

# ANTERIOR KNEE PAIN: UNCOMMON AETIOLOGIES

**ABSTRACT:** *The aim of this review is to inform clinicians of less common causes of anterior knee pain. Relatively less common conditions leading to anterior knee pain include infra-patellar contracture syndrome, conditions affecting the fat pad, saphenous nerve entrapment, prepatellar neuromas, increased intraosseous pressure of the patella, ganglions of the anterior cruciate ligament and cysts. The aetiology, clinical presentation, risk factors and management of each condition are outlined. Due to the common occurrence of anterior knee pain clinicians must remain vigilant in assessing the cause of this clinical presentation.*

LOUW Q  
BSc (Physiotherapy) University of  
the Western Cape, MASP (Masters of  
applied science in physiotherapy)  
University of South Australia

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## INTRODUCTION

The general and sporting populations commonly experience anterior knee pain. The most common diagnosis made at sports medicine clinics is patellofemoral pain and normally manifests as anterior knee pain (Bacqui et al 1996, Witman et al 1981). Despite the prevalence of anterior knee pain, examination findings are often obscured due to the multiple aetiologies and unclear pathogenesis that may lead to the development of anterior knee pain. Consequently the many proposed physiotherapeutic management approaches such as taping, strengthening, stretching, joint mobilisation, etc may be applied inappropriately. Improved understanding of relatively less common clinical patterns may serve as an impetus to enhance directed clinical reasoning, empowering clinicians to informed decision making regarding management.

## SEARCH STRATEGY

The review is based on a computerized search of the following databases, Current Contents, AMED, Medline and CINAHL since 1966. The following keywords were used for all databases:

- Infrapatellar knee pain;
- Anterior knee pain;
- Knee fat pad;
- Patellar tendon;
- Patella;
- Patellofemoral joint;
- Knee pain;

- Management and anterior knee pain;
- Physiotherapy and anterior knee pain;

All articles describing conditions leading to anterior knee pain were reviewed. This review presents 31 of the articles that met the requirements i.e. describing less common causes of anterior knee pain. One article was obtained from an electronic journal site, one from a medical web site and one through manual searching. The rest of the articles were retrieved from the databases mentioned.

The aetiology, clinical presentation, risk factors and management of the following conditions are presented:

1. Infra-patellar contracture syndrome,
2. Conditions affecting the deep infra-patellar bursa and fat pad,
3. Traumatic prepatellar neuroma;
4. Saphenous nerve entrapment,
5. Intraosseous hyperpressure of the patella;
6. Osteochondritis Desiccans of the patellofemoral joint;
7. Sinding -Larson Johansen disease;
8. Bony cysts or abscesses;
9. Isolated ganglions of the anterior cruciate ligament

Due to prolific literature available on patellofemoral syndrome resulting from malalignment of the patella, disorders of the patellar tendon, fat pad impingement, Plicae and Osgood Schlatter's disease these conditions will not be discussed in this paper.

## INFRAPATELLAR CONTRACTURE SYNDROME

Anterior knee pain with decreased range of knee movement is not uncommon to musculoskeletal physicians. This condition was first described in 1982 and was then termed patella infera syndrome (Paulos et al 1994).

It was believed to result from exaggerated pathological fibrous hyperplasia of the anterior soft tissues of the knee or as a result of factors associated with knee surgery such as immobility and muscle weakness. The condition may have an insidious onset or may develop after a traumatic knee injury or surgery (Ellen et al 1999, Paulos et al 1994). The patients' typically complaints are anterior knee pain, stiffness, giving way and intermittent swelling. Signs may include peripatellar and fat pad soft tissue contractures, quadriceps weakness, loss of knee extension (10 degrees or more) and flexion (25 degrees or more), significantly reduced superior patella mobility and permanent shortening of the patellar tendon (Paulos et al 1994). Since the description of infrapatellar contracture syndrome earlier mobilisation post

## CORRESPONDENCE TO:

Quinette Louw  
Department of Physiotherapy  
University of the Western Cape  
P.O. Box X17,  
Bellville, 7535  
Email:qlouw@uwc.ac.za

surgery has been advised (Paulos et al 1991, Paulos et al 1994).

