Total knee replacement in genu valgum

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Abstract: The purpose of this study was to review results of total knee arthroplasty in patients with genu valgum deformity. The hypotheses were: (1) treatment of advanced and osteoarthritis and the deformity in the same sitting. (2) And avoids morbidity, particularly peroneal nerve palsy and flexion instability; and (3) Make a protocol for the sequence of lateral structures release and the proper approach (anterolateral or anteromedial) and the type of prosthesis (Posterior stabilizer with PCL sacrificing, CCK (Constrained Condylar Knee) or hinged (TKR). 25 cases operated for valgus angle from 10 to 45 degrees, in Grade one: anteromedial approach with PS implant and release of the postero lateral capsule and lateral collateral ligament, Grade two: anterolateral approach intraoperative selection of the prosthesis of either non constrained or constrained according to the instability intraoperativly, with soft tissue release by pie crust release of ITB, release of the posterolateral capsule, LCL and POP successively. Grade three the same like grade two but using constrained condylar knee or hinged knee in case of complete torn of the LCL.
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1. Introduction

Valgus knee deformity is a challenge in total knee arthroplasty (TKA). This deformity (defined as a valgus angle equal to or greater than 10°) is observed in nearly 10 % of patients undergoing TKA [**Ranawat et al, (2005)**]. It can be congenital or secondary to osteoarthritis, rheumatic diseases, post-traumatic arthritis and to an over-correction consequent to a valgus osteotomy [**Favorito et al, (2002)**]. Excessive pre-operative malalignment predisposes to a greater risk of failure compared to well-aligned knees. For this reason it is important to correct the deformity during surgery even if it does not completely eliminate the increased risk of failure (1.9 vs 0.5 %) [**Ritter et al, (2013)**]. Grade I the deviation is less than 10°, passively correctable, with contracture of the lateral soft tissue but without elongation of the medial collateral ligament (MCL,80 % of cases). In grade II the axial deviation ranges between10 and 20°, the lateral structures are contracted and the MCL is elongated but functional (15 % of cases). Grade III deformityis present in the remaining 5 % of the patients; the axialdeformity is greater than 20°, the lateral structures are tight and the medial stabilisers are not functional [**Ranawat et al, (2005)**].

Patients and Method:

Between 2013 and 2016, 25 consecutive TKR were implanted in 22 patients three of this patients (12%) had bilateral genu valgum. only 15 knee (60%) had about 10 degrees valgus deformity (type 1), 5 knees (20%) had about11- 20 degrees valgus deformity (type 2) and 5 knees (20%) had 21-30 degrees valgus deformity (type 3). Patients had a mean age at the time of surgery of 59 years (range from 50 to 68 years), the group of patients included 17 females (77%) and 5 males (23%), 11 patients (50%) had the right knee only replaced (9 females and two males), 8 patients (36%) had left one only (6 females and two males), while 3 patients (12%) had bilateral TKR (2 females and one male). Of that group the female patients had staged bilateral TKR, 6 months apart, and the male patient with type 3 valgus deformityoperated for bilateral TKR in the same sitting to avoid leg length discrepancy and limping if we do only one side (Figure1),5 patients had previous intra-articular injection to the operated knee. 2 patients had high tibial osteotomy (HTO) for genu varus transformed to genu valgum due to overcorrection, all patients had cemented fixation.

Outcome was assessed prospectively using the Hospital for Special Surgery and Knee Society scoring systems; follow-up was by independent observer. Clinical and radiographic follow-up(average 12 months) was available for 25 knees (22 patients). The Hospital for Special Surgery score improved from 66 to 91 points. At follow up, Post-operatively, only 1 knee (4%) still had about 5 degrees deformity (score -1), and the remaining 24 knees (96%) had no deformity (score 0). No radiographic loosening, prosthetic failures, peroneal nerve palsies, or flexion instability occurred.

2. Patient assessment:

Criteria of inclusion:

Genu valgus (grade 1,2,3) with advanced osteoarthritic changes.

Criteria of exclusion:

Mild and moderate OA of the knee, morbid obesity, recent or current knee sepsis, remote source of ongoing infection, extensor mechanism discontinuity or severe dysfunction, medical conditions that compromise the patient's ability to withstand anaesthesia.

