‘Functional outcome following Total Knee Replacement for Inflammatory arthritis of Knee done in patients from 2008 to 2012’

DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQIUREMENTS OF TAMIL NADU DR.M.G.R MEDICAL UNIVERSITY FOR THE DEGREE OF M.S. (ORTHOPEDIC SURGERY) EXAMINATION TO BE HELD IN APRIL 2014

CERTIFICATE

This is to certify that the dissertation entitled "**Functional outcome following Total Knee Replacement for Inflammatory arthritis of Knee done in patients from 2008 to 2012**" is the original work of Dr.Arun Immanuel Muthiah D. done under my guidance towards the M.S. (Orthopaedic surgery) Degree Examination of Tamil Nadu Dr. M.G.R Medical University, Chennai to be held in April 2014.

Signature

Guide:

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Professor and Head , Orthopedics Unit III,

Christian Medical College,

Vellore – 632 004.

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July 25, 2013

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Sub: **FLUID Research grant project NEW PROPOSAL:**
Functional outcome following Total Knee Replacement for Inflammatory arthritis of Knee done in patients from 2008 to 2012.
Dr. Arun Immanuel Muthiah. D, PG Registrar, Orthopaedics, Dr. Alfred Job Daniel, Dr. Thomas Mathai, Orthopaedics, Dr. B. Antonisamy, Biostatistics.

Ref: IRB Min. No. 8251 [OBSERVE] dated 19.03.2013

Dear Dr. Arun Immanuel Muthiah. D,

The Institutional Review Board (Blue, Research and Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project entitled "Functional outcome following Total Knee Replacement for Inflammatory arthritis of Knee done in patients from 2008 to 2012." on March 19, 2013.

The Committees reviewed the following documents:

1. Format of IRB application
2. Information Sheet and Consent Form (English, Hindi nd Tamil)
3. Cvs of Drs. Alfred Job Daniel, Antonisamy, Arun Immanuel Muthiah D
4. A CD containing documents 1 - 3

The following Institutional Review Board (Research & Ethics Committee) members were present at the meeting held on March 19, 2013 in the CREST/SACN Conference Room, Christian Medical College, Bagayam, Vellore 632002.

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We approve the project to be conducted as presented.

The Institutional Ethics Committee expects to be informed about the progress of the project, any **adverse events** occurring in the course of the project, any **amendments in the protocol and the patient information / informed consent**. On completion of the study you are expected to submit a copy of the **final report**. Respective forms can be downloaded from the following link: http://172.16.11.136/Research/IRB_Polices.html in the CMC Intranet and in the CMC website link address: http://www.cmch-vellore.edu/static/research/Index.html.

A sum of Rs 40,000/- (Rupees Forty Thousand only) will be granted for 1 year.

Yours sincerely

Dr. Nihal Thomas
Secretary (Ethics Committee)
Institutional Review Board

CC: Dr. Alfred Job Daniel, Orthopaedics, CMC

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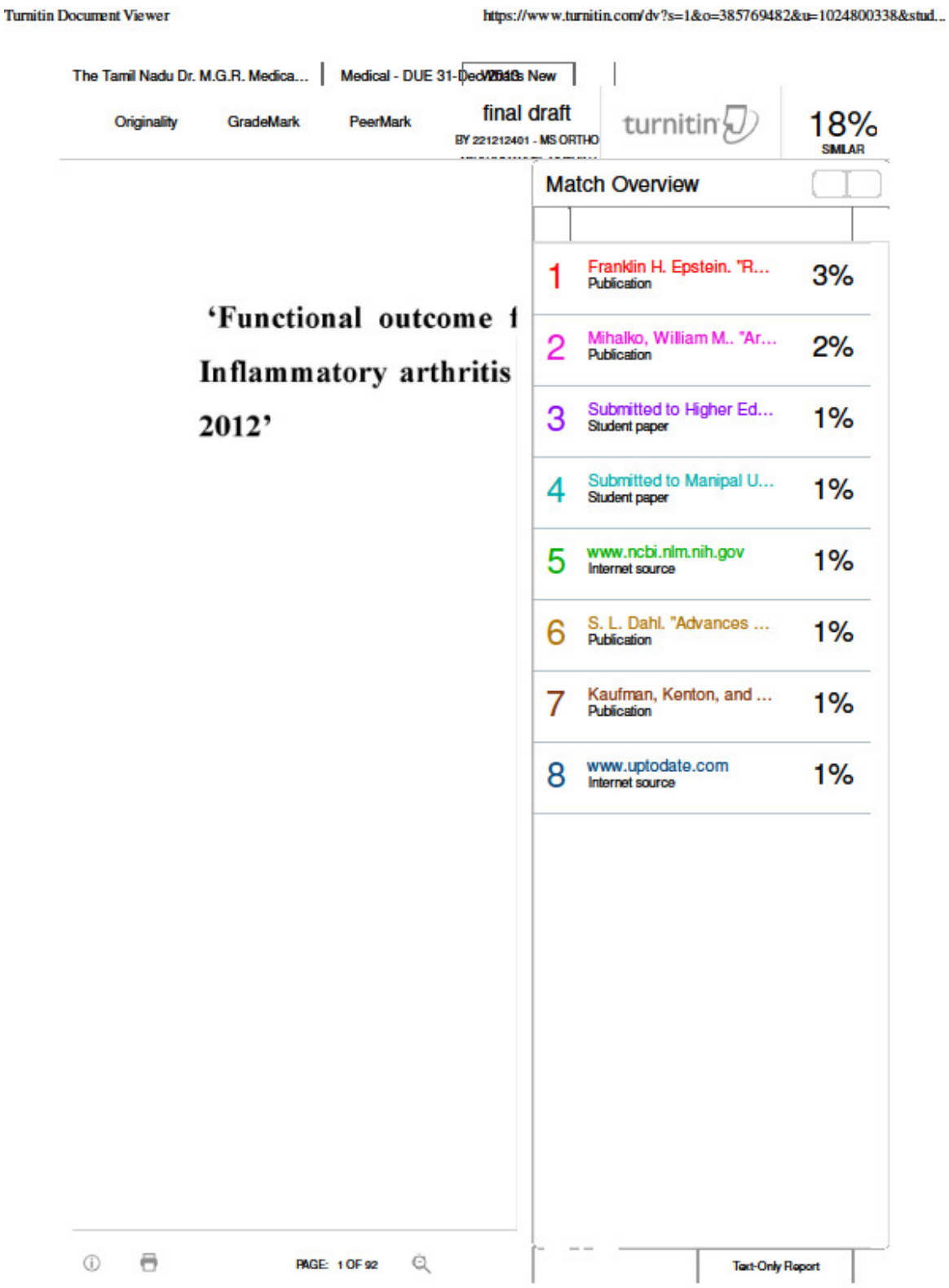
ANTI PLAGIARISM CERTIFICATE



ACKNOWLEDGEMENTS

First and foremost, I thank my Lord Jesus Christ , for showering me with His abundant grace and thus enabling me to complete this thesis.

I owe gratitude to Dr. Alfred Job Daniel (Guide) and Dr. Thomas Mathai (Co- guide) for all their guidance and support ,throughout this study.

The assistance provided by the biostatistician Dr. Antonisamy was invaluable. This is also an opportunity for me to place on record the aid of the Medical Record Officer Mr. Rajesh in the recruitment and follow up of the involved patients.

I also acknowledge the assistance by Mrs.Kothai , our office secretary , an ever smiling and ever helpful person.

Last but not the least my family, my wife , my two daughters Bettina and Danita, my parents and my in-laws , for all their prayers, patience and love.

TABLE OF CONTENTS

FORMAT

TITLE OF THE ABSTRACT : "**Functional outcome following Total Knee Replacement for Inflammatory arthritis of Knee done in patients from 2008 to 2012**"

DEPARTMENT : Orthopaedics Surgery

NAME OF THE CANDIDATE : Dr. Arun Immanuel Muthiah D.

DEGREE AND SUBJECT : MS Orthopaedics

NAME OF THE GUIDE : Dr. Alfred Job Daniel

OBJECTIVES: {Describe the objectives of your study (maximum 30 words)}

1. To evaluate the clinical, functional and radiological outcomes after TKR for inflammatory arthropathy performed in CMCH.

2. To identify potential factors that affect the functional outcome after TKR for Rheumatoid Arthritis.

METHODS: {Explain the clinical and statistical methods used (maximum 100 words)}

Patients who had TKR for RA during the period 2008-2013, in Orthopaedics Unit III were recruited for the study after informed consent. American Knee Society scores and functional scores were used for the assessment. Pre operative scores were obtained from previous medical records. Anteroposterior and lateral view radiographs of the involved knee were taken.

Paired t test was done to determine the significance in changes between the pre-operative and postoperative scores. Bivariate analysis using **Spearman correlation** and **logistic**

regression analysis was performed to assess the influence of various factors like age, BMI, use of steroids, methotrexate and duration of disease on the post-operative knee scores.

RESULTS: {Summarise the findings and conclusions of your study (maximum 90 words)}

- Significant improvement (p 0.000) was observed between the pre operative (57.3) and post operative (97.4) Knee Society scores, as well as improvement in functional scores from 36.3 preoperative to 85.2 points post operatively after TKR .
- Steroid usage had a significant positive correlation.
- Duration of disease and involvement of the other joint had a significant negative correlation to post-operative functional scores.
- Average age of patients at the time of TKR was 54 years, all were in stage IV disease, and the majority were women (n=20).

KEYWORDS: total knee replacement, rheumatoid arthritis, knee society score, functional score, steroid, methotrexate.

INTRODUCTION

Total Knee Replacement (TKR) is one among the most commonly performed orthopaedic surgical procedures, to treat severe arthritis of the knee joint either due to osteoarthritis or due to inflammatory arthropathy. . Over ninety percent of total knee replacements are performed for osteoarthritis. When there is cartilage damage in either medial, lateral compartment or patellofemoral joint , severe pain with deformity develops subsequently necessitating a total joint replacement.When anti inflammatory medications, lifestyle modification and physiotherapy do not succeed in relieving symptoms of pain and improving functional capacity ,joint replacement is considered as the last resort.

The prosthesis used in total knee replacement has a very accurate survival rate, which depends on the activity level of the patient and the type of prosthesis. Hence, TKR done for symptoms of osteoarthritis, the patients are generally older than the patients who undergo TKR for inflammatory arthropathy.

Rheumatoid arthritis (RA) is a chronic, systemic, inflammatory disorder that involves symmetrical small and large joints. If it is not identified early and treated, the damage to the bone and cartilage would become irreversible, leading to severe pain and deformity associated with loss of function. Owing to these reasons, the therapy for rheumatoid arthritis (RA) is mainly focussed on restricting the progress of synovitis and the protection of joint from injury. Within 10-20 years of the onset of the disease, despite disease modifying anti rheumatoid drugs (DMARDs), biological agents and anti inflammatory agents, severe damage to the joint cartilage occurs, mainly due to the growing synovium. Total knee replacement in RA has been an enormous boon to those who are suffering from pain and deformity because of severe restriction of knee joint movement. Hence the present study to

assess the functional outcome after TKR in inflammatory arthropathy was carried out in Orthopedics Unit III, Christian Medical College.

AIMS AND OBJECTIVES

1. To evaluate the clinical, functional and radiological aspects of the total knee replacement for inflammatory arthropathy performed in the Department of Orthopaedics, Christian Medical College, Vellore.

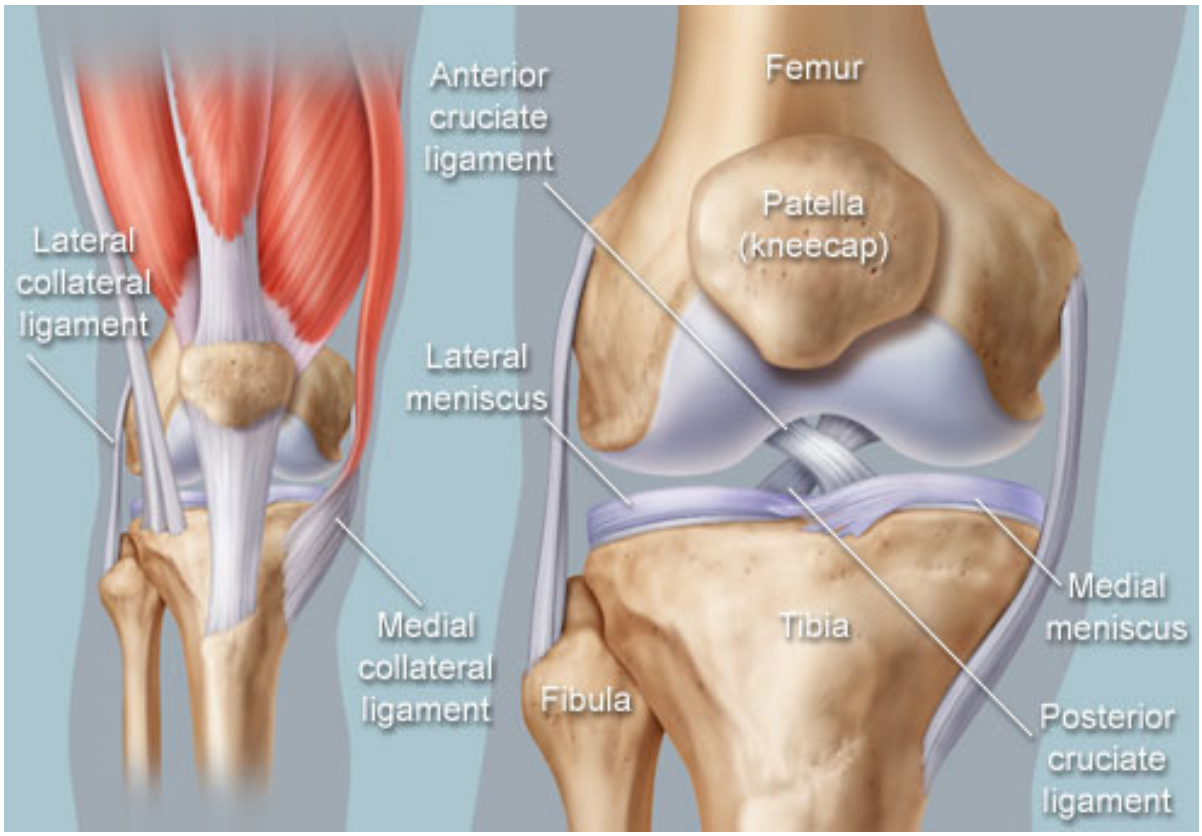
2. To identify potential factors that affect the functional outcome after Total knee repalcemnt for Rheumatoid Arthritis.

LITERATURE REVIEW

APPLIED ANATOMY- THE KNEE JOINT

The embryological development of knee joint originates from the leg bud at 28 days with the formation of femur, tibia and fibula by 37 days. The knee joint arises from blastemal cells with the formation of patella, cruciate ligaments and menisci by 45 days. The knee joint has two components : 1. Condylar joints : where the medial and lateral condyles of the femur articulate with the corresponding tibial condyles . 2. Gliding joint between the patella and the patellar surface of femur.

Hyaline cartilage covers all the articulating surfaces.



Source : WebMD

FEMUR

The femoral condyles are asymmetric in size and shape. The medial femoral condyle is relatively 1.7 cm longer than the lateral condyle in its outer circumference. This asymmetry in length produces axial rotation of the tibia on the femur during flexion and extension. The width of each individual condyle is similar, with the lateral dimension being slightly wider than the medial when measured at the center of the intercondylar notch. In the sagittal axis the lateral femoral condyle extends more anteriorly than the medial femoral condyle. In the coronal plane, the medial condyle extends distally than the lateral condyle. Viewing the femur along its anatomic axis makes the valgus appearance obvious. However in normal weight bearing alignment , condyles appear to be equal in length. The parallel femoral condylar surfaces are created by the mechanical axis configuration of the lower extremity. The mechanical axis configuration is a straight line from the center of the femoral head that intersects the center of the knee and ankle joints. The distal femoral joint line forms a 6 ° angle to the long axis of the femoral shaft , creating a physiological valgus of the distal femoral joint line. The sagittal curvature of the condyles has a radius that decreases posteriorly. The highest bone strength is found at the posterior aspects of the condyles, with the central area being relatively weak.

