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Nasal fractures in children and adolescents: Mechanisms of injury and efficacy of closed reduction☆

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ABSTRACT

Objectives: To determine the most common mechanisms of traumatic nasal deformity referred to pediatric otolaryngology. To examine the efficacy of closed reduction of nasal fractures in children and adolescents based on the parents' and surgeons' ratings of post-reduction nasal symmetry.
Methods: Case series and chart review within an urban, tertiary pediatric otolaryngology practice.
Results: 100 cases of traumatic nasal deformity met inclusion criteria over a 3-year study period. The mean age at presentation was 13 years (4 weeks–18 years); 55% were male and 70% were over the age of 12 years. The most common mechanism of injury was sports-related trauma (28%), followed by accidental trauma (21%), interpersonal violence (10%), motor vehicle collision (6%) and alcohol-related (2%). Of these 100 cases, 22% underwent closed reduction within a 14-day period following injury. All patients achieved symmetry in the operating room immediately following reduction. 21 of 22 post-reduction patients were assessed for nasal symmetry at the postoperative visit (7–10 days following surgery). The operating surgeon was satisfied with nasal symmetry in 43% of cases and the parent(s) satisfied in 81% of cases. Both parent and surgeon were satisfied with post-reduction symmetry 33% of the time.
Conclusion: The most common sources of traumatic nasal deformity in children and adolescents vary by age. In cases meriting operative intervention, parents appear to be satisfied with early postoperative results following closed reduction in approximately 80% of cases, however a result in which both parent and surgeon agree with successful re-establishment of symmetry occurs in only one-third of cases.

1. Introduction

Previous case series have highlighted differences in the epidemiology of pediatric and adult facial fractures [1,2]. Prior studies suggest that motor vehicle collisions may be the most common mechanism of pediatric nasal injury in the United States and Canada, however much of the data used in these reports was collected from rural areas or regional trauma centers [3,4]. The causes of traumatic nasal deformity among urban populations are less defined within the pediatric age group. There is also little known about the demographics of pediatric nasal fractures in the urban setting, especially in regard to differences in rates between genders and among races. Additionally, there is a paucity of data as it pertains to the efficacy of closed reduction of nasal fractures in children and adolescents compared to adults [2]. Children are more prone to greenstick fractures and the effectiveness of attempted reduction of such injuries in this population is not certain. As to whether or not younger children have more greenstick injuries than older children is also unknown, and the age at which the efficacy of closed reduction in a child approaches that of an adult has not been defined.

The goal of this study was to examine the mechanisms and demographics of pediatric nasal injuries in an urban practice. We also attempted to examine the efficacy of early surgical intervention by determining the rates of parent and provider satisfaction following closed reduction of nasal fractures in the younger child, prepubescent and teenage populations.

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Table 1
Gender and racial characteristics within each age subgroup among 100 children who presented to an urban, tertiary pediatric otolaryngology practice with nasal fractures.

	Total (n = 100) (%)	Age 0–5 yr (n = 10) (%)	Age 6–11 yr (n = 17) (%)	Age 12–18 yr (n = 73) (%)	p Value: test for significant relationship between age category and gender/race
Male	55 (55)	2 (20)	9 (53)	44 (60)	
					p = 0.06
Asian	8 (8)	2 (20	2 (12)	4 (5)	
Black	7 (7)	0 (0)	4 (24)	3 (4)	
Hispanic	10 (10)	1 (10)	0 (0)	9 (12)	
White	66 (66)	5 (50)	11 (65)	50 (68)	
Other/unknown	9 (9)	2 (20)	0 (0)	7 (10)	
					p = 0.04

