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Review Article On Advantages And Disadvantages Of Different Surgical Techniques Of Total Knee Replacement (TKR).

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Abstract:

Background -The operation known as a total knee replacement (TKR) involves replacing certain components of the knee joint with prosthetic ones. Between the femur and the tibia and fibula, the typical knee acts as a hinge joint. The surfaces where these bones connect can wear down with time, frequently as a result of arthritis or other illnesses, which can cause pain and swelling that interferes with people's daily activities. This is mostly observed in elderly people older than 60 years old. To overcome this the procedure of TKR is mostly used in the medical procedure in patients suffering with the end stage of osteoarthritis when all nonsurgical treatments fail. **Aim: -**The purpose of this article is to give a brief overview of the TKR procedure and its different methods with their advantages and complications. Describe the patient history associated with this procedure. Summarize the use of different methods and procedures for less complications and make the procedure more painless and effective for the patients. Texts, websites, and portals like Google Scholar and PubMed were used to gather pertinent literature, as well as research from various papers describing procedure of TKR and the different methods used in it. **Conclusion: -** To understand the review article one need Complete knowledge of the regional anatomy is essential for surgical exposure of the knee in TKR. After going through this review article, one comes to know about different types of surgical procedure involved under the TKR and the difference between the different methods used during the surgery. After reading the article, one may infer that medial parapatellar arthrotomy, also known as the anteromedial technique, has been the most widely used and has been regarded as the standard method of exposing the knee joint, offering better postoperative outcomes and fewer complications.

Keywords: - total knee replacement, complications, Local knee infection or sepsis.

Introduction: -

Total knee replacement (TKR) is a surgical procedure where damaged knee joint areas are replaced with artificial components. It is commonly used for conditions like symptomatic osteoarthritis, rheumatoid arthritis, post-traumatic arthritis, and other knee issues unresponsive to conservative treatments. TKR effectively reduces pain and improves quality of life in patients with severe degenerative changes affecting the knee cartilage. As alternative treatments often fall short, TKR is a leading option for symptom management. By 2030, annual TKR surgeries are projected to reach 3.48 million.[1] Despite its routine use, achieving proper balance and functionality in TKR is essential to reduce risks of wear and early implant failure. Even with improved surgical techniques, technology, and understanding of knee mechanics, about one in five TKR patients may still experience dissatisfaction due to complications.[2,3]

The complexity and individual variation in TKR outcomes stem from factors like pre-existing conditions, post-surgical challenges, and patient expectations. TKR designs and restrictions vary, and surgical approaches—such as anterior skin incisions, the medial parapatellar approach, Insall's modification, the trivector-retaining approach, or modified V-Y plasty—are chosen based on patient anatomy and health. For cases with significant bone abnormalities, revision needs, or varus/valgus instability, surgeons may use more supportive components like semi-constrained or hinged prosthetics. TKR success rates are around 90% over the last decade, but success depends on patient characteristics, surgical technique, postoperative care, and adherence to rehabilitation[4].

Materials and Methods: -

Texts, websites, and portals like Google Scholar and PubMed were used to gather pertinent literature, as well as research from various papers describing the procedure of TKR and the different methods used in it.

Classification: -

Basic surgical Technique for total knee replacement[5]: - The patient is positioned on the operating table and given anesthesia, as is standard in routine surgeries. Research shows no significant link between surgery duration and nerve palsy affecting mortality. Typically, a medial parapatellar arthrotomy with a midline incision is performed, though other approaches like the subvastus, mid-vastus, and lateral parapatellar routes are also options. More complex methods include V-Y turndown, tibial tubercle osteotomy, and quadriceps snip. Maintaining skin flaps and blood flow from medial to lateral is crucial, and a small cuff helps ensure proper wound healing post-arthrotomy. After medial soft tissue release from the proximal tibia, the lateral side is treated similarly. Although a comprehensive medial release is ideal, multiple factors often influence the approach. The infrapatellar fat pad, medial and lateral meniscus, and ACL may be partially or fully removed. If the PCL is sacrificed, a posterior-stabilizing implant is recommended. Patellar resurfacing is usually unnecessary unless there is severe patellofemoral arthritis or anterior knee pain. Studies show that patients who skip patellar resurfacing have higher revision rates and more anterior knee pain, while those who undergo it face a greater risk of fractures or tendon damage.

