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CASE REPORT

Secondary collapse of lateral femoral condyle following bone bruise : A case report

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The term bone bruise, in modern medicine, is still a relatively young one, which followed the advent of MRI. Resolution takes between 12 and 24 weeks, however clinical significance is unknown. We present the case of an 18-year-old male who developed bone bruising of his lateral femoral condyle, associated with meniscal injury and anterior cruciate ligament rupture, following a fall from a push bike. A subsequent injury then led to collapse of his lateral femoral condyle following initial resolution of his symptoms. This was managed operatively performing bony and soft tissue stabilisation.

This case highlights the issues associated with proven bone bruising and associated soft-tissue injuries in the knee, which cannot be considered innocuous injuries. We also raise the question as to whether patients should undergo a period of protected weight-bearing when a bone bruise is recognised on MRI.

Keywords : bone bruise ; lateral femoral condyle collapse ; MRI.

INTRODUCTION

The term bone bruise, in modern medicine terms, is still a relatively young one, only being postulated by Mink (*8*), and only after the advent of MRI. As yet, little is known about the pathology, histology and significance of the bone bruise. Often used synonymously to mean *bone contusion, occult microfracture or subchondral osseous lesion*, the term bone bruise usually refers to the areas of decreased signal intensity seen in T_1-weighted, or increased signal intensity on T_2-weighted MRI scans, in the sub cortical region of bone (*3,9*).

The physiology of the bone bruise until recently was speculated at being haemorrhage, trabecular micro fractures and oedema of the marrow without disruption of the adjacent cortices. Microscopic compression fractures of cancellous bone without disruption of the compact bone within the cortex differentiates bone bruise from fracture, which involves cancellous and compact cortical bone. Resolution can take anywhere from twelve to twenty four weeks (*2-4,12*).

The clinical significance of bone bruises is largely unknown. Postulated as a cause for pain following knee trauma, the bone bruise may have more substantial prognostic implications, and indeed may play a role in deciding a management strategy (*5*).

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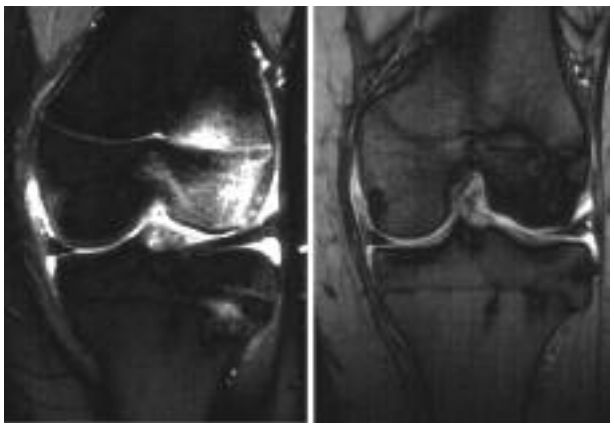

Fig. 1 (A+B). — MR Imaging of the knee. T_1 and T_2 weighted images showing the area of bone bruising in the lateral femoral condyle.

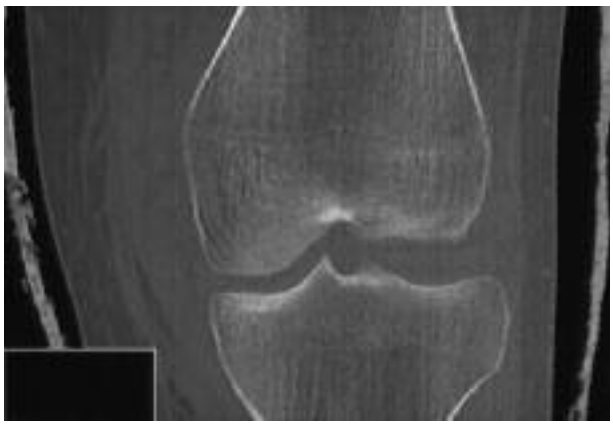

Fig. 2. — CT scan showing collapse of the lateral femoral condyle.

CASE REPORT

The following case presentation is that of an 18-year-old male motorcyclist who sustained an injury to his left knee when he fell off his bike whilst negotiating a corner at approx 15 mph and slid into a car.

Initially no fracture was identified on plain radiographs. Subsequent review in fracture clinic revealed an effusion, marked tenderness over the medial collateral ligament and difficulty reaching full extension. He was advised to mobilise pain permitting, and an MRI scan was arranged to assess the intra and extra articular ligaments around the knee.

Following the MRI scan (fig 1), prior to subsequent outpatient appointment, the swelling of the knee improved, and the boy returned to normal activity, although he was experiencing some pain.

He presented again to the accident and emergency department 12 days after the MR scan with a painful swollen left knee following a subsequent minor trauma when riding a pedal cycle. Plain films showed a possible depression fracture of the lateral femoral condyle, this was confirmed by a CT scan which showed a marked depression in the lateral femoral condyle (fig 2).

