DIFFERENTIATING TESTICULAR TORSION FROM ORCHITIS USING NON-CONTACT INFRARED THERMOMETER: A PROSPECTIVE, RANDOMIZED, BLINDED, ANIMAL STUDY*

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ABSTRACT

Objective: The aim of this study was to differentiate testicular torsion from orchitis using noncontact infrared thermometer. Materials and Methods: This was a prospective blinded animal study involving 21 rabbits assigned into 3 groups. The first group underwent ligation of one of their spermatic cords, the second group had one of their testicles inoculated with E. coli to stimulate orchitis, the third group acted as control. Individual testicular temperatures were taken using an infrared noncontact thermometer before and after spermatic cord ligation and testis inoculation. The observer taking the temperature was unaware of the underlying testicular pathology. The control group underwent scrotal thermometry only. Using the paired t-test, there was a significant temperature drop in the ligated testis compared to the nonligated side. Using the same test, there was significant temperature rise in the inoculated testis compared to the noninoculated testis. Results: By statistical analysis it was determined that a decrease in temperature between 1-1.8°C of the involved testis below the temperature of the opposite testis would favor testicular torsion, and a rise in temperature between 1.1-2.2°C in the involved testis over the temperature of the opposite testis would favor a diagnosis of orchitis. Conclusion: Based on this study, scrotal non-contact infrared thermometry can differentiate between testicular torsion and orchitis. This merits further study in human subjects correlating infrared thermometer findings with the actual intraoperative findings.

Key words: torsion, orchitis, infrared thermometer.

INTRODUCTION

Torsion of the spermatic cord is a urologic emergency requiring urgent management because of its life long sequelae. Only its proper and timely diagnosis can prevent necrosis and irreversible testicular damage. Oftentimes, the diagnosis is unclear when the history and physical examination is equivocal. In the younger age group, there is less opportunity for a proper examination due to the distress of the child. Hence it is usually justified to perform a surgical exploration if there is a doubt in the diagnosis.
In centers where doppler ultrasound or radionuclide imaging is available, the incidence of a negative surgical exploration is lower compared to less equipped centers. But not all centers can afford this equipment, which requires personnel and is operator dependent. The purpose of this study was to differentiate testicular torsion from orchitis using a noncontact infrared thermometer (Raytech Corporation, California) which is relatively inexpensive, non-invasive and easy to operate.

MATERIALS AND METHODS

Twenty one male rabbits with an average weight of 450 grams, were involved in the study. By block randomization, they were divided into 3 groups. The first group (7 rabbits) underwent ligation of one of their spermatic cords, the choice of which side to ligate was determined randomly. The incision favored was a Pfannensteil incision. Three hours after spermatic cord ligation, the rabbits underwent bilateral scrotal infrared thermometry (Raytech MT4 Noncontact Thermometer). Temperatures were taken on 4 quadrants of each testicle and the average was recorded. The ambient temperature from 24-26 oC. The observer was unaware of the actual ligated side.

The second rabbit group (7 rabbits) had one of their testicles inoculated with laboratory-grown E. coli 0.1 cc delivered in tryptic soy broth solution with concentrations of approximately 100,000 cfu/cc. The side chosen was determined by random selection. Two days before inoculation, core needle biopsies were taken on the testicle to be inoculated to determine the normalcy of that testis. Four days after inoculation, core needle biopsies on the testicle confirmed presence of neutrophilic infiltrates indicative of inflammatory process. A Pfannensteil incision was also made as in the first group. The rabbits then underwent scrotal temperature determination.

The third group (7 rabbits) acted as controls. Only Pfannensteil incision was done in this group. Scrotal temperature determinations were likewise taken.

The observer was blinded to the groupings and randomization of the subjects. The location of the incision did not reveal which testicle was involved. Only the surgeon knew which rabbits belonged to their specific groups. The results were then summarized and tabulated.

<table>
<thead>
<tr>
<th>Rabbit No.</th>
<th>Temperature before ligation</th>
<th>Temperature after ligation**</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Right Testes</td>
<td>Left Testes</td>
</tr>
<tr>
<td>1</td>
<td>36.4°C</td>
<td>36.3°C</td>
</tr>
<tr>
<td>2</td>
<td>36.1°C</td>
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<tr>
<td>3</td>
<td>36.5°C</td>
<td>36.4°C</td>
</tr>
<tr>
<td>4</td>
<td>36.4°C</td>
<td>36.8°C</td>
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<tr>
<td>5</td>
<td>36.2°C</td>
<td>36.4°C</td>
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<tr>
<td>6</td>
<td>36.5°C</td>
<td>36.3°C</td>
</tr>
<tr>
<td>7</td>
<td>36.2°C</td>
<td>36.4°C</td>
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</table>

* side-ligated
** temperature taken 3 hours after ligation

The average decrease in temperature of the involved testes before and after ligation was 1.2°C with a range of 0.9°C –1.5°C.

The average difference in the temperature of the ligated and nonligated testis was 1.3°C, with the ligated testis consistently cooler than the opposite nonligated testis. The difference in temperature between the ligated and nonligated testis ranged from 1°C-1.8°C.

Prior to any manipulation, the temperature of the right and left testis was measured and determined and were significantly different using the T-test, (α=0.05). It was noted that there was no significant difference between the temperature of the right and left testes before ligation.

After spermatic cord ligation, there was a significant change in the temperature before and after the procedure. There was a significant difference in the observer temperature of the involved testis before and after ligation using the paired T-test for correlated data, with a level of significance of α= 0.05.

Using paired t-test for correlated data, with p level of significance α= 0.05, there was a significant difference in the temperature of the ligated testis from the nonligated testis. Hence a drop in temperature between 1-1.8°C of the involved testis below the temperature of the opposite involved testis would favor the diagnosis of testicular torsion in the study rabbits.
The average increase in the temperature of the involved testis before and after inoculation was 1.6°C with a range of increase between 1.3-2.0°C.

The average increase in temperature of the inoculated testis from the opposite non inoculated testis was 1.7°C with a range of increase between 1.1-2.2 oC.

Using the T-test with a level of significance of $\alpha = 0.05$, there was no significant difference between the temperature of the right and left testis before inoculation. This signifies an almost similar left and right testicular temperature.

Using the paired t-test ($\alpha = 0.05$) for correlated data, there was a significant difference between the inoculated and noninoculated testis. Temperature elevation of the involved testis with in the range of 1.1-2.2°C over the temperature of the opposite uninvolved testis would favor a diagnosis of orchitis.

The control group showed no significant differences between the right and left scrotal temperatures.

DISCUSSION

Acute scrotum is a diagnostic dilemma. The differential diagnoses include spermatic cord torsion, torsion of testicular appendages, orchitis, epididymitis, trauma, hernia and the occasional tumor. Because of the difficulty in making an accurate diagnosis in these cases, many have supported a policy of early scrotal exploration to rule out torsion.1-2 Oftentimes surgical exploration turns out to be negative especially in centers with no sophisticated imaging tools. On the other hand, a misdiagnosis in conservative treatment is catastrophic, resulting in low salvage rate of the involved testis ranging from 26-89%.1

The diagnosis of acute scrotum should primarily rest on the history and physical examination.3 In some cases, there are definite, specific and clear cut signs and symptoms in the history and physical examination that will distinguish torsion from the other pathologies. But problems arise once one deals with an irritable child with anxious parents or an uncooperative patient. It is vital that the mechanical pathology (torsion) be distinguished from inflammatory pathologies, since treatment is different. This is where laboratory examinations and imaging tools can help. Laboratory tests such as testicular hemoglobin and testicular blood pH had been used before but results were conclusive. The accepted imaging modalities are doppler ultrasonography and nuclear testicular scans which have shown a high degree of accuracy. Accurate as they may be, they involve sophisticated, expensive equipment which is operator dependent and may even cause a delay in intervention. More often than not, patients with acute scrotum presents during nighttime or early hours of the morning when operators are available. A delay in intervention leads to a low salvage rate. For a successful recovery of testicular function, surgical intervention should be within the golden period of not more than four hours from the time of torsion.4

The significance of temperature changes on the testes had been primarily observed in infertile men with varicoceles. It was pointed out in several studies that a 1-2°C elevation was significant enough to cause

<table>
<thead>
<tr>
<th>Table 2. Temperature of rabbits who underwent E. coli inoculation.</th>
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<td>Rabbit No.</td>
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<td>7</td>
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</tbody>
</table>

* side ligated
** temperature taken 3 hours after ligation

<table>
<thead>
<tr>
<th>Table 3. Testicular temperature of control rabbits.</th>
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<tbody>
<tr>
<td>Rabbit No.</td>
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spermatogenic derangements. In veterinary medicine, scrotal temperatures are primary parameters in predicting pregnancy rate among bulls and the use of infrared thermography has become common in breeding to safeguard against delayed calving. In a study done by Coulter, they were able to designate temperature bands across the scrotum. The bands progressively become cooler as they approach the bottom of the scrotum. In cases of infection, vascular lesions, duct obstruction and tumors, these bands lose their symmetry. Another study done by Wegner and Weissbach reported the value of using plate thermography in diagnosing scrotal infection, tumors and varicoceles. They reported temperature elevation on the affected side. In our study, all the rabbits who had orchitis showed an average temperature elevation of 1.7°C on the affected side in comparison to the unaffected side. The rise in actual temperature was consistent in all subjects. The statistical evaluation of the temperature elevation was significant.

The value of temperature scanning as already gained fair acceptance in Europe. In the US, they remain skeptical of the method. The Russians in particular, noted 100% accuracy using thermovision in diagnosing hydrocele and epididymoorchitis and 89% accuracy in tumors. The main drawback in this investigative method is still the sophistication and the cost of equipment. Thermography uses heat sensitive plates requiring professional preparation and developing, while thermovision needs a heat sensitive camera which is easy to use, but is expensive. Our study however, uses an inexpensive ($100), easy, less sophisticated version of the infrared thermometer.

In the event of a testicular vascular accident (torsion or ligation), there were studies that showed a decrease in the scrotal temperature of the involved testes. Japanese literature reported an average of 3°C decrease in the scrotal temperature after spermatic vein ligation in varicoceles. An article by Hanly reported a 1°C decrease after spermatic vein ligation. A study done by Agger using a needle thermometer puncture, reported an average of 2.3°C decrease in temperature after ligation of the spermatic vein. In our study to simulate torsion, the entire spermatic cord was ligated and an average drop of 1.2°C was noted 3 hours after ligation. The 3rd hour post ligation was selected to be the standard time for temperature monitoring since it still falls within the golden period in which surgical intervention can produce good recovery of sperm function. The decrease in temperature showed statistical significance. A separate group of rabbit subjects (7) was assigned only as controls to further prove that there is no significant difference in the temperature between the left and the right testes. Hence in testicular pathology, the temperature of the uninvolved testicle could be used as reference to designate whether there is temperature rise or drop in the opposite involved testicle.

Presented with this data, we now have evidence that in animals, the use of this portable infrared thermometer is fairly accurate in diagnosing acute scrotum. The use of this instrument has provided a non-invasive, safe, fast, temperature reading. Ordinary mercurial contact thermometer is probably not suitable in this situation since it takes about a minute of skin contact before a reading is arrived at and to get the average testicular temperature it would take 4 minutes to cover 4 quadrants. These data, coupled with correlation from the history and physical findings, will hopefully enhance the accuracy in diagnosing the etiology of acute scrotum especially in areas where sophisticated diagnosis tools are unavailable.

REFERENCES
8. Tiktiiski O, Melnikova V, Moschalo VA. The role of thermography in the diagnosis of testicular diseases. Urol


CORRELATION OF TRANSRECTAL ULTRASOUND GUIDED PROSTATE NEEDLE BIOPSY RESULT WITH THE RADICAL PROSTATECTOMY SPECIMEN: COMPARISON OF THE TUMOR LOCATION AND TUMOR GLEASON GRADE*

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ABSTRACT

Objective: To correlate transrectal ultrasound (TRUS) guided prostate needle biopsy specimens, with emphasis on the location of potentially missed cancer and Gleason grade, with that of the radical retropubic prostatectomy (RRP) specimens. Methodology: A retrospective review was done involving patients who underwent bilateral pelvic lymph node dissection followed by RRP between February 1999 and July 2002. Patient's age, serum prostate specific antigen (PSA) level and tumor location were reviewed. Gleason grading was categorized into three groups: well-differentiated (Gleason 2-4), intermediate (5-7) and poorly differentiated (8-10). Histopathology grading results between needle biopsy and RRP specimens were correlated. Results: Thirty-eight males aged 65.7 + 6.2 with a mean pre-operative PSA of 16.85 were included in the study. Only biopsies of the basal region were consistent in both TRUS and RRP. On the other hand, biopsies of the apical region missed most of the cancers when compared with RRP specimen. TRUS Biopsy and RRP Gleason's Grade (p=0.5997) were comparable. However, it only had a low positive correlation. Finally, a significant (p=0.0082) undergrading of the well-differentiated biopsy specimens was noted. Conclusion: Tumor location on needle biopsy specimens did not correlate well with the final pathology specimens of the RRP. The basal region had the most consistent correlation with the RRP specimens while the apical area had the poorest. Down-grading of the well-differentiated cancers by needle biopsy specimens was observed when compared to the final histopathological result of the RRP specimen.