Fig. (1): A: Postoperative X-ray lateral view. B: Postoperative X- ray AP view both knees hinged total knee with bone graft fixed by 4mm cancelous screw in the right knee duo to massive lateral tibial plateau Hypoplasia, C: post operative photo of patient standing with well aligned knees (no genu valgum)

Pre-operative planning and implant selection:

Mandatory pre-operative radiographs of the knee undergoing TKA are: weight bearing anteroposterior, lateral. These are useful for planning and bone stock evaluation. Attention should be focused on lateral distalfemoral hypoplasia, posterior femoral condyle erosionand metaphysealremodelling both of the femur and tibia, which can lead to malalignment or malrotation of thefemoral component. The patellofemoral joint can bepartially dislocated. In addition anteroposterior and latera l views are mandatory to evaluate the amount of osseous resection needed to correct deformities without leading to knee instability. A weight-bearing long leg view is fundamental for the evaluation of lower limb alignment, deformity level and to plan the amount of correction [**Ranawat el al, (2001)**].

(b) Knee evaluation

The overall alignment should be assessed both in the supine and weight-bearing positions, and the gait should be observed, in order to identify other dynamic instabilities. Any sagittal deformity, such as fixed flexion contracture or recurvatum, as well as any rotational deformity, should be tested during the physical examination. The knee should be evaluated for anteroposterior laxity, range of motion (ROM), coronal and sagittal deformity, and mediolateral instability [**Robbins et al, (2001)**].

(c) Templating

In the radiographic anteroposterior view of the knee, a template of bone cuts should be performed. A line is drawn on the tibial anatomical axis and then a perpendicular one is drawn at the level of the lateral tibialplateau. This will give the surgeon an indication for the tibial resection. The femoral anatomical axis is drawn and then a second line with the desired amount of valgus (usually 3°) is also drawn at the level of the intercondylarnotch [**Ranawat et al, (2005)**].

(d) Selection of the implant

The implant selection should be carried out pre-operatively, based on the radiological and clinical evaluation. There is an open debate in the literature between posterior-stabilised (PS) and cruciate-retaining (CR) implants, also in valgus deformity. In valgus deformity, the PCL is often contracted and it may limit the deformity correction [**Krackow, (1990)**]. Furthermore, it may be more difficult to obtain the deformity correction with an intact PCL, since the PCL is a secondary stabiliser [**Matsuda et al, (2000)**]. Besides, the PS design is more stable than a CR one because of the postcammechanism and the PS design allows for greater lateralisation of the femoral and tibial components, which improves patellar tracking and minimises the necessity to perform a lateral retinacular release [**Ranawat et al, (2005)**]. For these reasons some authors suggested that it is simpler to substitute a contracted PCL with a PS design than to stabilise it using a CR implant, recommending that a PS design be used in valgus deformity [**Favorito et al, (2002)**].

Pre-operative and post-operative rating scales:

The knee were scored pre-operative and post-operative by the Hospital for Special Surgery Knee rating system (HSS knee score). The HSS Knee Score is based on a total of 100 points. Score is divided into 7 categories: pain, function, range of motion, muscle strength, flexion deformity, instability, and subtractions. The knee is initially given a score of 0; points are awarded and subtracted according to specific criteria. 100 points is the best knee and 0 is the worst knee. The categories and point scores were those found to be most useful from previous assessment scores. Researchers have found the HSS Knee Score to be valuable in evaluating the merits of different prostheses and instrumentation. To assess the patient's improvement over time, the evaluation is typically conducted at several different times: preoperatively, 6 months and 1 year after surgery, and then yearly. The measurements are most useful when used to evaluate a specific technique or prosthesis. Under this HSS Knee Score, a score of 85-100 was excellent, 70-84 was a good, 60-69 was rated fair, and below 60 was poor.

3. Results

The results of this study were evaluated using the Hospital for Special Surgery Knee score. They are presented in the table, pie charts and bar graphs. They are also presented in the simple of form of patient satisfaction, doubtful or not satisfied. Results are presented using mean, median, range, number of cases and percentage. Statistical analysis is carried out using Wilcoxon Signed Rank Test with reference to P-value which considers any result<0.05 to be significant.

At the last follow up for all patient's the average Hospital for Special Surgery knee score was 87.82 (ranging from 72 to 94) compared with average preoperative Hospital for Special Surgery knee score of 66.32 (ranging from 48 to 78), with an average increase of 21.50. one patient with preoperative score 78 and we did the surgery for him because he had pain affecting his quality of life plus valgus deformity that was cosmetically unaccepted for him and we didn't correction osteotomy because of the advanced arthritis that was only compatible with TKR.

