

Rheumatology: 10. Joint replacement of the hip and knee — when to refer and what to expect

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The case

An obese 67-year-old woman with a painful left knee consults her physician. She has been complaining of pain for the past year; however, over the past 2 months, the pain has become increasingly worse, and she is now limping. Her daily activities are becoming restricted, and she is no longer able to enjoy the long walks that she has been accustomed to. She has also noticed a gradually occurring “knock-knee” deformity.

This scenario is not uncommon in the primary care physician’s office. Musculoskeletal complaints of one sort or another make up about 20% of a family physician’s practice. Furthermore, among patients over the age of 55 years, osteoarthritis is one of the most disabling conditions seen (Fig. 1). This disorder may cause an otherwise active, productive person to become discouraged and sedentary because disabling pain accompanies any type of activity.

Although most patients with arthritis can be treated without surgery, some will eventually require joint replacement; other patients will experience such severe pain and disability that referral for consideration of joint replacement may be indicated as early as the initial visit.

Hip and knee arthritis are common problems that primarily affect elderly people. In British Columbia alone, 2600 hip replacements and 2100 knee replacements were performed in 1997 (billing information gathered by BC Medical Services Plan). Together, hip and knee replacements are almost as prevalent as the most commonly performed orthopedic procedure in BC, namely, knee meniscectomy. Thus, most primary care physicians will have to deal with patients who have undergone or are likely to require joint replacement.

History of total joint replacement

Total hip arthroplasty has stood the test of time as a pain-relieving operation that improves quality of life for many patients with end-stage hip disease (Fig. 2). The concept of hip replacement was first introduced by Wiles in 1938,¹ when a stainless steel ball was fixed to the femoral neck by means of a bolt, and a stainless steel socket was attached to the pelvis using a plate and screws. This, along with many other subsequent designs, had a short life expectancy and failed either because of loosening or breaking of the attachment devices.

In 1961, Charnley² devised a way to attach a prosthetic implant to bone using self-curing acrylic cement. This method was the first to demonstrate long-term success. Indeed, the excellent results for Charnley’s early cases continue to be reported today,³ and firm adherence of the implant to bone and minimization of the generation of wear particles continue to be the driving principles behind all modern hip arthroplasties.

Developments in total knee arthroplasty lagged behind hip replacement. True replacement of the knee joint by means of a hinge was attempted initially but, because of the unusually high stresses on this joint, most such designs failed and few hinged knee replacements are being performed today. The current concept behind

Review

Synthèse

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The Arthritis Society salutes CMAJ for its extensive series of articles on arthritis. The Society believes that this kind of information is crucial to educating physicians about this devastating disease.

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knee replacement is resurfacing arthroplasty, in which the femur, tibia and, often, the patella are resurfaced with metal and plastic, while the supporting extra-articular ligaments and tendons are retained to maintain joint stability and allow mobility. Excellent results have been achieved with this technique when the operation is performed for the correct indications.⁴

Indications for total joint replacement

Hip replacement

Although elderly people are the primary recipients of joint replacements, hip disorders requiring surgery are not restricted to this age group. They may occur at any age, beginning at birth with congenital or developmental dislocation of the hip. During the first decade of life, Legg-Calvé-Perthes disease is one of the more common causes of hip pain and later disability (see upcoming article in this series on diagnosing musculoskeletal pain in children by Peter N.



Fig. 1: Radiograph showing the classic features of osteoarthritis of the knee: the joint space is narrowed because of loss of articular cartilage, the subchondral bone appears more sclerotic than normal, and the knee has a varus deformity.

