Health Disparities in the Appropriate Management of Cryptorchidism

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Objective To assess regional practices in management of cryptorchidism with regard to timely fixation by the current recommended age of 18 months.

Study design A retrospective study was performed. Charts of all patients who underwent surgical correction for cryptorchidism by a pediatric general surgeon or urologist within a tertiary pediatric hospital in an urban setting were systematically reviewed.

Results We identified 1209 patients with cryptorchidism. The median age of surgical correction was 3.7 years (IQR: 1.4, 7.7); only 27% of patients had surgical correction before 18 months of age. Forty-six percent of our patients were white, 40% were African American, and 8% were Hispanic. African American and Hispanic patients were less likely to undergo timely repair ($P = .01$), as were those with public or no insurance ($P < .0001$). A majority (72%) of patients had no diagnostic imaging prior to surgery. A majority of patients had palpable testes at operation (85%) and underwent inguinal orchiopexy (76%); 82% were operated on by a pediatric urologist. Only 35 patients (3%) experienced a complication; those repaired late were significantly less likely to develop a complication ($P = .03$). There were no differences in age at time of surgery by surgeon type.

Conclusions A majority of our patients were not referred for surgical intervention in a timely manner, which may reflect poor access to care in our region. Public and self-pay insurance status was associated with delayed repair. Education of community physicians and families could be potentially beneficial. *(J Pediatr 2017;185:187-92).*

Cryptorchidism is one of the most common indications for genitourinary surgery and the most common congenital anomaly in boys, occurring in 4% of males.[1] Approximately 35%-43% of boys found to have cryptorchidism at birth will have spontaneous descent of the testes by 3 months of age, although ascent has been described in up to 22%.[2-5] The current American Academy of Pediatrics (AAP) guidelines state that boys should be referred for surgical evaluation by 12 months of age.[6] Furthermore, the American Urologic Association (AUA) recommends referral for evaluation for those who have not had descent by 6 months of age, with surgical intervention within a year from the time of referral (by 18 months of age).[7]

The reasons behind the need for early surgical intervention are concerns over the high rate of associated inguinal hernia (up to 90% of boys with cryptorchidism),[8-10] the increased risk of testicular torsion (estimated to be 10 times the lifetime risk of males with descended testicles),[11-14] and the association with subfertility[15-18] and testicular cancer.[19] In addition, the psychosocial development of these boys must be considered.

Cryptorchidism has been used as a marker for healthcare disparities in previous studies, with those at risk for low healthcare utilization having higher rates of delayed intervention.[20,21] As our tertiary children's hospital serves a population at highest risk of low healthcare utilization because of the high rates of underinsured or uninsured patients and a high proportion of families with a low socioeconomic status,[22,23] we sought to evaluate the adherence to the current AAP and AUA guidelines.

Methods

After institutional review board approval, individuals with cryptorchidism (*International Classification of Disease, Ninth Edition* codes 752.5, 751.51) who underwent surgical repair (current procedural terminology codes 54640, 54650, 54560, 54692, 54699, 55110, 54520) by any of our institution's pediatric general or urologic surgeons were identified from January 1, 2005 to December 31, 2014. Patients were identified from both the hospital and outpatient clinic databases.

Any patient older than 18 years of age was excluded from the study. Those patients with a documented diagnosis of testicular torsion, penile anomalies, and

AAP	American Academy of Pediatrics
AUA	American Urology Association
sCHIP	State Children Health Insurance Program

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retractile testes were excluded. Comorbidities were assessed by American Society of Anesthesiology (ASA) classification.

Outcome Variables

The primary outcome was surgical correction of cryptorchidism by 18 months of age, which is in accordance to the AUA guidelines.[7] Our cohort was dichotomized based on this 18-month cut-off into those who had timely repair and those who had delayed repair.

Predictor Variables

Chart review was performed, with particular attention paid to initial consultation appointments, patient demographics (date of birth, race, zip code, insurance status), reason for delayed referral if given, past medical history, and surgical measures. In addition, location of initial consultation (urban/academic clinic vs suburban/private clinic vs hospital), location of surgery (urban/academic children's hospital vs suburban/community surgery center), and type of surgeon was collected.

