



Total knee arthroplasty for severe osteoarthritis treatment outcomes: An evaluation study

Quang-Tri Lê¹✉, Ngoc-Thanh Do², Huu-Hung Phan³, Minh-Hoang Nguyen⁴

¹Department of Orthopedics, 7A Military Hospital, 466 Nguyen Trai Street, Ward 8, District 5, Ho Chi Minh City, 72706, Vietnam; Email: lqtri@ntt.edu.vn; tsbstri@yahoo.com

²Department of Orthopedics, 7A Military Hospital, 466 Nguyen Trai Street, Ward 8, District 5, Ho Chi Minh City, 72706, Vietnam; Email: bs.dongcothanh@gmail.com

³Department of Orthopedics, 7A Military Hospital, 466 Nguyen Trai Street, Ward 8, District 5, Ho Chi Minh City, 72706, Vietnam; Email: bsphhung@gmail.com

⁴Department of Orthopedics, 7A Military Hospital, 466 Nguyen Trai Street, Ward 8, District 5, Ho Chi Minh City, 72706, Vietnam; Email: nthoang@ntt.edu.vn; bsnguyenminhhoang@yahoo.com.vn

✉ Corresponding author

Department of Orthopedics, 7A Military Hospital, 466 Nguyen Trai Street, Ward 8, District 5, Ho Chi Minh City, 72706, Vietnam; Email: lqtri@ntt.edu.vn; tsbstri@yahoo.com

Article History

Received: 17 December 2019

Reviewed: 19/December/2019 to 09/February/2020

Accepted: 09 February 2020

E-publication: 15 February 2020

P-Publication: May - June 2020

Citation

Quang-Tri Lê, Ngoc-Thanh Do, Huu-Hung Phan, Minh-Hoang Nguyen. Total knee arthroplasty for severe osteoarthritis treatment outcomes: An evaluation study. *Medical Science*, 2020, 24(103), 1080-1085

Publication License



This work is licensed under a Creative Commons Attribution 4.0 International License.

General Note



Article is recommended to print as color digital version in recycled paper.

ABSTRACT

Aims: This study aims to evaluate the outcomes of knee arthroplasty for the treatment of severe osteoarthritis in 7A Military Hospital from Jun 2016 to Jun 2019. **Methods:** This study used a cross-sectional descriptive approach and made an investigation on 78

patients treated with total knee arthroplasty using Triathlon (Stryker) prosthetic knee in 7A Military Hospital from Jun 2016 to Jun 2019. *Results:* The maximum, minimum, and average ages of the patients were 95, 53, and 64.8 (11.3) years, respectively. There were 20 males (25.6%) and 58 females (74.4%) patients. Thirty-four patients had left knee arthroplasty, and forty-four had right knee arthroplasty. The average hospital stay-in was 9.8 (2.8) days, and the average monitor time was 17.2 (0.8) months. The average Knee Score was 59.6 (10.1) preoperatively and 89.2 (11.6) postoperatively; the difference was significant ($p < 0.05$). Average Knee Function Score was 33.5 (4.9) preoperatively and 79.3 (6.1), the difference was significant ($p < 0.05$). The average knee bending angle was 106.7° (16.2°). Pleasant of treatment outcome was achieved in 79.5% cases. *Discussion:* The results showed a definite improvement of knee conditions and functional movement, and the patient's responses were generally satisfactory, which was compatible with other literature reports. *Conclusion:* Knee arthroplasty is an effective treatment for severe cases of osteoarthritis; it relieves the pain, improves joint movement and ambulation, and increases life quality for the treated patients.

Keywords: Knee osteoarthritis; Total arthroplasty; Knee arthroplasty.

1. INTRODUCTION

Osteoarthritis in the knee is a common disease known to associate with progressive declines in strength, flexibility, and reduced ability to perform functional tasks. It is also one of the most frequent causes of disability, responsible for 80% of the years lived with disability related to osteoarthritis based on WHO's Global Burden of Disease Study 2010. Aged people and obese individuals are the most sensitive groups; hence in the context of an aging population and increasing prevalence of obesity, this disease has been a concerning issue. A study of the Framingham Osteoarthritis showed that knee pain and symptomatic osteoarthritis in the United States rose twice, and women and thrice in men during the 20 years of the research. It is also estimated that more than half of the patients older than 65 years have the radiographic indication of knee arthritis. Total knee arthroplasty is amongst the most successful and effective treatments for patients with severe osteoarthritis more than 90% of such operations are for treatment of knee osteoarthritis (Parratte and Pagnano, 2008; Swank et al., 2011; Van-Manen et al., 2012; Lohmander, 2013; Choi & Ra, 2016).

