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KLİNİK ARAŞTIRMA *Ortopedi ve Travmatoloji*

A similar analgesic protocol may be use after total hip and knee arthroplasty

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SUMMARY

It is said that patients undergoing total knee arthroplasty need more analgesics postoperatively than those undergoing total hip arthroplasty. In this study, we hypothesized that the same intramuscular morphine protocol may be used in both total hip and knee arthroplasties. This was a randomized, prospective, controlled trial. Twenty patients who were hospitalized for total hip arthroplasty and 20 patients for total knee arthroplasty consisted the study groups. Using visual analog scale for pain, the patients responded to questions regarding their first night's sleep and the side effects of morphine sulfate. On the first postoperative day, 20 mg/day (4x5 mg) intramuscular morphine sulfate were administered. The patients were questioned at the 6th and 24th postoperative hours. There were no statistical differences between the total hip arthroplasty and total knee arthroplasty groups in terms of pain, first night's sleep or the side effects of morphine sulfate at the 6th or 24th postoperative hours. After administration of the same intramuscular morphine sulfate protocol, early postoperative pain and the side effects of morphine sulfate were comparable between the total hip and knee arthroplasty groups, so the same intramuscular morphine protocol may be used in total hip and knee arthroplasties.

Key words: *Knee, hip, arthroplasty, morphine sulfate, pain, side effects, night's sleep*

ÖZET

Total kalça ve diz artroplastisi sonrası uygulanabilecek benzer bir analjezi protokolü

Total diz artroplastisi uygulanan hastaların total kalça artroplastisi uygulanan hastalarla karşılaştırıldığında postoperatif dönemde daha fazla analjezik ihtiyacı olduğu düşünülmektedir. Çalışmamızın amacı genel kanının aksine aynı analjezi protokolünün total kalça artroplastisi ve total diz artroplastisinde kullanılabileceğini göstermektir.

Randomize, prospektif ve kontrollü olarak planlanan çalışmaya total diz artroplastisi uygulanan 20 hasta, total kalça artroplastisi uygulanan 20 hasta dâhil edildi. Her iki gruba postoperatif dönemde 4x5 mg morfin sülfat intramusküler olarak uygulandı. Ağrı vizüel anolog skala ile değerlendirildi. İlk gece uyku kalitesi ve morfin sülfatın yan etkileri sorgulandı. Her iki grup arasında 6. ve 24. saatte yapılan değerlendirmelerde ağrı skoru, ilk gece kalitesi, morfin sülfatın yan etkileri açısından istatiksel fark saptanmadı.

Sonuç olarak, aynı analjezi protokolü total diz artroplastisi ve total kalça artroplastisi uygulanan hatalarda kullanılabilir.

Anahtar kelimeler: *Diz, kalça, artroplasti, morfin sülfat, ağrı, yan etkiler, gece uykusu*

Postoperative pain control is important for the comfort and rehabilitation of thepatients [1-3]. Morphine is an important option for postoperative pain relief and can be administered via intrathecal, intravenous, intramuscular or subcutaneous routes [3-5]. However, there are some restrictions to the use of morphine.

Pain relief effects the comfort level and follow-up process of patients, especially with regard to mobilization. Pain restricts early mobilization [1,6], which can hinder rehabilitation and increase the risk for deep venous thromboembolism [7,8]. The same analgesic drug and protocol are frequently used in both total hip arthroplasty and knee arthroplasty patients, even though the response to the same drug protocol may differ according to the type of arthroplasty. The most significant consideration in using morphine is the drug activity in patients undergoing different procedures. Postoperative pain management is essential in total hip and knee arthroplasty patients.

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It has been reported that patients undergoing total knee arthroplasty require more analgesia than those undergoing total hip arthroplasty [9-11].

One of the restrictions to the use of morphine is its side effects which include constipation, sedation, nausea, vomiting, dizziness, hallucinations, confusion, and shallow breathing [12]. The side effects of morphine can change according to type of surgery.