Key words: Transrectal ultrasound guided needle biopsy, radical retropubic prostatectomy.

INTRODUCTION

The widespread use of serum prostate specific antigen (PSA) coupled with transrectal ultrasound guided prostate

* Second Place Winner, 5th PUA-Patriot Poster Contest.
recent local study, Petero et al. reported the 14% yield for sextant biopsy increased to 23.3% using an extended 12-core biopsy technique. A major concern that another 20-40% of these patients will be diagnosed to have prostate cancer when a repeat biopsy is performed due to persistence of PSA elevation.

Furthermore, the ability of the biopsy specimen to accurately grade the tumor is subject to much debate. The universally accepted grading system for prostate cancer is the Gleason scoring system. Contemporary series have shown a poor correlation in the grading of the tumor when the biopsy Gleason score is compared with actual radical prostatectomy specimen. This has tremendous therapeutic implications considering the availability of minimally invasive treatment options for prostate cancer. Prostate brachytherapy has been shown to have comparable long term results with that of radical prostatectomy in low grade, well differentiated cancers. The biopsy Gleason score, therefore, is crucial to the best therapeutic option.

The objective of this study was to compare the yield of prostate needle biopsy with the radical prostatectomy specimen. Emphasis is given to location of missed cancers during the biopsy procedure.

MATERIALS AND METHODS

This is a retrospective review involving patients who underwent bilateral pelvic lymph node dissection followed by radical retropubic prostatectomy between February 1999 and July 2002. The patient age, serum PSA level, individual sites and the grade of positive and negative biopsy cores based on location and final pathology report were recorded. Clinical and pathological stages were assigned based on the TNM system. Specimens were serially sectioned from apex to base. All patients had a designated Gleason score on the needle biopsy and prostatectomy specimens, defined as the sum of the primary and secondary predominant patterns. The patients were divided into three groups according to the sum of the Gleason scores, i.e. well differentiated (Gleason 2-4), intermediate (5-7) and poorly differentiated (8-10). The preoperative biopsy and the pathology of the surgical specimen were examined by a single pathologist.

Comparisons and correlations in the Gleason grade of the needle biopsy and the prostatectomy specimens were determined using the Mann-Whitney-Wilcoxon rank-sum test and Spearman’s rho rank test, respectively. The accuracy of the needle biopsy in detecting cancer per location when compared to the final surgical specimen was assessed using the sensitivity, specificity, and positive and negative predictive values.

RESULTS

Thirty-eight males aged $65.7 \pm 6.2^{299.80}$ were included in the study. The mean pre-operative PSA was 16.85 (4.84-100). Table 1 shows the validity tests of TRUS biopsy of the different areas of the prostate gland. Among the areas biopsied, the right base ($p=1.000$) and left base ($p=0.8001$) were consistent in both TRUS and RRP. On the other hand, biopsies of the apical region have the lowest accuracy rates.

Table 1. Validity test of TRUS biopsy using RRP as gold standard.

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Positive Predictive Value</th>
<th>Negative Predictive Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Base</td>
<td>76.47</td>
<td>80.95</td>
<td>76.47</td>
<td>80.95</td>
</tr>
<tr>
<td>Right Mid gland</td>
<td>52.38</td>
<td>88.24</td>
<td>84.62</td>
<td>60.00</td>
</tr>
<tr>
<td>Right Apex</td>
<td>47.37</td>
<td>89.47</td>
<td>81.82</td>
<td>62.96</td>
</tr>
<tr>
<td>Left Base</td>
<td>66.67</td>
<td>52.94</td>
<td>63.64</td>
<td>56.25</td>
</tr>
<tr>
<td>Left Mid gland</td>
<td>60.71</td>
<td>80.00</td>
<td>89.47</td>
<td>42.11</td>
</tr>
<tr>
<td>Left Apex</td>
<td>52.00</td>
<td>92.31</td>
<td>92.86</td>
<td>50.00</td>
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</table>
on biopsy have similar pathological reading to that of RRP specimen while 3 (11%) were either upgraded or downgraded of the discrepancies between the biopsy and RRP specimen, only the downgrading of the well-differentiated biopsy specimens was significant (p=0.0082).

Therefore, strategies to improve detection by prostate needle biopsy should not only be limited to the number of cores but also to careful attention to the areas where the cancer is frequently missed.

The prostate is an ellipsoid-shaped organ and thus, the apical area represents the narrowest region and is prone to under-sampling when the biopsy is directed laterally. If overcompensation is done by directing the needle more medially, the transition zone may be sampled instead of the peripheral zone, which is the most common location of the cancer.

It was further shown that a significant number of the well-differentiated needle biopsy specimens were undergraded. Therefore, care should be taken in counseling patients as to the appropriate treatment option. Minimally invasive modalities such as prostate and seed implantation utilized as monotherapy may not be adequate because it was shown that low-risk patients characterized by a low Gleason Grade and low PSA had estimates of 5-year biochemical outcome compared with RRP, whereas intermediate-and high-risk patients treated with brachytherapy fared inferiorly when compared to radical surgery.16

**CONCLUSION**

Tumor location from needle biopsy specimens do not correlate well with the final pathology specimens from the RRP. Only the basal area has the most consistent correlation with the RRP specimens while the apical area has the poorest.

Under-grading of the well-differentiated cancer by needle biopsy specimens was observed when compared to the final histopathological result of the RRP specimen.

**RECOMMENDATIONS**

Future development of prostate needle biopsy protocols must not only deal with increasing the number of cores but more importantly, emphasizing the need to concentrate in areas of the prostate where cancers are commonly missed such as the apical area.

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### Table 2. Grade distribution.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Well Differentiated</th>
<th>Intermediate</th>
<th>Poorly Differentiated</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRUS Biopsy</td>
<td>7</td>
<td>27</td>
<td>4</td>
<td>38</td>
</tr>
<tr>
<td>RRP</td>
<td>5</td>
<td>29</td>
<td>4</td>
<td>38</td>
</tr>
</tbody>
</table>

* Grade is based on the TRUS biopsy: Well-differentiated (Gleason's 2-5), Intermediate (Gleasons 6-7) and Poorly-differentiated (Gleason's 8-10).
REFERENCES


ORIGINAL ARTICLE

COMPARISON OF SPIRAL COMPUTED TOMOGRAPHY RENAL ANGIOGRAPHY VERSUS DIGITAL SUBTRACTION RENAL ANGIOGRAPHY IN PRE-OPERATIVE KIDNEY DONOR EVALUATION

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Department of Urology, National Kidney and Transplant Institute

ABSTRACT

Objectives: At the National Kidney and Transplant Institute (NKTI), the conventional Seldinger technique renal arteriogram with Digital Subtraction Angiography (DSA) has been the standard for the evaluation of the renal vasculature of potential kidney donors. The acquisition of the Siemens Somatom Emotion Spiral Computed Tomography (CT) with software capable of multi-planar 3-dimensional imaging has led to the evaluation of its role as a possible alternative or replacement for DSA. The accuracy of each modality in identifying the actual renal vessel anatomy is determined using intra-operative findings. Materials and Methods: Between January and September 2001, a total of 116 potential kidney donors divided into two groups, underwent angiography at NKTI (59 DSA, 57 Spiral CT). The results were then compared with the actual intra-operative findings using Kappa test. The accuracy rate for each modality was also computed. Results: There was no statistical difference between the two modalities as to the sensitivity rate and the overall agreement with the intra-operative findings. Errors in detection by CT angiogram, particularly the missed pre-hilar or accessory arteries, were found to be comparable with the conventional DSA. Conclusion: The spiral CT renal angiography appears to be as accurate as the conventional DSA in detecting the actual renal vasculature. It has the potential to replace the conventional DSA being less invasive, less expensive and equally reliable in the evaluation of potential kidneys donors.

Key words: kidney donor, spiral computed tomography (CT) angiography, digital subtraction angiography (DSA), renal vasculature.

INTRODUCTION

The source of live donor kidneys come from the healthy, willing and highly motivated relatives of the recipient such as the siblings, parents, children, distant relatives as well as unusually motivated friends of the recipient in some highly selective circumstances. In no other area in medicine is an otherwise healthy individual asked to subject himself or herself to the potential morbidity or mortality of a major surgery for no apparent physical benefit.

The evaluation of a potential kidney donor is extensive and the final piece is the confirmation of the anatomic
integrity and vasculature of the donor kidney. This is usually performed using the conventional Seldinger technique catheter angiography either by a cut film or the intra-arterial DSA wherein computerized manipulation of the images makes it possible to obtain good quality studies with relatively small amount of contrast material. Complications from the procedure may be few and mostly minor such as pain and groin hematoma at the puncture site. But the potentially dangerous ones include direct injury to the vessel necessitating surgical exploration, formation of pseudoaneurysm, dissection, thrombosis, foreign bodies lodging within the vascular system and the most fatal, although rare, the massive immobilization of small vessel by cholesterol crystal in patients with significant atherosclerosis.\(^7\)

At the National Kidney and Transplant Institute, the conventional Seldinger technique catheter angiography remained the standard since it started its transplant program. The cut film was later replaced by digital imaging known as Digital Subtraction Angiography (DSA) for better quality films. Recently, the institute acquired the Siemens Somatom Emotion Spiral Computed Tomography (CT) provided with software capable of multi-planar 3-dimensional (3-D) imaging. Based on recent reports in foreign literature regarding its value in the imaging by 3-D reconstruction of the renal vasculature, we conducted a prospective study on its role in the evaluation of potential kidney donors.\(^1-18\)

**General Objective**

The general objective of this study was to compare the role of spiral CT angiography with the conventional DSA in the evaluation of the renal vasculature of potential kidney donors.

**Specific Objectives**

1. To determine the accuracy of each modality in identifying the actual renal vessel anatomy using the intra-operative findings as the gold standard.
2. To be able to recommend spiral CT angiography as an alternative, if not, as a replacement to the conventional digital subtraction angiography in the evaluation of potential kidney donors.

**MATERIALS AND METHODS**

We prospectively studied all potential kidney donors who later underwent donor nephrectomy at NKTI from January to September 2001. A total of 127 donor nephrectomy procedures were done during the period. Eleven patients were excluded because the Spiral CT angiograms were done outside the institution. Eleven patients were excluded because the spiral CT angiograms were done outside the institution. The remaining 16 patients were divided by allocating them in 2 groups. Of these, 59 underwent pre-operative DSA, while 57 underwent the spiral CT angiography. The angiogram results were then compared with the actual intra-operative findings. The accuracy rate was computed for each modality with the intra-operative findings as the gold standard. Kappa test was used to compare the 2 procedures.

**Conventional DSA Protocol**

The conventional Seldinger catheter renal angiography was performed using a 5-Fr pigtail catheter inserted via the femoral arterial route and positioned within the abdominal aorta near the renal artery ostium at the level of the second lumbar vertebrae. Aorto and renal angiograms were then obtained after rapid injection of 35 to 40 ml of non-ionic contrast material at a rate of 18-20 m/sec. All examinations were obtained with a computer-assisted digital subtraction technique. The entire procedure lasted at least one hour.

**Spiral CT Angiogram Protocol**

CT evaluation was performed using Somatom Emotion Spiral CT scan. Sequential CT scan or topograms were taken beginning at the level 15-20 mm. above the upper pole of the left kidney descending to the level of the aortic bifurcation. Transite time was then determined with the intravenous injection of approximately 70 to 100 ml of non-ionic contrast material at a rate of 18-20 m/sec. All examinations were obtained with a computer-assisted digital subtraction technique. The entire procedure lasted at least one hour.

The reconstruction was systematically performed with the Siemens software package capable of multi-planar 3-D image reconstruction. A radiologist viewed them in cine mode on the monitor at the workstation. Image was then analyzed and interpretation done based on the axial transverse
sections, 3-D reconstructed images and 2 dimensional reformations.

For both procedures, excretory urograms were taken about 10 minutes after the injection of the contrast material.

RESULTS

Tables 1 and 2 present the specific findings based on the number of arteries seen as well as the presence of pre-hilar arterial branches for each modality compared to the intra-operative findings. Table 3 summarizes all the results, which show an overall sensitivity rate at 91.25% for DSA, and 94.9% for spiral CT renal angiography. There was no statistical difference between the two modalities as to the overall agreement with the intraoperative findings.

Table 1. Digital subtraction renal angiography (DSA).

