

Clinical Process Instruction Manual

Musculoskeletal Tissue Recovery Process Instruction

Policy:

This procedure applies to all standard musculoskeletal tissue recoveries, and includes wrapping, labelling, and packaging for shipment.

Prevention of contamination of tissue is important, thus the recovery team must exercise proper aseptic technique at all times. Refer to *Surgical Attire and Conduct Process Instruction, CPI-9-523* and the *Tissue Recovery Sequencing and Zoning Process Instruction, CPI-9-524* for guidance on the prevention of cross contamination during recovery. Sterile technique shall be used at all times. Surgical techniques shall be accomplished with the same diligence as used for routine operative procedures. Additionally, the established order for procuring tissue is based on zone recovery. Tissue from Zone 1 should be recovered prior to Zone 2, which should be recovered prior to Zone 3 and so on. Tissues in a specific zone should be recovered in the order listed. Areas affected by trauma should be isolated first by covering them to contain any potential contamination and to prevent cross-contamination. If tissues from these areas are to be procured, they should be sequenced as the last to be recovered.

Multi Tissue Recovery Coordinators (MTRC) are responsible for carrying out the duties in this process instruction.

Process:

General

1. Compliance with the following principals shall apply to musculoskeletal tissue recovery:
 - 1.1. Recovery of tissue shall be performed in an operating room (OR), or pre-approved designated site such as the coroner's recovery suite.
 - 1.2. All tissue shall be recovered under sterile conditions, employing aseptic surgical techniques.
 - 1.3. Access to, and movement in and out of the recovery suite will be limited during musculoskeletal recovery.
 - 1.4. Tissue recovery procedures shall not occur after autopsy or embalming procedures have begun.
 - 1.5. Tissue shall be recovered from only one donor at a time within the same recovery suite.

Clinical Process Instruction Manual

Musculoskeletal Tissue Recovery Process Instruction

- 1.6. All recovery staff shall follow routine practices and shall wear Personal Protective Equipment (PPE) in addition to surgical attire when in contact with the donor. Refer to *Surgical Attire and Conduct Process Instruction, CPI-9-523*.
- 1.7. Musculoskeletal tissue recovery skin preparation shall commence within 24 hours of asystole, provided the body was refrigerated within 12 hours of asystole. Tissue recovery skin preparation shall commence within 15 hours of asystole if the donor has not been refrigerated. See On-Site Medical Records Review for Multi-tissue Recovery Process Instruction, CPI-9-263.
- 1.8. Areas of the skin that have abrasions, cuts or other trauma shall be avoided.
- 1.9. A cut resistant or metal glove shall be worn on the non-dominant hand during bone recovery.
- 1.10. Cultures of each musculoskeletal tissue shall be obtained on each individual tissue recovered, in accordance with established protocols.
- 1.11. Gloves should be changed when soiled, compromised and/or, at a minimum, between recovered tissues.
- 1.12. It is acceptable to vary the order of tissue removal, if necessary, provided that a comment is recorded on the donor record stating the reason for the deviation.

Supplies and Instruments

2. The recovery of musculoskeletal tissue includes the following materials:
 - custom musculoskeletal recovery pack
 - musculoskeletal instrument tray
 - serum tubes (e.g., red top, tiger top, SST) x 2
 - EDTA tubes (e.g., lavender top) x 2
 - Culture Swabs x 30
 - Cut resistant gloves x 2
 - reconstruction materials
 - surgical gloves (~ 20/technician)
 - sterile table cover x 2

Clinical Process Instruction Manual

Musculoskeletal Tissue Recovery Process Instruction

- Betadine
- Dexidin
- Prep Pack
- waxed thread
- suture needles
- cadaver bag
- blood draw syringe x2
- blood draw needles x 2
- alcohol wipes x 6
- dirty needle container
- Pre-Klenz
- transport shipper for tissue

Bone and Soft Tissue Recovery:

3. Humerus

- 3.1. A skin incision shall be made on the anterior aspect of the arm from the level of the acromion process proximally to a point 2 cm distal to the elbow. Remove and discard the blade and then change gloves.
- 3.2. Sharp dissection shall be continued through all muscle layers to the humerus.
- 3.3. The elbow shall be disarticulated by sharp dissection of all muscle and ligamentous structures.
- 3.4. The humerus shall be dislocated out of the shoulder joint and stretch the rotator cuff by pulling the humerus laterally, or laterally and inferiorly, but not below the bed line.
- 3.5. A knife shall be placed anteriorly to incise the insertion of the rotator cuff onto the glenoid by bringing the knife superiorly around the glenoid, below the acromion.
- 3.6. The humeral head shall be disarticulated from the glenoid fossa.
- 3.7. The humerus shall be taken to the back table for microbiological culturing and wrapping.

Clinical Process Instruction Manual

Musculoskeletal Tissue Recovery Process Instruction

3.8. If distal or proximal humerus are to be recovered, proceed as follows:

3.8.1. For proximal humerus recovery, incise above the elbow and use a Stryker saw or osteotome and mallet to transect the humerus. Remove the proximal humerus.

3.8.2. For distal humerus recovery, incise below the humeral head and use a Stryker saw or osteotome and mallet to transect the humerus. Remove the distal humerus.

4. Radius and Ulna

4.1. The radius incision shall be continued on the ventral aspect of the arm from just below the elbow to the base of the hand.

4.2. Sharp dissection shall be continued on surrounding muscles distally. Stay as close to the bone as possible to avoid cutting any major vessels.

4.3. The ulna and radius shall be disarticulated at the proximal end.

4.4. The ulna shall be disarticulated from the radius and the articular disc of the inferior radioulnar joint and remove the radius.

4.5. The ulna shall be taken to the back table for microbiological culturing and wrapping.

4.6. Sharp dissection of the muscles surrounding the radius shall continue. Stay as close to the bone as possible to avoid cutting any major vessels.

4.7. The radius shall be disarticulated from its distal attachments and remove.

4.8. The radius shall be taken to the back table for microbiological culturing and wrapping.

5. Lower Extremity

5.1. The anterior superior iliac spine shall be palpated. Follow the curve of the ilium posteriorly for approximately 10 cm. Begin the skin incision here.

5.2. With the scalpel blade, follow the contour of the iliac crest to the anterior superior iliac spine, then continue inferiorly along the midline of the thigh. The incision should only be deep enough to cut the skin layers. Take care not to penetrate into the muscle layers.

5.3. Gradually continue the incision medially to the patella, starting at a point approximately 10 cm proximal to the patella.

5.4. After passing the patella, continue the incision laterally and to the anterior tibia. Be careful not to cut or damage the patellar ligament or its insertion on the tibia.

Clinical Process Instruction Manual

Musculoskeletal Tissue Recovery Process Instruction

- 5.5. The incision shall continue to the distal tibia. The length of the incision may vary, based on which musculoskeletal tissues are being recovered.
 - 5.6. Be careful not to cut too deep and damage the underlying tendons and ligaments.
 - 5.7. The blade shall be removed and discarded into the sharps container. Gloves shall be changed.
 - 5.8. The skin shall be reflected back from the incision along its entire length, being careful not to nick the underlying fascia.
6. Fascia Lata
- 6.1. The reflection of the thigh skin and subcutaneous fat shall be continued, extending from the ventral surface of the thigh down to the level of the table.
 - 6.2. Blunt dissection shall be used to separate the skin and subcutaneous fat from the underlying fascia lata starting at the level of the anterior side of the tensor fascia lata muscle insertion down to the lateral side of the patella anteriorly; to the level of the knee joint laterally; and along the biceps femoris muscle from the posterior side of the tensor fascia lata muscle insertion down to the attachment of the tibialis tendon posteriorly.
 - 6.3. Do not cut into the fascia.
 - 6.4. The largest piece possible shall be removed by sharp or blunt dissection, depending on technician's preference.
 - 6.5. The fascia lata shall be returned to the back table for microbiological culturing and wrapping.
7. Tendons
- 7.1. The tibialis tendons, peroneus longus and brevis tendons, gracilis tendon and semitendinosus tendon are recovered following removal of the fascia lata.
 - 7.2. The gracilis and semitendinosus muscles and their tendons shall be identified.
 - 7.3. Beginning at the medial aspect of the tibial condyle, wrap your fingers around the gracilis tendon. Using a pulling motion, loosen the gracilis muscle from the surrounding tissues to a point at least midway up the thigh. Transect the muscle at the mid-thigh level and reflect inferiorly. Dissect down to the insertion point of the tendon on the medial surface of the tibia, just inferior to the tibial head. Transect the tendon from the insertion point using Mayo scissors.