Recently the condition has been described as consisting of three progressive stages (Ellen et al 1999). The first stage is characterised by induration of peripatellar and retinacular tissues. Patellar mobility is reduced and an extensor lag is evident. Early recognition of the syndrome is crucial since the first stage is amenable to non-surgical treatment (Ellen et al 1999). In the second stage the extensor lag is absent due to limitation of both passive and active range of movement. Further induration of the anterior structures of the patella extending to the tibia is evident. This creates a characteristic abrupt 'step off shelf' from the patellar tendon to the tibial tubercle. This sign is regarded as most characteristic of the syndrome and is referred to as a positive 'shelf sign'. Surgery with open intra-articular and extra-articular debridement for patients who progressed to stage two followed by immediate daily rehabilitation, may be needed. The third stage is notable for significant patellofemoral arthrosis and a low riding patella for several months or years. Treatment of the condition in the third stage by physiotherapy or surgery may fail (Ellen et al 1999).

#### **CONDITIONS AFFECTING THE DEEP INFRA-PATELLAR BURSA AND FAT PAD**

Disorders of the deep infrapatellar bursa may be a location of calcification, inflammatory bursitis, septic arthritis, gout and traumatic haemorrhage (La Prade 1998). The deep infrapatellar bursa does not communicate with the knee and is located posterior to the distal 38% of the patella tendon. The bursa is compartmentalized with a portion of the retropatellar fat pad (La Prade 1998).

Infection of the infrapatellar bursa is a rare occurrence and is more common in young people. Infection of the infrapatellar bursa may be considered in patients who have symptoms that resemble septic arthritis. The knee is typically held in rigid extension. Maximum tenderness can be palpated centrally near the patella ligament. The bursa can be palpated in the distal 1 to 2 cm of the patella tendon with the knee extended and the quadriceps relaxed. Operative

incision and drainage of the infrapatellar fat pad demonstrates purulent material. Successful management is achieved with intravenous and oral antibiotics. The recurrence rate is low (La Prade 1998).

#### **SAPHENOUS NERVE ENTRAPMENT (INFRAPATELLAR BRANCH)**

Saphenous nerve entrapment in the adductor canal is a frequently overlooked cause of anteromedial knee pain (Romanoff et al 1989). The saphenous nerve is the largest cutaneous branch of the femoral nerve. Just before leaving the canal the nerve divides into two branches, the infrapatellar and the descending branch (Lippitt 1993).

The adductor canal is located in the middle third of the thigh. It is bounded anterolaterally by the vastus medialis, medially by the sartorius and posterolaterally by the adductor longus. The femoral artery, vein and saphenous nerve are located within this canal (Romanoff et al 1989).

Of particular interest is the relationship of the infrapatellar branch and the sartorius muscle and tendon. One study involving 66 specimens of the infrapatellar nerve found that 35 passed through the sartorius muscle, 19 passed under and 13 passed over the muscle before distributing to the anterior and medial aspects of the knee (House and Ahmed 1977).

Possible aetiologies include traction to the saphenous nerve, indirect knee injury caused by angulatory or torsional forces, fat thighs with an element of genu varum and internal tibial torsion and following knee surgery (Romanoff 1989, Lippitt 1993). Entrapment of the nerve in the adductor canal may cause inflammation, oedema and paraesthesias on the anteromedial aspect of the knee. Pain may occur secondary to spontaneous firing of the saphenous nerve after compression. Local anaesthetic may serve as an important diagnostic tool. Surgical exploration with neurolysis and translocation of the nerve away from the compression site may be indicated if conservative measures fail to provide relief (Romanoff et al 1989).

#### **TRAUMATIC PREPATELLAR NEUROMA**

The location of the saphenous nerve

leaves it vulnerable to direct trauma yet only a few reports are described in the literature (Chambers 1972, Gordon 1952). However neuroma formation caused by damage to the infra-patellar branch after certain surgical procedures such as medial arthrotomies is more common (Hunter et al 1979, Slocum and Larson 1968).

Patients commonly present with anterior or anteromedial, burning knee pain. Some patients may complain of difficulty in performing knee flexion due to pain. A tender fusiform nodule may be present above the medial joint line and lie over the lower third of the patella. Tenderness and occasionally paraesthesia to even light pressure anterior to the knee is reported (Pinar et al 1996). Clinical examination is negative for ligamentous instability, meniscal lesions and patellofemoral disorders.

