

Infections in Total knees and Hip Replacements

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Performed as elective surgery procedures, Total Knee and Total Hip Replacements have proven to relieve pain and discomfort, while allowing the patient to become more active in life. Like for any procedure requiring a general anesthesia, there are risks but a small number of patients may develop superficial or deep infections following the procedure, requiring a hospitalization for antibiotic therapy. An infection may develop while in the hospital or later while you are at home or it may occur years after the surgical procedure.

The implantation of joint prosthesis is now-a-days, becoming increasingly common, especially when it has been estimated that around 800,000 THR and TKR are performed each year in the United States alone. Other joints have also benefited from such procedure like the shoulder, elbow, wrist, ankle and even the temporo-mandibular joints.

Infection is considered to be the most devastating of prosthesis-related complications, leading to prolonged hospitalization, repeated surgical intervention, and even definitive loss of the implant. The main risk factors to periprosthetic joint infections (PJIs) are advanced age, malnutrition, obesity, diabetes mellitus, HIV infection at an advanced stage, presence of distant infectious foci, and antecedents of arthroscopy or infection in previous Arthroplasty. Immuno-compromised patients and patients with diseases like rheumatoid arthritis or psoriatic arthritis are also at risk when such procedures are contemplated.

Joint prostheses can become infected through three different routes: by direct implantation or by hematogenic infection or simply by reactivation of a latent infection. Gram-positive bacteria predominate in cases of periprosthetic infections especially with *Staphylococcus aureus* and *Staphylococcus epidermitis*. We generally divide the infections into acute (within 4 weeks) and chronic manifestations.

Imaging studies are used after clinical evaluation to diagnose a peri-prosthetic infection. Standard X-Rays, Computer Tomography (CT) scan may help in distinguishing a septic from an aseptic loosening of the prosthesis. A three-phase bone scintigraphy using technetium has routinely demonstrated a high sensitivity but often a low specificity. Now-a-days, Positron emission tomography using “fluorodeoxyglucose” (FDG-PET) is used to enhance the clinical flair. With such adjunct, a definitive diagnosis of infection should be made by the isolation of the micro-organism from the joint fluid aspirated from the joint or from the surgical wounds or debrided material from surgical procedures, suspected of being infected. Gram-stain and cultures of the specimen will asset the pathogen and offer the sensibility to different antibiotics.

A successful treatment of an established infection will depend on an extensive debridement and appropriate antibiotic therapy. It may become also necessary to perform a two-stage procedure requiring the removal of the prosthetic devices (implants) after washing of the joint and the re-insertion of a new prosthesis in a later stage after proper antibiotic therapy.

Infections can be caused by bacteria especially coming from the gastrointestinal tract and invading the skin when our immune system tries to react to the invasion of the organisms by killing the invading bacteria in the blood stream. A total joint prosthesis (implant) is certainly, a foreign body made of different kind of metal alloys and hard plastic material called polyethylene which can easily become infected by any bacteria circulating in the bloodstream. This is the way an infection may enter in contact with a joint prosthetic device.

Preventive antibiotics are generally given before and after the procedure in prophylaxis, but if infection sets up deeply in the wound, it will need more intravenous antibiotics to cure such infection, although generally more surgical treatment consisting in irrigation and debridement may be necessary to cure the infection.

A total joint generally may become infected during the time of the original surgical treatment or anywhere from weeks to years following the

procedure. Major dental procedures such as a root canal or a dental extraction need to be avoided but if necessary, prophylactic antibiotic should be given. Any skin infections over the body or any other surgical procedure including colonoscopy etc. can be responsible for seeding the bacteria into the bloodstream. Patients with immune deficiencies like in disease like Lymphoma, HIV-AIDS, and disease like Diabetes Mellitus, Peripheral vascular diseases, people on immunosuppressive drugs such as corticosteroids or chemotherapy medication, or simply people with morbid obesity, can be at risk.

In case of a suspected total joint infection, one should develop extensive pain and stiffness, joint swelling, warmth and redness around the joint, with possible drainage, often purulent or sero-purulent. With such painful joint, they may develop chills, fever, night sweats, extreme fatigue and often an inability to bear weight on the involved extremity.

The sooner an orthopedic examination can be performed, the better it will be to determine the presence of an infected joint replacement (prosthetic device). This will give the patient the best chances to retain his prosthetics while treatment can be initiated as soon as possible by the orthopedic surgeon and the infectious disease specialist.

Radiological studies with Bone scans are necessary to evaluate the advanced stage of the infection and to determine the presence of changes in the bone. Imaging tests like regular X-rays and bone scans can help your doctor determine whether there is an infection involving the implants or the bone but laboratory tests are necessary to assess any infection. A CT Scan may assist in distinguishing between a septic and an aseptic loosening of the prosthesis. Periosteal reactions or lytic lesions can also be present with osteolysis as a hallmark of an infection to the bone. Finally, Ultrasonography can also be an adjunct to detect the presence of fluid collection in the soft tissues.

