



# Total knee replacement explained

In the US, the knee is the second most replaced joint after the hip. Here's what you need to know about management of patients undergoing this procedure.

By Amanda Perkins, DNP, RN

The first total knee replacement (TKR) was performed in 1968. When the TKR procedure was new, several replacement joints were produced and trialed, with many failing within a short period of time. In fact, in the 1970s and early 1980s, TKRs were considered to be a poor choice for patients with chronic knee pain. Fast-forward to today and the TKR is a commonly performed procedure with relatively high success rates. Over 600,000 knee replacements are performed each year in the US, with an estimated cost of \$9 billion or more annually.

In this article, we discuss the anatomy and physiology of the knee, conditions associated with the need for a TKR, pre- and postoperative care, and potential complications.

## **Anatomy and physiology of the knee**

The knee is the largest joint in the body, made up of the lower (distal) end of the femur, upper (proximal) end of the tibia, and the kneecap (see *Knee anatomy*). The knee is a hinge joint, meaning it's a freely moveable joint that moves in one plane, also known as a synovial joint. To review,

the femur is often referred to as the thigh bone, and the distal end forms one part of the hinge joint. The tibia is the weight-bearing bone in the lower leg, and the proximal end forms one part of the hinge joint. Each of these bones has condyles (rounded protuberances at the ends of the bone) that form the joint. The patella, or kneecap, is enclosed in the tendon of the quadriceps femoris.

The ends of the bones are covered in articular cartilage, which is found in synovial joints, making the bones freely moveable. Articular cartilage aids in the smooth movement of joints by providing cushion and reducing friction. Menisci are found between the femur and tibia and help cushion the joint. Ligaments, a type of connective tissue, connect bone to bone, whereas tendons connect muscle to bone. Under normal conditions, they stabilize the joint. The joint capsule encloses the joint and contributes to stability. When you think of a joint capsule, think of a sleeve. The joint capsule is lined with a synovial membrane that secretes fluid, which provides lubrication and prevents friction with movement.

### Conditions that lead to a TKR

The most common cause of chronic knee pain is arthritis, an inflammation of the joint that can be a causative factor in the need for a TKR. The types of arthritis frequently associated with TKRs are osteoarthritis (OA) and rheumatoid arthritis (RA).

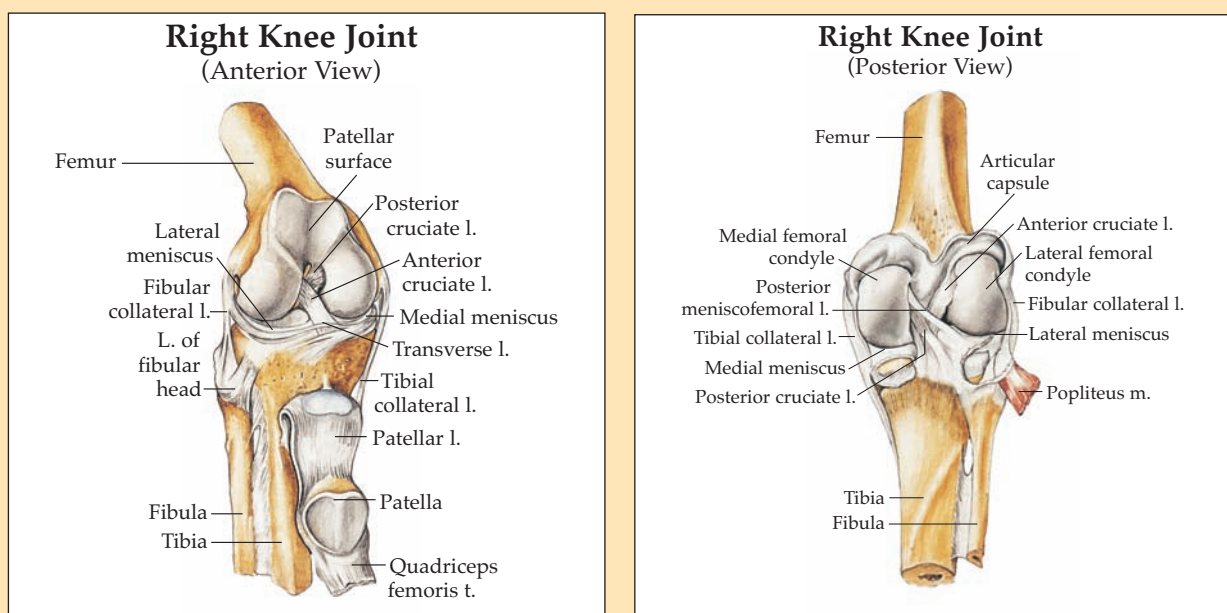
One of the most prevalent joint disorders worldwide, OA is a degenerative joint disease and the risk for it increases with age. OA can lead to pain and functional disability, resulting in the need for a joint replacement. With this disorder, the joints are inflamed and the articular cartilage and bone ends begin to deteriorate. The articular cartilage of the knee joint is gradually worn away until the surface is no longer smooth and becomes rough.