The sequence of steps during knee replacement will be dependent on the technique selected by the surgeon performing the procedure these techniques include:

1.1 **Anterior skin incisions**[6,7]**: -** The most common skin incision for primary TKR is the anterior midline incision, which provides an extensible route to the knee. To optimize exposure and avoid raising skin flaps, the knee is bent during the incision, allowing the subcutaneous tissue to collapse medially and laterally. This straight, longitudinal cut begins 6–12 cm above the patella, through its center, and ends at the tibial tuberosity's medial border, about 6 cm below the patella. Some surgeons add a slight medial curve to the incision above the patella to reduce scarring and pressure. Skin removal is guided by surgical goals, ensuring a thick medial skin flap that only minimally exposes the extensor mechanism. Widening the skin incision with subcutaneous tissue division helps minimize tissue necrosis and skin retraction. When pre-existing scars are present, they should be integrated into the incision whenever possible. Since most blood flow to the knee's anterior skin comes from the medial side, multiple incisions should begin laterally. Historically used incisions, such as the anterior Kocher U and Putti inverted U, are now avoided due to vascularity issues. Certain conditions—rheumatoid arthritis, diabetes, steroid use, obesity, or prior surgeries—can impact blood supply, warranting more conservative incisions to prevent necrosis. Any lateral or medial skin flaps should be made only deep to the fascia to maintain vascular integrity. When crossing previous incisions, a 90-degree angle with at least a 5–6 cm skin bridge is recommended to avoid complications from parallel incisions.

1.2 **Medial parapatellar approach**[8,9]**: -** The medial parapatellar approach, considered the gold standard for TKR, was first described by Von Langenbeck in 1878. This method involves following the medial quadriceps tendon border, leaving a tissue cuff on the patella for later capsule repair. After creating a longitudinal midline skin incision, the quadriceps tendon is extended along the parapatellar retinacula, leaving a 3-4 mm tendon cuff for closure, then curves around the medial patella and continues down the tibia. This approach exposes the knee's medial aspect, allowing for patella eversion by retracting the infrapatellar fat pad.

In obese patients, deepening the lateral subcutaneous flap aids patella eversion, though caution is needed to avoid flap necrosis by preserving subcutaneous tissue. If the patellar tendon is at risk of avulsion, a pin can be inserted to secure its tibial attachment. Further exposure can be achieved with a proximal incision between the vastus medialis and rectus femoris if needed. This approach offers excellent exposure and is straightforward to execute, though it can destabilize the patella by disrupting the quadriceps mechanism at the vastus medialis and quadriceps tendon junction.

During lateral retinacular release, care must be taken as the superior lateral genicular artery, the last remaining blood supply after fat pad removal, may be at risk. The infrapatellar branch of the saphenous nerve, supplying sensation to the knee's anteromedial side, is also at risk of injury, potentially causing a neuroma. If severed, burying the nerve end can help reduce post-surgery neuroma pain.

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1.3 **Insall's modification to medial parapatellar approach[10,11,12,13]: -** To address issues with extensor mechanism disruption, instability, and patellar articular surface damage, Insall modified the medial parapatellar approach first described by Sir Robert Jones in 1971. The procedure begins with a midline skin incision, with the quadriceps tendon severed 8–10 cm above the patella to expose the extensor mechanism. The quadriceps tendon is then incised where the medial patella meets its lateral two-thirds, followed by careful removal of the quadriceps expansion from the patella's medial region. Extending the incision along the medial patella leaves no tissue cuff for repair. After dividing the synovium and fat pad, the patella is lateralized. The medial retinaculum is reattached to the lateral two-thirds of the patella using sutures. The "three stitch test" is often used to assess patellar tracking: three stitches are placed between the medial retinaculum and patella at 90° knee flexion, with closure proceeding if no maltracking occurs.

