Age and Body Mass Index Has No Adverse Effect on Clinical Outcome of Unicompartmental Knee Replacement - Midterm Followup Study

Abstract

Introduction: Unicompartmental knee replacement (UKR) is well-established procedure for the anteromedial compartment of knee arthritis with intact anterior cruciate ligament. The significance of age and body mass index (BMI) is not clear in the outcomes of UKR. Our hypothesis was that age and BMI does not affect the clinical and functional outcome following fixed bearing UKR.

Materials and Methods: The study cohort of 148 was selected after stringent inclusion criteria and average followup was 5.6 years (range 2–10 years). The fixed bearing Miller Galante UKR procedure was carried out on all patients. Results: In the study cohort of 175, the average age of the cohort was 61.7 years. The sample size aged ≤55 years and aged ≥55 years was 38 and 137, respectively. The mean BMI of the cohort was 29.2 kg/m² (range: 21–38 kg/m²). The sample size of BMI ≤30 kg/m² and BMI ≥30 kg/m² was 117 and 58, respectively. In the cohort group, BMI ≤30 kg/m² and BMI ≥30 kg/m², there was no statistically significant difference in the Knee Society Score clinical scores, functional scores, and knee range of motion scores, (P > 0.05). This study infers no statistically significant difference in the clinical and functional outcome between age group ≤55 years and age ≥55 years, (P > 0.05). The failure rates of the group of BMI ≤30 kg/m² and BMI ≥30 kg/m² were 4.27% (5 knees) 3.44% (2 knees), respectively. The failure rates in the age group ≤55 years and group ≥55 years were 2 knees (3.44%) and 5 knees (4.27%), respectively. Conclusion: This study confirms that age and BMI does not influence the functional outcome and clinical outcome following fixed bearing UKR.

Keywords: Age, arthritis, body mass index, medial compartment knee, unicompartmental knee replacement

Introduction

Improved mid and long term results of the UKR, comparable with the excellent and well-known results after TKR, have contributed to the use of UKR on the younger, the active, and the obese population. For the past 20 years, the overall results of unicompartmental knee replacement (UKR) have been promising, and this procedure is, especially appropriate for anteromedial osteoarthrosis of the knee.

Our hypotheses were that UKR provides excellent clinical and functional recovery, and were not influenced by the age and body mass index (BMI) of the patients.

Materials and Methods

The research population comprised 148 patients that underwent 175 Miller-Galante (Zimmer, Warsaw, In) UKR surgery between 2001 January and 2010 January.

Patients with medial compartment knee arthritis were selected after fulfillment of inclusion and exclusion criteria. Inclusion criteria were patients age 40 or more, BMI <40 kg/m², no pain at rest, correctable varus deformity ≤15, flexion deformity ≤10, intact cruciate ligaments (anterior cruciate ligament, and posterior cruciate ligament), with minimum 90° of knee flexion and medial compartment osteoarthritis (Ahlback’s radiological grades 3 or 4) with “normal” other compartments. Patients with inflammatory arthritis, active or suspected infection in the knee, patellofemoral joint arthritis, posttraumatic arthritis, and previous history of high tibial osteotomy were excluded from the study.

All the patients had standard radiological assessment, including weight-bearing anteroposterior and lateral radiographs of knee joint, stress views (varus and valgus)
for the confirmation of the presence of full thickness of articular cartilage in the lateral compartment. The patellofemoral joint status was assessed by skyline view of the patella. Orthogonal views used for estimation of the mechanical axis and degree of varus deformity. The Ahlback’s classification\(^7\) used to grade the severity of arthritis. The Knee Society scores (KSSs) were used for the assessment of clinical and functional outcome in the postoperative followup.

The revision of UKR to total knee replacement due to any cause such as the loosening of components, infection, pain, or any other indications was defined as the failure of the surgery.

The statistical analysis performed using SPSS software (SPSS Inc., version 18.0). All the scale variables were tested for normality with the Kolmogorov–Smirnov test. Paired data were analyzed using a paired \(t\)-test. The Independent \(t\)-test was used to compare the KSS clinical and knee functional outcomes.