<table>
<thead>
<tr>
<th></th>
<th>Single renal artery</th>
<th>Double renal arteries</th>
<th>Single artery with pre-hilar branch</th>
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<tbody>
<tr>
<td><strong>1a.</strong> Single renal artery.</td>
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<tr>
<td>DSA</td>
<td>Intra-operative Findings</td>
<td></td>
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</tr>
<tr>
<td>Single artery</td>
<td>Single</td>
<td>41</td>
<td>2</td>
</tr>
<tr>
<td>Non-single</td>
<td>0</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>41</td>
<td>18</td>
<td>59</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>100.0%</td>
<td>Specificity</td>
<td>88.9%</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>95.2%</td>
<td>98.2%</td>
<td>100.0%</td>
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</table>

**1b. Double renal arteries.**

| DSA            | Intra-operative Findings |                        |                                   |
|----------------|--------------------------|-----------------------|                                   |
| Single artery  | Single | 4 | 1 | 5 |
| Double arteries | 0 | 54 | 54 | 65 |
| Total          | 4 | 55 | 59 | 69 |
| Sensitivity    | 100.0% | Specificity | 98.2% | Negative predictive value - 100.0% |
| Positive predictive value | 80.0% | 98.0% | 94.2% |

**1c. Single artery with pre-hilar branch.**

| DSA            | Intra-operative Findings |                        |                                   |
|----------------|--------------------------|-----------------------|                                   |
| Single artery  with pre-hilar branch | 11 | 0 | 11 |
| Non-single with pre-hilar branch | 2 | 46 | 48 | 50 |
| Total          | 13 | 46 | 59 | 69 |
| Sensitivity    | 84.6% | Specificity | 100% | Negative predictive value - 95.8% |
| Positive predictive value | 100.0% | 98.0% | 95.8% |

Table 2. Spiral CT angiography.

<table>
<thead>
<tr>
<th></th>
<th>Single renal artery</th>
<th>Double renal arteries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2a. Single renal artery.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spiral CT</td>
<td>Intra-operative Findings</td>
<td></td>
</tr>
<tr>
<td>Single artery</td>
<td>Single</td>
<td>44</td>
</tr>
<tr>
<td>Non-single</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>13</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>100.0%</td>
<td>Specificity</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>93.6%</td>
<td>98.1%</td>
</tr>
</tbody>
</table>

**2b. Double renal arteries.**

| Spiral CT      | Intra-operative Findings |                        |                                   |
| Single artery  with pre-hilar branch | 4 | 1 | 5 |
| Non-single with pre-hilar branch | 1 | 51 | 52 | 62 |
| Total          | 5 | 52 | 57 | 67 |
| Sensitivity    | 80.0% | Specificity | 98.1% | Negative predictive value - 98.1% |
| Positive predictive value | 80.1% | 98.1% | 98.1% |

Table 3. Summary of the results of DSA and spiral CT in comparison with the intra-operative findings.

<table>
<thead>
<tr>
<th></th>
<th>Single renal artery</th>
<th>Double renal arteries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3a. DSA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSA</td>
<td>Intra-Operative Findings</td>
<td></td>
</tr>
<tr>
<td>Single artery  with pre-hilar branch</td>
<td>44</td>
<td>0</td>
</tr>
<tr>
<td>Double arteries</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Single artery  with pre-hilar branch</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>5</td>
</tr>
</tbody>
</table>
This study has obviously demonstrated the potential value of spiral CT renal angiography in the evaluation of potential kidney donors.

**CONCLUSION**

The spiral CT renal angiography appears to be as accurate as the conventional DSA in detecting the actual renal vasculature. It has the potential to replace the conventional DSA being less invasive, less expensive and equally reliable in the evaluation of potential kidney donors.

**REFERENCES**

11. Kayman Am, Rozenbist AM, Figueroa KL, Hoffman Sd, Cynamon J, Karwa GL, Tellis VA, Lerner SE. Use of spiral computerized...


ORIGINAL ARTICLE

PROSTATE SPECIFIC ANTIGEN DENSITY OF THE TRANSITION ZONE ENHANCES SPECIFICITY OF PROSTATE SPECIFIC ANTIGEN IN THE DETECTION OF PROSTATE CANCER IN PATIENTS WITH INTERMEDIATE PSA LEVELS

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Section of Urology, Department of Surgery, University of Santo Tomas Hospital and Cardinal Santos Medical Center.

ABSTRACT

Objectives: This study was done to evaluate the importance of prostate specific antigen density of the transition zone (PSADtz) in prostate cancer detection by comparing it with PSA and PSAD in patients with PSA level in the diagnostic gray zone of 4-20 ng/ml. Another aim was to determine the optimum PSADtz cut-off value that would detect significant number of prostate cancers while at the same time, minimize unnecessary biopsies in patients with benign prostate. Materials and Methods: One hundred eight men with a suspicion of prostate malignancy, due to an elevated serum PSA (>4.0-20.0), participated in this prospective cohort study. The specificities at selected sensitivities of PSA, PSAD and PSADtz cut-off levels were computed. Receiver operating characteristic (ROC) curves were constructed to compare the 3 indices. Results: Twenty five patients were diagnosed to have prostate cancer for a detection rate of 22.9% (25/108). ROC curve showed PSADtz is superior to PSAD and PSA in predicting prostate cancer. At the PSADtz level of 0.47 ng/ml/cc, a sensitivity of 92%, specificity of 46.3% and a positive predictive value of 39.66% noted. Conclusion: PSADtz enhances the specificity of serum PSA and is superior to serum PSA and PSAD in predicting prostate cancer. At the PSADtz level of 0.47 ng/ml/cc, more than 90% of cancers will be detected while 46.3% unnecessary biopsies are avoided.

Key words: Prostate specific antigen density, prostate specific antigen.

INTRODUCTION

Prostate specific antigen (PSA) is the most important diagnostic test for assessing the potential for harboring adenocarcinoma of the prostate. Using the arbitrary PSA cut-off of 4 ng/ml, 30% of men in screening populations with values above this threshold has been shown to have prostate cancer in western literature. A local study using a sextant biopsy technique reported a 14% detection rate in patients above this PSA level. Despite increasing the number of biopsy cores to 12, the detection rate increased only to 23%. The lack of sensitivity of serum PSA as a tumor marker led to strategies to improve its performance. Newer tumor markers or methods to refine the performance of PSA through PSA derivatives has been implemented to improve the specificity of PSA. However, it remains unclear which method is superior in practical use.

It has been observed that there is a direct relationship between PSA level and prostatic hyperplasia. Thus, the concept of PSA Density (PSAD) was conceived to normalize PSA level to prostatic volume. The initial enthusiasm has been met with various conflicting results. It has been further established that prostate cancer cells do not actually produce more PSA than benign hyperplastic prostate cells due to lack of differentiation. Thus, PSA density of the transition zone (PSADtz) has been introduced to normalize serum PSA directly to the hyperplastic portion of the prostate gland. Like PSAD, numerous authors have reported contrasting results for and against the utility of PSADtz.

This study sets to evaluate the performance of PSADtz in the detection of prostate cancer by comparing it with PSA and PSAD in patients with PSA level in the diagnostic gray zone of 4-20ng/ml. We also aim to determine the PSADtz cut-off value that would significantly enhance the detection of prostate cancer and at the same time, minimize the number of unnecessary biopsies in patients with benign disease.

**MATERIALS AND METHODS**

This is a prospective cohort study involving 108 patients seen from January 2001 to September 2002 from 2 medical centers. The population was composed of men evaluated for prostate malignancy due to an elevated PSA and/or abnormal digital rectal examination. Serum PSA is considered abnormal if the patient level is higher than the widely accepted PSA cut-off level of 4ng/ml. Only men with intermediate serum PSA level (4-20ng/ml) were included in the study. None of the patients has any recent episodes of pararectal perturbation (e.g. catheterization, cystoscopy, prostate massage). All men underwent prostate imaging by ultrasound and 12-core prostate needle biopsy.

The prostate was ultrasonographically studied in the transverse and sagittal planes with the patient in left lateral decubitus position. The tri-axial distances at the maximal diameter of the length, height and width of the total prostate and transition zone were measured. The transition zone when hyperplastic is usually separated from the central and peripheral zones by a distinct layer of fibrous tissue that is clearly visible on ultrasonography. Prostate and transition zone volumes were calculated using the prostate ellipsoid formula (volume = 0.52 x length x width x height). Prostate imaging was provided by Acuson®, an ultrasound machine with 7.2 MHz probe and BK Falcon with 7.5 mhz multi-planar probe.

PSA density (PSAD) and PSA density of the transition zone (PSADtz) calculated as the quotients of serum PSA divided by the total prostate volume and the volume of the transition zone, respectively. The values were expressed in ng/ml/cc.

Transrectal ultrasound-guided needle biopsies were done with the prostate gland image in the sagittal plane. Biopsy cores were taken using an automated spring-loaded biopsy gun (Topnotch™) (Figure 1) utilizing the 12-core biopsy protocol as previously described (Figure 2).

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**Figure 1.** Core biopsy specimens were taken using an automatic spring-loaded biopsy gun with gauge 18 needle (Topnotch, Microvasive™).

**Figure 2.** The 12 core biopsy protocol: Specimens were taken at mid-sagittal line of each at the apex, mid-gland and base (heavy round markers) alternated by the laterally directed cores (x-markers).
The specimens were read by a single pathologist. A patient has prostate cancer if any of the cores has malignant tissue in the final histopathological report. Prostatic intraepithelial neoplasia is considered a benign report.

All biopsies, prostate imaging, determination of prostate gland and transition zone volumes were done by a single urologist.

Database was entered into a Microsoft Excel program.

### Statistical analysis

Patient profile which includes age, PSA, prostate volume, transition zone volume, PSAD and PSADtz were determined. These parameters were compared to those diagnosed with prostate cancer (CAP) and benign prostate disease (NEM) using a 2-tail, t-Test of independent variables.

The specificities at selected sensitivity level were computed for PSA, PSAD and PSADtz.

Receiver operating characteristic (ROC) curves, which chart the sensitivity against the specificity along a range of cut off values, were constructed for each index using SPSS ver 11.0. Comparison of the areas under the curve was made using the SPSS ver 11.0 software to evaluate the performance of PSA, PSAD and PSADtz in predicting prostate malignancy.

### RESULTS

Of the 108 men included in the study, 25 were diagnosed with prostate cancer and 83 have benign disease for a detection rate of 22.9% (25/108). Mean age, PSA, prostate volume, transition zone volume, PSAD and PSADtz of the patients with benign and malignant prostate disease were computed (Table 1).

Compared to those patients with benign prostate disease, patients with prostate cancer have significantly higher serum PSA, PSAD and PSADtz levels. They are comparable as to age, prostate and transition zone volumes.

<table>
<thead>
<tr>
<th>Total</th>
<th>CaP</th>
<th>Benign Disease</th>
<th>T-test 2-tail, 2 1-degree of freedom p=0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=108</td>
<td>n=25</td>
<td>n=83</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>68.24 (+/-8.05)</td>
<td>71.29</td>
<td>67.37</td>
</tr>
<tr>
<td>PSA</td>
<td>10.0 (+/-16)</td>
<td>12.75</td>
<td>9.10</td>
</tr>
<tr>
<td>Volume</td>
<td>22.8889 (+/-18.24)</td>
<td>14.99</td>
<td>24.25</td>
</tr>
<tr>
<td>PSAD transition zone</td>
<td>0.265 (+/-0.19)</td>
<td>0.41</td>
<td>0.22</td>
</tr>
<tr>
<td>PSAD transition zone</td>
<td>0.763</td>
<td>1.50</td>
<td>0.55</td>
</tr>
</tbody>
</table>

### Table 2. Specificity of the cut-off values of the PSA, PSAD and PSADtz at selected sensitivities.

<table>
<thead>
<tr>
<th>Sensitivity (%)</th>
<th>Total PSA Cut-off (ng/ml)</th>
<th>PSA Specificity (%)</th>
<th>PSAD Cut-off (ng/ml/cc)</th>
<th>PSAD Specificity (%)</th>
<th>PSADtz Cut-off (ng/ml/cc)</th>
<th>PSADtz Specificity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>6.84</td>
<td>22.5</td>
<td>0.196</td>
<td>48.8</td>
<td>0.485</td>
<td>63.0</td>
</tr>
<tr>
<td>85</td>
<td>6.5</td>
<td>16.4</td>
<td>0.194</td>
<td>47.1</td>
<td>0.473</td>
<td>60.2</td>
</tr>
<tr>
<td>90</td>
<td>6.35</td>
<td>15.1</td>
<td>0.192</td>
<td>38.2</td>
<td>0.47</td>
<td>46.9</td>
</tr>
<tr>
<td>95</td>
<td>6.00</td>
<td>13.3</td>
<td>0.147</td>
<td>22.6</td>
<td>0.339</td>
<td>27.7</td>
</tr>
<tr>
<td>100</td>
<td>4.2</td>
<td>0</td>
<td>0.036</td>
<td>0</td>
<td>0.067</td>
<td>0</td>
</tr>
</tbody>
</table>

Specificities of the PSA, PSAD and PSADtz at selected sensitivity levels were computed to evaluate the performance of in predicting prostate cancer (Table 2).