With administration of the same protocol for both knee and hip arthroplasty, the number of pain protocols of orthopaedic clinics may be lessened. We compared the efficacy and side effects of morphine sulfate between patients undergoing total hip arthroplasty (THA) and those undergoing total knee arthroplasty (TKA), and we hypothesized that the same intramuscular morphine protocol may be used in both total hip and knee arthroplasties.

MATERIAL and METHODS

This was a randomized, prospective, controlled trial. The target subjects were arthroplasty patients who were hospitalized in our clinic during the 14 months of the study period. During this period, 72 THAs and 93 TKAs were performed.

The inclusion criteria were hospitalization in our clinic for an elective THA or TKA, acquisiton,and approval of the informed consent, preoperative mobility without assistance, refraining from the use of analgesics during the week before surgery at our request, and surgery under general or epidural anesthesia according to one of the anesthesia protocols below. Osteoarthritic patients with a history of trauma or avascular necrosis, high-grade hip dysplasia (Crowe Classification, type 2, 3, 4), diabetes mellitus or neurological diseases, surgical complications during the surgery or any early postoperative complication that could decrease or increase the pain experienced were excluded.

Based on these criteria, 52 THA and 73 TKA patients were excluded and 40 patients were included in the study. The patients were classified into two groups as those undergoing THA or TKA, with 20 patients in each group. The mean age was 58.6 (37-76) years in the THA group and 62.6 (58-82) years in the TKA group. There were 6 male and 14 female patients in the THA group, and two male and 18 female patients in the TKA group.

With the approval of the Department of Anesthesia, the same anesthesia protocols were administered in all of the patients. The anesthetist, who knew the patients' preference for general or epidural anesthesia, determined the type of anesthesia. The general anesthesia protocol was thiopental 5 mg/kg, fentanyl 1 μg/kg, midazolam 0.03 mg/kg, and vecuronium bromide, 0.1 mg/kg for induction, followed by 50 % oxygen, 50% nitrous oxide, and 1-2 % sevoflurane delivered at 4 L/min for maintenance during surgery. At the end of the surgery, residual muscle relaxation was antagonized using neostigmine 0.03 mg/kg with atropine 0.015 mg/kg. Intramuscular diclofenac sodium at a dose of 75 mg was administered approximately 1h before wake-up, and intravenous morphine sulfate 5 mg was administered approximately 20 min before wake-up. The epidural anesthesia protocol consisted of an IV bolus of 500 mL of 0.9 % NaCl, followed by 0.5 % bupivacaine 85 mg administered into the epidural space. An epidural catheter was not used. General anesthesia was performed in seven patients in the THA group and four patients in the TKA group. Epidural anesthesia was performed in 13 patients in the THA group and 16 patients in the TKA group.

In all THA patients, surgery was performed using posterior approach through posterolateral modified Gibson incision with the patient in the lateral decubitus position. A cementless porous-coated acetabular cup, and proximal porous-coated femoral stem were used in the THA group. In all TKA patients, surgery was performed through a midpatellar skin incision and a medial parapatellar retinacular deep incision. Cemented posterior cruciate-retaining knee arthroplasty was preferred. Hemovac drains were used in both THA and TKA patients.

Intramuscular morphine sulfate (5 mg/6 h) was administered for 24 h. The first dose was administered when the patient's pain started, and the time of the first dose was recorded.

Primperan IV tid (10 mg of metoclopramide HCl, 14 mg of NaCl, 2.96 mg of sodium metabisulfite) tid and Ulcuran IV tid (50 mg ranitidine) were administered to patients who experienced nausea or vomiting.

