Assessment of Intraoperative Periarticular Cocktail Injection in Patients Undergoing Total Knee Replacement (TKR)

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ABSTRACT

Objective: Determine the average pain score after intraoperative periarticular cocktail injection in patients who have undergone total knee arthroplasty.

Background: Osteoarthritis of the knee is one of the most common and debilitating diseases in the world, affecting the quality of life of patients (QoL). Managing pain after a total knee replacement (TKR) is essential for post-operative rehabilitation. The use of epidural analgesics or parenteral opioids can lead to unwanted side effects that impede early recovery and rehabilitation. These side effects can be prevented by infiltrating a local pain reliever cocktail.

Objective: Determine the average pain score after intraoperative periarticular cocktail injection in patients who have undergone total knee arthroplasty.

Methodology: This descriptive case series study was conducted at orthopedics department from October 26, 2020, to April 27, 2021. In total, 124 patients with total knee replacement surgery were registered in this study. All surgeries and cocktail injections were carried out by one surgeon using a medial parapatellar arthrotomy. A cocktail consisted of 90ml normal saline mixed with 17.5 ml of bupivacaine (5%), 30 mg of ketorolac (2ml solution) and 0.5 ml of adrenaline was injected into the knee joint in all patients included in the study. Post-operative pain was recorded by the nurse with a 10-point Visual Analogue Scale (VAS) at 6 and 48 hours after surgery. All entries were processed using SPSS v25.0. The data were stratified by age, gender and BMI to process effect modifiers. An independent t-test was used after stratification. The p-value of 0.05 was found to be significant.

Results: The result of the study showed statistically decrease in pain score. The mean pain score after 6 hours was 5.17±1.03 that reduced to 2.93±1.11 after 48 hours.

Conclusion: Based on the results it can be concluded that the intraoperative periarticular cocktail injection is an effective treatment in reducing pain in patients undergoing total knee arthroplasty.

Keywords: Total Knee Replacement, Osteoarthritis, Intra-Operative Periarticular Cocktail Injection, Pain Score.

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INTRODUCTION

Total knee replacement is found to be the most beneficial procedure for advance osteoarthritis. For the better rehabilitation, to increase the patient satisfaction and reduce the hospital stay early post operative pain management play a central role after the total knee arthroplasty. It also helps to minimize the postoperative complications, including deep vein thrombosis and pneumonia[1]. Different patient has a different threshold for the pain, it is noted from the

past literature that this severe pain is experienced by approximately 60% of the patient and on the other hand the moderate pain is reported in the 30% of the patient experiencing the total knee replacement[2]. Pain is also associated with the fibrosis and limiting the range of motion, so it become more important to relieve the pain after the total knee replacement surgery[3]. In the past various kinds of analgesics were used to reduce the pain that include systemic or regional pain killers[4]. A type of painkiller known as periarticular cocktail drug injection has been found more effective than the other analgesics for the reduction of postoperative pain following TKR[5,6,7].

Pain can be controlled by multiple methods, but each has its own risks and beneficial effects for example, epidural anesthesia is a common method used to reduce the pain in postoperative patients. But it increases early mobilization significantly and leads to the complication including hypertension, headache and spinal cord infection. Nerve blockade is also a method used to reduce the pain, but it is associated with the high risk of neuromuscular structure injury, formation of hematoma and again infections[8].

The other opioid use systemically, such as morphine can induce nausea, vomiting, drowsiness, respiratory depression, retention of urine and constipation. Keeping this complication in view, an effective approach is needed[9]. An innovative idea is proposed to block the pain receptors locally. This can be possible by administrating the analgesic injections inter-articular or periarticular region of the knee joint. This is not only effective for reducing pain, but also cost effective and easy to administer without causing motor blockade. Also, it is a relatively simple method and can be applied without any extraordinary skill. Various studies showed the effectiveness of Locally applied analgesic injections. In a study, mean post-procedural pain score after 6 hours was 1.96±1.40 and 1.13±0.85 after 48 hours post-procedure[10]. In another study, mean post-procedural pain score after 6 hours was 4.32±1.86 and 2.68±1.21 after 48 hours post-procedure[11]. To our bed best knowledge, we did not find any such kind of study comparing the effect of locally injected the painkiller in reducing the pain in patient undergoing total knee replacement. In literature we also found some studies that reported controversial results. The main purpose of this study was to assess the mean pain score after intra operative periarticular cocktail injection in patient undergoing total knee replacement surgery. this study also enables the surgeons to adopt the best method in the management of pain in PRK patients[1].

