

(i) Investigation of the painful knee arthroplasty

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Abstract

Both total and unicompartmental knee arthroplasty are effective operations for the treatment of gonarthrosis. However, up to 20% of patients will return with pain and a suboptimal functional outcome. The investigation of such a patient is critical in determining an accurate diagnosis and establishing an effective management plan. Causes of pain can be broadly classified into extrinsic and intrinsic. The commonest intrinsic causes of pain are infection, component loosening, component mal-orientation and soft tissue impingement. Extrinsic causes, including hip and spinal pathology, may be responsible for the patient's symptoms and must be considered. Accurate evaluation uses a four-step procedure involving a detailed history, thorough clinical examination and microbiological plus imaging analysis. This review article will focus on each of these key steps and highlight some of the latest modes of investigating the painful knee arthroplasty.

Keywords 3D-CT; knee arthroplasty; knee replacement; painful knee joint; post-operative complication

Introduction

Registry data from England,¹ Scandinavia² and Australia³ suggest that the demand for primary knee replacement is set to rise in the coming decades at a rate of approximately 10% per annum. In the United States of America alone this figure is projected to rise by 672%, or 3.5 million, by 2030.⁴ Although TKA is an extremely successful procedure for gonarthrosis, reports suggest that up to 20% of patients will return over the medium-term with pain and dissatisfaction.^{5–8} At 5 years, about 8% of primary TKA patients will require revision surgery,^{1,9} a procedure that is associated with suboptimal functional outcome^{10,11} and great cost to the health economy. The investigation of the painful knee arthroplasty is therefore critical in determining the accurate diagnosis and establishing an effective management plan. Accurate evaluation of these patients uses a four-step procedure involving a detailed history, thorough clinical examination, microbiological analysis and imaging. While there are extrinsic causes, this article will focus primarily on the investigation of intrinsic causes

of pain following either unicompartmental (UKA) or total knee arthroplasty (TKA).

History

First, the nature of the symptoms should be established, including pain, instability, swelling and stiffness. Pain will often be the first complaint and it is important to discern if its character is the same, as or different to, the patient's pre-operative symptoms. Taking a good pain history is vital to the orthopaedic surgeon. The precise location of the pain and the factors that relieve or aggravate it should be identified. In particular, one should enquire as to whether the pain is associated with weight bearing and walking, implying a tibio-femoral issue, or when climbing up and down stairs, suggesting a patellofemoral problem. Pain related to activity rather than rest suggests instability, irritation of the soft tissues, loosening or mechanical impingement. Pain at rest may be caused by infection, or neuroma if made worse by contact with clothes. The chronicity of the pain and whether it arose in the early, intermediate or late phase following surgery will help to narrow the possible causes. Early pain may indicate an acute infection, prosthetic mal-alignment or soft tissue impingement. Pain occurring over the long-term is more likely to be caused by component loosening, polyethylene wear, ligamentous instability, stress fracture or late haematogenous infection. In the case of a painful UKA, one must consider the possibility of wear or meniscal damage to the adjacent tibio-femoral compartment and/or progression of patellofemoral degeneration.

The type and design of the knee prosthesis used should be identified, noting if the component was posterior cruciate retaining, sacrificing or constrained, and cemented or uncemented. In the case of UKA, a fixed or mobile bearing can be used, with the latter being susceptible to dislocation.

The original indication for the primary surgery should be reconsidered, as the patient may have an undiagnosed condition such as an inflammatory or crystal arthropathy that may be the underlying cause of symptoms. Indeed, it is important to note if the patient complains of arthralgia elsewhere in the body and whether the symptoms could be systemic in nature. There is an increased risk of infection in those who are immunocompromised through systemic disease such as diabetes, or for extrinsic reasons such as steroid treatment. In addition, one must consider the patient's psychological wellbeing pre- and post-surgery; several studies have demonstrated that pre-operative anxiety, depression and pain intolerance are predictors of persistent pain post-operatively.^{8,12}

Clinical examination

Before formally examining the knee, one should note from previous hospital records the presence of any pre-operative deformity or contracture, previous knee procedures and the specifics of the operative technique used. The painful knee should first be examined by observing the pattern of gait, noting the coronal alignment relative to the hip and ankle joint, as well as any thrust arising from instability. The foot progression angle should be assessed, where internal or external rotation relative to the neutral axis may indicate tibial mal-rotation. One should remember to compare findings to the contralateral knee, which

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may demonstrate anatomy that is native and normal specifically to that patient. Surgical scars should be inspected, noting any dehiscence, tethering, or dimpling indicative of fat necrosis. Erythema, swelling, or discharge suggest infection. Although a rare condition, loss of hair, skin discolouration and a shiny appearance to the knee suggests Complex Regional Pain Syndrome.

It is important to appreciate any swelling or effusion, suggesting either infection or haemarthrosis. With the latter, one should consider the possibility of active bleeding and failure to gain complete haemostasis during surgery, or over-activity of an anticoagulant or antiplatelet agent.

