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Timing of Orchiopexy in the United States: A Quality-of-Care Indicator

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Abstract

Objective—To investigate whether orchiopexies are occurring later than recommended by American Academy of Pediatrics 1996 guidelines (around age one). Adherence to guidelines is poorly studied.

Methods—Main Cohort: 4,103 boys insured from birth (Innovus i3, insurance claims database) Complementary cohort: 17,010 insured and non-insured boys (Pediatric Health Information System, PHIS)

Inclusion criteria: age ≤5 years at time of ICD-9-defined cryptorchidism diagnosis Primary outcome: timely surgery (orchiopexy by age 18 months)

Results—In Innovus, 87% of boys who underwent an orchiopexy had a timely orchiopexy. Of those who did not undergo surgery (n=2738), 90% had at least one subsequent well-care visit. Those who underwent timely surgery were referred to a surgeon at a younger age compared with those who underwent late surgery (4.1 months vs. 16.1 months, p<.00005). Predictors of timely surgery were number of well-care visits (OR 1.5, 95% CI 1.3–1.7), continuity of primary care (OR 1.9, 95% CI 1.3–2.7), and use of laparoscopy (OR 4.5, 95% CI 1.4–14.9). Family/internal medicine as referring provider was predictive of delayed surgery (OR 0.5, 95% CI 0.3–0.8). In PHIS, 61% of those with private insurance had timely surgery compared with 54% of those without private insurance (p< 0.0001).

Conclusions—We found an unexpectedly high adherence to guidelines in our continuously insured since birth Innovus population. Primary care continuity and well-care visits were associated with timely surgery. Further studies can confirm these findings in non-privately insured patients with the ultimate goal of instituting quality improvement initiatives.

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Keywords

cryptorchidism; health services research; orchiopexy; pediatrics; quality indicators; healthcare

Introduction

Cryptorchidism is common, affecting 1% of one-year-old boys and resulting in over 26,000 outpatient surgeries nationwide(1). Practice guidelines by the American Academy of Pediatrics (AAP) issued in 1996 recommend surgery around one year of age, a decreased age from prior guidelines(2). The benefits of early surgery include psychosocial effects, prevention of testicular degeneration(3–9), and decreasing the risk of testicular cancer(10). No study has investigated practice patterns outside of specialized children's hospitals(11) nor identified modifiable factors toward improving care.

To test our hypothesis that a substantial proportion of orchiopexies occur later than guideline recommendations, we examined data from Innovus i3, an insurance claims-based database. We aimed to investigate the current timing of orchiopexy to (1) provide descriptive data on a potential quality-of-care indictor and (2) identify targets to improve guideline compliance.

Materials and Methods

This study was exempt from institutional review board approval.

Data source

Innovus i3: We used a retrospective cohort defined in a private, national medical claims database populated by enrollees of UnitedHealthcare insurance. The database includes 30 million individuals during 2002–2007.

Inclusion Criteria

Only children born with continuous UnitedHealthcare insurance from the time of birth until at least 18 months after the first diagnosis of cryptorchidism were included in the study. This allowed for 100% follow-up and complete tracking of referral and surgery patterns. Boys with billing codes for cryptorchidism or orchiopexy (752.5, 752.51, 752.52, 62.5, 62.3, 63.53, 54520, 54550, 54560, 54640, 54650, 54690, 54692, 54699) first diagnosed at age ≤5 years were included. This first coding diagnosis of cryptorchidism did not preclude future spontaneous resolution or mis-diagnosis by the primary care provider.

Exclusion Criteria

We excluded boys with diagnoses occurring at age >5 years to exclude cases of ascending testes for which late orchiopexy is appropriate. Boys with testicular torsion (608.20–22, 63.52, 54600, 54620), low birthweight, extreme prematurity, and complex congenital conditions, as defined by Feudtner(12), were excluded.

Outcome Variables

The primary outcome was orchiopexy by age 18 months, dichotomized to yes/no. This cut-off was chosen based on 1996 AAP guidelines recommending surgery around age one, with some flexibility(2).