The table shows the general results.

No	Pre/ Post	Age	Sex	W	Side	C	Diag.	Prev. Proc.	Pain		Function			RM	M	FD	I	WA	EL	D	T
									walk	rest	Walk/ Stand	Stairs	Trans-fer								
									15, 10, 5,0	15, 10, 5,0	12,10, 8,4,0	5,2	5,2	0-18	10,8,4,2,0	10,8,5,0	10,8,5,0	-3 - 0	-5,-3,-2,0	-5,0	
1	Pre	56	F	65	Rt.	M	O.A	Non	5	10	8	2	5	10	8	10	10	-1	0	-25	66
	24 m post								15	15	10	5	5	14	8	8	10	0	0	0	90
2	Pre	60	F	69	RT.	M	O.A	Inj.	10	15	10	2	5	11	8	8	8	-1	-2	-30	74
	24m post								15	15	12	5	5	14	8	10	10	0	0	0	94
3	Pre	54	M	75	Lt.	M	O.A	Non	5	10	8	2	5	9	8	10	10	-1	0	-45	65
	18m post								15	15	10	5	5	14	8	10	10	0	0	5	92
4	Pre	54	M	73	Rt.	M	O.A	Non	10	15	8	2	5	10	8	10	10	0	0	-30	78
	18ms post								15	15	10	5	5	13	8	10	10	0	0	0	91
5	Pre	57	F	75	Lt.	M	O.A	Inj.	5	5	4	2	2	9	8	8	8	-1	0	-20	48
	18m post								10	15	8	2	5	14	10	10	10	0	0	-1	83
6	Pre	61	F	77	Rt.	M	O.A	Inj.	5	5	4	2	2	9	8	8	8	-1	0	-15	49
	12m post								10	15	10	2	5	14	10	10	10	0	0	0	86
7	Pre	58	F	76	Rt.	M	O.A	Non	5	10	4	2	5	10	8	8	8	-1	0	-14	58
	12m post								10	10	8	2	5	12	8	8	10	-1	0	0	72
8	Pre	60	F	72	RT	M	O.A	Non	10	10	8	2	5	12	8	8	8	-1	0	-13	69
	12ms Post								15	15	10	5	5	13	10	10	10	0	0	0	93
9	Pre	61	F	75	Rt.	M	O.A	Non	5	10	8	2	5	9	8	10	10	-1	0	-13	65
	12ms post								15	15	10	5	5	13	8	10	10	0	0	0	91
10	Pre	58	F	74	Rt.	M	O.A	Non	10	10	8	5	5	12	8	8	10	0	0	-27	76
	4ys post								15	15	10	5	5	14	8	10	10	0	0	0	92
11	Pre	63	F	71	Lt.	M	O.A	Non	10	10	8	2	5	11	8	8	8	-1	0	-14	69
	12m post								15	15	10	2	5	14	8	10	10	0	0	0	89
12	Pre	57	M	66	Rt.	M	O.A	Non	5	10	8	2	5	10	8	10	10	-1	0	-17	66
	12m post								15	15	10	5	5	13	8	10	10	0	0	0	91
13	Pre	62	F	75	Rt.	M	O.A	Non	5	10	4	2	5	10	8	8	8	-1	0	-10	58
	12m post								10	15	8	2	5	12	8	8	10	-1	0	0	77
14	Pre	54	F	70	RT	M	O.A	Non	10	10	8	5	5	12	8	8	10	0	0	-10	76
	9m post								15	15	10	5	5	14	8	10	10	0	0	0	92
15	Pre	57	F	67	Rt.	M	O.A	Inj.	5	10	8	2	5	11	8	10	10	0	0	-25	69
	9m post								15	15	8	2	5	13	8	10	10	0	0	0	86
16	Pre	61	M	77	RT	M	O.A	Inj.	5	10	8	2	5	10	8	10	10	0	0	-16	68
	9m post								15	15	8	2	5	14	10	10	10	0	0	0	85
17	Pre	58	F	63	Rt.	M	O.A	Non	5	10	8	2	5	11	8	8	10	-1	0	-12	66
	9m post								15	15	8	2	5	13	10	8	10	0	0	0	89
18	Pre	58	M	75	Rt.	M	O.A	Non	5	10	8	2	5	11	8	8	10	-1	0	-15	66
	12 ms Post								10	10	8	2	5	13	8	10	8	-1	0	0	73
19	Pre	55	F	71	Rt.	M	O.A	Non	10	15	10	2	5	11	8	8	8	-1	-2	-12	74
	12 ms post								15	15	12	5	5	13	8	10	10	0	0	0	93
20	Pre	60	F	74	Lt.	M	O.A	Non	5	10	8	2	5	10	8	8	10	-1	0	-2	65
	12ms post								15	15	10	2	5	12	10	8	10	0	0	0	87
21	Pre	63	F	77	Rt.	M	O.A	Non	5	10	8	2	5	10	8	10	10	-1	0	-2	65
	10m post								15	15	10	5	5	14	8	10	10	0	0	0	92
22	Pre	54	F	70	Lt.	M	O.A	Non	10	10	8	2	5	12	8	8	8	-1	0	-2	69
	9m post								15	15	10	5	5	14	10	10	10	-1	0	0	93