One day before the surgery, a visual analog scale (VAS, 10 point) was completed by the patients. The side effects of morphine sulfate were recorded on the duty nurses' charts. The patients were questioned at 6h and 24h postoperatively. The 6-h inquiry was about the time between wake-up and the postoperative 6th hour. The 24h inquiry was related to the time between the postoperative 6. and 24.hours. At the 6-h inquiry, patients were asked to use the VAS for pain and questioned for the presence of constipation, sedation, nausea, vomiting, dizziness, hallucinations, confusion, and shallowness of breathing. In the 24h inquiry, patients were asked to use the VAS for pain and questioned for the presence of these same side effects, and to rate their first night's sleep according to four choices: no pain and comfortable sleep; a little pain but no problematic sleeping; some pain and difficulty in sleeping; and severe pain without sleep.

Statistical analyses were performed by a statistician using the NCSS 2007 statistical program (NCSS statistical software, Kaysville, UT, USA). Statistically descriptive methods (mean and standard deviation) were used. The Mann-Whitney U test was used to compare the VAS scores between the THA and TKA groups. The VAS scores were compared between the 6th and 24th h in the THA or TKA group by using the Wilcoxon test. To compare the age and preoperative VAS scores between the THA and TKA groups, an unpaired t-test was used. The chi-squared test was used to compare gender, type of anesthesia, first night's sleep, and side effects of morphine sulfate between the THA and TKA groups. To compare the side effects of morphine sulfate between the 6th 24th h in the THA or TKA group, McNemar's test was used. P values <0.05 were deemed to be statistically significant.

RESULTS

Any statistically significant differences were not observed between the THA and TKA groups in terms of age, gender, preoperative VAS scores or type of anesthesia (respective p-values: 0.105, 0.114, 0.564, and 0.288; Table 1). Patients felt pain an average of 3.3 (0-6) hours after terminationof the operation.

There were no significant differences in the 6-h or 24-h VAS scores between THA, and TKA groups ($p = 0.327$ and $p = 0.056$, respectively). The 24-h VAS score was significantly lower than the 6-h VAS score within each group (THA group: $p = 0.0001$; TKA group: $p = 0.0001$; Table 2).

No statistically significant difference was observed between the THA and TKA groups in terms of the characteristics of the first night's sleep ($p = 0.149$; Table 3).

Table 1. Comparison between the THA and TKA groups.

		THA Group	TKA Group	
Age		58.6±10.08	62.6±6.16	p=0.105
Preoperative VAS		6.10±0.30	6.35±0.31	t=0.58 p=0.564
Gender	Male Female	6 (30.0 %) 14 (70.0 %)	2 (10.0 %) 18 (90.0 %)	χ^2:2,5 p=0.114
Anesthesia	Epidural General	13 (65.0 %) 7 (35.0 %)	16 (80.0 %) 4 (20.0 %)	χ^2:1.12 p=0.288

Table 2. Comparison of the VAS scores between the THA and TKA groups, and between the 6-h and 24-h inquiries.

	THA Group	TKA Group	MW	P
6-h VAS	4.25±2.53	5.25±2.86	163	0.327
24-h VAS	0.65±1.27	1.45±1.7	127	0.056
Z	-3.73	-3.84		
P	0.0001	0.0001		

Table 3. Comparison of the first night's sleep between the THA and TKA groups.

		THA Group	TKA Group	
First night's sleep	**A**	10 (50.0 %)	10 (50.0 %)	
	B	9 (45.0 %)	5 (25.0 %)	**χ^2:3,81**
	C	1 (5.0 %)	5 (25.0 %)	**p=0.149**

Table 4 compares the side effects of morphine sulfate between the THA and TKA groups at 6 and 24 h, and also between 6 and 24 h within each group. There were no significant differences between the THA and TKA groups in either the 6-h or 24-h scores for constipation (p = 0.311 or p = 0.311, respectively), nausea (p = 1 or p = 0.342, respectively), vomiting (p = 0.525 or p = 0.311, respectively) or dizziness (p = 0.072 or p = 0.147, respectively). Furthermore, within the THA or TKA group, there were no differences between the 6-h and 24-h scores for constipation, 6-h scores for vomiting and dizziness; no statistical differences between the 6-h and 24-h scores for nausea (THA: p = 0.998; TKA: p = 0.125); and no statistical differences between the 24-h scores for vomiting (TKA: p = 0.063), or dizziness (TKA: p = 0.998).