Specific blood tests like a complete blood count (CBC with differential), a C-Reactive-Protein (CRP) and a Sedimentation Rate (ESR) will be the first choice of the treating physician if he wants to determine the inflammatory process in the body. Both tests may be elevated, raising the suspicion of an infection. In the contrary, if they are normal, the knee may not be infected.

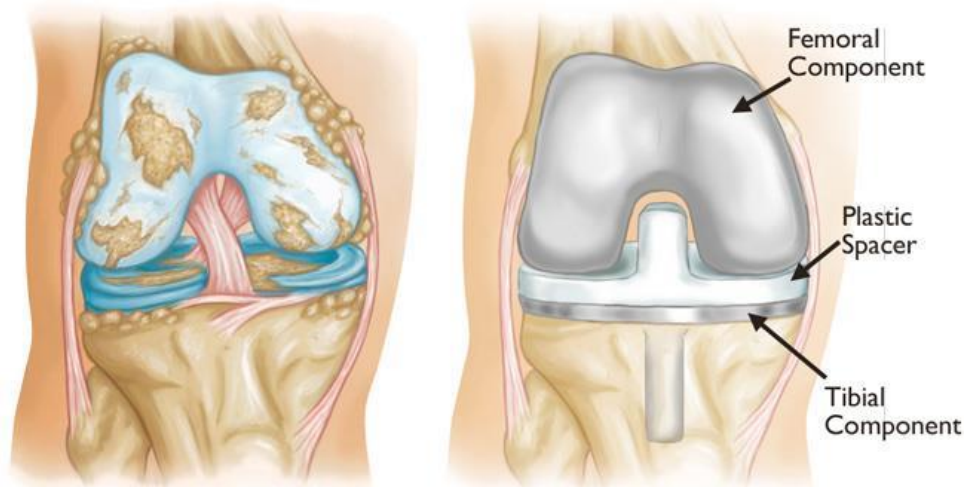
In the presence of an effusion in the joint, it may be helpful to perform an aspiration of the fluid from the knee or the hip joint, and send any

specimen for the search of white cells blood count and for cultures to the lab. In cases where the presence of bacteria or fungus or the presence of proteins is apparent or identified, with an elevation in the white blood cells count especially, the neutrophils, then an infection can be diagnosed or suspected.



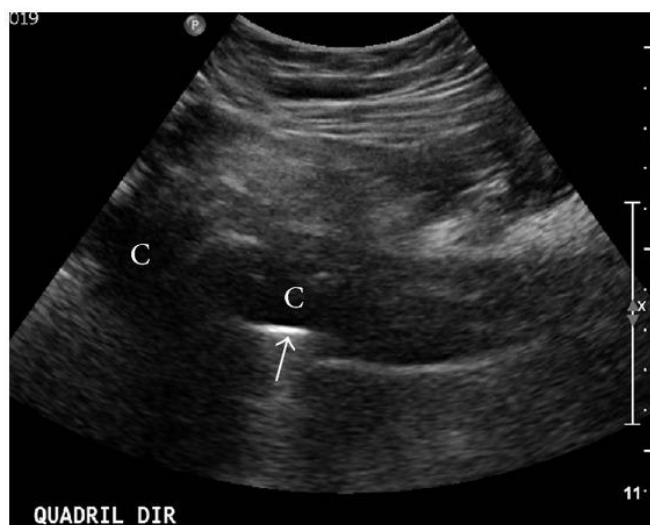
The infection can be judged, superficial, involving only the soft tissues or the skin but has not reached the prosthetic device itself or the joint. This will be considered as a superficial infection, and if caught on time, it may be treated conservatively with antibiotic therapy (IV or PO).

If the infection reaches the prosthetic device, it generally will require a surgical treatment consisting into possibly, an arthroscopic debridement in a first phase or in a formal arthrotomy with lavage and debridement, but if unsuccessful, in controlling the infection, the removal of the implants may follow.



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Generally, infections that go beyond the superficial tissues and gain deep access to the artificial joint almost always require surgical treatment. The implants may be cleaned or removed (metal and polyethylene as well as cement) if present because of contamination. They may be replaced immediately (in one-sitting) or in a delayed procedure, generally six weeks or more after proper IV antibiotics therapy. This is what we call a “Staged Surgery” because the longer the infection was present, the more difficult it will be to cure.



