of this phenomenon include patients with ectopic ureters which insert near the bladder neck or children with large ureteroceles that undermine the trigone and only manifest incontinence after surgical correction. Patients with imperforate anus may develop incontinence after primary repair typically due to the late effects of an unrecognized neurogenic bladder. Bladder extrophy whether closed primarily or in stages, may manifest incontinence despite excellent surgical technique. This inversion of the normal diagnosis and treatment paradigm can be confusing and obscure the true etiology of the incontinence. It is often useful when starting out on the evaluation to take time to clearly explain this distinction to the patient, parents, family, guardians and referring physicians. It will help prevent any misunderstanding about why the patient is wet.

Table 1 lists some of the causes of structural incontinence.

**TABLE 1 - Diagnoses Associated with Structural Incontinence**

<table>
<thead>
<tr>
<th>BLADDER AND URETER</th>
<th>URETHRA</th>
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<th>TRAUMA</th>
<th>IATROGENIC</th>
<th>NEUROGENIC</th>
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<td>Bladder extrophy</td>
<td>Epispadias</td>
<td>Imperforate anus</td>
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<td>Ectopic ureter</td>
<td>Ureteroceles</td>
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<td>Bladder fistula</td>
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<td>Urethral fistula</td>
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<td>Urethral or bladder neck hypermobility</td>
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<td>Cloaca anomalies</td>
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<td>Sacrococcygeal teratoma</td>
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<td>Lipomas</td>
<td>Spinal dysraphism</td>
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<td>Myelomeningocele</td>
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<td>Dermoid cyst or sinus</td>
<td>Diastematomyelia</td>
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<td>Tethered spinal cord</td>
<td>Aberrant nerve roots</td>
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**History and Physical Exam**

The evaluation of a child for structural incontinence begins with a thorough general history and a specific elimination history that is familiar to all urologists. Just as a complaint of hematuria, for example, triggers a cascade of targeted questions, so too should a complaint of incontinence.

1. From where does the urine leak? Is the wetting from the urethra or some other opening or source?
2. What is the wetting like? Is it associated with dysuria, pyuria or hematuria?
3. How bad is the wetting? Does it wet through underwear, diapers or some other opening or source?
4. When does the wetting occur? Is it sudden in onset? How long does it last?
5. Does any event or posture trigger it or change its severity? Does wetting occur in association with exertion, laughing, coughing or straining?
6. Have there been any other changes in the usual daily routine or activity since the wetting started?

The past medical and surgical history should be carefully reviewed with particular attention paid especially to previous evaluations, imaging studies and genitourinary surgery. Review of systems should include the words we use shape the world we see. Thus we will define structural or functional problems. We are now well into the 3rd century wherein the conceptual basis of organized medicine is based on reproducible data as well as exclusionary and inclusionary terminology. The language of our profession is important as the Sapir-Whorf hypothesis tells us – the words we use shape the world we see. Thus we will define structural urinary incontinence as urinary leakage due to a correctable structural problem. This definition includes common adult diagnoses such as vesicovaginal fistula in addition to the more typical pediatric urologic disorders such as extrophy, epispadias, bilateral ectopic ureters with a small bladder, duplication with an ectopic ureter, neuropathic bladder of myelomeningocele, urogenital sinus and cloacal anomalies. For the subsequent discussion we will exclude conditions such as vesicovaginal fistula and ectopic ureter with a duplicated system because evaluation of these does not require assessment of the efficacy of bladder storage or the bladder neck and sphincter.

Some conditions do not present with incontinence as a primary symptom, because, these congenital anomalies only manifest incontinence as (continued on the next page)
a detailed review of bladder and bowel habits, neurological signs and symptoms and musculoskeletal concerns. The physical exam should include a careful examination of the genitals, abdomen, pelvis and back. Are there abnormalities on the back? Is the location of the anus normal? What about the general appearance and gait? Is the history consistent with the surgical scars seen? If a post-surgical fistula is suspected, wet irritated appearing spots in the genital exam should be sought out and noted. Make note of the general body habitus and the range of motion and the dexterity of the arms and hands. These will be important factors to consider if the child will have to perform intermittent self-catheterization. Clearly if the child presents with a known history and diagnosis one can be more focused and directed. (See Figure 1)

Imaging and Investigative Procedures

Detailed ultrasonographic examination of the kidneys and bladder will reveal most abnormalities of the urinary tract. Computer tomography is occasionally useful for a renal anomaly such as a horseshoe kidney or crossed fused ectopia. Intravenous pyelogram, among the oldest of the urological imaging techniques, retains utility in offering an image of the course of the ureter from its renal origin to its insertion point whether in the bladder or at an ectopic site. Additionally this displays some functional information of the parenchyma and collecting system. Magnetic resonance imaging will play a greater role in the future combining the benefits of the other imaging techniques while avoiding radiation. Its chief limitation today is the need for general anesthesia in most children to achieve useful images. Renal function can be assessed by nuclear scan which will also demonstrate scarring and dysplasia. Cystoscopy with an exam under anesthesia has a limited role although useful in assessing the relationship of the bladder neck and urethra with other structures. This is important in planning of a proposed procedure which involves repositioning the urethra or bladder neck in cases of urogenital sinus. The lower urinary tract should be imaged with a voiding cystogram or fluoro-videourodynamic.

Urodynamics are critical to the evaluation of structural incontinence. Several basic urodynamic tests are important for all patients under scrutiny: cystometrogram (CMG) to assess bladder compliance and stability, Valsalva leak point pressure (VLPP) to assess bladder neck and sphincter competence, and a combination of a uroflow (URO) and post void residual (PVR) (if the patient is able to void) to assess adequacy of drainage. For neurologically normal patients with voiding a voiding cystourethrogram (VCUG) and post-void residual (PVR) are the first urodynamic steps. The VCUG will reveal strictures, urethral valves, vesicoureteral reflux, and bladder trabeculation. The scout film will also determine if there is significant constipation or bony anomaly. An elevated PVR is notable because it increases the risk for urinary tract infection and confirms the need for clean intermittent catheterization. Where available the VCUG can be combined with a cystometrogram as a single fluro-urodynamic study.

