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Lower Limb Joint Replacement in Patients with Rheumatoid Arthritis

Perioperative management considerations for patients with RA who need a total hip, knee, or ankle replacement

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Introduction

Rheumatoid arthritis (RA) is a chronic systemic connective tissue disease, and it is the third most common indication for lower limb joint replacement in Northern Europe and North America. [1] The etiology of the disease remains unclear, but there are strong associations with human leukocyte antigens (DRB1). [2] The prognosis is poor, with 80% of patients being disabled 20 years from primary diagnosis. [3] The medical treatment of RA has improved during the last 25 years, which is reflected by a 40% decrease in the rate of hip and knee surgery since a peak that was observed in the mid 1990s. [4] Anemia, raised erythrocyte sedimentation rate, and a high disease activity score have all been identified as risk factors for the need for large joint arthroplasty. [5]

Seventeen percent of patients with RA undergo an orthopaedic intervention within 5 years of initial diagnosis. [5] More than one third of patients will need a major joint replacement, of which the majority will receive a total hip or knee replacement (THR, TKR). [4] This review article summarizes factors involved in the perioperative management of major lower limb arthroplasty surgery for patients with RA.

Methods of Literature Search

We searched the PubMed [6] electronic database for studies published in English between 1960 and 2011. Our defined search term was: "rheumatoid" "replacement" "arthroplasty" and "outcome." This identified 669 eligible articles. All abstracts were reviewed and those matching the inclusion criteria were included; full papers were retrieved.

The inclusion criteria were:

- Articles reporting preoperative management of patients with RA receiving an orthopaedic intervention
- Articles reporting the survivorship and/or functional outcome and/or complications of primary total hip/knee/ankle replacements in patients with RA
- Articles reporting the survivorship and/or functional outcome and/or complications of revision total hip/knee/ankle replacements in patients with RA
- Articles reporting the rehabilitation of patients with RA after total hip/knee/ankle replacements
- Due to the insufficiency of published literature regarding arthroplasty in the patients with RA, further literature searches were executed. This was only performed when there were insufficient data to draw a conclusion about the question being addressed – for example, the use of tumor necrosis factor alpha (TNFα) drugs in patients with RA undergoing arthroplasty surgery.

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Table 1. Systemic Preoperative Assessment of the Rheumatoid Patient

History	Examinations	Investigations
Disease onset	Complete medical	Full blood count
Pattern and sequence	Joint inflammation	Urea & creatinine
Presences and persistent joint swelling	Joint damage and range of motion	Electrolytes
Pain (site, severity, duration)	Soft tissue integrity	Liver function tests
Morning stiffness	Extra-articular features	Chest radiograph
Functional limitations	Grip strength	Cervical spine radiograph
Non-articular features	General health	Electrocardiogram
Psychological features	Dental inspection	Urine dipstick +/– culture
Systemic features	Neurological assessment	Pulmonary function tests
Review of all systems		Echocardiogram (limiting cardiac pathology)
Drugs and allergies		Airway assessment
Prior anaesthetic and surgery		

Preoperative Assessment

In the preoperative assessment, the history, examination, and investigations need to be comprehensive, as described in Table 1. [7]

Eighty percent of RA patients have cervical spine involvement. Thirty percent have instability of the cervical spine, half of whom are asymptomatic. [8,9] Subluxation of the atlanto-axial joint, due to the destruction of the transverse ligament by inflammatory pannus, is defined as a distance of >3 mm between the anterior aspect of the atlas and dens on a plain lateral cervical spine radiograph. [7] Clinical symptoms of occipital headache, weakness of limbs, bladder and bowel dysfunction, and long track signs should alert the clinician to such pathology. Computed tomography (CT) may be helpful to assess the extent of subluxation. [10]

Immunosuppressants

Steroids are used as a therapeutic bridge to control symptoms until the disease-modifying anti-rheumatic drugs (DMARDs) take effect. If a patient has used long-term steroids, an increased dose should be given in times of stress to prevent an Addisionian crisis. Use of steroids in the perioperative period for general surgical procedures increases the infection rate and impedes wound healing. [11] There is, however, no published literature regarding the risk of steroid use in the perioperative period for arthroplasty surgery

Methotrexate is a commonly used DMARD and has been shown to improve symptoms and slow radiographic progression of joint destruction. [12] There is a single prospective randomized control trial: 388 patients undergoing elective surgery were randomized to either cease or continue with methotrexate. [13] A 2% infection rate occurred in those who continued methotrexate, with a decreased complication rate and number of flares of their rheumatoid disease. Those who stopped the methotrexate had a 15% infection rate. Hence, it would seem safe and beneficial for the patient to continue methotrexate perioperatively, and it may aid their postoperative recovery.