TIBIA

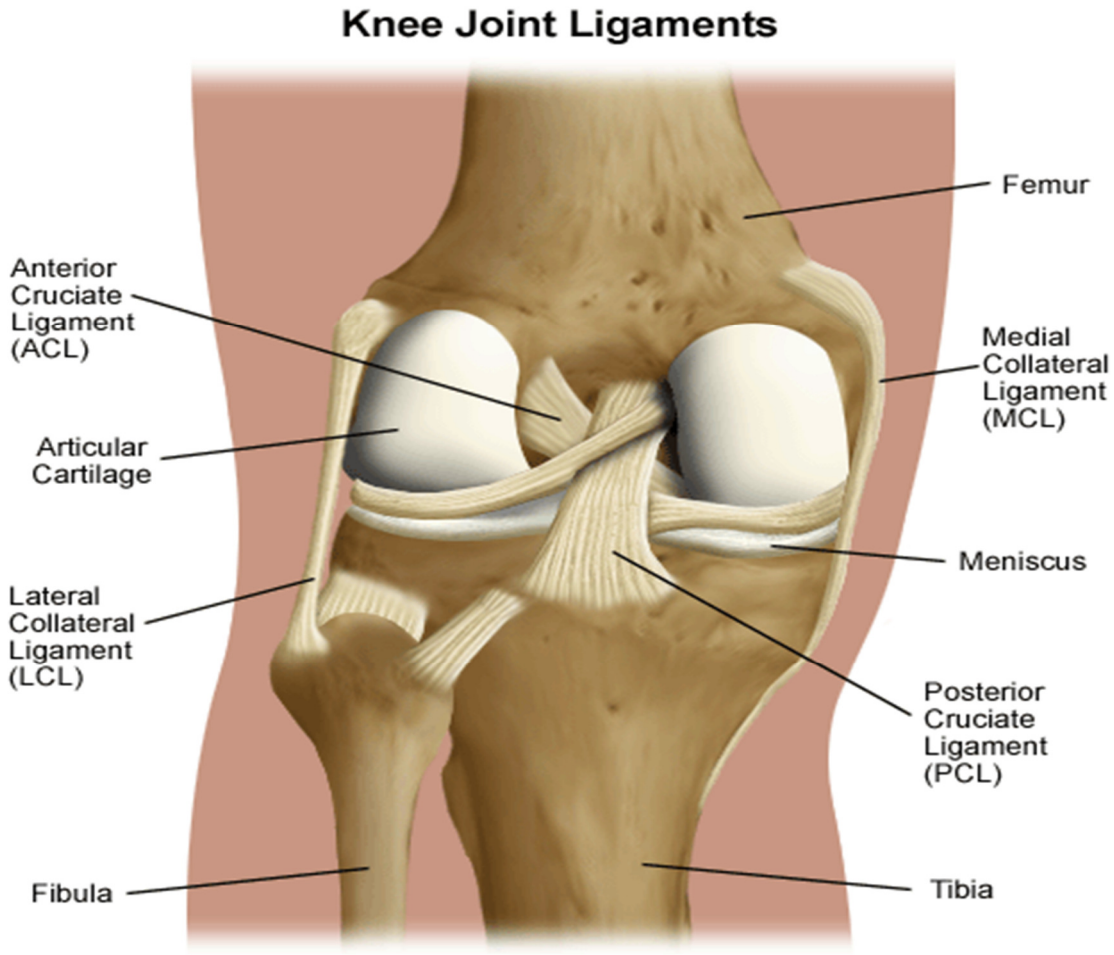
The medial tibial plateau is slightly concave and the lateral tibial plateau is slightly convex. In the sagittal plane the tibial condyles slope posteriorly approximately 10 degree. In the frontal plane the condyles are essentially perpendicular to the long axis of tibia. The highest pressure concentrations are located on the uncovered cartilage of the medial compartment and on the menisci as well as on the uncovered cartilage of the lateral compartment. Trabecular bone of the tibial epiphysis and metaphysis is responsible for the load transmission. The

medial tibial plateau is high strength area especially centrally and anteriorly. Preservation of bone stock of the tibial plateau should be considered in total knee arthroplasty, because optimum support is achieved by resecting 10 mm or less of tibial plateau. Excessive resection results in prosthetic loosening and alteration of desired component position.

PATELLA

The articular surface of the patella is divided into medial and lateral facets. Trabecular structure of the patella and the femoral trochlea is aligned normally to the joint surfaces.

LIGAMENTS:



http://medicalcenter.osu.edu

EXTRACAPSULAR LIGAMENTS

The superior attachment of ligamentum patellae is to the lower border of the patella and to the tuberosity of the tibia , inferiorly. It is actually a continuation of the quadriceps femoris muscle tendon in the central part . The superior attachment of the cord like , lateral collateral ligament is to the lateral condyle of the femur and to the head of the fibula inferiorly. Between the ligament and the lateral meniscus, runs the tendon of the politeus muscle.
The superior attachment of the band like, medial collateral ligament is to the medial condyle of the femur and to the medial surface of the shaft of the tibia inferiorly. It is attached to the edge of the medial meniscus. The oblique popliteal ligament is a tendinous expansion derived from the semimembranosus muscle which serves to strengthen the posterior aspect of the capsule.

INTRACAPSULAR LIGAMENTS:

ANTERIOR CRUCIATE LIGAMENT (ACL):

The main function of anterior cruciate ligament is to prevent anterior displacement of the tibia on the femur. Anteriorly, it is attached to the anterior intercondylar area of the tibia , from where it passes upward, backward, and laterally, to be attached to the medial surface of the lateral femoral condyle in the posterior aspect .

POSTERIOR CRUCIATE LIGAMENT (PCL):

The main function of posterior cruciate ligament is to prevent posterior displacement of the tibia on the femur. Posteriorly , it is attached to the posterior intercondylar area of the tibia and passes upward, forward, and medially to be attached to the lateral surface of the medial femoral condyle in the anterior aspect .

MENISCI:

The menisci are made of fibrocartilage and they are 'c' shaped . The thick peripheral border is attached to the capsule, and the thin inner border is concave and forms a free edge. The femoral condyles are in contact with the upper surface of the menisci and the tibial condyles are in contact with the lower surface of the menisci , leading to a cushioning effect between the long bones.. Their function is to deepen the articular surfaces of the tibial condyles to make it more concave in order to receive the convex femoral condyles.

KINEMATICS

Movements around the knee joint , during normal gait is more complicated than simple flexion and extension. Movement occurs in flexion and extension, abduction and adduction and rotation about the long axis of the limb. The restraint of the ligaments and the complex geometry of the articular surfaces , allow knee flexion to occur at a varying transverse axis. Failure to understand the complex nature of the movements in the knee joint , led to the failure of the early generation prosthesis. The latest prosthetic designs aim at simulating a normal knee joint with a close similarity to it's normal motion and kinematics. During normal gait, for the swing phase 67° of flexion is required, for climbing stairs 83 ° of flexion is required , for descending stairs 90 ° of flexion and to rise from a chair 93 ° of flexion is required(1).

GLOBAL MOTION

The tibiofemoral joint has two degrees of motion. This includes flexion and extension in the sagittal plane which is the first degree of freedom. The axis of rotation intersects the femoral condyle at an angle to the mechanical and anatomic axis. The optimal axis is steady, whereas the screw axis is not fixed . The symmetric optimal axis is constrained in such a way that axis

is the same for both right and left knees. The screw axis may not always coincide with the optimal axis,depending on the motion of the knee joint.

The second degree of freedom is axial rotation around the long axis of the tibia.

There is an automatic axial rotation that is involuntarily linked to flexion and extension. When the knee is flexed, the tibia rotates internally. Alternatively, when the knee is extended, the tibia rotates externally.

This coupled motion is called the “screw-home mechanism”. The possible explanation being , the unequal curvature of the femoral condyles causing this rotational movement and soft tissue factors like tightening of either or both the anterior and posterior cruciate ligaments.

TIBIO-FEMORAL JOINT ARTICULATING SURFACE MOTION

Frankel VH et al analyzed the surface motion of the tibio femoral joint from 90 degree of flexion to full extension in 25 normal knees and thereby determined the instant center pathway . They found the pathway to be semicircular and located in the femoral condyle. The centers fall within a circle with a diameter of 2.3 cm. (2)

Knee articulating motion is a combination of gliding and rolling between the femoral and tibial surfaces. The ratio of rolling to gliding is not constant throughout the entire range of flexion and is controlled by both the anatomy of the joint surfaces and constraints imposed by the anterior and posterior cruciate ligaments.

During flexion, the tibiofemoral contact point moves posteriorly proving the fact that anterior and posterior motion is coupled with extension and flexion. During extension, the centre of pressure is about 25 mm from the anterior joint line. This point moves posteriorly to reach 38.5 mm during flexion as the weight bearing surfaces move posteriorly on the tibial plateau.

PATELLOFEMORAL MOTION

The lever arm of the extensor mechanism in the lower limb is increased by the patellofemoral joint. This increases the efficacy of the quadriceps contraction. When the knee is flexed to 20°, the extensor lever arm function is at its maximum and maximum force of quadriceps extension is required at the final 20 ° of knee extension. The vector of forces through quadriceps and patellar tendons are more parallel to the joint reaction force when there is flexion of knee during standing. It is found that the patellofemoral joint reaction forces is 2-5 times the body weight during activities of daily living as described next. When the knee is flexed to 120 degree during squatting, the joint reaction force is as high as 7-8 times the body weight. There is rolling and gliding movement in femoral articular surface when the knee is flexed. The gliding motion is in clockwise direction throughout the range of flexion in knee. The mean patellar gliding is 6.5 mm per 10° of flexion (between 0 ° and 80° of flexion of knee) and 4.5mm per 10° of flexion (between 80° and 120° flexion of knee).

KNEE JOINT STABILITY

The muscles, ligaments, menisci, osseous geometry and joint capsule all combine in a coherent manner to produce joint stability.

JOINT SURFACE

The surface of distal femur is convex, whereas the proximal tibia is partially flat, concave medially and convex laterally. The tibial intercondylar eminence and the articular geometry provide some stability.

To decrease laxity during maximum load bearing , the geometric conformity of the articular surfaces , function as an influencing factor(3) .The femur moves upward on the tibial curvature , called ‘uphill principle’, in order to perform rotatory, anteroposterior and mediolateral movements (augmented by the tibial spines). During low load bearing situations, the soft tissue components like the capsule, ligaments and menisci provide the

stability of the joint. Whereas the conformity of the articulating condylar surface provides the joint with stability during maximum load bearing.

LIGAMENTOUS STABILITY

The ligament structures are able to resist translational forces and thus prevent translation of their bony attachments , mainly in the anteroposterior movements(4) . The contraction of the hamstrings provide an active restraint , by increasing the stiffness of the joint , thereby providing stability to knee joint. Valgus and varus stability is provided by the collateral ligaments. The torque generated at the joint articular surface provides rotational stability. In the frontal plane the force of the muscles contributes to the stability of the joint.

During maximal axial loading, at full knee extension, the balance between medial and lateral compartments, provides for the stability.

JOINT LOADING

The muscles around the knee joint need to contract at high forces to maintain joint equilibrium. Joint forces during climbing up and down the stairs, during downhill walking , rising from a chair are higher than during walking. The maximum forces are at greater joint flexion. Understanding of this will aid in deciding on the type of prosthesis to be used for TKA.

AXIAL AND ROTATIONAL ALIGNMENT OF THE KNEE

The normal alignment of the knee in lower limb has to be established for the success of TKR. This has been shown in many studies – correlating the restoration of alignment to the long term survival of TKR. The various problems associated with malalignment of total knee prostheses are

1. Tibiofemoral instability.
2. Patellofemoral instability.
3. Patellar fracture.

4. Knee stiffness.
5. Accelerated wear of polyethylene.
6. Loosening of the implant.

About 6 ° of valgus angle is present between the anatomical axes of the femur and the tibia which is shown by the line drawn from femoral head centre to the centre of the talar dome. The alignment is said to be in valgus when the mechanical axis is lies lateral to the knee joint centre and varus alignment when it is medial to the centre of the knee. It is determined by the line joining the centre of the femoral head and the centre of the intercondylar notch in AP view in plain radiograph and that of tibia by the line tibial plateau centre to the centre of the tibial plafond. The varus or valgus deviation from the neutral mechanical axis is determined by the angle between the mechanical axes of the femur and tibia. The tibial articular surface is in 3° of varus alignment with the mechanical axis. There is 9° of valgus between the mechanical axis, and the femoral articular surface. The placement of tibial components in more than 5° of varus tend to fail and this is shown in literature(5). In the coronal plane, the tibial component should be placed perpendicular to the mechanical axis of the tibia. The posterior tilt in the sagittal plane depends the type of implant used. The femoral component is placed in 5° to 6° of valgus.

Rotational alignment of total knee components is best assessed intraoperatively. The malalignment of the femoral component will affect balancing of flexion gap and patellofemoral maltraking. Placement of femoral component in approximately 3° external rotation in relation to posterior condylar axis will help getting rectangular flexion gap and balace medial and lateral collateral ligaments. The femoral component is placed with the posterior condylar surfaces parallel to the epicondylar axis. This method cannot be used if the posterior condyle has wear or there was hypoplasia of lateral femoral condyle resulting in valgus knee. In such situations the anteroposterior axis can be used.

Two primary techniques are used for the rotational alignment of the tibial component .

1. The centre of the tibial tray is aligned with the point marking the junction of the medial 1/3rd of the tibial tubercle with the lateral 2/3 in tibial platform.

2. The tibia is aligned with the flexion axis of the femur, through a range of motion with trial components in place.

This second technique helps to match the tibial component rotationally with the rotation of the femoral component. The chance of rotation mismatch is reduced but it leads to polyethylene wear. But this may lead to patellofemoral maltracking(6) as both the components rotate together. This may also cause higher incidence of patellofemoral pain(7).

PATELLOFEMORAL TRACKING

Prior to placing the final components, factors affecting patellofemoral tracking must be taken into consideration. The following factors increase the 'Q' angle , leading to lateral maltracking of the patella.

1.Subluxation occurs when the Q angle increases. This occurs when the tibial tubercle is displaced laterally by the internal rotation of the tibial component.

2. Lateral patellar subluxation occurs when the trochlea moves medially. This happens when the femoral component undergoes internal rotation or medial translation.

3. The patella is forced to function with an increase in Q angle , due to medial tracking of the bony patella . This is required to maintain centralization of the patellar component.

THE INDICATIONS OF TOTAL KNEE ARTHROPLASTY

1. The primary indication for TKA is to relieve pain., with or without deformity which occurs due to severe arthritis..
2. Clinical impression and radiographic findings should confirm the finding of knee arthritis.
3. Surgery is embarked only when all possible conservative measures are exhausted.
4. In elderly patients , with severe patellofemoral arthritis, in whom arthroplasty yields better results than patellectomy.
5. Flexion contracture exceeding 20°, which hampers gait in a significant manner.
6. Severe varus or valgus laxity necessitating the use of constrained condylar type of prosthesis, to ensure stability in the coronal plane.

CONTRAINDICATIONS OF TOTAL KNEE ARTHROPLASTY

1. Recent or an ongoing sepsis of the knee joint.
2. Current infection at a site apart from the knee.
3. Severe dysfunction of extensor mechanism.
4. Muscle weakness leading to a recurvatum deformity.
5. An existing, functional arthrodesis which is painless.
6. Co existing medical illness which poses a high risk for anaesthesia, predisposes to poor wound healing and leads to metabolic derangements..
7. Atherosclerotic disease of the affected knee.
8. Psoriasis of the skin , involving the knee
9. Recurrent cellulitis due to venous stasis.
10. Neuropathic arthropathy
11. Morbid obesity.

COMPLICATIONS OF TOTAL KNEE ARTHROPLASTY

INFECTION

Following TKR, infection is one of the most alarming complications. Factors that predispose to an increased rate of infection after TKA include:

1. Rheumatoid arthritis.
2. Superficial ulceration of the skin.
3. Prior surgery to the knee.
4. When hinged-knee prosthesis is used.
5. Obesity.
6. Co-existing infection of the urinary tract.
7. Usage of steroid.
8. Diabetes mellitus.
9. Renal failure.
10. Poor nutrition.
11. Malignancy.
12. Psoriasis.

TREATMENT OPTIONS FOR INFECTION:

1. Use of appropriate antibiotics.
2. Debridement
3. Resection arthroplasty
4. Arthrodesis of the knee joint.
5. Reimplantation , either in one or two stages.
6. Amputation

Treatment for infection depends on :

1. The nature of the organism and the intensity of the infection.
2. Condition of soft tissue over the operated site.
3. Continuity of extensor mechanism.
4. Prevailing medical condition of the patient.