Treatment may involve removal of the neuroma, but good response to Lidocaine injections is also reported (Pinar 1996, Chambers 1972). At follow-up the patients are pain free and knee movements are restored although patients may experience anteromedial numbness (Pinar et al 1996).

#### **INTRAOSSIOUS HYPERPRESSURE OF THE PATELLA**

Patella intraosseous hyperpressure has been proposed as a cause of anterior knee pain based on the knowledge that increased bone marrow pressure at the hip joint in the early stages of avascular necrosis results in hip pain (Sala et al 1999). In the 1960's it was observed that both the number of osseous trabeculae and the calcification of articular cartilage provoked chronic venous congestion in rats (Brookes and Helal 1968). A significant rise in intraosseous pressure in painful joints such as the knee may thus manifest as anterior knee pain and the condition was named "intraosseous engorgement-pain syndrome" (Lempberg and Arnoldi 1978). However in clinical practice, measurements of raised intraosseous pressure are too invasive and the condition remains a diagnostic challenge.

In normal patellae the intraosseous pressure is between 10 and 15mm Hg and about 20 mm Hg when measured horizontally. Intraosseous pressure is

influenced by a number of factors such as intracapsular changes, knee flexion angle, muscular and capsular tension that could cause temporal or permanent venous return blockage (Sala et al 1999).

Initial treatment is always conservative and may involve physiotherapy regimes such as stretching and myofascial release. Surgical options include bony drainage and osteotomies (Nerubay and Kathnelson 1986). Currently there is sufficient information to consider intraosseous hyperpressure as an important factor in patellofemoral pain aetiology. However several questions regarding the distinct clinical aspects of this condition remain unanswered.

#### **OSTEOCHONDRITIS DESSICANS OF THE PATELLOFEMORAL JOINT (OCD)**

Osteochondritis Dessicans of the patellofemoral joint is an uncommon condition that may be the cause of anterior knee pain and was first described in 1936 (Rombold 1936). The cause remains unknown and it is widely accepted to be a combination of the repeated trauma and ischaemia at susceptible sites such as the convex articular surfaces (Aichroth 1971). The lesions may be on the patella or the trochlear groove (Peters and McLean 2000).

Patients are commonly aged between 15 and 24 years and males are more often affected than females. The pain is usually located in the retropatellar area and often radiates medially or laterally from the patella. Catching, locking and clicking are also common features and significant malalignment of the patella and lower limb is obvious in most cases. Physical examination reveals peripatellar tenderness and crepitis in most of the patients (Peters and McLean 2000). The lesions are often identified on lateral or skyline x-ray views and careful examination is required. Arthroscopic examination must assess both the patella and the trochlear groove (Peters and McLean 2000).

Non-operative treatment may include Mc Connell taping, lateral retinacular stretching, vastus medialis oblique strengthening and activity modification (Gerard 1989). Surgical intervention is needed for patients with mechanical symptoms and includes arthroscopy

consisting of chondroplasty, removal of loose bodies or lateral retinacular release (Peters and McLean 2000).

#### **SINDING- LARSEN JOHANSEN DISEASE**

Sinding Larsen-Johansen disease is similar to Osgood Schlatter's Disease except that the disorder is found at the proximal end of the patellar tendon (inferior pole of the patella). The aetiology is unclear but appears to be a traction apophysis due to repeated strains resulting in micro-avulsions of the bone and subsequent calcification and ossification (Haywood et al 1996).

Active young boys aged between 10 and 14 are usually affected and they may also present with Osgood Schlatter's Disease. Pain is usually accentuated with activity and relieved by rest. The inferior pole of the patella tendon will be tender on palpation and resisted isometric contraction of the quadriceps muscle may reproduce the pain (Thabit and Micheli 1992).

The duration of the disease is normally nine to twelve months and restriction of activity seems to be the foundation of treatment. An exercise program involving stretching and progressive strengthening may also be beneficial (Haywood and Boyce 1996).

