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Original Contributions

A COMPARISON OF ACCIDENTAL AND NONACCIDENTAL TRAUMA: IT IS WORSE THAN YOU THINK

Jordan M. Estroff, MD,* Robert P. Foglia, MD, FACS,* and Julie R. Fuchs, MD, FACS†

*Division of Pediatric Surgery, Department of Surgery, University of Texas Southwestern Medical Center, Children's Medical Center, Dallas, Texas and †Lucille Packard Children's Hospital, Stanford University School of Medicine, Palo Alto, California

Reprint Address: Robert P. Foglia, MD, FACS, Division of Pediatric Surgery, Department of Surgery, University of Texas Southwestern Medical Center, Children's Medical Center, 1935 Medical District Drive, Dallas, TX 75235

☐ **Abstract—Background: Child abuse, or nonaccidental trauma (NAT), is a major cause of pediatric morbidity and mortality, and is often unrecognized. Our hypothesis was that injuries due to accidental trauma (AT) and NAT are significantly different in incidence, injury, severity, and outcome, and are often unrecognized. Objective: Our aim was to carry out an examination of the differences between pediatric injuries due to AT and NAT regarding incidence, demographics, injury severity, and outcomes. Methods: A 4-year retrospective review of the Trauma Registry at Children's Medical Center Dallas, a large Level I pediatric trauma center, comparing incidence, age, race, trauma activation, intensive care unit (ICU) need, Injury Severity Score (ISS), and mortality between AT and NAT patients was carried out. Results: There were 5948 admissions, 92.5% were AT and 7.5% were NAT victims. The NAT patients were younger (1.8 ± 3.3 years vs. 6.8 ± 4.2 years for AT patients; $p < 0.01$), more often required an ICU stay (NAT 36.5% vs. 13.8% for AT patients; $p < 0.0001$), and had a higher ISS 14.0 ± 9.7 vs. 7.5 ± 7.2; $p < 0.0001$). The mortality rate in NAT was 8.9% vs. 1.4% for AT ($p < 0.001$). Of the 40 NAT patients who ultimately died, 17.5% were not initially diagnosed as NAT. Conclusions: NAT victims differ significantly from the AT patients, with a greater severity of injury and a 6-fold higher mortality rate. Delayed recognition of NAT occurred in almost 20% of the cases. It is generally accepted that NAT is underestimated. Its increased mortality rate and severity of injury are also not well recognized compared to the typical pediatric trauma child.** © **2015 Elsevier Inc.**

☐ **Keywords—nonaccidental trauma; accidental trauma; pediatric surgery**

Institutional Review Board approval was obtained.

INTRODUCTION

Child abuse, or nonaccidental trauma (NAT), is often unrecognized until patients present with severe injury or death (1). In 2009, the U.S. Department of Health and Human Services (DHHS) reported 123,599 cases of pediatric physical abuse and a mortality rate of 1.4% (2). Over three decades, the outcomes of AT patients have improved. The national rate for pediatric trauma is approximately 2% nationally, as reported by the National Pediatric Trauma Registry (3). Our anecdotal experience is that NAT accounts for more severe injuries and a higher mortality rate than previously reported. Numerous articles have addressed accidental trauma (AT) and NAT. However, there are few articles comparing both NAT and AT. Roaten et al. showed a significant increase in head injury, thoracic, and integumental injuries ($p < 0.001$) in their 2006 study of NAT when compared to AT (3). The most common AT injuries were orthopedic, most often extremity fractures, while skull fractures and traumatic brain injury were the most common in

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the NAT group. The aim of this study is to compare incidence, demographics, severity of injury and outcomes of NAT to AT and see if differences exist.

METHODS

Children's Medical Center, Dallas (CMC) is an American College of Surgeons–verified Level I pediatric trauma center that admits 1400 to 1500 trauma patients annually. An Institutional Review Board–approved retrospective review of the Trauma Registry database at our hospital was performed for a 4-year period of January 2006 through December 2009. Inclusion criteria are all children in the Trauma Registry who were admitted to the hospital due to an acute injury. It also includes children who were dead on arrival or died in the emergency department (ED). Exclusion criteria include those trauma patients seen in the ED and discharged home without admission. A trained registrar completes a collection form for each patient in accordance with the National Trauma Data Bank guidelines. Our trauma program is a contributor to the National Trauma Data Bank.