This approach provides excellent joint exposure but has been linked to risks like patellar avascular necrosis, subluxation, stress fractures, and dislocation. Care must be taken to protect neurovascular structures, particularly the infrapatellar branch of the saphenous nerve and those within Hunter's canal. During flexion, the patella is everted and moved laterally, with access facilitated by releasing the suprapatellar pouch capsule.

Compared to the medial parapatellar approach, the subvastus technique preserves the extensor mechanism and most of the patellar blood supply. Studies show the subvastus approach leads to less blood loss, quicker recovery, and improved patellar tracking and knee flexibility, with patients experiencing earlier straight-leg raises and lower opioid use. This method also restores the hamstring-to-quadriceps ratio more quickly. Though less commonly used, the subvastus technique is suitable for most knee reconstructions except lateral noncompartmental replacements.

1.4 **Midvastus approach[14]: -** The midvastus technique, a muscle-splitting approach, was developed to balance exposure issues seen with the subvastus route. It starts with a standard midline incision, followed by blunt dissection through the vastus medialis along its fibers without cutting the quadriceps tendon. The incision is extended down the medial patella to the tibial tubercle, allowing patellar dislocation. While this technique has shown reduced lateral leakage and blood loss intraoperatively, studies have not proven it superior to the medial parapatellar method in terms of long-term functional outcomes. Some argue that it simplifies patellar eversion by working through thinner muscle, yet others find limited utility due to mixed results on accessibility and functional benefits.

1.5 **Trivector-retaining approach[15,16]: -** The "trivector retaining method" derives its name from vector analysis of the forces acting on the patella—specifically, the superior, superior lateral, and medial vectors. This method aims to protect much of the medial vector, enhancing the likelihood of quicker quadriceps recovery. In the trivector-retaining arthrotomy, a midline skin incision exposes the quadriceps muscles, with the vastus medialis obliquus fibers transected 1.5–2 cm medial to the quadriceps tendon. The patellar tendon is extended to the tibial tubercle without disturbing the quadriceps tendon, and the knee is flexed at 90–110 degrees for optimal incision conditions. However, this method can lead to increased blood loss and disruption of some medial arteries supplying the patella.

1.6 **Lateral approach[17]:** - The lateral approach, initially described by Keblish in 1982 and refined in 1991, allows joint access from the lateral side of the patellar tendon and is primarily used for TKR in valgus knees. It provides direct access to limiting lateral soft tissues and preserves medial patellar blood flow, addressing challenges like patellar maltracking often seen with the medial parapatellar method. The procedure requires either a distal midline skin incision extending past the lateral tibial tubercle or a lateralized anterior skin incision. An incision 1.5 cm from the tibial tubercle extends along the lateral patellar margin into the anterior compartment fascia. The infrapatellar fat pad and medial periosteal hinge aid in correcting the lateral retinacular defect. This approach is suitable for fixed valgus deformities, with the only contraindication being a fixed varus deformity.

1.7 **Modified V-Y plasty[18]: -** In the modified V-Y quadriceps turndown technique by Scott and Siliski, a second limb is added to the typical medial parapatellar retinacular incision, creating an inverted V shape across the quadriceps tendon through the lateral patellar retinaculum. It's crucial to identify and preserve the superior lateral genicular artery, located along the inferior border of the vastus lateralis, to avoid further devascularization of the patella by not thinning the scarred peri-patellar fat pad excessively. During closure, the patella and quadriceps tendon may shift distally, transforming the inverted V into a Y shape, which is beneficial for addressing quadriceps contractures from prolonged knee flexion. Closure requires non-absorbable sutures to facilitate early passive motion within a designated "safe" range and to prevent strain on the repair. An effective intraoperative tip is to rely solely on gravity for achieving 90-degree knee flexion. Studies by Trousdale et al., Windsor, and Insall have indicated postoperative extension lag, although this difference often resolves as quadriceps strength normalizes over time. Notably, Smith et al. found cases of osteonecrosis of the patella in eight out of nine full knee exposures using the quadriceps turndown technique, despite the absence of clinical symptoms.