Total knee arthroplasty has been performed since 1970 worldwide and is increasingly popular. The annual rate of total knee replacement increased seven-fold in the US from 1971 to 2008 and tripled in UK women from 1991 to 2006 (Carr et al., 2012). In the United States, 4.7 million individuals were living with a prosthetic knee in 2010 (Maradit-Kremers et al., 2015). In Viet Nam, knee arthroplasty has been done for more than a decade, most of the cases were total arthroplasty and were performed in large clinical centers (Le, 2000; Nguyen & Ngo, 2005; Truong, 2008; Ngo et al., 2010). Since 2015, 7A Military Hospital has carried out total arthroplasty for severe osteoarthritis patients and achieved positive initial results; however, none evaluation study of these results had been done. Therefore this study was carried out to evaluate the outcomes of total knee arthroplasty for severe osteoarthritis cases in 7A Military Hospital.

2. MATERIALS AND METHODS

Experimental participants

Participants of this study were severe osteoarthritis patients at III and IV stages (shown in radiographs) based on the criteria of Kellgren and Lawrence (1957). The prosthetic cemented Triathlon (Stryker) knee was used in this study.

Study design

This study followed the cross-sectional descriptive approach. The treatment outcome was evaluated based on the new Objective Knee Score (OKS) and Knee Function Score (KFS) of the Knee Society (Scuderi et al., 2012). The OKS was completed by surgeons, assessing "Alignment" through radiograph (max 25 points), "Instability" (max 25 points), "Joint motion" (1 point for each 5° degree of joint movement, allow 25+ points), and "Symptoms" (two 10-point scales rated by patients for their pain levels when walking and stair climbing). The KFS assesses four groups of activities with maximum score 100 points, including "Walking and Standing" (max 30 points), "Standard Activities" (max 30 points), "Advance Activities" (max 25 points), and "Discretionary Activities" (max 15 points). Postoperative clinical results were monitor for six months and one year.

Surgical procedures

Endotracheal and spinal anesthesia was used. Preoperative antibiotics (Cephalosporin third generation) was administered 30 minutes before surgery. The patient was laid on a supine position with proper sterilization and preparation beforehand. The tourniquet was applied close to the groin with the pressure of 350-400 mmHg after blood accumulation. We used the medial parapatellar approach

for operation. The incision of 10 – 15 cm was made on the knee midline from the tibial tuberosity to 4 – 5 cm apart from the superior pole of the patella. The incision was opened toward the joint, 1 cm apart from the inner border of the patella, running along the quadriceps tendon, and should be broad enough to move the patella aside for exposing the joint. The patella was turned outward to expose the joint. The knee was then bent to the maximum, and the menisci were released. The posterior and anterior cruciate ligaments were dissected; the bone spurs and inflammatory synovial strata were removed. Soft tissue contraction and severe knee disfiguration may require the additional release of lateral ligaments.

For femoral dissection, first, a drilled hole was made in the intercondylar fossa, 3 mm apart from posterior cruciate ligament to the front and 3 mm aside so that the drilling can approach the femoral canal. The intramedullary tube was inserted, and the distal femoral cut was located with a tilt of 7° from the femoral shaft axis. The standard cross-sectional thickness should be 10mm and was subject to change based on knee disfiguration. The anterior and posterior cuts were then performed so that the condyles made an eversion of 3°. The knee was then straightened and the leg was adducted to the fullest. The distance between cut femoral condyles and the tibial plateau was measured for the following tibial dissection. For the tibial dissection, the tibial axis positioning device was used. The cut had to go through the lowest position of the tibial medial condyle; in the case of severe disfiguration, the cross-sectional thickness at the lateral condyle should not exceed 10 mm. The cut was perpendicular to the tibial axis both in anteroposterior view or lateral view. The suitable size for the tibial component was selected. Bone spurs, inflammatory synovial strata, and cartilage on the patella were removed. Patella replacement should be performed in the case of erosion.

The prosthetic knee was tested for the criteria of total bending and unbending, medial-lateral and anteroposterior stability, physiological axis, patella sliding normality (no dislocation during knee bending). When inserting the implants, the tibial condyles and the femoral parts must turn outwards. The tibial component was added first followed by the femoral component, the tibial part slid into the tray and then fixed. The cement was applied to both the bone and the prosthetic implants for homogenous distribution. The knee was reduced and was left in an entirely straight posture during cement congealment as such posture enabled tight compression of the prosthetic implants towards the bones.

