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Age-Based Screening for Non-Accidental Trauma in Children Less than 3 Years Old with Femur Fracture

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LOE-Diagnostic-Level III

Purpose: Non-accidental trauma (NAT) is the second most common cause of death in children. AAOS CPG recommends NAT workup in children under 36 months who present with a femur fracture based on studies reporting a 13% incidence of NAT in this population. However, neither concomitant factors that increase risk nor a specific workup protocol have been described in the literature. The purpose of this study is to identify concomitant risk factors and determine the effectiveness of an age-specific screening protocol to identify NAT in children under 36 months with a femur fracture.

Methods: We performed an IRB-approved, retrospective review of 475 patients under 36 months who presented with a diaphyseal femur fracture from 2012-2018. Exclusions included workup at outside hospital and fractures due to MVC, OI, or birth. Data included outcome of NAT workups, demographics (ethnicity, gender, socioeconomic status, number of previous EC visits/other fractures, mechanism of injury, timing of presentation from injury). Patients were divided into age groups 0-6 months, 6-12 months, 1-2 years, and 2-3 years per our institution's age-specific NAT protocols (Figure 1).

Results: 417 patients were included. 315 (75.5%) had a complete work-up per protocol. 77/315 (24.4%) had a positive NAT workup resulting in removal from the caregiver. 38/61 (62.3%) patients 0-6 months were positive for NAT and were more likely to have a positive workup (OR 9.39) compared to other age groups. Ages 1-2 years had the highest rate of incomplete workup (55.17%). More boys presented with femur fractures (66.8%), but girls were more likely to have a positive workup (OR 2.38). Time from injury to presentation of greater than 5 days or unknown number of days was significant for NAT ($p < 0.0001$; OR 7.43). No significant difference in rate of NAT was found for mechanism of injury, ethnicity, or number of previous EC visits/other fractures.

Conclusions: To our knowledge, this is the largest study reporting rates of NAT in young children with femur fractures. An age-specific NAT screening protocol resulted in higher rates of positive NAT workups compared to historical literature (24.4% vs 13%) indicating that the AAOS CPG is even more important given that NAT is likely underidentified. Compounding risk factors for NAT in patients with femur fracture include age 0-6 months, female gender, and time from injury to presentation of 5+/unknown days.

Significance: NAT in young children with femur fractures may be under-identified and risk factor-based screening may improve our ability to protect young children.

Figure 1. Institutional age-based NAT screening protocol

- Children age 0-6 months
 - Non-accidental blood panel (amylase, lipase, CBC)
 - Skeletal survey
 - Head CT
- Children 6 – 12 months
 - Non-accidental blood panel (amylase, lipase, CBC)
 - Skeletal survey
 - Head CT (optional)
- Children 12-24 months
 - Non-accidental blood panel (amylase, lipase, CBC, etc.)
 - Skeletal survey
- Children 24-36 months
 - H&P (Has to mention whether NAT a concern, mechanism of injury, full exam)