Indications for Antibiotics:

1.Removal of prosthesis is not feasible.

2.Prosthesis is not loosened.

3. Virulence of the offending organism is low with known susceptibility to oral antibiotics.

4.Absence of multiple joint arthroplasties.

Arthrodesis performed with an intramedullary nail is more beneficial as partial weight bearing can be initiated immediately and fusion is dependable. Majority of surgeons prefer to perform debridement , with removal of the components . This is followed by administration of intravenous antibiotics for 4-6 weeks.

PMMA spacers incorporated with antibiotics are beneficial in many ways; 1. Sustains the soft tissue tension of the knee. 2. Delivers high levels of antibiotic to the local tissues. 3. Enables better exposure at the event of re implantation.4. Weight bearing can be maintained during the interim period.

Above knee amputation is embarked as the last option only in situations like severe life threatening infections, substantial bone loss , not responsive to arthrodesis and not amenable to resection arthroplasty.

PATELLOFEMORAL COMPLICATIONS

Patellofemoral complications include patellofemoral instability, fracture of patella, failure of patellar component, loosening, patellar clunk syndrome, and rupture of extensor mechanism. Patellofemoral instability can be caused by several factors, the most common being imbalance in extensor mechanism . This occurs when the lateral retinaculum is very rigid or the medial soft tissues are supple. Release of the tight lateral retinaculum is advised sparing the superior lateral geniculate artery. Laxity of the medial retinaculum can occur due to trauma in early post operative period or when the repair of medial capsule gives way. This can be avoided if the closure of retinacular capsular layer is performed with the knee in 90 ° flexion ensuring adequate tension in the medial retinaculum. The knee should be subjected to a full range of motion, after closure of the medial capsule to ensure adequacy of the repair.

NEUROVASCULAR COMPLICATIONS

Arterial compromise after TKA occurs in 0.03% to 0.2% of patients, with 25% resulting in amputation.

Peroneal nerve palsy is the only commonly reported nerve palsy after TKA. It occurs primarily with correction of combined fixed valgus and flexion deformities which is seen commonly in patients with rheumatoid arthritis.

When a peroneal nerve palsy is discovered postoperatively, flexion of the knee has to be maintained and the dressing has to be removed completely.

PERIPROSTHETIC FRACTURES

Supracondylar fractures of the femur occur in 0.3 -2 % , after TKA.

Risk factors include, use of steroids, feminine gender, rheumatoid arthritis, neurological disorders , anterior femoral notching, osteoporosis and revision arthroplasty.

THROMBOEMBOLISM

Deep Vein Thrombosis (DVT) is one of the most dreaded complications after TKR .

Risk Factors :

1. Age > 40 years.
2. Use of estrogen.
3. Stroke.
4. Nephrotic syndrome.
5. Prolonged immobilisation.
6. Congestive cardiac failure.
7. Indwelling catheter in femoral vein.
8. Obesity, smoking,varicose veins
9. Diabetes mellitus, Hypertension and Inflammatory Bowel disease.

DVT prophylaxis can be provided with i) Mechanical devices such as compression stockings , foot pumps . ii) Pharmaceutical agents such as low dose warfarin, low-molecular-weight heparin, fondaparinux (a pentasaccharide factor Xa inhibitor), and aspirin.

DESIGN GOALS

In broad terms, the design goals of any knee replacement are

1. Relief of pain
2. Good functional ability
3. Durability

The total knee arthroplasty designs can be classified into

1. Cruciate-retaining
2. Cruciate-sacrificing
3. Cruciate-substituting,
4. Constrained condylar and
5. Hinged designs.

1. **Cruciate sacrificing designs** compensate for the absence of the posterior cruciate ligament by cupping up of the tibial component, which increases the articular conformity to reduce translation and rotation during knee flexion.

2. **Cruciate retaining designs** rely on the integrity of the collateral and posterior cruciate ligaments; require less conforming articular surfaces to allow proper ligament function during knee range of motion.

3. **Posterior stabilized designs** evolved from the cruciate sacrificing components with the addition of a tibial post and femoral housing mechanism to prevent posterior subluxation. Posterior stabilized prostheses require the presence of competent collateral ligaments and should not be regarded as a constrained design, which also provides medial-lateral stability.

4. **Constrained condyar prostheses** with added height and conformity of the poly ethylene tibial spine and the femoral housing render medial-lateral stability and are used primarily in complex arthroplasties with compromised or absent collateral ligaments.

5. **Hinged designs** provide the most inherent stability but have an increased incidence of complications, including mechanical loosening. Hinged components are used for unique situations such as tumor excision necessitating resection of the collateral ligaments.

PRINCIPLES OF TOTAL KNEE ARTHROPLASTY

1. Proper instrumentation and familiarity with its usage.
2. Minimal removal of the tibial plateau at right angles to the long axis of the tibia.
3. Femoral cuts at right angles to the mechanical axis.
4. Maintenance of soft tissue envelope, especially the medial and lateral collateral ligaments, posterior capsule and ilio-tibial band at equal tension both in flexion and extension - providing static stability to the joint and equal flexion and extension gaps.
5. Provision of dynamic stability by the quadriceps, hamstrings and gastronemius muscles.
6. Re-alignment of quadriceps mechanism for stability of the patella.

RHEUMATOID ARTHRITIS

Rheumatoid arthritis is a chronic, inflammatory, symmetrical , peripheral polyarthritis of unknown etiology. Due to destruction of bone and cartilage, stretching of ligaments and tendons occur, leading to deformity. This leads to joint destruction, impairment of activities of daily living and eventually increases mortality

HISTORY

Rheumatoid Arthritis was first noticed in 1947, by a lady technician who worked for Dr.Harry Rose in Columbia. She discovered that her known serum agglutinated excessively. This observation was further developed by a rheumatologist Dr. Charles Ragan who performed the sheep cell agglutination test. This factor was later identified as Rheumatoid factor(8). The first criteria for classification was published in 1958 which was further revised

in 1988 and revised again in 2010. The diagnostic criteria was mainly based on the following clinical features(9).

1. Stiffness of the joints, more in the morning, persisting for a minimum of one hour following which utmost improvement is noted.
2. Swelling of the soft tissue around joints (Arthritis).
3. Symmetric joint involvement.
4. Subcutaneous nodules.
5. Positive test for Rheumatoid factor, Anti Citrullinated Protein Antibody (ACPA).
6. Radiographic evidence of erosion and periarticular osteopenia.

Table 3. The 2010 American College of Rheumatology/European League Against Rheumatism classification criteria for rheumatoid arthritis

	Score
Target population (Who should be tested?): Patients who	
1) have at least 1 joint with definite clinical synovitis (swelling)*	
2) with the synovitis not better explained by another disease†	
Classification criteria for RA (score-based algorithm: add score of categories A–D; a score of ≥6/10 is needed for classification of a patient as having definite RA)‡	
A. Joint involvement§	
1 large joint¶	0
2−10 large joints	1
1−3 small joints (with or without involvement of large joints)#	2
4−10 small joints (with or without involvement of large joints)	3
>10 joints (at least 1 small joint)**	5
B. Serology (at least 1 test result is needed for classification)††	
Negative RF *and* negative ACPA	0
Low-positive RF *or* low-positive ACPA	2
High-positive RF *or* high-positive ACPA	3
C. Acute-phase reactants (at least 1 test result is needed for classification)‡‡	
Normal CRP *and* normal ESR	0
Abnormal CRP *or* abnormal ESR	1
D. Duration of symptoms§§	
<6 weeks	0
≥6 weeks	1

Source: morphopedics.wikidot.com

"Joint involvement" refers to any tender or swollen joint on examination which is confirmed by evidence of synovitis in imaging. "Large joints" refers to shoulders elbows hips knees and ankles."Small joints" refers to metacarpophalangeal joints, 2 to 5 metatarsophalangeal joints, proximal interphalangeal joints, thumb interphalangeal joints and wrists.(10)

EPIDEMIOLOGY

Rheumatoid arthritis (RA) is the most prevalent inflammatory arthritis and about one percent of the population are affected by it.(11). It affect approximately 1% of the UK adult population. By using the 2010 criteria it was 35/100 000 population for 1987 criteria it was 27/100 000 at base-line presentation but increased to 36/100 000 cumulatively 5 years after symptom onset(12). The incidence of RA in India is similar to that of developed countries with prevalence of 0.75% by 1987 revised A R A criteria. It varies from 0.5% to 3.8% in women and 0.15% to 1.37% in men with peak incidence in fourth decade(13).

PATHOPHYSIOLOGY

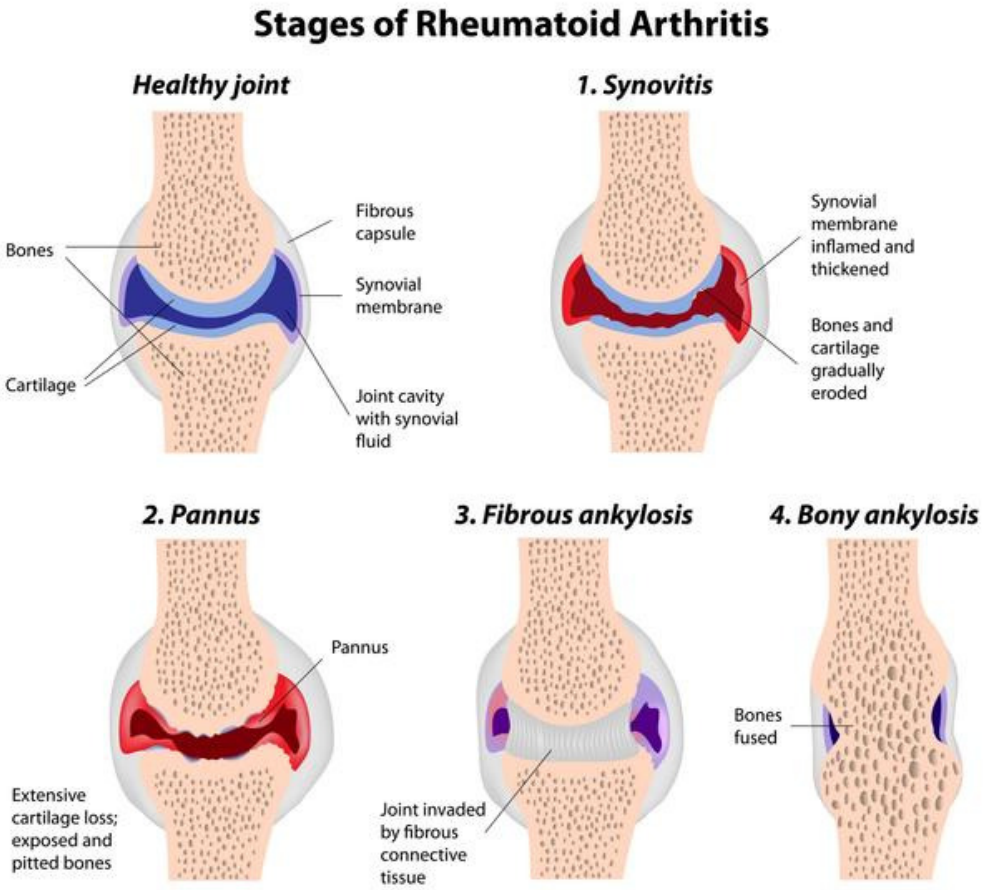
In order to treat effectively, the disease progression is divided into 5 clinical stages.

STAGE	PATHOLOGIC PROCESS	SYMPTOMS	PHYSICAL SIGNS	RADIOGRAPHIC CHANGES
1	Presentation of antigen to 'T' cells	Probably none	_____	_____
2	T cell proliferation,B cell proliferation,Angiogenesis in synovial membrane	Malaise, mild joint stiffness and swelling	Swelling of small joints of hands or wrists, or pain in hands, wrists,kness and feet	None

3	Accumulation of neutrophils in synovial fluid , synovial cell proliferation , without polarization or invasion of cartilage	Joint pain and swelling, morning stiffness, malaise and weakness	Warm, woollen joints, excess synovial fluid, soft tissue proliferation within joints, pain and limitation of motion, rheumatoid nodules	Soft tissue swelling
4	Polarization of synovitis into a centripetally invasive pannus.Activation of chondrocytes.Initiation of enzyme degradation of cartilage	Same as stage 3	Same as stage3, but more pronounced swelling	MRI reveals proliferative pannus, radiographic evidence of periarticular osteopenia
5	Erosion of subchondral bone, invasion of cartilage by pannus, chondrocyte proliferation, stretched ligaments around joints	Same as stage 3 plus loss of function and early deformity	Same as stage 3 , plus instability of joints,flexion contractures, decreased range of motion, extra articular complications	Early erosions and narrowing of joint spaces

Genetic susceptibility and random events , combine to predispose to Rheumatoid arthritis in patients with changes in the HLA Major histocompatibility genes. Smoking augments the susceptibility by 20 -40 fold. Epigenetic influences, such as hypomethylation of DNA or expression of micro RNAs, can also increase pro-inflammatory gene expression (15). As a result there is a breach in the immune tolerance mechanism, leading to inflammation of the synovium , matrix degradation, damage to bone and cartilage. Repeated activation of innate immunity has been cited as the most environmental cause. The induction of the peptidyl arginine deiminase (PAD) enzymes, which convert arginine to citrulline is an important

element. Increased citrullination occurs regularly(16). In RA, neoepitopes are produced by protein citrullination , initiating the production of Anti citrullinated protein antibodies . These ACPAs and other autoantibodies like rheumatoid factors (RFs) can appear even 10 years before clinical evidence of arthritis(17)



Source: www.healthtap.com

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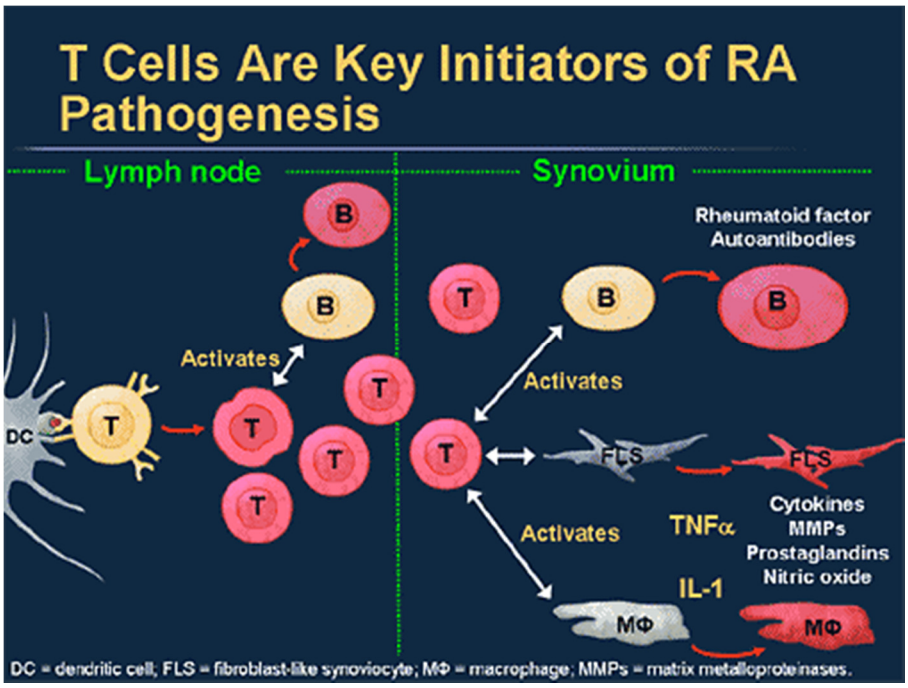
STAGE I :

Immunogenetics:



Source:www.medscape.org

Macrophages and dendritic cells in the synovial membrane ,are the antigen presenting cells. They ingest, process and present foreign proteins to T lymphocytes , which in turn stimulate a cellular immune response . This stimulates the differentiation of B lymphocytes into plasma cells that secrete antibody. Major Histocompatibility Complex (MHC) are the molecules are the receptors present on antigen presenting cells. Helper T cell receptors bind to the MHC-antigen complex. MHC Class II locus is associated with Rheumatoid arthritis. A major proportion of patients with rheumatoid arthritis carry HLA –DR4 ,HLA –DR 1 or both(18). The mechanism by which HLA –DR4 ,HLA –DR 1 are responsible for rheumatoid arthritis is based on the concept of ‘shared epitopes’.