Factors Affecting Total Knee Replacement (TKR) in Elderly Patients[19,20,21]

1. **Age**: Studies indicate a notable difference in pain and functional outcomes between patients under 65 and those over 75. Very elderly patients (aged over 80) often report greater improvements in daily comfort and pain postoperatively. In contrast, younger patients (average age 54) may experience issues such as stiffness, audible snapping, and persistent discomfort.

2. **Gender**: Male patients generally report better functional outcomes and higher activity levels post-TKR compared to female patients, who tend to experience more postoperative stiffness and chronic pain.
3. **Excess Weight and Obesity**: Weight management can significantly enhance quality of life and functional outcomes following TKR. Obese patients often experience less functional improvement compared to those with a healthier BMI. Long-term weight loss post-TKR is also linked to improved functional outcomes.
4. **Severity of Disease**: Patients with inflammatory arthritis may achieve excellent functional results due to advances in biological therapies, often seeing outcomes similar to those of knee osteoarthritis patients two years post-surgery. Those with severe diseases typically show greater functional improvement, though chronic joint disorders can negatively affect psychological well-being and treatment satisfaction.
5. **Diabetes**: Diabetic patients are at a higher risk for postoperative complications, yet TKR can still yield benefits. Comorbid conditions related to obesity may further influence clinical outcomes.
6. **Psychological Condition**: The psychological state of the patient plays a critical role in postoperative quality of life and recovery.
7. **Physical Condition**: Implementing a structured physical therapy and rehabilitation program for at least six weeks postoperatively can significantly aid recovery, reducing complications such as muscle soreness and stiffness.
8. **Other Factors**: Comorbidities can negatively impact quality of life ratings over time. Preoperative pain levels are correlated with postoperative quality of life, and conditions like fibromyalgia can exacerbate the experience of pain, affecting overall patient satisfaction and outcomes.

Contraindications for Total Knee Replacement (TKR)[22]

TKR is contraindicated in the following clinical conditions:

1. **Local Knee Infection or Sepsis**: Presence of infection in the knee area.
2. **Extensor Mechanism Dysfunction**: Impaired function of the knee's extensor mechanism.
3. **Recurvatum Deformity**: Deformity due to muscular weakness leading to knee hyperextension.
4. **Inability to Withstand Anesthesia**: Patients must be able to tolerate anesthesia, surgery, and wound healing.
5. **Severe Osteoarthritis of the Ipsilateral Hip Joint**: Significant hip joint issues can complicate surgery.
6. **Atherosclerotic Disease of the Leg**: Poor blood flow can lead to complications.
7. **Skin Conditions**: Conditions like psoriasis, fungal infections, neuropathic arthropathy, and chronic venous stasis disease.
8. **Remote Active Infection**: Ongoing infections elsewhere in the body can pose risks.
9. **Severe Vascular Dysfunction**: Compromised vascular health can hinder recovery.

Complications of TKR

Despite TKR being an effective procedure for advanced degenerative osteoarthritis, various complications can impact patient satisfaction and outcomes:

1. **Periprosthetic Fracture (PPF)[23]**: Occurs post-surgery, often related to poor bone quality and specific implant designs. Rates of PPFs can be as high as 20% in patellar cases.
2. **Aseptic Loosening[24]**: Caused by an inflammatory response leading to bone loss, resulting in pain and effusion. Persistent symptoms may require revision surgery.
3. **Wound Complications**: Includes superficial surgical infections, delayed healing, or deep infections requiring surgical intervention.
4. **Periprosthetic Joint Infection (PJI)[25]**: Occurs in 1-2% of cases, especially in patients with uncontrolled diabetes or chronic conditions. Staphylococcus species are common culprits, and treatment options depend on the timing of infection.
5. **Other Complications**:
   - Instability in knee planes and patellar maltracking can lead to anterior knee pain.
   - Extensor mechanism disruption.
   - **Patellar Clunk Syndrome[26]**: Characterized by popping and catching in the knee, often requiring surgical intervention.
   - **Stiffness**: Post-operative stiffness due to wound healing.
   - **Vascular Injury and Bleeding[27]**: Risks during the operative phase.
   - **Peroneal Nerve Palsy**: Common after valgus knee treatment.
   - **Metal Hypersensitivity**: Some patients may react to metal implants.
   - **Heterotopic Ossification[28]**: Formation of bone in abnormal locations post-surgery.

