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Factors affecting pediatric patient transfer in testicular torsion

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ABSTRACT

Background: Testicular torsion is a surgical emergency, and interhospital transfer could delay care and increase the risk of orchiectomy. This study identifies factors associated with transfer for pediatric testicular torsion.

Methods: This retrospective cross-sectional study examined emergency department (ED) visits for testicular torsion by men aged 1-21 y in National Emergency Department Sample from 2006 to 2012. Freestanding children's hospitals were excluded. Analyses were weighted to produce nationally representative estimates. Patient- and institutional-level predictors of transfer were evaluated using Rao–Scott chi-square tests and multivariable logistic regression.

Results: There were 11,435 ED visits for testicular torsion resulting in admission or transfer. In multivariable regression, the probability of transfer decreased with increasing age but remained higher for patients aged 15-17 y than for those aged 18-21 y (odds ratio [OR] = 1.51, $P < 0.001$) and was lower for patients living in zip codes in the highest income quartile (OR = 0.69 *versus* lowest, $P = 0.003$) or with listed comorbidities (OR = 0.55, $P < 0.001$). Transfer was less likely in the Northeast (OR = 0.28 *versus* Midwest, $P < 0.001$), at urban hospitals (OR = 0.31, $P < 0.001$), teaching institutions (OR = 0.55, $P < 0.001$), and level I or II trauma centers (OR = 0.31, $P < 0.001$). Transfer was less common with increasing annual pediatric ED volume (OR = 0.95 per 1000 patients, $P < 0.001$). Transfer rates increased significantly over the study period (23.6%-38.8%, $P < 0.001$).

Conclusions: Older adolescents with testicular torsion are more likely to be transferred than young adults. Interhospital transfers in these patients may represent a potential target for improving care. Future work should focus on evaluating the effect of transfer on the risk for undergoing orchiectomy.

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Introduction

Acute testicular torsion is a surgical emergency that requires prompt diagnosis and treatment to achieve testicular salvage. Recent studies have suggested that one in 1500 men will require surgery for testicular torsion before 18 y of age.[1] Orchiectomy rates vary from 32% to 64% and are influenced by a number of different patient and institutional factors including a patient's age, race, insurance type, duration of symptoms before presentation, distance from the hospital, and a hospital's annual admission volume and pediatric *versus* adult focus.[1-5] A shorter time from the onset of pain to the definitive surgical exploration is one factor that has consistently been shown to decrease a patient's risk of orchiectomy.[2,3] One recent study suggests that patients treated more than 6 h after the onset of symptoms may have 22 times the odds of undergoing orchiectomy rather than orchidopexy.[3] Previous studies have shown that presenting to an ambulatory care facility rather than a hospital resulted in unacceptable delay.[6] It has been suggested that delays from interhospital transfer could create a delay in care that could then increase the risk of orchiectomy.[1,2] In particular, older children usually present earlier and may be adversely affected by delays due to transfer. Previous studies examining transfer rates for testicular torsion did not compare specific pediatric and young adult age groups.[5,7]

The reasons for hospital transfers in pediatric testicular torsion are not well understood. It is assumed that characteristics such as patient age, medical comorbidities, and hospital characteristics such as pediatric *versus* adult focus would likely alter the chance of transfer. The extent of these factors' influence on the decision to transfer and whether there is an age threshold at which pediatric patients begin to be more likely to be treated rather than transferred remains unclear. The aim of this study was to evaluate patient and institutional factors that influence the rate of transfer in pediatric and young adult patients diagnosed with testicular torsion in the emergency department (ED). Specifically, we hypothesized that younger patients have a higher risk of transfer, and that even adolescents are significantly more likely to be transferred than young adults.

Methods

Study design

This was a retrospective cross-sectional study of ED visits for testicular torsion by patients aged 1 to 21 y from 2006 through 2012. This study used the Nationwide Emergency Department Sample (NEDS), which is part of the Healthcare Cost and Utilization Project sponsored by the Agency for Healthcare Research and Quality (AHRQ) and is a nationally representative data source for ED visits in the United States.[8] The NEDS is the largest all-payer ED database in the United States and includes between 25 and 32 million (unweighted) visits from over 950 hospitals throughout the United States each year during the study period. It represents a 20% stratified sample of US hospital–based EDs. Stratified sampling of visits is performed based on the following hospital characteristics: geographic region of the country, trauma center designation, urban–rural location, teaching status, and hospital ownership or control. All visits at participating EDs are included in the NEDS, whether the patient was admitted, discharged, or transferred. The NEDS is based on hospital discharge billing data and thus contains diagnosis and procedure codes as well as patient demographic characteristics and several hospital characteristics.

This study was considered exempt by the institutional review board at our institution, and we received approval to use the NEDS through a data use agreement with AHRQ.

Study population

We included visits by males aged 1 to 21 y with a diagnosis of testicular torsion in one of the 15 available diagnosis fields in the NEDS. Testicular torsion was defined based on the following International Classification of Diseases, 9th revision, Clinical Modification diagnosis codes: 608.2, 608.20, 608.21, or 608.22. Torsion of the appendix testis (608.23) and appendix epididymis (608.23) was not included. Patients seen at children's hospitals were excluded, as these hospitals would not be expected to transfer their pediatric torsion patients; these hospitals were defined as those with an average ED patient age of less than 10 y.[9] Finally, only patients who were either admitted to the same hospital or transferred to another short-term hospital were included; treated and released patients were assumed to be patients with intermittent torsion, rule out diagnoses, or miscoding.

Outcome and covariates

The primary outcome in this study was being transferred to another hospital. Patient-level characteristics considered included age (defined using the categories 1-8, 9-11, 12-14, 15-17, and 18-21 y), primary payer (defined as Medicaid, private insurance, self-pay, or other), median household income quartile for the patient's zip code (based on 2012 data: \$1-\$38,999; \$39,000-\$47,999; \$48,000-\$62,999; and $\geq$\$63,000), whether any other diagnosis was listed on the patient's record, weekend *versus* weekday visit, and the year and quarter of the year of the visit. Hospital-level characteristics evaluated included the average annual volume of pediatric ED patients seen during the years the hospital contributed to the NEDS in 2006-2012, geographic region (Northeast, Midwest, South, and West), trauma center status (level I or II *versus* level III or nontrauma), urban/rural designation, and teaching status. Detailed descriptions of the definitions of these hospital characteristics are available in the NEDS documentation.[10]

Statistical analysis

All statistical analyses were weighted to produce national estimates and were adjusted for the complex sampling design of the NEDS. Frequencies and percentages were used to summarize categorical variables overall and by whether a patient was transferred or admitted. Means and standard errors of the means were used to summarize continuous variables.