Primary causes :

1.Infectious agents:

Ebstein Barr virus has been associated with rheumatoid arthritis for more than 20 years. Eighty percent of patients with RA have a circulating antibody specific to Ebstein Barr virus antigen(19).Ebstein Barr virus is a polyclonal activator of B lymphocytes , leading to overproduction of Immunoglobulins(20).There is a molecular similarity between viral glycoprotein gp110 on the virus and 'susceptibility sequences' in the β chain of HLA Dw 4,Dw14 and DR1 class II MHC molecules(21).

Parvovirus B19 has also been associated with arthropathy because of it's presence in the synovial membrane of some of the patients with RA.

Recombinant Mycobacteria, release 'heat shock' proteins for which elevated levels of antibodies are found in patients with RA. In response to mycobacterial antigens, "double – negative" T lymphocytes (without CD4 or CD8 surface markers) with a distinct CD3 associated T cell receptor, are found in the synovium of patients with the disease.

2. Auto immunity:

Synovitis and centripetal depolarisation of destructive arthritis, is amplified by anticollagen antibodies. Proliferative synovitis leads to invasion and destruction of cartilage.The epitopes on the degraded portion of the collagen acts as an antigen and evokes an antibody response. This antigen –antibody complex , along with rheumatoid factor precipitates within the superficial cartilage and acts as a chemo-attractant for the invasive tissue(22).

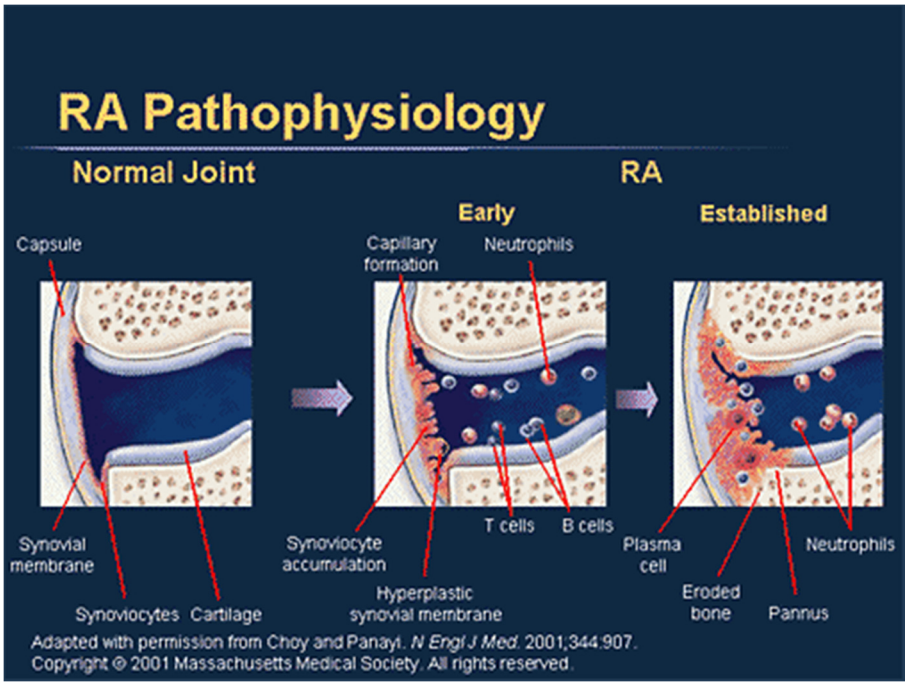
There is reduced glycosylation of IgG in RA. This abnormally glycosylated IgG may act as an immunogen in an individual who is genetically susceptible to RA.

Clinical manifestation:

No obvious clinical manifestation.

STAGES II & III:

Increase in number of T cells leads to the proliferation and differentiation of B cells, antibodies are formed within an expanding scaffold of new blood vessels and synovial cell proliferation in the perivascular areas of the synovial membrane.



1.Angiogenesis:

Macrophages induce the formation of new blood vessels by activating the endothelial cells mediated by cytokines. Endotheliel cells, once activated , form blood-carrying tubes and express plasminogen activator and metalloproteinases that help them to invade the connective tissue to deliver nutrients to proliferating cells(23).

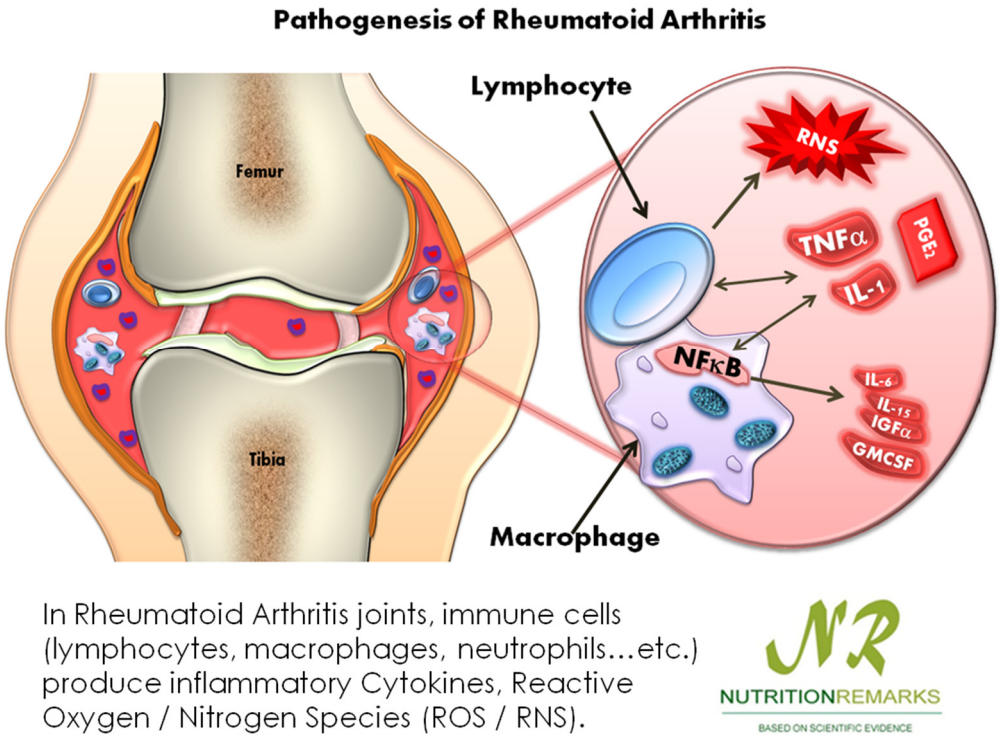
2. Homing of lymphocytes in the synovial membrane:

Post capillary synovial venules have endothelial cells with tall walls.Lymphocytes adhere to this endothelium, migrate through the walls of blood vessels and aggregate around the blood vessels below the synovial surface(24).Cytokines like γ interferons, interleukin -1 and Tumour necrosis factor –α, enhance the adhesion between the lymphocytes and the endothelial cells(24–26). In the synovial fluid, there are more helper T lymphocytes than suppressor T lymphocytes.

3.**Activation of B lymphocytes:**

B cells are activated by T cells. They proliferate and differentiate into antibody secreting cells mediated by cytokines like interleukin -2. Rheumatoid factor is an immunoglobulin directed against the Fc region of IgG. Almost 80 % of RA have rheumatoid factor positivity.They form large complexes that activate compliment cascade and also attracts the invasive and destructive pannus.

4.**Cytokines:** They are small proteins produced by immunocytes, fibroblasts and macrophages . They affect the gene expression in cells with cytokine recptors, seen mainly in the rheumatoid synovitis.Cytokines released from Tcells are interleukin -2, interleukin -3, interleukin -4 and γ interferons, cause activation and amplification of cellular and humoral immune response.



.Macrophages and fibroblasts synthesise Interleukin -1, interleukin -6, colony stimulating factor -1 and tumour necrosis factor α .They cause cell proliferation, increased prostaglandin and matrix degrading protease activity, resorption of bone and fever. These are found at a higher concentration than the T cell cytokines, in the synovial fluid.

5.Neuropeptides:

Substance P , a neurotransmitter released at the peripheral terminals of afferent nerves and Substance K , induce the release of interleukin -1 and other cytokines, activates the synovium in rheumatoid arthritis,to produce metalloproteinases and prostaglandins(27).

6.**Neutrophils and soluble phase inflammatory mediators:**

Activated component of C5a, platelet activating factor and leukotriene B4 are the chemoattractants found in the synovial fluid of rheumatoid arthritis. They attract a lot of neutrophils, which are activated by aggregates of immune complexes and phagocytosis of

cellular debris. The neutrophils are degranulated, releasing proteases and leukotriene B4. In the joint fluid , there is activation of complement cascade, release of lysosomal enzymes by neutrophils, activation of fibrinolysis, production of vasoactive kinins, activation of clotting cacscades and production of fibrin clots that coat the surface of cartilage and synovial membrane

CLINICAL MANIFESTATION ;

1.General fatigue and malaise.

2.The metacarpophalangeal , proximal interphalangeal and wrists are involved.

3.Morning stiffness (increase in extracellular fluid in and around the joint)

4.Warm joints.

5.Patients keep the joint flexed at 5-20 degrees to overcome pain.

Therapy :

1.Patient education.(on the ways to protect the joints, sustain muscle strength and cope with the stress)

2.Temperature regulation.

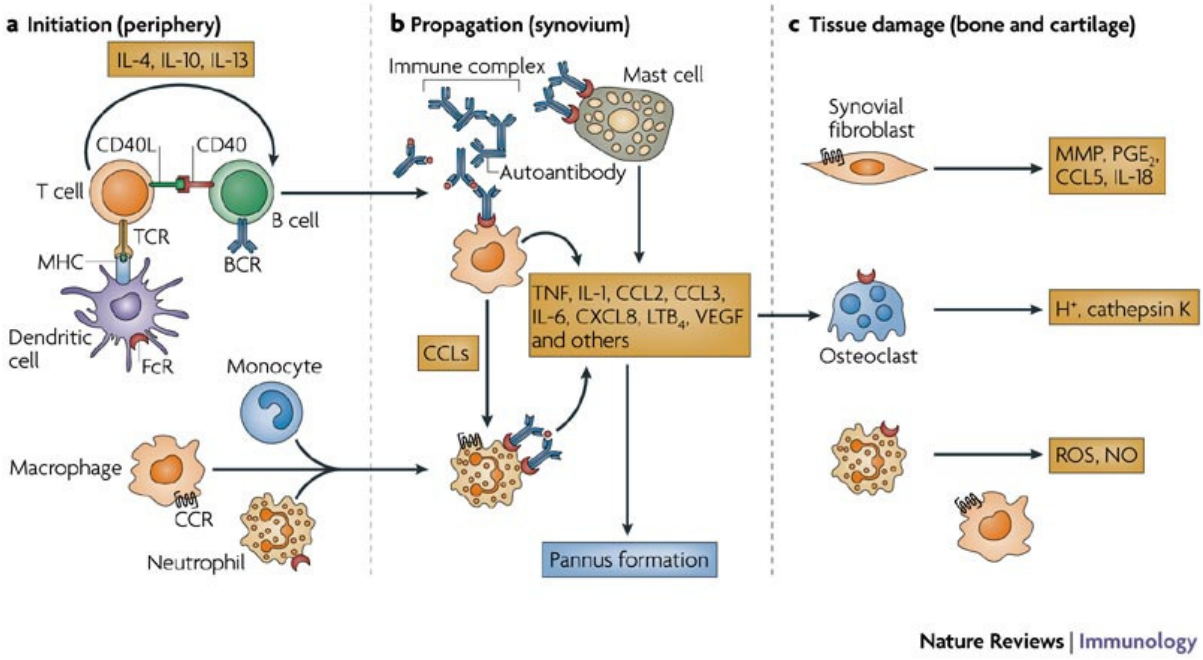
3.Occupational and physical therapy.(non weight bearing exercises)

4.NSAIDS: Foundation of drug therapy. Aspirin is safely used, need not stop at the commencement of second line drug therapy.

5.Low dose glucocorticoids .Dose of 5-7.5 mg/day of prednisolone can be used. Mainly in patients who are waiting for the effectof slower acting drugs.

6.Disease modifying drugs.Methotrexate (5-15 mg once a week) 25-40 % improvement in symptoms(28).Serious side effects are in the lungs and liver.

PATHOPHYSIOLOGY OF PANNUS FORMATION:



STAGE 4:

Proliferating synovium invades the tendons, cartilage and subchondral bone. The synovial tissue behaves like localised neoplasia and weighs 100 times more than it's original mass. There is localised growth of synovial lining cells. (Type I,II and III cells)(29). A large stellate cell (dendritic cell) produces a high level of collagenase and interleukin 1.The proteinases released by the synovial cells, collagenase and stromelysin, destroy all the matrix proteins found in the articular joint and bone. Chondrocytes also release the same enzymes which is responsible for creating lacunae around the chondrocytes. . Fibroblast-like

synoviocytes in the rheumatoid synovium can migrate from joint to joint, accounting for the symmetric and diffuse distribution.

STAGE 5:

There is irreversible destruction of cartilage , there may be systemic vasculitis. Physical therapy, occupational therapy and joint reconstructive surgery are the main components of treatment apart from glucocorticoids and cytotoxic drugs.

GOALS OF TREATMENT:

The primary aim of the treatment is to impede the development of skeletal deformity and long term impairment of function, by achieving clinical remission. Initiating DMARDS in the early stages of the disease prevents the progression to erosive arthritis. Comprehensive treatment with DMARDS, steroids or biological therapy, promotes increased rates of remission and restrains radiological progression. Inspite of the use of combination treatment with Methotrexate, other DMARDS and Biologic agents, some patients fail to respond sufficiently to the therapy. Such patients will eventually require replacement of the joint to re establish function .

In 1990s(30) approximately 25 percent of them underwent total joint arthroplasty and for patients with one total joint arthroplasty, in a period of one year 25% required an additional arthroplasty and 50% required an additional arthroplasty within seven years. About ten years after total joint replacement, around 6% of implanted knees and 4% of implanted hips , a second arthroplasty was needed.

Among younger patients with RA, aged 40 to 59, the rates of knee and hip surgery decreased by 19 and 40 percent, respectively. However these rates increased in patients older than 60

years. These results may reflect the beneficial effect of changes in anti rheumatic treatments(31).From the Finnish arthroplasty register, (1995-2010), total number of TKR performed for RA patients was 19 per 100.0000 in 1995 and 11 per 100,000 in 2010.The decline in performing arthroplasties for RA was more for upper limb procedures than lower limb procedures. There was a 2 fold increase observed, in the number of patients using Hydroxychloroquine, sulfasalazine and methotrexate(32).

In a study of 424 patients with RA , during a mean follow up of 14.8 years, 34.9 % underwent one or more surgical procedures involving the joints. Reconstructive surgeries were more common , women underwent more surgeries than men. However surgical management did not alter the overall survivorship among patients with RA(33).

INDICATIONS FOR SURGICAL MANAGEMENT IN RA :

1. Unmanageable pain in the joints, with activity or at rest.

2. Functional deterioration that is attributed to joint destruction.

3. Failure of all nonsurgical management (change in DMARDS, immunosuppresants or biological agents)

Plain radiograph should be obtained to document end stage nature of the disease .

Goal of surgery: Alleviation of pain and recovery of joint function.

Appropriate timing is essential , before the onset of permanent deformities, contracture of soft tissue and extreme muscle atrophy, for optimal post operative results.

SURGICAL OPTIONS FOR RHEUMATOID ARTHRITIS :

1. Soft tissue release to correct severe contractures.

2. Tenosynovectomy to excise inflamed tendon sheaths.

3. Arthroscopic repair of tendon rupture.

4. Open or arthroscopic synovectomy , to excise inflamed synovium in order to reduce pain , to temporarily prevent the cartilage destruction and to remove the debris that impinges on normal joint motion.

5. Osteotomy to realign the weight bearing bones in order to correct valgus or varus deformity of the knee.

6. Small joint implant arthroplasty.

7. Joint fusion to stabilise the destroyed joint like ankle and wrist

8. Metatarsal head excision to improve gait and alleviate foot pain severe forefoot pain.

9. Total joint replacement.

10. Decompression and stabilisation of cervical spine.

CONTRAINDICATIONS

1. Active systemic or articular infection

TOTAL KNEE ARTHROPLASTY IN RHEUMATOID ARTHRITIS

In patients with RA Total Knee Replacement (TKR) has demonstrated to be the most rewarding intervention that alleviates knee pain and enhances physical function(34).

PREOPERATIVE CONSIDERATIONS:

1. **AGE AND ACTIVITY**

   Among the patients who undergo TKR, RA patients were 10 years younger that osteoarthritis patients.