Ultrasound study showing fluid collection in a Total Hip Infected

Any late infections seen months to years after the total joint replacement generally require a staged surgery:

The first stage consists in removing the implants and in performing a washout of the joint with a debridement of the soft tissue with the placement of an antibiotic spacer to maintain joint alignment, while IV antibiotics therapy is carried out. A spacer are made of Bone Cement but

loaded with antibiotics is inserted for six weeks or more allowing bone penetration prior to the re-insertion of the next total joint prosthetic device.

Consultation is generally obtained from an infectious disease specialist to determine the proper antibiotic to be given and the duration of the antibiotic therapy according to the virulence of the bug responsible. Decision will be taken only when all the team agrees to undergo the second staged procedure with the re-implantation of a new prosthetic device, and only after a clearance by the infectious disease physician is obtained following periodic blood work, demonstrating the effectiveness of the antibiotics. Others may insist for an additional bone biopsy prior to the stage 2 “re-implantation”.

The stage-2 procedure is performed through the usual arthrotomy and the antibiotic spacer removed prior to a washout of the joint and insertion of the new components hip or knee. In a hip, the new stem used in the stage 2 revision will be longer than the previous one to assure a better intramedullary support bone in the proximal femur which may have been compromised after the debridement procedure. All new implants must be re-implanted together, in one stage with or without use of cement. The two-stage procedure is the most common technique used to treat deep infections with a cure rate at almost 90% after a ten years follow-up. Many chose differently when to re-insert the new prosthesis in the two stages with or without the use of a spacer impregnated of Vancomycin, after removal of the prosthetic devices. Others will choose to remove the prosthetic devices with or without the interposition of a muscle flap, performing a “Girdle stone procedure” as a salvage procedure especially when dealing with an unstable patient.

One will repeat the same peri-operative precautions taken at the insertion of the primary joint replacement with peri-operative antibiotics for 24 hours or 48 hours, while a minimal access (traffic) is permitted in the operating room during the procedure to avoid further contamination. TED Stockings for prevention of Deep Vein Thrombosis with Post-operative chlorhexidine solution washing are implemented. If dental work is contemplated in the future, preventive antibiotics are strongly suggested. A post-operative rehabilitation will help also in the recovery.

It is also good to know that a recent published article in the JBJS dealing with peri-prosthetic infections of the hip, has demonstrated a higher

mortality rate in the decade following the joint replacement with a five-fold increase in a 10-year risk. This report came as a surprise with a mortality rate about five-times higher in patients with a periprosthetic infection of the hip (Total Hip Replacement) when compared to others without infections. A team from University of Toronto led the research (Raman Mundi, Bleeshma Ravi et al)...

These researchers claimed that “the findings underscored any prevention, diagnosis or treatment of such fractures.” Infection is an unpredictable complication of Total Hip Arthroplasty and the risk of recurrent problem even after prolonged antibiotic therapy represent significant risks. It will affect long-term survival with disability and health problems.

The Toronto team (Mundi and al) has assessed the risks of death in 175,432 patients who underwent Total Hip Replacement between 2002 and 2021. 57% were women averaging an age of 67 years and the risk of death over ten years was compared with patients with or without infection, matching age, sex, obesity and other health factors. 11% of patients with periprosthetic infection died in follow-up compared to only 2.2% among patients without any infection. It was calculated that the mortality rate was 5.5 times higher in patients with peri-prosthetic infection.

One has to remember that joint prosthetic devices are very often offered as a way to alleviate pain in replacing a joint, especially the knees and hips. It remains that “infection” is the ultimate menace to the well-being of the one receiving such components. It is often the worse complication leading to a prolonged hospitalization, and many staged surgical procedures going from arthroscopic lavage to arthrotomy with often the removal of the prosthetic devices and later a re-implantation of a new device.

Discussing about peri-prosthetic infections, can't stop us from thinking about people prone to develop such infections like the obese individuals, the old, the one presenting with Diabetes Mellitus, or HIV at different stages of the diseases, the immunosuppressive patient etc. Often an infection can be transported into the system through direct implantation, or by hematogenously seeding (gastro-intestinal, dental...) or it can become reactive to a latent infection. In Joint replacement, often bacteria causing infections often are related to the staphylococcus family (Aureus and Epidermis).

In conclusion, the orthopedic surgeon has learned over the years, the best way in treating superficial and deep infections following total joint replacements. The removal of implants is expected when the infection reaches the prosthesis and a two-stage procedure using a methyl-metacrylate spacer impregnated with Vancomycin, while additional IV antibiotics are given, represents the state of art treatment prior to the re-insertion of the new components. Selected cases may benefit from a single procedure especially when the infection is superficial.

In writing this page, I can remember all the residents and physician-assistants who over the years have helped me in becoming the orthopedic surgeon that I am. They made be better while learning and practicing with me. I have also written this page for my brother-in-arms, Jorbin who is about ready to undergo a two-stage surgical procedure for an infected Total Knee Replacement. I hope this article will help him understand the actual management of his case.

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