Malleson and Richard D. Beauchamp). During adolescence, a slipped femoral capital epiphysis may cause hip pain at the time of its onset. All of these childhood hip disorders have the potential to cause degenerative joint disease, which may require total hip arthroplasty later in life. Other causes of hip degeneration include trauma, such as fractures of the femoral neck, femoral head or acetabulum and dislocations of the hip joint. Although trauma can occur at any age, young men in their third and fourth decade are at particular risk. In older people, primary osteoarthritis becomes a common cause of pain and disability requiring reconstructive surgery. Inflammatory conditions, such as rheumatoid arthritis or ankylosing spondylitis, may affect a person at any age, and reconstructive surgery is particularly effective in treating these diseases. Avascular necrosis of the femoral head is also a condition that may affect most age groups, particularly if the individual has been taking high-dose corticosteroids, and may lead to disabling secondary osteoarthritis that will require reconstructive surgery (Table 1).

Many of these conditions can be treated with total hip arthroplasty, which involves the replacement of both the upper femur and the acetabulum. However, because the longevity of total hip arthroplasty is limited to 10–20 years, the young, active patient is not an ideal candidate. Many conditions can be treated with alternatives to hip replacement. Acetabular dysplasia leading to early degenerative changes can be successfully treated with osteotomy of the periacetabular area.⁵ Similarly, some cases of avascular necrosis may be appropriately treated by means of an osteotomy. Nevertheless, the majority of patients with degenerative joint disease secondary to these conditions will



Fig. 2: Bilateral hip osteoarthritis: there is narrowing of the joint space, with subchondral sclerosis, cysts and osteophyte formation.

undergo total hip arthroplasty at some time for maximum pain relief.

The main indication for total hip arthroplasty continues to be pain. A patient with a nonpainful, but dysfunctional, joint, in terms of poor mobility, crepitus or instability, is not a good candidate for total hip arthroplasty. In general, the worse the pain preoperatively, the more satisfied the patient will be with the hip replacement.

Conservative treatments should be exhausted before considering total hip arthroplasty. These treatments should include simple analgesics, a trial of anti-inflammatory med-

ications if tolerated by the patient, activity modification, weight loss if possible and the use of a cane in the opposite hand. A patient should not be referred for hip joint replacement unless these methods have been tried.

An exception to this approach is hip pain in the young patient with radiographic evidence of acetabular dysplasia (Fig. 3). This condition is related to congenital dislocation of the hip and may be caused by incomplete treatment leading to a poorly developed acetabulum. The lack of proper development leads to abnormal biomechanical forces on the hip, early degeneration and osteoarthritis.⁶ Although rare, this

Table 1: Conditions associated with a need for joint replacement

Hip	Knee
Congenital dislocation	Osteoarthritis
Postseptic arthritis	Rheumatoid arthritis
Legg-Calvé-Perthes disease	Trauma
Slipped femoral capital epiphysis	"Battered knee syndrome"
Trauma:	Multiple epiphyseal dysplasia
• Fractures of the femoral neck, femoral head or acetabulum	Spondyloepiphyseal dysplasia
• Dislocations of the hip joint	Osteochondrodystrophies (e.g., achondroplasia and pseudo-achondroplasia)
Osteoarthritis	Developmental conditions:
Rheumatoid arthritis	• Blount's disease
Ankylosing spondylitis	• Trevor's disease
Seronegative spondyloarthropathies	Osteochondritis dissecans
Avascular necrosis of the femoral head	Hemophilic arthropathy
Multiple epiphyseal dysplasia	Seronegative spondyloarthropathies
Spondyloepiphyseal dysplasia	Spontaneous osteonecrosis of the knee
Osteochondrodystrophies (e.g., achondroplasia and pseudo-achondroplasia)	



Fig. 3: Acetabular dysplasia: the acetabulum (left) is more vertically oriented than normal and the superolateral aspect of the femoral head is not as covered as it is in a normal hip. After a Ganz periacetabular osteotomy (right), there is better coverage of the femoral head and a more horizontal orientation of the superior dome of the acetabulum, not unlike that of a normal hip.

condition is an important cause of osteoarthritis of the hip in young adults. In these patients, potent anti-inflammatory drugs may mask the progress of degeneration, depriving the patient of the opportunity for long-term pain relief and salvage of the hip joint by means of a realignment osteotomy of the acetabulum (Fig. 3). These patients should be referred early for orthopedic evaluation. Moreover, the young, active patient should be carefully counselled regarding the high risk of early loosening and failure of a hip replacement and the need for revision within 1 or 2 decades. Although young patients with severe end-stage degeneration of the joint must undergo total hip arthroplasty, they must understand that this is not a permanent solution to their problem and, indeed, they may be faced with more problems as the arthroplasty fails in 10–20 years.

