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Acute Haemarthrosis of Knee

Dr Jimmy Wong

Acute knee haemarthrosis resulting from either contact or non-contact injury usually indicates significant trauma to one or more important structures within the knee. It is imperative to recognize the potential significance of the injury and to arrange the timely referral. The significant lesions usually encountered include collateral and cruciate ligament tears, intra-articular fractures, meniscus tears, and patellar dislocation.

Fig 1. Picture showing right knee haemarthrosis after injury

History and Examination

Anterior cruciate ligament (ACL) tear should be considered in knee injury with a history of early onset of haemarthrosis. Often a "pop" sound is heard. The swelling that occurs with posterior cruciate ligament (PCL) tears may not be as marked as it is in ACL injuries. Meniscus tears can occur either with the cruciate ligaments tear or without other significant pathology, from a twisting injury. Acute patellar dislocation, often with spontaneous reduction, can mimic a medial collateral ligament (MCL) sprain, as the mechanism of injury typically includes valgus stress with external tibial rotation.

Collateral Ligaments

The diagnosis of the collateral ligament tear can usually be made by clinical examination. The valgus and varus stress tests should be performed at full extension and 30 degrees of flexion. Positive tests at full extension of the knee indicate that the injury is far more extensive than just the collateral ligament tear and usually also involves one or both cruciate ligaments. For less serious medial or lateral collateral ligament injuries where there is no displacement to varus or valgus stress at full extension but moderate laxity exists with a satisfactory end point when tested at 30 degrees of flexion, one should however still consider the possibility of associated injury to the ACL or the meniscus.

Anterior Cruciate Ligament

The classic anterior drawer sign carried out at 90 degrees of knee flexion is not reliable in the awake patient. The integrity of the ACL is best assessed by Lachman's test performed at 20 to 25 degrees of flexion, which yields 80% to 90% accuracy without anaesthesia. The pivot shift test is also highly sensitive and accurate but requires considerable relaxation, which few patients are able to provide in the acute setting because of pain and protective muscular guarding and spasm. ACL tears have often been shown to be associated with meniscus tears and sometimes chondral fractures.

Fig 2. MRI showing normal ACL

Fig 3. MRI showing rupture ACL

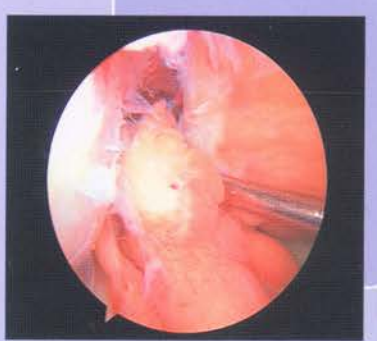

Fig 4. Arthroscopic appearance of ACL rupture

Posterior Cruciate Ligament

In acute posterior cruciate ligament (PCL) tears, haemarthrosis may not be as marked as it is in ACL injuries, since posterior capsular injury may also occur, which permits extravasation of the haemarthrosis. In contrast to ACL injuries, in which the classic anterior drawer sign is usually is not very reliable, the posterior drawer sign is usually positive in acute PCL rupture, although it can easily be misinterpreted as positive anterior drawer sign. The test is normally performed with the knee flexed 90 degrees and the foot supported on the examining table. In this position, the tibia sags posteriorly and, when pulled back to the neutral position by the examiner, can be mistaken for an abnormal anterior displacement. The key to this test is accurately assessing the starting point of the tibia. The normal anterior medial tibial step-off should be palpated prior to performing the examination. This is usually 1 to 1.5 cm. Diminished or absent anterior medial tibial step-off indicates PCL disruption. Another useful test is the sag sign. It consists of placing the legs in a relaxed position with the knees and hips flexed 90 degrees while the heels are supported and observing the prominence of the tibial tuberosities from a lateral perspective.

Patellar Dislocation

In the vast majority, spontaneous reduction occurs after the dislocation or subluxation episode. Without careful examination, it can be misdiagnosed as a medial colloateral ligament sprain, since the mechanism of injury typically includes valgus stress with external rotation. The medial retinacular injury and tenderness frequently is in the same general location as the proximal portion of the MCL. The critical test required to make the diagnosis is the patellar apprehension test. Any attempt to displace the patella laterally will be associated with pain and apprehension. As the patellar dislocates or during spontaneous reduction, the shear forces generated can produce chondral or osteochondral fractures of the patella of the lateral femoral condyle, with loose body formation.

