Joint Revision Surgery - When Do I Need It?

Joint replacement surgery is undoubtedly one of the greatest medical advances of our time. Hip and knee replacements have been performed in millions of Americans over the last four decades. These procedures have improved patients' quality of life by easing pain, improving range of motion, and increasing activity levels.

Currently, over 400,000 hip and knee replacements are performed in the United States annually. Although joint replacement surgery has been amazingly successful, approximately ten percent of implants will fail and require a second procedure, called revision, to remove the old implants and replace them with new components.

Joint revision surgery is a complex procedure that requires extensive preoperative planning, specialized implants and tools, and mastery of difficult surgical techniques to achieve a good result.

Most hip and knee replacement[1] procedures will perform well for the remainder of the patient's life. Current hip and knee replacements are expected to function at least 10 to 20 years in 90 percent of patients. This is due to several factors.

- **There are more surgeries performed on older individuals.** Older individuals tend to put lower demands on their implants.
- **Current state-of-the-art materials and techniques have improved the quality of implant fixation to bone.** This had historically been a weak link that created a potential site of failure.
- **Innovations in implant[2] technology.** Innovations have significantly decreased the amount of wear particles that are created by friction on joint surfaces.

As increasing numbers of young patients have these procedures, and as seniors continue to live longer, a growing segment of joint replacement patients will outlast their implants.

The decision to perform a revision joint replacement surgery will be based on several factors. The joint may become painful or swollen, due to loosening, wear, or infection. The function of the implant may decline, resulting in a limp, stiffness, or instability. Finally, serial examinations or X-rays may demonstrate a change in the position or condition of the components. All of these factors will determine when joint revision surgery is needed.

Reasons Implants May Fail

The anatomy of the hip and knee is very different after joint replacement as compared with its preoperative state. For example, there are large metallic objects and possibly cement. In addition there may be scar tissue and bone loss. These factors must be addressed in revision joint surgery.

Implants may fail for any of several physiologic reasons: loosening, infection, dislocation, or patient-related factors. The anatomy and pathophysiology of failed joint replacement implants[3] contribute to the decision to perform revision surgery.

Loosening

Some revisions will be necessary because the implants have loosened. When they were first put in, the large metal and plastic implants of joint replacement were placed with the intention of staying fixed for a long time. They were either cemented into position or bone was expected to grow into the surface of the implant. In either case, the implant was firmly fixed to bone.

However, the friction of the joint surfaces rubbing against each other wears away the surfaces of the implant, creating tiny particles. These particles accumulate around the joint. In a process called aseptic, or noninfected, loosening, the bonds of the implant to the bone are destroyed by the body's attempts to digest the wear particles. When the prosthesis becomes loose, the patient may experience pain, deformity, or instability. In addition, the process of digestion, or lysis, of wear particles also digests normal bone. This can weaken or even fracture the bone, and jeopardize the success of the revision surgery. In this event, surgery will also address the bone stock deficiencies. Aseptic loosening is the most common mode of failure of hip and knee implants.

Infection

Infection is another physiologic cause of implant failure. The large foreign metal and plastic implants can serve as a surface for bacteria to latch onto. In addition, the tissue that has been previously operated on has an altered blood supply, which may not be adequate to fight infection. Even if the implants remain well-fixed, the pain, swelling, and drainage often make revision necessary. Lastly, the chronic fight against an infection can weaken the patient and endanger their life. Realistic risk of infection with current surgical techniques and antibiotic regimens is about 0.5%. [4]

Dislocation

Dislocation is yet another mode of failure of joint replacement surgery.[5] (Dislocation is a sudden popping out or migration of the implant from its normal position.) It is more commonly a problem of hips rather than knees. The rate of dislocation after hip replacement ranges from zero to 10%, but averages about one in 50 patients. Some of these patients will experience multiple dislocations and require revision. The dislocation may be caused by loosening, inadequate soft tissues, bony or scar tissue impingement, incompatible component position, neurologic factors (such as neuropathy or Parkinsonism), or patient noncompliance.

Patient-Related Factors

Younger and more active patients have a higher rate of revision. [6] [7] Obese patients have a higher incidence of wear and loosening. Patients whose primary surgery was performed for inflammatory arthritis, patients with avascular necrosis, and patients with a previous hip fracture are at higher risk for loosening. These anatomic and physiologic conditions lead to the necessity of joint revision surgery.

Diagnosis

Joint replacement surgery has been shown to decrease pain and increase function in the vast majority of patients. Once a patient progresses through the postoperative period, symptoms of pain, as well as the stability and motion of the joint, should remain stable for an extended period of time.

