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The risk of manipulation under anesthesia due to unsatisfactory knee flexion after fast-track total knee arthroplasty

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ABSTRACT

Background: Fast-track TKA has significantly shortened the time available for physiotherapists to optimize knee ROM before discharge. Safety aspects concerning knee stiffness and the need for manipulation in a fast-track setting need to be illuminated. The study aims were to analyze if fast-track TKA can be considered safe considering rates of knee manipulation and if there is an association between knee ROM at time of discharge and the need for later manipulation.
Methods: Primary TKAs operated in 2011 at our institution were eligible for inclusion. The study group consisted of 359 TKAs.
Results: Manipulation of the knee was performed in 21 of 359 TKAs (5.8%). Seventy-one percent were discharged with a flexion ≥70° combined with an extension deficit of ≤10°. The occurrence of MUA for these patients was 4.3%. The prevalence of knee manipulation showed a statistically significant association with the achieved knee flexion at discharge ($p = 0.02$). Median length of stay was two days.
Conclusion: Compared with literature findings fast-track TKA surgery may be considered safe based on the acceptable rate of knee manipulations after TKA (5.8%). We suggest ROM of ≥70° flexion combined with an extension deficit of ≤10° as an "optimal-zone" for ROM at discharge. The reason for this is the low occurrence of MUA (4.3%) in relation to the large amount of TKAs it represents (71%). The indication for MUA is multifactorial and ROM at discharge serves only as an indicator of later MUA risk.

1. Introduction

Fast-track total knee arthroplasty, TKA surgery was first introduced in the 1990s and since then the approach has proved beneficial [1]. The fast track approach with a reduction of the surgical stress response as a cornerstone has reduced morbidity and mortality, increased patient satisfaction and also reduced postoperative hospital length of stay (LOS) hence reducing convalescence [2–5]. Before fast-track TKA surgery was introduced, patients were often hospitalized until they met certain range of motion (ROM) discharge criteria, which was based on the knowledge of ROM needed to walk, climb stairs, getting out of bed etc. [6]. This practice, however, resulted in LOS averaging up to 13 days [7] and as a result, low patient satisfaction and an increased risk of nosocomial diseases [8]. Since the introduction of fast-track TKA surgery, this has changed markedly. In the fast-track setting, ROM as a discharge criterion is replaced by functional discharge criteria leaving ROM measurement at time of discharge without immediate clinical importance. Studies have suggested that the measurement of ROM at discharge only serves as a possibility for inter-hospital comparison and not as an indicator for long-term outcome [7,9]. Some patients, however, do not gain satisfactory knee ROM after discharge and this can result in limitations in activities of daily living (ADLs) and dissatisfied patients. Knee manipulation under anesthesia (MUA) is a procedure used to treat a lack in flexion progress due to arthrofibrosis involving excessive pathologic postoperative scarring, which directly inhibits flexion [10,11]. In general, the indication for MUA is unsatisfactory knee range of flexion after TKA despite focused training efforts and when gross component malpositioning can be ruled out. The reduced LOS resulting from fast-track surgical principles and adherence to functional discharge criteria has resulted in a reduction of the time available for physiotherapists to train patients and optimize ROM before discharge. This could negatively affect the patients' chances of gaining satisfactory ROM after TKA surgery. The aim of this study was to assess the safety aspects of fast-track TKA concerning the risk of MUA after TKA surgery. Is a rapid discharge program to home associated with a higher rate of knee stiffness requiring MUA? Secondly, does knee ROM at time of discharge serve as a predictor of the need for later MUA?

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2. Materials and methods

By searching our institutional database of operations, we identified 398 primary TKAs operated at our department (Department of Orthopaedic Surgery, Copenhagen University Hospital Hvidovre, Denmark) in 2011. Of these, we excluded 20 TKAs that had undergone revision surgery for other causes than unsatisfactory ROM within the first year of primary TKA, and 19 TKAs because standardized goniometric measurements of ROM at time of discharge were unavailable. Thus, the study group consisted of 359 primary TKAs (338 patients/65% females) (Fig. 1). Study specific data concerning ROM and performed MUA's within one year of primary TKA were collected in an approved database. The discharge ROM was organized in intervals with flexion of <70°, 70°–<85°, ≥85° and extension deficits of <5°, 5°–<10°, ≥10° to give detailed information about the distribution of ROM at discharge.

Senior consultants specialized in arthroplasty surgery performed all surgical procedures using a standard length, medial para-patellar approach. During surgery, full extension was achieved as well as a minimum of 120° passive flexion (or until soft tissue contact in obese patients). The prostheses used were cemented, fixed bearing CR (cruciate retaining) (AGC, Biomet), uncemented, RP (rotating platform) (Vanguard ROCC, Biomet and PFC Sigma, Depuy) or cemented, fixed bearing PS (posterior stabilized) (LPS highflex and Gender, Zimmer). Standards of fast-track TKA surgery included a preference of spinal analgesia, administration of 1 g of tranexamic acid preoperatively, plugging of the femoral medullary canal, administration of local infiltration analgesia (LIA), and no application of drains. Multimodal oral opioid-sparing analgesia was given postoperatively to all patients (Cox2 inhibitor (celecoxib; 200 mg/12 hourly) paracetamol (slow release: 2 g/12 hourly), gabapentin (300 mg morning and 600 mg evening), with opioid only upon request). For thromboprophylaxis, Xarelto (rivaroxaban; 10 mg) was administered once a day until discharge, starting six to eight h postoperatively [12]. No extended prophylaxis was given and no mechanical devices were used (including compression stockings). Physiotherapy was initiated on the first postoperative day and continued until discharge by a team of dedicated arthroplasty in-hospital physiotherapists.