Twenty three of the 25 patients with prostate cancer have PSADtz more than 0.47 ng/ml/cc for a sensitivity of more than 90% and specificity of 46.9%. A positive predictive value of 39.66% was noted at this level.

Receiver operating characteristic (ROC) curves were constructed for PSA, PSAD and PSADtz. The graph showed that PSADtz outperformed PSAD and PSA (Figure 3). Computation and comparison of the areas under the curve using the SPSS ver. 11.0 software program showed their difference are statistically significant.
predictive value of almost 40%, a closer follow-up and more aggressive performance of repeat prostate needle biopsy may be advised to patients with initial negative biopsy report who have PSADtz level greater than 0.47ng/ml/cc.

The PSADtz determination has its limitation. Volume imaging and calculation is operator dependent. It is difficult to measure the transition zone volume correctly in some cases such as those with small transition zone or unclear margins between transition and peripheral zones. This requires degree of experience and expertise.

The cost issue must also be addressed. PSA transition zone or any prostate density measurement requires transrectal ultrasound equipment and therefore, may be associated with a significant cost. However, this must be weighed against the potential expense saved by not performing unnecessary biopsies in patients with benign prostate disease.

CONCLUSION

The determination of PSADtz resulted in the enhancement of serum PSA specificity. It was shown to be a superior parameter when compared to serum PSA and PSA density in patients with intermediate PSA level of 4-20ng/dl. Using the PSADtz cut-off level of 0.47ng/ml/cc, more than 90% of cancers will be detected while avoiding 44.4% unnecessary biopsies in patients with benign prostate disease.

Of particular interest is the PSADtz cut off value of 0.47 ng/ml/cc. Twenty three of the 25 patients with prostate cancer have PSADtz greater than and 48 out of 83 men with benign prostate have lesser values. In other words had we known this cut-off value prior to the biopsy we could have avoided 44.4%(48/108) unnecessary biopsies while missing only 2 cancers in a population of 108 men.

The previously suggested level of 0.25 ng/ml/cc16 and 0.3 ng/ml/cc15 for PSADtz resulted to 95% sensitivity with 47% specificity and 75% sensitivity with 54% specificity respectively using the sextant biopsy protocol.19 Although the PSADtz value of 0.47ng/ml/cc in our study was different, it still has comparable sensitivity and specificity of 92% and 46.9% respectively, using the 12-core biopsy protocol. A positive predictive value of 39.66% was noted at this PSADtz level. This incidentally, is the only paper, to the author's knowledge, that utilized the extended biopsy technique as applied for PSADtz.

Another issue to consider is: "When is a negative biopsy truly a negative biopsy?" Because of a positive predictive value of almost 40%, a closer follow-up and more aggressive performance of repeat prostate needle biopsy may be advised to patients with initial negative biopsy report who have PSADtz level greater than 0.47ng/ml/cc.

DISCUSSION

Our study has shown a statistically significant superiority of PSADtz over PSAD and PSA in improving the specificity of PSA in the detection of prostate cancer in men with intermediate PSA levels. Although at present the value of PSADtz in predicting prostate cancer remains controversial, our result lends credence to the previous reports14,15,16 suggesting the clinical value of PSADtz in the detection of prostate malignancy.

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The determination of PSADtz resulted in the enhancement of serum PSA specificity. It was shown to be a superior parameter when compared to serum PSA and PSA density in patients with intermediate PSA level of 4-20ng/dl. Using the PSADtz cut-off level of 0.47ng/ml/cc, more than 90% of cancers will be detected while avoiding 44.4% unnecessary biopsies in patients with benign disease. A more aggressive follow-up and closer interval in the performance of repeat prostate needle biopsy may be suggested to patients who have initial negative biopsy report and PSADtz level greater than 0.47ng/ml/cc.

Acknowledgment

To Vianney Marie Mandapat, MD for providing technical assistance.

REFERENCES


PREDICTORS OF UPPER TRACT DETERIORATION AMONG CHILDREN WITH MYELODYSPLASIA

Ma. Victoria C. Estañoł, MD; Jason L. Letran, MD; Nilo delos Santos, MD and David T. Bolong, MD

Section of Urology, Department of Surgery, University of Santo Tomas Hospital.

ABSTRACT

Introduction: Upper urinary deterioration is a common sequela of neurogenic bladder dysfunction in children with myelodysplasia. Therefore, it deserves attention and thorough investigation. Early identification of factors that can contribute to development of upper tract deterioration is ideal. Objective: To identify risk factors in the development of upper tract deterioration and to predict those children who will most likely develop under tract deterioration. Materials and Methods: A cross sectional study of all pediatric patients with myelodysplasia enrolled in a multidisciplinary surveillance program at our institution was done. The development of upper tract deterioration was determined by progression of hydronephrosis and/or vesicoureteral reflux, one grade higher from previous study. Factors evaluated were age, sex, presence of voiding dysfunction, recurrent urinary tract infection (UTI), presence of hydronephrosis, vesicoureteral reflux, detrusor – sphincter dyssynergia, detrusor areflexia, and a detrusor leak point pressure of >40 cm H2O and the early institution of clean intermittent catheterization (CIC). Results: A total of 100 patients were included in the study. Forty two percent developed upper tract deterioration. The most significant factor was the presence of vesicoureteral reflux. When multiple logistic regression analysis was done, the other factors noted to be significant were age, presence of recurrent UTI, hydronephrosis, vesicoureteral reflux, clean intermittent catheterization and >40 cm H2O detrusor leak point pressure. Conclusion: Being aware of the predictive value of these risk factors, one will be able to direct management. We found that acceptance of any high risk parameter will identify most patients at risk of upper tract deterioration. As a consequence of this strategy, we will be able to predict the outcome of patients with myelodysplasia.

Key words: myelodysplasia, upper tract deterioration.

INTRODUCTION

Despite modern urological care, complications in children with myelodysplasia continues to be a daunting challenge. One of the most important goals of urological care in these children is the prevention of upper tract deterioration. However, literature searches revealed varied results and unfortunately there is not enough information on the variables that could predict its deterioration.

The urinary tract is a major source of morbidity and mortality for patients with myelodysplasia. At present, 32% of children with myelodysplasia still run the risk of upper tract deterioration. Before 1970, upper tract deterioration
was reported to occur in 40 to 90% of untreated children by age 10 years.1,2

Because upper tract deterioration continues to be a potential problem in children with myelodysplasia, caregivers must be capable of predicting who among these patients would develop upper tract deterioration in the presence of risk factors: age, sex, presence of recurrent UTI, voiding dysfunction, hydronephrosis, vesicoureteral reflux, high detrusor leak point pressure, detrusor sphincter dysynergia, detrusor areflexia and whether clean intermittent catheterization was started is ideal. Our objective was to identify the risk factors in the development of upper tract deterioration and to predict which children would likely develop upper tract deterioration.

**Review of Literature**

Treatment of the child with myelodysplasia presents the urologist with many challenges. The long-term treatment of these patients must ensure low pressure storage and drainage of urine to protect the kidneys.3 Anti-cholinergic medications and/or intermittent catheterization are effective treatment methods for neurogenic bladder dysfunction secondary to myelodysplasia.4

Teichman, et al found three significant risk factors that lead to deterioration: the female gender, urinary infection and vesico-ureteral reflux; they found no correlation between any urodynamics parameters and renal deterioration.5 Based on this result, they advocated surveillance. Urodynamic studies and intervention were reserved when upper tract changes occurred. Previous studies have also shown that female patients have higher incidence of vesico-ureteral reflux, infection and lower rate of reflux resolution. Consequently, they have a higher incidence of cortical loss.6

Early intervention in terms of clean intermittent catheterization (CIC) benefits the dynamics of the bladder over the long term.7,8 Hernandez, et al. has shown improvement in bladder dynamics in 70% of patients treated with early CIC.8,9 The Boston Children’s Hospital experience with 20 high-risk children who were treated with CIC prophylactically, reflux developed in only 15%, in contrast to those who were only observed for 9-16 years, where vesicoureteral reflux (VUR) and hydronephrosis developed in 80% of children.6 Bloom, et al. have shown similar results in 200 children.10

In 1981, McGuire et al, demonstrated that detrusor leak point pressure determined the fate of upper tracts. This study involved 42 myelodysplastic patients. Of those patients who had leak point pressure greater than 40 cm H20, 81% had signs of upper tract deterioration on excretory urography (IVP). In contrast, only 10% of the group with lower leak pressure had upper tract changes.3 Bauer, et al. confirmed that urodynamic parameters had a predictive value in determining the fate of the upper tracts in the newborn with myelodysplasia. The parameter that is most important to them was the presence of detrusor sphincter dysynergia.11

Van Gool, et al. also reported a prospective study in older children and suggested that dysynergia is an important cause of impaired bladder drainage, hydroureteronephrosis and vesicoureteral reflux.12

In a retrospective study of Klose et al, 130 patients were reviewed of whom 21 had vesicoureteral reflux (16%) and 4 had hydronephrosis (3%). This incidence of vesicoureteral reflux and hydronephrosis was lower than any other study previously cited. The reported rates of resolution of vesicoureteral reflux (67%) and hydronephrosis (100%) were also higher than any other in the literature. They believe that the risk of catheter induced trauma, infection and psychosocial strain outweighs the benefits of prophylaxis, and that the use of urodynamic criteria defining high risk patients lead to over treatment, of patients who could be salvaged otherwise.13 These conflicting results have led us to some degree of confusion. We did this study to find out what really is/are the factor/s that influence upper tract deterioration in children with neurogenic bladder/myelodysplasia.

**MATERIALS AND METHODS**

This is a cross sectional study between 1990 and 2002. One hundred pediatric patients with myelodysplasia were enrolled in a spina bifida support group-multidisciplinary surveillance program at our hospital. The surveillance group included a pediatric urologist, pediatric neurologist, pediatric neurosurgeon and pediatrician. In all cases, the primary spinal cord defect was repaired. After surgery, all patients underwent baseline urodynamic studies in the first 6 months.

The sample size met the requirement for multiple regression analysis, which should be at least ten times for each variable.
The study consisted of 60 girls and 40 boys with myelodysplasia. The median patient age at initial evaluation by our service was 9 months (mean 9 months, range 17 days to 19 years old). History of recurrent UTI and voiding dysfunction was noted.

Urinalysis, urine culture and sensitivity, ultrasound of the kidneys and bladder with post void urine determination, and video urodynamics were done at the initial evaluation. Routine urine cultures and antibiotic prophylaxis was maintained for children with reflux. Anticholinergic medications were prescribed to 17 children (17%) for multiple indications, including incontinence, poor compliance, low bladder volume and high leak point pressure. Clean intermittent catheterization was started on those 73 children with increased residual urine, detrusor sphincter dysynergia and increased detrusor leak point pressure. Repeat ultrasound and video-urodynamics evaluation was done after 6 months.

Voiding cystourethrography was performed when there were abnormalities in any study. Nuclear renal scans were performed in patients with parenchymal disease or suspected of having ureteropelvic junction obstruction. Routine cystography generally was discontinued if there was no evidence of reflux, hydronephrosis or infection for more than 1 year.

The urodynamic studies were performed using an Avanti Laborie machine and room temperature saline with a fill rate of 20 cc per minute in children and 5 cc per minute in infants. Bladder capacity was computed based on what was reported on literature. Abdominal pressure was monitored with an 8F rectal balloon catheter. A double lumen 6F and 8F intravesical catheter was used for bladder filling and pressure determination. Maximum detrusor pressure required to overcome urethral resistance, the leak point pressure, was recorded. When no leakage was observed maximal detrusor pressure at maximum cystometric capacity was substituted for leak point pressure. Detrusor leak point pressure greater than 40 cm H20 was considered normal.

Adhesive perineal skin electrodes were used to record sphincter electromyography. Detrusor-sphincter dyssynergia was diagnosed when the bioelectrical activity in the external urethral or anal sphincter failed to decrease with a reflex detrusor contraction or when there is no sphincter activity but the sphincter failed to open as manifested by high leak point pressure (40 cm H:0).

Patients were re-evaluated, every 6 months for 3 years and yearly thereafter. Renal ultrasonography and urodynamics were repeated every six months until toilet training, after which they were repeated if wetting, infection or hydronephrosis ensued. Children in whom urodynamic and/or upper urinary tract abnormality, and/or urinary tract infection developed were further evaluated by lumbosacral computed tomography (CT scan) or magnetic resonance imaging (MRI) and voiding cystourethrography, respectively.

Upper tract deterioration has multiple definitions. In this study, deterioration of upper tract is defined as the progression of hydronephrosis and/or reflux one grade higher from the previous study. Patients with hydronephrosis secondary to ipsilateral, high-grade reflux were classified as having refluxed only, not hydronephrosis, of the particular renal unit. The resolution of deterioration was defined as complete disappearance of reflux or hydronephrosis for greater than 6 months without corrective surgery.

Data collected was encoded using Epi Info 2000: Univariate analysis was done by computing for the unadjusted odds ratio and multivariate analysis using logistic regression analysis.