Palpation of the knee should take into account the structures beneath. A neuroma will present with hypersensitivity over the scar site and may be indicative of damage to the infrapatellar branch of the saphenous nerve. This purely sensory nerve arises from the adductor canal to supply the medial and anterior aspect of the knee. It is prone to injury when approaching the knee through a midline or medial parapatellar incision. It divides into two branches: the superior is located about 24 mm below the inferior pole of the patella in both flexion and extension; the inferior branch is more variable and is found 60 mm from the same landmark in extension and 70 mm in 90° of flexion.¹³ Diagnosis can be confirmed if the pain is abolished by a local anaesthetic block or patch.

Next, one should check the integrity of the quadriceps and patellar tendon. Damage to the extensor apparatus is uncommon, with an incidence of 1%, and is related to the integrity of the surgical repair. One should note whether the patella was resurfaced, and if so then the amount of bone resected. The patella should be palpated and patellar tracking observed: tenderness along either the medial or lateral border may indicate an undersized patellar button, with resulting articulation of the unresected bone on the femoral component (Figure 1). Abnormal tracking may be a consequence of patellar button mal-alignment, over medialization and/or internal rotation of the femoral component,^{14,15} or tibial component internal rotation.¹⁶

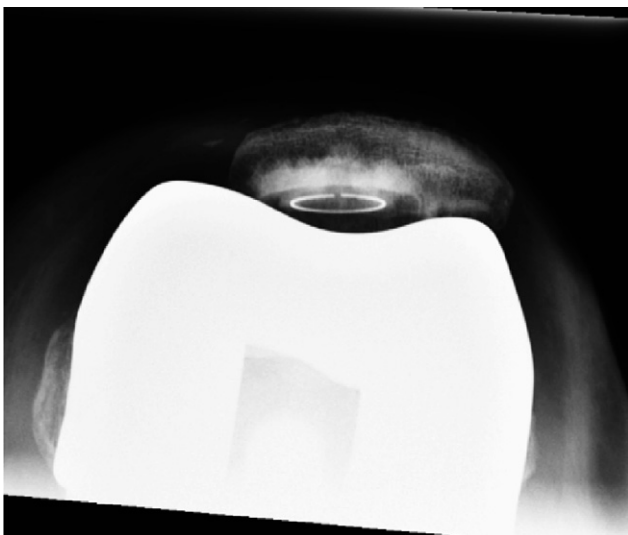


Figure 1 An eccentric placed patella button, leaving an exposed lateral patellar facet, causing pain on knee flexion.

Over-stuffing of the PFJ will present with anterior knee pain, evident when the patella is compressed by the examiner as the knee flexes between 30° and 60° flexion (Clark's test).

Next, one should note the passive and active range of movement and ligamentous stability of the joint. Any hyperextension, fixed flexion or extensor lag should be identified. Specifically, one should also examine the integrity of the medial and lateral collateral ligaments with varus/valgus stress testing in extension and in 30° and 90° of knee flexion. Antero-posterior laxity should be tested as well, with flexion laxity evident when an anterior or posterior drawer is performed with the knee in 90° flexion.

Examination of the lumbar spine, hip, foot and ankle should also be part of the routine assessment of patients with a painful TKA, and may help to discern any extrinsic causes of pain.

Extension instability

This may be symmetric or asymmetric.¹⁷ Symmetric instability occurs when the extension gap is not filled by the thickness of the components and is primarily due to excessive bone removal from the distal femur or proximal tibia with resulting joint line shift. Asymmetric extension instability is more common, and normally related to under-correction of a pre-operative angular deformity. For instance, concerns about releasing the medial collateral ligament in a varus knee can lead to under-correction, leaving the knee tight in flexion. With time, the mal-alignment and associated excessive tension on the medial side may stretch out the soft tissues on the lateral side and/or lead to excessive medial polyethylene wear from overload.

Flexion instability

This is seen most often in patients in whom the TKA is well fixed and well aligned axially. The manifestation of flexion instability ranges from the patient complaining of a sense of instability to frank dislocation. The laxity may be due to inadequate filling of the flexion space with the implant due to either under-sizing of the femoral component or an excessive posterior tibial slope. Another reason is iatrogenic disruption or late failure of the posterior cruciate ligament. Assessment of flexion laxity in 90° of knee flexion should form part of the routine examination, regardless of whether a cruciate retaining, sacrificing or substituting prosthesis is *in situ*. In particular, the patient with a posterior stabilized knee may complain of instability with the knee in flexion and varus (when putting on a sock, for example) and is typified by a loss of flexion gap and collateral ligament laxity.

Outcome scores

Using an outcome score will provide an objective measure of the patient's pain, as well as a reference value to compare any further intervention. Several dimensions of function can be assessed giving the user a fuller picture of the patient's disability.

Oxford knee score (OKS)

The OKS has been used extensively in the orthopaedic literature and is highly sensitive for patients undergoing primary^{5,18,19} and revision knee surgery.²⁰ This measure contains 12 questions that assess pain and functional ability over a range of everyday activities²¹ on a scale from 0 to 4, with the least symptom scoring the maximum '4'. Hence the overall score ranges from '0' (most severe symptoms) to '48' (least symptoms).

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