Fig 5. Arthroscopic appearance of large chondral defect

Meniscus tears

Meniscus tears often occur in association with ligamentous injuries. However, major meniscus tears also occur without any other significant pathology in acute knee injuries with haemarthrosis. In the acute setting, tenderness at the joint line may be the only clue and high index of suspicion often leads to the diagnosis.

Fig 6. Displaced bucket handle tear of medial meniscus showing "double PCL sign" in MRI

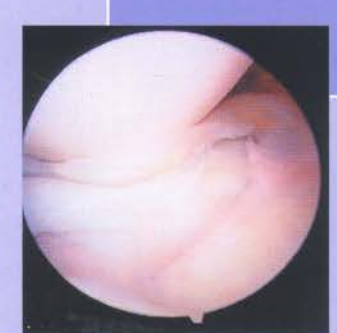

Fig 7. Arthroscopic appearance of a displaced bucket handle tear of medial meniscus

Acute Knee Haemarthrosis

Possible injuries

- Intra-articualar fractures
- ACL/PCL tear
- Mensicus tear
- Patellar subluxation/dislocation
- Osteochondral fracture

History and Examination

- Mechanism
- Onset of swelling
- Sites of tenderness
- Lachman's test
- Anterior/Posterior drawer
- Sag sign
- Valgus and varus stress tests

X-rays

This is important in the acute setting where fractures may suggest a more emergent nature to the problem. This is especially important for displaced articular fractures. Avulsion fractures may suggest injury to soft tissue structures. A Segond fracture, or lateral capsular sign, has been shown to have a high correlation to ACL disruption. Osteochondral fractures may be also shown if the osseous components are sufficiently large to permit visualization.

Fig 8. Plain X-ray showing Segond fracture or lateral capsular sign

Magnetic Resonance Imaging (MRI)

MRI is one of the most accurate means by which to assess bone, soft tissue and marrow abnormalities. Although reliance on MRI can never substitute for an accurate, detailed physicalk examination, it is a valuable tool in cases where a clear-cut clinical diagnosis cannot be made. However, some shortcomings in the use of MRI exist. Some of these are technical limitations of the modality itself, including its occasional oversensitivity. The best example of this is the identification of meniscus degeneration in unexpected locations.

Arthroscopy

Arthroscopy is sometimes required in which the diagnosis is not certain after repeated examinations, and imagings. It is also necessary when it is considered therapeutic. Displaced meniscus tear and osteochondral fractures are some common indications for early arthroscopy. Avulsion fracture of ACL from the tibial attachment is often amendable to arthroscopic assisted re-attachment.

R.I.C.E. for Soft Tissue Injuries

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A soft tissue injury is an acute connective tissue injury that may involve muscle, ligament, tendon, capsular and cartilaginous structures. In a sprain, strain, bruise or crush, the local network of blood vessels is damaged, and the oxygenated blood can no longer reach the tissues, resulting in cellular damage. The damaged blood vessels bleed, so the injured tissue contains dead cells, extracellular substance and extravasated blood (Evans, 1980). Tissue healing in response to such damage can be classified into three phases:

- Inflammatory phase
- Proliferative phase
- Maturation and remodeling phase

Inflammatory swelling starts to develop approximately two hours after the injury and may last for days or weeks. The immediate management to control the acute inflammatory response is important to minimize the undesirable effect of the natural healing process.

R.I.C.E.

RICE is the acronym for Rest, Ice, Compression and Elevation. RICE is commonly prescribed for patient with acute soft tissue injury.

Rest

In order to reduce the metabolic demands of the injured area and to

avoid further increase in blood flow, rest for the injured area is essential at the early stage after injury. The ways of rest can range from minimization of movements of the affected limb to strict immobilization with splintage or plaster slab, depending on the degree of the soft tissue injury. The duration of rest also depends on the severity of initial injury. It is well known that immobilization will lead to disuse atrophy, formation of adhesions and joint stiffness. However, too early mobilization at the injured tissue can exacerbate the inflammatory response. In less severe injury, early active mobilization can usually be started within a few days after the injury. Animal studies showed that controlled mobilization would affect the viscous property of connective tissue and promote healing of dense fibrous tissue (Buckwalter, 1995; Jarvienen and Lehto, 1993). The optimal time of rest should be guided by the degree of initial injury and the inflammatory response of the patient.