Discussion:[29,30,31]

Total Knee Replacement (TKR) is a surgical procedure aimed at improving the quality of life for patients aged 65 to 85 suffering from conditions like osteoarthritis, rheumatoid arthritis, and avascular necrosis. Patients qualify for TKR when conservative treatments fail, particularly if they experience persistent inflammation, require anti-inflammatory injections,

or have a history of knee trauma. Key selection criteria include age, gender, BMI, severity of the disease, and the impact on daily life.

Various surgical approaches exist, such as the medial parapatellar, subvastus, and midvastus techniques, each with its advantages and disadvantages. The medial parapatellar approach offers straightforward access but may lead to complications like patellar dislocation. The subvastus approach preserves the extensor mechanism and reduces blood loss, while Minimal Invasive Total Knee Arthroplasty (MIS TKA) involves a smaller incision for quicker recovery but is contraindicated for obese patients.

Postoperative complications can include periprosthetic fractures, aseptic loosening, wound infections, and patellar clunk syndrome. Effective postoperative care is vital for minimizing these risks, involving maintaining a clean surgical site, managing pain with medications, and adhering to activity restrictions. Overall, TKR can greatly enhance patient quality of life, provided candidates are selected carefully and postoperative guidelines are followed diligently.

Conclusion:

Complete knowledge of the regional anatomy is essential for surgical exposure of the knee. Such information enables a correlation between the diseased state and the proposed procedure. Although the medial parapatellar arthrotomy or anteromedial approach has been the most common and has been considered the standard approach of exposure of the knee joint, the selection of surgical approach for TKR should be determined by the presenting clinical scenario as well as the training and experience of the surgeon. The front aspect of the joint can be sufficiently exposed for TKR with careful planning and arthrotomy selection.

References :-

1. Von Langenbeck B. Zur resection des kniegellenks. Verhandlungen der Deutschen Gesellschaft für Chirurgie. 1878;7:23–30.
2. Hofmann AA, Plaster RL, Murdock LE. Subvastus (Southern) approach for primary total knee replacement. Clin Orthop Relat Res. 1991;269:70–77.
3. Engh GA, Holt BT, Parks NL. A midvastus muscle-splitting approach for total knee replacement. J Arthroplast. 1997;12:322–331.
4. Warren RF, Marshall JL. The supporting structures and layers on the medial side of the knee: an anatomical analysis. J Bone Joint Surg Am. 1979;61:56–63.
5. Ksander GA, Vistnes LM, Rose EH. Excisional wound biomechanics, skin tension lines and elastic contraction. Plast Reconstr Surg. 1977;59:398–410.
6. Stern SH, Moeckel BH, Insall JN. TKR in valgus knees. Clin Orthop. 1991;273:5–8.
7. Insall J. A midline approach to the knee. J Bone Joint Surg Am. 1971;53:1584–1586.
8. Vaishya R, Singh AP, Vaish A. Outcome of subvastus approach in elderly nonobese patients undergoing bilateral simultaneous total knee replacement: a randomized controlled study. Indian J Orthop. 2013;47(4):430–431.
9. Mochizuki RM, Schurman DJ. Patellar complications following total knee replacement. J Bone Joint Surg Am. 1979;61:879–883.
10. Erkes F. Weitere Erfahrungen mit physiologischer Schnittführung zur Eröffnung des Kniegelenks. Beiträge zur klinischen Chirurgie. 1929;147:221.
11. Roysam GS, Oakley MJ. Subvastus approach for total knee replacement: a prospective, randomized, and observer-blinded trial. J Arthroplast. 2001;16:454–457.
12. Matsueda M, Gustilo RB. Subvastus and medial parapatellar approaches in total knee replacement. Clin Orthop. 2000;371:161–168.
13. Chang CH, Chen KH, Yang RS, Liu TK. Muscle torques in total knee replacement with subvastus and parapatellar approaches. Clin Orthop. 2002;398:189–195.
14. Maestro A, Suarez MA, Rodriguez L, Guerra C, Murcia A. The midvastus surgical approach in total knee replacement. Int Orthop. 2000;24:104–107.
15. Parentis MA, Rumi MN, Deol GS, Kothari M, Parrish WM, Pellegrini VD. A comparison of the vastus splitting and median parapatellar approaches in total knee replacement. Clin Orthop. 1999;367:107–116.
16. White RE, Allman JK, Trauger JA, Dales BH. Clinical comparison of the midvastus and medial parapatellar surgical approaches. Clin Orthop. 1999;367:117–122.
17. Engh GA, Parks NL. Surgical technique of the midvastus arthrotomy. Clin Orthop. 1998;351:270–274.
18. Insall J. A midline approach to the knee. J Bone Joint Surg Am. 1971;53:1584–1586.
19. Van der Bruggen W, Hirschmann MT, Strobel K, Kampen WU, Kuwert T, Gnanasegaran G, Van den Wyngaert T, Paycha F. SPECT/CT in the postoperative painful knee. Semin Nucl Med. 2018 Sep;48(5):439-453.

