Urine Cytology in Pediatric Patients: A Clinicopathologic Correlation of 191 Cases

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ABSTRACT

Background: Urine cytology is an important diagnostic tool in the detection of bladder neoplasms and other pathologic processes of the genitourinary tract. Neoplasms of the urinary tract are distinctively uncommon in the pediatric age group, however non-neoplastic disease processes are fairly common. This present study evaluated the clinical utility of urine cytology exclusively in the pediatric population.

Design: A retrospective search was done for all urine samples examined in the cytology unit of our department from 1995 to 2010. A total of 191 urinary specimens (representing 171 patients) from patients 1-18 years of age were identified. The cytologic and follow-up clinical data was systematically analyzed and correlated.

Results: The median age was 9 years (range, 3 months-17 years) with a gender distribution of 112 male and 59 female (M:F=2:1). Most common presenting symptom was hematuria, followed by frequency. The largest diagnostic group consisted of benign/normal cytopathologic findings (88%) or displayed acute inflammation (21%), reactive changes (24%), and hematuria (40%). Crystals were identified in 2% of cases and polyoma virus features were present in 1.6%. One case was suspicious for malignancy while 21 cases were called atypical based largely on architectural atypia. A total of 11 cases had surgical follow-up. The great majority of these (55%) had urinary calculi. One benign neoplastic case (papilloma) was identified, while 2 cases progressed to end stage renal disease. Thirteen cases with atypia were not followed by either repeat urines or surgical biopsies. No urothelial neoplasm was identified by urinary cytology in the study group.

Conclusions: A large majority of urinary specimens in pediatric age group are benign, display reactive changes or hematuria. Urothelial neoplasms are a rarity and were identified in only 1 case in our study group. Cytologic atypia in pediatric age group is an uncommon category, and not associated with cancer follow-up. Majority of cases with atypical diagnosis in pediatric age group are benign, with no need for follow-up repeat urines or tissue biopsies.

BACKGROUND

Urine cytology, a direct microscopic evaluation of shed urothelial cells is used for the detection of neoplastic cells in the urine. It is a convenient non-invasive test with historically high specificity for bladder cancer. It has poor sensitivity especially for low grade tumors; as such a negative result cannot exclude the absence of a low-grade disease. Further drawbacks include the fact that its interpretation can be difficult in patients with inflammation, it is operator dependent, and its accuracy is affected by cellular yield. Instrumentation, inflammation, infection, recent surgical therapy, immunotherapy, radiotherapy, and chemotherapy can each affect the cellularity and cytomorphology of the specimen and therefore need to be accounted for before a final interpretation is made. Neoplasms of the urinary tract are distinctively uncommon in the pediatric age group, however non-neoplastic disease processes are fairly common. This present study evaluated the clinical utility of urine cytology exclusively in the pediatric population.

DESIGN

Retrospective data from our institution's cytology unit were collected for all reviewed urine cytologic specimens between 1995 and 2010. Relevant patient medical records were subsequently accessed, and all cytologic and histologic data were collected with a minimum 2-year follow-up. Clinical and pathologic variables that were examined included the date of collection, reason for urinary evaluation (first presentation of hematuria, surveillance for known hematuria or urothelial tumors, and others), type of specimen (voided, washing, or catheterized). A total of 191 urinary specimens (representing 171 patients) from patients 1-18 years of age were identified. The cytologic and follow-up clinical data was systematically analyzed and correlated.

RESULTS

The median age was 9 years (range, 3 months-17 years) with a gender distribution of 112 male and 59 female (M:F=2:1). Most common presenting symptom was hematuria, followed by frequency. The largest diagnostic group consisted of benign/normal cytopathologic findings (88%) or displayed acute inflammation (21%), reactive changes (24%), and hematuria (40%). Crystals were identified in 2% of cases and polyoma virus features were present in 1.6%. One case was suspicious for malignancy while 21 cases were called atypical based largely on architectural atypia. A total of 11 cases had surgical follow-up. The great majority of these (55%) had urinary calculi. One benign neoplastic case (papilloma) was identified, while 2 cases progressed to end stage renal disease. Thirteen cases with atypia were not followed by either repeat urines or surgical biopsies. No urothelial neoplasm was identified by urinary cytology in the study group.