**Results**

Among the 148 patients, 57.1% (86) were male, 42.1% (62) were female of which 89 knees on the right side and 86 knees on the left side were replaced. The mean age at the time of index surgery was 61.7 years (range: 44–80 years), with the average age for males was 62.7 years and for females was 60.3 years, respectively. The mean BMI of the cohort at the time of index surgery was 29.19 kg/m\(^2\) (range 21–38 kg/m\(^2\)), mean BMI for males was 29 kg/m\(^2\) and for females it was 29.4 kg/m\(^2\) [Table 1].

The mean preoperative range of movement of BMI \(\leq 30\) kg/m\(^2\) was 111.3° and BMI group \(\geq 30\) kg/m\(^2\) was 108.7°, 95% confidence interval (CI) (−0.95, 6.20) \(P > 0.05\), respectively. The mean postoperative range of movement at the recent followup of BMI \(\leq 30\) kg/m\(^2\) was 118.4° and BMI \(\geq 30\) kg/m\(^2\) 118.3°, 95% CI (−3.7, 3.9) \(P > 0.05\), respectively.

The mean preoperative KSS knee scores for BMI \(\leq 30\) kg/m\(^2\) and BMI \(\geq 30\) kg/m\(^2\) was 47.4 and 46.2, 95% CI (−0.55, 2.96) \(P > 0.05\), respectively. The mean postoperative KSS knee scores at the recent followup for BMI \(\leq 30\) kg/m\(^2\) and BMI \(\geq 30\) kg/m\(^2\) was 91.6 and 92.4, 95% CI (−3.77, 2.06), \(P > 0.05\) respectively. The mean preoperative knee functional score (KFS) scores for BMI \(\leq 30\) kg/m\(^2\) and BMI \(\geq 30\) kg/m\(^2\) was 55.3 and 54.9, 95% CI (−1.12, 1.82) \(P > 0.05\), respectively. The mean postoperative KFS scores at the recent followup for BMI \(\leq 30\) kg/m\(^2\) and BMI \(\geq 30\) kg/m\(^2\), 91.6, 92.7 95% CI (−4.48, 2.23) \(P > 0.05\), respectively. In this study cohort, there was no statistically significant difference in KSS clinical and functional scores, \(P > 0.05\) [Table 2].

The average age of the cohort was 61.7 years. The sample size age group \(\leq 55\) and age \(\geq 55\) years was 38,137, respectively. The mean preoperative range of movement for age \(\leq 55\) and age \(\geq 55\) years age 111.5°,110.1°, 95% CI (−2.51, 5.38) \(P > 0.05\), respectively. The mean postoperative range of movement for age \(\leq 55\) and age \(\geq 55\) years was 116.7°, 118.9°, 95% CI (−6.36, 1.95) \(P > 0.05\), respectively. The mean preoperative KSS knee score for age \(\leq 55\) and age \(\geq 55\) years, 46.4, 47.2 t(173) 95% CI (−2.70, 1.17), \(P > 0.05\), respectively. The mean postoperative KSS Knee score for age \(\leq 55\) and age \(\geq 55\) years, 92.2, 91.7 95% CI (−2.79, 3.63) \(P > 0.05\), respectively. The mean preoperative KFS score for age group \(\leq 55\) and age \(\geq 55\) years, 54.4 and 55.4 95% CI (−2.55, 0.66) \(P > 0.05\), respectively. The mean postoperative KFS score for group age \(\leq 55\) years and age group \(\geq 55\) years, 91.3, 92.1 t(173) 95% CI (−4.53, 2.88) \(P > 0.05\), respectively [Table 3].

The preoperative varus of the study cohort improved from \(7^\circ\) (2° to 14°) to \(3^\circ\) (neutral to 5°), respectively. There were no signs of progression of arthritis in the lateral compartment in the cohort at last follow X-ray.

There were no significant complications per-operatively and postoperatively such as fractures, deep infection, deep vein thrombosis, and progression of arthritis.