Newer targeted immunotherapy such as TNFα antagonists are more effective in disease control, with slowing of radiographic joint destruction. [14] The evidence as to whether these drugs should be continued or stopped during orthopaedic procedures is limited. One study of 31 patients undergoing foot and ankle surgery demonstrated no difference in the infection rate if patients continued with their TNFα prescription. [15] A larger retrospective study of 128 patients undergoing major orthopaedic surgery revealed an increased infection risk in those who remained on TNFα antagonists (odds ratio 21.8), and an associated increased risk of deep vein thrombosis (odds ratio 2.8). [16]

Surgical Sequence

Wilkinson et al suggest addressing lower limb arthropathy before the upper limb. Their hypothesis is that prior fragile upper limb interventions may be damaged by mobilization on crutches after lower limb surgery. [7] The surgical sequence they recommended is forefoot, hip, knee, hindfoot, and then ankle, which they deemed the order of "reliability" of the procedures. Constructing a base on which to build would be logical; the "reliability" of different procedures is arguable and individual patient assessment may dictate a different protocol. Hindfoot fusion may necessitate plaster immobilization, and could be considered at an earlier stage. Restoration of the correct femoral alignment and length with a THR precedes the TKR to allow correct implant alignment and rotation. Significant joint stiffness and/or contracture at adjacent or bilateral joints may be optimally addressed by simultaneous arthroplasty. Preoperative long leg standing alignment radiographs and a CT scan for assessment of soft tissue integrity and bone loss can help plan surgery.

Total Hip Replacement

Technical challenges of performing THR in patients with RA are mainly due to bone loss, osteopenia, and protrusio acetabuli. These patients are not suitable for hip resurfacing because of the risk of secondary osteoporosis. [17]

Until recently, there was little evidence to support the use of cemented over uncemented THR. Chmell et al reviewed 39 patients with juvenile rheumatoid disease (66 hips) who received a cemented THR with a mean follow of 15.1 years. [18] They report a stem survival of 85% and a cup survival of 70% for various implant designs. Creighton et al reviewed 75 patients (106 hips), all of whom received a cemented prosthesis. Stem survival was 98% and cup survival was 92% at 10 years. [19] They also demonstrated an association of cup loosening with younger patients. Jana et al, using an uncemented stem in 64 patients (82 hips) for juvenile RA, reported a survival of 98.1% at 11 years. However, various cemented and uncemented cups were used.

Analysis of 2,557 primary THRs using various implants for patients with RA from the Finnish arthroplasty register found the best survival to be with uncemented proximally circumferentially porous-coated stems (89% survival at 15 years) and cemented all-polyethylene cups (80% survival at 15 years). [20] However, more recent data from the Norwegian arthroplasty register suggested that cemented THR was superior to uncemented THR, with a 10 year survival of 89% and 81% respectively. [21]

Protrusio acetabuli is a common occurrence in the rheumatoid hip, and technical difficulties can be encountered due to medial wall deficiency. Two grading systems are used: that of Charnley, [22] relative to the ilio-pectineal line, and more commonly, Hirst et al, [23] relative to the ilio-ischial line (Table 2).

Table 2. Grading of Protrusio Acetabuli

Grading of protrusio acetabuli according to the distance between the acetabular line (medial wall of acetabulum) and the ilio-ischial line

Grade	Men	Women
I	3-8 mm	6-11 mm
II	8-13 mm	12-17 mm
III	>13 mm with fragmentation	>17 mm with fragmentation

Figure 1. *Grade II protrusio acetabuli (A) in a female who underwent total hip replacement with medial bone graft and restoration of the center of rotation (B).*

