

CONSEQUENCES OF ANTERIOR FEMORAL NOTCHING AFTER TOTAL KNEE ARTHROPLASTY

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ABSTRACT:

BACKGROUND: Osteoarthritis of the knee, one of the most common causes of disability, continues to increase in prevalence as the older adult and obese populations grow. More than 50% of patients older than 65 years have radiographic changes in the knee that indicate arthritis. **MATERIALS AND METHODS:** This is a prospective study of 250 Total knee replacements performed for Osteoarthritis of knee. Study done at Department of Orthopaedics, Smimer hospital, Surat from May 2022 to January 2023. follow up for patients were being followed on 15 days, 6 weeks, 3, 6 and 12 months and degree of anterior notching was determined by postoperative radiographs. **RESULTS:** 250 patients enrolled in our study. Average age of the patients was 63 years. Total No. of TKAs were 249. In which 165 were female and 84 were male. Total number of patients that developed notching was 52 which is 21% of the patient's undergoing surgery. In our study 38 patients developed grade 1 notching while 14 developed grade 2 notching. **CONCLUSION:** From the study it can be concluded that There is no significant increase in risk of supracondylar femur fracture due to anterior notching. [Yates' corrected p value 0.88(>0.05)]. The duration of pain following notching initially reduces the range of motion immediate postoperatively, but on longer follow up range of motion was satisfactory in both the patients with notching as well as in the ones without notching. However longer follow up is necessary. Anterior notching is more common in females probably due to small sized distal femur in Indian population. There is no difference in clinical outcomes between notching and without notching patients. Both groups have same range of motion, no or minimal pain, can sit with cross legs and can squat.

KEY WORDS: *Anterior femoral notching, Total knee replacement.*

INTRODUCTION:

Osteoarthritis of the knee, one of the most common causes of disability, continues to increase in prevalence as the older adult and obese populations grow. A successful total knee arthroplasty can improve biomechanics of the joint, realign soft tissues and mitigate structural and functional deficits. The success of total knee arthroplasty (TKA) relies on many factors:

- Patient selection
- Prosthesis design
- Soft tissue balancing
- Alignment of components
- Restoration of joint line

Amongst them, component and limb alignment is one of the most important factors determining the longevity of TKA.

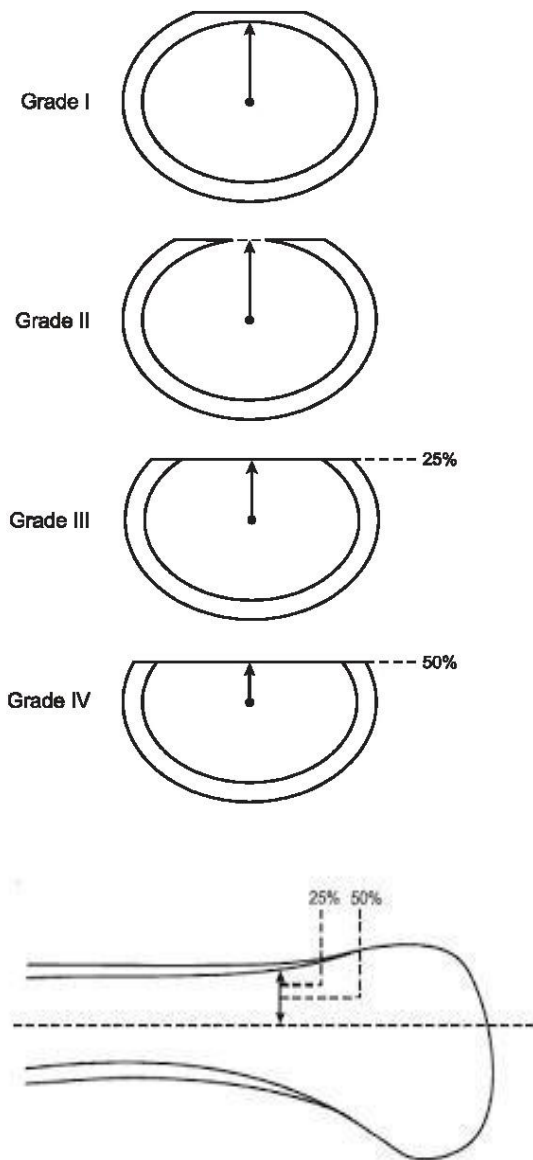
Femoral notching occurs when a bone defect (notch) in the anterior femoral cortex occurs due to bone cuts for the femoral component insertion in total knee arthroplasty (TKA). Anterior femoral notching should be avoided because it contributes to complications, such as a postoperative supracondylar femoral fracture. The purpose of the present study was to investigate the effects of notching of the anterior femoral cortex.

Femoral Notching in Total Knee Arthroplasty:

Definition: Violation of the anterior cortex (+/- medulla) of the distal femur during preparation in TKR. It happens during taking anterior femoral cut by using posterior referencing as the depth of the anterior cut is not measured directly.