The natural history of failed implant surgery is an increase in pain, a change in the position of the implant, or a decrease in the function of the implant with limp or dislocation. Patients who demonstrate these symptoms and signs may require revision joint surgery. Therefore, a standard assessment[8] is performed, including a history and physical examination, X-rays, laboratory tests, and possibly aspiration or scintigraphic studies.

Physical Examination

The history and physical examination will identify patients who have a change in their pain level. Also, information can be obtained regarding activity levels and use of assistive devices, such as crutches or a cane. Pain of the hip may present as either groin or buttock pain. In addition, pain of the hip can sometimes be perceived of as knee pain, and vice versa. Swelling of the knee can be assessed easily, but swelling of the hip area may be more subtle. Mechanical failure or infection may also present with redness and warmth of the affected joint. A limp or deformity may be identified.

X-Rays

X-rays taken of the area around the joint replacement yield important clues regarding stability of the implant. Failure due to the most common cause, aseptic loosening, can be identified by several findings. For example, the implant may have moved, compared to previous X-rays, or there may be a lucent line between the component and the cement or bone, signifying that the bond between the bone and implant has degraded. Areas of bone loss, or lysis, can be identified. Mechanical failure with broken implants or severe wear is also assessed by comparison to previous X-rays. For these reasons, serial follow-up radiographs are recommended to catch joint failure at an early stage.

Laboratory Tests

Common laboratory tests for possible failed joints include a complete blood count, an erythrocyte sedimentation rate (ESR), and a C-reactive protein test (CRP). These studies are most helpful in the detection of infected joint replacements. The blood count may identify an anemia from chronic disease, and rarely may detect an elevated white blood cell count. The ESR and CRP may be abnormal in the presence of an inflammatory process, such as infection.

Additional Tests

Joint fluid may be removed with a needleand analyzed, a technique called aspiration, to give clues as to a possible infection. The knee joint can usually be reached with a needle in the physician's office, but the hip more commonly requires a setting that has fluoroscopic X-ray capabilities. In addition, scintigraphic studies that use short-acting radioactive isotopes may be used. Short-acting radioactive isotopes which are injected into the bloodstream may be used. One scintigraphic study, the Technetium99 bone scan, can detect abnormal bone activity such as infection, fracture, or irritation from prosthetic motion. Another study, the Indium111 scan, may be used to detect infection. All of these methods can be used when the natural history of joint replacement changes and revision becomes a possibility.

Treatment Alternatives to Revision Surgery

Although there are some surgical alternatives to revision joint surgery, they are rarely used, due to two main factors: these procedures can sometimes be more complex and lead to worse results than revision surgery and the results of modern revision joint surgery are outstanding.

One alternative to hip revision is called resection arthroplasty. This involves removal of the entire hip joint. This can give some relief of pain but naturally will lead to a decrease in function as compared to modern hip replacement.

Another procedure is called fusion, also known as arthrodesis. It may be used as an alternative to knee revision. Again, pain may be relieved, but at the expense of keeping the knee in a straight, nonbending position. These procedures may have a use in cases of severe joint infections that cannot be eradicated.

Greater than 90% of patients who undergo revision procedures will be expected to have good to excellent results, even considering the higher rate of complications as compared to first-time joint replacement. After weighing the alternatives, most patients and physicians prefer revision to other surgical options.

Nonsurgical Treatment

Benefits and Limits

Revision joint surgery, as previously stated, can be a major procedure that requires complex techniques. It can also have a higher complication rate than primary surgery. In addition, some patients are not medically able to tolerate a long and difficult surgical procedure.

Because of this, nonoperative treatment options are sometimes considered as a first step in the treatment of a failed implant. Obviously, problems that would damage remaining bone quality or make later treatment difficult would eliminate the nonsurgical options. Also, patients treated nonsurgically must realize that they may have significant limits on their function and activity.

Pain that is caused by a failed joint replacement may initially be treated with an increase in pain medications. These treatments may be limited by side effects, such as gastrointestinal upset and ulcers, drowsiness, and constipation. Increased reliance on assistive devices, such as a cane, crutches, or a walker, may be used to postpone revision. Likewise, a brace may decrease episodes of instability or dislocation. These techniques may be cumbersome and a burden to the patient, however. Modification and restriction of activity itself can be used to decrease symptoms. The less active a patient is, the less likely they are to be symptomatic. Finally, some infected joint replacements are treated with suppressive antibiotics to control the infection symptoms. This approach has a variable success rate and would not be expected to eradicate the infection.

Surgical Intervention and Considerations: Hip Surgery

Surgical intervention with joint replacement surgery[9] can be a complex and challenging procedure. Several potentially difficult portions of the surgery must be considered. Common to all joint revisions is an assessment of existing bone quality, removal of the failed components, reconstruction of remaining bone and soft-tissue structures, and successfully fixing the new components to the bone.