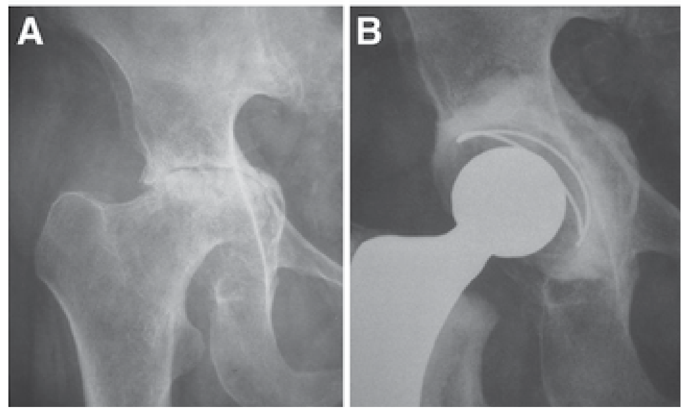
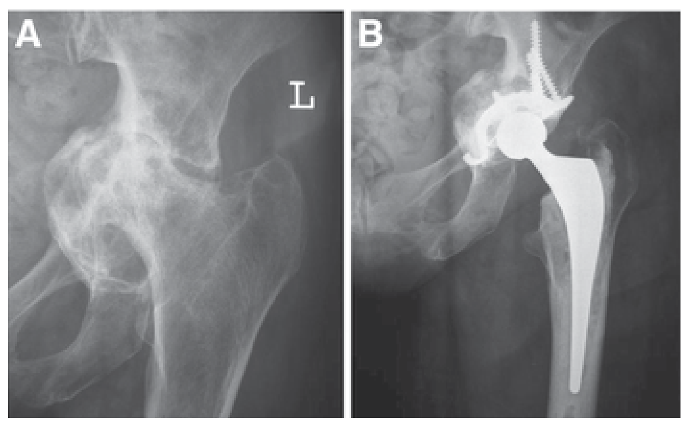
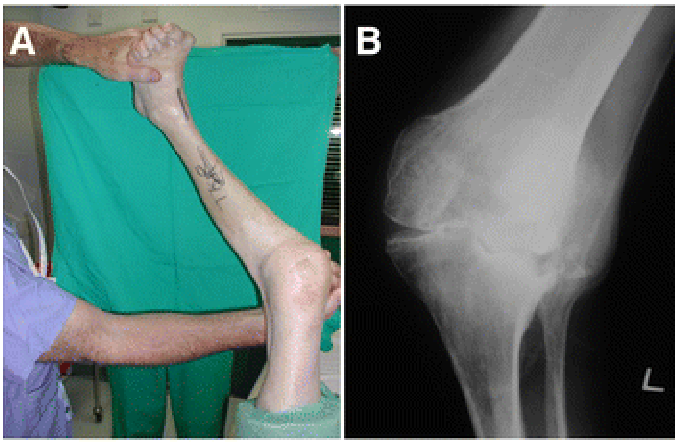


Figure 2. *Grade III protrusio acetabuli (A) with cage augmentation and medial bone graft (B).*



Hirst also described the Wrightington technique for bone grafting the acetabular floor, using 2-mm discs cut from the dislocated femoral head, which are molded using a dome pusher to conform to the acetabular floor. Restoration of the center of rotation lateral to Köhler's teardrop is essential (Figure 1). To further improve cement fixation, 6-mm holes may be drilled around the periphery of the acetabulum. The cement is placed directly onto the floor graft with insertion of the cup. More extensive acetabular destruction in Grade III protrusio may require a cage and additional bone grafting to prevent early failure (Figure 2).

Figure 3. *Valgus deformity of knee (A) due to avascular necrosis and bone destruction (B).*