Classification system: Tayside classification 2009(Scotland):

- i. Violation of the outer table of the anterior femoral cortex
- ii. Violation of the outer and the inner tables of the anterior femoral cortex
- iii. Violation up to 25% of the medullary canal (from the inner table to the center of the medullary canal);
- iv. Violation up to 50% of the medullary canal (from the inner table to the center of the medullary canal) and unclassifiable.



AIMS AND OBJECTIVES:

- To study consequences of anterior femoral notching after total knee arthroplasty.
- To compare the clinical outcome between patients who developed notching and patients without notching.

- To study the outcome of periprosthetic supracondylar femur fracture treated with open reduction and internal fixation and compare it with other treatment modalities.

RESULT AND CONCLUSION:

250 patients enrolled in our study. Average age of the patients was 63 years.

Total No. of TKAs were 249. In which 165 were female and 84 were male.

Total number of patient that developed notching was 52 which is 21% of the patients undergoing surgery

In our study 38 patients developed grade 1 notching while 14 developed grade 2 notching

KSS score:

Over the past 3 decades the most popular knee rating systems have been those of the Hospital for Special Surgery and the Knee Society. The Knee Society released a revised knee rating system in 1989 and updated it in 2011. Because of increased patient demands and expectations over the past 2 decades, this latest update has been tailored to incorporate patient-specific activities and patient-perceived expectations. The updated system now consists of preoperative and postoperative objective measurements recorded by the surgeon and patient-driven measures evaluated by patients concerning their perceptions of the most important and deleterious aspects of their knee arthritis and replacement surgery.

The first parts of the score include patient demographics and the patient's **Charnley functional score**. The objective measures and knee score (out of 150 points depending on range of motion measures) include alignment and instability, which account for up to 50 points.

MATERIALS AND METHODS:

This is a Prospective study of 250 total knee replacements performed for osteoarthritis knee. Patients were enrolled into study based on the scrutiny of hospitals operative records.

Time frame: may 2022 to January 2023

Place of study: SMIMER SURAT

All surgeries were performed by the same orthopedic surgeon however implants were varied. These patients were to be followed up for an average period of 1 year. Follow up protocol being 15 days, 6 weeks, 3,6 and 12 months. The degree of anterior femoral notching was determined by postoperative radiographs. Classification of notching was done by Tayside classification. Clinical outcomes were compared using range of motion(ROM), Western Ontario and McMaster Universities Osteoarthritis Index(WOMAC) score and Knee Society

Score (Knee score and functional score) between two (notching and without notching) groups.

Inclusion criteria:

- Documented patients with osteoarthritis knee.
- Documented patients with rheumatoid arthritis knee.

Exclusion criteria:

- Less than 6 months follow up.
- Revision total knee arthroplasty
- Previous supracondylar femur fracture.

Patients who are not willing to participate or not came for follow up. Preoperative clinical findings were obtained from extensive scrutiny of available records in form of operative records discharge cards, preoperative x-rays and case sheets. Patients were assessed for pain, deformity, range of motion, activity level and functional capabilities preoperatively. Anterior midline or medial parapatellar incision was used for all our surgeries. Choice of implant was guided by pre op stability and deformity of patient’s knee and economic considerations. We used cement in all the surgeries.¹ No patellar resurfacing was done however we did perform patelloplasty in some patients. Soft tissue release as required was done for deformity correction.

Pre operative protocols:

All the patients were to undergo thorough preoperative investigations – ECG, chest x-ray, 2D echo, all the relevant blood investigations, medical and surgical advices taken in case of respective comorbidities. Bilateral knee AP(standing) and lateral xrays were taken. Pre op evaluation of deformity was done by measuring tibiofemoral angle and Hip knee axis. When such radiographs were not feasible, pelvic radiographs were used to determine the distal femoral valgus cut. Computed tomography and magnetic resonance imaging were requested to confirm stress and intra-articular

fractures. All patients were given antibiotic prophylaxis preoperatively.

Complications:

ICU Admissions: There were 1 ICU admissions among tkr patients already had compromised cardiopulmonary functions and the surgery lead to increased stress and was transferred for regular observation and monitoring as they had altered blood pressure after the surgery.

Electrolyte imbalance: 3 patients had electrolyte imbalance postoperatively. The incidence may be attributed to greater hemodynamic load and other preexisting renal and cardiac co morbidities. The most commonly found abnormality was hyponatremia. Patients recovered from imbalance after correction in form of fluids and constant monitoring of blood parameters.

Late infection and revision surgery: There were one lately infected case after 6months in TKR due to which they had to undergo revision surgery, where debridement and arthrodesis of knee joint was done. There were total 1 revision surgery performed during study.

Deep Vein Thrombosis (DVT):

Deep vein thrombosis (DVT) is considered to be a common complication of total knee replacement but no single such case was seen during the study attributed to early mobilization of patient and vigorous physiotherapy started from post-op day 1. There is 4.3% overall incidence of DVT in patients operated for total knee replacement without pre-operative prophylaxis.

Periprosthetic Fracture:

Periprosthetic fractures occur intra-operative in patients with older age, female sex and patients with osteoporotic bone and as a result of surgical insult. Though, there is no such intraoperative complication occurred in this study. One patient came with periposthetic fracture due to fall down.