Table 4. Comparison of the morphine sulfate side effects between the THA and TKA groups, and between the 6-h and 24-h inquiries.

		THA Group	TKA Group	
6-h Constipation	(-)	20 (100.0 %)	19 (95.0 %)	χ^2:1,02
	(+)	0 (0.0 %)	1 (5.0 %)	p=0,311
24-h Constipation	(-)	20 (100.0 %)	19 (95.0 %)	χ^2:1,02
	(+)	0 (0.0 %)	1 (5.0 %)	p=0,311
McNemar's		-	-	
6-h Sedation	(-)	20 (100.0 %)	20 (100.0 %)	
24-h Sedation	(-)	20 (100.0 %)	20 (100.0 %)	
6-hNausea	(-)	8 (40.0 %)	8 (40.0 %)	χ^2:0
	(+)	12 (60.0 %)	12 (60.0 %)	p=1
24-h Nausea	(-)	9 (45.0 %)	12 (60.0 %)	χ^2:0,902
	(+)	11 (55.0 %)	8 (40.0 %)	p=0,342
McNemar's		0.998	0.125	
6-h Vomiting	(-)	12 (60.0 %)	10 (50.0 %)	χ^2:0,404
	(+)	8 (40.0 %)	10 (50.0 %)	p=0,525
24-h Vomiting	(-)	12 (60.0 %)	15 (75.0 %)	χ^2:1,02
	(+)	8 (40.0 %)	5 (25.0 %)	p=0,311
McNemar's		-	0.063	
6-h Dizziness	(-)	20 (100.0 %)	17 (85.0 %)	χ^2:3,24
	(+)	(0.0 %)	3 (15.0 %)	p=0,072
24-h Dizziness	(-)	20 (100.0 %)	18 (90.0 %)	χ^2:2,1
	(+)	(0.0 %)	2 (10.0 %)	p=0,147
		-	0.998	
6-h Hallucinations	(-)	20 (100.0 %)	20 (100.0 %)	
24-h Hallucinations	(-)	20 (100.0 %)	20 (100.0 %)	
6-h Confusion	(-)	20 (100.0 %)	20 (100.0 %)	
24-h Confusion	(-)	20 (100.0 %)	20 (100.0 %)	
6-h Shallow Breathing	(-)	20 (100.0 %)	20 (100.0 %)	
24-h Shallow Breathing	(-)	20 (100.0 %)	20 (100.0 %)	

No sedation, hallucinations, confusion, or shallow breathing were reported at either the 6-h or 24-h inquiry in either group.

DISCUSSION

No difference was observed between the THA and TKA groups in terms of age, gender, preoperative VAS scores or type of anesthesia. It has been reported that more analgesia is needed in total knee arthroplasty patients than in total hip arthroplasty patients [9-11]. In the present study, the same postoperative analgesic protocol was administered to both THA and TKA patients, and postoperative pain was similar among the patients.

There are some limitations to this study. The first morphine dose was administered when the pain began, thus differences in duration of morphine sulfate administration were apparent in the protocol. We sought to assess the response of the two groups to the analgesia protocol, and thus we think that these time differences did not negatively affect the results. The dose of morphine sulfate used was 5 mg/dose. The ideal dose may be more than we used, but this dose was chosen to minimize dose-dependent side effects [13,14]. Many patients were excluded from the study in order to select the patients with comparable characteristics in terms of pain measurements. As pain is a subjective symptom and affected by multiple factors, minimization of additional issues increased the reliability of our study. We investigated the side effects of morphine sulfate in our protocol, but 24 h was too short of a time for some side effects such as constipation to become evident.