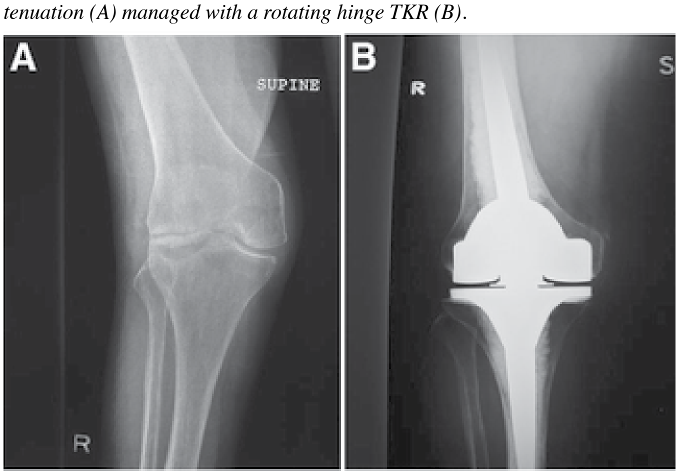


Total Knee Replacement

Poor bone stock, avascular necrosis, deformity, and contracture (Figure 3) can present technical challenges. Implant augmentation and bone grafting may be required. An implant that retains the posterior cruciate ligament (PCL) is favored by many surgeons for osteoarthritis of the knee. In rheumatoid disease, however, there is soft tissue destruction resulting in joint instability. Even if the PCL is intact intraoperatively, it may subsequently be eroded by inflammatory pannus postoperatively, resulting in an unstable prosthetic joint. Laskin reviewed 178 rheumatoid patients at an average of 8.2 years of follow up and demonstrated a 50% instability rate with PCL-retaining implants, in contrast to a 1% instability rate with the PCL-sacrificing implants. [24]

Longer-term results in rheumatoid disease are limited. Goldberg et al [25] and Kristensen et al [26] demonstrated a 0% to 14% instability rate for PCL-sacrificing implants, respectively. Gill et al [27] and Meding et al [28] have shown similar rates of instability for PCL-retaining implants (1.5% and 9.9%, respectively). The differences between the reported instability rates may relate to disease severity and medical treatment, with more recent studies having the advantage of modern pharmacokinetics and preservation of soft tissues.

Figure 4. *Significant valgus deformity and concomitant medial collateral attenuation (A) managed with a rotating hinge TKR (B).*



For patients with significant valgus deformity and concomitant medial collateral attenuation, a rotating hinge (Figure 4) may be the treatment of choice, [29] as an extensive lateral release may result in "overstuffing" of the joint, with an increased risk of midflexion instability. Furthermore, if the patient has a marked fixed flexion contracture of >30 degrees, then threshold for a constrained design should be low, particularly in older patients. [30]

The 15-year survival, excluding infection, for cemented total knee arthroplasty in patients with RA is 96.5% and 91% for PCL-retaining and PCL-sacrificing implants, respectively. [28,31] However, it could be argued that the increased failure rate in those who received a PCL-sacrificing implant had a higher grade of rheumatoid disease with severe joint destruction and, hence, the indication of a stabilized implant. Cemented implants may be the preferred option in poor bone stock and osteoporosis. Vigano et al described a 10-year survival rate of 98.4% using an uncemented TKR for RA patients. The average age of their cohort was 49.5 years. It could be argued that these patients had a better bone stock than older patients, facilitating osteointegration.

Shoji et al conducted a retrospective comparison of rheumatoid patients undergoing TKR with and without patella resurfacing, and they found no difference in pain or functional outcome. [32] In contrast, Kajino et al conducted a prospective randomized controlled trial of rheumatoid patients undergoing TKR, and they found improved pain relief and functional outcomes for patients receiving patella resurfacing. [33]

Total Ankle Replacement

The survival of total ankle replacement (TAR) does not parallel that of THR and TKR. The reported success rate of TAR in RA ranges from 40% to 100%. [34] Mechanical loosening of the components is the major cause of revision surgery. [35] A recent long-term follow up of 33 TARs for RA reported an 85% survival rate at 10 years when failure was defined as removal of the prosthesis. The survival rate decreased to 64% if signs of radiographic loosening were included. [35]

Failure after TAR has been shown to be much higher in patients with greater than 15° of varus or valgus deformity. [36,37] When a concomitant planovalgus forefoot abductus deformity exists, arthroplasty is a more difficult and less predictable procedure. Success will require a simultaneous or two-stage triple arthrodesis to correct the deformity, which is generally too severe to be corrected with a simple subtalar fusion. Patients are often frail or have poor soft tissues, making two-stage operations unattractive and a simultaneous triple arthrodesis a high-risk venture.

