



## Mid-term outcomes of posterior capsular release for fixed flexed deformity after total knee arthroplasty

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Fixed flexion deformity also called flexion contracture is relatively rare, but a very demanding functional limitation that both surgeons and patients may have to deal with. The purpose of the present study was to evaluate the functional outcomes after posteromedial capsular release in case of fixed flexed deformity > 15°. Between June 2011 and November 2018, 15 patients (6 males and 9 females) were treated with open posterior capsular release through medial approach for fixed flexion deformity of the knee > 15° and prospectively followed with a minimum follow-up of 2 years. Primary outcome was knee extension measured with a manual goniometer and secondary outcome treatment related complications. All patients reported inability to walk and clinical semiology of pain and swelling. The mean age of the study population at surgery was 61.7 years with a mean BMI of 30.9 kg/m<sup>2</sup>. Complete data were recorded for all patients. Statistically significant improvement was found in clinical and functional assessment tools analyzed from baseline to the latest follow-up (p<0.05). More precisely, the mean postoperative fixed flexion deformity was decreased from 23.57° to 2.86°. No adverse effect or major complications were recorded during follow-up.

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*Ethical Approval: all procedures 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.*

*Informed Consent: written informed consent was obtained from all subjects before the study.*

Posterior open release via posteromedial was shown to be an efficient and safe salvage procedure to deal with persistent fixed flexion deformity of more than 15° following TKA at two years follow-up. However, future studies with a higher number of participants and longer follow-up should be conducted to validate our data.

**Keywords:** fixed flexion deformity; flexion contracture; stiffness; total knee arthroplasty; release.

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## INTRODUCTION

Total knee arthroplasty (TKA) is considered among the most effective and reliable treatments for patients with advanced knee osteoarthritis (1). However, patients' satisfaction is still relevant, as up to 20% of them continue to have postoperative pain, functional limitations, and low treatment satisfaction rate (2).

Several conditions adversely affect postoperative results and cause poor outcomes, including stiffness and more so fixed flexion deformity (FFD) leading to dissatisfied patients (3,4). Indeed, patients with postoperative fixed flexion deformity, also called flexion contracture, have a significant higher incidence of anterior knee pain and functional limitations (5).

It has been documented that fixed flexion deformity results in extended forces across the patello-femoral and the tibio-femoral joints. Activities of daily life, such as standing and walking, in a flexed knee require increased stress on the extensor mechanism and result to accelerated fatigue. In addition, the quadriceps force required to stabilise the knee rises with the degree of FFD (6,7).

Various factors affecting FFD following total knee arthroplasty, including implant design, surgical technique, reduced preoperative range of motion (ROM), trauma sequelae, prior knee surgery, inflammatory diseases and incipient arthrofibrosis (8-11). The prevalence of this major complication is still variable in the literature and ranges from 1.5 to 17% (12-14).

The majority of the cases presenting minor fixed flexion deformity may be tolerated by the patient and resolved with time or may be without clinical relevance (15). However, for severe contractures, above 15°, surgical treatment is necessary (16,17).

Different treatment modalities have been described to cope with this significant issue, including manipulation under anaesthesia (MUA), arthroscopic or open debridement, and lastly, implant revision (1,15,17-19).

Thus, the purpose of the present study was to evaluate the functional outcomes after open posteromedial capsular release, a less invasive pro-

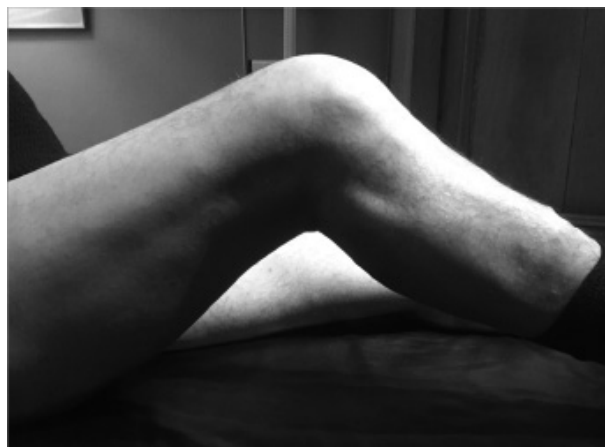


Figure 1.

cedure than revision surgery, in the case of fixed flexion deformity > 15°.

## MATERIALS AND METHODS

Between June 2011 and November 2018, 15 patients (6 males and 9 females) were treated with open posteromedial capsular release for fixed flexion deformity greater than 15° (Fig. 1) following total knee arthroplasty. All patients prospectively followed with a minimum of a two-year follow-up and prior to surgery reported inability to walk, limited range of motion, pain, and swelling. The mean age of the study population at surgery was 61.7 years, with a mean BMI of 30.9 kg/m<sup>2</sup>. The inclusion and exclusion criteria are listed in Table 1. Patients' demographic characteristics are provided in Table 2.

