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Bennett fracture dislocation

Review and management

Background
Bennett fracture dislocation is an intra-articular fracture of the base of the first metacarpal with resultant dislocation of the first carpometacarpal joint. The fracture is unstable, and with inadequate treatment leads to osteoarthritis, weakness and/or loss of function of the first carpometacarpal joint.

Objective
This article reviews the current literature on Bennett fracture and describes the clinical assessment and management of a Bennett fracture.

Discussion
Bennett fractures usually result from falling on an extended or abducted thumb or an impact onto a clenched fist. The patient presents with pain and loss of function of the first carpometacarpal joint. Management can involve closed reduction, with or without percutaneous Kirschner wire fixation, or open reduction and internal fixation, with adequate reduction and the maintenance of reduction being the key to a successful outcome. Due to the difficulty of management it is recommended that patients be referred to a specialist hand surgeon.

Keywords: metacarpal bones; intra-articular fractures; carpometacarpal joint; dislocation; hand; orthopedic procedures

Bennett fracture is an intra-articular fracture of the base of the first metacarpal with resultant dislocation of the first carpometacarpal joint.[1] It was initially described by Edward Hallaran Bennett in 1882.[2] Since its first description, the treatment of this fracture has remained the subject of much debate. The fracture is unstable and concern exists as to whether inadequate reduction/fixation leads to long term consequences such as osteoarthritis, weakness, or loss of function of the first carpometacarpal joint.

Most Bennett fractures are caused by indirect forces such as falling on an extended or abducted thumb or an impact onto a clenched fist. Many attribute these fractures to punching, in which the flexed and adducted thumb strikes the opponent's head or jaw.[3,4] However, the incidence from falls, motor vehicle accidents and work injuries appear similar.[5,6]

Bennett fracture accounts for around one-third of all fractures of the first metacarpal in adults. The fracture predominates in adult males and usually occurs in the dominant hand.[1]

Anatomy

The first carpometacarpal joint is unique in that it includes only an articulation between the trapezium and the base of the first metacarpal. The joint is completely isolated from the rest of the carpometacarpal joints of the hand. The articulation is saddle-shaped which allows greater motion, but consequently there is less inherent stability from the bony anatomy.

Of significance in Bennett fracture is the volar oblique ligament, or beak ligament, which inserts at the base of the first metacarpal and opposes the action of the abductor pollucis longus.[1] When a fracture occurs this opposing action is interrupted, an intra-articular fracture propagates separating a fragment which remains attached to this strong ligament and the pull of the abductor pollucis longus dislocates the remaining base of

Figure 1. Anatomy of a Bennett fracture

the thumb metacarpal.[6] *Figure 1* illustrates the anatomy of a Bennett fracture.

Clinical examination

The patient presents with pain and loss of function of the first carpometacarpal joint. Acutely this is always accompanied by haematoma and inflammation. Tenderness to palpation will be present over the proximal part of the first metacarpal. Decreased function will be present including reduced power in the thumb, inability to grip, weakness in pincer grip and reduced range of motion. Occasionally the thumb will appear shortened, and careful examination will reveal bony crepitus.[1,4]

Examination should start with initial observation looking for any deformities, both with the hand at rest and in flexion. Sensation should be examined next followed by active movements of all joints in the thumb. This is followed by examination of passive movements, and if appropriate, resisted movements to assess tendon function. If fracture is suspected plain film radiographs should be performed requesting views of the thumb.[7]

It is also important to remember that in cases where the injury has occurred due to trauma, patients should be examined appropriately to ensure they have not suffered any other injuries.

Management

Bennett fractures may be treated conservatively with closed reduction and plaster casting, closed reduction and percutaneous Kirschner wire fixation or via open reduction and internal fixation (ORIF). Each treatment modality has advantages and disadvantages and each requires significant expertise.

