Straight to the Operating Room: An Emergent Surgery Track for Acute Testicular Torsion Transfers

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Objective To assess the effect of implementing an emergency surgery track for testicular torsion transfers. We hypothesized that transferring children from other facilities diagnosed with torsion straight to the operating room (STOR) would decrease ischemia time, lower costs, and reduce testicular loss.

Study design Demographics, arrival to incision time, hospital cost in dollars, and testicular outcome (determined by testicular ultrasound) at follow-up were retrospectively compared in all patients transferred to our tertiary care children's hospital with a diagnosis of testicular torsion from 2012 to 2016. Clinical data for STOR and non-STOR patients were compared by Wilcoxon rank-sum, 2-tailed t test, or Fisher exact test as appropriate.

Results Sixty-eight patients met inclusion criteria: 35 STOR and 33 non-STOR. Children taken STOR had a shorter median arrival to incision time (STOR: 54 minutes vs non-STOR: 94 minutes, $P < .0001$) and lower median total hospital costs (STOR: $3882 vs non-STOR: $4419, $P < .0001$). However, only 46.8% of STOR patients and 48.4% of non-STOR patients achieved surgery within 6 hours of symptom onset. Testicular salvage rates in STOR and non-STOR patients were not significantly different (STOR: 68.4% vs non-STOR: 36.8%, $P = .1$), but follow-up was poor.

Conclusions STOR decreased arrival to incision time and hospital cost but did not affect testicular loss. The bulk of ischemia time in torsion transfers occurred before arrival at our tertiary care center. Further interventions addressing delays in diagnosis and transfer are needed to truly improve testicular salvage rates in these patients. *(J Pediatr 2018;192:178-83).*

Approximately 15% of children presenting with acute unilateral scrotal pain will be diagnosed with testicular torsion, a frequent pediatric emergency affecting 3.8 per 100 000 boys in the US.[1,2] The identification and management of torsion-induced testicular ischemia is a race against time, for the rate of testicular salvage is highest within the first 6 hours of symptoms.[3-5] Obstacles to timely care are multifactorial, and in combination, contribute to post-torsion orchiectomy rates > 40% nationwide.[1,6,7]

Despite the urgency with which suspected torsions must be treated, approximately one-third of torsion patients will be transferred to a tertiary care center for their surgery.[8] Reasons for transfer include family preference, desire for pediatric anesthesia/surgical expertise, or unwillingness of the on-call local surgeon/urologist to care for a child with torsion. As the transfer inevitably adds to total ischemic time, the ability to accept these patients expeditiously is of utmost importance. Consequently, we implemented an emergent surgery track that maneuvered ultrasound-confirmed torsion transfers directly from the ambulance bay straight to the operating room (STOR), bypassing redundant emergency department (ED) re-evaluation. We hypothesized that STOR cases would have decreased arrival to incision time compared with those who were taken first to the ED, save healthcare dollars, and reduce testicular losses. For the first 52 months after implementation, a retrospective clinical effectiveness review was conducted as well as a cost analysis of this new management model.

Methods

With institutional review board approval, patients from February 2012 to May 2016 who received care at Children's Health (CH) with a diagnosis of testicular torsion were identified by *International Classification of Diseases, Ninth Revision* (608.2), *International Classification of Diseases , Tenth Revision* (N44.0), and current procedural terminology codes relating to orchiectomy, orchiopexy, or testicular

AC	Access center
CH	Children's Health
ED	Emergency department
STOR	Straight to the operating room

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torsion reduction (54600, 54620, 54650, and 54800). A retrospective chart review was performed to identify interhospital transfers. Exclusion criteria included (1) cases transferred via access center (AC) without sonographic confirmation of acute torsion, (2) perinatal torsion, (3) cases requiring additional medical evaluation because of comorbid conditions, (4) cases where an elective, nonurgent orchiectomy was performed secondary to length of ischemia time, and (5) cases performed at satellite facilities. Transferred cases meeting inclusion criteria were categorized as STOR and non-STOR by cross-referencing AC records of whom had been transferred STOR.