Information reviewed includes patient age, sex, race, trauma etiology (NAT or AT), trauma activation, Injury Severity Score (ISS), hospital admission, intensive care unit (ICU) admission, need for operative intervention, mortality, death in the ED, and cause of death. Trauma activation was initiated based on anatomic, physiologic, and mechanism of injury criteria using the American College of Surgeons Committee on Trauma Guidelines (4). The trauma activation call was usually made by the ED physician after receiving information from the team transporting the child to the hospital, or after the child arrived at our hospital. Should any provider interacting with the patient, from emergency medical services to the attending physician, suspect NAT, a social work consult is initiated. If, after speaking with the guardian, the social worker agrees with the team that there is sufficient evidence of abuse, for example, bruising on a nonambulatory child or broken ribs on an infant, then the ED physician or ED advance practice professional will initiate a consultation to the REACH (Referral Evaluation of At Risk Children) team. The diagnosis of NAT is made by REACH. This team has a medical director, nursing personnel, and social workers, all of whom are specifically trained to evaluate the child and family in a potential NAT case. An ISS was assigned after all injuries were identified upon discharge or death. Data are presented as mean ± standard deviation (SD). Univariate analysis was performed using Fisher's exact, χ^2, or Student's *t*-test where appropriate, using GraphPad software (La Jolla, CA). Statistical significance was defined at the $p < 0.05$ level.

RESULTS

A total of 5948 patients were entered into the study. Patient demographics are shown in Table 1. There were 5499 (92.5%) AT and 449 (7.5%) NAT admissions (Figure 1A). Males accounted for the majority of patients in both groups, and the percentage was not statistically different. The mean ± SD age of AT victims was 6.8 ± 4.2 years, older than the mean age of NAT patients (1.8 ± 3.4 years; $p < 0.0001$).

There were a number of differences identified in the AT and NAT cohorts. Of the AT group, 13.8% required an ICU stay, compared to 36.5% of the NAT children ($p < 0.0001$). Mean ± SD ISS was 7.5 ± 7.2 for AT patients, almost doubling to 14.0 ± 9.7 for NAT patients ($p < 0.0001$). AT patients had trauma activation called more frequently (25.4% vs. 19.4% in the NAT group; $p < 0.005$). Operation was required at some point during their hospitalization in 49.9% of the AT patients and in 9.3% of the NAT patients ($p < 0.0001$). In the NAT cohort, African Americans were disproportionately represented at 29.6% vs. 14.5% in the AT population ($p < 0.001$). The length of stay between the two groups was not different, 3.4 ± 5.5 days for the AT patients vs. 4.1 ± 6.1 days for the NAT patients.

There was an overall 2% mortality rate, 1.4% in AT patients and 8.9% in NAT patients ($p < 0.001$) (Table 2 and Figure 1B). The 40 NAT deaths accounted for 34.5% of all mortalities in the study. Patient characteristics for the fatalities are shown in Table 2. Similar to the admission data, the NAT patients who died were significantly younger in comparison to AT fatalities (1.7 ± 1.7 years vs. 5.3 ± 4.3 years; $p < 0.001$). There was a significant difference in the number of children pronounced dead in the ED, with 42.1% of the 76 AT deaths occurring in

Table 1. Demographics of All Trauma Registry Patients

Demographics	Accidental Trauma	Nonaccidental Trauma	*p* Value
Patients, n (%)	5499 (92.5)	449 (7.5)	
Age (years), mean ± SD	6.79 ± 4.22	1.82 ± 3.38	<0.0001
Male, n (%)	3416 (63.5)	252 (56.9)	
Race, n (%)			
Caucasian	2272 (41.3)	121 (26.9)	<0.001
African American	797 (14.5)	133 (29.6)	<0.001
Hispanic	2052 (37.3)	161 (35.3)	
Other	378 (6.9)	34 (7.6)	
Trauma activation, n (%)	1388 (25.4)	86 (19.4)	<0.005
Operation, n (%)	2742 (49.9)	42 (9.3)	<0.0001
ICU admission, n (%)	757 (13.8)	164 (36.5)	<0.0001
ICU LOS, mean ± SD	3.4 ± 5.52	4.14 ± 6.14	
ISS, mean ± SD	7.5 ± 7.2	14.0 ± 9.7	<0.0001
Mortality, n (%)	76 (1.4)	40 (8.9)	<0.001

ICU = intensive care unit; ISS = injury severity score; LOS = length of stay.