The CMG is best suited to measure compliance and document uninhibited bladder activity. Poor bladder compliance is associated with high intravesical storage pressures. High storage pressures are the genitourinary equivalent of high arterial blood pressure, without immediate problems but providing insidious and relentless harm. High bladder pressures inevitably cause damage as a pressure head working against normal ureteral peristalsis transporting urine into the bladder from the kidney. Over time, urinary stasis develops and leads to infection, stone formation, hydronephrosis, pyelonephritis and ultimately renal damage and parenchymal loss. Multichannel or multiple testing with simultaneous urethral pressure monitoring and electromyography are useful ancillary tests. Their chief value in determining if detrusor sphincter discoordination is present. For patients with very patulous bladder neck or high grade reflux, one may need to try to seal the bladder neck or ureteral orifice using an occlusion balloon catheter to get a more accurate measure of bladder compliance. The CMG will also yield an accurate measure of bladder capacity and whether this is sufficient for the patient current and future needs.

The Valsalva Leak Point Pressure (VLPP) is currently the preferred method of assessing the competency of the bladder neck and sphincter in keeping the patient continent against shifts in intra-abdominal pressures such as that experienced with lifts and transfers. The VLPP should not be confused with the Bladder Leak Point Pressure (BLPP), also called the Leak Point Pressure (LPP) in the older literature. The BLPP is a passive test which is an indirect measure of bladder compliance. It arose at a time when the now ubiquitous electronic computer driven urodynamic machines were rare or unavailable. The basic water manometer or polygraph was then the standard urodynamic apparatus. The BLPP was a practical way to indirectly measure the compliance of a bladder. The pressure at which leakage occurs during passive filling through a urethral catheter is the BLPP. The assumption is that if the bladder leaks at a low pressure (low BLPP) it is unlikely to be able to hold more fluid and thereby achieve a higher volume and its greater pressure. Today the BLPP has been supplanted by the modern CMG which can yield hundreds to thousands of data points per test. The oft quoted ‘magic number’ for the LPP of 40 cm H2O is the value where bladder storage pressure hinders ureteral peristalsis. The fully computerized CMG allows a full pressure volume curve to be plotted and direct measurement of compliance. It should be clear that as an indirect measure we are making certain assumptions which may not always be correct. Patients with a patulous urethra and wide open bladder neck will leak almost immediately and so have a low BLPP yet we don’t know for certain that their bladder compliance is good or bad. Patients who have had indwelling Foley catheters for years and who have gradually eroded away their proximal urethra and bladder necks (sadly still not yet a rare and unheard of condition, especially among institutionalized patients) may have very small fibrotic non-compliant bladders but because they lack any continence mechanism, their BLPP will be very low.

In a normal healthy child or adult, what is the leak point pressure? In these patients, it is practically infinite. The reason is that in normal children and adults experience discomfort and fullness long before bladder pressures reach a point where they would leak out around any test catheter. So too, blunt trauma to a full bladder is more likely to cause rupture than leakage. These observations can be extended to patients who are not normal. For example consider the spinal cord injury patient who has a very high BLPP of 55 cm H2O at 650 ml. Is this patient suffering from poor bladder compliance and at risk for renal damage? The answer is “no” if that person never practically experiences that pressure. If this hypothetical pa
tient drains her bladder regularly and only gets 300 ml with each catheterization where the pressure is only 9 cm H2O, the 65 cm H2O of the BLPP is moot. The BLPP is therefore of value as a quick and easy indirect way of assessing bladder compliance but needs to be interpreted in the reality of actual bladder volumes of a given patient.

The Valsalva Leak Point Pressure (VLPP) is also called the Stress Leak Point Pressure (SLPP) or the Abdominal Leak Point Pressure (ALPP). This is also an indirect measurement and was created in an effort to find a reproducible and objective measure of bladder neck and proximal urethral resistance when subjected to stress. It is an indirect measure of continence in the face of coughing, laughing and other changes in intra-abdominal pressure. It is carried out in much the same way as the CMG and the BLPP but unlike those tests, it is a dynamic test and requires that the patient actively strain, cough, Valsalva or perform other maneuvers that increase intra-abdominal pressure after the bladder has been filled. If leakage occurs, the intravesical pressure is noted and that is recorded as the SLPP. If no leakage occurs the highest pressure point reached is noted and the SLPP is noted be “greater than” that value. Like the BLPP this test was created as a qualitative method for the practicing urologist to objectively assess stress related continence. Efforts to directly measure the resistance or pressure exerted by the bladder neck and proximal urethra (and the internal and external sphincters) all suffered from tremendous variability and that the test methods (such as direct pressure profile measurements) affected the results so as to render them impractical. The hope was that if we could not measure the effect of that area which is responsible for continence (bladder neck and proximal urethra, sphincter) then perhaps we could measure it indirectly. It is analogous to the type of destructive testing down on alloys by engineers in material science. If one had a sample of a new alloy steel and wanted to know its strength, it is possible to analyze the metal and from its structure and composition one can accurately project its strength. This method however is laborious and requires data which are hard if not impossible at times to acquire. A practical solution to this dilemma was to simply take a sample of the alloy and to apply progressively more force to the sample until it broke or irrevocably bent. The breaking or bending point would then be the upper limit of its strength. In our situation because we lack the tools to reliably measure the bladder neck and sphincter mechanism’s competence directly we determine it indirectly by seeing what intravesical pressure is needed to cause leakage. For most patients a VLPP above 100-120 cm H2O will be adequate to ensure social continence, but this figure can be acceptably lower in those who are more sedentary.

The urodynamic evaluation when complete should be able to answer conclusively the following basic questions: How much can the patient store and is storage at a safe pressure? Those who cannot will require a larger capacity bladder and will probably need to have an augmentation. Can the patient void in a coordinated normal fashion to effectively empty the bladder? Those who cannot, will need to perform intermittent catheterization and consideration should be given to the question of whether the patient can perform self-catheterization. Are the bladder neck and sphincter able to maintain continence against shifts in intra-abdominal pressure? If not, the patient may require a urethral sling, bladder neck reconstruction, or in some cases, closure of the urethra. The urodynamic evaluation must ultimately take into account practical concerns for the patient and family. If the patient is found to require intermittent catheterization, one should assess whether the child can do so independently. Does the child have sufficient dexterity? Does the body habitus allow for easy access to the urethral meatus? If not, a Mitrofanoff procedure may also be needed to create an easier to access continent stoma.