Name of the author	No. of TKA	Distribution between RA & OA
Ranawat et al(35)	93 knees ,AGE < 55 years	80 % RA / 20 % OA
Dalury et al(36)	87 knees, AGE < 45 years	87 % RA /13 % OA
Gill et al(37)	68 knees, AGE < 55 years	46 % RA / 56 % OA

They had a mean follow up of 9.2 years and all of them had excellent functional scores comparable to patients with osteoarthritis. However the rates of joint replacement has been on the decline. 1990s, saw the peak of joint replacemnts for RA. Among patients aged 40-59 years, rates of surgery in 2003-2007 was 19 % lower ,compared to 1983-1987.This has been mainly contributed to effective anti rheumatic drug treatment with better DMARDS and biological agents(31).

2. MULTIPLE JOINT INVOLVEMENT

Rheumatoid arthritis involves multiple joints. 50 % of patients with knee involvement have concomitant hip involvement(38). There is controversy regarding the priority of the joint surgery in patients where both hip and knee joints were involved in the same limb. It is accepted that lower limb surgery is to precede the upper limb surgery when possible(39). In the upper limb wrist deformities should be corrected before the hand surgeries to maintain distal stability and alignment. In the lower limb it is accepted that hip replacement should be performed prior to knee replacement when both indicated(40). Pain relief obtained from hip replacement may aid in delaying the necessity for the knee replacement. The rehabilitation after the hip replacement may be more tolerable when with significant ipsilateral knee involvement. In addition adequate arc of hip motion will be required for the deep knee flexion which is essential for successful TKR. 30% of stage III and IV patients with combined hip and knee lesions had good function level after successful hip and knee replacement(41). Prior to TKR the upper limb joints need evaluation inorder to ensure the effective use of assistive devices that essential for ambulation in the early post operative period. 80% of RA patients have cervical spine involvement with atlanto axial instability(42) and also increased risk of basilar invagination and sub axial instability. Hence routine radiograph of cervical spine with flexion and extension views should be obtained. Hyperextension of the patient's neck for intubation should be avoided during intubation(40). In the event of atlanto axial instability the patient should be referred to a spine surgeon for stabilisation of cervical spine prior to joint replacement surgeries. They also have systemic side effects like anemia and cardiovascular complications which require pre operative assessment(43).

3. MEDICATION HISTORY:

Medication	Comments
NSAIDs	Discontinue 5 half-lives before surgery. Aspirin should be stopped 7-10 days before surgery
Corticosteroids	Individualized based on the magnitude of surgery and the severity of patient's illness
Methotrexate	Continue perioperatively for all procedures. Consider withholding 1 to 2 doses for patients with poorly controlled diabetes; the elderly; and patients with liver, renal, or lung disease
Leflunomide	Withhold 1-2 days before surgery and restart 1-2 weeks later or withhold 2 weeks before surgery and restart 3 days later
Sulfasalazine	Withhold 1 day before surgery and restart 3 days later
Hydroxychloroquine	Continue for all procedures
TNF antagonist	Withhold etanercept for 1 week, and plan surgery for the end of the dosing interval for adalumimab and infliximab Restart 10-14 days postoperatively
IL-1 antagonist	Withhold 1-2 days before surgery and restart 10 days postoperatively

Medications used in patients with RA are divided into three categories.

I) **NSAIDS**

II) **DMARDS** : Methotrxate, leflunamide, sulfasalazine,azathioprine,hydroxychloroquine and Biologic agents like TNF α inhibitor and Interleukin 1 inhibitor.

III) **GLUCOCORTICOIDS**

I) **NSAIDS :** Inhibit Cyclo oxygenase I (COX I) and impair thromboxane dependent platelet aggregation. Aspirin irreversibly blocks COX I , resulting in efficient inhibition during the complete life span of platelet. Hence aspirin should be discontinued 7-10 days prior to surgery, for the drug to be cleared from circulation. Selective COX 2 inhibitors like celecoxib, need not be blocked, as they do not influence this mechanism of inhibition of platelet(44).

II) GLUCOCORTICOIDS :

Chronic use of glucocorticoids has proven to be detrimental to the quality of bone, wound healing and skin infection. In the pre operative period, patients on long term steroids, should receive a 'stress dose', dosage of 50-100 mg every 8 hours, and tapered to pre operative dosing once patient is hemodynamically stable(45).

III) DMARDS :

Methotrexate causes alterations in fluid balance and increases risk of peri operative infections(46). As methotrexate and it's metabolites are excreted by the kidney, in patients with renal impairment, it should be withheld for 1 week prior and 1-2 weeks after the surgery. Biological agents like abatacept, TNF α inhibitor and rituximab also should be withheld for 1 week before and after sugery.

INTRA OPERATIVE CONSIDERATIONS:

1**.Quality of Bone** :

Bone quality is typically low in RA due to the inflammatory processs itself and the chronic use of steroids(45). Prostaglandins released from rheumatoid synovium , causes subchondral bone resorption(47).This is of utmost importance , as acceptable fixation and support of components , mainly on the tibial side require adequate subchondral platform. Hence cemented TKR is preferred in patients with RA(48).Secondary osteonecrosis around the knee may be seen in patients with RA. Large uncontained bone defects, caused by bone collapse can be repleted with either bone graft or modular prosthesis augmentation. The use of stem extensions and offset stem can help in component positioning , reduces stress at bone implant interphase and supplements fixation. There can be large bone

cysts, with an intact peripheral cortical rim. Such defects can be filled with autologous bone grafting or allograft.

2.Soft tissue;

Medications and chronic steroid usage in RA will preclude to atrophy of soft tissue causing poor wound healing and late infections. Flexion contracture of the knee can develop due to the varus or valgus deformity and also in wheel chair bound patients. Hence preoperative serial manipulation of the joint with casting or posterior soft tissue release, is essential to reduce the flexion contracture.

Fixed valgus deformity of the knee occurs with contracture of lateral collateral ligaments, joint capsule, ilio-tibial band , popliteus and joint capsule, with laxity of medial structures. Correction of such a deformity , requires division of iliotibial band to the lateral collateral ligament at it's femoral origin. Complete synovectomy is also recommended in order to reduce recurrent synovitis after TKR.

3.Bone deformity :

Proper rotational alignment of the femoral prosthesis is needed to achieve good outcome after TKR.. Transepicondylar axis and posterior condyles are reliable landmarks for rotation assessment. In RA, deformity of the knee , can distort the posterior condyles leading to malalignment of femoral prosthesis. In valgus knees, lateral femoral condyle can be hypoplastic, hence determining rotational axis for femoral prosthesis has to done with caution. In valgus deformities, there can be sinking of lateral tibial condyle, leading to difficulty in ascertaining the level of tibial osteotomy. Hence the 10 mm stylus should be placed at a level greater than usual in the imaginary convex lateral tibial plateau level.

COMPLICATIONS:

1. Deep wound infection.
2. Poor healing of the wound.
3. Periprosthetic fractures.
4. Joint deformity and laxity, poor bone quality.

CLINICAL TRIALS :

1).4381 primary TKR operations were performed between 1985-1995 for RA , data taken from Swedish Knee arthroplasty register. Tricompartmental knee arthroplasty was the commonest type of surgery performed. Loosening and infection were the main causes for revision arthroplasty. 10-years cumulative revision rate was 5 %. Cemented tibial components resulted in lower revision rates than uncemented ones(49).

2)In a study by Sharma et al(50), they analysed the long term clinical and radiological results of 63 uncemented Low Contact Stress total knee replacement in patients with RA. The mean follow up was 12.9 years , with a 4.8 % of revision and 3.2 % of infection rate .At final follow up , the mean Clinical and Functional Knee society scores were 90 and 59 respectively. The mean range of movement was 104 degrees. There were significant radiolucent lines seen in 32% of the knees .One case of peri prosthetic fracture was noted Survival rate was 85.5 % .

3) In 2008, Trieb et al (51) analysed long term clinical and radiological outcomes of 68 TKA in 50 patients with RA. The mean follow up was 11.2 years. The survival rate for prosthesis was 81.6 %.No significant difference was found between cemented, uncemented or hybrid fixation in terms of prosthesis survival. The average clinical and functional knee society scores were 77.2 points and 75.3 points at the final follow up. The rate of infection was 1.5%.

4) Amy R. Crowder et al(52) described the long term results of 32 patients , age < 55 years who underwent TKA for RA. The average follow up was 18 years.The Knee society clinical score improved from an average of 41 points pre operatively to 86 points post operatively. The functional score improved from 40 points to 51 points at the final follow up.6 patients required revision, reasons quoted were polyethylene wear, osteolysis and tibial tray fractures.2 patients had femoral component loosening and 1 with femoral peri prosthetic fracture.

5) Jun Ito et al(53) analysed the clilnical and radiological outcome after 36 cemented kinematic TKR in patients with RA. The mean flexion angle was 99°. 27.8% patient had radiolucent lines in tibial or femoral bone cement interfaces. The survival rate of the prosthesis was 93.7 %.

6) Jose et al , in 1996(54), published long term results of TKR in stage III and IV RA. The mean follow up was 12.7 years. The average range of motion was 95°, 4.1 % had delayed sepsis, 2 had asceptic loosening.The survivorship of the prosthesis was 91 %.There was significant relief of pain which lasted for an average of 12 years.The functional scores were lower as compared to scores in osteoarthritis due to the polyarticular involvement of the disease. Delayed infection proved to be the greatest risk to the longevity of the TKA in RA. 23 % of patients had patellofemoral pain .This was attributed to the fact that the patellofemoral groove was not sufficiently recessed in the prosthetic design of the Total Condylar Prosthesis.The patella is subjected to high stresses in flexion, causing anterior knee pain.

7) Yan et al (55), compared the technique of soft tissue balance and joint tension maintenance in TKR done for patients with RA associated wth severe or moderate flexion contracture. Severe flexion deformity is usually due to the combination of bone loss, valgus,

musculotendinous , ligamentous and capsular contractures. Soft tissue release surgery and additional bone cuts were performed in all cases of severe flexion contractures. There is usually posterior subluxation of tibia, proximal tibial bone deficiency combined with valgus deformity , external rotation of the tibia associated with contracture .There is also traction of iliotibial tract and biceps muscle(56). To achieve correction of deformity, to equalize the medial and lateral soft tissue tension is very critical. For the success of TKR, appropriate soft tissue balancing in the form of ligament and capsular release at the time of arthroplasty, proper positioning of the components to align the lower limb is very essential(57,58). Once bony alignment is achieved , the medial and lateral joint laxity should not exceed 2 mm in the varus and valgus testing. In this study, the average range of movement in severe flexion contracture was 31.86 ° pre operatively and 115.72° post operatively. The Knee society score improved from 27.4 pre op to 80.67 post operatively. In the moderate flexion contracture group , the range of movement was 68.16° pre operatively and 118.34° post operatively. The Knee society score improved from 43.6 pre op to 87.15 post operatively. Supportive devices like splints were used in some patients to correct residual flexion.

8) Kristensen et al reviewed the results of 71 primary TKR , performed on RA patients with Insall-Burstein total condylar knee prosthesis. 5 % of patients complained of residual pain. 58 % could walk for > 500 metres , median range of motion was 108 °. 8/71 required revision out of which three were done for asceptic loosening and 5 /71 underwent arthrodesis due to deep infection.

9) Schrama et al(59) published a prospective population based study on 2462 TKRs done in RA patients, data taken from Norwegian Arthroplasty register (1987-2008). RA patients with TKR had 1.6 times higher risk of revision for infection than patients for Osteoarthritis. Possible explanation would be that vulnerable soft tissue envelope around the knee joint in

RA patients would make the TKR more susceptible to infection. In similar study by Ravi et al high incidence of infection within 2 yrs of TKR was seen than in OA knee(60).

10) The outcome of periprosthetic infection in RA patients was generally worse than that in non-RA patients. There was high risk of treatment failure following delayed debridement and two-stage exchange without the use of antibiotic-impregnated bone cement. These findings highlight the need and importance of monitoring and aggressive treatment for periprosthetic infection in post TKR in RA(61).

MATERIALS AND METHODS

TYPE OF STUDY : Prospective Observational Cohort study.

SCHEME OF RESEARCH:

Patients who underwent total knee arthroplasty for inflammatory arthritis in the year 2008 to 2012 under Orthopedics Unit III, were recruited into the study after informed consent. All patients with rheumatoid arthritis, who underwent total knee replacement between 2008 and 2012, were followed up in out patient department and assessment of their clinical, functional and radiological outcomes based on American knee society scoring was performed. The hospital numbers of the eligible patients was obtained from CMCH Operation theatre register and in patient list from Computerised Hospital Information Processing System .

They were informed by telephone and by post, to come for follow up in Ortho OPD. Their current clinical and functional scoring was assessed using the American Knee Society score. Plain Radiograph of both knees, AP & lateral views were taken at the follow up visit and radiological assessment of the joint was done .Their pre op American Knee society and functional score was obtained from the previous In patient chart. Other variables like

1. Age of the patient
2. Sex of the patient
3. BMI
4. Duration of Disease (RA)
5. Intake & duration of medical management with Methotrexate (DMARDS)

6. Intake ,dosage & duration of Steroids
7. Category of patient

were also analysed during the follow up visit.

INCLUSION CRITERIA:

1. Patients who have undergone Total Knee Replacement for Rheumatoid Arthritis with positive RA factor in CMCH Orthopedics Unit III .
2. Seronegative Inflammatory Arthritis of knee.
3. Who were willing to take part in the study.

EXCLUSION CRITERIA:

1. Patients who underwent TKR for osteoarthritis.
2. Who were not willing to participate in the study.

Variables analysed :

1. Body Mass Index: BMI was calculated by the formula weight in kgs/ height in metres ^{2} . They were categorised as follows :

Body Mass Index: Proposed Asian Criteria

Classification of obesity	Body Mass Index (kg/m²)	
	Proposed Asian criteria	Previous WHO criteria
Underweight	<18.5 kg/m²	<18.5 kg/m²
Normal range	18.5 to <23 kg/m²	18.5 to <25 kg/m²
Overweight	23 to <25 kg/m²	25 to <30 kg/m²
Obese	>25 kg/m²	>30 kg/m²

Adapted from: *The Lancet*. 2004;363:157-63.

2.Duration of the disease ; This was calculated from the time of onset of disease as mentioned in the previous medical records and as described by the patient.

3.Use of Methotrexate and steroid :The details regarding the usage of methotrexate and steroid , in the pre operative period and post operative period was obtained from outpatient prescription records and from the verbal report of the patient.

4.Stage of the disease ; This was assessed by clinical examination and from prior medical records.

5.American Knee Society and Functional score : This was assessed using the following questionnaire.

Knee Society Knee Score

Patient Category	
A. Unilateral or bilateral (opposite knee successfully replaced) **B.** Unilateral, other knee symptomatic **C.** Multiple arthritis or medical infirmity	
	Points
Pain	
None	50
Mild or occasional	45
Stairs only	40
Walking and stairs	30
Moderate	

	Points
Occasional	20
Continual	10
Severe	0
Range of Motion	
(5 degrees =1 point)	25
Stability (Maximal Movement in Any Position)	
Anteroposterior	
<5 mm	10
5-10 mm	5
> 10 mm	0
Mediolateral	
<5 degrees	15
6-9 degrees	10
10-14 degrees	5
>15 degrees	0
Subtotal	
Deductions (minus)	
Flexion contracture	
5-10 degrees	2

	Points
10-15 degrees	5
16-20 degrees	10
>20 degrees	15
Extension lag	
<10 degrees	5
10-20 degrees	10
>20 degrees	15
Alignment	
5-10 degrees	0
0-4 degrees	3 points each degree
11-15 degrees	3 points each degree
Other	20
Total deductions	
Knee score[*]	
Function	
Walking	
Unlimited	50
>10 blocks	40
5-10 blocks	30

	Points
<5 blocks	20
Housebound	10
Unable	0
Stairs	
Normal up and down	50
Normal up; down with rail	40
Up and down with rail	30
Up with rail; unable down	15
Unable	0
Subtotal	
Deductions (minus)	
Cane	5
Two canes	10
Crutches or walker	20
Total deductions	
Function score[*]	

From Insall JN, Dorr LD, Scott RD, et al: Rationale of the Knee Society clinical rating system, Clin Orthop Relat Res 248:13, 1989.

* If total is a minus number, score is 0.