The major issue in closed reduction is to obtain and then maintain adequate fracture reduction to allow healing in an anatomical position. Consequences of inadequate fracture reduction in the short term are pain and grip weakness and in the long term, osteoarthritis of the first carpometacarpal joint.[8] For this reason these fractures should only be treated by specialist hand surgeons given the risk of future disability associated with inadequate reduction.

There are a number of methods of closed reduction. All of which involve traction on the thumb to pull the metacarpal distally with concurrent gentle pressure pushing the metacarpal base medially to return it to anatomical position.[1]

The most basic method of closed reduction is reduction of the fracture under adequate analgesia/sedation followed by plaster cast immobilisation for up to 6 weeks. Most early methods of closed reduction recommended a plaster slab holding the thumb in radial abduction. However cadaveric studies with simulated Bennett fractures suggested a cast with the thumb in a position of moderate adduction and opposition better reduced the fracture fragments.[9]

A second method of reduction described by Wagner involves reduction of the fracture followed by percutaneous insertion of a Kirschner wire through the base of the metacarpal across the joint and into the trapezium to hold the reduction in place.[8] This wire remains in place for a period of around 4 weeks, at which time the wire is removed and a rehabilitation program is started.

Spangberg and Thoren[10] described another method in which a Kirschner wire is placed into the distal metacarpal fragment and then traction is exerted on this wire via a frame and rubber bands to reduce the fracture and maintain this position.

Open reduction involves opening up the fracture and reduction under direct vision followed by insertion of either Kirschner wires or lag screws in order to hold the reduction in place (*Figure 2a, b*). All methods of open reduction are followed by treatment in a plaster slab for up to 4 weeks.

A study by Lutz et al[11] comparing ORIF with the Wagner technique suggested that the Wagner technique is preferable where there is a large proximal fragment and that ORIF should be used where the fracture is irreducible or a Kirschner wire is unable to be passed across the fracture into uninjured bone at the base of the thumb.

Figure 2a, b. Open reduction and internal fixation of a Bennett fracture

Many studies have shown unsatisfactory reduction using closed methods.[12–14] Contrasted with this are a number of studies which show a much higher percentage of patients with satisfactory reduction using ORIF.[9,10] Thurston and Dempsey suggested that the best results were achieved in reductions where there was a residual displacement of less than 1 mm. They found that the method used was not important, however it was more reliably achieved through ORIF.[15]

Medium term follow up studies by Griffiths[14] and Cannon et al[16] have shown good functional results in patients treated conservatively. However, a long term follow up study by Livesley[17] in which patients were followed for an average of 26 years found a high incidence of joint degeneration and functional problems. Livesley suggested that conservative management should not be advocated, however long term follow up studies of open reduction of Bennett fractures are lacking.

Newer techniques are now incorporating arthroscopic visualisation of reduction and inspection on the chondral damage,[18] as this is correlated with the future progression of osteoarthritis.

Rehabilitation involves early mobilisation of interphalangeal joints at 2–3 weeks or when K wires are removed if used.[7,19] With internal fixation, return to work – or in the case of athletes, progressive training – can be expected at around 4–6 weeks or when the fracture is nontender and shows radiological evidence of union, incorporating the aid of hand therapy (progressive active and passive ROM therapy) and splintage (generally with a shortened hand based opponens splint) with the advice of the treating surgeon.[7,19]

Summary of important points

- Bennett fractures put the patient at significant risk of future morbidity if inadequately treated (including continual dislocation/subluxation, malunion and an increase in osteoarthritis due to incongrual articular surfaces related to inaccurate reduction).

- Methods of treating Bennett fractures include closed reduction with or without percutaneous Kirschner wiring, and open reduction and internal fixation. The most important aspect of treatment is anatomic reduction and maintenance of this until union.
- Studies suggest that open reduction and internal fixation is associated with more reliable reduction and better long term outcomes, however, this technique is technically demanding. These fractures should therefore be referred to a specialist hand surgeon for definitive management in a timely fashion after initial imaging and immobilisation.

Authors

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