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# Original Contributions

# PREVALENCE OF RETINAL HEMORRHAGES IN INFANTS PRESENTING WITH ISOLATED LONG BONE FRACTURES AND EVALUATION FOR ABUSE

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☐ **Abstract—Background: Fractures are a frequent reason for emergency department visits and evaluation for abusive head trauma is an associated concern in infants. Recent guidelines have suggested that retinal examination may not be necessary in the absence of intracranial injury, but there is a lack of empirical evidence in infants < 1 year of age. Objective: Our aim was to evaluate the prevalence of retinal hemorrhages in infants with isolated long bone fractures. Methods: Retrospective chart review of infants < 1 year of age who presented to an urban, tertiary care pediatric hospital between January 2004 and April 2014 with the diagnosis of an acute long bone fracture or retinal hemorrhages. Patients were excluded for head injury, altered mental status, injury mechanism of motor vehicle accident, multiple fractures or injuries outside the fracture area. Patients were identified through trauma registry data and International Classification of Diseases codes. Results: One hundred and forty-six patients had isolated long bone fractures, of which 68 patients did not undergo a retinal examination and 78 patients had dilated eye examinations, with no patients identified as having retinal hemorrhages. There were 46 patients identified with retinal hemorrhages concerning for abuse. No patients with retinal hemorrhages had isolated long bone fractures. Conclusions: In infants < 1 year of age presenting with isolated long bone fractures, a dilated eye examination to evaluate for retinal hemorrhages is not likely to yield additional information. Our results support recent studies that a subset of children and infants may not require dilated eye examinations in the evaluation of possible abuse.** 

☐ **Keywords—retinal hemorrhages; fracture; child abuse; infant; child**

## INTRODUCTION

According to the U.S. Department of Health and Human Services, approximately 2% of children < 1 year of age were victims of abuse (1). In children < 12 months of age, 25% of all fractures result from abuse (2). Acute fractures are a frequent reason for emergency department (ED) visits and constitute 10%–25% of all pediatric injuries (3). Determining whether the injury is inflicted vs. accidental is essential to preventing repetitive abusive injuries, particularly in nonverbal patients. When a nonambulatory or young patient presents with an acute fracture, evaluation for associated abusive head trauma (AHT) is a critical concern, as head trauma is the primary cause of mortality in abused children (4,5). Current recommendations state young and nonambulatory patients presenting with a fracture and concern for abuse should be evaluated utilizing a detailed history, physical examination, skeletal survey, and a computed

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tomography (CT) of the head (6,7). Guidance from the American Academy of Pediatrics has recommended a dilated eye examination by an ophthalmologist with pediatric experience to evaluate for retinal hemorrhages (RHs) in any infant or young child who is a suspected victim of physical abuse (8). Only the most recent guidelines have suggested that retinal examination may not be necessary in the absence of intracranial injury, but there is a lack of empirical evidence in infants < 1 year of age in isolation from older children (9).

Evaluation by an ophthalmologist with pediatric experience often requires transfer of patients to tertiary care centers. Even when an ophthalmologist with pediatric experience is accessible, retinal examination increases patient and familial stress, expends more resources, and increases costs. Recent studies that included children up to 2 years of age and older have shown that dilated eye examinations may not be required in all children evaluated for abuse (10–13). The purpose of this study was to determine the prevalence of RH in patients < 1 year of age with a long bone fracture and no other identified signs of abuse. We also sought to identify infants at low risk for RH who may not require a dilated eye examination on a routine basis.

## MATERIALS AND METHODS

This study is a retrospective chart review of children < 1 year of age who were evaluated in the ED or inpatient unit at a tertiary care children's hospital for either an isolated acute long bone fracture or retinal hemorrhages from January 2004 through April 2014. The study was approved by the Institutional Review Board at the academic center. Exclusion criteria were known head injury, altered mental status, the injury was sustained in a motor vehicle accident, multiple fractures not of a single bone group (radius/ulna or tibia/fibula), and signs of injury away from the fracture site, including bruising, lacerations, petechia, hematomas, or areas of swelling.

Patients were identified through the trauma registry and billing office by querying for any fracture using International Classification of Diseases (ICD) codes 800.00–829.1. Patient data were collected from paper records (January 2004 through April 2010) and electronic medical records (April 2010 through April 2014). For those patients included in the final analysis, collected data included age, sex, presence of and description of retinal hemorrhages, location and type of fracture, and whether a skeletal survey or CT of the head was performed. Information on race was not consistently available and was not recorded. All charts were reviewed by a board-certified pediatrician. To ensure reliability of the data, patient information was subsequently reviewed by a board-certified child abuse pediatrician or a board-certified pediatric emergency physician. To verify that no patients with RH were missed, an additional search was performed using ICD code 362.81 for RH. At our institution, RH data were also included in the trauma registry beginning in 2008. Charts of patients identified as having RH were reviewed to ensure no patients were missed by fracture ICD codes and trauma registry database information. Presenting chief complaint and initial presentation to the ED were also identified for those with RH. Demographic variables for patients undergoing a retinal examination vs. those who did not were compared using the Mann-Whitney U test, $\chi^2$ test, or Fisher's exact test, as indicated. A $p$ value < 0.05 was considered statistically significant. Analyses were performed using SPSS software, version 21.0 (IBM Corporation, Armonk, NY).

## RESULTS

A total of 810 patients with long bone fractures were identified, of which 146 patients had isolated long bone fractures (Figure 1). Of those with isolated long bone fractures, 78 patients underwent dilated eye examinations and 68 patients did not undergo a retinal examination. Of the 78 patients with isolated long bone fractures and retinal examinations, none had retinal hemorrhages. Subanalysis of this group showed that all of the patients had skeletal surveys and 53 had a CT of the head performed. Of the 68 patients without retinal examinations 53 had skeletal surveys and 13 had a CT of the head performed. Those

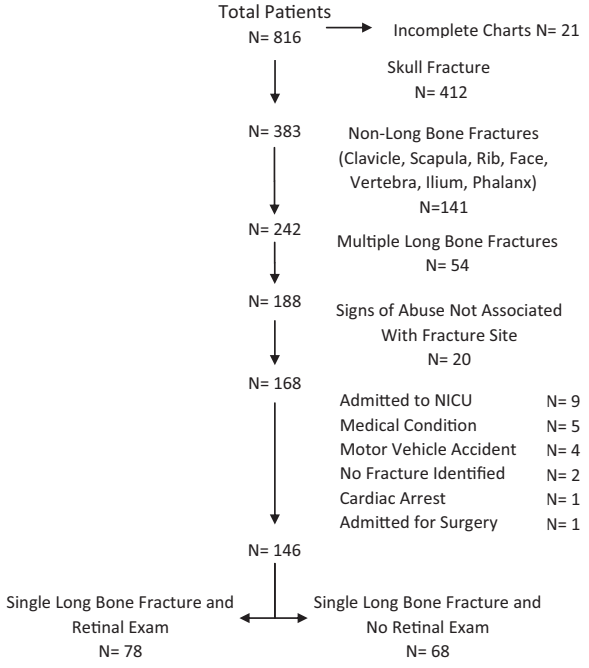


**Figure 1. Study flow diagram. NICU = neonatal intensive care unit.**