



QUESTION : What is the latest thinking on clavicle fracture internal fixation?

ANSWER | The first thing to understand is that the clavicle can fracture in 3 distinct zones, medially, laterally or in the middle one third. The treatment will depend on which zone is injured. There have been many classifications described over the years but none of them have been particularly helpful when it came to treatment decision making. Robinson was the first to describe clavicle fractures in relation to their displacement and degree of comminution, *via* the Edinburgh classification. He then used his parameters to predict the risk of non-union, in such fractures, with good affect. The Edinburgh classification system has been shown to provide more reliable prognostic information in middle third fractures, in comparison to other classification systems.

Middle Third Fracture: Most fractures occur in the middle one third of the bone (85%). The majority of these are not significantly displaced and can be treated in a sling. The sling is used for comfort and range of motion exercises can be performed once the pain settles down. Figure of 8 slings/bandaging also can be used (but do not offer any advantage over a simple sling that supports the arm) and have a higher dissatisfaction rate because they are very uncomfortable. The teaching for many years has been that all clavicle fractures heal and none of them cause clinical problems, even with a significant malunion.

There were some (relative) indications for surgery of the clavicle and these included:

- If there was neurological or vascular compromise.
- If the skin was "threatened" because of pressure from the bone fragments.
- If the skin had been breached adjacent to the fracture (an 'open' fracture).
- If there was also a fracture of the shoulder blade (a floating shoulder)

Historical perspective: Since these are quite rare situations, most fractures ended up being treated with a sling. In the 1960s two famous surgeons reported their results of a large series of clavicle fractures treated nonoperatively with good outcomes. If you read their original papers they do suggest a subset of fractures that are best treated with surgery but somehow that part of the message got lost along the way. In these series a mal-union of the clavicle, where the clavicle heals in a shortened and rotated positioned, was considered to be of no consequence.

Over the last 20 years, reports have grown in the literature which question these long-held beliefs but the non-operative message is so strong and ingrained that the new evidence is still questioned.

The new data show that:

- Symptomatic non-union is much more common than previously reported
- Malunion can cause significant symptoms (particularly when the clavicle heals in a position of more than 2cm of shortening).
- Many fractures heal with a rotational deformity as well as shortening

Anatomy and Function: The clavicle is an "S" shaped bone. As the arm is raised above the head the shoulder moves closer to the sternum and this mechanism is interfered with when the clavicle heals in a shortened and rotated position. The end result is the major upper limb muscles now having to work over a shorter length. Studies on muscle contraction tension demonstrate that when a muscle is at a shorter resting length, its twitch tension decreases. In an active individual this can then lead to periscapular fatigue related pain as these muscles have to work harder to maintain high upper limb

function. There can also be significant cosmetic change with shortening of the whole shoulder girdle and issues such as thoracic outlet syndrome developing.

When things changed.... A trauma surgeon in Canada noticed that his patients with clavicle fractures did not universally do well (as he had been taught they would). He performed a high quality (Level 1) study in an attempt to find out if his observations were actually correct. His results demonstrated many advantages when treating displaced shortened middle one third clavicle fractures with an operation.

The main advantages of an operation reported in this study were:

- A lower risk of the bone not healing properly (non-union - 15% sling vs 1.6% plate and screws)
- A lower risk of the bone healing in a shortened position - which resulted in fatigue related symptoms in around the shoulder (15% sling vs 0% plate and screws)
- Improve function of the arm with an operation (DASH scores)
- A better body image

These results have been reproduced in other studies which followed but do not apply to fractures which are not significantly shortened or rotated.

Based on these studies and biomechanical analysis of upper limb movement with various degrees of clavicle shortening, we now tend to recommend surgery for fractures with about 2cm of shortening or significant malrotation, as well as the indications listed above.

Medial Third Fractures: Medial third clavicle fractures are the least common and can be the most difficult to treat. They are often very comminuted which makes internally fixing them almost impossible. Since they are cancellous bone they tend to heal well but very displaced fractures may benefit from internal fixation or perhaps a soft tissue reconstruction of the area. If they have shifted posteriorly and are causing a vascular or respiratory compromise they must be reduced and fixed.

Lateral Third Fractures: Lateral third fractures are basically classified according to whether they involve the coraco-clavicular ligament or not. If the fracture is medial to the coraco-clavicular ligament then the medial fragment of the clavicle is pulled upwards and often results in a non-union. If there is enough lateral bone to achieve rigid internal fixation they can be treated with plate fixation alone but often a coracoclavicular reconstruction is required as well. In situations where at least one of the coraco-clavicular ligaments are intact or if the fracture is lateral to them then sling treatment is usually effective.

Summary:

- Clavicle fractures are common.
- They do not all do well with non-operative treatment.
- Un-displaced midshaft fracture should be treated with a sling.
- Stable lateral fractures should be treated with a sling.
- Unstable lateral fractures need surgery.
- Displaced medial fractures may need surgery.
- Displaced, comminuted and shortened fractures should be treated with surgery in most cases.

As always, the advantages of an operation must be weighed against the risks of the surgery to allow the patient to make an informed choice. Ideally surgery should take place within 2 weeks of the injury and I encourage early referral for any patients who wish to discuss their options or who you feel may be appropriate candidates for surgery.

Doron Sher

**Nonoperative Treatment Compared with Plate Fixation of Displaced Midshaft Clavicular Fractures: A Multicenter, Randomized Clinical Trial; Canadian Orthopaedic Trauma Society, The Journal of Bone and Joint Surgery (American). 2007;89:1-10.*