Conclusion

The evaluation and treatment of structural incontinence challenges pediatric urologists. The variety of possible causes and the likelihood of evaluation after prior therapy can be discouraging. When approached in a systematic fashion, it is possible to expeditiously conduct an assessment which yields useful information to help guide treatment.

References


Bladder Outlet Surgery for Congenital Incontinence

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Pediatric urologists face indications of bladder outlet surgery for congenital incontinence in two main situations, congenital neurogenic bladder (mainly myelomeningocele) and patients with bladder exstrophy or incontinent posterior epispadias. Restoring the active sphincteric mechanism to achieve continence is an illusive exercise. ‘Continence’ involves active, complex neuromuscular mechanisms, while surgery can only achieve ‘dryness’ by creating passive increased bladder outlet resistance.

The difficulty, therefore, is to find the adequate balance between sufficient outlet resistance to store urine and achieve dryness, and compliant outlet resistance to empty the bladder with adequate pressure and without residue. This difficult challenge which aims at preserving the upper urinary tracts and achieving ‘social dryness’, involves three main protagonists: the bladder reservoir which can be modified either with chemotherapy (mainly anticholinergics) or surgery (augmentation), the bladder innervation which can be modulated (neuromodulation) and the outlet resistance which can be increased permanently (injection of biocompatible substances, urethral lengthening; urethral suspensions; cervicocystoplasty) or increased intermittently (artificial urinary sphincter).

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The quality of bladder emptying is the essential issue. ‘Normal’ micturition in these two groups of patients have been reported although very rare and one should certainly not anticipate this possibility in both groups. The aim of the treatment is to achieve regular, complete, low pressure bladder emptying in order to reduce the incidence of urinary tract infections, stones and protect the whole urinary tract. Bladder emptying can be achieved either through the urethra or through a continent conduit. It implies either the use of intermittent catheterization or an intermittent increase of bladder pressure (Crédé technique) to “force” the bladder outlet resistance. This latter solution generates ‘obstructive’ micturition and may result in complications as will be mentioned.

The complexity of the problem is also increased as bladder behavior changes with growth, and quite often urodynamic profiles deteriorate especially in the prepubertal period. It is, therefore, essential to closely follow these patients from birth to adulthood and prepare them for the surgical events which may be decided. This implies a multidisciplinary approach involving pediatric urologists, pediatric orthopaedic surgeons, neurosurgeons, psychologists, clinical nurse specialists, physiotherapists, etc.

Management of congenital incontinence must consider the whole patient including urinary and fecal incontinence, orthopaedic autonomy, dexterity, intellectual development, social environment and psychological status. Developing the indication of surgery for a congenital abnormality is, therefore, a long process which implies repeated explanations, psychological preparation and well defined expectations.

In this article, we will focus on surgery of bladder outlet resistance.

Spina Bifida Group

Three revolutions have changed the management of congenital neurogenic bladder. The first is intermittent catheterization described by Lapides in 70’s; the second is the continent vesicostomy described by Mitrofanoff in the 80’s, and the last is the continent colostomy described by Malone in the 90’s. What are the causes of incontinence in the myelomeningocele patients? They — insufficient reservoir, insufficient outlet resistance, or both.

Clean intermittent catheterization (CIC) allows low pressure, regular and complete bladder emptying. It is, therefore, an ideal option to protect the upper urinary tract. Complications of CIC are rare although long-term studies clearly demonstrate a significant risk of infections, urethral false passage, urethritis, epididymo-orchitis, and stones. When used alone, only 25% of our patients can achieve ‘social’ dryness, which implies that 75% remain wet between catheterizations. It is in this latter group of patients that complementary procedures are needed to increase outlet resistance and/or to increase the reservoir. Various options exist. We will review only the surgical options to increase outlet resistance, as the endoscopic techniques using bulking agents are discussed in another section of this issue.

Urethral Lengthening

The original technique using a tubularized flap of bladder wall was originally described by Kropp and subsequently simplified by Pippi-Salle and ourselves. This technique creates a Cohen-like system where the bladder neck occlusion is achieved by a flap-valve mechanism at the level of the lengthened urethra. A multicenter survey published in 2000 showed 80% good results in girls and 50% in boys. The main complications reported were difficulty in catheterization, infections, stones, urine retention, persistent or recurring incontinence essentially due to an insufficient flap-valve effect or to a fistula between the lengthened urethra and the bladder reservoir. Most of these patients had a concomitant bladder augmentation and a Mitrofanoff conduit, which makes the assessment of the results of this technique quite difficult.

Urethral Suspension

These are the best known alternatives in which outlet resistances are increased by elevating the urethra or the bladder neck toward the anterior pelvic wall. These are mainly the Marshall-Marchetti procedure, the Burch procedure, the Jeffs suspension, or more recently the TVT prosthesis. Here again, very few series are reported in the pediatric population of congenital incontinence. The group from Liverpool reported 23/26 good results and a multicenter review published in 1995 showed an overall 78% success rate to achieve ‘social continence’.

Like in the urethral lengthening group, most of these patients had a concomitant bladder augmentation which makes any interpretation of the value of this procedure difficult. However, Decter in 1993 reported a group of patients who underwent urethral suspension without augmentation and found only 25% dry patients.

Artificial Urinary Sphincter

It is probably with this technique that the best results of dryness are reported with 84% success rate for Gonzales and a revision rate of 1.63 per patient. The French multicenter study published in 1996 had very similar results with 83% complete dryness, 1 revision in 63 patients, 2 revisions in 42 patients, 21/107 mechanical problems, 40/107 surgical complications and 39/107 urodynamic changes.

TVT (Tension Vaginal Tape) and Reemex

In postpubertal girls, a vaginal access becomes available to insert these devices, which are well known to adult urologists and gynecologists. We have a limited experience (4 patients) of this technique which is much less invasive than the previous ones. All 4 patients were immediately dry after insertion of this device. A potential risk of urethral erosion is well reported in the literature.

