

Original Research Article

Multimodal periarticular cocktail injection using steroid in total knee arthroplasty: a double blind randomised trial

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ABSTRACT

Background: Multimodal periarticular cocktail injection (MPCI) containing local anesthetics, adrenaline, and anti-inflammatory agents such as NSAIDs have been promising in terms of quick functional recovery. This study evaluates the efficiency of steroid as a component of MPCI in knee arthroplasty.

Methods: This is a prospective, double-blind, RCT where 36 patients with osteoarthritis were included and randomized to receive MPCI either with steroid or without steroid. Pain was evaluated by visual analogue scale (VAS) at preoperative and postoperatively at rest, and during activity. The range of motion of the knee was looked for in a similar way. The amount of NSAIDs and the duration of NSAID usage were noted till the last follow-up.

Results: Both non-steroid and steroid groups were similar with regard to VAS at rest and during activity, or range of motion, at all postoperative observations. The postoperative knee society knee score in the steroid group improved significantly as compared to that in non-steroid group at the one-month (84.1 ± 13.1 and 65.9 ± 12.1 ; $p < 0.0045$) and three-month follow-up (90.2 ± 16.3 and 72.5 ± 16.6 ; $p < 0.0027$), but no significant difference was noted at six-month follow up. There was no significant difference in consumption of NSAIDs within 72 hours between the two groups. The duration of piroxicam usage in patients in the steroid group was significantly shorter than that in the non-steroid group, (7.2 ± 0.7) compared with (10.5 ± 1.9) weeks; $= 0.012$.

Conclusions: The Study validates usage of steroid in MPCI due to faster rehabilitation and less consumption of NSAIDs and no additional risk of post-operative complications.

Keywords: Periarticular injection, Total knee arthroplasty, Pain

INTRODUCTION

Total knee arthroplasty (TKA) is the treatment of choice for advanced arthritis of the knee incapacitating the patient.¹ More than two third of the patients report moderate to severe pain in the immediate post-operative period which is a cause of dissatisfaction.² Postoperative pain has also been considered as an indirect cause of

complications such as pneumonia and deep vein thrombosis.³ A battery of pain management techniques are available including femoral nerve block (FNB), patient controlled analgesia (PCA), epidural analgesia, with or without sciatic nerve block, and multimodal periarticular cocktail injection (MPCI). Each of these methods are technically demanding, costly and associated with side effects.^{1,4} Results from recent studies show that

using the method of MPCCI with a low concentration local anesthetics, adrenaline, and anti-inflammatory agents such as non-steroidal anti-inflammatory drug (NSAID) or steroids have shown good pain control and improvement in range of motion after surgery.^{1,2,5,6} There has been concern regarding an increased risk of post-operative infection and tendon rupture after periarticular injection of steroid.⁷⁻⁹

We have designed this study as a prospective, double-blinded, randomized controlled trial to compare the efficacy of pain control after TKA, using MPCCI with steroid or without steroid.

METHODS

We sought approval by the appropriate ethical committees related to the institutions. All patients less than 75 years of age and eligible for TKA for osteoarthritis were included. Written informed consent was obtained from each patient. Those patients who had any major systemic illnesses (renal, cardiac, liver or coagulopathy) or any known hypersensitivities to any of the test drugs were excluded. 36 patients that met clinical criteria were recruited into the study. The demographic and disease profiles of the treatment and control groups were similar (Table 1).

All patients were operated by medial parapatellar approach under spinal anesthesia. No tourniquet was applied. The Depuy PFC Sigma implant was used in all patients. Patients were randomized to receive one of two types of MPCCI, either steroid group or non-steroid group. Both surgeons and patients were double-blinded to the injection administered. In the steroid group, 18 patients received injections with a local anaesthetic agent 0.75% ropivacaine 30 ml, 1:1000 adrenaline 0.5 ml, 7 mg of betamethasone. After lavage of the surgical site, prior to cementing, the MPCCI was infiltrated into the posterior joint capsule and into the periarticular soft tissues (the medial, lateral collateral ligaments, the quadriceps tendon, the patellar tendon), periosteum and subcuticular tissues.