Table 1. — Inclusion and Exclusion Criteria of eligibility

### Inclusion Criteria

1. Fixed flexion deformity >15°
2. Male and female gender with primary TKA
3. At least 1 year after implantation
4. Body Mass Index (BMI) < 35 kg/m<sup>2</sup>
5. Clinical semiology of pain, swelling, stiffness and inability to walk

### Exclusion criteria

1. Previous surgery for stiffness
2. Inflammatory joint disease, rheumatoid or septic arthritis
3. Preoperative flexion contracture

Table 2. — Patient's Demographic Characteristics

Characteristic	Patient Data
Sex	Female, n=9 Male, n=6
Age	61,7 years (range 56-71)
BMI	30.9 kg/m <sup>2</sup> (range 28-34)
Side	Right, n= 8 Left, n= 7
Indication for TKA	Primary OA n= 12 Post Traumatic OA n= 3
ASA	II n = 5 III n = 9 IV n = 1

All the procedures were performed by the same senior surgeon. Patients were placed in supine position under general anaesthesia with tourniquet application after administration of common antibiotic prophylaxis. Standard sterile preparation and draping were systematically used. A soft and meticulous manipulation was initially performed to regain better motion or full extension. Then, a longitudinal incision of approximately 5-8 cm long was made starting from the medial epicondyle and extended caudally parallel to the femoral shaft. A retrocondylar arthrotomy was performed, and the medial part of the posterior joint capsule was gradually detached from the distal femur using electro surgical diathermy. No rasps were used to avoid bony reaction. All adhesion scars were detached from their bony cortical adherences until just past the lateral femoral condyle avoiding the risk of injury of the peroneal nerve (Fig. 2). The knee was then extended until full range of motion often with a small “crack” rupturing the remaining lateral condyles adherences (Fig. 3). Finally, the incision was closed. A suction drain was not placed systematically. A compression bandage was applied for 48 hours.

Primary outcome was knee extension as measured with a manual goniometer with patient in supine position from the lateral side of the knee. Secondary outcome was to report treatment related major complications. Major complications included

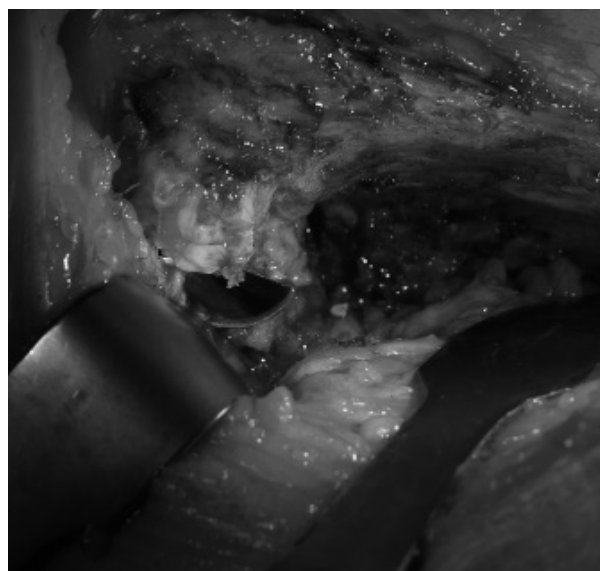


Figure 2.

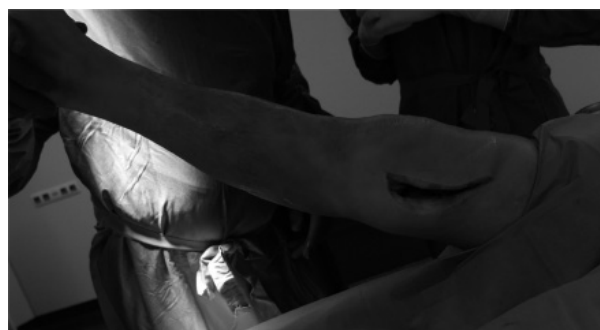


Figure 3.

the cases with persistent fixed flexion deformity above 5° or needing revision surgery.

All patients accepted to follow the same rehabilitation protocol, with intermittent mobilization using a knee continuous passive motion (CPM) unit, extension postures as tolerated, repeated static quadriceps contractions, and wear of a dynamic extension brace at night.

All data were analysed by an independent statistician. Statistical analysis was conducted using SPSS 24.0 (IBM Corp, Armonk, NY). For all the values, the mean and standard deviation are provided. The Saphiro-Wilk test was used to check if data were normally distributed. The paired t test for normally and the Wilcoxon signed-rank test for non-normally distributed data were performed to

analyze outcomes between pre-operative and post-operative findings, respectively. P-values less than 0.05 were considered statistically significant.

## RESULTS

Fifteen patients who met the eligibility criteria were included in this study and prospectively followed for at least 24 months (range 24-89 months). Complete data were recorded for all patients. Statistically, significant improvement was found in clinical and functional assessment tools analyzed from baseline to the latest follow-up ( $p < 0.05$ ). More precisely, the mean postoperative fixed flexion deformity was decreased from  $23.57^\circ$  to  $2.86^\circ$ . Radiographs during follow-up revealed no signs of prosthesis loosening, periprosthetic fracture, or dislocation. No adverse effects or major complications were recorded during follow-up.