When a patient has this condition, the affected joint(s) will be stiff and painful. Signs and symptoms of OA include unilateral joint pain and stiffness that increase with activity and lessen with rest.

RA is a chronic and progressive autoimmune disease that leads to systemic inflammation. When a patient has RA, his or her body begins to attack itself, specifically the synovial membrane, which may be completely destroyed and the joint calcified. With this condition, the joints may be destroyed and, in some instances, fused.

It's important to understand that the signs and symptoms of RA are systemic, distinguishing this disorder from OA. When a patient has RA, his or her joints will be affected bilaterally and signs and symptoms may include inflammation, redness, swelling, warmth, stiffness, and pain. In contrast with OA, the pain associated with RA will be more severe at rest and decrease with activity. Systemic signs and symptoms that may develop include a low-grade fever, weakness, fatigue, and anorexia. When a patient has RA, the organs can become inflamed and damaged over time. However, organ damage is relatively rare. When it does occur,

### Knee anatomy



Source: Anatomical Chart Company



organ involvement may include the heart, lungs, skin, and kidneys. Additionally, the nerves, muscles, and blood vessels may become involved.

## TKR 101

The goal of a TKR is to restore function and reduce pain, allowing patients to live more comfortably and maintain as much independence as possible. A TKR can improve quality of life for a relatively long period of time, with an expected duration of 10 to 15 years or longer.

## Indications

The following are indications for a TKR:

- severe pain and stiffness that affects activities of daily living and quality of life
- moderate-to-severe pain when at rest
- chronic knee inflammation and swelling
- knee deformity
- failure to respond appropriately to treatment.

## Procedure

The components of a TKR are the femoral component, tibial component, and patellar button (see *Picturing TKR*). When a TKR is completed, the top of the tibia and lower end of the femur are replaced. The TKR procedure, also referred to as a knee arthroplasty, involves the following steps:

- Prepare the bone by removing damaged cartilage and a small amount of underlying bone.
- Position the metal implants. In this step, the cartilage and bone that were removed are replaced by metal implants.
- Resurface the patella by cutting the undersurface and resurfacing with a plastic button. It's important to note that this step isn't always completed.
- Insert a spacer between the metal components to allow for smooth movement.

## Preoperative evaluation and care

Before a TKR, patients will have typically visited a healthcare provider and had a medical history obtained, physical

## Preoperative care

Before a TKR, the following should occur:

- medical history
- physical exam
- imaging of the knee, typically an X-ray
- patient education about the procedure and postoperative care
- outpatient physical therapy visit
- autologous blood donation (in some cases)
- head-to-toe nursing assessment
- antibiotic administration.

