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Total Knee Replacement in Severe Varus Deformity

[1]**Khaled M.Hassan,**[2]**Mohamed E. Attia,** [2]**Ahmed M. Attia ,** [3]**Salah al-Deen A. Mohamed**
[1]**Department of Orthopedic Surgery, Faculty of Medicine –Zagazig University, Egypt.**
[3]**Department of Orthopedic Surgery, Faculty of Medicine, Garyan University in Libya**

Corresponding Author:
Name: Salah al-Deen al-Sharef Mohamed
Tel : 01013274918
&Email:
Salah.elfeturi@gmail.com

ABSTRACT

Background: Varus deformity is predominantly the commonest deformity in candidates for total knee arthroplasty. Obtaining a well positioned and stable prosthetic construct with restoration of the normal mechanical axes of the limb and joint line have been shown to have an important bearing on the final outcome of knee replacement operations.

Objectives: The purpose of the current study is to evaluate patients with varus osteoarthritis who are candidates for total knee replacement, their pre-operative planning, and methods for bony and soft tissue.

Patients & Methods: In the period between May, 2018 and March, 2019, Retrospective-prospective cohort study was conducted involving 18 patients with 18 knees who underwent primary total knee arthroplasty due to severe varus knee deformity osteoarthritis.

Results: The average knee society score improved from 24.22 preoperatively to 79.44 postoperatively and improvement of the functional knee score from 24.05 preoperatively to 80.33 postoperatively No sign of component loosening or osteolysis could be identified on the radiograph of final follow-up of all patients.

Conclusions: Patients with severe degrees of varus OA are more likely to have medial tibial bone defects and must be reconstructed by either bone grafts or metal augments and in the same time uploading the tibial surface by long stem to distribute part of the load stresses to the diaphysis.

Keywords: Varus, deformity, Knee, Arthroplasty

INTRODUCTION

There are patients with arthritic knees who present very late for treatment. Thus, they present with severe knee deformity, unyielding contractures, and major bone defects. The treatment of these cases requires extensive soft tissue release to attain proper alignment. It may necessitate the use of stems, wedges, and constrained or hinged prostheses. These additions or constrained prostheses are expensive and increase the cost of the procedure two-fold to three-fold. Failure to manage these cases adequately may lead to premature loosening and failure [1]. Varus deformity means deformity in the frontal plane with deviation of the mechanical axis of the whole limb from the normal ranges and passes medial to the center of the knee

Khaled M., et al..

.Radiographically, Varus deformity is defined by any preoperative tibiofemoral angle less than naturally occurring anatomic valgus, typically less than 7 degrees.in severe varus deformity the angle more than 20 degrees [2, 3].

Total knee arthroplasty (TKA) is extremely challenging if the aim is to correct pronounced deformity. Also, balancing the soft tissues to use the least amount of constraint is difficult. Severe preoperative deformities have long been a challenge for surgeons performing TKA[4].

Restoring the knee alignment to an angular anatomic normal of 5° valgus may be difficult and may require intraoperative ligament releases and/or ligament tensioning to achieve proper ligament balance [5] .

Most of the surgical modalities that deal with severe deformities depend on constrained implants, long tibial stem, wedges, bone grafts [6].

The aim of this study is to evaluate the result of 18 patients with severe varus knee deformity regarding the clinical and radiological result the candidate were followed for 12 month period from may 2018 to march 2019.

PATIENTS AND METHODS

In the period between May, 2018 and March, 2019, Retrospective-prospective cohort study was conducted involving 18 patients with 18 knees who underwent primary total knee arthroplasty due to severe varus knee deformity osteoarthritis.

Written informed consent was obtained from all participants and the study was approved by the research ethical committee of faculty of medicine zigzag university. The work has been carried out in accordance with the code of Ethics of the world medical association (Declaration of Helsinki) for studies involving humans.

Inclusion criteria: All patients male and female with severe degenerative varus knee deformity, aged above 30 years.

Exclusion criteria: Any patient with mild, moderate varus, Rheumatoid arthritis, Sever debilitated disease. The group of patients included 2 males (11.1%) and 16 (88.9%) females with a mean age at the time of surgery of 67 years old (range from 55 to 83 years), 11patients had the right knee replaced, 7 patients had the left one. 5 knees had flexion deformity. 3 knees had mild flexion deformity (less than 15˚) while 2 knees had moderate flexion deformity (15˚-30˚).

*Methods:*I. Preoperative assessment:

[A] Clinical assessment:

It included a detailed history and a full physical examination.

1. **History:Personal history:** Name, Age &Sex.

- Local: The local assessment focused in particular on quantifying the pain and disability.