RESULTS

Data of all patients was entered in Epidata work sheet. Analysis was done with SPSS software. For continous variables, Mean, Median , mode and Standard deviation was calculated. To compare the improvement between pre operative and post operative Knee society and functional scores, paired 't' was used. To determine the correlation between age, BMI, duration of disease, use of methtrexate , use of steroid, with the Knee society and Functional scores, logistic regression analysis was done.

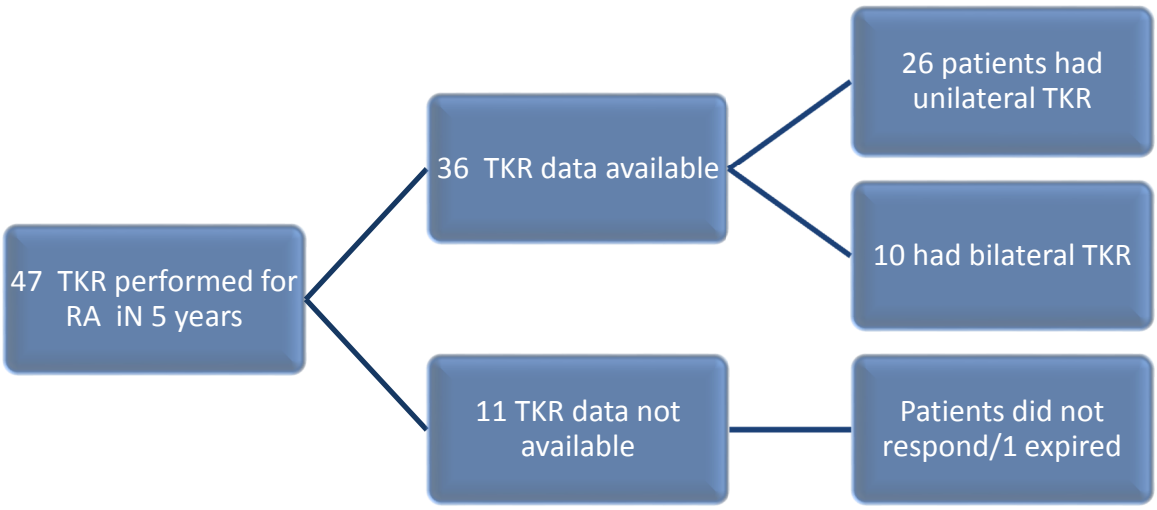


Figure 1 : Shows the scheme of recruitment. Fifty seven TKR were performed for RA in the last 5 years. Twenty Six patients responded in person, mail or through phone conversation. Ten of them had bilateral TKR done (at different sittings), hence scores were calculated for 36 knees. All surgeries were performed by the same group of surgeons belonging to orthopaedics unit III.

AGE DISTRIBUTION:

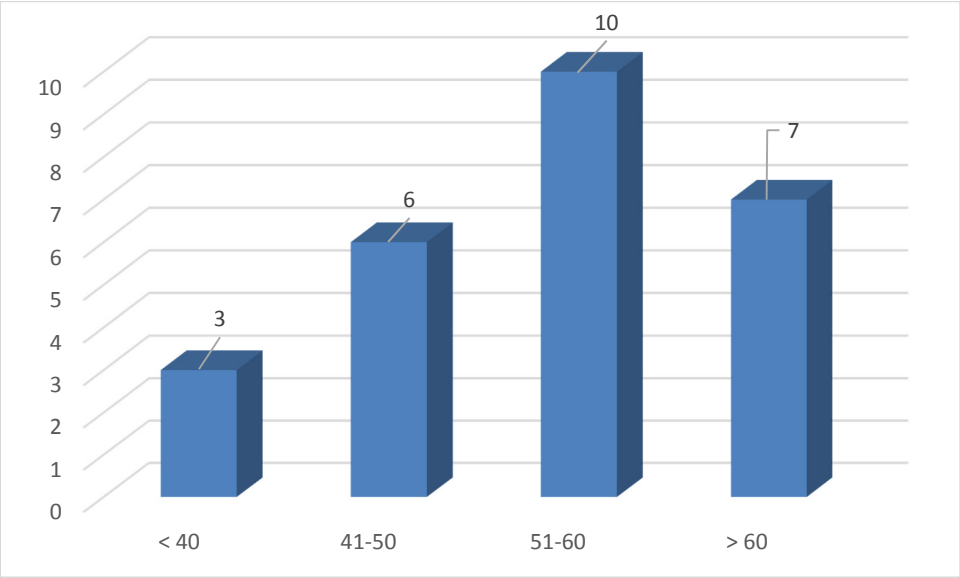


Figure 2 : Shows the age distribution ,. The average age of the subjects studied, was 54 years with a standard deviation of ±11.5. Ten patients were between 51-60 year . Seven patients were more than 60 years old. Six patients were between 41-50 years. Three patients were less than 40 years old.

Body Mass Index: BMI was calculated by the formula weight in kilograms/ (height in metres)².

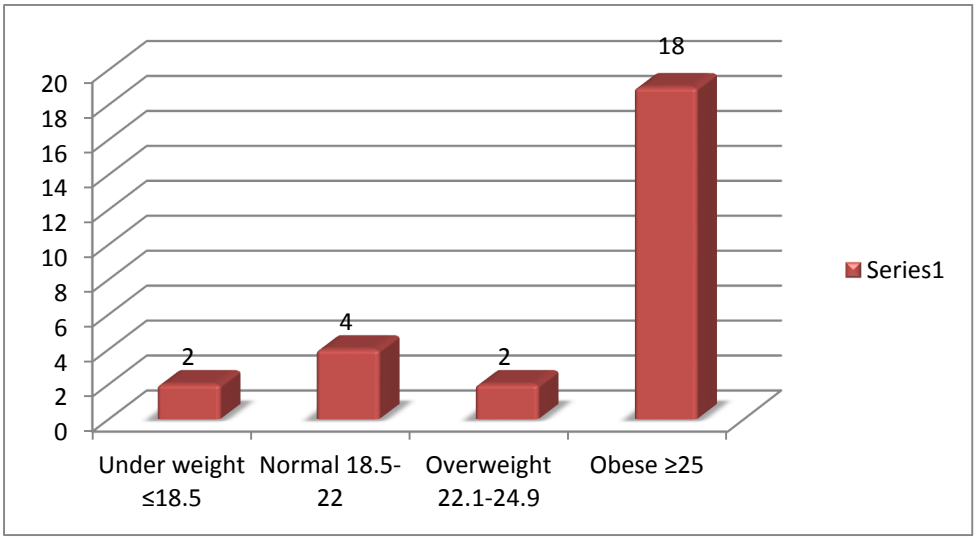


Figure 3: Shows the distribution of BMI of all the patients recruited. Two patients were in the underweight category, 4 were in the normal range , 2 were overweight and 18 were obese. The average BMI of the subjects studied was 27.04 kg/m² with a Standard deviation of ± 4.02.

SEX DISTRIBUTION :

Figure 4:

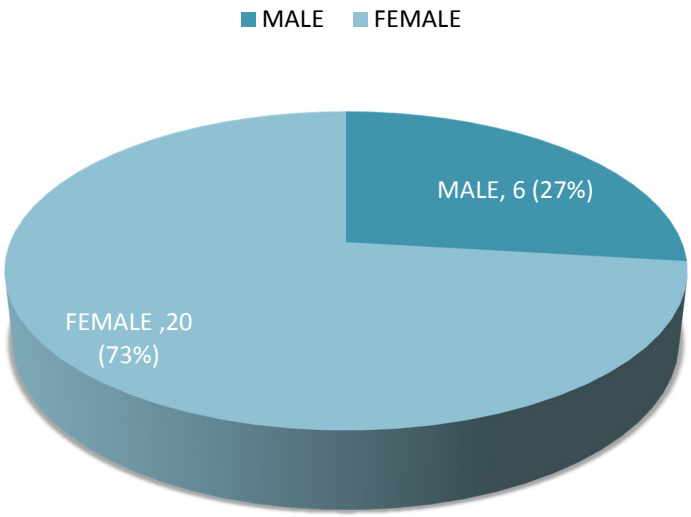


Figure 4 : Shows the distribution of patients. Only 6 patients were males and majority (n=20) were females. Only 2 male patients had bilateral knee replaced and 8 women had bilateral knee replaced.

FACTORS	MEAN	STD DEV	MINIMUM	MAXIMUM
AGE(Years)	54	11.54	31	75
DURATION OF DISEASE (Years)	8.86	6.257	3	30
MONTHS OF FOLLOW UP	37.75	19.18	3	93

SIDE OF KNEE REPLACED :

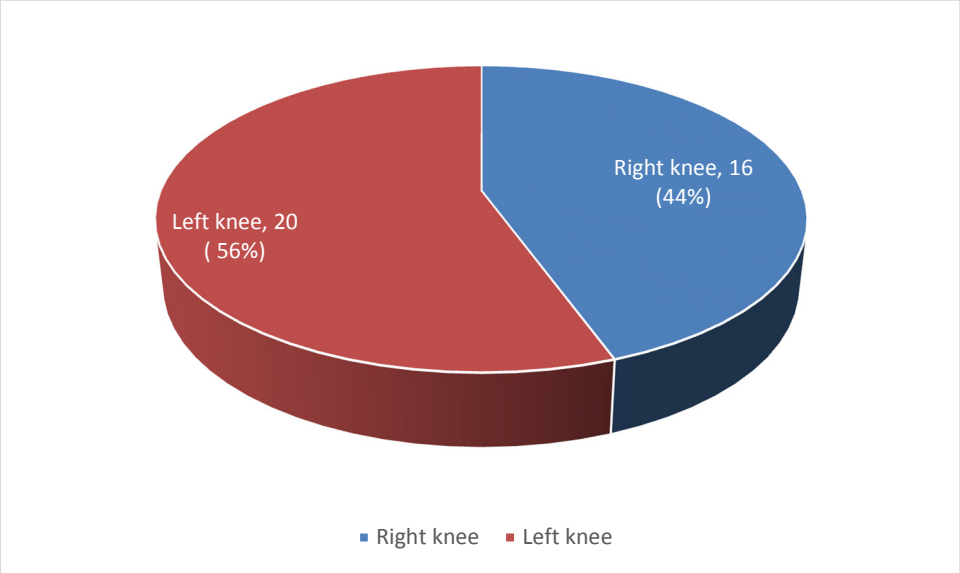


Figure 5 : Shows the side of the knee replaced. Twenty patients had left knee replaced. Sixteen had right knee replaced.

RELATION WITH OTHER JOINTS:

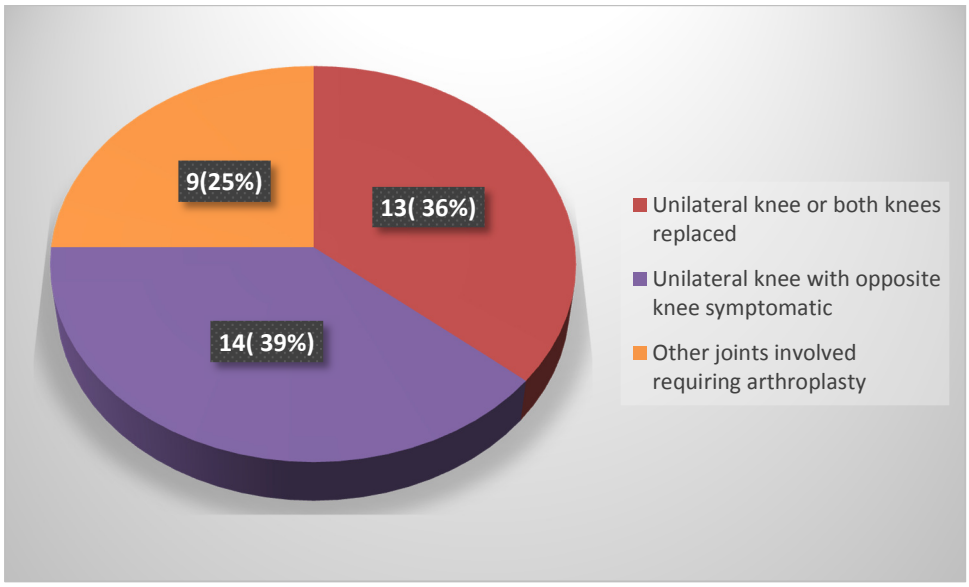


Figure 6: Shows the relationship of the index knee with the opposite knee and other joints. In 13 TKR , there was unilateral knee replacement or both knees were replaced. Fourteen patients had unilateral TKR, with the opposite knee symptomatic. Nine patients had other joints involvement(like hip joint , shoulder etc.) with deformity requiring arthroplasty.

DURATION OF DISEASE BEFORE KNEE REPLACEMENT :

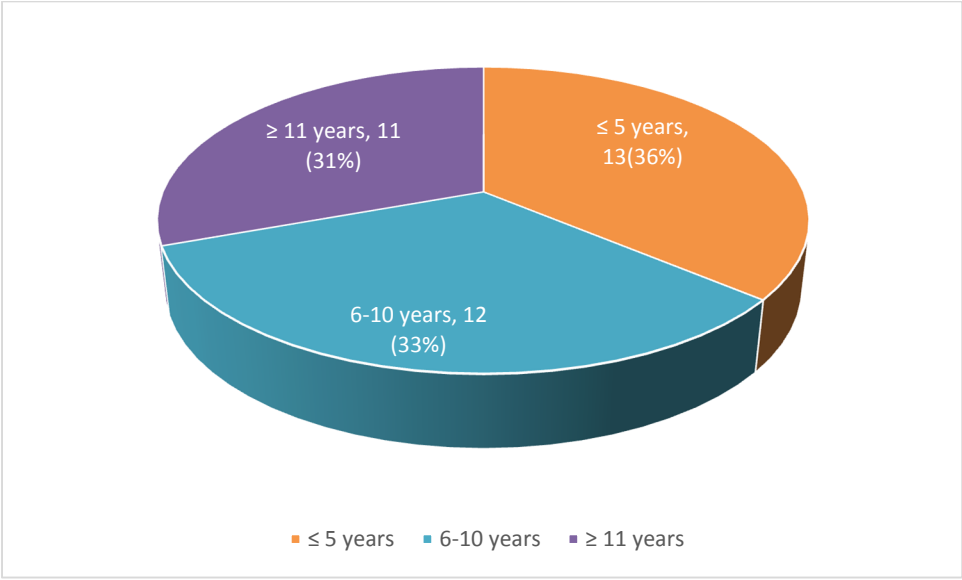


Figure 7 : Shows the duration of the disease prior to the replacement. Thirteen subjects , had less than 5 years duration of illness prior to the replacement. Twelve had 6-10 years of duration of illness prior to the surgery. Eleven TKR were performed after 10 years of duration of the disease. At the time of recruitment, the average duration of disease was 8.86 years with a SD of ± 6.25. All the patients recruited were in stage IV of the disease. On Radiological examination, none of the patients had evidence of lysis seen in the x-ray.

