

Functional results of periarticular multimodal injection for reducing pain during total knee prosthesis surgery: a randomized-controlled trial

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Abstract

The study aim was to investigate the effect of periarticular drug injection during total knee arthroplasty surgery on postoperative mobility and functional status in early period. *Material and Method.* In this prospective study, 40 patients undergoing total knee prosthesis were included. Participants were divided into 2 groups randomly. The intervention group (n = 20) underwent standard surgical procedures with periarticular multimodal cocktail (containing 1 ml Morfin, 1 ml Adrenalin, 1 gr Sefazolin, 20 ml Marcain, 1 ml Depomedrol, 27 ml Physiological Saline solution). The control group (n = 20) underwent standard surgical procedure only. The same rehabilitation program was applied to the participants in both groups received the same rehabilitation program on first day after operation. The program continued as a home exercise regime. Pain intensity and range of motion of knee joint were measured three times after surgery: second day, 15th day and 30th day. Functional level was recorded with *Knee Society Knee Arthroplasty Evaluation Form* after one month. The two groups were compared using by Shapiro Wilk test and Mann-Whitney U test. Results: There were significant differences in pain intensity between the two groups at second day and 30 th day (p<0,05). The significant difference was in favor of intervention group. When the two groups were compared in terms of range of motion of the knee, there were no significant differences (p>0,05). There were significant differences between the two groups in terms of *Knee Society Knee Arthroplasty Evaluation scores/Knee Score* (p<0,05). Conclusion: The results of the study indicate that using multimodal cocktail can be used to decrease pain, which indicate functions of the knee after total knee prosthesis surgery.

Keywords: total knee prosthesis, multimodal injection, pain, range of motion.

Introduction

Degenerative changes caused by various causes in the knee joint cause pain and limitation of movement, leading to a decrease in quality of life. In cases where other treatment options are inadequate, arthroplasty is a procedure that orthopedic surgeons often prefer and practice. With the advancing basic surgical principles, although surgical improvements give promising results, knee arthroplasties are one of the major orthopedic operations leading to postoperative pain. Acute postoperative pain increases the length of hospital stay and increases cost (1). At the same time, the duration of rehabilitation that should be started from the first day after surgery also limits the functional outcome of the patient due to pain related delay. In the postoperative period, reducing pain, increasing joint range of motion, protecting from complications, providing independent ambulation and increasing quality of life are the basic goals (2).

As a result of surgical techniques and medical developments in prosthetic technology, the life span of prosthesis has increased, causing patients who have not previously been candidates for surgery to enter the indication spectrum. This suggests that more total knee arthroplasty will be performed in the future (2). Rehabilitation significantly affects the results of total knee prosthesis arthroplasty. Reduction of postoperative pain, which is a major obstacle to this process, is important. Several studies have been conducted in the literature on post-operative pain management (3). Systemic or neuroaxial opioids are preferred in postoperative pain treatment. However, opioids have side effects such as respiratory depression. Therefore, the search for methods to reduce postoperative pain and the dose of opioid used continues (4, 8). With the better understanding of pain mechanisms in the last decade, the concept of pre-emptive analgesia has developed. Pre-emptive analgesia is primarily aimed at managing painful stimuli, including post-operative pain frequency and prevention of central sensitization (9).

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The main goal of modern pain management is to reduce pain at both central and peripheral levels using multimodal protocols. This strategy will increase functional levels by allowing patients to participate in post-operative rehabilitation.

Intraarticular drug injection is one of the tasks of multimodal pain management (10,11). The aim of this study to show the effects of periarticular drug injection just used during total knee arthroplasty surgery on postoperative mobility and functional status in early period after surgery.

Material and method

This prospective study includes 40 patients who underwent total knee prosthesis in Sani Konukoğlu Hospital Department of Orthopedics and Traumatology, Gaziantep, Turkey. Before to the commencement of the study, this research carried out on humans has been in compliance with the Helsinki Declaration, adopted by the 18th World Medical Assembly, Helsinki, Finland, June 1964 and all participants signed an informed consent form before the study. The etiology of all patients was primary gonarthrosis. Individuals were divided into 2 groups randomly. Both groups were operated by the same surgeon. The intervention group (n=20; mean age=66 yrs.) underwent standard surgical procedures during surgery as well as periarticular multimodal cocktail (Table 1). The control group (n = 20; mean age=63,3 yrs.) underwent standard surgical procedure. The same rehabilitation program was applied to the participants in both groups from postoperative first day and continued as a home program.

Table 1. Multi-modal Cocktail Content

Medication	Strength/Dose
Morfin	1 ml
Adrenalin	1 ml
Sefazolin	1 gr
Marcaïn	20 ml
Depomedrol	1 ml
Physiological Saline solution	27 ml

Surgery protocol. Under appropriate anaesthesia, the corresponding knee brace was prepared. Anteriorly, a string was inserted with a longitudinal incision. Capsular medial parastellar opened. Osteophytes cleared. Femur tibia and patellar incisions were made. 1 cement and appropriate components were placed. After washing, Participants into the intervention group was periarticular injected. Injection wasn't made the participants into the control group. The coats were closed and the surgery was terminated.