Consideration of each of these challenges is essential to produce successful revision joint surgery.

In hip revision surgery, both the femoral (stem and ball) components as well as the acetabular (socket) portion must be addressed.

- The hip bones may have deficiencies due to lysis and loosening, fracture, or shielding of the bone from normal stress. These deficiencies are graded according to several classification methods.
- Once this assessment is performed, a method to remove the existing components is selected. If some parts of the implant are still functioning, efforts may be made to retain them. Specialized removal techniques[7] have been developed, including surgically splitting the femur bone to remove the cement and implants, as well as power and hand instruments, which accurately cut around the prosthesis.
- When the failed components are removed, the remaining bone may require a complex reconstruction, involving larger or longer implants, bone grafting using ground-up bone or large segments of bone, and possibly cement and metal cages.
- Finally, the selected revision hip implant must be firmly fixed to the bone, either through bone growing into small pores in the outer layer of the implant or by cementing the construct into place.

Surgical Intervention and Considerations: Knee Surgery

Knee revision surgery entails consideration of the femur (thigh bone), tibia (shin bone), and patella (kneecap) components.

- Bone stock deficiencies are classified according to several grading systems, and lysis, fracture, or stress shielding can lead to bone loss.
- The failed components are removed by a combination of surgical methods and specialized instruments. Reconstruction may require implants with extensions to reach better-quality bone and that effectively replace lost ligament stability.
- Ground-up or bulk bone graft may be used.
- An implant is fixed in place through cemented or bone in-growth techniques.

Surgical Technique

Joint revision surgery is usually performed as a planned surgical procedure. Patient condition and characteristics of the failed and new components will contribute to the planning process. Most surgical methods will proceed along a similar stepwise pattern.[11]

Before Surgery

Preoperatively, blood donation may be required, due to the extensive dissection necessary to perform this surgery. Additionally, antibiotics will be given either before or early in the case to aid in prevention of infection. The patient will be brought to the operating room suite and anesthetized[9] for pain control and muscle relaxation.

Considerations

The surgical incision may utilize the site of the previous incision or it may be placed in another location. It is likely that a more-extended incision will be used in order to facilitate implant and scar removal as well as simplify the insertion of the new component. Great care is taken during dissection, as the normal position and appearance of nerves and blood vessels can be altered by the previous surgery and wear of the old components. The failed implants and any old cement pieces are removed using specialized techniques.[10] In addition, abnormal bone and scar tissue is removed to achieve a new bed for fixation of the prosthesis.

Techniques

Reconstruction of the hip or knee bones must then be performed. Some procedures will have bone almost equal to a primary procedure. Others will have more-severe bone loss. In these cases, revision will require the use of bone graft and/or metallic plates, cages, and screws. Once bone has been reconstructed, the process of implantation can begin.

Several techniques are available to implant the revision joints.

Hip implants can be

- Porous-coated to allow bone in-growth
- Fixed close to the joint if bone quality is acceptable, or may have to rely on fixation down the bone if there is poor remaining tissue. Alternatively, the hip can be cemented into position.
- Implanted using a combination of bone graft and cement.

Knee revision implants

- May be about the same size as primary implants, or they can have extensive stems, wedges, and build-ups if bone quality is poor.
- May substitute for damaged or absent ligaments.
- Will often use cement for fixation, but occasionally uncemented techniques are selected.[10]

After Surgery

Once the components are in place, the closure of tissue layers is performed. Drains are placed to collect any fluids or blood. The joint may be protected after surgery in a brace or splint. The medical condition of the patient is closely monitored and blood count is assessed. Antibiotics and some method of blood clot prevention will be continued in the postoperative period and thus complete the steps of the surgical procedure.

Potential Surgical Complications

Any surgery can have potential complications. The complexity of revision joint surgery increases the chance of complications. A realistic assessment of these risks is essential prior to a revision procedure.

Infection, bleeding, and trauma to nerves or blood vessels are a potential with any surgical procedure. These are addressed and minimized by using antibiotics before and after surgery, working in a sterile operating room, use of blood-preserving techniques, and utilizing well-planned surgical exposures. The risk of these complications is higher than primary procedures.

Malpositioning or loosening of the new components is possible. In addition, the revision implants may migrate due to poor bone quality or inadequate fixation to the bone. More-severe destructive processes with greater preoperative bone loss are more likely to create this problem.