MATERIALS AND METHODS

This was a descriptive case series study. The sample size of 124 was calculate by taking an expected mean pain score 1.13±0.85 after 48 hours post-procedure on VAS. While the confidence level was 95% with margin of error 15%. Both male and female gender of age ranging from 18 to 70 years undergoing total knee replacement were included in the study. Patients having co morbid condition such as anemia, diabetes mellitus and hypertensive were excluded. After taking approval from ethical review committee, 124 patients presenting in the Department of Orthopaedic, who met the inclusion criteria were enrolled into this study. Written informed consent and detailed history were taken from every patient. For all the patients, intra-operative periarticular cocktail injection was given. All the patients received spinal anesthesia with a combination of 0.5% bupivacaine and 0.5 mL (25 mg) fentanyl.

Standard treatment protocols:

30 to 40 minutes before the incision, 1.5 g of injectable cefuroxime was used as antibacterial prophylaxis. Using a medial parapatellar arthrotomy technique, only one surgeon performed all the procedures and cocktail injections. In all of the patients in the trial, a cocktail of 90ml normal saline mixed with 17.5 ml bupivacaine (5%), 30 mg ketorolac (2ml solution), and 0.5 ml adrenaline was injected into the knee joint. A 21-caliber needle and syringe were used to infiltrate. In all of the instances, cemented cruciate-sacrificing implants were employed. The tourniquet was loosened after insertion of the components and cement binding, and hemostasis was established before the incision was closed. During the first two days following the procedure, intravenous injections of Diclofenac (75 mg) and inj. Tramadol (100 mg) with inj. Ondansetron (4 mg) was administered every 12 hours, followed by naproxen tablet 500 mg and tramadol hydrochloride tablet (37.5 mg) with paracetamol (325 mg) over the next 10 days. In individuals for whom the above drugs were ineffective or not tolerable, a buprenorphine patch (10 mg) or oral pregabalin (75 mg) was used. All patients were looked out for until their discharge.

Data Collection:

At 6 hours and 48 hours after surgery, the nurse used a 10-point VAS to document postoperative discomfort. The VAS is a 10-centimeter line with a 0 indicating no pain and a 10 indicating the most

atrocious agony. A pre-defined form was used to collect the data.

Data Analysis:
SPSS v25.0 was used to enter and process all of the data. Mean S.D. Served to determine age and VAS score at 6 and 48 hours. Frequencies and percentages were used for the description of gender. To account for effect modifiers, the data were stratified according to age, gender and BMI. An independent t-test was performed following stratification. A p-value of less than 0.05 was considered significant.

RESULTS

Total 124 patients undergoing total knee replacement were selected for this study. Among these patients, 79(63.7%) were males, while 45(36.3%) were females. Mean age of the patients was 45.61±14.58 year.

Majority of the patients 62(50.0%) had ages >45 years, while 23(18.5%) and 39(31.5%) patients were between 18-30 years and 31-45 years age groups respectively. There are many reasons for chronic pain in young adults undergoing knee replacement especially in our population. In our study group the most common reasons were Osteoarthritis, Rheumatoid arthritis, post-traumatic arthritis and Congenital condition such developmental dysplasia of the hip or Blount's disease.

According to body mass index distribution, 69(55.6%) had normal BMI, while 36(29.0%) and 19(15.3%) were overweight and obese respectively.

Mean pain score after 6 hours was 5.17±1.03 and 2.93±1.11 after 48 hours.