Cervicocystoplasty (Young-Dees like procedures)

This procedure is mostly used in the exstrophy group but has been reported in the group of neuropathic bladder. The results on small series have been amazingly good but interestingly almost no centers use this technique anymore in these patients.

Bladder Neck Closure and Mitrofanoff

This is the ultimate solution when all the other ones have failed. The results are actually not as good as one would expect in the group of neuropathic bladders, as leakage may occur through the urethra despite a careful closure of the bladder neck.

Exstrophy Epispadias Complex

In this group, incontinence is related to an abnormal bladder reservoir, rudimentary sphincteric structures and abnormal pelvic anatomy.

Since the original description of Young cervicocystoplasty, several variants have been published, all aiming at funnelling, lengthening, suspending or angling the bladder neck to increase bladder outlet resistance. Although some patients may achieve nearly normal voiding, in many cases, the pattern of voiding obtained is obstructive, leading to forced and incomplete emptying, exposing the patient to severe recurrent complications.

In 2003, we reported 105 long-term results of bladder neck surgery in 80 exstrophy patients and 25 epispadiac patients with a mean follow-up of 11 years. Overall results were good in 45% (of the exstrophy group (girls: 46%; boys: 40%), and 47% and 75% in boys and girls respectively, with epispadias. Nearly 50% of exstrophy patients required further surgical attention and 40% in the epispadias group. Among the complications found, infections (65% in the exstrophy group: 48% in the epispadias group), stones (24%, 8%), dilatation of the upper urinary tract (26%, 20%), early and late retention and bladder rupture (16%, (continued on the next page)
4%), were common, and resulted from the obstructive pattern of micter-
ritation generated by these types of procedure.

In a previous publication from 1994 on a cohort of 73 bladder neck
reconstructions, 69% had satisfactory urinary ‘continence’ with volitional
voiding, regardless of the number of operations needed to achieve these
results39. Almost 10 years later, the same patients showed a marked deteriora-

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Before we address specific questions about the AUS there are a number of general comments that should be made. We are primarily discussing our experience in the children with neuropathic bladders but will comment on other diagnoses such as exstrophy. There has been a concern that deterioration in bladder dynamics will occur after implantation of the AUS. This can occur with the AUS but can also be seen with any procedure that increases outlet resistance. Unfortunately, we have been unable to urodynamically identify those patients that go on to have a second procedure to increase bladder compliance after placement of the AUS. We have been surprised in some children with low capacity bladder to find that the bladder has stretched up quite nicely and maintained adequate compliance. We have also been surprised at children who seemingly had a large capacity low pressure bladder where the bladder dynamics have deteriorated. Therefore, our approach has been to not augment this group initially but follow these patients with serial upper tract imaging and urodynamics after insertion of an AUS.

Placement of an AUS comes with the realization that it is a mechanical device that may malfunction at some point in time and this should always be discussed with the patient and family. We have had several patients where the device had a mechanical complication yet the patient remained dry. These patients have not required a second procedure to replace the AUS in order to maintain continence. It appears that the fibrotic sheath created after placement of the AUS maintains adequate urethral resistance in this group. From a surgical technique standpoint, we have found the technique of Lottmann of stripping the peritoneum and approaching the bladder neck from behind the bladder very helpful. This virtually always gets you in the correct plane without concern for injury to the vagina, urethra or rectum.

**DPU: Why would we use the artificial urinary sphincter?**

Once surgery is elected the first question we want answered is “can the child empty the bladder spontaneously?”. This may require Valsalva voiding. If the answer is “yes”, we would recommend placement of the AUS as it is the only procedure that will provide continence without the need for life long clean intermittent catheterization (CIC). Furthermore, the AUS may well provide superior continence results. The AUS affords the surgeon the opportunity to achieve superior urinary continence results and allow spontaneous voiding without encroaching on bladder capacity.

**DPU: Who are candidates for the artificial urinary sphincter?**

There is no one bladder neck procedure that is suitable for all patients. Variables such as ambulatory status, gender and ability to void, and upper extremity function all should be factored into the decision process. Again, those children that can empty spontaneously (no need for CIC) are ideal candidates. In general, continence rates, regardless of the procedure, are higher in females than males. In females who are unable to empty, we have had excellent results from slings/wraps, and, therefore, there is no need to use an artificial device. In males who are unable to empty there may still be a role for the AUS. This is particularly true if augmentation is not required. Continence rates have been excellent in this group and are superior to the sling, Salle, wraps or Young – Dees – Leadbetter in our hands in males. There has been no difficulty catheterizing through the AUS. Only the Kropp procedure has had similar continence in our male patients but the Kropp nearly always requires bladder augmentation. We also believe that the pure epispadiac is an excellent candidate for the AUS.

We should also comment on who is not a candidate. We would not place the sphincter in those with a prior failed bladder neck operation. In general, the results have been poor in the exstrophy patient. Both of these situations have a high erosion rate.

**DPU: What are the risks of sphincter placement?**

Complications associated with the placement of the AUS are either surgical or mechanical. Surgical complications include injury to the urethra, rectum or vagina. When injury to the urethra or bladder neck occurs the procedure should be abandoned in order to reduce the risk of AUS infection and erosion. Injury to the rectum occurred in two of our 134 patients in the Indiana series. When this occurs, surgical removal of the AUS and components is required. The diagnosis can be made via rectal examination in the patient with persistent fever following placement of an AUS. Simple injury to the vagina can be closed primarily with placement of the AUS around the bladder neck as planned. Two patients in the Indiana Series had inadvertent placement of the AUS around the urethra and vagina. Both of the patients in which this occurred required a vaginoplasty after removal of the AUS. Infection and or erosion of the AUS may occur and usually presents as new onset incontinence, dysuria or hematuria. When identified, removal of the device is required. Bladder augmentation rupture is a complication that may develop in any patient following a procedure to increase outlet resistance. Augmentation rupture occurred in 7% of the patients in the Indiana enteroctostomy series.

Mechanical complications, which includes kinks, leaks or pump malfunction varied significantly between the second and third generation AUS sphincter systems. For the pre-800 series AUS, a mechanical complication occurred in 64% and every 7.6 patient years as compared to the 800 series AUS that experienced a malfunction in 30% and every 16 patient years. Clearly, the modifications to the 800 series AUS, as well as the quick connect device, and seamless reinforced tubing, all have significantly decreased these complications.