In the non-steroid group, 18 patients received only the local anaesthetic agent and adrenaline injections, without corticosteroid.

All patients received oral piroxicam 20 mg given the night before surgery and oral piroxicam 20 mg every 12 hours for 8 days. Injection diclofenac 75 mg slow IV was given on SOS basis for first 3 days (not more than thrice a day). Topical diclofenac gel was applied every four hours.

The main outcome measure was the control of post-operative pain, which was estimated using a visual analogue scale (VAS) in which zero represented no pain and ten represented maximum pain which the patient ever experienced. VAS was measured preoperatively and at postoperative hours 2, 6, 12 of day 1 and days 2, 3, and 7

at rest, and at postoperative days 1, 2, 3, and 7 during activity. The range of motion (ROM) was recorded preoperatively and at postoperative days 1, 2, 3, and 7.

All patients were followed up at postoperative 1, 3, 6 and 12 months. The knee society knee scores were recorded at preoperatively and postoperative 1, 3, 6 and 12 months. The duration of piroxicam usage was also recorded at the last follow-up. Complications such as post-operative infection and tendon rupture were documented.

The data were processed using SPSS statistical software version 13.0 (SPSS Inc., USA). Univariate analysis was performed by Chi-squared or Fisher's exact tests for comparison of proportions between categorical data. The Mann-Whitney U test was used to compare the non-parametric data between two independent samples.

A p value ≤ 0.05 was considered to be statistically significant.

RESULTS

There were no significant differences in the general clinical data (age, gender, body mass index (BMI), deformity degree, and operative time) between the two groups (Table 1). There were no differences between the non-steroid and steroid groups with regard to VAS at rest and during activity, or ROM, at any postoperative observation time respectively (Figures 1-3). There was no significant difference in consumption of NSAIDs within 72 hours between the two groups (Figure 4).

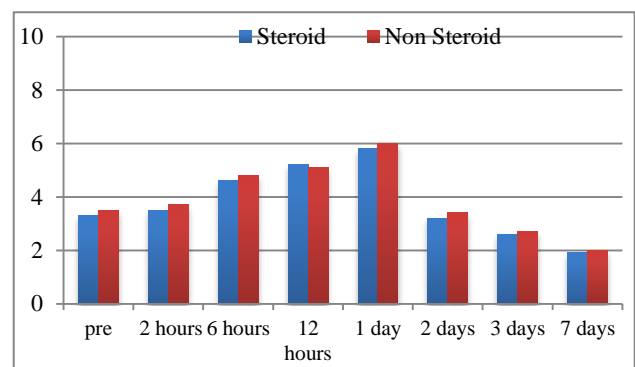


Figure 1: VAS score at rest.

The preoperative knee society knee score showed no significant differences between the two groups. Although the postoperative knee society knee score of both groups improved significantly following TKA during the early postoperative period ($p < 0.05$), the postoperative knee society knee score in the steroid group improved significantly as compared to non-steroid group at the one-month (84.1 ± 13.1 and 65.9 ± 12.1 ; $p < 0.0045$), three-month follow-up (90.2 ± 16.3 and 72.5 ± 16.6 ; $p < 0.0027$), but after postoperative six-month the Knee Society Knee Score showed no significant difference between the two groups (Figure 5). The duration of piroxicam usage in patients in the steroid group (7.2 ± 0.7) was significantly

shorter than that in the non-steroid group (10.5±1.9) weeks; p=0.012) (Figure 6). None of the patients in our study had complications like infection or tendon rupture. (Table 1).