Ice

Ice is commonly used to reduce inflammation, haemorrhage, swelling and pain in soft tissue injuries. The principal effects of ice are to reduce the blood circulation to the injured area by vaso-constriction and to reduce tissue temperature to diminish the metabolic demand and production of metabolites. The effect of cooling on metabolism is vital in limiting the degree of injury. Cell necrosis takes place within a few hours after injury, releasing lysins and inducing local oedema, which would lead to secondary cell damage (Low and Reed, 2000). Cooling in the early stages of injury, during the initial 2 hours, will minimize secondary cell necrosis by reducing the metabolic demand (McLean, 1989). Pain relief by the ice application can be achieved by several mechanisms (Low and Reed, 2000):

- Reduction of oedema and reduced release of pain-inducing metabolites
- Reduction of transmission of pain impulses, possibly via A delta fibres
- Cold as sensory stimuli acting on a pain gate mechanism

Considerations in Ice Application

(1) Mode of Ice Application
Flaked or crushed ice (photo 1) is the most common mode of ice application. It is easy to mould the flaked ice embedded in a wet towel or plastic bag to the surface of the affected area to achieve good contact (Belitsky et al, 1987; McMaster et al, 1978) (photo 2). Comparisons have been made between the use of ice pack in a wet towel or in a plastic bag (De Domenico et al, 1991) and it is suggested that the two methods are comparable in terms of cooling efficiencies. Placing the ice pack beneath the injured limb is generally not advisable as the weight of the limb may cause local ischaemia and sometimes an ice burn.

Photo 1

Photo 2

(2) Duration of Ice Application
It is generally recommended that ice should be given for 20-30 minutes in order to achieve the results of decreased pain, blood flow and metabolism (Ho et al, 1994; Knight, 1989; McMaster et al, 1978; Taber et al, 1992); although it is commented by others that the recommendations are only based on empirical experience rather than on evidence (MacAuley 2001). The duration of ice application should be longer for a patient with large subcutaneous deposits of fat (Wolf and Basmajian, 1973). The placement of ice pack over the nerve trunk such as the common peroneal nerve should receive extra precautions to prevent nerve palsy due to localized pressure. Therefore, the duration of ice application in individual cases will depend on (a) the target tissue of ice treatment - decrease in bone metabolism requires a longer period of ice application; (b) the presence of subcutaneous fat; and (c) risk of complications such as nerve palsy and ice burn.

(3) Frequency of Ice Application
The recommendations for the frequency of ice application after a soft tissue injury vary from every 1-2 hours to several times a day (MacAuley, 2001). Again, the scientific evidence for the recommendations is sparse. In an experiment of 30-minute application of ice chips to the knees of a group of 13 healthy subjects (Oosterveld et al, 1992), the skin temperature dropped from a mean of 28°C to 12°C and the intra-articular knee temperature decreased from an average of 32°C to 23°C. The skin temperature returned to 25°C and the intra-articular knee temperature increased to 28°C two and a half hours after the removal of the ice chips. In patients with soft tissue injuries, it is expected that the temperature rise after ice application would be faster. Therefore, the frequency of ice application in every 2 hours may be indicated in the acute phase of injury.

(4) Contraindications to Ice Application
In the presence of some pathological conditions, ice application would be contraindicated (Low and Reed, 2000):

- Raynaud's disease
- Cryoglobinaemia
- Cold urticaria
- Application of ice to left shoulder or large body area of patient with cardiac disease
- Application of ice to patient with very high blood pressure
- Obstructive oedema caused by deep vein thrombosis

Compression

Compression is applied to limit the oedema formation caused by the exudation of fluid from the damaged capillaries into the tissue. This will control

Photo 3

ANSWERS TO RADIOGRAPHIC QUIZ

On the frontal radiograph, multiple abnormal gas lucencies are seen distributed extensively within the lateral soft tissues of the upper leg. There is no associated bony abnormality. No periosteal reaction is noted. Findings are highly suggestive of gas-forming infection (e.g. abscess) within the soft tissues of the leg.

