Total hip and knee replacement surgery

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Abstract

Total hip and knee replacements are becoming increasingly prevalent and an increasing range of techniques and materials are now available. We review the indications, the key issues regarding surgical and material options and the complications of total joint replacement surgery for the hip and knee.

Keywords Arthroplasty; complications; indications; materials; total hip replacement; total knee replacement

Introduction

Total hip and knee replacements (THRs and TKRs) are among the most common operations performed in the UK with over 83,000 THRs and 84,000 TKRs recorded on the UK National Joint Registry (NJR) in 2014.[1] THRs and TKRs aim to restore function and relieve pain by replacing the articulating surfaces of the joints and can result in dramatic improvements in patient's quality of life. There are now a considerable range of components and materials available for use in THR and TKR surgery along with a variety of surgical techniques. This review outlines the indications, material and surgical options and the complications of THR and TKR surgery.

Clinical presentation and indications for treatment

The primary indication for total hip or knee replacement is osteoarthritis (THR − 93%, TKR − 96%). Other indications include inflammatory arthritides, trauma and post-traumatic sequelae and congenital deformities.[1] The primary reason for presentation is pain and functional limitation.[2] Pain can be centred around the joint or may be referred, from the hip to the knee for example, and is classically described as worse on exercise and relieved by rest. A careful history should aim to rule out other sources of symptoms, such as intra-articular infection or spinal pathology. Other key pieces of information include co-morbidities, history of trauma or previous surgery, treatments undertaken to date, the psychosocial impact of the patient's symptoms and their expectations from treatment.[3]

Thorough examination of a hip or knee joint is essential and the key steps are summarized in Boxes 1 and 2 below. The joint above and below the joint in question should be examined as well as the neurovascular status of the limb.

Examination of the hip

- Look at the patient whilst standing
- Inspect the gait
- Perform Trendelenburg's test
- Assess range of movement
- Perform Thomas' test
- Leg length measurement

Box 1

Examination of the knee

- Stand the patient and look
- Inspect the gait
- Feel for effusion or tenderness
- Assess range of movement
- Assess cruciate and collateral ligaments

Box 2

Osteoarthritis is characterized by progressive degeneration of the articular cartilage and is highly prevalent in the elderly population. Usually, simple plain radiographs are sufficient to make the diagnosis (Figure 1). Classically, radiographic changes of osteoarthritis include loss of joint space (assessed using a weight-bearing radiograph), subchondral sclerosis, osteophytes and subchondral cysts.[4]

THR is now commonly performed for intracapsular neck of femur fractures if the patient fulfils the National Institute for Health and Care Excellence (NICE) criteria for this (Box 3).[5] There is also a movement towards the treatment of distal femoral fractures using joint replacement surgery; the increased cost of which can be offset by the reduced care costs as patients are able to mobilize immediately following such surgery, reducing the length of stay.

Treatment options

Elective joint replacement surgery is primarily a lifestyle choice and should therefore only be undertaken when non-operative interventions have been investigated or exhausted. Non-surgical management of osteoarthritis of the hip or knee can significantly reduce symptoms and may help to slow the progression of the disease.[6] Options include simple analgesia, weight loss, regular exercise, physiotherapy and corticosteroid injections. Treatments should be tailored to the individual patient and take into account personal values and functional demands.[3]

Joint preserving procedures for the knee are performed commonly; options include arthroscopy and debridement, microfracture or autologous chondrocyte implantation and high tibial osteotomy.[7] These interventions are primarily indicated in young patients (<50 years) with early stages of the disease where preservation of the bone and joint should be the priority. Compartmental procedures are also available for isolated

