

*OTA Annual Meeting Oct 12, 2013*

*The Operative versus Non-operative Treatment of Common*

*Upper Extremity Injuries: What Does Evidence Based*

*Medicine Tell Us?*

## Fractures of the Clavicle

Michael D. McKee

Professor, Division of Orthopaedic Surgery  
Department of Surgery, St. Michael's Hospital and the  
University of Toronto, Toronto, Canada

**1. Introduction:** Clavicle fractures are common injuries accounting for 2.6% of all fractures<sup>1</sup> and occur most commonly in young active individuals<sup>2</sup>. Middle third (or mid-shaft) fractures account for approximately 80% of all clavicle fractures<sup>1,2</sup>, and have traditionally been treated non-operatively, even when significantly displaced. However, more recent studies have shown non-union rates of up to 21% in displaced midshaft clavicle fractures and unsatisfactory patient oriented outcomes in up to 31%. In addition, clavicular malunion has recently been described by multiple authors as a distinct clinical entity with characteristic clinical and radiographic features. Possible explanations for the increased residual disability seen following the non-operative care of these fractures may be changing injury patterns, increased patient expectations, more complete follow-up (including patient-oriented outcome measures) and eliminating children (with their inherently good prognosis and remodeling potential) from the data analysis. It is clear that there is a role in selected individuals for primary operative fixation of displaced fractures of the shaft of the clavicle.

## **2. The incidence of nonunion following non-operative care of displaced mid-shaft fractures of the clavicle**

A number of recent studies of completely displaced, mid-shaft fractures of the clavicle reveal nonunion rates between 15% and 20%<sup>5,6</sup>. These studies were recently summarized in a meta-analysis that found a nonunion rate of 15.1% following non-operative care of these fractures<sup>7</sup>.

## **3. The incidence of symptomatic clavicular malunion following non-operative care**

Malunion of the clavicle is a distinct clinical entity with characteristic orthopaedic (weakness, easy fatigueability, scapular winging), neurologic (thoracic outlet syndrome) and cosmetic (droopy, asymmetric shoulder, difficulty with backpacks, shoulder straps etc.) symptoms<sup>9-12</sup>. It is associated with increasing degrees of clavicular shortening. While radiographic malunion is always seen following displaced clavicular shaft fractures, clinically symptomatic malunion has an incidence of 15-20%.

## **4. The rate of nonunion following surgical repair**

There are multiple, modern studies that show plate fixation is an extremely effective technique for treatment of clavicular shaft fractures with a low complication and nonunion rate<sup>14,15</sup>. A meta-analysis described a nonunion rate with plate fixation of 2.2%, which represents an 86% risk reduction for nonunion compared to the same fracture treated non-operatively (nonunion rate 15.1%)<sup>7</sup>. Intramedullary fixation is another option with a high, albeit variable, success rate.

## **5. Strength deficits following non-operative care.**

Hill et. al. were the first to use a patient-oriented outcome measure, and found 31% of patients described unsatisfactory outcome after non-operative care of displaced clavicle fractures<sup>6</sup>. This may be explained by significant residual strength deficits following the conservative treatment of these fractures. Using an objective strength testing protocol for both maximal effort and endurance (which had not been done previously) strength deficits ranging from 10% to 35% were found in patients a mean of 54 months after non-operative care of a displaced fracture of the clavicular shaft<sup>16</sup>.

## **6. Evidence-based medicine**

There are a number of randomized clinical trials that compare operative to non-operative treatment of displaced fractures of the clavicle. These studies provide clear facts that can be used when counseling patients regarding treatment options.

## 7. Summary

The choice to proceed with operative intervention for a displaced mid-shaft fracture of the clavicle will be a decision made between surgeon and patient. There is increasing evidence from Level 1 prospective and / or randomized trials that, for carefully selected patients, primary operative fixation of displaced clavicular fractures results in superior outcome.

## 8. References

1. Neer, C “Fractures of the Clavicle” *Fractures in Adults*, Rockwood and Green Eds, JB Lippincott, 2<sup>nd</sup> edition ,p 707-713.
2. Rowe CR. An atlas of anatomy and treatment of midclavicular fractures. *Clin Orthop Rel Res.* 58:29-42, 1968.
3. Hill JM, McGuire MH, Crosby L “Closed treatment of displaced middle-third fractures of the clavicle gives poor results” *J Bone Joint Surgery(B)*, 79B, No.4, 1997; pp 537-541.
4. Robinson CM, Court-Brown CM, McQueen MM, Wakefield AE. Estimating the risk of nonunion following non-operative treatment of a clavicle fracture. *J Bone Joint Surg(A)* 86A:7, 1359-1365, 2004.
5. Zlowodzki M, Zelle BA, Cole PA, Jeray K, McKee MD. Treatment of mid-shaft clavicle fractures: Systemic review of 2144 fractures. *J Orthop Trauma.* Vol 19:7, 2005, 504-508.
6. Basamania CJ, “Claviculoplasty” *J Shoulder Elbow Surg*, Vol. 8, No. 5, 1999; p 540. (Abstracts: Seventh International Conference on Surgery of the Shoulder, 1999).
7. Chan KY, Jupiter JB, Leffert RD, Marti R “Clavicle malunion” *J Shoulder Elbow Surg*, Vol. 8, No. 4, 1999; pp 287-290.
8. Kuhne JE, “Symptomatic malunions of the middle clavicle” *J Shoulder Elbow Surg*, Vol. 8, No. 5, 1999; p 539. (Abstracts: Seventh International Conference on Surgery of the Shoulder, 1999).
9. McKee MD, Wild LM, Schemitsch EH. Midshaft malunions of the clavicle. *J Bone Joint Surg*, 85A:5, 790-797, 2003.
10. McKee MD, Pedersen EM, Jones C, Stephen DJG, Kreder HJ, Scemitsch EH, Wild LM, Potter J. Deficits following non-operative treatment of displaced, mid-shaft clavicle fractures. *J Bone Joint Surg(A)*, 2005.
11. Andersen K, Jensen PO, Lauritzen J. The treatment of clavicular fractures: Figure of eight bandage versus a simple sling. *Acta Orthop Scand.* 1987;58:71-74.
12. Potter J, Schemitsch EH, Jones C, Wild LM, McKee MD. Does delay matter? The restoration of objectively measured shoulder strength and patient-oriented outcome in immediate versus delayed reconstruction of displaced mid-shaft fractures of the clavicle. *J Shoulder Elbow Surg*, 2005.
13. McKee MD and the Canadian Orthopaedic Trauma Society. A multi-centre randomized controlled trial of non-operative versus operative treatment of displaced clavicle shaft fractures. *J Bone Joint Surg(A)*, 2007, Vol 1, pp 1-9.