Knee replacement

Knee disorders are also not restricted to elderly people. Although end-stage degenerative joint disease secondary to osteoarthritis and rheumatoid arthritis continues to be the major indication for total knee arthroplasty, other conditions can lead to end-stage degeneration and knee replacement.

Childhood disorders leading to severe degeneration of the knee are not as common as hip disorders, but a few conditions lead to either premature degeneration of the articular cartilage or to malalignment. For example, multiple epiphyseal dysplasia, spondyloepiphyseal dysplasia and other much less common osteochondrodystrophies can lead to premature degeneration of the knee. Dwarfing conditions such as achondroplasia and pseudo-achondroplasia and other skeletal dystrophies can lead to premature limb malalignment, typically in varus malalignment, and to degeneration of the joint. Furthermore, developmental conditions of childhood and adolescence such as Blount's disease, Trevor's disease and, more commonly, osteochondritis dissecans can on occasion lead to severe degeneration requiring a knee replacement later in life.⁷

More commonly, however, young patients are faced with the consequences of traumatic injuries that are often trivial but eventually lead to degeneration of the joint and the need for a knee replacement. Total meniscectomy was once thought to be a benign operation; it was the treatment of choice for a tear of the meniscus in the days before the advent of arthroscopic surgery in the 1970s.^{8,9} Unfortunately, many patients who underwent total meniscectomy at a young age develop severe osteoarthritis, requiring either osteotomy to correct the resulting malalignment and take the weight off the arthritic joint compartment or, more commonly, a knee replacement 15–20 years later.

Finally, hemophilic arthropathy continues to be a challenging though very uncommon indication for total knee arthroplasty. This is best handled at a tertiary care centre because of the complicated medical and surgical considerations for this group of patients (Table 1).

The timing of patient referral for a knee replacement is

similar to that for a hip replacement. The nonoperative treatment of arthritis of the knee is also very similar to that of the hip, and the measures discussed earlier apply here. In addition, an off-loader brace can be tried in cases of isolated lateral or medial compartment osteoarthritis. Intra-articular injections of corticosteroids or visco-augmentation agents can be administered in consultation with the orthopedic surgeon or rheumatologist.

Techniques, pitfalls and complications

Total hip arthroplasty

Hip replacement is carried out using either a posterior, abductor-sparing approach or an anterolateral, abductor-splitting approach. Each method has its own merits and pitfalls; however, in experienced hands, similar results should be expected for both methods. The posterior approach is associated with a slightly higher risk of postoperative hip dislocation.

Once the hip joint is exposed and the hip dislocated, the femoral head is removed and the acetabulum exposed. The acetabular fossa is then carefully machined to fit a hemispherical, or a near-hemispherical, socket, with or without cement. This is accomplished by the judicious removal of some bone with reamers. The femur is entered, and the medullary canal is carefully prepared to accept the femoral component (Fig. 4). Care has to be taken to prevent an intraoperative fracture or perforation of the femur with the power instruments. Care must also be taken to ensure correct orientation of the acetabular and femoral components. This is critical to the stability of the arthroplasty, because malorientation of the components is one of the most common causes of a postoperative dislocation of the hip. Fur-



Fig. 4: Total hip arthroplasty.

thermore, careful attention to preoperative planning and intraoperative detail will allow equalization of leg lengths in 90% of patients. In 10% of patients, intentional leg lengthening of up to 1 cm is required to maintain stability.

