CIS Self-Study Lesson Plan
Lesson No. CIS 267 (Instrument Continuing Education - ICE)

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AESCULAP ACADEMY®

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Total Joint Arthroplasty of the Hip and Knee

LEARNING OBJECTIVES

1. Discuss the basic procedures and instrumentation for total hip arthroplasty
2. Discuss the basic procedures and instrumentation for total knee arthroplasty
3. Review the reprocessing of total joint instrumentation

Instrument Continuing Education (ICE) lessons provide members with ongoing education in the complex and ever-changing area of surgical instrument care and handling. These lessons are designed for CIS technicians, but can be of value to any CRCST technician who works with surgical instrumentation.

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TOTAL JOINT ARTHROPLASTY, OR TOTAL JOINT REPLACEMENT, IS a surgical procedure to repair the functionality of a joint. The most commonly-replaced joints are the hip, knee and shoulder. In total joint arthroplasty, the joint may be resurfaced, an artificial joint may be implanted, or both. Damaged joints are replaced with artificial implants that mimic the action of the joint. Damaged bone and tissue are removed, and components of plastic, metal or ceramic are put in place to replicate the action of the joint.

The newest method of total joint replacement involves a minimally-invasive technique for hip or knee replacement; this technique requires incisions of 4 inches or less. Minimally-invasive total joint replacement is performed with either one or two small incisions, allowing for less tissue disturbance. In minimally-invasive joint replacement, the important difference for the patient is the care taken to limit the disruption of muscles, ligaments and tendons under the skin.

OBJECTIVE 1: DISCUSS THE BASIC PROCEDURES AND INSTRUMENTATION FOR TOTAL HIP ARTHROPLASTY

In total hip arthroplasty, the patient is draped and an incision is made in the side of the hip. In traditional hip replacement surgery, a 10- to 12-inch incision is made, while for minimally-invasive surgery, the incision is around 4 inches. The incision is made along the thigh, around the area where the pocket would be in a pair of pants; it is made in this area so the tensor fasciae latae and rectus femoris muscles may be retracted, thereby allowing an opening to the pelvis and femur. A femoral hook set is an important instrument system that allows this surgery to be performed. (Figure 1)

Figure 1: Femoral Hook Set

Femoral hooks raise the femur into a desirable position for an anterior approach. From here, the surgeon locates the femoral neck, the area underneath the ball joint connecting the hip and femur, with a cobb elevator. Then, using an oscillating saw (Figure 2), a portion of the femoral neck is cut away, and a mallet and osteotome are used to displace the joint.

Next, using x-rays, the surgeon

Figure 2: Battery-powered Drill and Saw

Figure 3: Acetabular Grater and Handle

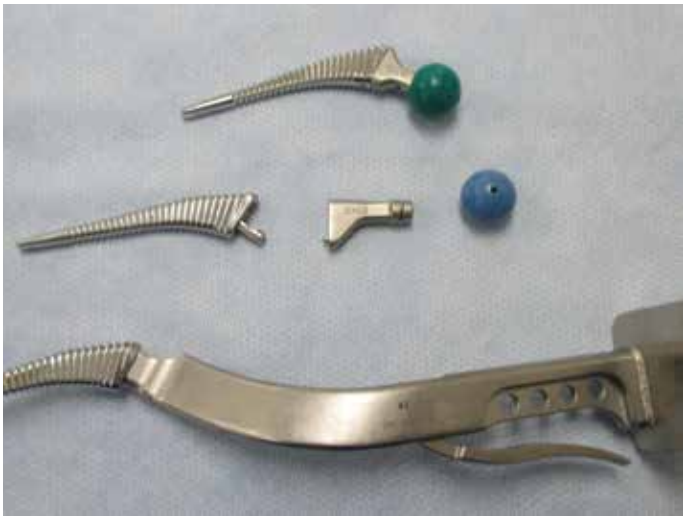

Figure 4: Handle, Broaches and Trials

Figure 5: Cutting Block

determines if enough of the femoral neck was removed. Once the joint is dislocated, the surgeon positions the patient for a desirable approach at the pelvis. Using an acetabular grater (Figure 3), the surgeon reams out the surface of the hip socket (acetabulum), sizing up one by one until the desired size is achieved.

X-rays are again used to determine if the placement and size are good. Next, either a trial cup or the actual implant is inserted. The implants themselves are "press fit" and require no bone cement to stay in place; however, they do have the ability to be screwed into the bone. The surgeon uses an implant inserter and mallet to go in at a 35° to 40° angle to ensure there is no movement in the implant. This portion of the surgery is now completed.

The surgeon then uses a starting broach (Figure 4) and mallet to ream out a cavity inside the femoral bone. This is the start of where the second implant will be placed. The surgeon uses a canal finder to decide the angle of the broaching, starting off with a small broach and moving up in size until a suitable fit is found.

Broaching compresses the bone rather than cutting out the bone. When the desired size is reached, a calcar planer is used to smooth the bone around the broach. A trial neck and trial head are attached to the broach and inserted into the cavity created by the reaming process. X-rays determine the placement, and the surgeon attempts to make the new alignment as close as possible to the opposite hip. When the new implants are properly aligned and matched, the surgeon removes the broach and inserts a metal implant into the femur. The next step involves connecting the femur implant and the pelvic implant, and checking the placement one final time with an x-ray; this completes the hip replacement and all that remains is suturing the incision.

Figure 6: Tibial and Femoral Knee Trials

OBJECTIVE 2: DISCUSS THE BASIC PROCEDURE AND INSTRUMENTATION FOR TOTAL KNEE ARTHROPLASTY

Like hip surgery, the total knee arthroplasty begins with draping of the patient. A pneumatic tourniquet is applied to stop blood flow to the limb during the surgery. The surgeon marks the surface of the knee and leg from slightly above the knee to about halfway down the shin. With the patient's knee in a flexed position, the surgeon makes the opening incision. The skin and tissue are retracted to give view to the femur, patella (knee cap) and tibia.