Predictor Variables

Predictor variables were selected *a priori* based on face validity and literature review. These included type of surgeon; concurrent hypospadias (752.61–752.65, 752.69); use of laparoscopy (54690, 54692, 54699); volume of referring provider; continuity of care (defined by whether the subject saw the same primary care physician at the first well-care visit and the time of referral, regardless of total number of visits); use of preoperative imaging (76870, 93975, 93976, 74181, 74182, 74183, 72195, 72196, 72197); year of birth; and number of total well-care visits, not necessarily by the same provider each visit, as an indicator of health care utilization. Total number of well-care visits was standardized to number of well-care visits per year of enrollment.

Complementary analysis

Pediatric Health Information System (PHIS): As a supplement to the main analysis with Innovus's highly insured population, we also used PHIS to assess a population with both privately and non-privately insured subjects. We preferred our own analysis of PHIS over using results found in the literature(11) to best explore the the effects of insurance on outcomes with as similar methodology as possible. This also allowed for confirmation of prior analyses of PHIS data.

PHIS is an administrative database comprising 43 free-standing children's hospitals. Twenty-four hospitals had retrievable records for both inpatient and outpatient surgeries.

Inclusion and exclusion criteria were applied in a similar manner to that described above, except children with prior congenital conditions were not excluded as comprehensive medical history was not available. Insurance types were categorized to private vs. public/uninsured. Predictor variables used for the PHIS model included year of surgery, use of laparoscopy, hospital volume (total yearly admissions), and type of surgeon. There was inadequate data to include the remaining covariates used with Innovus. PHIS reported two categories of surgeon (urologist and general surgeon) whereas Innovus reported three (pediatric urologist, adult urologist, and general surgeon).

Statistical Methods

We used a multivariable logistic regression model including the *a priori* predictors, regardless of results of univariate analysis. Goodness of fit was checked using the Hosmer-Lemeshow test. All tests were 2-sided and significance level was set at 0.05. The proportion of subjects with timely orchiopexy was calculated by dividing the number with timely orchiopexy by the total number with orchiopexies. To investigate bias introduced by limiting the cohort to those diagnosed at age ≤5 years, we performed a sensitivity analysis expanding the cohort to age ≤ 18 years to assess the proportion with timely surgery.

Results

In Innovus, application of inclusion and exclusion criteria resulted in 4,103 subjects for analysis (Figure 1). Table 1 shows demographic characteristics for those who underwent orchiopexy and those who never underwent orchiopexy but had a diagnosis of cryptorchidism.

Of those who underwent orchiopexy, 87% did so by age 18 months. Mean age at referral to a surgeon was significantly younger for those who underwent surgery by 18 months than after (4.1 months vs. 16.1 months, p<.00005). A similar difference was found for the mean age at diagnosis.

Significant predictors for timely surgery on multivariate analysis were number of well-care visits, continuity of primary care, use of laparoscopy, and type of referring provider. Non-significant predictors were year of birth, type of surgeon, volume of referring provider, use of scrotal imaging, and concurrent hypospadias (Table 2).

Of boys who had a diagnosis of cryptorchidism, but did not undergo surgery (n=2,738), 90% had at least one subsequent well-care visit. Mean number of well-care visits after diagnosis was six. 14% saw a surgeon for cryptorchidism within 6 months of the first diagnosis, but still did not undergo surgery.

In PHIS, of 17,010 subjects, 61% of those with private insurance had timely surgery compared with 54% of those without private insurance ($p< 0.0001$). Multivariate logistic analysis showed type of insurance (OR 1.3, 95% CI 1.2–1.4) and the use of laparoscopic surgery to be predictors of orchiopexy by age 18 months (OR 1.4, 95% CI 1.3–1.6). Volume of treating hospital was also statistically significant but the clinical significance of the effect size was minimal (OR 1.02, 95% CI 1.02–1.03). Similar to the Innovus data, type of surgeon and year of surgery did not predict timing of orchiopexy (Table 3).

Comment

Our study reports several important findings. First, in contrast to prior studies, we show that substantial adherence to guidelines can be achieved in a population continuously insured from birth through at least 18 months after diagnosis. The only other study investigating adherence to AAP guidelines (using PHIS) reported 43% of subjects had undergone orchiopexy by age two(11). Even in countries with government-based universal health care, of those undergoing orchiopexy, the proportion of boys doing so by age two has ranged from 4% to 43%(13–15).