Clinical Process Instruction Manual

Musculoskeletal Tissue Recovery Process Instruction

- 7.4. Blunt dissection shall be used to expose and loosen the tendon and muscle of the semitendinosus from the knee to the mid-shaft of the femur. Transect the muscle at the mid-shaft and reflect inferiorly. Dissect to the insertion point of the tendon on the medial surface of the upper tibial shaft. Transect the tendon from its insertion using heavy scissors.
- 7.5. The tibialis anterior tendon, which lies on the anterior aspect of the medial malleolus directly beneath the path of the greater saphenous vein, shall be identified. Expose the tendon and then the muscle, superior to the medial malleolus, using blunt dissection with heavy scissors. Transect the muscle in the area of the proximal third of the tibia. Return to the medial malleolus and expose the tendon down to its insertion site into the medial cuneiform. Transect the tendon at the insertion site.
- 7.6. The tibialis posterior tendon lies on the posterior aspect of the medial malleolus. Expose the tendon and then the muscle, superior to the medial malleolus, shall be identified using blunt dissection with heavy scissors. Transect the muscle in the area of the proximal third of the tibia. Return to the medial malleolus and expose the tendon down to its insertion sites into the navicular and medial cuneiform bones. Transect the tendon at these insertion sites.
- 7.7. The peroneus longus tendon, which lies on the posterior aspect of the lateral malleolus shall be identified. It is the second tendon posteriorly. Expose the tendon and then the muscle, superior to the lateral malleolus, using blunt dissection with heavy scissors. Transect the muscle in the area of the proximal third of the tibia. Return to the lateral malleolus and expose the tendon down to where it crosses the tuberosity of the cuboid bone and continues under the sole of the foot. Transect the tendon at the point where it crosses the cuboid.
- 7.8. The quadriceps muscle shall be isolated and transected half way up the femoral shaft. Pull the quadriceps tendon and muscle back in order to expose the knee articulation. Use the scalpel and cut away muscle attachments at the articulation point, being careful not to cut the meniscus. Bend the knee to disarticulate the femoral head.
- 7.9. The peroneus brevis tendon, which lies on the posterior aspect of the lateral malleolus, shall be identified. It is the first tendon posteriorly. Expose the tendon and then the muscle, superior to the lateral malleolus, using blunt dissection with heavy scissors. Transect the muscle in the area of the proximal third of the tibia. Return to the lateral malleolus and expose the tendon down to where it attaches to the 5th metatarsal bone. Transect the tendon at its bone insertion site.
- 7.10. The peroneus longus and brevis tendons may be recovered simultaneously, but should be separated for culturing and wrapping.

Clinical Process Instruction Manual

Musculoskeletal Tissue Recovery Process Instruction

7.11. Microbiological culturing and wrapping should occur immediately following the recovery of each tendon.

8. Femora

8.1. Sharp dissection shall be continued through the thigh muscle area to the shaft of the femur, superior to the condyles.

8.2. The shaft of the femur shall be followed distally and continue sharp dissection until the quadriceps tendon is reached.