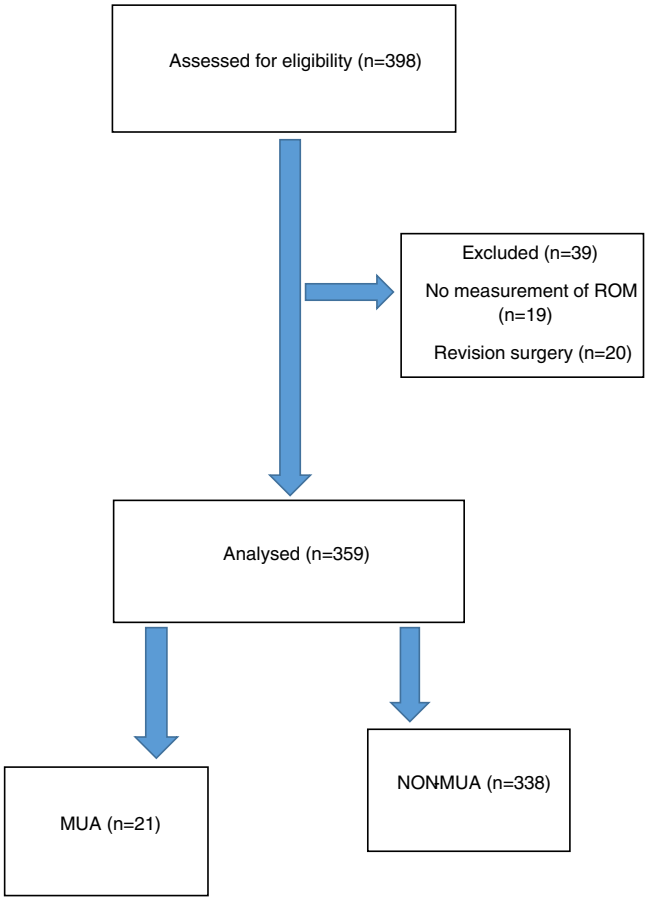

Fig. 1. Patient flow diagram.

The rehabilitation protocol consisted of mobilization with assistive devices on the first postoperative day and active and passive flexion on day 2. CPM (continuous passive motion) machines were not used. Physiotherapists supervised all inpatient physiotherapy in two 1-hour sessions per hospital day. When patients met functional discharge criteria (Table 1 [12]), they were discharged from hospital to their own homes. After discharge, physiotherapy was continued with a maximum of eight outpatient group sessions. Patients unsatisfied with ROM at follow-up underwent further active and passive flexion under instructions of a physiotherapist. Patients were advised to continue oral pain relief treatment with Paracetamol and NSAID for up to two weeks after surgery.

Prior to discharge standardized measurement of knee ROM was performed by a physiotherapist using a long-armed goniometer with the lateral epicondyle of the femur as the midpoint of the goniometer measurements. Patients were placed in a supine position with the hip and knee in neutral rotation. The proximal arm was parallel to the long axis of the femur and pointing at the greater trochanter. The distal arm was parallel to the long axis of the fibula and pointing at the lateral malleolus. In this set-up, it was possible to measure both knee flexion and extension deficit if present.

MUA was performed if patients were dissatisfied with the outcome of flexion after TKA and 1) if no progression were seen despite training efforts, 2) if there were specific complains of inability to perform ADLs, and 3) if gross malpositioning of TKA components were ruled out as a cause for the reduction in ROM. At our institution, MUA was performed with complete muscle relaxation and arthroscopically assisted. The hip was flexed to 90° of flexion and the surgeon bent the knee until he encountered a firm end-point. The proximal shaft of the tibia was then used as a lever arm forcing increased flexion. All MUA procedures were followed by arthroscopic debridement during the same anesthesia and the manipulation procedure repeated as needed. After MUA patients received supervised daily active and passive ROM exercises and three days of CPM (continuous passive motion)-machine exercises. After discharge exercises continued on an outpatient basis until satisfactory ROM was achieved. All patients who underwent MUA were scheduled for a three months follow-up consultation with the operating surgeon. Oral treatment with paracetamol, NSAID, and gabapentin was started on the day of operation. Opioids were used as rescue medication. The treatment was continued for one week.

3. Statistics

The data were presented as median values and ranges, and comparisons were made using the two-sample Wilcoxon rank-sum (Mann–Whitney) test. Binomial data are presented as percentages, and comparisons were made by Pearson's chi-square test. The level of significance was set at $p < 0.05$. A logistic regression model was used to estimate the effect of discharge flexion on MUA after TKA, the model was

Table 1
Functional discharge criteria.

Ability to get dressed independently
Ability to get in and out of bed
Ability to sit and rise from a chair/toilet
Independence in personal care
Mobilization with walker/crutches, and ability to walk >70 m with crutches
In addition, sufficient oral pain treatment (VAS < 5 on activity) and acceptance of discharge are prerequisites for discharge.