For most patients, the acetabular component is fixed without cement. It is usually porous-coated, allowing for bone growth into the metal shell. A similar strategy may be used on the femoral side. Alternatively, the femoral component may be inserted with cement. More recently, hydroxylapatite coatings have been added to enhance the fixation of the femoral stem in cementless total hip arthroplasty.

Excessive leg lengthening and hip dislocation may have the greatest negative impact on the patient but are not the most serious complications of total hip arthroplasty. The most serious complication, apart from a fatal pulmonary embolism, is deep infection. The risk of postoperative deep infection is 0.5%–1%.¹⁰ In any patient with new onset of pain after a successful hip or knee replacement, particularly when the pain is sudden, an infection should be suspected and the patient should be re-referred without delay. In the immediate postoperative period, infection is manifested by prolonged drainage or delays in wound healing. The primary care physician should not attempt to treat such infection but should contact the original orthopedic surgeon. Antibiotics alone are rarely, if ever, indicated; they only serve to mask the diagnosis and delay proper surgical treatment, with the potential for disastrous consequences.

Intraoperative neurovascular injury occurs in fewer than 0.5% of uncomplicated hip replacements.¹¹ Intraoperative fractures may occur in a few cases; however, for the most part, they are of no consequence if recognized and treated appropriately.

In addition to these local risks, systemic risks are also possible. Because most patients who have total hip arthroplasty are elderly, there is a possible risk of cardiorespiratory and central nervous system disease, but this is not very common. In addition, the risk of thromboembolic disease is substantial. Without prophylaxis, the risk of a deep venous thrombosis is about 70%, the risk of pulmonary embolism is between 10% and 20%, and the risk of a fatal pulmonary embolism is about 1%–2%.¹² These risks can be substantially reduced with prophylaxis. The most commonly used prophylactic agent is warfarin, although some centres are starting to use the low molecular weight heparins. Low-dose unfractionated heparin is not effective.¹³ With adequate prophylaxis, the risk of pulmonary embolism, in our experience, should be below 5%.

Total knee arthroplasty

Total knee arthroplasty is performed using a standard anterior midline incision, although this must be modified depending on the location of any previous incision. The patella is reflected laterally, the knee is dislocated and the joint surfaces are cut to accommodate the implants. It is critical to realign the knee perfectly, regardless of the de-

gree of preoperative deformity (Fig. 5). Failure to achieve normal knee alignment will seriously compromise the longevity of the implant. A well-performed knee replacement for the correct indication should have a 96% survival rate at 10 years.¹⁴

Most failures that are currently seen are either directly or indirectly related to an intraoperative technical error or infection. Because the patella is reflected laterally, the insertion of the patellar tendon into the tibial tubercle is at risk. If retraction is overzealous, the tendon can rupture. This is a disastrous complication without an effective solution and is, therefore, best avoided. The patella continues to be the most troublesome component in knee replacement. Most surgeons resurface the patella routinely, although some surgeons only resurface severely damaged patellae. Regardless of which approach is taken, the rate of substantial problems related to the patellofemoral joint continues to be about 7.5%.¹⁵

These complications include subluxation or dislocation of the patella, unexplained pain, fracture, loosening, osteonecrosis or patellar clunk syndrome. The latter is a curious entity whereby a nodule of scar tissue forms at the inferior pole of the patella, leading to a painless snapping sensation and sound during flexion and extension. It is easily treated with local excision of the nodule. Other complications include stiffness, reflex sympathetic dystrophy, in-



Fig. 5: Total knee arthroplasty.

jury to local neurovascular structures and intraoperative fracture.⁴

As with total hip arthroplasty, the most serious complication is infection, and the risk of infection is below 1%.¹⁶ The primary care physician is urged to contact the original orthopedic surgeon immediately whenever an infection after knee replacement is suspected. Antibiotics should not be administered before re-referral.