**DPU: What are the results?**

The AUS continues to be one of the most effective means of achieving urinary continence in patients with low urethral outlet resistance. Our data is very similar to the Detroit, Boston and Toronto series that report continence results from 85-95%. Specifically, at Indiana University, 134 patients (93 male, 41 females) have undergone implantation of an artificial urinary sphincter. A total of 59 patients initially received an AMS 742/792 (American Medical Systems, Inc., Minnesota, Minnesota) artificial urinary sphincter, of whom 33 were subsequently changed to an AMS 800, while 75 initially received an AMS 800 model. Complete urinary continence was achieved in 86%, improved in 4% and not achieved in 10%. Of those with a sphincter in place, 92% were continent. In terms of bladder emptying after artificial urinary sphincter insertion 22% of patients voided, 11% voided combined with clean intermittent catheterization, 48% now perform clean intermittent catheterization only via the urethra, 16% performed it via a catheterizable channel and 3% used urinary diversion. A total of 164 secondary surgical procedures were performed, including 38 of our 134 patients who required bladder augmentations (28%). A total of 30 of the 134 sphincters were permanently removed.

**DPU: Is there anything that we should caution the reader about?**

Several points deserve mentioning to the reader regarding placement of the AUS. It is paramount for the families to appreciate that routine follow-up with bi-annual renal ultrasounds after placement of the AUS is mandatory. Bladder deterioration requiring augmentation oc-
Slings Without Bladder Augment for Neurogenic Incontinence

Why have most children undergoing slings for neurogenic incontinence also been augmented?

Warren Snodgrass, Chief of Pediatric Urology, Children’s Medical Center, Professor of Urology, UT Southwestern Medical Center, Dallas, Texas

Slings to increase bladder outlet resistance in neuropathic disorders were initially described for children in the mid 1980s, and when Perez et al. reviewed published outcomes from the first decade of their use they noted enterocystoplasty had been performed in 70% of cases. Almost another 10 years later in 2004 there were 4 separate reports concerning slings for neurogenic incontinence presented to the AUA, and of this total of 162 children 95% were augmented.

Most children with neuropathic bladders have myelomeningocele, and their dysfunction generally can be categorized into 2 subtypes. Some have high intravesical storage pressure, which untreated usually leads to bladder trabeculation, reflux and/or hydronephrosis. Most often the combination of anticholinergics and intermittent catheterization will reduce storage pressures, and also result in urinary continence. The minority who do not respond to medical therapy undergo enterocystoplasty. A second group of children maintain intravesical pressures less than 40 to 50 cm water (with or without anticholinergics), thereby protecting the upper tracts, but have an incompetent outlet with urinary incontinence. It is these patients who potentially benefit from slings or other surgical procedures to increase outlet resistance, but do they also need bladder augmentation?

Background

The artificial sphincter initially was used to compress the bladder neck in children with neuropathic incontinence. Although effective, 3 reports published in 1986 called attention to bladder deterioration and subsequent incontinence, reflux and hydronephrosis developing from this induced outlet obstruction. These adverse changes were noted early after surgery to as long as 5 years later, and Light and Pietro found neurophysiologic evaluations did not predict in which patients they would occur. A subsequent report by Kronner et al. stated preoperative urodynamics also were not predictive of need for enterocystoplasty following sphincter implantation.

McGuire et al. first described slings for neurogenic incontinence in 8 teenager girls using the Stamey technique. Of note, they found a bladder capacity of only 150 cc was sufficient for a satisfactory outcome, and since urethral closing pressures only increased approximately 15 cm water, they assured the upper tracts were not at risk. Accordingly, only 1 of their patients, with “almost no capacity,” underwent prior augmentation. Slings have gained popularity over the ensuing 20 years, in part due to concerns for the long term reliability of the artificial sphincter in children and dissatisfaction with bladder neck procedures such as the Young-Dees or Kropp for neuropathic incontinence. Despite McGuire’s assertion that slings would not cause outlet obstruction to the extent of the sphincter, and his observation that a bladder capacity of only a third of predicted volume was adequate, most children undergoing slings have been augmented as well.

Slings with Augmentation

Reasons for enterocystoplasty during sling procedures in children have not always been stated. One justification is persistent hyperreflexia or decreased compliance despite anticholinergic therapy. However, dosages prescribed and means of administration, i.e., oral and/or intravesical, or currently, patches, rarely have been provided. Since moving to Dallas I have been involved with care of children with neuropathic bladders through the Scottish Rite Hospital, which provides service for some 600 patients from the entire state. Consequently I have evaluated children who previously have been under the care of others and have noted considerable variation in anticholinergic use, suggesting at least some descriptions of failed “maximal” medical therapy may instead have reflected inadequate medical trials before augmentation.

Another reason for enterocystoplasty is decreased bladder capacity, although few authors state how this determination was made. Does the commonly used formula of volume = 30 (age +2) apply to patients with myelomeningocele or caudal regression whose body habitus may be significantly smaller than normal? Palmer et al. found bladder capacity in these children to be an average of 25% less than predicted by formula. The incontinent bladder outlet also may complicate measurement of true capacity, even if attempts are made to prevent leakage with a balloon catheter. Finally, maximum storage capacity is less important than is a

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sufficient volume at pressure less than 40 cm water to allow intermittent catheterization at intervals of 3 or more hours.

The reason that most children have been augmented during sling procedures is most likely because of concern that a significant percentage otherwise will experience bladder deterioration. However, there are problems with the studies mentioned above regarding this occurrence after sphincter implantation, making extrapolation of outcomes to slings questionable. For example, some patients reported in the mid 1980s did not have preoperative urodynamics, most were not on postoperative anticholinergic therapy, few if any had intermittent catheterization, and their follow-up after sphincter insertion was not standardized. Although bladder and upper tract damage in some cases were not found until years after surgery, Light and Pietro in evaluating their results in the institution where the artificial sphincter was developed, stated these changes developed early after surgery and most often responded to anticholinergics. Today it is recognized that urodynamics are the foundation of preoperative assessment, anticholinergics and regular bladder emptying via intermittent catheterization are essential for most patients to maintain low storage pressures, and follow-up in all patients with neuropathic bladders is lifelong, regardless of surgical interventions.