The VAS is commonly used for assessing pain which was also employed after THA and TKA surgery. Pain relief after hip and knee arthroplasty increases the comfort level of the patients and provides an opportunity for early mobilization and discharge [1,7]. In our study, when the 6-h and 24-h pain values were compared within the THA or TKA group, pain relief was evident. The mean VAS score after THA or TKA surgery, in the early postoperative period,

has been reported in the literature ranging between 1 and 4 points [15-18]. Although similar pain management protocols were used after THA and TKA surgeries, it has been reported that TKA patients experience more pain than THA patients after surgery [9-11]. Our study results do not agree with those studies. In our study, similar VAS scores were obtained at both 6 and 24 h in the THA and TKA groups, in which a similar pain management protocol was used. Thus, the pain management protocol that we used produced similar levels of comfort in the THA and TKA patients.

Sleep plays an important role during postoperative recovery. Patients for whom night sleeping is comfortable have rapid recoveries [19,20]. In our study, patients in both THA and TKA groups indicated that they slept comfortably during the first postoperative night. No patient in either group reported severe pain or sleepless nights, and the patients in both the THA and TKA groups gave similar answers to the question regarding the first night's sleep.

Morphine has side effects, with nausea and vomiting being most frequently reported [1-3]. Likewise, the most frequent side effects in our study were nausea and vomiting. It is possible that other drugs, including those used in anesthesia, might have caused postoperative nausea and vomiting. However, the types of anesthesia were the same in both groups in our study. Furthermore, no significant differences were observed between the 6-h and 24-h nausea and vomiting scores, whereas the side effects of the drugs used in anesthesia would be expected to have decreased by 24 h after administration. Constipation, sedation, dizziness, nausea, vomiting, hallucinations, confusion, and shallow breathing were all similar between the THA and TKA groups at 6 and 24 h.

In conclusion, the same intramuscular morphine protocol may be used in total hip and knee arthroplasties. With this protocol, early postoperative pain relief and the side effects of morphine were similar in both groups.