#### **BONY CYSTS OR ABSCESES**

The presentation of cysts can be similar to patellofemoral pain due to patella malalignment. The onset of anterior knee pain is often insidious in onset and is increased by sporting activity. The patient may not present with any swelling, locking or warmth. However the distinguishing feature may be severe night pain especially after activity (Swain 2000). X-rays may show a lytic lesion. A case of a 17 year-old male basketball player whose X-rays demonstrated a 3cm lytic lesion in the proximal tibial metaphysis was reported (Swain 2000). A bone scan showed intense metabolic uptake in the area of the cysts. Biopsy of the cysts in this case ruled out a tumor, but a Brodie's abscess was found in the proximal tibia (McCauley 1988). Treatment mainly involves surgical removal, drainage and antibiotic therapy (McCauley 1988). Lesions larger than 3cm may require bone grafting.

#### **ISOLATED GANGLIONS OF THE ANTERIOR CRUCIATE LIGAMENT**

Ganglia around the knee joint are now well described though still unknown to many clinicians. Pathogenesis of the condition is unclear but they may present a mucinous degeneration of connective tissue as is the case with other ganglia (Maffulli et al 1993). A ganglion may also arise from a herniation of synovial tissue through a defect of the joint capsule. Some authors also propose that the end process of cystic degeneration of the ligament may lead to weakening and partial rupture (Sjovall 1943, Maffulli et al 1993).

Reported cases illustrated that these ganglia are more common among sports people (Maffulli et al 1993). Usually no memorable traumatic incident is reported although the role of trauma is still unclear. (Maffulli et al 1993). In cases where trauma was reported the recollected incident preceded the onset of symptoms by a variable period ranging from 8 months to 6 years (Bromley and Cohen 1967). Examples of possibly related traumatic incidents include motor vehicle accidents and knee twisting type of injuries (Bromley and Cohen 1967).

Patients experience anteromedial knee pain aggravated during running and squatting. Mild effusion and anteromedial joint line tenderness may be present accompanied by vastus medialis wasting. Pain is often reproduced on rotation with the knee in 45 degrees of flexion. Instability tests are negative and x-rays are unremarkable (Maffulli et al 1993). Arthroscopic examination reveals a cystic mass and in most reported cases the ligament is still stable (Maffulli et al 1993). Immediate physiotherapy post arthroscopy is recommended and patients may resume sporting activity after three weeks. The recurrence rate appears to be low and full function is usually restored post treatment.

#### **CONCLUSION**

Patellofemoral pain is probably the most common knee presentation among young active individuals (Bacqui and Brukner 1996). Clinicians are currently hampered by poor consensus in the categories of a definition, classification, clinical assessment, diagnostic tests and

management of anterior knee pain. An understanding of the nature of the pain behaviour, location of the symptoms and recommended physical examination tests such as muscle length, etc are valuable. However, the reliability of many of the measures used to assess patella position, patella movement, muscle length, neural dynamics, Q-angles and measurement of intraosseous pressure are questionable in the clinical setting leading to errors in clinical reasoning and management (Gutbill et al 1997).

Further research, more reliable clinical tools, appropriate outcome measures, well designed clinical guidelines may assist musculoskeletal clinicians in understanding the variable aetiology of anterior knee pain leading to individualized management protocols, optimal outcomes and improved patient satisfaction.