-**Pain**: pain is subjective and difficult to quantify. However factors which assist patient selection, severity of pain and indications for surgery include night pain, analgesic regime (pain threshold) and pain quantification (subjective) using a visual or numerical analogue scale. Activity related pain was assessed in details for scoring (rest pain, associated with stairs only or stairs and walking)

-**Disability**: the patient's disability (pain, loss of movement, impaired function) may be considered severe enough to warrant total knee replacement when it represents an unacceptable compromise in their quality of life (irrespective of age). Impaired function included walking disability, stair climbing function and using of ambulatory aids.

General history: was taken in full details in such major surgery especially:

- Cardiac diseases or previous admission in coronary care unit.
- Chest diseases.
- Peripheral vascular diseases: ischemia, cluadication pains.
- Previous history of deep venous thrombosis.
- Systemic diseases: diabetes mellitus, hypertension.

2. Physical examination:

a. General assessment: This was done to assess the patient's general fitness for such surgery:

Khaled M., et al..

Blood pressure, cardiovascular examination, chest examination, abdominal examination.

b. Local examination: Complete local examination of the involved knee joint was done with particular emphasis on:

1. Deformity: Assessment of the deformity as regard:
- Degree.
- Correctable or fixed deformity.
- Associated deformities (flexion or rotatory deformity)

2. Instability
- Medio-lateral instability:
    -Lateral ligament laxity.
    -Degree of lateral opening.
    -Medial structures contracture.
   -Antero-posterior   instability   or posterior sag (PCL integrity).
        - Extension lag.

3. Range of motion: Both active and passive range of motion was assessed, as the pre-operative range of motion is the most determinant factor of the post-operative range.

4- Complete neurovascular examination of the affected limb:
- Peripheral pulsation.
- Pitting edema of the affected limb (venous insufficiency)
- Sensory examination (neuropathic joint).
- Motor power (quadriceps, hamstring).

Reconstruction by Bone graft
Age: 69   **Sex:** female
Approach: medial para-patellar
Prosthesis: Constraint condylar knee with long stem tibia. The medial tibialcondyal has a bony defect 10mm in depth reconstructed by autograft and fixed by 2 cancellous screws
Diagnosis: varus osteoarthritis of the right knee

Table (1): Clinical items of case no. 12 pre &6 months post-operatively:

	Pre-operative	Post-operative
Tibio- femoral angle	20º varus	7º valgus
Medio-lateral instability	severe lat laxity	nil
Range of motion	80	100
Flexion deformity	5	Nil
Extension lag	Nil	Nil
Total knee society score	25	87

Statistical analysis

Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis. According to the type of data qualitative represent as number and percentage, quantitative continues group represent by mean $\pm$ SD , the following tests were used to test differences for significance;. difference and association of qualitative variable paired by Mac Nemmar . Differences between quantitative paired groups by paired t test. P value was set at <0.05 for significant results & <0.001 for high significant result.

RESULTS

Table (2): Knee function scoring distribution at pre and post

	Pre	Post	Paired t	P
Knee function scoring	24.05±4.0	80.33±5.5	41.992	0.00**

Knee function scoring significantly improved from 24.05±4.0 pre operation to 80.33±5.5 post-operative

Table (3): Pain scoring distribution at pre and post

	Pre	Post	Paired t	P
Pain	10.27±2.88	24.6±3.87	-13.42	0.00**

Pain improved significantly from 10.27±2.88 pre operation to 24.6±3.87 post operation

Table (4): Flexion Deformity Score

Flexion Deformity Score improved 7.2±2.7 pre operation to 9.8±0.6 post operation

The average flexion deformity preoperative was 8.6 degrees ranging from 0-25 degrees equals 7.2 points in the score system .The average post-operative flexion deformity was 0.34 ranging from 0-5 degrees equals 9.8 points in the score system. This test is of high significance.

Table (5): Pre operation Varus and post operation Valgus distribution among studied group

This table shows that Varus pre operation was 26.05±5.8 improved to 6.22±1.0 valgus after operation

	Pre operation Varus	Post operation Valgus	Paired t	P
Deformity	26.05±5.8	6.22±1.0	14.182	0.00**

**Table (6): Range of motion score distribution at pre and post**

No significant change in range of motion as it was 83±2.58 pre operation and 95±1.24 post operation