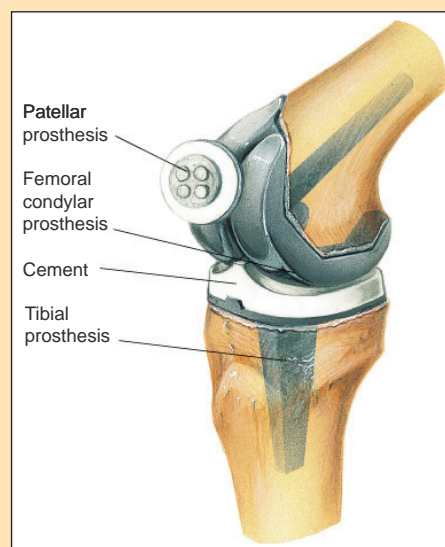
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exam, and X-rays completed. Additionally, when caring for a patient who's planning on undergoing a TKR, preoperative education is extremely important and should always occur. Preoperative education adequately prepares the patient for the procedure and postoperative care such as pain management, effectively reducing anxiety and increasing empowerment. In some instances, the patient may be asked to meet with physical therapy preoperatively to work on postoperative mobility, such as crutch walking and exercises.

Before surgery, some surgeons may prefer the patient to make an autologous blood donation. This ensures that blood is

## Picturing TKR



Source: Lippincott's Nursing Advisor, 2010





### memory jogger

Remember **CMST** when monitoring for signs of postoperative bleeding.

**C**olor: Are both lower extremities the same color? Is any discoloration present, such as redness or cyanosis?

**M**otion: Is the patient able to move his or her toes? Is the patient able to move his or her lower extremities? Are any differences noted between the right and left lower extremity?

**S**ensation: Is the patient experiencing any abnormal sensations, such as numbness or paresthesia (pins-and-needles)?

**T**emperature: Are both lower extremities the same temperature? Is poikilothermia (lower extremity the same temperature as the environment) present?

available and ready for the patient if needed. An autologous blood donation carries a much lower risk than an allogenic blood transfusion in which blood from a donor is used.

The preoperative nurse completes a thorough head-to-toe assessment with appropriate documentation to identify the patient's baseline before surgery, enhancing postoperative care. Before surgery, the surgeon may order an antibiotic to be administered, which may be continued for a few doses postoperatively and then discontinued.

#### Postoperative evaluation and care

Postoperatively, the patient will have a dressing in place and, in some instances, a drain. Nursing staff members are responsible for monitoring the dressing and checking for bleeding. If bleeding is observed on the dressing, the area should be circled, dated, and timed so it can be closely monitored for an increasing amount. At many institutions, the surgeon is the person who completes the first dressing change.

Before completing a dressing change on a patient with a TKR, check the healthcare provider's orders. When completing dressing changes, observe the site for signs and symptoms of infection, such as redness, edema, warmth, and purulent drainage. It's also important to monitor lab values such as white blood cell counts. If a drain is in place, monitor the drain for output, noting color, amount, and

consistency. The drain should be emptied per policy and documented in the patient's record as output.

In addition to monitoring the dressing for bleeding, monitor the patient for other signs of bleeding, such as decreased hemoglobin and hematocrit levels, tachycardia, hypotension, dizziness, and syncope. Check the patient's neurovascular status postoperatively per the healthcare provider's orders and nursing judgment. Remember CMST: color, motion, sensation, and temperature. When checking neurovascular status, both sides should be checked. It's also important to check the patient's mobility level and pain.

Encourage the patient to get out of bed early and often to prevent postoperative complications associated with immobility. It may be beneficial to avoid using urinals and bedside commodes, instead ambulating the patient to the bathroom. If an indwelling catheter is present, it will often be removed on postoperative day one. It's important to document the time that the catheter is removed so urinary output can be monitored closely. If the patient hasn't voided for 6 hours after the removal of the catheter, it may be beneficial to perform a bladder scan. The patient can also be encouraged to increase fluid intake to aid with voiding.