Since the warning of Kronner et al. that preoperative urodynamics do not predict adverse changes from outlet obstruction by the artificial sphincter is so commonly quoted to justify up front enterocystoplasty, it is reasonable to more closely examine their data. Although their series focused on 38 children undergoing sphincters without augments, the total number of patients operated actually was 73, as another 35 had slings with enterocystoplasty. Differences in these 2 groups that determined whether or not to perform augmentation were not described, but rather the decision was based upon the “judgment” of the various surgeons whether or not to perform augmentation were not detailed. It seems possible there was a bias towards enterocystoplasty.

Another pitfall in comparing slings to sphincters is that even purposefully “tight” slings probably exert less compression on the bladder outlet than do artificial sphincters. Most series measuring detrusor leak point pressure (DLPP) after slings show an increase of some 15cm water outlet than do artificial sphincters. Most series measuring detrusor leak point pressure (DLPP) after slings show an increase of some 15cm water pressure. In contrast, unless there is significant tissue atrophy, artificial sphincter augmentation was not detailed. It seems possible there was a bias towards enterocystoplasty.

No child with DLPP greater than 30 cm water before surgery developed hyperreflexia or worsening compliance. One had stable capacity, 4 noted increased capacity, and 4 had decreased capacity. Except for 1 male with diminished volume, who also had a lower postoperative DLPP indicating sling failure, all these patients were continent. No child with DLPP greater than 30 cm water before surgery developed hyperreflexia or worsening compliance. One had stable capacity, 4 noted increased capacity, and 4 had decreased capacity. Except for 1 male with diminished volume, who also had a lower postoperative DLPP indicating sling failure, all these patients were continent. No child with DLPP greater than 30 cm water before surgery developed hyperreflexia or worsening compliance. One had stable capacity, 4 noted increased capacity, and 4 had decreased capacity. Except for 1 male with diminished volume, who also had a lower postoperative DLPP indicating sling failure, all these patients were continent. No child with DLPP greater than 30 cm water before surgery developed hyperreflexia or worsening compliance. One had stable capacity, 4 noted increased capacity, and 4 had decreased capacity. Except for 1 male with diminished volume, who also had a lower postoperative DLPP indicating sling failure, all these patients were continent. 

Satisfactory urinary continence was achieved in this series for most children with neurogenic bladder outlet incompetence by slings alone. Only

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A Pragmatic Approach to the Use of Bulking Agents for the Management of Major Structural Incontinence in Children and Adolescents

Henri B. Lottmann, M.D.

In September 1997, we initiated a prospective clinical study to evaluate endoscopic cervico urethral injection of dextranomer based implants (Deflux®) for the treatment of severe incontinence in children and adolescents. All 5 to 20 years old patients treated at our institution for severe incontinence were eligible for study inclusion. Exclusion criteria were vesicoureteral reflux, uncontrolled bladder overactivity and poor bladder compliance. An informed consent was obtained from the patient or parents. The urine had to be sterile at the time of treatment. From September 1997 to September 2004, 41 males and 20 females 5 to 20 years old (mean age 10.3) with 26 cases of exstrophy-epispadias, 27 neuropathic bladder, 5 bilateral ectopic ureters and 3 miscellaneous (one epispadiac type urethral duplication, one traumatic urethral rupture and one isolated bladder neck deficiency) were enlisted in the study. Four of the patients with neuropathic bladder had undergone a previous bladder neck sling to improve continence, whereas 16 patients with exstrophy-epispadias complex had previously undergone Young-Dees bladder neck plasty with bladder augmentation in 3. Sixty-one patients received 1 (40), 2 (17) or 3 (4) injections, comprising a total of 86 treatment sessions. Patients were placed under general anesthesia for endoscopic injection. Mean injected volume per session was 3.9 cc (range 1.6 to 12) with injection placement in males at the bladder neck and below the verumontanum in the area of the external sphincter. In females, injection placement was all along the urethra. The male patients who had undergone a previous Young-Dees type bladder neck plasty were injected along the tube and below the veru montanum. All the injections have been performed transurethrally; in each site injections are performed in the 5, 7 and 12 o’clock position. Except for the five first treatment a supra pubic catheter was systematically inserted and kept on continuous drainage for five post operative days to allow the puncture site to heal before the patient starts to void or catheterize again and to limit the risk of early post operative urinary retention. More recently, we have started to inject the bladder neck via a suprapubic approach; this route is particularly convenient in patients with a neuropathic bladder, but not so easy in the patient with a bladder exstrophy due to the low insertion of the peritoneum. Short term results seem promising but the number of patients and the follow up are too short to be reported. None of the 22 patients who were voiding before treatment had to start clean intermittent catheterization after treatment or had significant post-void residual. No adverse effect related to the dextranomer based implants was observed thus far. Result of treatment on continence and bladder capacity was evaluated at one, six and twelve months and each consecutive year using videourodynamics, renal ultrasound, urine culture as well as subjective feedback received from the patient and family regarding continence.

Videourodynamics was mainly useful to study the evolution of bladder capacity, activity and compliance. Results were classified as cured (a dryness interval of four hours between micturation or CIC), or significantly improved (minimal incontinence requiring no more than 1 pad (continued on the next page)
Table 1 - Results in term of continence (dry or significantly improved) along follow up in 61 patients (presented at the ESPU-AAP section on urology second joint meeting, Uppsala, June 15-18, 2005 and accepted for publication in the 2006 pediatric supplement of the J Urol)

- One month: 48/61 patients (79%)
- Six months: 31/55 patients (56%)
- One year: 24/46 patients (52%)
- Two years: 18/35 patients (51%)
- Three years: 16/31 patients (52%)
- Four years: 12/25 patients (48%)
- Five years: 9/21 patients (43%)
- Six years: 4/11 patients (36%)
- Seven years: 2/5 patients (40%)

From our experience and the reports in the literature from other authors regarding the use of bulking agents for the management of major incontinence in the pediatric population, it appears that:

1. Two bulking agents have been evaluated on long term in this indication and are still in use: polydimethylsiloxane (Macroplastique®) and dextranomer based implants (Deflux®); bovine collagen based implants have been abandoned due to safety concerns as well as lack of long lasting effect.
2. Short and long-term results are similar with these two bulking agents.
3. Although these pathologies are very different, results are similar in patients with extrophy-epispadias complex or patients whose sphincter incompetence is of neuropathic origin.
4. Results are also similar in males and in females.