Deep venous thrombosis[x] and pulmonary embolism, or blood clots in the legs or lungs, can occur in conjunction with a revision procedure. The extensive surgery with subsequent twisting and trauma of the blood vessels can create clotting. In addition, the relative immobility of the patient after surgery increases the chance of clots. A clot in the lungs can become a life-threatening situation if the clot is large.

Dislocation of a hip implant is more common after revision surgery. This is due to the extensive dissection required to remove the failed components as well as the poorer quality of the surrounding soft tissues after multiple procedures. In order to decrease the chance of dislocation, soft tissues are stretched out, which can lead to a lengthening of the operated leg.

Medical conditions can be aggravated or caused by the extensive revision procedure. Patients may have heart and lung complications, or stroke conditions. Rarely, death can occur. The decision to perform revision joint surgery is made when the benefits of pain relief and functional improvement outweigh the risk of these potential complications.

Rehabilitation and Convalescence

Rehabilitation after joint revision surgery is as aggressive as possible without damaging the new implant construct. In most cases, physical therapy will be initiated within 24 hours of the procedure. Therapy will continue for up to three months following the surgery.

Weightbearing may be restricted at first and a protective brace may be utilized.

Assistive devices, such as a walker or crutches, will be used early in the convalescence period. Patients will progress to a cane or no assistive device. In the hip[13] , as in primary surgery, precautions may be placed regarding sitting, bending, and sleeping positions. For the knee,[14] emphasis will be placed on regaining motion.

Restrictions remain in place for six to 12 weeks. Some patients will begin their rehabilitation in a rehabilitation hospital setting, while others will opt for home and outpatient therapy.

Improvement in strength and limp may continue to improve over one to two years.

Conclusion

The decision to have joint revision surgery is based on many factors. Although joint replacement is successful in many patients, certain signs and symptoms will indicate that the implant has failed. Joint revision surgery is necessary when pain, swelling, limp, stiffness, or instability of a failed prosthesis become too great. Fortunately, modern techniques and materials for revision surgery will yield many more active years for most patients.

Reference List

1. Paprosky WG, Greidanus NV, Antonius J: Minimum 10-year results of extensively-porous-coated stems in revision hip arthroplasty. Clin Orthop 1999;369:230-242
2. Katz RP, Callaghan JJ, Sullivan PM, Johnston RC: Long-term results of revision total hip arthroplasty with improved cementing techniques. J Bone Joint Surg Br 1997; 79:322-326
3. Younger TI, Bradford MS, Magnus RE, Paprosky WG: Extended proximal femoral osteotomy: A new technique for femoral revision arthroplasty. J Arthroplasty 1995; 10:329-338
4. Jiranek WA, Hanssen AD, Greenwald AS: Antibiotic-Loaded Bone Cement For Infection Prophylaxis in Total Joint Replacement. J Bone Joint Surg Am 2006, 88:2487-2500
5. Shinar AA, Harris WH: Bulk structural autogenous grafts and allografts for reconstruction of the acetabulum in total hip arthroplasty. A sixteen-year average follow-up. J Bone Joint Surg Am 1997; 79:159-168
5. Shinar AA, Harris WH: Bulk structural autogenous grafts and allografts for reconstruction of the acetabulum in total hip arthroplasty. A sixteen-year average follow-up. J Bone Joint Surg Am 1997; 79:159-168
6. Huo MH, Parvizi J, Gilbert NF. What's New in Hip Arthroplasty. J Bone Joint Surg Am 2006, 88:2100-2111
7. Archibeck MJ, White RE. What's New in Adult Reconstructive Knee Surgery. J Bone Joint Surg Am 2005, 87:1656-1665
8. Leopold SS, Rosenberg AG, Bhatt RD, Sheinkop MD, Quigley LR, Galante JO: Cementless acetabular revision: Evaluation at an average of 10.5 years. Clin Orthop 1999; 369:179-186
9. Schmalzreid TP, Callaghan JJ: Wear in total hip and knee replacements. J Bone Joint Surg Am 1999; 81:115-136
10. Hanssen AD, Rand JA: Evaluation and treatment of infection at the site of a total hip or knee arthroplasty. Instr Course Lect 1999; 48:111-122
11.

Haas SB, Insall JN, Montgomery W III, Windsor RE. Revision total knee arthroplasty with use of modular components with stems inserted without cement. J Bone Joint Surg Am 1995; 77:1700-1707

Last reviewed: September 2007

Related Topics

Infections (http://orthoinfo.aaos.org/topic.cfm?topic=A00197)

Total Knee Replacement (http://orthoinfo.aaos.org/topic.cfm?topic=A00389)

OrthoInfo
The American Academy of Orthopaedic Surgeons
6300 N. River Road
Rosemont, IL 60018
Phone: 847.823.7186
Email: orthoinfo@aaos.org