AAP well-child guidelines explicitly state that a physical exam should be performed at every well-child visit, which includes examination for testicular descent(16, 17). Unfortunately, studies show that only a minority of practicing pediatricians regularly use such guidelines(18). Therefore, it is not surprising that a national assessment of well-child care demonstrated only 38% compliance with quality-of-care indicators(19).

Given these reports of poor guideline adherence, we were surprised that 87% of boys in our study received a time-appropriate surgery. To explain these findings, we first posit that our cohort enjoyed continuous private insurance coverage from birth through at least 18 months after diagnosis. Multiple studies have shown that children with private insurance receive better care than those enrolled in Medicaid(20, 21). Our analysis of PHIS data confirms the prior PHIS study showing that privately insured children are more likely to undergo timely orchiopexy compared with those without private insurance(11). Additionally, using Innovus uniquely enabled us to exclude children with complex pre-existing conditions. These conditions can justifiably delay orchiopexy because of anesthetic risks and the prioritization of more pressing health concerns. Finally, in an effort to exclude cases of ascending cryptorchidism, for which late orchiopexy is appropriate, we limited our primary analysis to those age ≤5 at the time of diagnosis, which was not done in other studies. To investigate the effect of this exclusion, we performed a sensitivity analysis of Innovus data. Inclusion criteria were expanded to include boys ≤ 18 years and enrolled in UnitedHealthcare from the age of one year or younger. The insurance requirement ensured adequate tracking of causes behind delays in care, such as prior lack of access to care, missed diagnosis, or poor follow-up. This led to the inclusion of an additional 779 subjects with a similar proportion undergoing timely orchiopexy compared with our primary findings (87%). The similarity of

findings in both analyses highlight the importance of continuous, early health insurance in this highly selected population; when continuity is present, care improves.

Our second important finding established continuity of primary care (seeing the same provider at the first well-care visit and the time of referral) as a quality-of-care indicator. Subjects with continuity of care doubled their odds of a timely orchiopexy compared with those without continuity. A recent systematic review demonstrated that continuity of care improves, not just patient perceptions of care(22), but measured quality of care(23). Our data suggest that continuity of care is a feature that, if incentivized by payors and sought by patients, may result in higher quality care for boys with cryptorchidism. As federal efforts to improve population health gain momentum, the concept of "equality in quality" is salient in the environment of universal health care as quality should be preserved as health care coverage expands(21, 24, 25). Defined measures of quality, such as continuity of care, will help measure equality.

Third, we found that boys referred by family practitioners or internists had half the odds of receiving a time-appropriate surgery compared with those referred by pediatricians. This suggests that physicians who do not focus on the care of children may not be as familiar with treatment standards or may not have the infrastructure in place to facilitate timely consultations.

Fourth, we found that use of laparoscopy predicted time-appropriate orchiopexy in both databases. Only those with non-palpable testicles undergo laparoscopic orchiopexy; therefore, non-palpability of the testicle may motivate families or physicians to address the condition urgently. Palpable testicles, perceived as "almost" in the correct position, may influence families or physicians to "wait a little longer" for spontaneous descent.

Fifth, boys who underwent late orchiopexy were diagnosed later and referred later (average delay 12 months) than boys with timely orchiopexies, despite having an average of three well-care visits yearly. This finding is consistent with prior data suggesting causes for orchiopexy delays reside at the primary care level and could reflect an inadequate exam or lack of familiarity with guidelines(13, 14). Parental responsibility also plays a role as more well-care visits per year predicted early orchiopexy, independent of whether there was continuity of care.

Our results using Innovus and PHIS complemented each other. We were able to confirm that the insured population does enjoy a treatment advantage. Results of both databases were remarkably similar in finding the use of laparoscopy was an important predictor of timely orchiopexy while confirming factors not predictive of timely orchiopexy. Two reasons contributed to the slightly higher proportion with timely surgery found in Innovus versus the insured population in PHIS. First, the population in Innovus, being continuously insured since birth, is an even more privileged population than the insured population in PHIS, which might have had lapses in coverage. Second, the exclusion of those with pre-existing conditions in Innovus likely excluded those prone toward delayed surgery.