Statistical Analyses

Categorical variables were compared using χ^2 tests. Normally distributed continuous variables were compared using a Student *t* test and non-normally distributed continuous variables were compared using a Wilcoxon rank-sum test. Simple logistic regression was used to determine significant variables ($P < .2$) for inclusion in a multiple logistic regression model. Backwards elimination methodology was used to develop the final model presented in the manuscript. Statistical significance for univariate tests and for the final multivariable logistic regression model was set at $P < .05$. Statistical analysis was completed using SAS v 9.3 (SAS Institute, Cary, North Carolina).

Geographic Information

Geographic information was mapped using the ArcGIS Online software from Esri (Redlands, California). The base map layer was "Light Gray Canvas," which was overlaid with the 2016 USA Average Household Income map image layer from Esri. Finally, the percent of patients receiving timely repair in each zip code was calculated and mapped by zip code.

Results

We identified 1209 patients during a 10-year period. The median age of referral for our patient population was 3.2 years (IQR: 1.1, 7.4), with a median age of operation of 3.7 years (IQR: 1.4, 7.7); only 27% of our patients underwent surgical repair of cryptorchidism by 18 months of age. A majority of patients had private insurance (50%) or public insurance (45%). White patients made up 46% of our cohort, African Americans accounted for 40% of our cohort, Hispanic patients accounted for 8%, and Asian patients accounted for 6% of our cohort.

The majority of boys were referred by their primary care provider (84%); however, 13% were identified either during a hospitalization or emergency department visit for another medical condition. The patients diagnosed by their primary care provider were referred at a younger age (2.8 years; IQR: 1.0, 7.1) than those diagnosed during an emergency department visit (5.8 years, IQR: 1.5, 13.1) or by their parents (5.3 years, IQR: 1.4, 7.9) ($P = .004$).

Bivariate Analysis

Patients with delayed repair were more likely to have a delay in referral for surgical correction (median: 5.2 vs 0.7 years, $P < .0001$; **Table I**); however, the median time from referral to surgical fixation was not significantly different between those who received timely repair and those who underwent delayed repair (median: 2.4 months). Those who underwent delayed repair came from zip codes with lower median incomes ($37 892 vs $39 996, $P = .005$) and higher percent poverty rates (19.8% vs 17.1%, $P = .01$); graphical representation can be found in the **Figure** (available at www.jpeds.com). There was no statistical difference in who initially diagnosed the cryptorchidism between those who had delayed repair and timely repair, with most patients being diagnosed by a pediatric provider. A higher proportion of patients who were referred to the suburban/private clinic had timely repair, while a higher proportion of patients that were referred to the urban/academic clinic had delayed repair ($P < .0001$). Patients with nonpalpable testes were more likely to garner an earlier referral. The majority of boys who had a delayed repair had a palpable testicle ($P < .0001$). In addition, there was no difference in the diagnostic imaging modality used to aide in diagnosis, with a majority of both those that underwent delayed repair and timely repair not having any imaging (72%).

Table II describes the operative measures. Our pediatric urologists treated a majority of the patients (82%). The majority of the boys had their operation at the main children's hospital. A greater proportion of the boys that had their operation at the surgery center underwent timely repair (39% vs 24%, $P < .0001$). Boys that had a timely repair were more likely to have an intra-abdominal testis ($P < .0001$) found. The operative procedure performed was significantly different between those who underwent delayed repair vs those who underwent timely repair ($P < .0001$). The timely repair group had a greater proportion of laparoscopic orchiopexy (5% vs 3%), abdominal orchiopexy (9% vs 4%), and orchiectomy (20% vs 10%) performed. Patients who underwent delayed repair were more likely to undergo inguinal orchiopexy (80% vs 65%). There were no significant differences in the total number of operations between those who underwent delayed repair vs timely repair. Those who underwent timely repair had a greater rate of complications (5% vs 2%, $P = .03$).

When comparing the cohorts by race, there were significant differences in the proportion of boys who had timely repair (**Table III**). Asians (38%) were repaired earliest followed by Whites (29%), African Americans (23%), and Hispanics (22%) ($P = .012$). Asian boys were the youngest while African American boys were the oldest at age of referral and age of surgery, but the differences did not meet statistical significance ($P = .12$; $P = .08$). Because of variance, the time from referral to surgery was statistically different between groups ($P = .02$) even though