International Orthopaedics (2019) 43:1543–1544
https://doi.org/10.1007/s00264-019-04293-2

LETTER TO THE EDITOR

Letter to the Editor on "The impact of the third fragment features on the healing of femoral shaft fractures managed with intramedullary nailing: a radiological study"

Shih-Jie Lin[1] · Kevin Liaw[2] · Tsan-Wen Huang[1,3]

Received: 23 December 2018 / Accepted: 2 January 2019 / Published online: 15 January 2019

We read with great interest the article by Giovanni Vicenti et al. "The impact of the third fragment features on the healing of femoral shaft fractures managed with intramedullary nailing: a radiological study" in the September 2018 edition of International Orthopaedics [1]. The study suggests that the third fragment size (cut-off 40 mm) and the mean third fragment displacement (cut-off 12 mm) are the leading factors to influence the fracture healing.

The authors measured the third fragment angle, fracture gap, third fragment size and mean third fragment displacement. Compared to our previous work [2], the authors added fragment angle to investigate the potential effect of the third fragment in the bone healing. As similar data from An et al. and Lee et al. [3, 4], the third fragment degree of displacement and the third fragment size play leading roles in this issue. It is undoubted that the authors use logistic regression analysis to depict a very conclusive message for prognosis. However, the authors neglected to address inter-observer reliability. This creates an obvious bias. The consistency or reliability in the measurement of the four parameters may be different. We believe the consistent measurement of the fracture gap should be better than the measurement of fragment angle or displacement due to various fragment positions and appearances. This may give out an unsubstantiated message of the algorithm to readers.

The authors investigate many characteristics of the third fragment but the fragment width. Actually, the fragment width plays an important role in the degree of the Winquist classification [5]. This system depicted the comminution of femoral shaft fractures, especially, in the case of a butterfly fragment. In biomechanics and biology of fracture healing, the butterfly fragment width of the bone may have more impact on stability at the fracture site than other parameters. It was believed that micromotion at the fracture site enhanced indirect fracture healing and too much motion resulted in delayed healing or non-union [6]. After the inflammation phase, granulation tissue, cartilaginous callus formation and ossification all occurred depending on the interfragmentary strain at the fracture site. Woven bone forms once the strain falls below 1% [7]. A wider third fragment usually implicates a small surface area of contact at the fracture gap of proximal and distal fragments. We believed that this may be a key factor in affecting cyclical micromotion/load and eventually fracture healing time.

References

1. Vicenti G, Carrozzo M, Caiaffa V et al (2018) The impact of the third fragment features on the healing of femoral shaft fractures managed with intramedullary nailing: a radiological study. Int Orthop 2018 Nov 17. **[Epub ahead of print]**. https://doi.org/10.1007/s00264-018-4214-2
2. Lin S-J, Chen C-L, Peng K-T, Hsu W-H (2014) Effect of fragmentary displacement and morphology in the treatment of comminuted femoral shaft fractures with an intramedullary nail. Injury 45:752–756. https://doi.org/10.1016/j.injury.2013.10.015
3. An K-C, Kim Y-J, Choi J-S et al (2012) The fate of butterfly fragments in extremity shaft comminuted fractures treated with closed interlocking intramedullary nailing. J Korean Fract Soc 25:46. https://doi.org/10.12671/jkfs.2012.25.1.46
4. Lee JR, Kim H-J, Lee K-B (2016) Effects of third fragment size and displacement on non-union of femoral shaft fractures after locking

✉ Tsan-Wen Huang
b8601081@cgmh.org.tw

[1] Department of Orthopaedic Surgery, Chang Gung Memorial Hospital, No. 6, West Section, Chia-Pu Road, Pu-Tz City 61363, Chia-Yi Hsien, Taiwan

[2] Department of Diagnostic Radiology, Blount Memorial Hospital, Maryville, TN 37804, USA

[3] College of Medicine, Chang Gung University, Taoyuan City 33302, Taiwan

for intramedullary nailing. Orthop Traumatol Surg Res 102:175–181. https://doi.org/10.1016/j.otsr.2015.11.014

5. Winquist RA, Hansen ST Jr (1980) Comminuted fractures of the femoral shaft treated by intramedullary nailing. Orthop Clin North Am 11(3):633–648 https://www.ncbi.nlm.nih.gov/pubmed/7413179
6. Marsell R, Einhorn TA (2011) The biology of fracture healing. Injury 42(6):551–555. https://doi.org/10.1016/j.injury.2011.03.031
7. Nyary T, Scammell BE (2015) Principles of bone and joint injuries and their healing. Surgery 33(1):7–14. https://doi.org/10.1016/j.mpsur.2014.10.011