**Operational Definitions**

**Voiding dysfunction** – presence of urgency, incontinence, enuresis, frequency and incomplete voiding.

**Recurrent UTI** – more than 2 episodes of UTI in 6 months as documented by urine culture.

**Detrusor leak point pressure >40 cm H20** was considered normal.

**Upper tract deterioration** – means progression of the hydronephrosis and/or reflux one grade higher from their previous study. Patients with hydronephrosis secondary to ipsilateral, high-grade reflux were classified as having reflux only, not hydronephrosis, of that particular renal unit.

Normal urodynamic studies refer to normal bladder capacity and compliance, no hyperreflexia or uninhibited contractions during filling, a sustained detrusor contraction at capacity with complete emptying, normal sphincter elec-
myography potential at rest, appropriate responses to sacral stimuli and bladder filling, and synergy during voiding.

Detrusor sphincter dyssynergia is diagnosed when biochemical activity in the external urethral or anal sphincter failed to decrease during a reflex detrusor contraction.

RESULTS

One hundred pediatric patients were included in the study and were followed for development of upper tract deterioration. The study consisted of 60 girls and 40 boys with myelodysplasia. Median patient age at initial evaluation by our service was 9 months (mean 9 months, range 17 days to 19 years). Of these, 42% developed upper tract deterioration and 17% had surgery (bladder augmentation/vesicostomy).

Majority of children with myelodysplasia consulted for urological evaluation after 2 years of age. Among patients who consulted after age of 2, 35 (53%) developed upper tract deterioration with odds ratio of 4.3 (C.I. 1.6647, 11.3923). Among female patients, 28 (46%) of 60 had developed upper tract deterioration, while 14 (35%) of 26 male patients had developed upper tract deterioration. Odds ratio was 1.6 (C.I. 0.7127, 3.7053).

Among patients with recurrent urinary tract infection, 9 (25%) of 36 developed upper tract deterioration, with odds ratio of 3.19 (C.I. 1.2988, 7.8525). In patients with voiding dysfunction, 14 (38%) of 37 had upper tract deterioration, with an odds ratio showed 1.31 (C.I. 0.5733, 3.0131) (Table 1). In-patients with whom clean intermittent catheterization was not started early, 4 (16%) of 25 had upper tract deterioration, with odds ratio of 1.8 (C.I. 0.5100, 5.7240).

Moreover, 33 (65%) out of 51 patients with hydronephrosis and upper tract deterioration with odds ratio of 8.15 (C.I. 3.2361, 20.5163). In patients with vesicoureteral reflux, 31 (72%) of 43 patients developed upper tract deterioration with odds ratio of 10.80 (C.I. 4.2353, 27.5556). In patients with detrusor-sphincter dyssynergia 29 (50%) of 58 had upper tract deterioration with odds ratio of 2.23 (C.I. 0.5100, 5.7240).

Among patients with increased detrusor leak point pressure (DLLP), 29 (69%) of 42 had upper tract deterioration with odds ratio of 7.72 (C.I. 3.1415, 18.9807). While in patients with detrusor areflexia, 18 (46%) of 39 had upper tract deterioration with odds ratio of 1.3 (C.I. 0.5863, 2.9781).

When multiple logistic regression analysis was done, sex had a p value of 0.248 voiding dysfunction had a p value of 0.519, detrusor areflexia had a p value of 0.501, while detrusor-sphincter dyssynergia had p value of 0.559 which is greater than 0.25. Therefore, they were all excluded in the final model. All other independent variables had significant p values (p<0.25) (Table 2). Sample outcome analysis is shown in Table 3.

Table 1. Potential risk factors of 100 children with myelodysplasia at tertiary training hospital, January 1999 to December 2001.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Odds Ratio</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age</td>
<td>4.3</td>
<td>1.6647 11.3923</td>
</tr>
<tr>
<td>2. Female</td>
<td>1.6</td>
<td>0.7127 3.7053</td>
</tr>
<tr>
<td>3. Recurrent UTI</td>
<td>3.19</td>
<td>1.2988 7.8525</td>
</tr>
<tr>
<td>4. Voiding Dysfunction (VD)</td>
<td>1.31</td>
<td>0.5733 3.0131</td>
</tr>
<tr>
<td>5. Hydronephrosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Vesicoureteral Reflux (VUR)</td>
<td>10.80</td>
<td>4.2353 27.5556</td>
</tr>
<tr>
<td>7. Detrusor Sphincter Dyssynergia (DSD)</td>
<td>2.23</td>
<td>0.9704 5.1282</td>
</tr>
<tr>
<td>8. Detrusor Leak Point Pressure (DLLP)</td>
<td>7.72</td>
<td>3.1415 18.9807</td>
</tr>
<tr>
<td>9. Detrusor Areflexia</td>
<td>1.3</td>
<td>0.5863 2.9781</td>
</tr>
<tr>
<td>10. CIC</td>
<td>1.8</td>
<td>0.5100 5.7240</td>
</tr>
</tbody>
</table>

Outcome* upper tract deterioration

Table 2. Logistic regression statistics.

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Regression Coefficient</th>
<th>Standard Error (SE)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLLP</td>
<td>2.696443</td>
<td>0.7094279</td>
<td>-</td>
</tr>
<tr>
<td>ICP</td>
<td>-1.782373</td>
<td>0.8007078</td>
<td>0.026</td>
</tr>
<tr>
<td>VUR</td>
<td>1.623652</td>
<td>0.771225</td>
<td>0.035</td>
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<tr>
<td>US</td>
<td>1.125682</td>
<td>0.7861291</td>
<td>0.152</td>
</tr>
<tr>
<td>UTI</td>
<td>1.01969</td>
<td>0.6626959</td>
<td>0.124</td>
</tr>
<tr>
<td>Age</td>
<td>2.02221</td>
<td>0.7457774</td>
<td>0.007</td>
</tr>
<tr>
<td>Constant</td>
<td>-4.626868</td>
<td>1.081688</td>
<td>-</td>
</tr>
</tbody>
</table>

Detrusor areflexia, detrusor sphincter dyssynergia, voiding dysfunction and sex with p value of >0.25 excluded from regression analysis.
reflux has been cited to be between 22 and 40%\textsuperscript{3,8,11,21,23,24} ours was 43%. The incidence of hydronephrosis has been reported to be between 20 and 48%.\textsuperscript{8,9,14,15,21,22,24} Our was 51%. Since reflux is the most important factor associated with cortical loss and that early institution of catheterization prevents reflux,\textsuperscript{4,9,12,23,24} one can surmise that it will also lessen the incidence of cortical loss.

A number of studies have advocated the use of urodynamics to predict renal outcome. McGuire et al. showed the association of high leak point pressure to ureteral dilatation and vesicoureteral reflux in 42 patients.\textsuperscript{3} Bauer (36 infants)\textsuperscript{11} and Sidi (30 newborns)\textsuperscript{9} et al. demonstrated the association of detrusor-sphincter dyssynergia with upper tract changes. McLorie et al. delineated the relationship of bladder volume, bladder thickness, detrusor-sphincter dyssynergia and urethral resistance to grade of hydronephrosis in 215 children.\textsuperscript{15}

We also found the presence of voiding dysfunction, detrusor-sphincter dyssynergia and detrusor areflexia to be insignificant. Teichman et al. also stated that detrusor sphincter dyssynergia was not a predictor of upper tract deterioration.\textsuperscript{5}

**DISCUSSION**

The goals of urological care in children with myelodysplasia are the prevention of upper urinary tract deterioration, infection and ultimately to have a dry and continent individual.\textsuperscript{1,5} To prevent upper tract deterioration and to institute management, most urologists have used upper tract imaging, voiding cystourethrograms and urine cultures for surveillance. The routine use of urodynamics is not universally accepted due to differing opinions on its reliability, interpretation and prognostic value.\textsuperscript{5} This assumption is in contrast with other studies,\textsuperscript{8,11,19,20,22,23} which indicate an association between detrusor leak point pressure and ureteral dilatation.\textsuperscript{21}

Preservation of upper tracts occurred when children were managed early in life. When seen at an age of >2 years old, the chance of having upper tract deterioration increased 4 times.

Three significant factors were cited in the literature as risk factors namely: female gender, urinary infection and vesico-ureteral reflux.\textsuperscript{5} Contrary to previously reported higher incidence of cortical loss in female patients with myelodysplasia, our study did not show the female sex to be a significant factor on logistic analysis.

We reviewed the recent literature on myelodysplastic children. The incidence of vesicoureteral reflux has been cited to be between 22 and 40%\textsuperscript{3,8,11,21,23,24} ours was 43%. The incidence of hydronephrosis has been reported to be between 20 and 48%.\textsuperscript{8,9,14,15,21,22,24} Our was 51%. Since reflux is the most important factor associated with cortical loss and that early institution of catheterization prevents reflux,\textsuperscript{4,9,12,23,24} one can surmise that it will also lessen the incidence of cortical loss.

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**CONCLUSION**

Being cognizant of the predictive value of these risk factors, one will be able to direct management with prior knowledge of probability of developing upper tract deterioration. We found that acceptance of any high risk parameter will identify the most patient at risk of upper tract deterioration. As a consequence of this strategy, we will be able to predict the outcome of patients with myelodysplasia.

**RECOMMENDATION**

We find it reasonable to use this model to achieve the possible benefit of preventing upper tract deterioration when correctly identified. The model assumes that the effects of each content factor are additive (in the log-odds, space). Thus, the analysis must be converted back to probabilities and relative risks.
REFERENCES


CASE REPORT

EXCISION OF A LARGE PROSTATIC UTRICLE USING THE TRANSRECTAL POSTERIOR SAGITTAL APPROACH

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ABSTRACT

The surgical management of Mullerian duct remnants remains a challenge. The disorder is rare and the allowance for error is narrow due to the close proximity of these lesions to the structures in the pelvic recto-urethral region namely: the ejaculatory ducts, pelvic nerves, rectum, vas deferens and ureters. Many approaches have been described with the goal of draining, fulgurating or excising these lesions. Such approaches are effective and yield satisfactory results. However, potential complications such as inadvertent injury to pelvic nerves and the adjacent structures causing impotence and rectal injury necessitating diverting colostomy are associated with these approaches. Peña et al in 1995 reported the use of a transrectal posterior sagittal approach as an alternative to minimize these complications. We present our initial experience in the management of large prostatic utricular cyst using this innovation.

Key words: Mullerian duct remnants, prostatic utricular cyst, transrectal posterior sagittal approach.

INTRODUCTION

The Mullerian or paramesonephric ducts are present in all human embryos during the early stages of development. In males, these structures will become rudimentary due to the secretion of the Mullerian regression factor by the fetal testis. Only vestigial remnants persist—the cephalad end as the appendix testis and the caudal end as the prostatic utricle. Incomplete regression leads to formation of cystic structures in the recto-urethral area (Figure 1.)

The incomplete regression of the Mullerian ducts is related to an error in the hormonal function of the fetal testes—either production or sensitivity to local testosterone or the Mullerian regression factor. This explains the

association of Mullerian ducts and various states of intersex, hypospadias and cryptorchidism. Approximately 11% of severe hypospadias have enlarged utricles. Diagnosis is easily obtained as they are readily demonstrated by retrograde urethrography or voiding cysto-urethrogramy. Indications for treatment of persistent Mullerian ducts are based on symptoms. Infection, post void dribbling and voiding obstruction are the most frequent indications for intervention.

Surgical excision is the definitive treatment of a symptomatic utricular cyst. Many approaches have been described to this end, including suprapubic4, transvesical5, retropubic6, perineal7, posterior with rectal retraction8, transurethral9 and laparoscopic10. Such approaches are effective and yield satisfactory results. However, they are associated with potential complications including inadvertent injury to pelvic nerves causing impotence5 and rectal injury necessitating a diverting colostomy. The posterior approach with rectal retraction is also associated with rectal denervation12 leading to fecal incontinence. The transvesical transtrigonal approach (Figure 2), the most popular among urologists, has the added disadvantage of prolonged urinary drainage to allow bladder healing. A theoretical disadvantage is that the trigone may not function properly after being divided, resulting in vesico-ureteral reflux. In 1995, Pena et al described the transrectal posterior sagittal approach14 as an alternative to avoid these complications.

We present our initial experience in the excision of a large prostatic utricular cyst using this method. We will expound the surgical technique and principles behind the new application this approach in the excision of Mullerian duct remnants.