## DISCUSSION

The most important finding of the present study was that posterior capsular release is an effective and safe procedure to manage severe fixed flexion deformity following total knee arthroplasty at two-year follow-up. All patients regain a close to normal ability to walk and improve functional and clinical outcomes. Hence, this technique can be applied when conservative treatment has failed to restore painful contractures and stiffness.

It has been well established that extension deficits considerably limit the expected range of motion and increase the necessary quadriceps strength to stabilize the weight bearing on the flexed knee. Moreover, this strength is directly related and increases with the degree of the deformity (20). To date, there is no clear consensus in the literature regarding neither the definition nor the incidence of FFD. Recently, Tibbo et al. (21) defined as acquired idiopathic stiffness a ROM  $< 90^\circ$  persisting for  $> 12$  weeks after total knee arthroplasty and reported a mean prevalence of 4%. They also found a significant negative correlation between stiffness and both female sex and obesity.

The consequence of minor contracture may be tolerated by the patient and resolved with time or

may be without clinical relevance. Nevertheless, beyond 15 degrees, it may cause severe disability and functional limitation, hence surgical treatment is required (16,17).

Several procedures have been described in the literature to deal with flexion contracture after TKA persisting to the conservative treatment (15,22,23).

The less invasive option is manipulation under anesthesia which is most effective within the first 3 months from the index procedure and minor FFD (24,25). Indeed, in their retrospective study, Namba et al. (26) concluded that flexion contractures are not significantly improved after late MUA (after 90 days). Moreover, Cates et al. (22) reported that this technique seems to be associated with poor outcomes in the case of extensive flexion contractures. The majority of the patients included in the current study presented chronic contracture at least one year after implantation. Hence, the potential benefits of MUA raised questions and, thus, was avoided. It is important to note that some of the patients reported MUA in the early postoperative period obviously without satisfactory outcomes, as they had to be treated surgically after all.

Posterior capsular release is crucial for satisfactory results when surgical treatment is applied. This procedure, either open or arthroscopic, has been conducted previously to deal with moderate to severe flexion contracture, unrelated to TKA, arthro-fibrotic knee with satisfactory results (27,28).

Bellemans et al. (29) confirm the efficacy of posterior capsular release in concomitance with bone resections through their four steps algorithm to correct flexion contracture in total knee arthroplasty. They described that almost 99% of knees with flexion contracture less than 30 degrees could be corrected with posterior capsular release and both meticulous resection of the osteophytes and overresection of the distal femur.

To our best knowledge, this is the first clinical study reporting results of isolated open posterior capsular release for severe flexion contracture after total knee arthroplasty. A less invasive procedure such as an arthroscopic release was avoided due to both the limited value of this technique (30) and the difficult posterior access to the knee; thus, it is less effective in correcting extension lag (31).

The present study results demonstrated a statistically significant progress from baseline to final follow-up. Fixed flexion deformity decreased from a mean of 24° preoperatively to a mean of 2.9° after procedure. Recently, in their retrospective review, Vahedi et al. (17) described a more invasive procedure. In fact, they combined posterior soft-tissue release (posterior capsule and hamstring tendons) with prophylactic peroneal nerve decompression and botulinum toxin type A injection. A total of 19 patients (21 knees) were included in their study, with a knee mean flexion contracture of 27° before surgery. At the final follow-up of two years, they reported a significant improvement as all patients regained full extension to 5° of hyperextension. These findings are quite similar to the outcomes reported in the present study. However, the included cohort could not reach full extension or even hyperextension. Nevertheless, this difference is not crucial for activities of daily life; combined with the less invasive and more cost-effective character of the procedure it appears as a preferable treatment option.

Fehring et al. (15) evaluated the efficacy of revision surgery for painful postoperative flexion contractures. They reported good clinical and functional outcomes at an average of 79 months follow-up. Extension improved from an average of 32.9° preoperatively to an average of 2.9° postoperatively. They concluded that revision surgery for significantly symptomatic flexion contractures after total knee arthroplasty could improve ROM and diminish pain. However, four out of fourteen patients had not complete resolution of their FFD. One patient had a 5° residual flexion contracture and 3 patients had residual flexion contractures of 10° or greater. This fact is in discordance with the present study as no case of above 5° of residual flexion contracture was observed. Moreover, it should be noted that revision surgery remains a major procedure thus, it should be applied as the last alternative when other routine surgical treatments, such as open posterior capsular release, options have failed.

There are also specific limitations that have to be considered in the current study. First, it was a case series with small number of subjects involved

and limited follow-up period. Second, the majority of the patients had their primary TKA in another institution, hence no adequate data regarding the preoperative conditions were provided. Third, the variety of the primary implants and finally the different surgical techniques could also be considered as another limitation. However, patients were suggested to have implant revision and were reluctant to proceed as imaging did not indicate any malplacement.

## CONCLUSION

Posterior capsular release via posteromedial approach was shown to be an efficient and safe salvage procedure to deal with persistent fixed flexion deformity greater than 15°, following TKA at two years follow-up. However, future studies with a higher number of participants and longer follow-up should be conducted to validate our data.

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