For Periprosthetic supracondylar femur fracture, Lewis and Rorabeck classification is most commonly used

Lewis and Rorabeck Classification (1997)	
Type I	Nondisplaced; component intact
Type II	Displaced: component intact
Type III	Displaced; component loose or failing

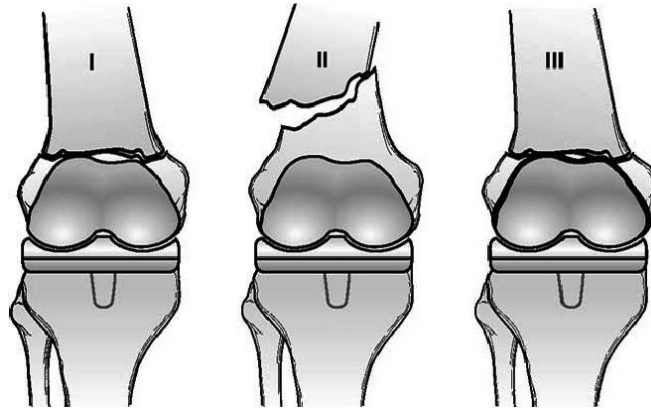


Fig 25 Lewis and Rorabeck classification

Nerve Palsy:

Though rare, but popliteal nerve palsy is associated with total knee replacement mainly in lean and thin patients and due to excessive instrumentation in posterior part of knee. Neuro-praxia is also seen in patients where tourniquet pressure intraop was excessive or tourniquet time was more. But, none such case was seen during our study

Popliteal artery injury: This is also a rare but most dangerous complication which might occur during total knee replacement due to over manipulation and excessive instrumentation around posterior part of knee. No such complication occurred during our study.

RESULTS:

200 patients enrolled in our study. Average age of the patients was 63 years. Sex distribution of enrolled patients is shown in the chart below.

Total No. of TKAs were 249. In which 165 were female and 84 were male.

Total number of patient that developed notching was 52 which is 21% of the patients undergoing surgery.

In our study 38 patients developed grade 1 notching while 14 developed grade 2 notching.

Out of 38 females who developed notching it was observed that 26 were having grade 1

In our study out of 197 patients of without notching, 1 developed periimplant supracondylar femur fracture, while out of 52 patients with notching, periimplant supracondylar femur fracture was occurred in only 1 patient.

Average duration of hospital stay was 6 days

All the patients were mobilized on 1st post-operative day with exception of patients with restriction due to lack of confidence.

DISCUSSION:

This is a prospective study of 249 total knee Arthroplasty, The results obtained in our study are

compared with various previous studies [i.e Gujarathi et al., (2009- UK), Ritter et al., (2005-USA), ⁵ Figge et al. (1990), Merkel and Johnson (1986),].The average age of patients in our study was 63 years. With youngest patient were being 55 years old and the oldest being 71 years. Out of the total 200 patients in our study 133 were females and 67 were males, stressing on the fact that more of the females ultimately get the total knee replacement done than male. All the patients were mobilized on 1st post-operative day barring few restrictions like , lack of confidence on patient’s behalf, icu admissions. During the preparation of the distal femur, notching is relatively common despite sophisticated instrumentation. In some literatures, the incidence of notching in TKR has been observed to be 29.8% (Ritter et al.2005) and 41%(Gujarathi et al.2009). The incidence of notching of the anterior femoral cortex in TKR in this study was 21%. Culp et al. (1987) measured the depth of notching on the lateral postoperative radiographs. They concluded that violation of the anterior femoral cortex in the supracondylar region up to 3 mm reduces its torsional strength by 29%². However, the depth of encroachment of anterior femoral cortex and medullary cavity of the distal femur has not been classified clinically or radiographically in the literature. In our study, the depth of the notching was classified into 4 grades according to the encroachment of the femoral cortex (outer and inner table) and medullary canal. The validity of this new classification for notching was substantially reliable. Clinical outcome of both notched and non-notched femur is same. Which was measured by WOMAC score and KSS score (knee score and functional score). Ritter et al.2005 also described that anterior femoral notching had no significant effect on the postoperative range of motion, knee score, functional score, the need for a lateral release or postoperative pain³.

CONCLUSION:

From the study it can be concluded that:

- There is no significant increase in risk of supracondylar femur fracture due to anterior notching.[Yates' corrected p value 0.88(>0.05)]
- The duration of pain following notching initially reduces the range of motion immediate postoperatively, but on longer follow up range of motion was satisfactory in both the patients with notching as well as in the ones without notching. However longer follow up is necessary.
- Anterior notching is more common in females probably due to small sized distal femur in indian population.
- There is no difference in clinical outcomes between notching and without notching patients. Both groups have same range of motion, no or minimal pain, can sit with cross legs and can squat.
- Periprosthetic supracondylar femur fractures treated with Dual plating have good clinical outcome(with full range of motion and minimal pain). They unite well without any deformity and shortening.

**Case : 58-year female with B/L osteoarthritis of knee operated for B/L TKA.
Grade II notching is developed on Rt side**



Post op x-ray



Clinical image at 3months follow up

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