The total number of revision surgeries performed was 7, in the cohort of 175 UKRs accounting 4% of failures in

| Table 1: Descriptive statistics |
|-------------------------------|
| Category                      | \(n\) | Minimum | Maximum | Mean±SD |
|-------------------------------|------|---------|---------|---------|
| Age                           | 175  | 44      | 80      | 61.7±8.62 |
| Preoperative followup         | 175  | 22      | 129     | 63.6±26.27 |
| BMI                           | 175  | 38      | 29.19±3.78 |
| Preoperative ROM              | 175  | 135     | 110.46±11.28 |
| Postoperative ROM             | 175  | 135     | 118.3±11.89 |

SD=Standard deviation, BMI=Body mass index, ROM=Range of motion

| Table 2: Body mass index group \(\leq 30\) and \(\geq 30\) kg/m\(^2\) statistics |
|-------------------------------|
| Parameter                   | BMI \(\leq 30\) | BMI \(\geq 30\) | \(n\) | Mean±SD |
|-------------------------------|---------------|----------------|------|---------|
| Age                           | \(<30\) | 117 | 62.5±9.004 |
| Preoperative ROM              | \(<30\) | 117 | 111.3±11.770 |
| Postoperative ROM             | \(<30\) | 117 | 118.4±11.833 |
| Pre-KSS                       | \(<30\) | 117 | 47.4±5.490 |
| Post-KSS                      | \(<30\) | 117 | 91.6±9.949 |

SD=Standard deviation, BMI=Body mass index, ROM=Range of motion, KSS=Knee society score, KFS=Knee functional score
Table 3: Age ≤55 years and age ≥55 years group statistics

| Parameter | Age   | n    | Mean±SD |
|-----------|-------|------|---------|
| BMI       | <55   | 42   | 29.9±4.496 |
|           | >55   | 133  | 28.9±3.518 |
| Preoperative ROM | <55   | 42   | 111.5±11.396 |
|           | >55   | 133  | 110.1±11.273 |
| Postoperative ROM | <55   | 42   | 116.7±13.419 |
|           | >55   | 133  | 118.9±11.375 |
| Pre-KSS   | <55   | 42   | 46.4±5.185 |
|           | >55   | 133  | 47.2±5.653 |
| Post-KSS  | <55   | 42   | 92.2±8.522 |
|           | >55   | 133  | 91.7±9.406 |
| Pre-KFS   | <55   | 42   | 54.4±4.559 |
|           | >55   | 133  | 55.4±4.631 |
| Post-KFS  | <55   | 42   | 91.3±10.245 |
|           | >55   | 133  | 92.1±10.713 |

SD=Standard deviation, BMI=Body mass index, ROM=Range of motion, KSS=Knee society score, KFS=Knee functional score

In the study, in the cohort 117 UKRs of BMI ≤30 kg/m², the failure rate was 4.27% (5 knees), and the main factor for failure was unexplained pain in 1.70% (2 knees), loosening of component 1.70% (2 knees), and polyethylene wear 0.85% (1 knee). In the cohort BMI ≥30 kg/m², failure rates were 3.44% (2 knees) and the factor for failure was unexplained pain.

In the cohort 133 UKRs of age ≥55 years, the failure rate was 4.27% (5 knees) and the main factor for failure was unexplained pain in 2.7% (3 knees), loosening of component 1.70% (2 knees), and polyethylene wear 0.85% (1 knee). In the cohort age ≥30 kg/m², failure rates were 3.44% (2 knees) and the factor for failure was unexplained pain.

Discussion

The long term success of UKR depends on the stringent patient selection criteria and surgical technique. Bremner-Smith et al., in their study reported that KSS knee scores tend to decline with advancing age, but results of the present study reported age did not influence the clinical and functional scores. The mean age at the time of index surgery was 61.7 ± 8.6 years, and the KSS Knee score of the cohort was 91.8 ± 9.2, and function score was 92 ± 10.1 at the last followup (P < 0.001).