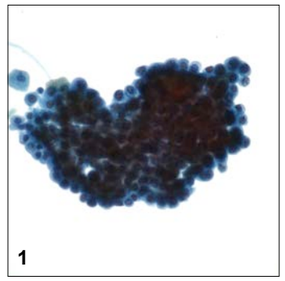

Figure 1. Case diagnosed as suspicious for low grade urothelial neoplasm due to papillary clusters with irregular edges and mild cytologic atypia, in voided urine, X600. Final histologic diagnosis was urothelial papilloma.

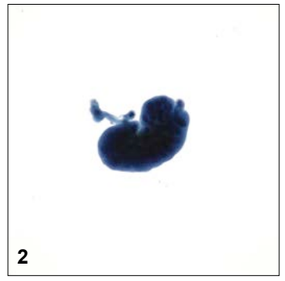

Figure 2. Case diagnosed as atypical cells present due to the presence of papillary clusters with smooth edges, but in voided urine, X600. Final histologic diagnosis was negative and patient was treated for urinary calculi.

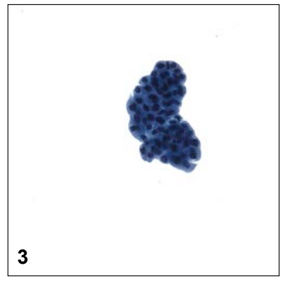

Figure 3. Case diagnosed as reactive urothelial atypia due to papillary clusters with smooth edges and mild cytologic atypia, in instrumented urine, X600. Final histologic diagnosis was urothelial papilloma.

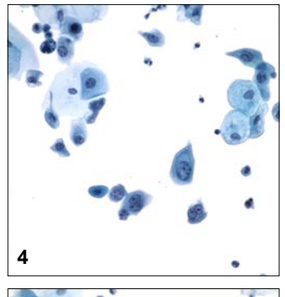

Figure 4. Case diagnosed as reactive urothelial atypia due to single urothelial cells mild cytologic atypia, in voided urine, X600. Final histologic diagnosis was negative and patient was treated for urinary calculi.

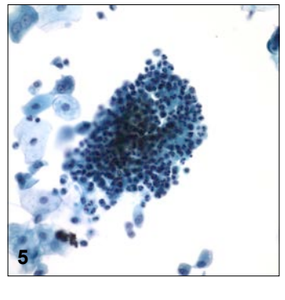

Figure 5. Case diagnosed as acute inflammation due to abundance of neutrophils, in voided urine, X400. Final histologic diagnosis was negative and patient was treated for urinary calculi.

Table 1. Distribution of patient, cytologic and pathologic criteria

	Number (%)
Patient	
Median age (year, range)	9 (3 months – 17 years)
Gender (male/female)	112 (65.5%)/59 (34.5%)
Presenting symptoms	
Hematuria	129 (75.4%)
Frequency	10 (5.8%)
Urgency	4 (2.3%)
Hypertension	3 (1.8%)
Urine – Mode of Collection	
Voided	108 (56.5%)
Instrumentation	42 (22.0%)
Unspecified	41 (21.5%)
Urine – Cytology	
Benign/Normal	169 (88.5%)
Reactive	46 (24.1%)
Acute Inflammation	41 (21.0%)
Crystals	4 (2.0%)
Polyoma Virus	3 (1.6%)
Atypical	21 (11.0%)
Suspicious	1 (0.5%)
Histology (n=11)	
Urinary calculi	7 (54.5%)
Papilloma	1 (9.1%)
Florid Cystitis	1 (9.1%)
End stage renal disease	2 (18.2%)

CONCLUSIONS

- A large majority of urinary specimens in pediatric age group are benign, display reactive changes or hematuria.
- Urothelial neoplasms are a rarity in the pediatric age group and were identified in only 1 case in our study group (papilloma).
- Cytologic atypia in pediatric age group is an uncommon category, and not associated with cancer follow-up.
- The majority of cases with atypical diagnosis in pediatric age group are benign, with no need for follow-up repeat urines or tissue biopsies.

REFERENCES

1. Gaston KE, Pruthi RS. Value of urinary cytology in the diagnosis and management of urinary tract malignancies. Urology. 2004;63:1009-16.
2. Yafi FA, Brimo F, Auger M, et al. Is the performance of urinary cytology as high as reported historically? A contemporary analysis in the detection and surveillance of bladder cancer. Urol Oncol. 2013; Feb 11. Epub ahead of print.
3. L.G. Koss, D. Deitch, R. Ramanathan *et al.* Diagnostic value of cytology of voided urine. Acta Cytol. 1985;29:810-814.