When the patient is in bed, a pillow should be placed under the operative leg to decrease edema, but never directly under the knee. The knee should be straight. Encourage the patient to turn and reposition every 2 hours at minimum to avoid skin breakdown. Provide prompt incontinence care if the patient is incontinent. Also prioritize deep vein thrombosis (DVT) prevention, with ambulation, leg exercises, and compression stockings.

#### Complications

The following complications may be associated with a TKR: infection, blood clots, pulmonary embolism (PE), and



neurovascular injury. The risk of infection is increased if the patient has malnutrition, diabetes mellitus, or RA or if he or she is obese.

Research has shown that the administration of preoperative antibiotics is an important infection prevention intervention. Both I.V. antibiotics and antibiotic-impregnated bone cement have been shown to be effective. When using I.V. antibiotics, it's recommended that the first dose be initiated within 60 minutes of the surgery and the antibiotics be discontinued with 24 hours of surgery completion. When combined, I.V. antibiotics and antibiotic-impregnated bone cement may be more effective than either alone.

Due to the fact that malnutrition has been associated with an increased risk of infection, the patient's nutritional status should be assessed before a TKR. Uncontrolled diabetes also increases the risk of infection, so glycemic control is important for the patient undergoing a TKR. Before surgery, it may be beneficial to evaluate the patient's A1C levels because these levels provide a picture of glycemic control over a prolonged time.

Lastly, RA has been associated with increased infection rates in patients undergoing a TKR. In fact, for patients with RA, the infection rate after a TKR is 1.6 times greater than the infection rate in patients who have OA.

Postoperatively, the risk of a prosthetic joint infection increases if an indwelling urinary catheter is used, a blood transfusion is needed, and/or wound drainage is prolonged.

The placement of an indwelling urinary catheter increases the risk of a catheter-associated urinary tract infection, but it also increases prosthetic joint infection risk. When indwelling urinary catheters are used, it's best practice to remove them within 48 hours. In some instances, a catheter won't be placed, which decreases the risk of infection.

## did you know?

Research is being conducted on the use of mobile apps for patient monitoring after a TKR. Mobile apps have been shown to be beneficial because they can be used to monitor and motivate patients. They can also enhance patient involvement and self-management while improving communication between the patient and the healthcare team.

Allogenic blood transfusions are associated with an increased risk of prosthetic joint infection when compared with autologous blood transfusion. As can be expected, prolonged wound drainage increases the risk of infection. Additionally, subcutaneous hematomas increase the risk of bacterial growth. Prolonged wound drainage also increases tension on the wound and delays healing, which will ultimately increase the risk of infection.

To prevent complications associated with a TKR, flexion of the knee joint should begin shortly after surgery. Mobility helps decrease the risk of complications such as blood clots and PE. It's important to prevent complications because a failed TKR leads to additional knee replacement surgeries. When a revision to a TKR is needed, the recovery time is longer, success rates are decreased, and patients often find the entire process more difficult.



## Postoperative care

After a TKR, postoperative care should include the following:

- Monitor the dressing and check for bleeding.
- If bleeding is noted on the dressing, circle, date, and time the area of shadowing.
- If a drain is present, monitor and empty the drain per facility protocol.
- Monitor for signs and symptoms of bleeding, such as tachycardia, hypotension, dizziness, and syncope.
- Monitor all ordered labs, paying close attention to hemoglobin, hematocrit, and white blood cell counts.
- Complete neurovascular checks per the healthcare provider's orders and nursing judgment.
- Remove the indwelling catheter if one is in place.
- Monitor urinary output.
- Encourage ambulation.
- Elevate the leg, never placing a pillow under the knee.
- Implement DVT prevention measures.

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## A routine surgery

The TKR is a commonly performed surgery, routinely seen in most hospitals. Due to the frequency with which these surgeries are completed, many nurses are likely to encounter patients who've undergone a TKR. That's why it's important that nurses have a basic understanding of the TKR procedure, including preoperative and postoperative care and complications.

*Stay tuned for our next issue when we take a look at total hip replacement. ■*

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