20. Jones CA, Voaklander DC, Johnston DWC, et al. Health-related quality of life outcomes after total hip and knee arthroplasties in a community-based population. J Rheumatol. 2000;27:1745–1752.
21. Wylde V, Beswick A, Bruce J, Blom A, Howells N, Gooberman-Hill R. Chronic pain after total knee arthroplasty. EFORT Open Rev. 2018 Aug;3(8):461–470.
22. Jones CA, Voaklander DC, Johnston DWC, et al. Health-related quality of life outcomes after total hip and knee arthroplasties in a community-based population. J Rheumatol. 2000;27:1745–1752.
23. Plenge U, Nortje MB, Marais LC, et al. Optimising perioperative care for hip and knee arthroplasty in South Africa: a Delphi consensus study. BMC Musculoskelet Disord. 2018 May 09;19(1):140.
24. Loures FB, Correia W, Reis JH, Pires E, Albuquerque RS, de Paula Mozela A, de Souza EB, Maia PV, Barretto JM. Outcomes after knee arthroplasty in extra-articular deformity. Int Orthop. 2019 Sep;43(9):2065–2070.
25. Ryan SP, Goltz DE, Howell CB, Attarian DE, Bolognesi MP, Seyler TM. Skilled nursing facilities after total knee arthroplasty: the time for selective partnerships is now! J Arthroplasty. 2018 Dec;33(12):3612–3616.
26. Clement ND. Patient factors that influence the outcome of total knee replacement: a critical review of the literature. OA Orthopaedics. 2013;1:11.
27. Hawker GA, Bohm E, Dunbar MJ, Jones CA, Noseworthy T. The effect of patient age and surgical appropriateness and their influence on surgeon recommendations for primary TKA: a cross-sectional study of 2,037 patients. JBJS. 2022 Apr 20;104(8):700–8.
28. Vasso M, Antoniadis A, Helmy N. Update on unicompartmental knee arthroplasty: current indications and failure modes. EFORT Open Rev. 2018 Aug;3(8):442–448.
29. Lotke PA. Knee arthroplasty. 3rd ed. Raven Press; 1995. p. 1–19.
30. Insall JN, Thompson FM, Brause BD. Two-stage reimplantation for the salvage of infected total knee arthroplasty. J Bone Joint Surg. 1983;65:1087–1098.
31. Meek RM, Greidanus NV, McGraw RW. The extensile rectus snip exposure in revision of total knee arthroplasty. J Bone Joint Surg. 2003;85:1120–1131.