The patella is then moved to the side and the anterior fat pad is excised (removed). The surgeon uses a rongeur to remove osteophytes (bone spurs) from the patella, femur and tibia. The patellar tendon is moved out of the way and held in place with a screw. Tissue is removed from the tibia to make it easier for the surgeon to work on the tibia. The tibia is exposed by using a Hohmann-type retractor. Once the surgeon has a good view of the tibia, alignment tools are placed at the surgical site to locate where bone will be removed. When the bone to be removed is identified, a cutting guide (block) (Figure 5) is attached to the alignment tools and held in place by two straight pins. With the cutting guide secured, the alignment tools are removed. An oscillating saw is then used to make the cuts needed to remove the bone. Once that is completed the cutting guide is taken off and the cut bone will be removed.

Next, using a femoral drill bit, the surgeon makes a canal for an alignment rod going into the femur. With the alignment rod inserted, another cutting guide is affixed to it. Bone from the front and back of the femur is removed (similarly to the procedure for the tibia). After removal of the bone, one last guide is put in place: a cutting guide with a sizing notch. The sizing notch is used to remove bone from the middle of the last three cuts. With all cuts made, the surgeon then measures to determine which size trial must be used. Once selected, the trial is screwed into place.

Moving back to the tibia, the bone is again levered out with a retractor, and a tibial sizer is placed on top of it. A tibial drill drills down the tibia and a final cavity is made with a keel punch. Following this step, a curved tibial trial (Figure 6) is placed on top of the tibial sizer. With that in place, the surgeon places the femoral and tibial trials together and moves the leg to check for the fit of the trials and the leg's range of motion.

If everything is satisfactory, the tibial and femoral trials are removed. Once again, a rongeur is used to remove any tissue that may get in the way of

the implants. The area is then flushed profusely to remove any debris. Bone cement is then added to the bones and permanent implants are put into place; any excess cement is removed. One last check for fit is made by moving the leg through the range of motion. The patella is then put back into place and the patellar tendon is released. Finally, the tissue is sutured back up in layers, and the total knee arthroplasty is complete.

OBJECTIVE 3: REVIEW THE REPROCESSING OF TOTAL JOINT INSTRUMENTATION

The most important part of the decontamination of total joint instrumentation is point-of-use cleaning in the surgical suite. Removal of gross bioburden such as bone and tissue, washing blood off of the instruments, and applying a transport treatment allows for effective cleaning of these complex surgical instruments in the Central Service/Sterile Processing (CS/SP) department, and extends the instruments' working life.

Upon receiving the instrumentation into the decontamination area, the first step is to separate power instruments, such as drill and saws, and other items that cannot be run in an automated washer. In accordance with the manufacturers' instruction for use (IFU), bioburden should then be manually cleaned from the instruments to render them safe to handle in the assembly area.

After the instruments have undergone handwashing, those to be cleaned in an automated washer are addressed. Again, gross soil should be removed. All cannulated instrumentation should be brushed with the correct size brushes to ensure all surfaces of the instrumentation, both visible and out of sight, are physically cleaned. It is especially important for the technician to understand which instruments are assembled during surgery from components in a set. Like all surgical instruments, these must be disassembled before cleaning to ensure that all surfaces receive chemical, thermal and physical (impingement) cleaning treatment. The next step is to immerse the instrumentation in a sonic bath that uses cavitation (the process of air bubbles imploding) to loosen bioburden before washing. After the sonic cycle is complete, the instrument sets are run though the appropriate cycle in a mechanical washer, as indicated by the manufacturer's IFU.

Upon receiving the instrumentation from decontamination, CS/SP technicians must closely inspect the instruments for cleanliness and proper functionality, with close attention being paid to all grooves, serrations, cannulations and hinges; those are areas where bioburden can hide and be difficult to remove during the cleaning process. While inspecting for bioburden, the technician must also inspect the devices for damage (e.g., pitted instruments, bent instruments, poorly-aligned instruments and malfunctioning power equipment). If damage is present, the instruments must be sent out for repair. When everything is determined to be clean and in good working order, the sets should then be assembled according to the manufacturer's inventory list, or the facility's custom set list.

After inspection, instrument sets may be placed in a rigid container or wrapped as a graphic tray. CS/SP technicians must always remember the F.I.L.L. acronym: Filters, Indicators, Labels and Locks. Without these critical components of sterile packaging, the sterility of a tray cannot be considered ready for the next procedure. In accordance with the manufacturers' IFU, total joint instruments and sets are then sterilized using one of several methods, including hydrogen peroxide, ethylene oxide and, most commonly, steam sterilization.

CONCLUSION

Total joint replacement is indicated for pain and loss of mobility in joints. With the replacement of a damaged joint, the patient will enjoy greater mobility, less pain and improved strength. Total joint procedures can also ameliorate deformities in gait or appearance. The goal of joint replacement is improved quality of life for the patient. With care and proper training, CS/SP technicians can make a positive contribution to the wellbeing of the millions of total joint replacement patients by ensuring instruments used for their procedures are properly reprocessed and managed. C

RESOURCES

- https://stanfordhealthcare.org/medical-treatments/m/minimally-invasive-joint-replacement-surgery.html
- http://orthoinfo.aaos.org/topic.cfm?topic=A00389
- https://www.youtube.com/watch?v=5NqJa_J2dfw
- https://www.youtube.com/watch?v=54zARyjnRFQ

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