USE OF METHOTREXATE:

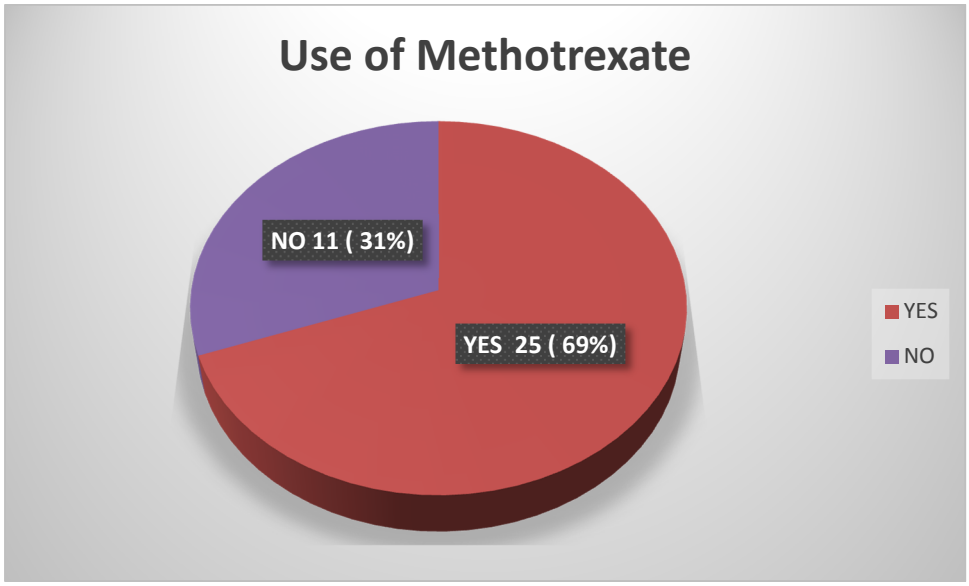
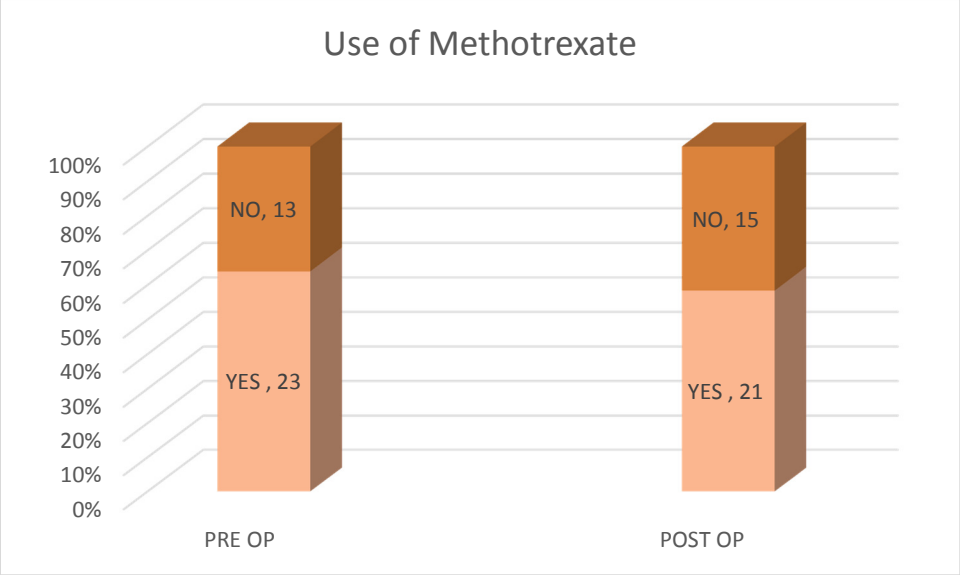


Figure 8 : Shows the use of Methotrexate for the treatment of Rheumatoid arthritis. Sixty nine percent (n=25) were given Methotrexate for RA, 11 subjects did not require Methotrexate.

Use of Methotrexate (pre op and post op): **Figure 9** :Shows the proportion of patients who were treated with pre op and post op Methotrexate. Twenty three subjects required Methotrexate preoperatively and 21 required post operative Methotrexate



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USE OF STEROID:

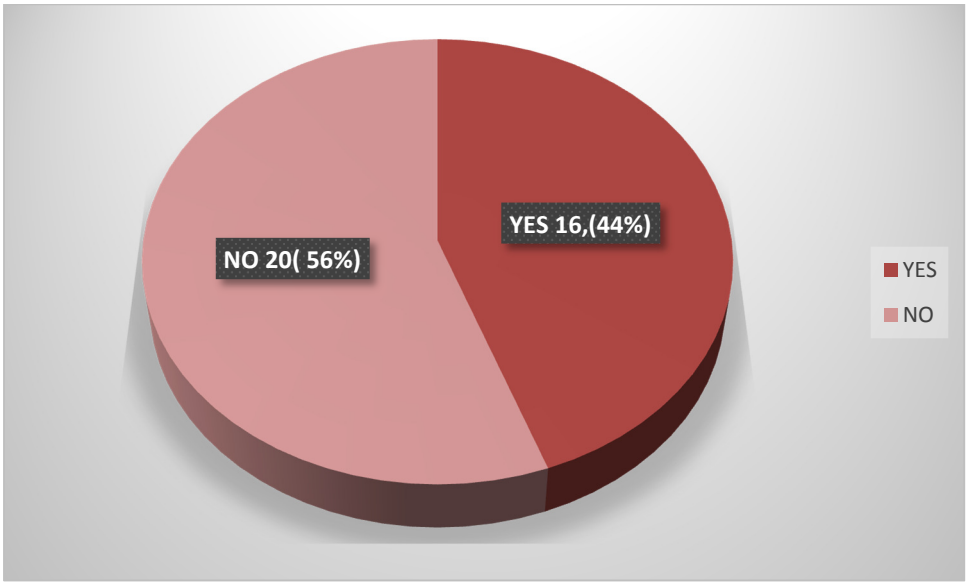


Figure 10: : Shows the use of Steroid for the treatment of Rheumatoid arthritis among the subjects recruited . Forty four percent were given steroid for RA. Fifty six percent did not require steroid.

Use of steroid (pre op and post op):

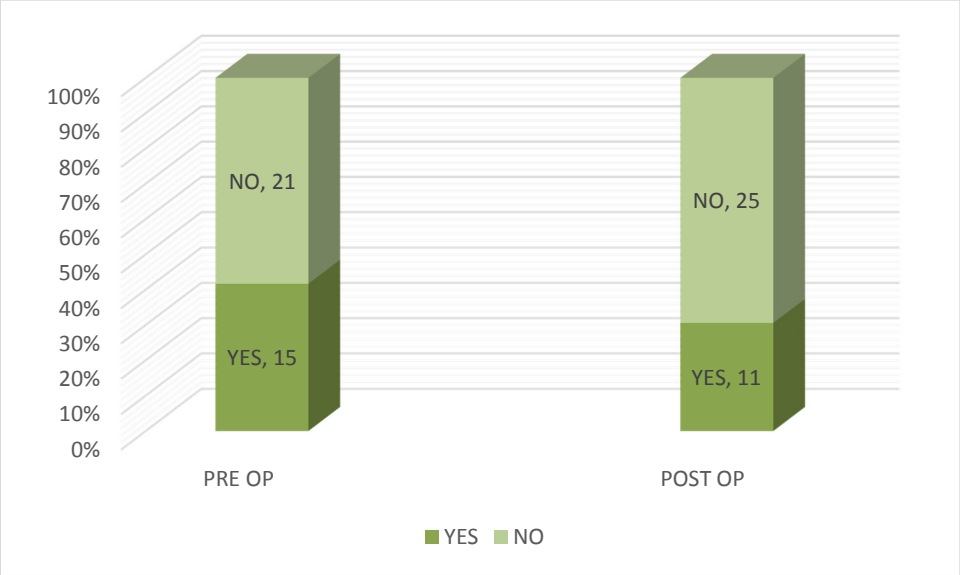


Figure 11: Shows the proportion of patients who were treated with pre op and post op steroid. Fifteen subjects required steroid preoperatively and 11 required post operative steroid .

PRE OPERATIVE AND POST OPERATIVE KNEE SOCIETY SCORES:

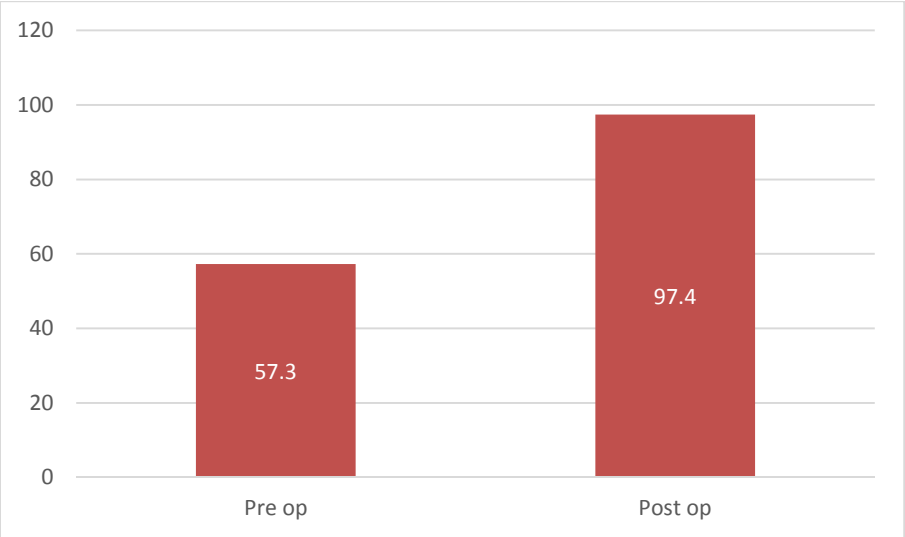


Figure 12: Shows the pre operative and post operative Knee society scores.

KNEE SOCIETY SCORE	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
PRE OP	57.3	18.3	10	88
POST OP	97.4	4.4	80	100

Figure 13 : Shows the mean and standard deviation of the pre operative (57.3) and post operative (97.4) knee society scores.

CHANGES IN THE PRE AND POST OPERATIVE KNEE SCORE:

DIFFERENCE IN THE PRE AND POST OPERATIVE KNEE SCORES	**MEAN**	**STANDARD DEVIATION**	**95 % C.I**		**SIGNIFICANCE (p)**
			LOWER	UPPER	
	40.03	18.45	33.84	46.32	0.000

Figure 14 : Shows the mean difference in the pre op and post operative knee scores. There was a significant improvement (p 0.000) between the pre operative and the post operative scores.

PRE OPERATIVE AND POST OPERATIVE FUNCTIONAL SCORES:

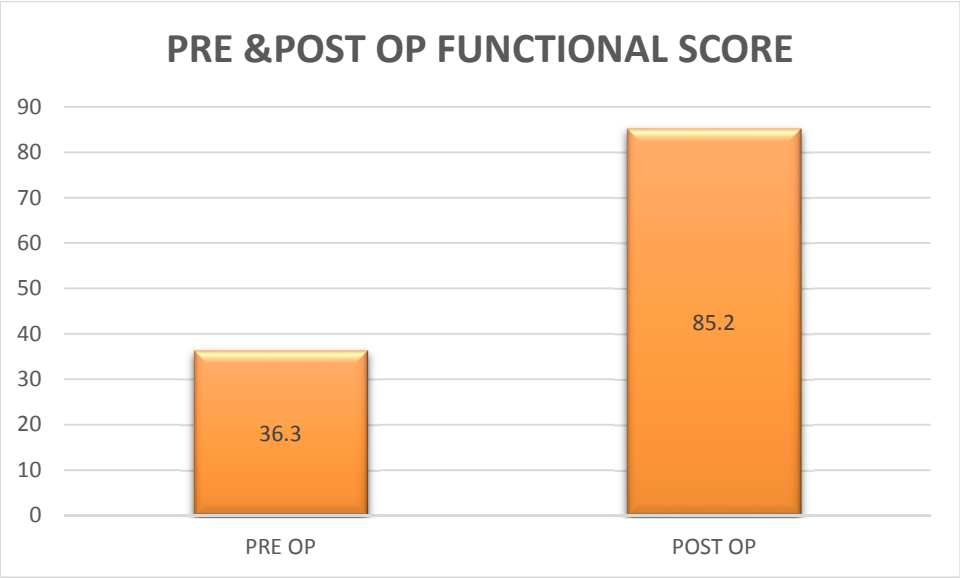


Figure 15 : Shows the pre operative and post operative functional score after Total knee replacement in Rheumatoid arthritis.

FUNCTIONAL SCORE	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
PRE OP	36.3	20.96	0	80
POST OP	85.28	19.1	30	100

Figure 16 : : Shows the mean and standard deviation of the pre operative (36.3) and post operative (85.28) functional scores

CHANGES IN THE PRE AND POST OPERATIVE FUNCTIONAL SCORE:

DIFFERENCE IN THE PRE AND POST OPERATIVE FUNCTIONAL SCORES	MEAN	STANDARD DEVIATION	95 % C.I		SIGNIFICANCE (p)
			LOWER	UPPER	
	48.88	24.08	40.73	57.03	0.000

Figure 14 : Shows the mean difference in the pre op and post operative functional scores. There was a significant improvement (p 0.000) between the pre operative and the post operative scores.

CORRELATION BETWEEN AGE AND THE SCORES:

Bivariate analysis was performed with Spearman correlation test.

AGE		Preop knee score	Post op knee score	Pre op functional score	Post op functional score
Spearman	Correlation coefficient	0.134	0.104	-0.181	-0.021
	Significance	0.43	0.437	0.291	0.902

Figure 15 : Shows the correlation between the age of the subjects and the scores .There was no significant correlation between the age of the patient and the knee or functional score (pre op and post op).

CORRELATION BETWEEN BMI AND SCORES:

BMI		KNEE SCORES		FUNCTIONAL SCORES	
		PRE OP	POST OP	PRE OP	POST OP
Spearman	Correlation co efficient	-0.154	0.018	-0.036	-0.186
	significance	0.392	0.922	0.842	0.301

Figure 16: Shows the correlation between the BMI of the patients recruited and the scores. There was no statistical significance found.

CORRELATION BETWEEN DURATION OF DISEASE AND SCORES:

DURATION OF DISEASE		KNEE SCORES		FUNCTIONAL SCORES	
		PRE OP	POST OP	PRE OP	POST OP
Spearman	Correlation co efficient	-0.310	-0.006	-0.185	-0.213
	significance	0.066	0.971	0.279	0.213

Figure 17:Shows the correlation between the duration of disease and the scores. There was statistical significance found.

CORRELATION BETWEEN USE OF METHOTREXATE AND SCORES:

USE OF METHOTREXATE		KNEE SCORES		FUNCTIONAL SCORES	
		PRE OP	POST OP	PRE OP	POST OP
Spearman	Correlation co efficient	-0.0276	-0.154	0.182	0.465
	significance	0.103	0.370	0.288	0.004

Figure 18: Shows the correlation between the use of methotrexate and the scores. There was significant correlation (p 0.004) found between the use of methotrexate and the postoperative functional scores.

CORRELATION BETWEEN USE OF STEROID AND SCORES:

USE OF STEROID		KNEE SCORES		FUNCTIONAL SCORES	
		PRE OP	POST OP	PRE OP	POST OP
Spearman	Correlation co efficient	-0.243	0.157	0.215	0.495
	significance	0.154	0.359	0.208	0.002

Figure 19: Shows the correlation between the use of steroid and the scores. There was significant correlation (p 0.002) found between the use of steroid and the post operative functional scores.

FACTORS AFFECTING THE POST OPERATIVE KNEE SCORE:

Factors such as age of the patients recruited, BMI , duration of disease, use of methotrexate, use of steroid and the involvement of other joints ,were considered to determine their effect on the post operative knee score by multivariate logistic regression analysis.

	BETA CO - EFFICIENT	SIGNIFICANCE	95 % CI	
			LOWER	UPPER
AGE	-0.040	0.871	-0.208	0.172
BMI	-0.083	0.688	-0.569	0.381
DURATION OF DISEASE	0.152	0.511	-0.226	0.442
USE OF METHOTREXATE	-0.366	0.302	-10.235	3.302
USE OF STEROID	0.183	0.539	-3.774	7.054
OTHER JOINT INVOLVEMENT	0.193	0.650	-3.494	2.220

Figure 20: shows that none of the above mentioned factors has an effect on the postoperative knee scores.

FACTORS AFFECTING THE POST OPERATIVE FUNCTIONAL SCORE:

Factors such as age of the patients recruited, BMI , duration of disease, use of methotrexate, use of steroid and the involvement of other joints ,were considered to determine their effect on the post operative functional score by multivariate logistic regression analysis.

	BETA CO - EFFICIENT	SIGNIFICANCE	95 % CI	
			LOWER	UPPER
AGE	0.074	0.627	-.0.392	0.639
BMI	- 0.104	0.418	-1.78	0.76
DURATION OF DISEASE	-0.450	0.003	-2.3	-0.510
USE OF METHOTREXATE	-0.251	0.250	-28.56	7.75
USE OF STEROID	0.689	0.001	12.45	41.57
OTHER JOINT INVOLVEMENT	-0.392	0.032	-16.114	-0.784

Figure 21: From the above table, there is significant negative correlation between duration of disease (p 0.003) and other joint involvement (p 0.03) affecting the postoperative

functional score. There is a significant (p 0.001) positive correlation between the use of steroid and postoperative functional scores.

CLINICAL PICTURES:

1.Mrs. X ,67 years old lady, who underwent bilateral TKR for RA (at different sittings), right knee was done 7 years ago and left knee was done 1 year ago. Her pre operative Knee society score was 55 points for right knee, 52 for left knee which improved to100 points for right knee and 95 for left knee. Her pre operative functional score was 25 points for both knees which improved to 100 for both knees post operatively. Her active ROM was 0°-100° at follow up.

Picture1 : Shows both knees in full extension.

Picture 2: Shows both knees in flexion.

