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CASE STUDY

Injury to the posterolateral corner of the knee: emergency department assessment and management

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1. Introduction

Registered advanced nurse practitioners (RANPs) are recognised as senior decision makers within the emergency department team (ED). The RANP employs a range of skills such as comprehensive health history, advanced physical examination, problem solving, clinical decision-making, and expert judgment to formulate diagnoses and management plans for their patient's health care needs (Gibbons, 2013).

Nurses working in Advanced Practice roles are an increasingly vital component of the multidisciplinary approach to care delivery within the Irish emergency care setting (HSE, 2013a). RANPs are recognised as a senior clinical decision maker within the emergency department team (HSE, 2013b).

RANPs are increasingly extending and expanding their scope of practice beyond their initial competencies (Lowe, 2010), and must therefore be aware of emerging trends in injury presentations. To ensure optimal patient care many of these patient care episodes are managed collaboratively with other health care professionals (NCNM, 2008).

2. Initial case presentation

A 40 year old man self presented to the ED following an injury to his left knee. He was triaged as a triage category 3 (Manchester Triage) to the RANP on duty who undertook the initial patient assessment. Systems review outruled head, neck, abdominal, spinal, chest, or pelvic injuries and other distracting injury. The patient reported tripping the previous evening and a fall down the last three steps of a staircase at home following alcohol ingestion, with immediate pain and a feeling of "something going" in his knee. He was immediately unable to weigh bear following injury. He did not however notice any swelling until the subsequent morning of his initial presentation.

Previous relevant medical history was limited to a right knee arthroscopy 5 years previously. He was not taking any regular medications, and had no known medication allergies. His self report of pain was 7/10 on presentation. Analgesia (paracetamol/acetaminophen 1 g and ibuprofen 400 mg) was prescribed and provided at triage in line with departmental protocol, which reduced the patient's self report of pain to 3/10 at time examination. The patient was noted to smell of alcohol, but was alert, orientated and did not appear intoxicated at the time of examination.

3. Overview of posterolateral corner knee injuries

Despite being the largest joint in the body the knee lacks inherent stability, making it dependant on ligamentous structures to maintain alignment of its articulating bones (Bickley, 2009). The structures of the posterolateral corner (Fig. 1) act in conjunction with the anterior cruciate and posterior cruciate ligaments to provide static and dynamic joint stability (Geiger et al., 2013). There is an increasing awareness of the clinical significance of posterolateral corner (PLC) injuries (Davenport, 2010) and of the importance of early recognition of these injuries to improve surgical and clinical outcomes (Sekiya, 2008) as untreated injuries may result in chronic functional instability (Raheem, 2007). The incidence of posterolateral knee injuries remains unclear, although it is recognized that many of these injuries go unrecognized. The incidence in patients with acute knee ligament injuries with a hemarthrosis was 9.1% (LaPrade et al., 2007), with advances in clinical examination and imaging techniques

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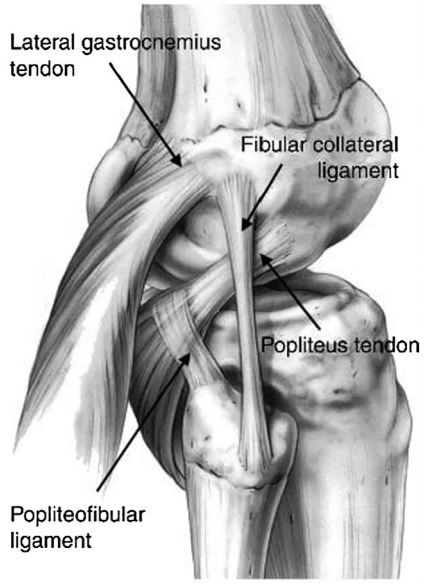

Fig. 1. Illustration of the anatomy of the posterolateral corner demonstrating the three major components: lateral (fibular) collateral ligament, popliteus tendon, and popliteofibular ligament. Reproduced with permission from *Journal of the American Academy of Orthopaedic Surgeons*.

resulting in increased numbers of patients diagnosed with these injuries.

4. Anatomy and biomechanics

The PLC of the knee is an anatomic structure which has a complex arrangement of structures (Geiger et al., 2013). This anatomy can be divided into three tissue layers; however there does not seem to be standardisation of the layers, as can be seen in the differences in the papers of Davies et al. (2004), Geiger et al. (2013) and Morelli et al. (2013). This may be in part attributable to the high anatomic variability in the PLC (Green and Swiontkowski, 2008) and competing nomenclature in the literature (DeLee et al., 2009). For the purposes of this paper the systematic approach of Geiger et al. is outlined below.