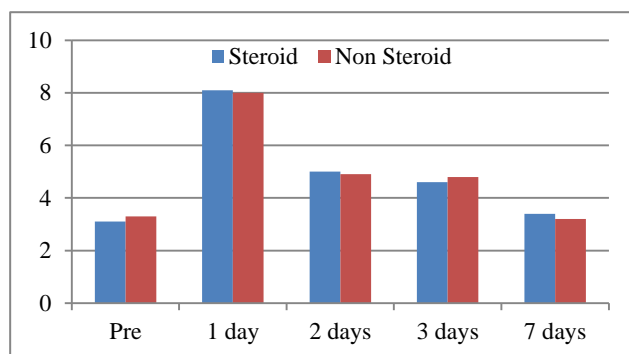


Figure 2: VAS score during activity.

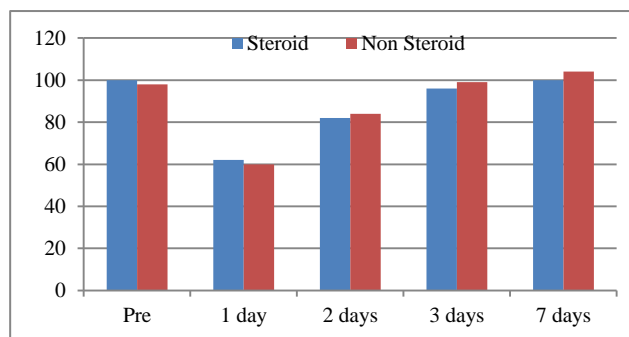


Figure 3: Range of motion.

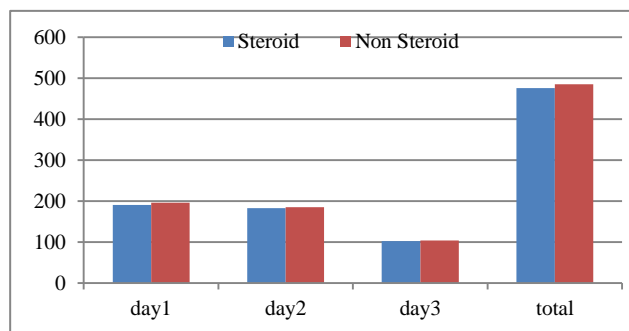


Figure 4: NSAIDs consumption.

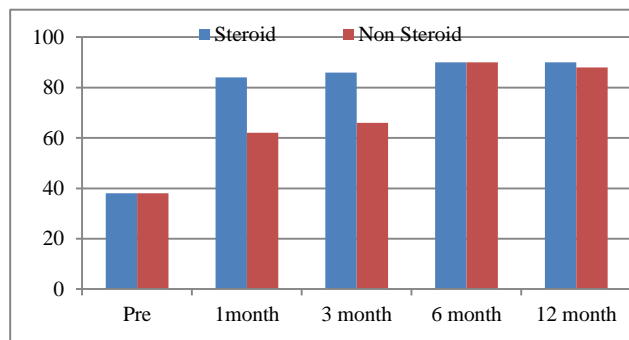


Figure 5: Knee society score.

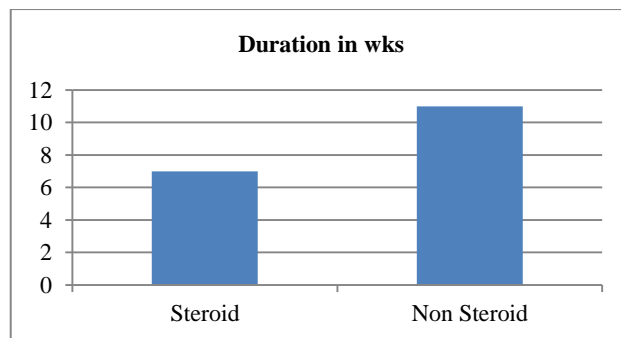


Figure 6: Duration of piroxicam usage.

Table 1: Clinical general data.