Our study is generalizable nationally to children with continuous private health insurance from birth and should not be applied to children without private insurance for any portion of their early childhood. While these results derive from an ideal population from an insurance standpoint, they represent care in various settings, including community practices. We restricted the Innovus analysis to diagnoses occurring at age ≤5 in order to exclude cases of ascending testes. While this restriction invariably led to the exclusion of subjects without ascending testes, we assessed this effect through our sensitivity analysis. The sensitivity analysis supported the minimal effect of age restriction on outcomes, a finding we attribute to the benefits of having continuous insurance from birth. We chose to include subjects with

diagnoses of retractile testes, given they underwent orchiopexy, as true retractile testes do not require surgery. Inclusion of retractile testes, which are typically followed for longer lengths of time to determine true surgical indication, would bias our proportion with timely orchiopexy downward, which thus further supports our findings. We could not account for those who dropped out of the insurance system; however in an effort to minimize this bias, we included only those who were continuously enrolled in the insurance plan for 18 months after diagnosis of cryptorchidism. Our study relies on diagnosis codes, which may carry errors we could not detect.

Those diagnosed with cryptorchidism but never underwent orchiopexy could have experienced spontaneous resolution or been mis-diagnosed. Both possibilities occur in up to 50% each of all diagnoses(3, 26), thus that one-third of our cryptorchid population underwent orchiopexy is grossly appropriate. Lack of orchiopexy would be appropriate for these two situations; however, we cannot be certain whether some subjects who did not have an orchiopexy might have medically needed one and were misclassified. Prior studies have shown that race influences timing of orchiopexy and could have similar implications on whether patients underwent orchiopexy at all(11). We could make no conclusions regarding race and orchiopexy because of a large proportion of missing race data. The mean number of well-care visits after diagnosis of cryptorchidism was six, which suggests that for the majority of patients, lack of follow-up was not the reason behind the lack of surgery.

Conclusion

With guidelines available, the management of boys with cryptorchidism should be clear. Among those with private insurance, treatment is more consistent with recommendations than among those without private insurance. We have identified modifiable measures of quality such as continuity of primary care, the type of referring physician, and delays in diagnosis and referral. Solutions to such obstacles, such as primary care provider education, have been proven effective in improving orchiopexy outcomes(27). Further studies should investigate whether similar factors influence the timing of orchiopexy in non-privately insured patients. Quality improvement initiatives can then be instituted to increase compliance with quality-of-care indicators.

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Abbreviations

AAP	American Academy of Pediatrics
PHIS	Pediatric Health Information System

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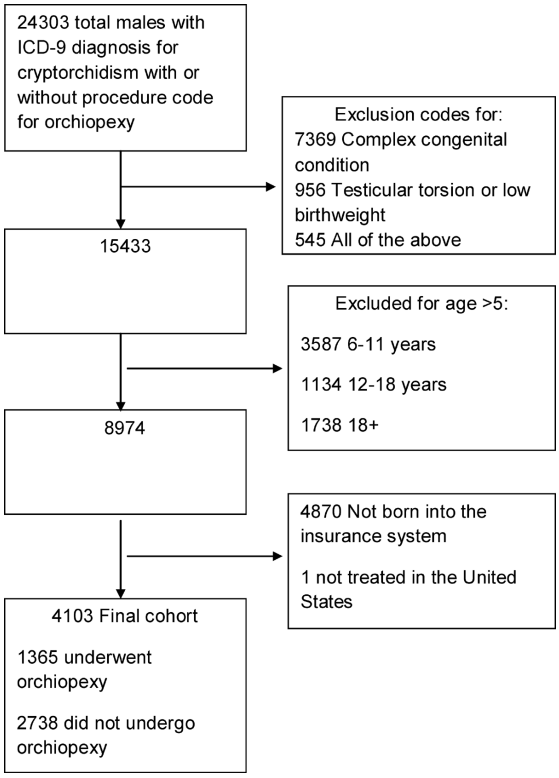

Figure 1.
Construction of study cohort in Innovus i3.

Table 1

Demographic characteristics in subjects with cryptorchidism in Innovus i3.