- Superficial layer: includes the lateral fascia, iliotibial tract and biceps tendon
- Middle layer: includes the patellar retinaculum and the patellofemoral and patellomeniscal ligaments
- Deep layer: includes the lateral collateral ligament, the lateral meniscotibial ligament, the popliteus muscle and tendon, the popliteiofibular ligament, the arcuate ligament, the fabellofibular ligament and the lateral joint capsule with its attachment to the lateral meniscus edge

The PLC structures in addition to resisting varus and external rotation forces, have also been shown to assist in resisting posterior translation of the tibia (Geiger et al., 2013).

The passive stabilisers in the PLC are the capsular and non-capsular ligaments, while the dynamic stabilizers are the musculotendinous units and their aponeuroses (Geiger et al., 2013). The passive stabilisers include the lateral collateral ligament (LCL), the popliteofemoral ligament, the posterolateral joint capsule, the arcuate ligament complex and the fabellofibular ligament (Green and Swiontkowski, 2008). In support of the anatomic variability of the posterolateral corner, Seebacher et al. (1982) demonstrated that the arcuate or fabellofibular ligaments were absent in 20% and 13% of the population respectively. The dynamic stabilizers of the posterolateral corner include the popliteus, iliotibial band, lateral head of gastrocnemius and biceps femoris tendon.

Many structures which may be considered anatomically one unit, often provide both passive and dynamic stability. An example is the popliteus muscle–tendon complex (DeLee et al., 2009), where the popliteofemoral ligament acts to passively stabilize the PLC while the popliteus acts as a dynamic stabiliser. Of the posterolateral corner stabilizers Canale and Beaty (2012) suggest that the LCL and the popiteal tendon provide the major restraints to posterolateral instability.

5. Mechanism of injury

The majority of PLC injuries occur due to athletic activity participation, with the remainder primarily due to falls or road traffic collisions (DeLee et al., 2009). While it has been proposed that all PLC injuries involve some rotational force (Griffin and Miller, 2013), a number of specific mechanisms have been found in the relevant literature (see Table 1).

6. Clinical assessment of the knee

Joint assessment is framed by the look, feel and move orthopaedic framework to assess joint function by comparing the affected joint to the contralateral side (Firestein et al., 2012; Purcell, 2010). This is combined with a comprehensive history taking which includes but is not limited to presenting chief complaint, events surrounding the present illness, past history, family history, personal and social history and systems review (Bickley, 2009). Thorough assessment is required to adequately manage posterolateral knee injuries with a clear understanding of the regional anatomy, biomechanics and common mechanisms of injury as undiagnosed PLC injuries can result in chronic posterolateral instability (Geiger et al., 2013). As the knee is the most commonly injured joint in the body (LaPrade et al., 2012), RANPs should be adept in physical examination techniques which improve their sensitivity to detect clinical important injuries, including those involving the PLC.

Physical examination of the knee should ideally begin with observation of gait followed by a focused inspection, palpation, and movement (Bickley, 2009). Both knees should be compared as well as the hip and ankle joints for related injuries (Talley and O'Connor, 2014). Inspection involves observing for alignment, joint contours and effusions, scars, wounds, colour, deformity, muscle wasting, and symmetry (Bickley, 2009). Palpation involves checking for temperature, areas of tenderness including joint lines, specific bony tenderness (patella and fibula head), collateral ligaments, medial and lateral compartments, posterior soft tissues, quadriceps and patellar tendons, effusions, and neurovascular examination. Movement is performed within the confines of the patient's pain. Active, passive and resisted movements which comprise of flexion, extension and straight leg raise should be tested (Bickley, 2009; Kastelein et al., 2008).

Table 1
Specific mechanism of injury for PLC.

- Direct blow to the medial aspect of the proximal tibia in a fully extended knee, with the force directed in a posterolateral direction or external rotation (Green and Swiontkowski, 2008)
- Hyperextension injury (Beall et al., 2007) (often non-contact)
- Anterior rotatory dislocations (varus stress and hyperextension)
- Posterior rotatory dislocation (varus stress, posteriorly directed blow to a proximal tibia in flexion, i.e dashboard injury)
- Forceful deceleration while the distal leg is planted (Green and Swiontkowski, 2008)
- Abrupt external rotation of the extended knee (Beall et al., 2007)