Revision Arthroplasty Surgery

Data regarding revision THR in rheumatoid patients are limited. The outcome of cemented cup revision for RA is inferior to patients without RA, with a 64% radiographic failure rate at 7 years. [38] This survival rate falls further at 9 years to 44% when an uncemented cup is used at revision. [39] Schreurs et al improved survival with the application of morselised bone graft in combination with a cemented cup at revision, reporting an 80% survival at 12 years. [40]

High failure rates have been reported for revision TKR in patients with RA. Garcia et al report a survival for all knees (27 mechanical failures and 18 infected revisions) of 76% at 5 years. They also, more worryingly, report a 34% mortality rate at 6 months for RA patients revised for infection. [41]

Rehabilitation

Patients with RA have a longer length of hospital stay, with slower functional improvement, than patients undergoing joint replacement surgery for primary osteoarthritis. A study of 1,361 rheumatoid patients and 26,096 osteoarthritic patients undergoing lower limb arthroplasty found the length of stay to be only 1 day longer, but it did show a slower, more gradual improvement of their functional independence score. [42] Stanley et al demonstrated that RA patients undergoing bilateral TKR had a similar functional outcome and complication rate as those undergoing staged procedures, but they had the benefit of a more rapid recovery relative to staged procedures. [43]

Complications

Evidence from the Swedish joint registry suggests that periprosthetic fractures are more common among patients with rheumatoid disease compared to osteoarthritis patients, with a hazard ratio (HR) of 1.56. [44] Similar figures have been reported from the Finnish registry (HR 2.1). [45] This predisposition to fracture may to be secondary to poor bone quality. [45] The management of periprosthetic fractures can be challenging and associated with high morbidity and mortality. [43]

The risk of arthroplasty infection is greater for patients with RA. Bongartz et al conducted a retrospective review of 462 patients (657 implants) who received either a TKR or THR. They compared infection rates for RA patients with a matched cohort of patients with osteoarthritis. [46] They found RA patients to be at an increased risk of prosthetic joint infections for both primary (HR 4.08, 95% CI 1.35-12.33) and revision surgery (HR 2.99, 95% 1.02-8.75).

Conflicting evidence exists regarding the risk of venous thromboembolism (VTE) post-arthroplasty surgery in patients with RA, with Chotanaphuti et al. [47] declaring RA to be a risk factor and Guan et al [48] claiming RA to be protective for VTE. A retrospective review of nearly 5 million patients with RA showed that RA was an independent risk factor for pulmonary embolism and deep vein thrombosis in hospital patients who did not undergo surgery, with a relative risk of 2.25 and 1.9, respectively. [49]

Patient Outcomes

Patients with active disease, raised rheumatoid titer, or clinical depression do not improve to the same extent as patients without. [50] Ethgen et al performed a cost/outcome analysis of arthroplasty for patients with RA, finding good pain relief that was equal to that of patients with primary osteoarthritis, but there was only a minor improvement in the functional outcome. [51] They also demonstrated reduced use of DMARDS, with cost savings, which may relieve the patient of drug-related adverse effects. Sledge proposed the key to a successful surgical outcome for patients with RA is for the surgeon to be familiar with the technical challenges of patients with polyarthritis and to work as part of a multidisciplinary team. [1]

Summary

RA is a systemic disease, and as with any other medical co-morbidity, the patient should be optimized preoperatively using a multidisciplinary approach. The continued use of methotrexate does not increase infection risk, and aids an early recovery with control of the disease during the perioperative period. Biologic agents (TNFα antagonists) should be stopped preoperatively due to the increased infection rate. Patients should be made aware preoperatively of the increased risk of infection and periprosthetic fracture rates associated with their disease.

The surgical sequence is commonly hip, knee, and then ankle. Cemented THR and TKR have superior survival rates over uncemented components in RA patients. The need for bone grafting for protrusio acetabuli should be identified during preoperative planning. The evidence is not clear regarding a PCL-sacrificing versus a PCL-retaining implant in TKR, but a PCL-sacrificing component limits the risk of early instability and potential revision. Patella resurfacing as part of a TKR is associated with improved outcomes and should be considered in the rheumatoid patient. The results of TAR remain inferior to THR and TKR. RA patients achieve equivalent pain relief, but their rehabilitation is slower and their functional outcome is not as good. However, the key to managing these complicated patients is to work as part of a multidisciplinary team to optimize their outcome.

Competing interests

The authors declare that they have no competing interests.

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Source

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