The joint capsule, the quadriceps tendon, and the patellar tendon were carefully reconnected to ensure quick rehabilitation. The pressure drainage was applied for 48 hours. Conventional postoperative treatment (antibiotics, pain remedy, and edema treatment) was implemented. Conventional preventive anticoagulant administration included Lovenox 04 ml subcutaneous injection for three days after surgery, then clopidogrel 75mg (2 tablets/ day) for a month. Pain relief was performed postoperatively and before rehabilitative exercising. Rehabilitation consisted of exercises for quadriceps femoris muscles, gluteal muscles, lower leg muscles, hip, and ankle. The patient had walking exercises with a crutch from day 3 to week four postoperatively, and normal ambulation could be achieved four weeks after surgery.

Data analysis

The data were analyzed using standard medical statistics using SPSS 16.0 software.

Ethical declaration

The patients and relatives are well-informed of their conditions and treatments and were asked to take part in the study. Participation was strictly volunteered and verified by signed documents. This study was genuinely done by the listed authors and had not been published in any scientific journal. Medicine Scientific Research Ethics Committee of the 7A Military Hospital approved this study (Number: 161/QĐ-HĐYĐ-BV7A, date: 25.06.2016)

3. RESULTS

General Information

The maximum, minimum, and average ages of the patients were 95, 53, and 64.8 (11.3) years, respectively. There were 20 males (25.6%) and 58 females (74.4%) patients. There were four patients with stage III knee osteoarthritis and 74 with stage IV; 34 had osteoarthritis on the left knee and 44 on the right. The average hospital stay-in and monitoring time was 9.8 (2.8) days and 17.2 (0.8) months, respectively.

Knee injury characteristics

Primary osteoarthritis happened in 69 patients (88.5%) (Figure 1). Six cases (7.7%) had post-traumatic osteoarthritis, and four (5.1%) had rheumatoid arthritis. Sixty-two cases (79.5%) had genu varum over 10°. Twelve cases (15.4%) had genu varum with flexion contracture. Six cases (7.7%) had genu valgum.

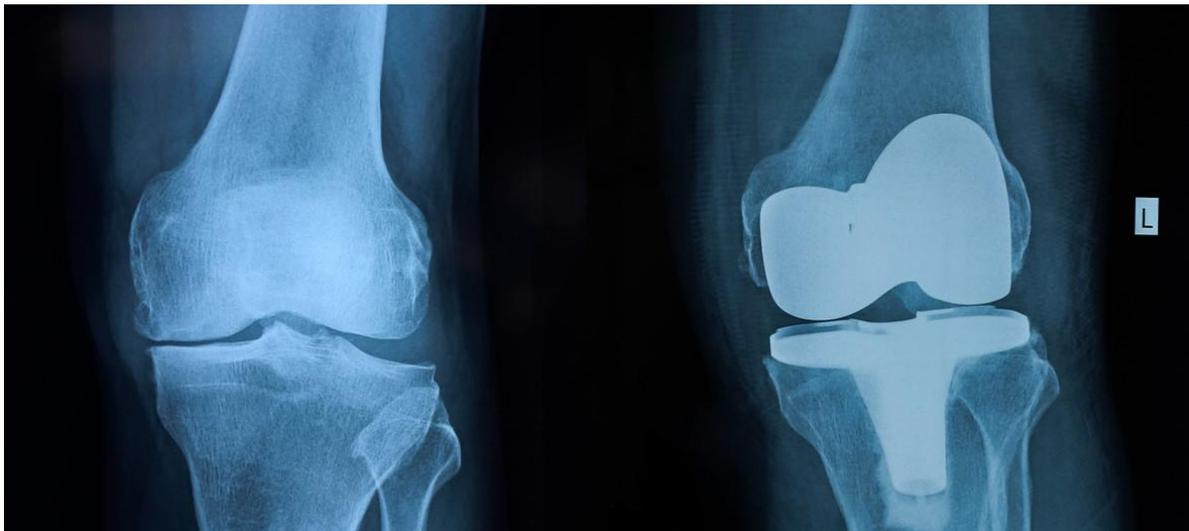


Figure 1 A case of a 67-year-old patient with osteoarthritis before and after the surgery

Objective Knee Score before and after surgery

The averaged Knee Score (OKS) was 59.6 (10.1) preoperatively and 89.2 (11.6) postoperatively. The difference was significant ($p < 0.05$). The detailed results were presented in Table 1.

Table 1 Objective Knee Score outcome of the studied patients.