Table 1: Frequency distribution of gender, age and BMI:

Gender	Frequency	Percent
Male	79	63.7
Female	45	36.3
18-30 years	23	18.5
31-45 years	39	31.5
>45 years	62	50.0
Normal	69	55.6
Overweight	36	29.1
Obese	19	15.3

Table-2: Pain score after 6 hours and 48 hours post-operatively

	VAS after 6 hours	VAS after 48 hours
N	124	124
Mean	5.17	2.93
Std. Deviation	1.03	1.11
Minimum	4	1
Maximum	7	5

Table 3: Stratification of pain score after 48 hours with respect to gender, Age groups and BMI.

	Constructs	n	Mean	Std. Deviation	p-value
Gender	Male	79	2.97	1.18	0.533
	Female	45	2.84	0.99	
Age Groups	18-30 years	23	2.91	1.36	0.970
	31-45 years	39	2.89	1.09	
	>45 years	62	2.95	1.04	
BMI	Normal	69	2.93	1.13	0.995
	Overweight	36	2.92	1.16	
	Obese	19	2.94	1.03	

DISCUSSION

In terms of optimal recovery, adequate pain management after knee replacement surgery was a big problem[12,13]. A multi-modal strategy emphasizes the many routes that contribute to postoperative pain[14,15,16]. To reduce discomfort and improve results, a periarticular cocktail injection, including a number of medications was tried.

These medications inhibit inflammatory responses and reduce the sensitivity of pain receptors in the peripheral nervous system. Intraoperative periarticular cocktail injections were carefully examined during knee arthroplasty[17,18]. Some studies have examined steroids as anti-inflammatory medications in addition to ketorolac, morphine, ropivacaine, and adrenaline[19,20]. Surgical trauma following total knee arthroplasty changes the response of the neurological system. This injection contains steroids, which are an essential component. Corticosteroids block the enzyme phospholipase A2, which reduces the formation of proinflammatory arachidonic acid derivatives like prostaglandins and

leukotrienes[21]. Therefore, steroid infiltration in the periarticular space may reduce prostaglandin synthesis and postoperative inflammatory response.

Reduced pain and functional recovery were described by Parvataneni et al after steroid-free periarticular injections which were comparable to those reported after standard nerve blocks and patient-controlled analgesic pumps[22]. After steroid surgical procedures, Christensen et al. have noticed a shorter hospital stay, but no improvement in pain, knee motion, or function at the beginning of the postoperative period[23]. Others who have used periarticular cocktail injection without steroids have reported similar levels of pain relief and narcotic intake, suggesting that the other medications are more essential in terms of pain reduction than the steroid in periarticular cocktail injection[24].

Pang et al, on the other hand, found that adding triamcinolone acetonide to the periarticular cocktail injection in total knee replacement resulted in immediate and short-term pain alleviation and physiotherapy with no higher risk of infection[25].

After total knee replacement, Fu et al found that a periarticular cocktail injection, including morphine, bupivacaine, and betamethasone decreased the need for morphine and improved pain management, with no clear hazards, and concluded that betamethasone was the important component of this injection[26]. There was a change in VAS after 6 hours and 48 hours in our study. In the 2 post-operative days, we did not find any worsening of discomfort when the effects of the local anesthetic in the periarticular cocktail injection disappeared.

In research, the average post-operative pain score at 6 hours was 1.96 ±1.40, while at 48 hours it was 1.13± 0.85 11. In other studies, the mean postoperative pain score was 4.32 ±1.86 after 6 hours and 2.68± 1.21 after 48 hours 1. Intraarticular injection of corticosteroids was associated with an increased risk for infection in the literature[27,28]. According to Papavasiliou, intrarticular steroid injections administered less than a year before surgery increase the risk of infection following surgery[29].

Contrary to what is thought, problems related to intraarticular steroids are quite rare 30. During the follow-up, we found no cases of post-operative infection. However, injections in the skin around the incision should be avoided, particularly if the patient's immune system is weakened by chronic diseases such as diabetes or rheumatoid arthritis. Our study had some limitations as well. The study design is descriptive. The study was conducted in a single center with a small number of populations. A large RCT is required to reach the final conclusion.

CONCLUSION

Based on the results it can be concluded that the intraoperative periarticular cocktail injection is a effective treatment in reducing pain in patients undergoing total knee arthroplasty.

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