Lidgren et al., reported age at the time of surgery is a significant factor for implant survival both in UKR and TKR, and age is not a good criterion for deciding between the two treatments. The published literature reports in younger patients TKR provides reliable function and good survival and also advocated for unicompartmental osteoarthritis. The retention of the cruciate ligaments, restoration of knee kinematics, preservation of bone, and better functional results are the advantages of UKR over TKR. The revision of UKR is easier than TKR.

Tabor et al., compared 5–20 years results of fixed bearing UKR in patients age over or under 60 years at the time of surgery. The survival rate for all the implants was 93.7% at 5 years, 89.8% at 10 years, 85.9% at 15 years, and 80.2% at 20 years. Parratte et al., reported good functional and radiological outcome in 35 patients of 50 years or younger, 12 years survivorship of 80.2% with fixed bearing UKR. Pennington et al., reported good results in patients 60 years or younger with fixed bearing UKR with 11 years survivorship of 92%. Price et al., in a multicenter study of the Oxford UKR compared 512 patients, older than 60 and 53 patients under and showed that this implant functions well and is durable in patients younger than 60, although the survival was lower for this group (91% at 10 years in the <60 group vs. 96% in the >60 group).

In the study cohort, 21.7% (38) were aged ≤55 years and 78.3% (137) aged ≥55 years. There was no statistically significant difference in KSS knee scores and functional Knee scores between the two groups. In the age group ≤55 years, two patients (5.2%) underwent revision surgery, for polyethylene wear and for unexplained pain. The failure rate in the age group ≥55 years was 3.6% [5 knees]. The main cause of failures was unexplained pain in three patients [2.17%] and loosening the component was reported in two patients (1.4%). Considering the cohort size between the two age groups, the revision rate was not statistically significant among the groups. From this study, it is evident no statistically significant difference between two aged groups with respect revision rate, KSS knee score, and functional scores during the followup 2–10 years.

Berend et al., reported 22% early implant failure rate in UKR patients with BMI of 32 kg/m² or greater at mean followup time of 40 months (range, 24–69 months). Author of the study attributed the failures were due to tibial plateau fractures, aseptic loosening, infection, intractable pain, or further development of degeneration in the lateral compartment. Tabor et al., reported obese patients had higher survival than those who are not obese in the mean followup of 20 years in 82 patients. Studies have reported that patients with high BMI have inferior results than do with patients with lower BMI in Total Knee Replacement. Heck et al., reported that patients with BMI of 32.6 kg/m² have higher revision rate in comparison to patients with BMI 24.7 kg/m² at a mean followup of 6 years (maximum 14.8 years), in review of 294 consecutive UKR performed at 3 centers. He also reported higher risk of failure in patients heavier than an arbitrary cutoff weight of 81 kg (P = 0.0001), also cautioned the body weight >82 kg as an absolute contraindication for the UKR. Bonutti et al., reported the patients with BMI of 35 kg/m² or greater are at higher risk of early failure when compared to BMI <35 kg/m² at a mean followup 3 years (range, 2–6 years). In another study by Kuipers et al., reported in patients with Oxford PhaseIII UKR found no early difference between obese and nonobese patients.
Body weight is no longer a contraindication to UKR and over correction is the single significant factor detrimental to survival of UKR as reported by Cavaignac.21

In this study cohort of BMI ≤30 kg/m² and BMI ≥30 kg/m², there was no statistically significant difference in the clinical and functional outcome following UKRs (P > 0.05). The failure rates were more in the group of BMI <30 kg/m², with 4.27% (5 knees) needed revision surgery. The main cause of failure was unexplained pain (2 knees); loosening of the component (2 knees), and polyethylene wear (1 knee). The failure rates in the BMI group >30 kg/m² were 3.44% (2 knees) and main factor was unexplained pain.

The main limitation of the study was it was retrospective case series study. The average follow up of the study was short when compared with the most series present in the literature. In conclusion, this study confirms age and BMI should no longer be considered contraindication to UKR.

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Conflicts of interest
There are no conflicts of interest.

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