REPORT

G.E is a 15-month old boy born to a 23-year old via cesarean section due to cephalo-pelvic disproportion. At birth the urethral meatus was noted at the midscrotum. Karyotyping done several weeks after showed he has a 46XY genotype. He had 2 episodes of symptomatic urinary tract infection (UTI) documented by urine culture and sensitivity. Ultrasound of kidneys and bladder were unremarkable. He was referred to us for the evaluation of UTI and management of hypospadias. On physical examination, he was noted to have scrotal hypospadias with a fairly developed urethral plate. There was a moderate chordee, with moderate scrotal transposition; and an undescended right testis, which was palpable in the inguinal region. Voiding cysto-urethrogram was done with difficulty of passing the catheter into the bladder. Results showed a 4.0 cm prostatic utricle arising from the posterior wall of the prostatic urethra lying anterior to the rectum and extending up to the level of the bladder neck (Figures 3-6). The size as well as the proximal and distal margin of the utricle would make it difficult with the previously described and more popular transvesical and suprapubic techniques. We felt it would be best to approach the lesion through a transrectal posterior sagittal approach. This approach was originally used for the repair of anorectal malformations15 and rectourethral fistula16. It was later adopted to excise prostatic utricular cysts14.

Surgical Technique

The patient was admitted 2 days prior to the procedure. He was given normal saline enema thrice until the return flow was clear with the last enema done 4 hours prior to the surgery. Intervenous antibiotic was given 1 hour prior to the procedure.

He was placed in a dorsal lithotomy position for cystourethroscopy. Findings showed a large utricle with the opening located dorsally and proximal to the verumontanum. Under cystoscopic guidance, a French 8 foley catheter was inserted into the utricle and the balloon inflated with 3cc water. Thereafter, the patient was placed in a prone position with the pelvis elevated by bolsters (jackknife).
A midline posterior sagittal incision running from the middle portion of the sacrum and extending onto the perineum was made passing longitudinally through both the posterior and anterior edges of the anus (Figure 7). The incision was deepened by dividing the parasagittal muscle, sphincteric muscle complex and levator ani. This was carried down further by passing longitudinally through the external anal sphincter and rectum remaining precisely at the midline. An electrical muscle stimulator was used frequently to confirm muscle contractions on both sides of the midline incision. The inflated balloon of the catheter helped in the localization. Meticulous dissection was used to traverse the anterior wall of the rectum onto the lesion (Figure 8). Intraoperatively, the prostatic utricle was confirmed to lay anterior to the rectum and posterior to the urethra in the retro-urethral space. Traction sutures were placed on the cyst wall to aid in the dissection. The neck of the cyst was visualized as it entered the prostatic urethra and was excised (Figure 9). The urethral catheter was then advanced into the bladder. The urethral defect was closed with continuous absorbable polygalactin (Vicryl™️) 5-0 sutures under direct vision. The rectum and sphincteric musculature were re-approximated using the muscle stimulator to confirm the realignment of symmetric structures. The ano-rectal anatomy was normal pre-operatively and it is very important that it must remain anatomically and functionally normal after the procedure.

The patient was kept on NPO until the third day. Post-operative course was unremarkable. He was discharged after the 5th post-operative day. The catheter was removed after 1 week. Subsequent follow-up revealed he was completely continent of urine and stool.
DISCUSSION

The transrectal posterior sagittal approach to the lower posterior pelvic area was described by Peña and De Vries in 1982. Initially, this procedure was for anorectopalsy in patients with imperforate anus. This technique provides excellent exposure and access to the recto-urethral region and was later adopted in the excision of Mullerian duct remnants. In his initial report in 1995, Peña used this approach to excise a huge prostatic utricle in a 3-year-old boy.

As previously described, the transrectal sagittal approach entails a midline incision from the mid-sacrum extending to the perineum and rectum remaining in the precise midline. The anterior and posterior edges of the rectum were opened to enter the recto-urethral region. By staying in the precise midline, one avoids the injury to the paired neuro-vascular bundles on the lateral aspect of the prostate, responsible for erectile function. Unrecognized rectal injury may lead to fistula formation and reconstructive failure. These potential complications of the more popular approaches previously listed are practically avoided with the transrectal posterior sagittal approach. When excising enlarged utricles that communicate with the urethra as in our case, it is important to identify the cysto-urethral juncture as carefully as possible. Overzealous resection could result to the damage of the urethra or sphincter mechanism. In cases of a large utricular cyst, it may be technically easier to go through the rectum (transrectal posterior sagittal) than around it (posterior approach with rectal retraction). Moreover, the latter is associated with rectal denervation which may result in fecal incontinence.

Two general principles need to be emphasized to preserve fecal continence when using the transrectal posterior sagittal approach: 1) to remain strictly in the medial plane and 2) to reconstruct the structure in a precise and meticulous manner with the help of the electric muscle stimulator. The electrical muscle stimulator is vital in upholding these 2 fundamental principles. This instrument allows the surgeon to suture precise muscle portions to the corresponding structures in the opposite side. In this manner the surgeon can preserve the entire muscle complex necessary for fecal continence.

Lastly, as the original author of the procedure clearly stated: the application of the transrectal posterior...
sagittal approach does not invalidate the use of the other approaches but broadens our armamentarium as surgeons with the addition of a technique that offers excellent exposure and safe approach to the recto-urethral region.

CONCLUSION

Our initial experience with the transrectal posterior sagittal approach proved successful. By adhering to the principles laid out, excellent exposure was achieved. The potential complications associated with the more common procedures were avoided. A functional and anatomical reconstruction was attained. All these add up to the successful surgical management of a large prostatic utricular cyst.

REFERENCES

4. Smith JA and Middleton RG. Surgical approach to large mullerian duct cysts. Urology 1979; 14: 44.
ACUTE URINARY RETENTION IN A FOUR-YEAR OLD BOY WITH Rhabdomyosarcoma of the Prostate

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Section of Urology, Department of Surgery, University of Santo Tomas Hospital

ABSTRACT

A case of embryonal rhabdomyosarcoma of the prostate presenting as acute urinary retention in a 4-year old boy is described. A suggested algorithm for the diagnostic approach of acute urinary retention in the pediatric age group is presented. Essential in the diagnosis and prognostication of rhabdomyosarcoma were radiographic assessment and biopsy. Treatment options included chemotherapy, radiotherapy and adjuvant surgery.

Key words: Acute urinary retention, rhabdomyosarcoma, prostate

INTRODUCTION

Most patients with acute urinary retention are men over the age of 60 and the risk increases with age.1 The etiology is usually obstructive due to an enlarging prostate; however, in children, causes vary greatly from those seen in adults. Thus, when acute urinary retention is found in pediatric patients, it poses a diagnostic challenge. A boy with acute urinary retention caused by rhabdomyosarcoma of the prostate is presented and the diagnostic and therapeutic approach discussed.

CASE REPORT

A 4 year old boy with a 4 month history of diagnosed recurrent urinary tract infection had difficulty urinating; he had several episodes of catheterization. The patient was referred to us. Digital rectal examination revealed a 2 x 2 cm hard prostate mass. Initial renal and urinary bladder ultrasound showed residual urine; however, there were no cystic or solid masses and stones. Prostate biopsy gave a pathologic diagnosis of embryonal rhabdomyosarcoma. The Intergroup Rhabdomyosarcoma Study Modified TNM Pretreatment Classification is Stage 2. He underwent 48 cycles of VAC regimen (vincristine, actinomycin D, cyclophosphamide).

He was asymptomatic for 7 months until he was seen again because of dysuria, hematuria and decreased force and caliber of urine. On digital rectal examination, the prostate was hard, nodular, mobile and enlarged to grade II. A 4.1 x 3.9 x 4.9 cm intraluminal lobulated mass in the bladder and with mild caliectasia on the right renal unit were detected on ultrasound. CT scan showed a mass in the region of the prostate gland with signs of bladder invasion without pelvic lymphadenopathies (Figure 1). Prostate biopsy showed embryonal rhabdomyosarcoma. Chest radiograph and liver enzymes were normal.

He underwent cystoprostatectomy with an ileal conduit and appendectomy. The resected bladder and prostate weighed 100g. The prostatic mass was yellow brown, smooth and ill-defined measuring 6x5x0.5 cm. Sections through the prostate and bladder showed gross
infiltration of the superficial muscular layer of the bladder wall (Figures 2a + 2b). Microsections disclosed an acellular neoplasm composed of atypical cells arranged haphazardly, most of them small and varying in shape from round to oval spindle shaped. Infiltration into the adjacent bladder and prostate was also seen. This patient after resection is classified under group II (IRS staging system).

DISCUSSION

Acute urinary retention is an infrequent symptom and uncommon in childhood. Children are often unable to express the sensation of bladder fullness or the inability to void. Acute urinary retention in the pediatric population is defined as the inability to empty the bladder voluntarily for >12 hours with a urine volume greater than that expected for age [(age in years + 2) x 30cc] or a palpably distended bladder.

Acute urinary retention generally has a number of possible etiologies which can be divided into several main
categories: obstructive, infectious, traumatic, pharmacologic, neurogenic, psychodynamic and extraurinary causes. Studies in the etiology of urinary retention in children is scarce. One retrospective study reports the significant incidence of a number of etiologies, including neurologic (17%), voiding dysfunction (15%), urinary tract infections (13%), constipation (13%), adverse drug effects (13%), local inflammatory causes (7%), locally invading neoplasms (6%), benign obstructing lesions (6%), and idiopathic causes (6%).

Because of the varied etiologies of acute urinary retention unique to the pediatric population, a careful systematic evaluation is essential, keeping in mind the most important diagnostic considerations in this age group. Figure 3 shows the suggested algorithm for the diagnostic evaluation of acute urinary retention in children.

Most cases can be identified with a carefully done history. Obstructive causes can present with urinary hesitancy, decreased force and caliber of stream, terminal dribbling, and overflow incontinence. Dysuria, frequency, urgency, hematuria, chills, low back pain may indicate urinary tract infection. Any previous or recent history of trauma, urethral catheterization and manipulation may raise the possibility of urethral stricture. Bowel habits and perirectal tenderness should be asked to rule out gastrointestinal causes. The list of recent medications taken should be reviewed for the presence of anticholinergics, antihistamines, and sympathomimetics, the most common drugs notorious for altering voiding dynamics. Infrequent voiding or avoidance of voiding may point to voiding dysfunction. Furthermore, a careful neurologic history should be obtained to exclude neurogenic etiologies.

A detailed physical examination is necessary with focus on key areas namely the abdomen, bladder, external genitalia, motor and sensory examination, and digital rectal examination. Abdominal examination may reveal palpable distended bladder with increased discomfort upon Crede maneuver. A palpable mass will suggest pediatric solid tumors (e.g. neuroblastoma, rhabdomyosarcoma, Wilm’s tumor). Digital rectal examination should be performed to evaluate fecal impaction, rectal tone, perineal sensation, masses and evaluation of the surrounding structures like the prostate. A thorough neurologic examination is completed in all patients with acute urinary retention particularly in young patients with no obvious etiology.

After the history and physical examination, the workup should be directed in establishing the final diagnosis. Laboratory procedures and appropriate imaging which help in the differential diagnosis.

Although rare, rhabdomyosarcoma is a serious disease that should not be missed. It is one of the causes of acute urinary retention in children and early diagnosis is aided by digital rectal examination. Rhabdomyosarcoma is an aggressive neoplasm which rapidly spreads by local infiltration into the surrounding tissues and eventual metastatic dissemination. It accounts for 4-8% of all childhood malignancies. In the Philippines, it comprises 2.2% of all childhood malignancies. Most common sites are the head and neck followed by the genitourinary tract with an incidence ranging from 0.5 to 0.7% cases per million children less than 15 years of age. The cause of rhabdomyosarcoma is multifactorial and strong evidence points to congenital factors. It has been linked to abnormalities of the tumor-suppressor gene p53 which is located in the short arm of chromosome 17 and it is commonly part of Li-Fraumeni syndrome, although 10% of children suffering from rhabdomyosarcoma are independent of this syndrome.

Rhabdomyosarcoma can arise at any site that has developed from embryonal mesenchyme, which can, but not necessarily develop into striated muscle. Histologically, it has 4 major subtypes: embryonal, alveolar, pleomorphic and undifferentiated (Horn and Enterline classification). Embryonal type accounts for about two-thirds of the cases.

The clinical presentation varies with the site of tumor, size and effect on surrounding organs. Prostatic rhabdomyosarcoma can be large and painless but obstructive symptoms are usually present. Acute urinary retention is a common presentation of this disease, thus rhabdomyosarcoma must be ruled out in pediatric patients presenting with acute urinary retention, a palpable abdominal mass, a palpable mass on digital rectal examination and hematuria.

Once the diagnosis of rhabdomyosarcoma is suspected through history and physical examination, radiographic assessment of primary and potential metastatic sites is mandatory. At present, the most common diagnostic means are the ultrasound scan, CT and MRI. The solid component of rhabdomyosarcoma is described in the literature as

**RHABDOMYOSARCOMA OF THE PROSTATE**
hyperechoic or hypoechoic compared to the surrounding healthy tissues and sometimes it is possible to detect focal anechoic areas within the mass representing necrosis and hemorrhage.  

CT scanning is the most widely used modality for evaluating primary location and metastasis and newer spiral CT technique allows faster and more accurate data acquisition. The metastasis may affect any area but the seat of dissemination can vary with the primary location of the tumor. For instance, rhabdomyosarcoma of the prostate is more likely to metastasize to the lung or bone marrow compared to rhabdomyosarcoma of the bladder.  