The previous MR image, when reviewed, showed a tear of the posterior horn of the lateral meniscus, a rupture of the medial collateral ligament (MCL), a probable rupture of the anterior crruciate ligament (ACL), and a large bone bruise in the lateral femoral and tibial condyles with no cortical depression.

The patient was treated surgically, with arthroscopic assisted elevation of the lateral femoral condyle under image intensifier control (fig 3).

A depression in the articular surface of the lateral femoral condyle was visualised at arthroscopy and measured to a depth of five millimetres. The impaction extended from the notch increasing progressively laterally. The ACL was indeed ruptured ; anterior draw, Lachman's test and pivot shift were all positive on examination under anaesthesia. A bucket handle tear of the lateral meniscus was also confirmed. Punches were used under image intensifier control through a window in the lateral femur.

The aim of this presentation is to emphasise that the bone bruise is not necessarily an innocuous incidental lesion that can be forgotten about.

Classification

The first classification of bone bruises was constructed by Mink and Deutsch, who used the term occult to mean hidden. Fractures of the marrow or articular surface that are undetectable by conventional radiographs become visible on MRI (*8*). Subsequently modified by Vellet *et al*, bone bruises were divided into three categories depending on their position in the subcortical bone and their

Fig. 3. — Image intensifier intra-operative pictures showing elevation of the depressed lateral femoral condyle.

characteristic pattern. These are reticular, geographic and linear (*11*).

DISCUSSION

Impaction fractures are not occult. They occur in conjunction with geographic subcortical fractures. They represent a depression in the articular cortical osteochondral surface. Osteochondral fractures can also be distracted, in association of variable quantities of marrow fat. Osetochondral lesions can be either overt or occult (*11*).

Rangger *et al* studied the histopathological cryosectional appearance of bone bruise biopsies, taken during arthroscopy, from patients with meniscal injuries ; they showed that the bruise was indeed microfractures of the cancellous bone with oedema as well as bleeding in the fatty marrow (*10*). Between the intact lamellar bone trabeculae, necrosis of the fatty marrow could also be found due to protrusion of fragments of hyaline cartilage mixed with highly fragmented bony trabeculae.

Bone bruises are more common that originally thought. Vellet *et al* studied a population of 120 patients with acute post-traumatic haemarthrosis and found that 72% had occult subcortical lesions (*11*). This is similar to the prevalence found by Mink and Deutsch (*8*). Bretlau *et al* found the general prevalence of bone bruises to be 56% (35 of 63) when patients presenting with acute knee trauma over a two month period to A&E were studied (*3*). Lynch *et al* found the general incidence of bone bruise to be as low as 20% in a retrospective study of 434 consecutive patients referred for evaluation of acute knee injury (*7*).

Many studies have shown that the bone bruise is associated with ligament damage in the knee (*1,3,5,6*). Bretlau *et al* reported an incidence of another lesion (ACL or MCL rupture) being present in the knee when a bone bruise is detected on MRI to be as high as 94%. They also found that it was twice as common to find a bone bruise on the lateral femoral condyle (18 of 35 : 51%) or the lateral tibial plateau (22 of 35 ; 63%) than at similar sites on the medial side (35% and 26%) (*3*).

There is documented evidence of the association between ACL rupture with bone bruise. The published prevalence is between 70-80%, Vellet *et al* reported 79% (*11*), Bretlau *et al* reported 67% (*2*). Lynch *et al* reported 77% (*7*).

Bretlau also commented on the higher prevalence of bone bruises found in total ACL rupture when compared to partial ACL rupture (*3*). This is in keeping with assumption that greater forces are required for total ACL rupture. The occurrence of a bone bruise with a partial ACL rupture is surprising, given the proposed pathological mechanism. It may suggest that the patients with partial ACL injury and bone bruise experienced a greater traumatic insult and are therefore, at a greater risk of post-traumatic arthritis.

The mechanism of injury to cause a bone bruise is undoubtedly complicated. Deceleration coupled with rotation of the tibia relative to the femur, and valgus stress are thought to be responsible for most bone bruises. Eighty-eight percent of impaction injuries and 62% of geographical bone bruises were caused by injuries producing these forces in one study by Vellet (*11*). In the case of ACL rupture, it is

the valgus force on the knee with the femur in external rotation that causes rupture of the ACL. The lateral compartment is then able to sublux forward, tibia relative to the femur, and impact the posterior lateral lip of the tibia against the lateral femoral condyle, most commonly the middle third (*6,13*).

The bone bruise is caused by the crushing of the subchondral bone. The force required to do this must, therefore, damage the overlying articular cartilage. Due to the elasticity displayed by the cartilage, overt injury particularly at arthroscopy may not be immediately apparent.

CONCLUSION

This case asks the question of the significance of the bone bruise. If a bone bruise is present, be it isolated or associated with ligament injury, a period of protected weight bearing would allow the weakened micro structure to heal. This case highlights the need for this. A bone bruise has become an impacted fracture causing significant surgical morbidity that could potentially have been avoided by simple immobilisation or restriction of weight bearing.

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