2. Mrs. P, 66 years old lady who underwent TKR for right knee 7 years ago and for left knee , 5 years ago. Her pre operative Knee society score for right knee was 52 and left knee was 52, both of which improved to 90 and 80 respectively. Her pre operative functional score was 50 for both knees which had improved to 100 in both knees, at follow up. Her pre operative radiographs are as follows:

Picture 3: Shows both knees (standing) in the anteroposterior view showing valgus deformity - Pre op.

Picture 4 (above): Shows both knees in lateral view, with flexion deformity (pre op).

Picture 5: Shows both knees, anteroposterior view, post op, total valgus angle left knee- 5°, right knee -3°.

Picture 6 (above : Shows left knee , lateral view (post op).

Picture 7: Shows right knee, lateral view (post op).

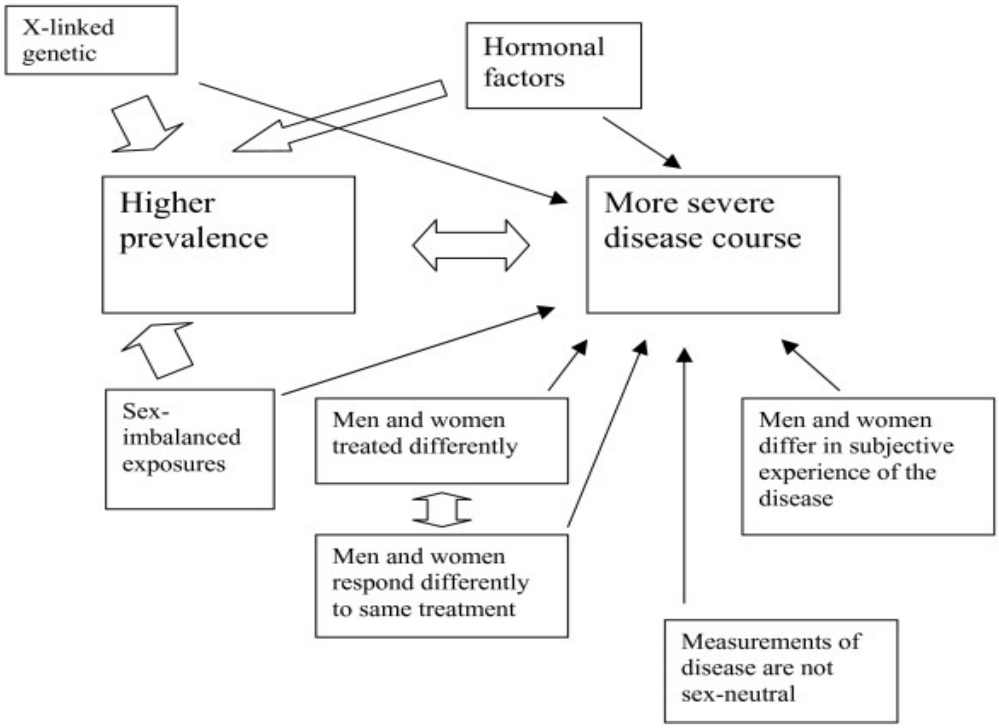
DISCUSSION

DEMOGRAPHIC DETAILS:

Out of 47 TKRs performed for rheumatoid arthritis, 36 TKRs could be followed up. The probable explanations are, due to the underlying disease process, these patients are home bound, the address mentioned in the previous medical records mighty be faulty and the domicile of majority of the patients was from far off places like, West Bengal and Jharkand.

The average age of the patients was 54 years in our study , which clearly depicts the fact that TKR for RA is performed at a younger age .The average of patients undergoing TKR for osteoarthritis has been quoted as 67 years (62) in one study and 75.1 years (63) in another. The pathological process affecting the knee starts quite early in Rheumatoid arthritis progressing to more severe stages, requiring arthroplasty at an earlier age than osteoarthritis. The average age for TKR in RA has been reported earlier is 43.2 years (52),52 years(48) , 61.3 years (64) and 62.8 years (51) in various studies. The majority (n=10) of the participants were between 51-60 years.

There were more number of women (n=20) than men (n=8) who underwent TKR for RA. In RA, females are affected three times more often than males. The genetic factors (X linked) and other hormonal factors involved in the pathogenesis of the disease may explain this finding(65). In earlier literature, among those underwent TKR for RA ,82 % were females, 18 % were males(51) and 80 % were females with 20 % were males in another study(48). Eight out of twenty women in our study, underwent TKR in both knees as compared to only 2 males who underwent bilateral TKR. In osteoarthritis too, rates of TKR are higher for women than men(63).



Source: Sex differences in rheumatoid arthritis: more than meets the eye...

Ronald F van Vollenhoven, BMC Journal *BMC Medicine* 2009, **7**:12 doi:10.1186/1741-7015-7-12

Duration of RA is an indirect indicator of the severity and stage of the disease. In our study the average duration of disease prior to TKR was 8.86 years. More commonly, patients who are in stages III and IV of RA, who do not have significant improvement in symptoms with medical management (DMARDS, STEROIDS), undergo TKR for the relief of pain and improving their functional status. All the patients recruited for the study were in stage IV of the disease which is characterised by arthritis, painful restricted range of movements, soft tissue contractures and deformity. The average follow up after the index TKR was 37 months ranging from 3 months to 93 months.

Regarding other joint involvement, around 14 patients had a symptomatic opposite knee which was not replaced yet, 9 patients had other joints involved which will have a bearing on the functional outcome of the patient.

USE OF METHOTREXATE:

Though perioperative use of immunosuppressant like methotrexate has been associated with poor wound healing, in a recent study, it has not been found to increase the infection rates and it helped in better postoperative recovery with less number of flare ups (42). In our study, 69% (n=25 knees) were using methotrexate for the treatment of RA.

USE OF STEROID:

In our study, 15 subjects were using steroids pre operatively and 11 were using post operatively. Chronic steroid use has been associated with poor wound healing, poor bone quality and secondary osteonecrosis around the TKR site which can be attributed to the disease process also(40).

KNEE SOCIETY SCORES:

There was a significant improvement in the American knee society scores. The average preoperative score was 57.3 points and postoperative score was 97.4 points. There was a 70% improvement in the scores after the TKR. Pain, range of motion and stability of the joint are taken into consideration for assessing the scores and TKR has been found to significantly improve the knee society scoring (p 0.000).

FUNCTIONAL SCORES:

The average preoperative functional score was 36.3 and postoperative score was 85.2, showing a 130 % increase after TKR in RA. Mobility of the patient and the use of aids are taken into consideration. There was a significant improvement in the scores after TKR (p 0.000).

DATA FROM OTHER STUDIES :

S.no	Name of the study	No.of subjects	Results
1	Rodriguez et al(54)	104 knees, class 3 & 4 of disease, average 12.7 years follow up	Scores were excellent in 81% , fair in 16 % and poor in 3 %.
2	Sharma et al(50)	63 TKR , mean follow up 12.9 years	Clinical and functional scores were 90 and 59.Range of movement 104°
3	Trieb et al(51)	68 knees, mean follow up 11.2 years	Knee society score 77.2 and functional score 75.3
4	Parvizi et al(66)	25 knees with JRA, mean follow up 10.7 years	Knee scores improved from 27.6 to 88.3, functional scores from 14.8 to 39.2
5	Kyun Woo et al(67)	179 knees , mean follow up 10.1 years	Knee society scores improved from 47.5 to 91.2 and functional scores from 43.6 to 82.3
6	Yamanaka et al(68)	32 knees, average follow up 8.3 years	Knee score was 88 and functional score was 70 with a maximum flexion angle of 115.6°

FACTORS AFFECTING THE PRE OP AND POST OPERATIVE SCORES:

Bivariate analysis with Spearman correlation was performed to find the correlation between the age of the patient, BMI, duration of disease, use of methotrexate and steroid, and the scores.

There was no statistical significance observed, on the correlation between the age, BMI, duration of the illness and the scores. However there was significant positive correlation found between the use of methotrexate (p 0.004) and postoperative functional scoring. There was also a significant positive correlation observed between the use of steroid (p0.002) and postoperative functional scores.

Using logistic regression analysis on the effect of various factors affecting the knee society (post op) and functional scores (post op) was analysised. Only the use of steroid had a significant (p0.001) positive effect on the postoperative functional scores. Duration of the disease (p 0.003) and the involvement of other joints (p0.03) had a significant negative effect on the postoperative functional scoring.

This can be explained by the fact that, longer the disease activity, the more severe and poly articular in nature, which has a bearing on the functional activity of the patient. RA patients have severe impairment of function, are more wheel chair or home bound, more dependent on walking aids due to the progressive inflammatory nature of the disease leading to permanent deformity and disability. There was no significant correlation noticed between age of the patient, BMI, duration of the disease, use of methotrexate, use of steroid, other joint involvement and postoperative knee society scores.

CONCLUSION

1. Average age of the patients undergoing TKR for RA was 54 years which is lower than the average age at which patients with osteoarthritis undergo TKR.
2. The average duration of illness, prior to the index TKR was 8 years by which time all the patients recruited were in stage IV of the disease.
3. Majority of the recruited, (n=20) were women, compared to only 8 men.
4. There was significant improvement in the Knee Society and functional scores (p 0.000) after TKR in RA. Average Knee society scores were 57.3 points pre op and 97.4 points post op. Average Functional scores were 36.3 points pre op and 85.2 points post op.
5. Use of steroid showed a significant positive correlation with the post op Functional score.
6. Duration of the disease and other joint involvement had a significant negative correlation with the postoperative functional score.
7. Use of American knee society and functional scoring, helps us to objectively predict the success of the surgery. This will encourage the surgeon and the treating physician to improve care for patients with RA.

LIMITATIONS

1. Since most of the patients were from North India, all of them could not come for follow up to CMCH.
2. Sufficient sample size is required to prove the influence of various patient related factors on the pre and postoperative scores.
3. Use of the Knee society and Functional scoring system should be made mandatory for all preoperative patients and at subsequent visits to outpatient department.
4. Long term follow up of these patients is required to determine survival of the prosthesis, asceptic loosening, need for revision arthroplasty and the incidence of delayed deep seated infection.

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APPENDIX 1

INFORMED CONSENT Informed Consent form to participate in a research study

:Functional outcome following Total Knee Replacement for Inflammatory Arthritis

Study Number: Subject's Initials: _____ Subject's Name: _____

Date of Birth / Age:_____

(i) I confirm that I have read and understood the information sheet dated _____ for the above study and have had the opportunity to ask questions. [ ]

(ii) I understand that my participation in the study is voluntary and that I am

free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. [ ]

(iii) I understand that the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published. [ ]

(iv) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s) [ ]

(v) I agree to take part in the above study. [ ]

Signature (or Thumb impression) of the Subject/Legally Acceptable Representative:_____

Date: _____/_____/_____

Signatory's Name: _____

Signature of the Investigator: _____

Date: _____/_____/_____

Study Investigator's Name: _____

Signature of the Witness: _____

Date:_____/_____/_____

Name of the Witness: _____

APPENDIX 2

ABBREVIATIONS

1.TKR –Total Knee Replacement

2.TKA- Total Knee arthroplasty

3.RA –Rheumatoid arthritis.

4.ACL- Anterior cruciate ligament

5.PCL –Posterior cruciate ligament.

6. DMARDS-Disease Modifying anti Rheumatoid drugs.

APPENDIX 3

Proforma for assessing Functional outcome after Total Knee arthroplasty in inflammatory arthropathy

1.NAME :

2.AGE :

3.SEX : Male /Female

4.OCCUPATION :

5.BMI :_____ kg/m²

6.DURATION OF DISEASE :_____ YEARS

7.STAGE OF DISEASE :

8.USE OF METHOTREXATE : Yes / No

9.IF YES, DURATION OF USE :_____ Before operation

_____ After operation

10.USE OF STEROID : Yes/No

11.IF YES , DURATION OF USE :_____ Before operation

_____After operation

12.DATE OF OPERATION :

13.NEED FOR REVISION ARTHROPLASTY: Yes/No

1	623168	D	2	51	NURSING	26.2	3	2	4	1	3	0	1	3	1	########	2	1	76	100	35	100	1
2	235249	B	1	58	AGRICULT	30.1	8	1	4	1	8	5	1	0	5	########	2	1	67	100	25	100	2
3	489646	D	1	31	BUSINESS	27.6	12	1	4	1	0	4	2	0	0	########	2	2	13	100	10	100	2
4	489646	D	1	31	BUSINESS	27.6	12	2	4	1	0	4	2	0	0	########	2	1	13	100	10	100	2
5	456930	C	2	66	HOUSE WI	22.8	8	2	4	2	0	0	2	0	0	########	2	2	52	80	50	100	2
6	456930	C	2	66	HOUSE WI	22.8	10	1	4	2	0	0	2	0	0	########	2	1	52	90	50	100	2
7	889584	C	2	53	HOUSE WIFE		3	2	4	1	3	1	2	0	0	########	2	2	75	100	10	100	2
8	358342	F	2	75	HOUSE WI	25.8	10	2	4	2	0	0	2	0	0	########	2	2	63	98	5	90	2
9	330728	D	2	55	HOUSE WI	22.7	4	1	4	1	2	2	1	2	4	########	2	3	88	100	40	40	1
10	76588	D	2	42	HOUSE WI	18.3	7	2	4	1	7	1	1	7	1	########	2	2	63	98	40	80	2
11	188375	F	2	36	HOUSE WI	31.1	6	1	4	1	1	1	1	2	1	########	2	2	20	95	10	60	2
12	188375	F	2	36	HOUSE WI	31.1	6	2	4	1	1	1	1	2	1	########	2	1	10	98	10	60	2
13	247027	D	1	50	ELECTRICIAN SAI		4	2	4	1	4	5	2	0	0	########	2	1	59	100	702	90	2
14	608196	C	2	67	HOUSE WI	26.7	5	1	4	2	0	0	2	0	0	########	2	2	55	100	25	90	2
15	608196	C	2	67	HOUSE WI	26.7	11	2	4	2	0	0	2	0	0	########	2	1	52	100	25	100	2
16	138019	D	1	42	TRAVEL A	29.1	13	2	4	1	1	0	1	1	0	########	2	2	58	98	50	90	2
17	227188	D	2	58	SUPERVIS	28.3	3	1	4	2	0	0	2	0	0	########	1	2	68	100	70	100	2
18	227188	D	1	58	SUPERVIS	28.3	8	2	4	2	0	0	2	0	0	########	2	1	43	100	50	100	2
19	179979	F	2	47	TEACHER	20.1	7	2	4	1	2	1	1	2	1	########	2	2	60	100	70	90	2
20	640557	B	2	59	HOUSE WI	28.6	11	2	4	1	10	5	2	0	0	########	2	3	65	100	35	90	2
21	640557	B	2	59	HOUSE WI	28.6	13	1	4	1	10	3	2	0	0	########	2	3	60	100	35	90	2
22	192730	C	2	62	HOUSE WI	28	3	2	3	1	10	1	1	10	1	########	2	2		90		90	
23	153640	F	2	50	HOUSE WI	24.6	9	1		2	0	0	2	0	0	########	2	1		90		90	
24	153640	F	2	50	HOUSE WI	24.6	9	2		2	0	0	2	0	0	########	2	1		100		100	
25	191672	F	2	54	HOUSE WI	34.7		2		1	2	1	1	2	0	########	2	3		88		70	
26	559633	D	2	49	HOUSE WI	26	5	1		1			2	0	0	########	2		95		80		
27	559633	D	2	49	HOUSE WI	26	5	2		1			2	0	0	########	2			95		80	
28	994005	D	1	34	GROCERY	26.4	3	1		2	0	0	2	0	0	########	2	1		98		100	
29	626052	D	2	56	HOUSE WI	20	4	1		1		0	1		0	########		1		98		90	
30	659069	D	1	63		25.4		2		1		0	2	0	0	########	2			98		90	
31	552936	C	2	73	HOUSE WI	28	30	1	4	1	4	0	1	2	0	########	2			100		60	
32	552936	C	2	72	HOUSE WI	28	30	2	4	1	4	5	1	2	0	########	2	3		100		60	
33	553264	D	2	64	HOUSE WIFE		5	1	4	1	1		2	0	0	########	2	2	65		50		
34	362335	A	2	55	HOUSE WI	34.5	12	1	4	1	12	4	2	0	0	########		1					
35	362335	A	2	55		34.5	12	2		1	12	4	2	0	0	########		1					
36	623168	D	2	51	NURSING	26.2	3	1	4	1	3	0	1	3	1	########	2	1	81	100	35	100	2