The systemic complications after a knee replacement are the same as those discussed for hip replacement. Thromboembolic disease is more resistant to prophylaxis with warfarin than after total hip arthroplasty. The rate of thromboembolic disease is similar to that after hip arthroplasty. If warfarin is to be used, which we do not recommend, it is to be continued for at least 2 weeks, and preferably for 6 weeks after surgery. Alternatively, a low molecular weight heparin, such as enoxaparin, may be used.¹⁷

Postoperative care, potential complications and rehabilitation

Certain precautions must be taken to prevent a postoperative dislocation. When the components are properly oriented, the most common cause of postoperative dislocation is poor patient compliance.

Weight bearing depends on the fixation of the implants. Full weight bearing is usually possible immediately after surgery, unless cementless fixation is used for the femoral stem. In this case, toe-touch weight bearing, where the patient is only allowed to touch the ground with the toes while using crutches or a walker, is allowed for 6 weeks, and partial to full weight bearing is begun over the next 6 weeks. Physiotherapy is usually withheld until after the 6-week check-up to reduce the risk of abductor avulsion and postoperative dislocation.

After a hip or knee replacement, the patient is allowed to sit up in a chair on the first postoperative day. Walking begins on the second day. By the third postoperative day, the patient is switched to oral analgesics and intensive physiotherapy starts. On the fifth day, the patient is discharged from hospital. Although the patient is generally discharged home, in some parts of the country he or she is discharged to a rehabilitation facility first.

Six weeks after surgery for either the hip or knee, the patient is generally ambulatory. After 3 months, most patients are able to return to their previous activities and can usually return to work. After total joint arthroplasty, patients are discouraged from doing heavy labour and participating in strenuous sporting activities. Walking, cycling and swimming are allowed. Running, downhill skiing and competitive tennis are not recommended.

For at least 3 months after hip surgery, the patient must sit with the hips in an abducted position on a high chair or sofa only. The hip should not be flexed beyond 90°. Most patients find it convenient to use a firm cushion to elevate

Key points

- Osteoarthritis is one of the most disabling conditions that affect patients over 55 years of age.
- Many patients with arthritis will eventually require joint replacement surgery, and most primary care physicians will have patients who have undergone or will require joint replacement.
- The main indication for total joint arthroplasty is intractable pain that can no longer be successfully controlled by conservative therapy alone.
- Total hip and knee arthroplasty have greatly improved the quality of life of patients with degenerative disease and are among the most cost-effective operations in medicine today.
- Although complications are uncommon, they still do occur and can be serious; careful preoperative assessment and planning are mandatory to ensure that complications are kept to a minimum.

low seats in unfamiliar surroundings or in motor vehicles. Patients are also instructed always to use a reaching tool to pick up objects off the floor and to avoid forward bending.

After total knee arthroplasty, aggressive physiotherapy is indicated immediately. Although some centres use continuous passive motion machines immediately after surgery, there is no proof that these devices improve the ultimate outcome. Range of motion exercises, followed by muscle strengthening, are required for at least 6 weeks, and often for 3 months, following total knee arthroplasty. Rarely, a patient may develop arthrofibrosis requiring manipulation under anesthetic.

After both total hip and knee arthroplasty, persistent leg edema is possible. The patient should not be alarmed because this is a common finding. In 1%–3% of cases, this swelling will persist indefinitely and may require treatment with a prescription compression stocking. Most cases, however, will subside within 6 months of surgery. When the swelling is marked, duplex Doppler ultrasonography, if available, or venography is indicated to exclude the diagnosis of a deep venous thrombosis.

In summary, total joint arthroplasty continues to be among the most successful operations performed today. Patient satisfaction is very high, and the results are excellent.

The case revisited

The patient described at the beginning of this paper is clearly a candidate for total knee arthroplasty after medical treatment with anti-inflammatory medications, rest, activity modification and the use of a cane have been tried. She should expect substantial pain relief and a gradual return to her previous daily and recreational activities. She will be able to return to golf, gardening, walking, swimming and cycling.

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