These results can be summarized as follows:

1. Very short term results (less than six months) indicate that 75% of patients are either dry or significantly improved (minimal urinary incontinence, requiring no more than one pad per day; patient not seeking for any further treatment). Up to three years after treatment 50% of the patients are still either dry or significantly improved. Up to nine years after treatment, around 40% of the patients are still either dry or significantly improved.
2. One to three treatment sessions are necessary to achieve such results; more than three sessions are usually not effective and might compromise other treatment options.

At a first glance, these results might not appear to be so impressive, particularly considering the cost for a successful treatment. However, considering the severity of the condition of these incontinent patients, the limited success rates achieved with much more aggressive procedures, one might try to define what the place of bulking agents could be amongst the wide armamentarium for treatment of major sphincteric incompetence.

OPTION 1

If you are an “aggressive” surgeon, with a wide experience in the field of pediatric incontinence and achieving exceptionally good results you could say: “This method does not work well enough, lets fix the problem with surgery.” What results can be expected with such an approach?
Bladder Neck Closure

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In children with a structural or neurogenic disease as in meningomyelocele and exstrophy, the treatment of incontinence can be difficult. Anticholinergics and clean intermittent catheterization can help but are often insufficient to completely cure the incontinence. In order to cure these children, surgical therapy is often needed. Sometimes only bladder augmentation can help. In those children with structural and or neurogenic sphincter deficiency, a surgical procedure to increase the resistance at the level of the bladder neck must be added. A wide variety of surgical options are available to obtain this, and are reported in this issue.

Bladder neck closure (BNC) and creating a continent diversion is only an option after failure of these reconstructions. However it is an option and the reported dryness rates are higher than with any other procedure. The technique to close a bladder neck is relatively simple, however, former failed reconstructions can be at the origin of scar tissue formation, creating a difficult dissection and failure of closure. In boys, the bladder is transsected just cranial to the prostate, after isolating the neurovascular bundles. In girls, transsection is done between the bladder neck and urethra.

The bladder is then mobilized on the dorsal aspect to the level of the ureteric orifices. The opening is sagittally closed in three layers: mucosal, muscular and serosal. The urethral stump is closed in 2 layers. In order to avoid contact between the 2 former openings, the bladder stump is fixed ventrally and the urethral stump dorsally. An omental flap can be mobilized and brought between the 2 stumps. A catheter is left in the bladder for 2 weeks. After 2 weeks, water tightness is checked by means of a cystography.

In closing the bladder neck, one must consider that the safety mechanism of a leak is suppressed. The procedure can, therefore, only be done in patients with a reliable reservoir. Also patients’ compliance regarding catheterization is important to consider. As many of these patients are adolescents, they tend to decrease their catheterization frequency especially when they stay dry. A good explanation of the possible threats to the upper tract and regular control visits with renal ultrasound are, therefore, necessary. Despite 100% dryness rate described in our study with BNC, one must be very careful in promoting this technique. In this study results of BNC in 17 children (9 male, 8 female) were reviewed. Ten children (5 male, 5 female) suffered neurogenic incontinence in meningomyelocele, 5 children (4 male, 1 female) had bladder exstrophy, 1 girl suffered iatrogenic incontinence after treatment of an ectopic ureterocoele and 1 girl suffered structural incontinence after pelvic fracture. Previous surgery for incontinence was done in 12 children with 36 procedures. Primary BNC was done in 5 children. For continent diversion the appendix was used in 13, the ureter in 2, a Monti procedure in 1, and an ileal valve in 1. In 9 children, ileal bladder augmentation was performed at the time of BNC. Four children were augmented before. After BNC, all patients were completely dry. One girl suffered stomal incontinence during the night. This resolved after bladder augmentation. Patient satisfaction was extremely high.

As for complications, urinary tract infections were seen in 9 patients. Stomal complications were seen in 8 patients. All these complications were seen in the first 6 months after the continent diversion.

Five years later all 17 patients are still continent. Further augmentation was done in 1 girl. Stomal revision was required in 3 patients, bladder stones removed in another 2 patients, and 1 girl and 1 boy developed bladder rupture due to delayed catheterization. The bladder rupture was the only complication directly related to the BNC. Typically in late puberty and adolescence these children neglect CIC. As no safety pop-off valve is available they are not confronted with incontinence when catheterization is delayed. Good follow-up and clear warning for this possible severe complication is essential in patients who undergo BNC.

BNC is an irreversible procedure. The patient or his parents need to give full informed consent. The possible threat to the upper tracts must be considered. Other issues such as potency and ejaculation in boys must also be considered. From a technical point of view, BNC is easier than reconstruction. However, the challenge for the surgeon is not to perform a difficult operation for his/her own satisfaction but to perform an operation for the patient’s satisfaction. In this regard, BNC must be considered one of the possible procedures in reconstructive surgery of the lower urinary tract.

In recent years 3 more studies have been published on the outcome of BNC. O’Connor reports an 83% success rate in 35 patients 1. Shpall reports a complication rate of 15% in 37 patients 2. Nguyen, however, reports only a 40% success rate even after repeated procedures 3. Remarkably, a high incidence of leakage of the continent diversion was reported in their series.

In conclusion, bladder neck closure is a procedure to be considered in the treatment of the failed bladder neck reconstruction. However, an experienced surgeon is needed to do this surgery.

References

I bolted upright, sweating profusely. I had been dreaming that it was 2050, the 99th meeting of the Society for Pediatric Urology. The yearly panel “Much Ado About Nothing” or “What to do with the Testicular Nubbin” was being presented (I guess I was surprised that were any nubbins left by that time). Howard Snyder was waxing about how he thought laparoscopy was mandatory, (and so much fun!!). Barry Belman, finger waving, was emphasizing how important it was to be certain that there was no processus vaginalis left behind (a slogan obviously borrowed from the Bush Administration).

It seemed somewhat strange that so many attendees were wearing Bose Noise Canceling Headphones during the panel.