REFERENCES

1. **Peters CL, Shirley B, Erickson J.** The effect of a new multimodal perioperative anesthetic regimen on postoperative pain, side effects, rehabilitation, and length of hospital stay after total joint arthroplasty. *J Arthroplasty* 2006;21(6 Suppl 2):132-138. http://dx.doi.org/10.1016/j.arth.2006.04.017
2. **Ranawat AS, Ranawat CS.** Pain management and accelerated rehabilitation for total hip and total knee arthroplasty. *J Arthroplasty* 2007;22(7 Suppl 3):12-15. http://dx.doi.org/10.1016/j.arth.2007.05.040
3. **Rossi MD, Hasson S, Kohia M, Pineda E, Bryan W.** Mobility and perceived function after total knee arthroplasty. *J Arthroplasty* 2006;21:6-12. http://dx.doi.org/10.1016/j.arth.2005.02.013
4. **Bourne MH.** Analgesics for orthopedic postoperative pain. *Am J Orthop* 2004;33:128-135.
5. **McSwiney M, Cooper J, Karadia S, Campbell M.** Intravenous regional analgesia using morphine. The effect on postoperative pain following total knee arthroplasty. *Acta Anaesthesiol Scand* 1997;41:345-347. http://dx.doi.org/10.1111/j.1399-6576.1997.tb04696.x
6. **Møiniche S, Hansen BL, Christensen SE, Dahl JB, Kehlet H.** Patients' activity and length of stay after hip arthroplasty with balanced analgesia and early mobilization. *Ugeskr Laeger* 1992;154:1495-1419.
7. **Lotke PA, Lonner JH.** The benefit of aspirin chemoprophylaxis for thromboembolism after total knee arthroplasty. *Clin Orthop Relat Res* 2006;452:175-180. http://dx.doi.org/10.1097/01.blo.0000238822.78895.95
8. **Ragucci MV, Leali A, Moroz A, Fetto J.** Comprehensive deep venous thrombosis prevention strategy after total-knee arthroplasty. *Am J Phys Med Rehabil* 2003;82:164-168. http://dx.doi.org/10.1097/01.PHM.0000052586.57535.C8
9. **Linsell L, Dawson J, Zondervan K, Rose P, Carr A, Randall T, Fitzpatrick R.** Population survey comparing older adults with hip versus knee pain in primary care. *Br J Gen Pract* 2005;55:393-394.
10. **Parvataneni HK, Shah VP, Howard H, Cole N, Ranawat AS, Ranawat CS.** Controlling pain after total hip and knee arthroplasty using a multimodal protocol with local periarticular injections: a prospective randomized study. *J Arthroplasty* 2007;22(6 Suppl 2):33-38. http://dx.doi.org/10.1016/j.arth.2007.03.034
11. **Rathmell JP, Pino CA, Taylor R, Patrin T, Viani BA.** Intrathecal morphine for postoperative analgesia: a randomized, controlled, dose-ranging study after hip and knee arthroplasty. *Anesth Analg* 2003;97:1452-1457. http://dx.doi.org/10.1213/01.ANE.0000083374.44039.9E
12. **Andersen G, Christrup L, Sjøgren P.** Relationships among morphine metabolism, pain and side effects during long-term treatment: an update. *J Pain Symptom Manage* 2003;25:74-91. http://dx.doi.org/10.1016/S0885-3924(02)00531-6
13. **Bates JJ, Foss JF, Murphy DB.** Are peripheral opioid antagonists the solution to opioid side effects? *Anesth Analg* 2004;98:116-122. http://dx.doi.org/10.1213/01.ANE.0000090147.97636.77
14. **Carmichael FJ, Rolbin SH, Hew EM.** Epidural morphine for analgesia after caesarean section. *Can Anaesth Soc J* 1982;29:359-363. http://dx.doi.org/10.1007/BF03007526

15. **de Beer Jde V, Winemaker MJ, Donnelly GA, Miceli PC, Reiz JL, Harsanyi Z, et al.** Efficacy and safety of controlled-release oxycodone and standard therapies for postoperative pain after knee or hip replacement. *Can J Surg* 2005;48:277-283.
16. **Kullenberg B, Ylipää S, Söderlund K, Resch S.** Postoperative cryotherapy after total knee arthroplasty: a prospective study of 86 patients. *J Arthroplasty* 2006;21:1175-1179.
http://dx.doi.org/10.1016/j.arth.2006.02.159
17. **Saito N, Horiuchi H, Kobayashi S, Nawata M, Takaoka K.** Continuous local cooling for pain relief following total hip arthroplasty. *J Arthroplasty* 2004;19:334-337.
http://dx.doi.org/10.1016/j.arth.2003.10.011
18. **Usichenko TI, Edinger H, Witstruck T, Pavlovic D, Zach M, Lange J, et al.** Millimetre wave therapy for pain relief after total knee arthroplasty: a randomised controlled trial. *Eur J Pain* 2008;12:617-623.
http://dx.doi.org/10.1016/j.ejpain.2007.10.004
19. **Buvanendran A, Kroin JS, Tuman KJ, Lubenow TR, Elmofty D, Moric M, et al.** Effects of perioperative administration of a selective cyclooxygenase 2 inhibitor on pain management and recovery of function after knee replacement: a randomized controlled trial. *JAMA* 2003;290:2411-2418.
http://dx.doi.org/10.1001/jama.290.18.2411
20. **Cremeans-Smith JK, Millington K, Sledjeski E, Greene K, Delahanty DL.** Sleep disruptions mediate the relationship between early postoperative pain and later functioning following total knee replacement surgery. *J Behav Med* 2006;29:215-222.
http://dx.doi.org/10.1007/s10865-005-9045-0