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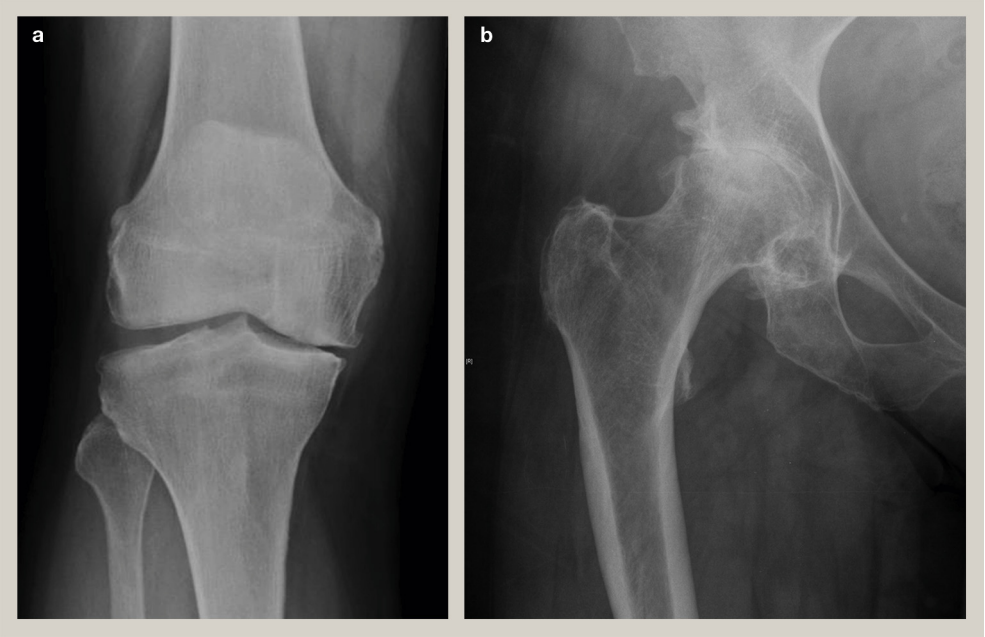

Figure 1 Anteroposterior radiographs of the (a) knee and (b) hip joints, demonstrating the classic features of osteoarthritis.

arthritis in parts of the knee, such as medial unicondylar and patello-femoral joint replacements. Joint-preserving surgical interventions in the hip are less commonly performed but can include arthroscopy and debridement, peri-acetabular osteotomy and femoro-acetabular impingement surgery.[8] Patients with advanced disease for whom non-operative interventions have proved insufficient should be considered for joint replacement surgery.

Total hip replacement

Implant choice

The choice of implant depends on the indication for surgery, the patient's anatomy and the skill set of the surgical team. The main decisions to be made are the fixation, the type of bearing used and the size of the femoral head.

Fixation (Figure 2a and b)

Fixation may be cemented, uncemented or hybrid (e.g. the stem is cemented and the cup is uncemented). The NJR data report that 38% of THRs are cemented, 41% are uncemented and 21% are hybrid.[1]

Uncemented prostheses rely on a 'press-fit' technique, where the implants are impacted into the bone, and require 'bony ingrowth' to become firmly secured. They use coverings such as hydroxyapatite to promote this process.[9]

NICE guidelines: total hip replacement for intracapsular hip fractures

- No cognitive impairment
- Medically fit for anaesthesia and the surgery
- Mobile outside with no more than one stick

Box 3

Cement acts as a grout to fix the prostheses in place and requires no bone growth for fixation. Loads are transferred across the large bone-cement interface meaning lower potential for stress risers to occur, making this technique more appropriate in osteoporotic bone.[5] Cemented prostheses either use the composite-beam principle (the stem supported fully by the cement with no movement, e.g. Charnley), or the taper-slip principle (the polished stem is allowed to subside slightly, causing radial hoop stresses to spread the load, e.g. the Exeter stem).

Rarely, cementing may be associated with complications such as fat embolism but modern techniques have reduced the incidence of this. The current technique (fourth generation) includes vacuum mixing of the cement, cement restrictors, cleaning with pulsatile lavage, retrograde injection of cement, pressurization of the cement and the use of a centralizer on the implant.

Long-term outcomes for cemented and uncemented techniques demonstrate no clear difference and choice of fixation should be made based on the individual patient characteristics and the experience of the surgeon.[1]

Bearing surfaces

The bearing is the interface between the two components. Bearing surfaces should be low friction, resistant to wear and have good biocompatability properties.[10] The NJR reports that the majority (59%) of hip implants in the UK were metal-on-plastic with a metal femoral head and polyethylene acetabular cup[1]; the remainder are made up of ceramic bearings, metal-on-metal bearings and other hybrids.

Metal-on-plastic bearings have the longest history and the most evidence to support their use.[1] High-density polyethylene used for the plastic acetabular component in most systems is hard wearing and has low friction and low immunogenicity properties making it, for many, the gold standard bearing. Plastic micro-particles that are produced through wear may lead to lysis

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