Recently, improved contrast resolution of MRI have offered new potentials for staging rhabdomyosarcoma with multiplanar studies and better tissue characteristics. Biopsy of the site involved is necessary for the histologic classification of rhabdomyosarcoma. Some authors suggest endoscopic biopsy to avoid risk of needle tract seeding.  

There are two main study groups involved in improving the outcomes of patients with rhabdomyosarcoma, the Intergroup Rhabdomyosarcoma Study (IRS) and the International Society of Pediatric Oncology; however, they are using two different staging systems. The International Society of Pediatric Oncology group uses a pretreatment TNM staging system (Table 1) while the IRS uses the postsurgical clinical classification system (Table 2), the latest of which Study V which has enumerated the following favorable prognostic factors:

1. undetectable distant metastases  
2. primary sites in the orbit and nonparameningeal head/neck and genitourinary nonbladder/prostate region  
3. grossly complete surgical removal of localized tumor at the time of diagnosis  
4. embryonal/botryoid histology  
5. tumor size < 5 cm  
6. age younger than 10 years at diagnosis

Multidisciplinary therapy has significantly improved the prognosis in patients with rhabdomyosarcoma. Current therapy depends on tissue biopsy. In the current IRS-IV protocol, the initial approach is multiagent chemotherapy and then reimaging is performed. The most commonly used agents are vincristine, actinomycin D and cyclophosphamide. Table 3 shows the chemotherapeutic (VAC) protocol used in our patient.

### Table 1. Intergroup Rhabdomyosarcoma Study (IRS) modified TNM pretreatment staging classification.  

<table>
<thead>
<tr>
<th>Stage</th>
<th>Site</th>
<th>Invasiveness</th>
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<th>Mets</th>
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<tr>
<td>1</td>
<td>Non-bladder</td>
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<td>All</td>
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<td>No</td>
</tr>
<tr>
<td></td>
<td>Non-prostate</td>
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<tr>
<td>2</td>
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<tr>
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<td>All</td>
<td>All</td>
<td>Nodes</td>
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<tr>
<td></td>
<td>Prostate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>All sites</td>
<td>All</td>
<td>All</td>
<td>All</td>
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</table>

### Table 2. Intergroup Rhabdomyosarcoma Study I to III staging system (IRS I-III).  

<table>
<thead>
<tr>
<th>Clinical Group</th>
<th>Extent of Disease and Resectability</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>A. Localized tumor, confined to site of origin, completely resected</td>
</tr>
<tr>
<td></td>
<td>B. Localized tumor, infiltrating beyond the site of origin, completely resected</td>
</tr>
<tr>
<td>II</td>
<td>A. Localized tumor, gross resection, but with microscopic residual disease.</td>
</tr>
<tr>
<td></td>
<td>B. Localized &quot;extensive&quot; tumor, (spread to regional lymph nodes), completely resected.</td>
</tr>
<tr>
<td></td>
<td>C. Extensive tumor, (spread to regional lymph nodes), gross total resection but with microscopic residual disease.</td>
</tr>
<tr>
<td>III</td>
<td>A. Localized or locally extensive tumor, gross residual disease.</td>
</tr>
<tr>
<td></td>
<td>B. Localized or locally extensive tumor, gross residual disease after &quot;major&quot; resection (50% debulking).</td>
</tr>
<tr>
<td>IV</td>
<td>Any size of primary tumor, with or without regional lymph node involvement, with distant metastases, irrespective of surgical approach to primary tumor.</td>
</tr>
</tbody>
</table>

Currently, the IRS is investigating the role of new agents like the topotecan, paclitaxel and ifosfamide. Chemotherapy is continued until there is complete remission; however, if there is partial remission a surgical approach is mandated. Adjunctive surgical procedures may range from excision of a residual tumor, to radical prostatectomy, to anterior exenteration with urinary diversion. Once curative exenteration has been performed, and only when the patient is in a disease-free state, could the issue of reconstruction of the genitourinary tract be addressed. Timing for this
Table 3. Chemotherapeutic protocol for treatment of rhabdomyosarcoma.12

<table>
<thead>
<tr>
<th>VAC PROTOCOL</th>
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</thead>
<tbody>
<tr>
<td>Vincristine (V)</td>
</tr>
<tr>
<td>1.5 mg/m² IV (max 2 mg)</td>
</tr>
<tr>
<td>Actinomycin D (A)</td>
</tr>
<tr>
<td>0.015 mg/kg/day IV x 5 (max 0.5 mg)</td>
</tr>
<tr>
<td>Cyclophosphamide (C)</td>
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<tr>
<td>2.2 g/m² with MESNA</td>
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Schedule of Treatment

Induction (Week 0-16)

- **VAC**: Week 0, 3, 6, 16
- **V**: Week 1, 2, 4, 5, 7, 8, 10
- **VC**: Week 9, 12

Evaluate on week 8 and anytime between 17-19

Continuation (Week-20-43)

- **VAC**: Week 20, 23, 29, 32, 38 and 41
- **V**: Week 21, 22, 24, 25, 30, 31, 33, 34, 39, 40, 42 and 43

Evaluation at week 28
Regimen to end on week 43 then evaluate on week 46 or 47

intervention must be considered on an individual basis. The approach of delayed reconstruction is advocated by Duel and colleagues.4

If residual disease is present postoperatively, both radiotherapy and chemotherapy are initiated. The IRS-IV pilot study confirmed that hyperfractionated radiotherapy (1.1 Gy x 54 fractions twice daily for a total of 59.4 Gy) combined with chemotherapy is feasible and tolerable.11

The 5-year progression-free survival for nonbladder nonprostate genitourinary tumors is 84 percent compared with 73 percent for bladder and prostate tumors. The most important factors determining the outcome is the clinical group. Our patient belongs to IRS clinical group II. The percent progression free survival of this group is 75-80% after 5 years (Figure 3).

CONCLUSION

Acute urinary retention is an uncommon diagnosis in children that can be the presentation of a variety of serious conditions. One such condition is prostatic rhabdomyosarcoma. Although rare, rhabdomyosarcoma is a serious disease that should not be missed, and early detection is vital in the prognosis of the disease.

An accurate diagnosis is essential in the practice of urology, and to achieve this, the clinical problem must be approached in a logical sequence. Our suggested algorithm for the evaluation of acute urinary retention in children serves as a clinical practice guideline that can aid in the early detection of such diseases as rhabdomyosarcoma and reduce the costs of patient evaluation.

REFERENCES


AN ECTOPIC URETER WITH AN ABERRANT CONNECTION TO THE IPSILATERAL INTRA-ABDOMINAL TESTIS ASSOCIATED WITH A REFLUXING IPSILATERAL MEGAURETER AND AN AGENETIC CONTRALATERAL KIDNEY

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ABSTRACT

A two and half-year old boy with multiple congenital anomalies underwent re-implantation of right ureter in the first year of life. He presented then with a Grade IV reflux and hypertension. He also had recurrent episodes of febrile urinary tract infection (UTI) and voiding cystourethrogram (VCUG) and intravenous pyelography (IVP) revealed a right double collecting system with a Grade II reflux in one of the ureters. Cystoscopy and retroperitoneal exploration revealed an ectopic ureter which was located lateral to the re-implanted ureter. Its proximal end terminated in the right intraabdominal cryptorchid testis located lateral to the right kidney. Right ureterectomy and orchiectomy was done. Histopathologic analysis of the specimen confirmed the specimen to be the ureter and the testis. The presentation is unusual and the first reported case of the proximal end of an ectopic ureter attached to the epididymis.

Key words: Unilateral renal agenesis, vesicoureteral reflux, cryptorchid testis, ureter, vas deferens

INTRODUCTION

Double ureters are not unusual urologic congenital anomalies. The accessory ureter is often attached to a renal moiety or ends blindly proximally. The objective of this paper was to report for the first time an unusual variant of ureteral duplication that the proximal end of the ureter is attached aberrantly to the undescended intra-abdominal testis.

The past history revealed a right hydronephrosis detected by pre-natal sonography with an agenetic left kidney. He was delivered by cesarean section and was noted to be hypertensive. He was also noted to have a low type imperforate anus, hypospadias [mega-meatus intact prepuce (MIP) variant], bilateral congenital cataracts, and right cryptorchidism. Cardiac murmurs were also appreciated.

Postnatal sonograms confirmed left renal agenesis with a hydronephrotic right kidney, and VCUG revealed Grade IV reflux as a single system on the right.

CASE REPORT

A 2 and a half year old male was referred because of recurrent febrile UTI.

At two days of age, anoplasty was performed and five days later, he underwent a cutaneous vesicostomy.
Subsequent operations done were repair of cataracts (4 months old) and closure of vesicostomy (7 months old) and unilateral right ureteral reimplantation. Since then, the patient had been having recurrent episodes of febrile UTI. Subsequent cultures revealed growths of Pseudomonas aeroginosa and Escherichia coli and appropriate antibiotics were given.

On admission, DTPA scan revealed a normal sized right kidney with adequate function and a dilated but non-obstructed collecting system. Urodynamics revealed a hyperactive urinary bladder with multiple uninhibited contractions. Cyclic VCUG revealed Grade I-II VUR which stopped at what could be the ureteropelvic junction (Figure 1a). He was initially managed conservatively but developed fever shortly. IVP was done on the second admission which revealed a dilated and tortuous right ureter (Figure 1b). Comparison with the VCUG done earlier revealed that the refluxing ureter was not consistent with the dilated tortuous ureter connected to the right kidney.

Cystoscopy revealed a urethral meatus located ventrally at the coronal sulcus, dilated anterior urethra, mild bladder trabeculations and a wide mouthed diverticulum located at the floor extending to the left lateral bladder wall. The ureteral orifice was not identified probably secondary to the previous re-implantation.

Since there was no other non-invasive procedure that can be employed to verify the presence of a double ureter, a retroperitoneal exploration was done.

At the retroperitoneal exploration, two ureters were found (Figure 2). A non-dilated ureter traversed laterally toward the lower pole of the right kidney. A second ureter was dilated and tortuous which was perceived to be the re-implanted ureter and found to enter the urinary bladder posteriorly. The laterally located and non-dilated ureter tapered superiorly, terminating into the epididymis of the intrabdominal right testis (0.8 x 0.5 cm) located inferolaterally to the right kidney (Figure 3).

A right ureterectomy with orchiectomy was done as the ureter was refluxing with no perceived function and connects to the testis proximally. This presentation may have precipitated the bacterial epididymitis that presents as recurrent febrile UTI.
Figure 3. Intra-operative findings: The non-dilated ureter tapers superiorly, terminating into the intra-abdominal testis.

Postoperative course was unremarkable and he was discharged on the 6th POD. He remained afebrile postoperatively with subsequent follow-ups on the second week and one month after the procedure.

Histopathology confirmed the specimens to be the ureter and testis. The testis was immature with no germinal cells or Leydig cells present. The ureter was lined proximally by transitional cells. The fibrous cord revealed the vas deferens which was lined by cuboidal cells. A direct connection from the ureter to the vas could not be established nor disproved histopathologically as there were areas lined by cuboidal/columnar cells at the mid portion of the ureteral specimen.

DISCUSSION

Embryology

An understanding of the embryology of the kidneys, ureter and gonadal system is necessary in order to understand the deviant patho-embryogenesis of this case (Fig. 4).

The metanephros or the kidney begins its development at the 4th-5th week with the emergence of the ureteral bud at the lower end of the mesonephric duct. The forming ureter sends out signals to the nephrogenic end for the condensation and proliferation of the cells which will later develop as the kidney. This in turn induces the ureteral bud to grow and branch.

Initially, there exists a common excretory duct which consists of a portion of the mesonephric duct between the origin of the ureteral and cloaca. This segment will later expand and invert into the urogenital sinus at 8 weeks AOG to form half of the trigone. The ureteral orifice migrates cephalad and laterally while the mesonephric duct moves distally and mediola. It reaches its final position at 12 weeks age of gestation (AOG).

The mesonephric duct becomes part of the epididymis, seminal vesicle and the vas deferens. The onset of sexual differentiation begins with the appearance of mesonephric bodies and ducts. The testis develops separately. At the 5th week, proliferation and migration of primordial germ cells from the yolk sac occurs at the ventromedial surface of the mesonephric bodies. This will later replace the mesonephric body as the latter regresses at the end of the 6th week.
The gubernaculum appears as a column of mesenchymal tissue during this time and will develop simultaneously with the abdominal wall to form the inguinal canal and the inguinal external and internal rings. This outcome will guide testicular descent that will start after the 12th week. There are 2 stages of descent. The first one is intraabdominal migration which results from the swelling of the gubernaculums. This ends at the 16th week AOG. The second stage of descent is the transinguinal which results from the gubernacular regression.

The mesonephric duct regresses and segments will develop into the male ductal system as local testosterone is released from the developing gonad. The fusion of testicular and epididymal ducts occur in mid pregnancy.

