Pathoanatomy of the medial comminution of pediatric distal humeral supracondylar fracture: Assessment using CT images

Ryu Igaki¹, Tomohiro Yasuda¹, Yuki Samejima¹, Yuko Irie¹, Yuto Murakami¹, Taisuke Yoneya², Keikichi Kawasaki¹, Koji Kanzaki¹

¹Showa University Fujigaoka Hospital, Yokohama, Japan, ²Yokohama Shintoshi Neurosurgical Hospital, Yokohama, Japan, ³Showa University Northern Yokohama Hospital, Yokohama, Japan, ⁴Showa University, Tokyo, Japan

E-mail: ryu.1.9669@gmail.com

Disclosures: Ryu Igaki(N), Tomohiro Yasuda(N), Yuki Samejima(N), Yuko Irie(N), Yuto Murakami(N), Taisuke Yoneya(N), Keikichi Kawasaki(N), Koji Kanzaki(N)

INTRODUCTION: Closed reduction and percutaneous pin fixation are the most common treatment methods for pediatric humeral supracondylar fractures. Medial comminution has been reported as a risk factor for the loss of reduction. However, medial comminution has traditionally been assessed using plain radiographs. To the best of our knowledge, no study has been performed to assess the pathoanatomy. We aimed to define the pathoanatomy of medial comminution using CT images.

METHODS: We collected all pediatric supracondylar fracture treated at our affiliated hospitals over a 7-year period (2017-2023). A total of 162 children underwent surgery. CT scans were taken for 83 patients. The inclusion criteria required the presence of medial comminution on CT images. The exclusion criteria encompassed individuals aged >12 years, flexion-type fractures, T-condylar fractures, patients with bone metabolic disorders, and diaphyseal fractures. Fracture classification was evaluated using the Wilkins-modified Gartland classification system based on preoperative anteroposterior and lateral radiographs. Medial comminution was evaluated based on reformatted CT images.

RESULTS SECTION: This study included a total of 39 patients, comprising 28 males and 11 females. The patients had an average age of 6.7 years, with an age range between 3 and 10 years. The fracture occurred in the right arm of 14 patients and the left arm of 25 patients. 13 cases were Wilkins-modified Gartland Type Iib, 26 cases were Type III fracture. Medial comminution was further classified into Type A, which involved partial fragments on the medial column, and Type B, which represented complete damage. Type A fractures were typically characterized by the presence of posterior medial small fragments or with posterior medial compression fractures. Out of the total cases, 31 were classified as Type A, while 8 were identified as Type B.

DISCUSSION: Supracondylar humerus fractures are common in children. The Wilkins-modified Gartland classification system is the most widely used classification. Treatment usually is directed according to these fracture types. Medial comminution is associated with a loss of Baumann’s angle and varus malalignment. There is a trend toward lateral-only pin fixation. When lateral-only pin fixation is applied to pediatric supracondylar fractures, medial comminution is considered a risk factor for loss of reduction. However medial comminution has been defined as a lack of cortical contact on the medial column, determined by the presence of a small butterfly fragment or comminuted small fragment visible on radiographs. To our knowledge, no report has been conducted assessing the pathoanatomy of medial comminution. We conducted an assessment of the pathoanatomy of medial comminution using CT images. We identified 2 subtypes: cases in which medial comminution was only posterior or involved small fragments posteriorly were classified as Type A, and cases involving the entire collapse of the medial column were classified as Type B. We found that Type A is approximately 80%, and Type B is approximately 20%. Our study has several limitations. This was retrospective study and has selection bias. We did not investigate the correlation with clinical outcome.

SIGNIFICANCE/CLINICAL RELEVANCE: This study holds significant clinical relevance in addressing the lack of medical knowledge concerning the pathoanatomy of medial comminution in pediatric supracondylar humerus fractures. By comprehensively evaluating the patterns of medial comminution, this study has the potential to aid in assessing fracture stability, guiding pin configuration, and reducing the likelihood of Loss of Reduction.

FIG.1.Type A  FIG.2.Type B