Manipulation under anaesthesia for stiffness following knee arthroplasty

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ABSTRACT

INTRODUCTION Stiffness following knee arthroplasty is a frustrating complication and a significantly disabling problem. We present our experience of knee stiffness requiring manipulation under anaesthesia (MUA) as the first line of treatment following partial or total knee arthroplasty.

PATIENTS AND METHODS All stiff knees requiring MUA over a 6-month period from March to August 2007 were retrospectively analysed from theatre records and case notes. Data were collected regarding demographics, range of knee motion before and after manipulation and at subsequent follow-up. Complications of the procedure and outcomes were also analysed.

RESULTS Twenty-one patients (11 female, 10 male) underwent MUA. The average age was 62 years (range, 56–80 years). Sixteen primary and 3 revision total knee replacements underwent manipulation, as did one medial unicompartmental replacement and one patellofemoral arthroplasty. General anaesthesia with good muscle relaxation was used in all but one patient. The mean duration between arthroplasty and MUA was 13.2 weeks (range, 6–32 weeks). The range of knee movement improved from a mean range of 10.4–71.2° in the pre-MUA period to 2.1–94.0° post-MUA and at follow-up was 2.3–91.9°. The mean arc of motion improved from 60.2° (range, 40–80°) pre-MUA to 91.9° (range, 45–120°) post-MUA. The mean improvement in the arc of motion was 31.6° ($P < 0.001$). At an average follow-up of 3 months (range, 6 weeks to 8 months), the mean arc of motion was 90.4° (range, 40–120°). The mean improvement in knee movement from the pre-MUA at the follow-up was 30.2° ($P < 0.001$). One patient failed to gain any improvement from MUA. There were no complications noted from the procedure.

CONCLUSIONS MUA has a role in the treatment of early stiffness with excellent immediate outcomes. We advocate that MUA should be the first line of management for stiff knee arthroplasties after failed physiotherapy.

KEYWORDS

Knee – Arthroplasty – Stiffness – Manipulation

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Stiffness following knee arthroplasty is a disabling problem and a frustrating complication both for the surgeon and the patient. The actual definition of what constitutes knee stiffness is variable in the literature. Kim *et al.*¹ describe stiffness as flexion contracture of $> 15^\circ$ and/or $< 75^\circ$ of flexion of the knee, whereas Christensen *et al.*² have defined it as an arc of knee motion $< 70^\circ$.

When the problem is identified early, a trial of intensive physiotherapy might help in regaining functional range of movement. When this fails, the various treatment options available are manipulation under anaesthesia (MUA), arthrolysis (open/arthroscopy), exchange poly and revision arthroplasty.

We have offered MUA as the first treatment option, after failed physiotherapy, for all stiffness knees following arthro-

plasty at our centre. This study examines the immediate outcome of MUA following knee arthroplasty and its benefit at a short-term follow-up.

Patients and Methods

We retrospectively evaluated all the patients who had manipulation under anaesthesia after knee arthroplasty between March 2007 and August 2007. For the purpose of study, unicompartmental, tricompartmental, patellofemoral and revision arthroplasties were included as knee arthroplasties. The indication for MUA was knee range of movement $< 70^\circ$ or flexion contracture $> 15^\circ$. The patients were also reviewed at follow-up to monitor the range of improvement in the short term. The data were gathered from theatre

records and case notes. Factors analysed were the relevant predisposing factors, type of implant used, the surgeon grade, the duration between the arthroplasty and the MUA and the type of anaesthesia. The ranges of motion before and after manipulation and at follow-up were measured using a pocket goniometer. Statistical analysis was done using the two-sample *t*-tests for comparison of range of movements before and after manipulation.

Technique of MUA

Under adequate muscle relaxation, the manipulation was done with the ipsilateral hip flexed to 90°. With the leg held close to the knee joint (to decrease the lever arm), steady progressive loading was applied till palpable and audible break of adhesions were heard. Beyond this firm point, no further pressure was applied. Postoperatively, active assisted physiotherapy was instituted. The use of a continuous passive motion machine or cryotherapy was advocated on an individual patient basis. The patients were discharged from physiotherapy when satisfactory range of movement was obtained.

Results

Twenty-one patients underwent manipulation under anaesthesia following knee arthroplasty in the 6 months of the study period. The average age was 62 years (range, 56–80 years) with 11 female and 10 male patients. Primary osteoarthritis was the indication for arthroplasty in all the patients. The relevant past medical history included seven patients with body mass index (BMI) more than 30 kg/m², three patients with diabetes mellitus and one patient was on long-term warfarin.