	(+) Orchiopexy N=1365	(-) Orchiopexy N=2738	P Value
Mean age at diagnosis (months)	8.2 ± 11.4	7.6 ± 10.8	0.12
Median year of birth	2003	2004	<0.001
Location, N(%)			
West	208 (15.2)	373 (13.6)	0.2
Midwest	533 (39.1)	1044 (38.1)	
Northeast	171 (12.5)	318 (11.6)	
South	453 (33.2)	1002 (36.6)	
Missing	0	1 (0.04)	
Race, N(%)			
White	817 (59.9)	1383 (50.5)	<0.001
Black	34 (2.5)	86 (3.1)	
Hispanic	89 (6.5)	213 (7.8)	
Asian	45 (3.3)	103 (3.8)	
Other	18 (1.3)	37 (1.4)	
Unknown	362 (26.5)	916 (33.5)	
Type of referring provider, N(%)			
Pediatrician	1036 (75.9)	1761 (64.3)	<0.0001
Family or internal medicine	176 (12.9)	437 (16.0)	
Hospitalist, neonatology, obstetrics	95 (7.0)	403 (14.9)	
Type of surgeon, N(%)			
Adult urologist	667 (48.9)		
Pediatric urologist	357 (26.1)		
General surgeon	341 (25.0)		
Type of surgery, N(%)			
Open	1275 (93.4)		
Laparoscopic	90 (6.6)		
Mean no. well care visits per year	4.4 ± 2.6	9.2 ± 20.8	<0.0001
Continuity of primary care provider, N(%)	754 (55.2)	1189 (43.4)	<0.0001
Scrotal imaging used, N(%)	248 (18.2)	381 (13.9)	0.0004
Concurrent hypospadias, N(%)	169 (12.4)	199 (7.3)	<0.001

Type of provider or surgeon totals may not sum to 100% as some providers were unclassified.

Table 2

Univariate and multivariate analysis for predictors of orchiopexy by 18 months of age in the Innovus i3 dataset.

	Univariate OR (95% CI)	Multivariate OR (95% CI)
Year of birth		
1997–2002	Reference	Reference
2003–2007	1.3 (1.0–1.9)	0.8 (0.5–1.2)
Type of referring provider		
Pediatrician	Reference	Reference
Family or internal medicine	0.5[a] (0.3–0.7)	0.5[a] (0.3–0.8)
Hospitalist, neonatology, obstetrics	0.8 (0.5–1.6)	1.2 (0.6–2.5)
Type of surgeon		
Adult urologist	Reference	Reference
Pediatric urologist	1.3 (0.9–2.0)	1.2 (0.8–1.8)
General surgeon	1.2 (0.8–1.9)	1.2 (0.7–2.0)
Volume of referring provider		
Bottom tertile	Reference	Reference
Mid tertile	0.9 (0.6–1.3)	0.7 (0.4–1.1)
Top tertile	0.9 (0.6–1.4)	0.8 (0.5–1.3)
Mean no. of well care visits per year	**1.5[b] (1.3–1.6)**	**1.5[b] (1.3–1.7)**
Laparoscopic surgery	**4.0[b] (1.2–12.8)**	**4.5[b] (1.4–14.9)**
Continuity of primary care provider	**2.1[b] (1.5–2.9)**	**1.9[b] (1.3–2.7)**
Scrotal imaging used	1.0 (0.6–1.5)	1.0 (0.6–1.6)
Concurrent hypospadias	1.2 (0.7–2.1)	1.3 (0.7–2.2)

Those with orchiopexy <18 months of age, N=1,018; Those with orchiopexy >18 months of age, N=165

[a] p value ≤ 0.005 (predictor associated with late orchiopexy)

[b] p value ≤0.01 (predictor associated with timely orchiopexy)

Table 3

Multivariate analysis for predictors of orchiopexy by 18 months of age using the Pediatric Health Information System (PHIS) dataset stratified by insurance type.

	Private insurance[a] Multivariate OR (95% CI)	Public or no insurance[a] Multivariate OR (95% CI)
Year of surgery	1.0 (1.0–1.0)	1.0 (1.0–1.0)
Type of surgeon		
Urologist	Reference	Reference
General surgeon	0.9 (0.8–1.1)	1.1 (1.0–1.2)
Volume of treating hospital (per 1000 admissions)	1.0[b] (1.0–1.0)	1.0[b] (1.0–1.0)
Laparoscopic surgery	1.6[b] (1.3–2.0)	1.3[b] (1.1–1.6)

Those with orchiopexy <18 months of age, N=7,089; Those with orchiopexy >18 months of age, N=5,855

[a] Insurance type was an independent predictor of orchiopexy by age 18 months (OR 1.3, 95% CI 1.2–1.4).

[b] p value ≤ 0.03