	Mean ±SD	T. value	p. value	Sig
Pre	10. 4±2.4	3.949	<0.001	HS
Post	11.7±1.2			

Table (7) : Complication distribution among studied group

		N	%
Complication	No	16	88.9
	Infection	2	11.1
	Total	18	100.0

Only 2 cases (11.1%) had superficial skin infection
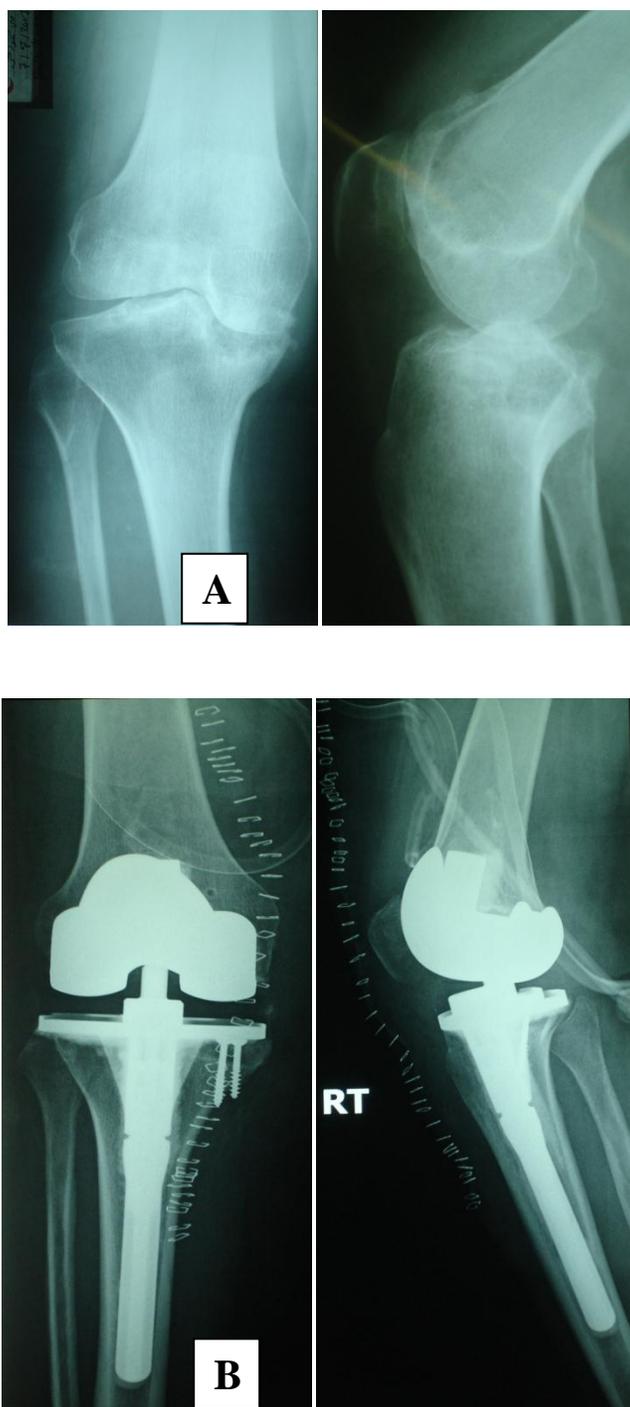
Figure (1): A: A-P and Lateral view right knee of 69 old female with advanced O.A. knee with 17º tibio-femoral varus angle. **B:** Immediate post-operative X-ray with 7º valgus angle and excellent component position and evident bone graft fixed by 2 cancellous screws.
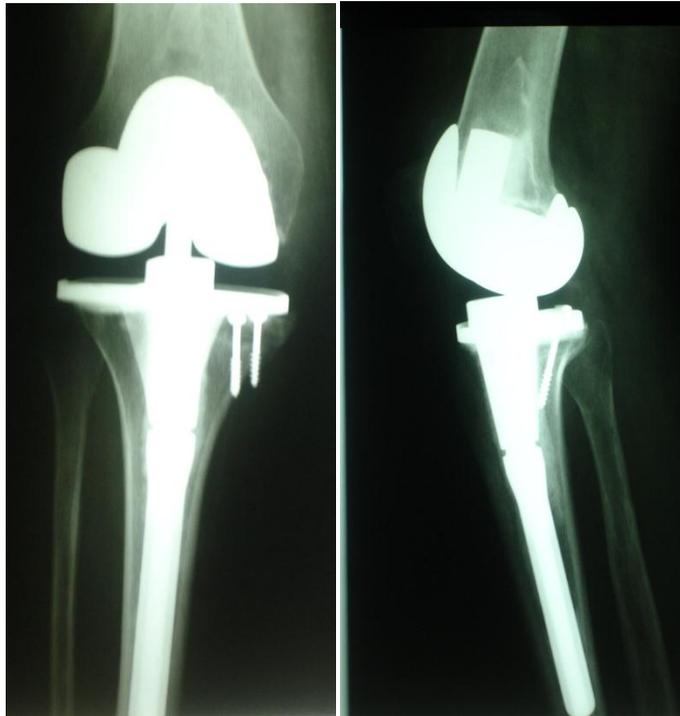
Figure (2): 9 months follow up x-ray with excellent result and complete bone graft incorporation