Subsequent MRI examination confirmed the presence of an abscess in the deep subcutaneous tissue of the left lateral upper leg. In addition, there was associated muscle oedema. There was no involvement of the bones and neurovascular structures. MRI is the modality of choice for delineating the compartments involved in infection and is imperative for pre-operative workup.

the amount of inflammatory exudates and reduces the amount of fibrin and formation of scar tissues. Many studies have evaluated the combined effect of ice and compression (Barlas et al, 1996; Healy et al, 1994; Levy and Marmar, 1993; Whitelaw et al, 1995). Though with different study designs, these studies all lead to a general conclusion that the combination of ice and compression will result in reduced pain and swelling. Compression in clinical setting is usually achieved by the use of elastic stockings (e.g Tubigrip) (photo 3), strapping (photo 4), and crepe bandaging (photo 5).

Photo 4

Photo 5

Elevation

Elevation of the injured part lowers the pressure in local blood vessels and helps to limit bleeding. It also improves the drainage of inflammatory exudate through the lymph vessels, thus reducing oedema (photo 6). Studies have shown that elevation above the subject's heart level can help to reduce swelling and to increase drainage of the extravascular fluid away from the injured area (Baumert, 1995; Neilsen, 1983). It is a common practice to combine elevation with compression but care has to be taken to avoid compromising arterial supply in case of arterial insufficiency (Neilson, 1983).

Photo 6

RICE, being inexpensive and readily available, is commonly used as an immediate management of soft tissue injuries in the sport fields, clinics and hospitals. However, care and appropriate application are important to avoid adverse effects and complications.

News in Flash

Congratulations to Professor John Leong who has been awarded the "Academician of the Chinese Academy of Science" in recognition of the enormous contributions which he has made towards research in "Treatment of Spinal Disorders and Correction of Spinal Deformities". Professor Leong has been the first scholar from the field of Clinical Medicine in Hong Kong to receive this rare and outstanding award.

The 2001 S.C. Fong visiting professor, Prof Hiroaki Fukuda from Japan, renowned as a shoulder expert, visited the Department on 5th November 2001 for a week. Apart from giving lectures and demonstrating surgeries, he also showed the staff his wisdoms in treating some difficult shoulder conditions.

Professor Sir Harry Fang and Professor Hiroaki Fukuda

Congratulations to Professor Keith DK Luk and Dr Hu Yong who have been successful in obtaining a HK$497,520 grant from the "Occupational Safety and Health Research Grant 2000" granted by the Occupational Safety and Health Council to work on the project "Using Topography of Surface EMG for Occupational Low Back Pain (LBP) Assessment". The project aims to evaluate the effectiveness of using Topography of surface EMG in the assessment of occupational low back pain.

The Hong Kong Baptist University has recently approved a research grant pf HK$413,580 to the Department in support of a clinical study, "A pilot study on the safety and efficacy of the Traditional Chinese Medicine blood cleansing therapy in the treatment of osteoarthritis", undertaken by Dr Peter KY Chiu as Principle Investigator. Congratulations to Dr Peter Chiu!

Congratulations to Dr WY Cheung and Dr Daniel Yip who have recently won the A.R. Hodgson Award and Arthur Yau Award respectively with their presented papers on " Prospective randomized control study of the clinical and radiological outcome on postero-medial fragment fixation in Kyle's III inter-trochanteric fracture of femur" and "Pre-operative skin traction for hip fractures using the foam boot method - a prospective randomized study of 311 patients" at the Hong Kong Orthopaedic Association 21st Annual Congress 2001. The A.R. Hodgson Award and the Arthur Yau Award are respectively presented to the best and the second best local clinical papers judged by an adjudication panel based on a scoring system.

Radiographic Quiz

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A 77 year-old male patient admitted to the hospital with fever, chills, rigors and left lower limb swelling. Ultrasound investigation showed liver abscess but no deep venous thrombosis of the left leg was evident.

Plain radiograph of the left leg was taken due to persistent left leg pain. What are the findings on this frontal radiograph? What is your diagnosis?

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