Complications

In the literature different main complications have beendescribed [2]:

	Complications of other literatures	Our complications
Tibiofemoral instability	2–70 %	4% (one knee)
Recurrent vagus deformity	4–38 %	4% (one knee)
Poor post-operative ROM	1–20 %	8% (2 knees)
Wound problems	4–13 %	8% (2 knees)
Patellar stress fracture and osteonecrosis	1–12 %	0%
Patellar maltracking	2–10 %	4% (one knee)
Peroneal nerve palsy	0.3–9.5 %	0%

4. Discussion

Krackow et al, (1991) had operated 134 knees (we did 25) all cases were Types I and II (we did type I, II, III), only in Type I he did lateral soft tissue release and Type II he did medial capsular tightening he used CR implant Knee Society post-operative knee score was 87.6 (± 10.6) close to our result (87.82) and mean post-operative functional score was 52.3 with the same minimum follow up 2 years with Same result for types I and II.

Whiteside,(1999) had operated 231valgusknees(we did 25), only grade II and III (12–45°)(we did type I, II, III). He did realease of LCL+POP ext and ITB; tight in flex and posterior capsule release was done only when necessary and 10 % required release of the PLCHe used CRno higher constrained prosthesis; no post-operative instability at 6 years follow-up**.**

Brilhault et al, (2002) had operated 13 knees (we did 25) their valgus deformity were more than10° (we did type I, II, III), He did LCL advancement with CCK implant His KSS score was32–88, our result (87.82), and functional score was 45–73Follow up for 6.5 years he didn't found anypost-operative tibiofemoral or patellar instability and all in all his result was satisfactory with stable alignment we have this complication in 5% of our patients.

Boyer et al, (2009) had operated63 patients with valgus angle more than10°His approach was Lateral parapatellar approach, ITB release, PLC and gastrocnemius release successively. Knee score improved from 37 to 91, average 64 so it was less than our score and the average score of other literatures flexion from 113 to 117°, functional score from 29.5 to 78.7 and pain score from 0.8 46.

Mullaji and Shetty, (2010) had operated 10 cases with>10° valgus angle, the least number of cases of literature he used to do LCL+POP release with sliding osteotomy using computer navigation and PS implant. He did not find any complication within 20 months follow up our range of complications was 4%. Computer navigation allows precise measurement of the difference between medial and lateral gaps as well as the limb alignment and to determination of the effect of sequential soft tissue releases on both.

Bremer et al, (2012) had operated 79 cases with valgus angle from 8–40°**.** The technique was distalisation of the insertion of the LCL and POP by sliding osteotomy of the lateral femoral Condyle. he used CR implant oxford score improved from22 points preoperatively to 45 points the worst score in literatures; 1 knee revised for infection and 1 due to non-union of tibial tubercle; 3 cases with complications associated with the procedure; all revised successfully Good stability after procedure; no conversion to a semi-constrained or constrained knee prosthesis average complication rates.

Treatment of complications for tibiofemoral instability we did revision total knee replacement, in recurrent valgus deformity we did distal femoral varus osteotomy with fixation by distal femoral locking plate, in poor ROM we did MUA, in wound infection we did washout and replacement of the ployetheline insert and in patellar maltracking we did revision total knee replacement with more external rotation of the femoral component.

Conclusion:

We routinely use a PS implant in type I deformity. In type II deformity we decide the level of constraint on the operative field, based on the integrity and functionality of the MCL. Ifthere is a medial residual instability we do not perform a medial tightening, but we prefer to switch to a higher constrained implant. In type III deformities we routinely use a condylar constrained or, in the most severe cases, a rotating hinge prosthesis.

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