Postoperative Rehabilitation Program. The rehabilitation program was started in the first day after surgery till discharge. This program contains the following exercise regime: isometric exercises for gluteal, quadriceps muscles and straight leg lift of operated extremity, ankles pump exercise.

After discharge, the program contains strengthening exercises for hip and knee muscles. All participant were advice to make the strengthening the exercise for one month. After one month, all invited to our clinic for control and measurements.

Measurements. Demographics belonging to the participants of the two groups including, age, gender, height, weight, occupation, education level, and duration of hospitalization were recorded. Body Mass Index (BMI) was calculated (Table 2). Amount of knee range of motions was measured three times: post-op second day, 15th, and 30th day. Pain intensity was evaluated using by a visual analogue scale (VAS)(12). At the same time, the Knee Society Knee Arthroplasty Evaluation Form (KSKAE Form) was used to evaluate functional level of the participants on 30th day after surgery.

Table 2. Demographics and duration of hospitalization of the two groups

Groups	N	Operated Side (n)		Gender n(%)		Mean age (year)	Duration of Hospitalization (day)	BMI (kg/m ²)
		Right	Left	Man	Woman			
Intervention	20	14	6	3	17	66	3,25	30,8
Control	20	12	8	2	18	63,3	4,30	34,4

Statistical analysis. The normality hypothesis of the data extracted from the participants was calculated using by Shapiro Wilk test. To compare of the results belonging to the two groups, Mann-Whitney U test was used to show the differences. $p < 0.05$ was selected as to determine differentiation level.

Results

There were no significant differences between the two groups in terms of second day, 15th day and 30th day range of motion of knee joints ($p > 0,05$).

Pain intensity scores obtained from VAS decreased numerically in interventional group more than those in the control group. There were significant differences in pain intensity between the two groups at the second and 30th day ($p < 0,05$). The significant difference was in favor of intervention group. There were significant differences between the two groups in terms of *Knee Society Knee Arthroplasty Evaluation scores/Knee Score* either ($p < 0,05$) (Table 3).

Table 3. Results obtained from the study by groups

Variables		Intervention Group (n=20)	Control Group (n=20)	p
		Mean ± SD	Mean ± SD	
Amount of Flexion, degree	Second day	86 ± 22,7	75,7 ± 23,4	0,141
	15th day	115 ± 22,7	104,2 ± 16,6	0,053
	30th day	130,25 ± 14,1	127,2 ± 10,44	0,114
Amount of Extension, degree	Second day	131,5 ± 9,04	131,2 ± 6,8	0,478
	15th day	137,2 ± 6,1	136,5 ± 5,4	0,344
	30th day	139,7 ± 1,1	139 ± 2,05	0,157
VAS	Second day	4,8 ± 2,1	6,3 ± 2,5	0,031*
	15th day	2,8 ± 1,7	4,1 ± 2,3	0,068
	30th day	0,7 ± 1,3	2,3 ± 1,9	0,001*
Knee Society Knee Score	30th day	88,6 ± 10	69,3 ± 19,1	0*
Knee Society Function Score	30th day	73,7 ± 21,2	70,75 ± 17,8	0,322

VAS: Visual Analog Scale

Discussion and Conclusion

Total knee arthroplasty is one of the most successful treatments for knee osteoarthritis in the last phase (13). Pain is the most common symptom to manage after TKA. Effective pain management leads to earlier knee mobilization, early onset of physiotherapy, decreased postoperative complications, and increased patient satisfaction (14,15).

Traditional analgesic options in total knee arthroplasty; patient controlled opioid use, epidural analgesia and femoral nerve block. The use of systemic opioids is associated with side effects such as nausea, vomiting, pruritus, and sedation. These may affect functional rehabilitation (16). Hypotension and urinary retention are more frequent in patients undergoing epidural anesthesia (17). Although the femoral nerve block is a good postoperative analgesic procedure, it affects the early rehabilitation process because of the drowsiness and weakening of the quadriceps function (18). Periarticular multi-modal drug injection is effective post-operative analgesics and side effect is minimal (19).

Wang et al. (20), which examined pain management after total knee arthroplasty in 2015 in a meta-analysis, there was no significant difference between the post-op second day VAS scores between the groups receiving femoral nerve block and periarticular multimodal drug injection. There was significant difference between the VAS scores on second and 30th day in favor of the intervention group in our study. In the meta-analysis, straight leg lift and knee flexion joint range of motion were examined for functional level. Meta-analysis evaluated the results at 24th hour and second day and there was no significant difference between the groups. The functional level in our study was determined by the knee flexion of the second day, 15th and 30th day, knee extension, and the KSKAE Form scores on the 30th day. There were no significant differences between the groups in extension and flexion degree.

All participants just evaluated in this study discharged couples days after operation. The participants were advised to keep making the exercises regime in their homes. This was the limitation of this study. That's why expected functional improvements were not seen in the participants.

There was significant differences on the Knee Society Knee Score in favor of the intervention group. The results of the study indicate that using multimodal cocktail can be used to increase knee score and decrease pain after total knee prosthesis surgery. This leads to positive impact on rehabilitation program.

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