8.3. A horizontal cut shall be made approximately 3 inches proximal to the patella and leave the quadriceps tendon intact.

8.4 The patellar ligament is procured intact and attached to both the tibia and the patella, together with a portion of the quadriceps tendon. Reflect the patellar ligament from the femur and continue with sharp dissection around the distal femur. Stay as close to the bone as possible to avoid cutting major vessels.

8.4.1 The femur shall be disarticulated from the tibia, leaving the quadriceps, patella and patellar ligament intact on the tibia and taking care not to damage the menisci.

8.5 Sharp dissection shall continue along the femoral shaft to its proximal end.

8.6 The proximal femur and femoral head shall be disarticulated from surrounding attachments, staying as close to the bone as possible in order to avoid cutting any major vessels. Remove the femur.

8.7 The femur shall be returned to the back table for microbiological culturing and wrapping.

9. Menisci, Tibiae and Fibulae

9.1. As noted in 8.4.1 above the patellar ligament is procured intact and attached to both the tibia and the patella, together with a portion of the quadriceps tendon and menisci.

9.2. The skin shall be dissected from the muscles surrounding the tibia.

9.3. Sharp dissection of surrounding muscles distally shall continue. Stay as close to the bone as possible to avoid cutting any major vessels.

9.4. The tibia shall be disarticulated from the fibula at their proximal ends.

9.5. The tibia shall be disarticulated from the fibula at their distal ends and remove the tibia.

9.5.1. the menisci are left in place on the tibia.

Clinical Process Instruction Manual

Musculoskeletal Tissue Recovery Process Instruction

- 9.6. The tibia shall be returned to the back table for microbiological culturing and wrapping.
- 9.7. Sharp dissection of the muscles surrounding the fibula shall continue. Stay as close to the bone as possible to avoid cutting any major vessels.
- 9.8. The fibula shall be disarticulated from its distal attachments and remove.
- 9.9. The fibula shall be returned to the back table for microbiological culturing and wrapping.

10. Achilles Tendon

- 10.1. A scalpel shall be used, make a u-shaped incision beginning approximately 4 cm superior to and approximately 3 cm ventrally from the heel and continuing around the bottom of the heel to approximately 4 cm proximally on the opposite side. Remove the skin incision blade (or the entire scalpel) and dispose of it in a sharps container or place it off to the side of the table until discarded. Alternatively, the incision utilized to recover the tibia – fibula may be continued, either medially or laterally as desired, by incising the skin from the point at which the tibia – fibula incision was terminated to a point about 2 cm inferior to the calcaneus. The skin is reflected to visualize the calcaneus. Remove the skin incision blade (or the entire scalpel) and dispose of it in a sharps container or place it off to the side of the table until discarded.
- 10.2. Blunt or sharp dissection shall be used to expose the entire length of the Achilles tendon from its insertion into the calcaneus distally to a point approximately 3 - 6 cm above the origin of the gastrocnemius.
- 10.3. Blunt or sharp dissection shall be used to remove the Achilles tendon from the gastrocnemius muscle at the most proximal point possible.
- 10.4. The calcaneus and talus should be removed together by starting with sharp dissection between the talus and the navicular bones. The calcaneus can be then further dissected, with sharp dissection, and the two bones are removed together with the attached Achilles tendon.
- 10.5. The Achilles tendon and its attachments shall be returned to the back table for microbiological culturing and wrapping.

11. Hemi-Pelvis

- 11.1. The iliac crest shall be exposed by sharp or blunt dissection, being careful to maintain the integrity of the bowel while freeing any ligamentous attachments. If bowel contents are exposed, consider the field contaminated and do not recover. Document in the donor record.