DISCUSSION

Varus deformity is predominantly the commonest deformity in candidates for total knee arthroplasty. This deformity possibly underlies pathomechanics that led to the progression of the arthritic process, and may compromise the outcome of the arthroplasty itself [5]. Obtaining a well positioned and stable prosthetic construct with restoration of the normal mechanical axes of the limb and joint line have been shown to have an important bearing on the final outcome of knee replacement operations. Also, proper soft tissue balancing during TKA is paramount step in optimizing the mechanical balance of the knee joint. Soft tissue contractures that result from varus coronal plane deformity can pose a difficult problem and the surgeon must have a standard procedure for managing such situations in the operating room[4] average preoperative HSS (Hospital of special surgery) Knee Score System 24.22±5.07 (range from 18 to 35). Overall result was good (70-84 points). (25%) knees had excellent results (85 to 100 points), (60%) had good results (70 to 84 points), (10%) had fair results (range 60 to 69

points) and two knees (5%) had poor results (<60).

This study is comparable to **Mullaji et al** The mean preoperative were 22. to 99.1 postoperative and the function knee score from 22.8 to 72.1. Their results were coincided with the present study results [7]. **Teeny et al** reported that in their study the mean post operative knee society score 89. Sixteen knees (59%) in the varus deformity group were rated excellent and 11 knees (41%) good. There were no fair or poor results. preoperative score is better as our patients seeks orthopedic advise late and we do cases with sever degrees of angular deformity [4]. **El-Sebai** was coincided with the present study as the mean knee society scored improved from 9.62 preoperatively to 83.35 postoperatively [8]. **Thimmegowda and purusho, 2017** found that the mean postoperative HSS Knee score increased from 28.9 to 89 [9]. **Dixon, Parsch, Brown, & Scott,** the Mean postoperative HSS increased from a mean of 24 to a mean of 94, comparable to our results[10].

In our study, the average pain score preoperative was 10.27 points, and the average score postoperative was 24.6 points. Dixon,

Parsch, **Brown, & Scott,** reported average pain score was 7.1 points and post-operative were 28 points. reported Post-operative pain score 28.6 points[10]In our study the average preoperative instability score was 5.33 points, and the average postoperative instability score was 9.55 points .Our results are nearly similar to **Thimmegowda, purusho, 2017** their average preoperative instability score was 5 points, and the average postoperative score was 7.9 points[9].

In our study the average range of movement preoperative was 83degrees, and the average range postoperative was 95 degrees. The average range of movement score preoperative was 10.4 points, and the average score postoperative was 11.7 points. Our results are nearly similar to Dixon, Parsch, **Brown, & Scott, .**Their average preoperative range of movement 87 degrees and postoperative range of movement 96 degrees the average range of movement score preoperative was 10.8 points and the average score postoperative was 12 points. Nearly similar results present between previous two studies[10]. **El-Sebai** reports improvement in range of movement from 87 degrees preoperative (10.8 points) to 118 degrees postoperative (14.7 points).This study has better results due to better post operative rehabilitation program which improve range of movement[8].

In our study the average flexion deformity preoperative was (8.6) degrees ranging from (0-25) degrees equals (7.2) points in the score system .The average post operative flexion deformity was (0.34) ranging from (0-5) degrees equals (9.8) points in the score system. Dixon, Parsch, Brown, & Scott, (2004)average flexion deformity preoperative was 6.6 points and postoperative was 9.2 points[10].

In our study there were 18 cases with preoperative varus deformity tibio-femoral angle more than 20° main 26.05° range (20°-35°). Postoperative valgus 6.22° range (3°-10°). (Dixon, Parsch, **Brown, & Scott,** mean pre-operative varus deformity of 24° (range, 20°–40°) The mean postoperative tibiofemoral angle was 4° of valgus[10]. (**Mullaji, Padmanabhan,**

& Jindal, mean pre-operative varus deformity of 22° (range, 20°–40°)The mean postoperative tibiofemoral angle was 5.3 of valgus [7]. Thimmegowda, purusho. 2017 mean pre-operative varus deformity of 30° The mean postoperative tibiofemoral angle was 5° of valgus[9].

CONCLUSION

- Patients with severe degrees of varus OA are more likely to have medial tibial bone defects and must be reconstructed by either bone grafts or metal augments and in the same time uploading the tibial surface by long stem to distribute part of the load stresses to the diaphysis.
- Patients with mild degrees of flexion deformity show much improvement in the HSS compared to those with severe degrees of flexion deformity.
- longtibial stems could be used in managing sever tibial bone defect.

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