A clinical effectiveness database was constructed to compare outcomes of these 2 groups. Demographics, insurance status, imaging studies, operative reports, and follow-up clinical examinations were extracted from the medical record. The primary outcome of interest was time from arrival at CH to time of first incision (arrival to incision time). The secondary outcomes of interest were overall ischemia time, testicular loss, and hospital cost. Overall ischemia time was defined as total time from symptom onset to first incision. Patients achieving surgery within 6 hours were considered to have undergone treatment within the critical ischemic window. Testicular loss was defined as either surgical orchiectomy or determination of significant atrophy per routine postoperative ultrasound. A > 50% difference in volume compared with the contralateral testis or absence of blood flow on Doppler was considered to represent testicular loss.[9] Hospital cost was defined as all direct and indirect hospital costs obtained from the CH billing database. Ambulance costs were excluded as these values were available only for patients transported by CH ambulances. Totals were adjusted for inflation employing monthly, seasonally adjusted chain-type price indices and are presented in constant 2016 US dollars.

STOR Pathway

In 2012, CH implemented a novel pathway to improve the care of sonographically diagnosed torsion transfers by bypassing the ED. After receiving a physician transfer request, CH AC employees initiated the STOR pathway by establishing a physician-to-physician phone conversation. This conversation established patient history and physical examination, including symptom duration and the results of the testicular ultrasound. After telephone confirmation by the accepting pediatric urologist, the AC arranged patient transfer and relayed estimated time of arrival information to the on-call nursing staff for operating room team mobilization. Patients were transported directly from the ambulance bay to the preoperative area, then promptly re-evaluated by the pediatric urologist and anesthesiologist; if surgery was still indicated, consents were obtained, and the child was taken directly to the operating room.

Not all transferred patients undergoing surgical detorsion went through the STOR pathway at our hospital. Reasons for this included (1) transfers arranged outside of the AC, (2) failure of the AC to initiate the STOR process, and/or (3) failure of the accepting pediatric urologist to utilize the STOR pathway. As the STOR pathway became better established and known by hospital employees, implementation improved yearly from only 20% execution in 2012 to 100% execution in 2016 (**Figure 1**).

Surgical Exploration for Suspected Torsion

All patients for whom surgery was indicated proceeded to the operating room for scrotal exploration. During the duration of the study period, most patients with confirmed torsion underwent orchiopexy regardless of presumed testis viability in accordance with a separate, ongoing, National Institutes of Health-funded clinical trial. In rare cases performed by

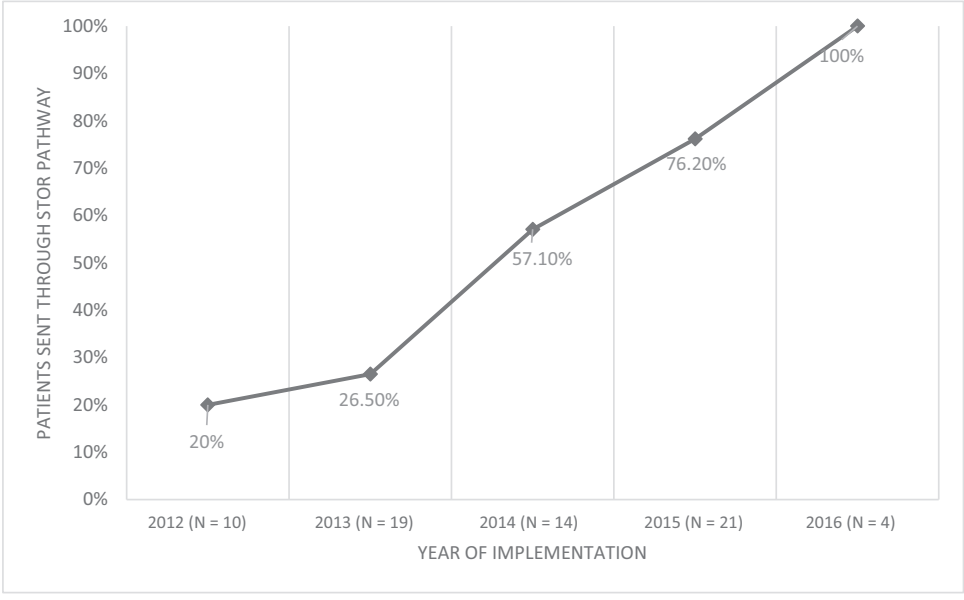

Figure 1. Success of STOR implementation from 2012 to 2016: Percentage of transfer patients sent through STOR pathway by year.