Indices	Steroid group (n=18)	Non-steroid Group (n=18)	P values
Age (years)	63.2±5.7	65.3±4.3	0.563
Gender (F/M)	16/2	16/2	1.000
BMI (kg/m ²)	27.53±4.81	26.38±3.27	0.254
Deformity (varus/valgus)	12.5±4.7 (Varus)	11.1±5.4 (Varus)	0.481
Operative time (min)	93.4±2.3	90.1±1.5	0.736
Incision complication	0	0	1.000

DISCUSSION

Adequate pain management after knee arthroplasty has been a major concern in terms of optimal recovery.^{10,11} A multimodal approach targets different pathways contributing to post-operative pain.¹²⁻¹⁴ MPCII consisting of a variety of drugs have been used to decrease pain and improve outcome. These medications control inflammatory responses and reduce the peripheral sensitization of pain receptors.

Peri-articular cocktail Injections intraoperatively have been studied exhaustively in knee arthroplasty.^{6,15,16} Apart from, ketorolac, morphine, ropivacaine and adrenaline, some studies have explored steroids as anti-inflammatory agents.^{6,17,18}

Surgical trauma during TKA modifies the responsiveness of the nervous system. Corticosteroids are key component of this injection. Corticosteroids inhibit phospholipase A2, reducing the production of pro-inflammatory derivatives of arachidonic acid such as prostaglandins and leukotrienes.¹⁹ Thus, the periarticular infiltration of steroid may reduce the production of prostaglandins and decrease postoperative inflammatory response following surgery.

Parvataneni et al reported pain relief and functional recovery with MPCII without steroid similar to those following traditional nerve blocks and PCA pumps.^{7,20}

Christensen et al observed reduced duration of hospital stay following surgery using steroid PCI, but there was no improvement in pain, range of motion of knee, or function in the early postoperative period.⁹

There are others who have reported similar degrees of pain relief and narcotic consumption using MPCPI without steroids, suggesting that the other drugs are more important in terms of pain relief than steroid in MPCPI.^{1,6,19}

But Pang et al demonstrated the addition of triamcinolone acetonide to the MPCPI in UKA had both immediate and short-term benefits in terms of pain relief and physiotherapy with no increased risk of infection.²¹

Fu et al reported reduced requirement of morphine and better pain control with MPCPI containing morphine, bupivacaine and betamethasone, with no obvious risks after TKA, and concluded betamethasone to be the key component of this injection.²

In our study there was no difference between the non-steroid and steroid groups with regard to VAS at rest and during activity, ROM, and consumption of analgesics within first 72 hours. We observed no worsening of pain when the effects of the local anaesthetics in the MPCPI wear off, at postoperative 2 days.

The postoperative knee society knee score in the steroid group improved significantly as compared with that in non-steroid group at one-month, but no significant difference after postoperative six-month, and the duration of piroxicam usage in patients in the steroid group was significantly shorter than that in the non-steroid group.

We used NSAIDs (piroxicam) pre- and post-operation to achieve multimodal pain management and to look for the anti-inflammatory effect of steroid in our MPCPI. The requirement of post-operative NSAIDs decreased significantly, and thereby decreased the potential side effects on gastrointestinal tract and cardiovascular systems.

There are reports available in literature that intra-articular corticosteroid injection may increase the risk of infection.^{8,22,23} Papavasiliou claimed that intra-articular steroid injections given within an year before the surgery increase risk of postoperative infection.²⁴ On the contrary, there are reports that the complications associated with intra-articular steroids are only rare.^{25,26} We found no cases of post-operative infection at follow-up at one year.

It is however recommended to avoid injection on the skin around the incision, also in cases where immunity is compromised due to chronic disorders like diabetes mellitus, rheumatoid arthritis.

CONCLUSION

The patients who received corticosteroid in MCPI in TKA had faster rehabilitation and less NSAIDs requirement in post-operative period, with no increased risk of infection or tendon rupture at follow-up at one year validating the high efficacy and safety of MCPI with the addition of a corticosteroid.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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