Objective Knee Score result	Before the surgery		After the surgery	
	Number	Percentage	Number	Percentage
Very good	0	0	63	80.8%
Good	0	0	12	15.4%
Average	4	5.1%	3	3.8%
Poor	74	94.9%	0	0
Total	78	100%	78	100%

Knee Function Score

The average Knee Function Score (KFS) was 33.5 (4.9) preoperatively and 79.3 (6.1) postoperatively. The difference was significant ($p < 0.05$). The detailed results were presented in Table 2. Satisfaction with the treatment was achieved in 79.5% of the patients.

Table 2 Knee Function Score outcome of the studied patients.

KFS Result	Pre-operation		Six months postoperation		One year postoperation	
	Number	Percentage	Number	Percentage	Number	Percentage
Very good	0	0	62	79.5%	65	83.3%
Good	0	0	11	14.1%	11	14.1%
Average	7	9.0%	5	6.4%	2	2.6%
Poor	71	91.0%	0	0	0	0
Total	78	100%	78	100%	78	100%

4. DISCUSSION

Knee osteoarthritis usually occurred in aged women with osteoporosis and was treated by various methods without a result, which is compatible with the study data. Other studies also reported a higher female ratio (Le, 2000; Nguyen & Ngo, 2005; Truong, 2008; Ngo et al., 2010; Van-Manen et al., 2012; Carr et al., 2012; Meding et al., 2012; Yang et al., 2012; Maradit-Kremers et al., 2015). The main reason for knee arthroplasty in this study was primary osteoarthritis (88.5% of the cases). The disease had been progressed for years; the patients suffered from many difficulties in daily activities and had extended time treatment with internal medication. Post-traumatic osteoarthritis made up of 7.7% cases; four patients had tibial plateau fractures with failed surgical treatment. This group had severely disfigured post-traumatic soft tissue; hence modification of them for joint stability was a great challenge. Four patients

(5.1%) suffered from rheumatoid arthritis sequelae with damaged cartilage, inflammatory capsule and poor bone quality which required reinforcement from cancellous bone implants taken from the removed bone; consequently, these patients got more severe postoperative pain which badly affected functional rehabilitation – four cases with “average” OKS outcome were because of this reason.

Varus malalignment is atypical knee disfiguration result of knee osteoarthritis (Scuderi et al., 2012). The patients usually had damaged tibial plateau cartilage and medial femoral condyle. The worst deviation seen in this study reached the angle of 30°; such deviation was not difficult for knee soft tissue modification as a good range of knee bending was achieved after the release of the iliotibial band. Six cases (7.7%) had valgus malalignment, which was a rare one; in such cases, lateral ligament orthopedics was required. Twelve cases (15.4%) had genu varum with flexion contracture; the balancing of soft tissue in these cases was complicated and demanded the release of iliotibial band in the posterior capsule and the attachment site of the hamstring tendon.

The knee score before and after surgery (59.6 and 89.2, respectively) was significantly different ($p < 0.05$), and the outcome of axis adjustment was positive, which was compatible with other studies. Meding *et al.* (2012) reported average knee score was 54 preoperatively and 75-89 after the operation. Arthur *et al.*, (2013) reported preoperative and postoperative knee scores were 31 and 79, respectively. Ranawat *et al.*, (1993) reported 83% “very good” result, and Scott *et al.*, (1998) reported 86.5 “good” and “very good” outcomes, which are higher than our study (80.8%). The reason was probably the increasing quality of equipment and devices in this kind of surgery, which enabled better axis adjustment results. Four patients with sequelae of rheumatoid arthritis (5.1%) had more severe postoperative pain, which badly affected functional rehabilitation and resulted in the corresponding three cases with only “average” OKS result. We suggest further study with a larger sample will be beneficial for a better assessment of the postoperative outcomes.

There was a significant difference in the functional knee outcome before and after surgery ($p < 0.05$), and the functional rehabilitation yielded improvements. Cloutier *et al.* (1999) reported satisfaction in 90.9% of the patients which was higher than our study; the reason was probably because our patients were in the late stages with severe osteoarthritis and significant deviation, especially the patients with rheumatoid arthritis and post-traumatic osteoarthritis, moreover the surgeons in our study still lacked adequate experiences in axis adjustment and soft tissue balancing, which can be improved in the future. Meanwhile, Choi and Ra (2016) reported that patient satisfaction could range from 75% to 92%. In our opinion, our study results fit reasonably well with the literature, but further studies are necessary to optimize the procedures and assessment of total knee arthroplasty outcomes.

5. CONCLUSION

Knee arthroplasty in 7A Military Hospital managed to yield good results. It can be considered as the optimal choice for severe cases of knee osteoarthritis; it can provide pain remedy, knee motion improvement, and increase of life quality for patients with a highly damaged knee.

Declaration

Scientific Responsibility Statement

The authors declare that they are responsible for the article’s scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Funding

This research received no external funding.