2. Methods

After institutional review board approval was obtained, a pediatric otolaryngology practice database was queried for diagnosis codes consistent with nasal fracture and traumatic nasal deformity (International Classification of Diseases 9th edition (ICD-9) codes: 738, 802, 802.1, and 470). Consecutive cases presenting to the pediatric otolaryngology service at an urban, tertiary pediatric level-1 trauma center were identified over a three-year study period. Patients referred to this institution primarily reside within urban or densely populated suburban areas. Patients' charts were reviewed for age, sex, race, mechanism of injury, and choice of management (observation versus closed reduction). Patient charts lacking any of these qualifiers were excluded, with the exception of subjects who did not wish to identify themselves by race and subjects with an unknown mechanism of injury. Imaging was not obtained by the otolaryngology team for uncomplicated nasal injury, whereas computed tomography (CT) of the facial bones was obtained in cases of severe facial trauma when multiple facial fractures were suspected. If imaging was obtained by other departments, it was not used in the diagnosis of nasal fracture; diagnosis was made by physical examination. Criteria for intervention by closed reduction included prompt referral within 7–10 days of trauma and appreciable nasal asymmetry on examination. For those patients who underwent closed reduction, the operative notes and postoperative clinic notes were reviewed. Closed reduction was performed under general anesthesia following decongestion with topical oxymetazoline. Nasal bones were repositioned with a Boies elevator and Asch forceps and stabilized with a commercially available external splint. In 7 patients (33%), internal nasal packing with Gelfoam, Merocel, or Surgicel was used as a bolster for mobile nasal bones based on surgeon's preference, and removed or allowed to dissolve during the first postoperative week. The external splint was removed at the 1-week postoperative visit. To be included in the outcomes aspect of this study, clear notation of the surgeon's perception of symmetry in the operating room and at the 1-week postoperative visit was required. Similarly, only subjects with documentation of a level of parental satisfaction at the postoperative visit were included for the outcomes arm of the study. Unsatisfactory results were defined as presence or absence of any persistent asymmetry on frontal view of the nose, from nasal tip to brow.

Data was collated in a spread sheet for tabulation (Microsoft Excel), Student's t-test was performed to make pairwise comparisons, and Pearson chi-squared tests were used to test the hypothesis of random distribution of statistical events across multinomial codings. Statistical significance was set at $p < 0.05$.

3. Results

Over a 3-year study period spanning October 2010 through September 2013, there were 100 cases of traumatic nasal deformity that met inclusion criteria. The mean age at presentation was 13 years (4 weeks–18 years); 55% were male and 70% were over age 12 years. The majority of patients were Caucasian (66%) followed by Hispanic (10%), unknown/other race (9%), Asian (8%) and black (7%). Asian patients tended to present at a younger age and black children most commonly presented between ages 6 years and 12 years (p = 0.04) (Table 1). Overall, the most common mechanism of injury was sports-related trauma (28%), followed by accidental trauma (21%), interpersonal violence (10%), motor vehicle collision (6%) and alcohol-related (2%). The mechanisms of injury varied by age with accidental fall and birth trauma predominating in the 0–5 years group, accidental fall in the 6–11 years group, and sports-related injuries in the 12–18 years group ($p < 0.0001$) (Table 2).

Imaging was obtained in 14% of cases, with plain radiographs ordered in 9% of cases, and CT obtained in 5% of cases. In all cases other than those concerning for multiple facial fractures, imaging was ordered by a primary care physician or by emergency department staff.

Table 2
Mechanism of injury varies by age subgroup among children who presented with nasal fractures. MVC-motor vehicle collision; EtOH-alcohol-related injury.

	Total (n = 100) (%)	Age 0–5 yr (n = 10) (%)	Age 6–11 yr (n = 17) (%)	Age 12–18 yr (n = 73) (%)	p-Value: test for significant relationship between age category and mechanism of injury
Sports	28 (28)	0 (0)	4 (24)	24 (33)	
Accidental trauma	10 (10)	0 (0)	2 (12)	8 (11)	
Accidental fall	20 (20)	5 (50)	9 (53)	6 (8)	
Interpersonal violence	10 (10)	0 (0)	1 (6)	9 (12)	
MVC	6 (6)	0 (0)	0 (0)	6 (8)	
Congenital/birth trauma	4 (4)	3 (30)	0 (0)	1 (1)	
EtOH	2 (2)	0 (0)	0 (0)	2 (3)	
Other/unknown	20 (20)	2 (20)	1 (6)	17 (23)	
					$p < 0.0001$