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#### REFERENCES

- Aichroth P (1971): Osteochondral fractures and their relationship to osteochondritis desiccans of the knee. An experimental study in animals. *Journal of Bone and Joint Surgery* 53B: 448-454
- Bacqui P and Brukner P (1996): Injuries presenting to an Australian Sports Medicine Center: A 12 month study: *Clinical Journal of Sports Medicine* 7: 28-31
- Brookes M, Helal B (1968): Primary osteoarthritis, venous engorgement and osteogenesis. *Journal of Bone Joint Surgery* 50B: 493-504
- Bromley J and Cohen (1967): Ganglion of the posterior ligament. Report of a case. *Journal of Bone and Joint Surgery* 47 A: 1247-1249
- Chambers G (1972): The prepatellar nerve: A cause of sub-optimal results in knee arthroscopy. *Clinical Orthopaedics* 82:157-161
- Cutbill J, Ladly K, Bray R, et al (1997): Anterior knee pain: A review. *Clinical Journal of Sports Medicine*; 7: 40-45
- Ellen M, Jackson H, DiBiase S (1999): Uncommon causes of knee pain. A case report of infrapatellar contracture syndrome. *American Journal of Physical Medicine and Rehabilitation* 78: 4: 376-380.
- Gerard B (1989): The patellofemoral pain syndrome: A clinical trial for the Mc Connell program. *Australian Journal of Physiotherapy* 35: 71-80
- Gordon G C (1952): Traumatic prepatellar neuroma. *Journal of Bone and Joint Surgery (British)* 34:41:44
- Cutbill J, Ladly K, Bray R, et al (1997): Anterior knee pain: A review. *Clinical Journal of Sports Medicine*; 7: 40-45
- Haywood H and Boyce W (1996): Knee overuse injuries in the skeletally immature athlete. *Physiotherapy Canada* 48:3: 190-196
- House J, Ahmed K (1977): Entrapment neuropathy of the infrapatellar branch of the saphenous nerve. A new peripheral nerve entrapment syndrome. *American Journal of Sports Medicine* 5: 5: 217-224
- Hunter LY, Louis DS, Ricciardi J, O'Conner (1979): The saphenous nerve: its course and medial arthroscopy. *American Journal of Sports Medicine* 7: 227-230
- Lempert RK, Arnoldi CC (1978): The significance of intraosseous hyperpressure in normal and diseased states with special reference to the intraosseous engorgement-pain syndrome. *Clinical Orthopaedics* 136:143-56
- La Prade (1998): The anatomy of the deep infrapatellar bursa of the knee. *The American Journal of Sports Medicine* 26:1:129-131
- Lippitt A (1993): Neuropathy of the saphenous nerve as a cause of knee pain. *Bullitin Hospital for Joint Diseases* 52: 2: 31-33
- Maffulli N, Binfield M and King J (1993): Isolated ganglions of the anterior cruciate ligament. *Medical Science and Sports Exercise* 25: 5: 550-553
- McCauley P (1988): Brodie's abscess. A long-term review. *Clinical Orthopaedics* 234: 211-216
- Nerubay J, Katnelson A (1986): Osteotomy of the patella. *Clinical Orthopaedics* 207:103-7
- Paulos L, Wnorowski D, Beck C (1991): Rehabilitation following knee surgery. Recommendations. *Sports Medicine* 11: 257 - 275
- Paulos L, Wnoroski D and Greenwald A (1994): Infrapatellar contracture syndrome. Diagnosis, Treatment and Long-Term follow-up. *The American Journal of Sports Medicine* 22: 4: 440-449
- Peters T and Mc Lean L (2000): Osteochondritis Desiccans of the patellofemoral joint. *American Journal of Sports Medicine* 28:1:63-67
- Pinar H, Ozkan M, Akseki D and Yorukoglu K (1996): Traumatic prepatellar neuroma. An unusual cause of anterior knee pain. *Surgery and Sports Traumatology. Athroscopy* 4: 154-156
- Rombold C (1936): Osteochondritis Desiccans of the patella: A case report. *Journal of bone and joint surgery* 18:230-231
- Romanoff M, Cory P, Kalenak E et al (1989) Saphenous nerve entrapment in the adductor canal. *American Journal of Sports Medicine* 17:4: 478-481
- Sala D, Silvestre A, Gomar-Sancho F (1999): Intraosseous pressure of the patella as a cause of anterior knee pain. *Medscape orthopedic and sports medicine: www.orthopaedics.medscape.com*
- Swain R (2000): An unusual cause of anterior knee pain in an adolescent basketball player. *Clinical Journal of Sports Medicine*: 10:2: 142-143
- Sjoval H (1943): A case of ganglion in a ruptured posterior cruciate ligament of the knee. Isolated Ganglions of the anterior cruciate ligament. *Acta Chiropractic of Scandinavia* 87:331-41
- Slocum D and Larson R (1968): Pes Anserinus transplantation: a surgical procedure for control of rotary instability of the knee. *Journal of Bone and Joint Surgery (America)* 56: 719-729
- Thabit G and Micheli L (1992): Patellofemoral pain in the paediatric patient. *Orthopaedic Clinics of North America* 23:4:567-884
- Witman P, Melvin M, Nicholas J et al (1981): Common problems seen in a metropolitan sports injury clinic. *Physician and Sports Medicine* 9: 105-8