**Etiogenesis of the multiple congenital anomalies:**

The patient presents with a multitude of congenital anomalies. Some of the genitourinary defects can be explained by the possible disruption in the embryologic development.

Unilateral renal agenesis (URA) has been theorized to occur with faulty or non-appearance of the ureteral bud. The abnormality is said to have occurred after the 4th week AOG.

According to Macgee, there are 3 types of unilateral and renal agenesis.

- **Type I** occurs before 4th week with complete agenesis of genito-urinary structures.
- **Type II** early 4th week complete URA with partial development of reproductive organs.
- **Type III** After 4th week with mesonephric structures developing normally.

Based on this classification, a type III URA can be surmised to have occurred. This is supported by the fact that the left testis is at its normal size and location. According to Arfeen (1993) absence of one kidney occurs more frequently on the left side and familial tendency has been theorized to exist.

The incidence of URA is 1 every 1100 birth (Doroshow and Abeshouse, 1961) and recently 1 in every 1200 (Shieh 1990).

Genital anomalies are also observed with unilateral renal agenesis. There is a 10-15% of URA with genital anomalies in males (females 25-50%).

Anomalies of other organ systems are also frequent

1. **CVS** 30% - septal and valvular cardiac defects
2. **GI** – 25% - Imperforate anus/anal or esophageal atresia
3. **Musculoskeletal** – 14% vertebral and phalangeal abnormalities

Cascio (1999) reported a relatively high incidence of contralateral reflux, as seen in our patient.

However, the controversy does not lie on the URA as it is not a rare congenital anomaly. It is the presence of a second refluxing ureter at the fibrous end of the cryptorchid testis which probably gives rise to an epididymitis-like presentation, hence the episodes of urosepsis.

We are presenting 3 theories or hypotheses to explain the unusual presentation in our patient.

**Hypothesis #1 (Figure 5)**

Appearance of a second ureteral bud which initially forms a separate metanephric duct and system but later becomes entangled with the testis on its descent.

A second ureteral outpouching appears caudal to the 1st ureteral bud. The Weigert-Meyer rule is followed: the second ureter will assume a more medial and superior location. The gonad and its wolffian (mesonephric) duct derivatives are congruently developing. Possibly at the time of descent, at 12 weeks AOG, the testis coiled at the developing kidney and ureter at its proximal 3rd, possibly strangling the blood supply from the ipsilateral supernumerary kidney. The same event can also happen to the wolffian duct. Adhesions formed with the p/3 ureter and the epididymis of the developing gonad.
Subsequently, the supernumerary kidney undergoes degeneration and regression. The wolffian duct also becomes rudimentary and later disappears. Gubernaculum is still intact and pulls the testis and the attached ureter caudally. However, because of ureteral supporting structure, full descent was arrested or possibly the gubernaculum regressed early, partially completing the intraabdominal migration.

**Points versus this hypothesis:**

This hypothesis is based on the premise that there is no direct connection between the ureter and the vas deferens. Also, dysplastic kidneys would have recognizable remnants and these would be characterized by the presence of primitive tubules, representing the degenerating kidney.

**Hypothesis: #2 (Figure 6)**

The refluxing structure is actually the vas deferens, and during embryologic development, drains into the urinary bladder. Reflux occurs and this promoted metaplastic changes into the epithelium of the vas into transition cell-like structures.

The injury or the disruption of the development of the wolffian structures would have occurred at 6-8 weeks when the common excretory duct begins to invert into the urogenital sinus. The mesonephric duct normally would attach itself to the verumontanum. Instead, it inserts into the bladder.

Reflux occurs and induces changes into the columnar epithelium to resemble transitional epithelium/pseudo stratified epithelium.

Points favoring this hypothesis: apparent initial VCUG failed to show refluxing “second ureter”, supporting the
The distal end is attached to the gonadal system and the presentation of the proximal ureteral end attached to the gonadal structures is indeed unusual.

The question also arises regarding the presence of direct connection between the two structures. Histopathologic examination of the specimen failed to confirm or deny this.

Thus the embryologic events that could have lead to this unusual presentation remains to be a subject of debate. The presented hypotheses are only some of the possible scenarios that may have occurred at the time of embryogenesis.

Among the 3 presented hypotheses, we tend to favor the third proposed scenario. We surmise that the embryologic insult occurred between 8-12 weeks. Injuries at this time of embryologic development can explain the type III URA. It is also within this time frame that the common excretory duct will invaginate into the urogenital sinus to form half of the trigone. The epithelium later developed as it would have if it had formed the trigone thus providing us with the most likely explanation of the histologic presentation of the resected specimen. This can also explain the recurrent febrile UTI after a previous successful re-implantation.

Thus, the surgery done (ureterectomy with orchiectomy) was necessary to relieve the patient’s problem. As this is a case of unilateral kidney, we had to be aggressive in taking steps to maintain its function. The resected testis grossly was small and atrophic and had no germinal function. Histopathology failed to reveal Leydig cells, so hormonal function is practically absent. The contralateral testis was normal in size and consistency and could provide the hormonal requirements of the child once he reaches puberty. The patient was discharged afebrile and so far has remained free from recurrent UTI episodes.

REFERENCES


CASE REPORT

“HUTCH” DIVERTICULUM

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ABSTRACT

A 21 year old male consulted because of persistent right flank pain, dysuria and recurrent episodes of urinary tract infection. KUB-IVP showed bilateral hydronephrosis with right nephrolithiasis. Ultrasonography revealed bilateral bladder diverticula. Cystoscopy was done and revealed a bilateral “Hutch” diverticulum. Voiding cystourethrogram revealed vesicoureteral reflux on both sides. Because of this condition, surgical correction of vesicoureteral reflux was done. Post-operative stay was unremarkable and was discharged improved.

Key words: diverticulum, “Hutch” diverticulum

INTRODUCTION

In 1961, John Hutch first described a congenital bladder diverticulum associated with posterior urethral valve of neurogenic bladder. Bladder diverticula are unusual congenital abnormalities that occur primarily in a male child with smooth-walled bladder, most often solitary and occurs without evidence of obstruction.1 This may also be due to an inherent weakness in the bladder musculature.2 The most common location of these diverticula is lateral and cephalad to the ureteral orifice because this is the weakest point within the bladder. These occasionally expand within the Waldeyer’s fascia to cause ureteral reflux or project intramurally to obstruct the bladder neck or urethra. Usually, they prolapse outside the bladder at the expense of paraureteral mucosa which alters the anatomy of ureterovesical junction and allows either transient or permanent reflux.3

Objectives

1. To describe the presentation of a patient with “Hutch” diverticulum.

2. To review the diagnostic modalities and treatment options based on the literature.

CASE REPORT

We present a 21 year old male from Diliman, Quezon City who sought consult for the first time because of persistent right flank pain of four months duration, associated with dysuria. There was no fever noted. The patient had a history of recurrent episodes of urinary tract infection (UTI) and had been treated at the Bulacan Provincial Hospital with quinolones affording temporary relief. KUB-IVP was done showing bilateral hydronephrosis and nephrolithiasis in the right lower pole. There was tenderness on the right flank area on physical examination. Persistence of these symptoms prompted consult and patient was subsequently admitted.

The patient was admitted with an initial impression of hydronephrotic kidney, bilateral more severe on the right probably secondary to ureterolithiasis. Laboratory examinations revealed normal CBC, BUN and serum
creatinine. Urinalysis showed microscopic hematuria of 12-25/hpf and wbc of 2-3/hpf. A KUB ultrasound was requested and showed moderate hydronephrosis, bilateral with nephrolithiasis, right lower pole and bilateral bladder diverticula (Figs. 2 & 3). Voiding cystourethrogram showed reflux on both ureters (Fig. 4); and GFR Scan was requested which revealed a total of GFR of 101.38 ml/min with decreased renal function on the left at 9ml/min (9.13 ml/min) and 91 ml/min on the right (92.25%). The cystoscopy showed a bilateral periureteral bladder diverticulum, in which the right is larger than the left. Retrograde pyelography showed bilateral hydronephrosis, more severe on the right and with markedly dilated ureter on both sides (Fig. 4). Due to the persistence of the condition, the patient underwent surgery. Intraoperative findings revealed bilateral bladder diverticulum located cephalad and posterior to the orifice, 7 cm in size and bilaterally dilated ureters. A bilateral ureteroneocystostomy (Politano-Leadbetter) with ureteral tailoring, with DJ stenting on the right, and open-ended stenting on the left ureter, plus suprapubic tube cystostomy was done (Figs. 5 & 6). Patient was discharged improved after 11 hospital days, and was advised weekly follow-up.

Two weeks later, the patient presented with right flank pain and was re-admitted. KUB x-ray showed a right proximal 3rd ureterolithiasis causing obstruction. Patient underwent right ureterolithotomy. The rest of the hospital stay was unremarkable.

Figure 1. Retrograde pyelographic studies showing bilateral hydronephrosis.

Figure 2. Sonographic picture showing the bladder with left diverticulum.

Figure 3. Sonographic picture showing the right diverticulum.

Figure 4. Cystogram showing the two bladder diverticula.
DISCUSSION

We present a 21 year old male, with bilateral periureteral bladder diverticula, called a Hutch diverticula. It may present with flank pain, recurrent UTI, dysuria, hematuria, lower abdominal swelling, bladder stones and bladder rupture. Although a rare event, acute urinary retention due to urethral compression can occur in patient with congenital diverticulas. Poor bladder emptying due to the diverticulum and loss of elasticity due to the inflammatory reaction will lead to infection. If the infection persisted, squamous metaplasia and stone formation within the cavity may occur.

Bladder diverticula can be seen and diagnosed on a voiding cystourethrogram. It is the most important diagnostic tool in detecting its presence as seen in our patient.

Intravenous pyelography, although important, in evaluating the upper tracts, is not believed to be the best method of diagnosing a bladder diverticulum. A medial deviation of the ureter would suggest the condition. Our cystoscopic procedure initially diagnosed the bladder diverticula. Cystoscopy is important to ascertain that there is no tumor or other pathology in the bladder that may be left unrecognized. The management of diverticulum includes observation if it is small (<5cm) and asymptomatic. Indications for surgery are persistent infection, stone formation and ureteral obstruction. All of these were seen in our patient.

The surgical management of bladder diverticulum can be performed in four ways: intravesical, extravesical, combined or endoscopic/laparoscopic approach. With a large diverticulum (>5cm), an extravesical or intravesical approach may be most appropriate management and endoscopic treatment reserved for small diverticula (<5cm).

The surgical goals reserved for the correction of a vesicoureteral reflux caused by “Hutch” diverticula are: First, creation of a flap valve mechanism at the distal ureterovesical junction; second, creation of a 5:1 ratio of ureteral tunnel length to the ureteral diameter, and third, the pressure inside the distal ureter should slightly exceed that of the bladder.

Among the intravesical approaches, Politano-leadbetter, Glenn-Anderson and Cohen are the most popular with the success rates of 97-99%, 97-98% and 98%-99%, respectively.

In 1998, Eugene Mimewich, Jeffrey Wacksman, Alfor Lewis and Curles Sheldon showed that the extravesical approach is a highly successful procedure with a low incidence of postoperative contralateral vesico-ureteral reflux, particularly in detrusorrhaphy. This approach is a safe, simple and effective method in the management of a refluxing ureter with an associated diverticulum.

The combined procedure which is called the Pequin technique, combines an extravesical ureteral mobilization with an intravesical reimplant. Its has a success rate of 96%.

The degree of difficulty puts the laparoscopic extravesical reimplant in disfavor compared with the open reimplant surgery. The difficulty in the visualization of the deep retrovesical space along with an extended operative
time have led to limited applications of this approach to date.

Successful endoscopic transvesico-transurethral approaches was reported by K. Okamura, et al., in Nogoya University School of Medicine and Atsumi Hospital in Japan in 2 patients in which the mouth of the diverticulum was closed in 2 layers under pneumobladder using 2 percutaneous ports placed into the bladder as well as the urethral route.12

In our patient, we used a Politano-Leadbetter technique wherein a new ureteral subepithelial tunnel was made at the area of the new hiatus which is a reliable method for correction of vesicoureteral reflux. This is being used by most urosurgeons and has a high success rate of 97-99%.

CONCLUSION

“Hutch” or bladder diverticulum is an unusual condition that presents as flank pain, dysuria and recurrent UTI. Obstructive-like symptoms due to vesicoureteral reflux or ureteral obstruction, occurs as the diverticula enlarges. A voiding cystourethrogram is the best procedure in detecting bladder diverticulum, although IVP is still important in evaluating the upper tracts. Cystoscopy is useful in detecting other abnormalities within the bladder. Persistent infection, stone formation and ureteral obstruction are indications for surgery. The goal of management is to relieve the vesicoureteral reflux or ureteral obstruction by creating a flap valve mechanism at the ureterovesical junction. The open intravesical and extravesical approach are still being recommended because of its promising outcome. The laparoscopic technique has limited applications because of its modest outcome and longer operative time.

REFERENCES