Conflict of interest

None of the authors received any type of financial support that could be considered a potential conflict of interest regarding the manuscript or its submission.

Contribution

This work was carried out in collaboration with all authors. All authors read and approved the final manuscript.

REFERENCE

1. Arthur CHC, Wood AM, Keenan ACM, Clayton RAE, Walmsey P, Brenkel I. Ten-year results of the Press Fit Condylar Sigma total knee replacement. *Bone Joint J.* 2013;95-B:177-80.
2. Carr AJ, Robertsson O, Graves S, Price AJ, Arden NK, Judge A, et al. Knee replacement. *Lancet.* 2012;379:1331-40.
3. Choi YJ, Ra HJ. Patient Satisfaction after Total Knee Arthroplasty. *Knee Surg Relat Res.* 2016;28(1):1-15.
4. Cloutier JM, Sabouret P, Deghrar A. Total Knee Arthroplasty with Retention of Both Cruciate Ligaments. A Nine to Eleven-Year Follow-up Study. *Bone Joint Surg Am;* 1999; 81: 697-702.
5. Felson DT, Niu J, Gross KD, Englund M, Sharma L, Cooke TD, et al. Valgus malalignment is a risk factor for lateral knee osteoarthritis incidence and progression: findings from the Multicenter Osteoarthritis Study and the Osteoarthritis Initiative. *Arthritis Rheum.* 2013;65(2):355-62.
6. Kellgren JH, Lawrence JS. Radiological Assessment of Osteo-Arthrosis. *Ann Rheum Dis.* 1957;16(4):494-502.
7. Le P. Total knee joint: basic issues. HCMC: University of Medicine and Pharmacy at Ho Chi Minh City; 2000. (in Vietnamese)
8. Lohmander LS. Knee replacement for osteoarthritis: facts, hopes, and fears. *Medicographia.* 2013;35:181-8.
9. Maradit-Kremers H, Larson DR, Crowson CS, Kremers WK, Washington RE, Steiner CA, Jiranek WA, Berry DJ. Prevalence of Total Hip and Knee Replacement in the United States. *J Bone Joint Surg Am.* 2015;97(17):1386-97.
10. Meding JB, Meding LK, Ritter MA, Keating EM. Pain Relief and Functional Improvement Remain 20 Years After Knee Arthroplasty. *Clin Orthop Relat Res.* 2012;470(1):144-9.
11. Ngo VT, Nguyen VT, Nguyen QT, Doan VQ, Nguyen TS, Nguyen TT, et al. Remarks on initial results of total knee arthroplasty at Viet-Duc Hospital. *Vietnam J Med.* 2010;2:29-33. (in Vietnamese)
12. Nguyen TC, Ngo BK. Initial outcomes of total knee arthroplasty at Saigon – ITO Orthopedics Hospital. *HCMC J Med.* 2005;9(S2):134-6. (in Vietnamese)
13. Parratte S, Pagnano MW. Instability after total knee arthroplasty. *J Bone Joint Surg.* 2008;90(1):184-94.
14. Ranawat CS, Flynn WF, Saddler S, Hansraj KK, Maynard MJ. Long-term results of the total condylar knee arthroplasty 15-year survivorship study. *Clin Orthop.* 1993;286:94-102.
15. Scott WN, Rubinstein M, Scuderi G. Results after knee replacement with a posterior cruciate substituting prosthesis. *J Bone Joint Surg.* 1998;70(8):1163-73.
16. Scuderi, G.R., Bourne, R.B., Noble, P.C. et al. The New Knee Society Knee Scoring System. *Clin Orthop Relat Res.* (2012);470:3-19.
17. Swank AM, Kachelman JB, Bibeau W, Quesada PM, Nyland J, Malkani A. Prehabilitation Before Total Knee Arthroplasty Increases Strength and Function in Older Adults With Severe Osteoarthritis. *J Strength Cond Res.* 2011;25(2):318-25.
18. Truong TH. Initial results of total knee arthroplasty at HCMC Orthopedics Hospital. 15th Conference of Orthopaedics in Ho Chi Minh City; 2008. 16-21. (in Vietnamese)
19. Van-Manen MD, Nace J, Mont MA. Management of Primary Knee Osteoarthritis and Indications for Total Knee Arthroplasty for General Practitioners. *J Am Osteopath Assoc.* 2012;112(11):709-15.
20. Yang B, Yu JK, Chen LX, Wang YJ, Wang J, Ma D. Sex, age, and annual incidence of primary total knee arthroplasty: a university affiliated hospital survey of 3118 Chinese patients. *Chinese Med J.* 2012;125(22):3952-5.