Clinical Process Instruction Manual

Musculoskeletal Tissue Recovery Process Instruction

- 11.2. A curved osteotome, or equivalent sharp instrument, shall be used to remove muscle tissue from the dorsal and ventral sides of the iliac wing.
- 11.3. Muscle tissue shall continue on the ventral surfaces of the pubic ramii to the symphysis pubis.
- 11.4. The symphysis pubis shall be disarticulated using the osteotome and mallet.
- 11.5. Muscle from the posterior side of the pubis to the ischium shall be removed, including attachments within the obturator foramen.
- 11.6. The sacroiliac joint shall be disarticulated using downward pressure on the lateral aspect of the iliac crest. An osteotome can be wedged in the joint to help provide leverage, but take care not to damage the ilium lateral to the joint with the osteotome.
- 11.7. The hemi-pelvis should be removed from its soft tissue bed with the acetabulum, ischium and ilium all intact.
- 11.8. The hemi-pelvis shall be returned to the back table for microbiological culturing and wrapping.

12. Iliac Crest

- 12.1. Blunt and sharp dissection, using scissors and osteotomes, is used to strip soft tissues off the iliac crest and the pubis and to free ligament attachments.
- 12.2. An osteotome and mallet shall be used to cut through the sciatic notch and across the ilium.
- 12.3. The remainder of the iliac crest is removed at the sacroiliac junction by using osteotomes.
- 12.4. Care must be taken not to damage the bowel while freeing any ligament attachments.

Wrapping Tissue for Transport

13. For RegenMed/MSAT:

- 13.1. The procedure for wrapping a procured tissue is designed to lessen the likelihood of contamination between tissues and to protect the tissues during transport.
- 13.2. After each piece of tissue has been cultured, it is inserted into a sterile bag, which is then wrapped with a blue sterile wrap. The blue sterile wrap is taped closed. It is acceptable to use more than one wrap or additional bags. Complete the information on the sterile labels and then tape on the outside of the blue sterile wrap. The information on the sterile labels include:
 - donor identification number (Trillium Gift of Life Network (TGLN) number)
 - name of tissue and side (left or right)

Clinical Process Instruction Manual

Musculoskeletal Tissue Recovery Process Instruction

- 13.3. The wrapped tissue can be handed off to the circulator at any time after this labeling is completed and is placed into sterile bags, which are labeled with the side of recovery (“Left” or “Right”) and the Recovery ID number.
- 13.4. Both bags are then placed in one large sterile bag, with a tie cable around the mouth of the bag.
- 13.5. The bag is labeled with the donor number, anywhere on its outer surface, using a handwritten or pre-printed label.
14. The wrapped tissue is then placed in the validated transport container. The transport container shall ensure that required environmental conditions are maintained for the duration of transport. The transport container must indicate that human tissues are enclosed as well as the name, phone number and address of the recovery establishment.
15. Each transport container shall be labeled with a completed Recovered Musculoskeletal Tissue Transplant Label – RegenMed (CSF-9-153) or -MSAT (CSF-9-152) with the following information:
- “Donated Human Tissue for Transplant”;
 - an indicator that the tissue is not yet suitable for transplantation: “Quarantine: Not Suitable for Transplant in its Current Form”;
 - handling instructions for storage during transport and upon receipt;
 - name, address and contact information of the retrieval establishment; and
 - name, address and contact information of the accepting tissue bank.
16. Recovery documentation shall be completed, including any problems or incidents that occurred during the procedure, in iTransplant or on the Tissue Recovery form (CSF-9-146) if applicable.
17. A completed and signed Recovered Bone Tissue Package Insert and Recovered Musculoskeletal Tissue Transplant Label must accompany the tissue during transport. A copy shall be included in the donor chart.

Records:

- No records

Clinical Process Instruction Manual

Musculoskeletal Tissue Recovery Process Instruction

References:

- Standards for Tissue Banking, American Association of Tissue Banks, United States, 14th edition, 2017. D5.000, D5.530
- *Surgical Attire and Conduct Process Instruction, CPI-9-523*
- *Tissue Recovery Sequencing and Zoning Process Instruction, CPI-9-524*