Was this a BAD DREAM or simply another episode of the Twilight Zone? I had just been re-elected Secretary of the organization for the 32nd straight year (no other candidates would consent to run) and was responsible for writing the annual report.

The panel had been preceded by a talk about how important it was to screen for renal scarring in refluxers over 80 years of age (provided that the original foreskin was mailed in within 30 days) passed unanimously. Members were skeptical about the medico legal implications but the official legal monitoring team to the meeting seemed accepting. A new nanotechnology model showed that in fact the dorsal plate did not exist and was a figment of our imagination. Members were heartened to hear that, as, ipso facto, if the plate did not exist then all the stenosis, fistulas and retrusive measures did not in fact exist either! What a relief to the parents!

Warren Snodgrass was placed on a 24 hour suicide watch till the next morning.

Bill Cromie strongly suggested that this information be e-mailed to all parents whose children had stenosis, fistulas or retrusive meatusos, as the numbers were so large. He also suggested this information be made available immediately to the Federal Data Bank of Hypospadias Failures. Alan Retik, STILL chief at Boston Children’s Hospital proposed a 6 step hypospadias repair but the official HMO monitors at the meeting defeated this immediately. He seemed to take this defeat in stride and said he would be back another day. In turn, the membership voted “Kudos” for Alan (non monetary) and made him the first Honorary Honorary Honorary Member and recipient of the David Innes Williams Award (for the puzzled younger members, look up DJ on Google!).

Brent Snow suggested a novel idea that Pediatric Urology be designated as a true subspecialty with its own Board Certification. He added that if one was not fellowship trained, it would be forbidden to read or even think about pediatric urology. This would be monitored closely.

If it were not to be recognized by the American Board of Urology then a special certificate could be issued. If the special certificate proved controversial, then in its stead, a gift certificate to Neiman Marcus would be offered. If this proved to be too expensive then… (the membership was encouraged to use their imagination to fill in the blanks) and it would be voted upon at the next meeting.

Unfortunately the Journal of Pediatric Urology failed due to a lack of a single subscription. The membership agreed that the $5 subscription fee did in fact seem inordinately high and was perhaps causative. All five “Original Articles” over the last 30 years were designated to be placed in the SPU Time Capsule, with the caveat that it never be opened as exposure to air or confirmation might be detrimental. A suggestion that a summary of the most important take-home messages from the Annual Meeting be placed in the SPU sponsored fortune cookies was unanimously passed.

Dues for new members of the SPU were increased to $160,000 US (EU 140,000) ensuring and confirming the latest data that pediatric urology was in fact an O sum game for Fellows going out in practice. A proposal that a $3 mail in rebate form be used in all hypospadias repairs (provided that the original foreskin was mailed in within 30 days) passed resoundingly. Members were skeptical about the medical legal implications but the official legal monitoring team to the meeting seemed accepting. A new source of income was suggested since urologists are really “plumbers” why not charge traveling time between home and office (hospital) and back home again?

Max Maizels again offered his popular course (The Well Tempered Temper) for those members who were angry and felt duped about going into pediatric urology in the first place. He suggested that the class action suit against the American Academy of Pediatrics for malicious persuasion be dropped.

Efforts to add 10 days of research to the 8 week fellowship (excluding nights, weekends and holidays) were soundly defeated. Some members were adamant that too little meaningful data could be mined in such a short time, and anyway, the one partially funded lab in the world for...
pediatric urology research was too far away (and you had to go through Atlanta). The combined BS, MD, MS, JD, FR 14 week program was fortunately extended however.

Tony Atala presented a fascinating extension of his work - managing to grow an exact replica of himself from scratch in tissue culture. His efforts however to demand 2 FTE salaries were frowned upon, given the potential for abuse.

The Health South, Tyco, World Com and Enron Fellowships were reaffirmed but not funded. The Bed Bath and Beyond Enuresis Lectureship was cancelled due to severe lack of interest.

The Meredith Campbell Lecture “How Opal Mehta Got Kissed, Got Wild, and Got a Life” was given by Kaavya Visnanathan from Harvard. When it was pointed out that the lecture was a direct steal from her own book, no one seemed to care as plagiarism was not strongly encouraged.

The DaVinci Code was at long last cracked by a crack research team from Yale - the members were astonished to find it shared the same genetic focus with the “extraordinary urinary frequency syndrome” a major breakthrough with enormous implications for the future.

Free facial Botox injections were again offered to the membership in the Exhibit Hall in an effort to help keep a straight face during the Research Meeting. The Hand (Hands) on Robotic Clitoral Reconstruction course was again a huge success with standing room only. This huge pool of potential surgery has not gone unnoticed by the members, it would appear.

The membership committee voted that all past members could continue to be members with the one caveat that those non-fellowship trained were forbidden to wear the SPU bow tie (THERE IS A GOD AFTER ALL!). A motion by female members requiring that the number of papers accepted be proportional to the female: male ratio was greeted with enthusiasm by the female members. A male member suggested that this would be unfair and discriminatory since there were only 10 men left! A like motion to have surgical reimbursement rates substantially higher for female members was tabled and referred to a gender neutral sub-committee (? bisexual) at Johns Hopkins. A motion from several female members suggested that the men stop whining and “Get Real!”

A motion was made by one of the original members still alive that in the future the program include at least a FEW names that he might recognize.

Finally a new society was suggested by a splinter group of the Society for Fetal Urology – to be called the Society for PreFetal Urology. It was noted that there may be some resistance to this from concerned religious organizations and that funding might be problematic.

The Society adopted a new motto “Always Low Prices - Always” (provided Wal-Mart does not object). President Alice Johnson RN adjourned the meeting.

Respectfully submitted,
Richard M. Ehrlich, M.D., Secretary for Life

When I realized that this was all a DREAM (nay NIGHTMARE) I felt a palpable sense of relief knowing that Pediatric Urology would always be in capable hands in the future. I could not help but feel that, in fact, “Reflux Is Good” – the title of next year’s keynote address.

P.S. Thanks again for the plaque you give me every year for starting Dialogues in Pediatric Urology, but if it is not too much trouble please just put it in the mail. My attendant is complaining about pushing the wheelchair through the increasingly crowded airport each year!