Sixteen primary total knee replacements (76% of MUA) and three revision total knee replacements (14% of MUA) needed manipulation, and one patient each (5% of MUA) for medial unicompartmental knee arthroplasty and

Table 1 Type of implants used for the primary knee arthroplasty in this series

Implant type	Number (<i>n</i> = 21)
AGC Biomet knee system	10
Advance Medial pivot knee system	6
LCCK Zimmer knee	2
Oxford unicompartmental knee	2
Avon patellofemoral knee system	1

patellofemoral joint replacement. All the primary arthroplasties were performed by consultant surgeons except for two procedures done by trainee registrars. Table 1 shows different types of implants used for primary knee arthroplasty in the patients.

Thirteen manipulations (65%) were done under 12 weeks and 8 manipulations after 12 weeks following the primary procedure. The mean duration between arthroplasty and MUA was 13.2 weeks (range, 6–32 weeks). Except for one patient who had the manipulation done under spinal anaesthesia (for medical reasons), general anaesthesia with good muscle relaxation was used for all the other patients. There were no complications noted from the procedure.

The range of knee movement improved from a mean range of 10.4–71.2° in the pre-MUA period to 2.1–94.0° post-MUA and at follow-up was 2.3–91.9° (Fig. 1). The mean arc of motion improved from 60.2° (range, 40–80°) pre-MUA to 91.9° (range, 45–120°) post-MUA. The mean improvement in the arc of motion was 31.6° ($P < 0.001$). At an average follow-up of 3 months (range, 6 weeks to 8 months), the mean arc of motion was 90.4° (range, 40–120°; Fig. 2). Manipulation improved the range of movement in all cases, except in one patient. The mean improvement in knee movement from the pre-MUA at follow-up was 30.2° ($P < 0.001$).

Figure 1 Plot of the knee range of motion before and after MUA and at follow-up.

Discussion

Manipulation for stiffness following total knee replacement has a reported low prevalence rate (1.3%).¹ Our study included 21 manipulations done in a 6-month period. In the same period, the total number of knee arthroplasty performed at our centre was 519 (429 total knee replacements, 70 unicompartamental knee replacements and 20 patellofemoral joint replacements). This roughly estimates the prevalence of MUA to be 4%. Our study also included MUA performed for stiff revision knee arthroplasty and partial knee arthroplasty.

The aetiology for stiffness following knee arthroplasty is poorly understood and is, therefore, described as being multifactorial. Pre-operative, intra-operative and postoperative causes have been cited as reasons for the stiffness.^{3,4} In our study group, the relevant pre-operative factors were present in a total of eight patients. These included three patients with high BMI and diabetes, four patients with high BMI and one patient who was on long-term warfarin for atrial fibrillation.

The mean duration between knee arthroplasty and the manipulation was 13 weeks in our study. In 13 patients, MUA was done within 8 weeks of the primary procedure. Our aim was to recognise knees with poor range of motion at the first follow-up (6 weeks) and offer manipulation. Though the verdict is not clear, various studies have shown no difference in outcomes from early or late manipulation.^{5,6} However, an early (at 2 weeks' postoperatively) manipulation study of patients with rheumatoid arthritis showed that MUA failed to increase the ultimate flexion of the knee in 70% of the cases.⁷

The immediate results from manipulation in our group were satisfactory. Only one patient did not benefit from MUA. This lady had a painful revision knee arthroplasty with only 20–65° movement. She did not improve following manipulation either immediately or on follow-up. Seven patients in our study had flexion contractures of more than

15°. Four of these improved to full extension after manipulation which was maintained at follow-up. In three patients, only moderate improvement in extension could be retained at the follow-up. Namba *et al.*⁶ have shown that flexion contractures are not significantly improved after late MUA (after 90 days).

The reported complications from MUA in the literature are fracture, wound dehiscence, patellar ligament avulsions, haemarthrosis, heterotopic bone formation and pulmonary embolism.^{7–11} We did not encounter any complications during or after the manipulation in any of the patients. It is important to recognise extrinsic factors (*e.g.* neurologically related muscle rigidity, muscle tightness due to injury or ipsilateral hip osteoarthritis) before excluding the intrinsic causes for stiffness.¹² MUA will only be useful for intra-articular adhesions and not for oversized or mal-aligned components and soft tissue imbalances. The aim of MUA is to break the intra-articular adhesions; any further manipulation beyond this can result in untoward complications.

Not all stiff knees require or undergo a manipulation procedure. Patients with pain-free joints choosing to accept their restricted joint motion or medical reasons that prevent further procedures under anaesthesia are examples of such cases. It would be of benefit to know if stiff knees, if left to themselves and continued with physiotherapy, would improve in due course. However, a literature search did not reveal any such case-control studies. Therefore, it is our recommendation that a large prospective case-control study be conducted to look into this aspect.

Conclusions

Manipulation for knee stiffness is notorious for the various complications associated with the procedure. However, with careful attention to technique, it does offer a safe and effective solution to the problem. We recommend MUA as the first line of treatment after failed physiotherapy for stiffness following knee arthroplasty.

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