

Effect of intrathecal morphine on pain score in total hip arthroplasty

Anja Mandarić^{*1}, Zrinka Orešković¹, Ivan Marić², Marijana Žura¹, Sandra Morović³

¹ University Hospital Centre Zagreb, Department of Anaesthesiology, ICU and Pain Therapy

² Clinical Hospital Dubrava, Department for Orthopaedics and Traumatology, Clinic for surgery

³ Aviva Medical Centre

OPEN ACCESS

Correspondence:

Anja Mandarić
anja.mandarić2@gmail.com

This article was submitted to RAD
CASA - Medical Sciences
as the original article

Conflict of Interest Statement:

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 15 January 2023

Accepted: 15 April 2023

Published: 26 June 2023

Citation:

Mandarić A, Orešković Z, Marić I, Žura M, Morović S. Effect of intrathecal morphine on pain score in total hip arthroplasty 556=62-63 (2023): 54-58 DOI: 10.21857/m8vqrtg109

Copyright (C) 2023 Mandarić A, Orešković Z, Marić I, Žura M, Morović S. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

ABSTRACT:

Introduction: The advantage of intrathecal morphine is due to its delivery into the subarachnoid space with direct access to opiate receptors and ion channels, while clinical duration of action can be as long as 20 hours. Joint replacement surgery is reported to be one of the most painful surgical procedures. The key factor for short postoperative length of stay and rapid functional recovery is pre-operative, intraoperative and postoperative analgesia. Spinal anaesthesia incorporating intrathecal morphine has been used as a systemic opioid-sparing technique. The most frequently investigated dose of intrathecal morphine was 100 µg.

Materials and Methods: In this study, spinal anaesthesia with the addition of morphine for intrathecal administration at a dose of 200 µg and 250 µg was administered to patients who underwent surgery for total hip arthroplasty and VAS pain scale was monitored postoperatively in the next 24 hours. The study group was compared to a group of patients who received standard intravenous analgesia postoperatively.

Results: Intrathecal application of morphine improves pain management in the first 24 postoperative hours in comparison to a control group who has received a systemic combination of opioid and non-opioid analgesics as part of postoperative analgesia.

Conclusions: The use of intrathecal morphine at a dose of 200 µg or 250 µg is an extremely good analgesic method in the postoperative period after surgery for total hip arthroplasty.

KEYWORDS: Intrathecal, Hip arthroplasty, Morphine, Pain management, Regional anaesthesia

SAŽETAK:

UČINAK INTRATEKALNOG MORFIJA NA SKALU BOLI KOD OPERATIVNOG ZAHVATA UGRADNJE TOTALNE ENDOPROTEZE KUKA

Uvod: Prednost primjene intratekalnog morfija je njegova isporuka u subarahnoidalni prostor s izravnim pristupom opioidnim receptorima i ionskim kanalima a kliničko djelovanje može biti i do 20 sati. Operativni zahvat ugradnje totalne endoproteze kuka smatra se jednim od najboljih kirurških zahvata u medicini. Ključni čimbenik kratkog postoperativnog boravka i brzog funkcionalnog oporavka je preoperativna, intraoperativna i postoperativna analgezija. Spinalna anestezija koja uključuje intratekalni morfij korištena je kao sustavna tehnika koja smanjuje upotrebu opioida intravenski. Najčešće ispitivana doza intratekalnog morfija je 100 µg.

Materijali i metode: Kod bolesnika koji su podvrgnuti operativnom zahvatu ugradnje totalne endopro-

teze kuka primijenjena je spinalna anestezija s dodatkom morfija za intratekalnu primjenu u dozi od 200 µg i 250 µg te je praćena VAS skala boli 24 sata postoperativno. Ispitivana skupina uspoređena je sa skupinom bolesnika koji su postoperativno primali standardnu intravensku analgeziju.

Rezultati: Intratekalna primjena morfija efikasnije smanjuje subjektivni osjećaj boli u prva 24 postoperativna sata u usporedbi s kontrolnom skupinom koja je primala sistemska kombinaciju opioidnih i neopioidnih analgetika kao dio postoperativne analgezije.

Zaključak: Primjena intratekalnog morfija u dozi od 200 µg i 250 µg izuzetno je dobra analgetska metoda u postoperativnom razdoblju nakon operacije ugradnje totalne endoproteze kuka.

KLJUČNE RIJEČI: endoproteza kuka, intratekalni morfij, lijećenje boli, regionalna anestezija

INTRODUCTION

The advantage of intrathecal morphine is due to its delivery into the subarachnoid space with direct access to opiate receptors and ion channels. Clinical duration of action can be as long as 20 hours given the biphasic pattern.

Joint replacement surgery is reported to be one of the most painful surgical procedures. The key factor for short postoperative length of stay and rapid functional recovery is pre-operative, intraoperative and postoperative analgesia (1). Spinal anaesthesia incorporating intrathecal morphine has been used as a systemic opioid-sparing technique. The most frequently investigated dose of intrathecal morphine was 100 µg (7,8).

MATERIALS AND METHODS

This retrospective study was conducted in University Hospital Centre Zagreb, Department of Orthopaedic surgery and Department of Anaesthesiology, ICU and pain therapy. In this study, the difference between the use of standard methods of analgesia, which include systemic administration of opioid and non-opioid analgesics, and the administration of intrathecal morphine in patients after total hip arthroplasty was examined. 100 patients were included in the research, who, due to primary coxarthrosis, were scheduled to have a total hip replacement. After the patients have been given an indication for the planned operation by the orthopaedist, all patients were examined in the anaesthesiology outpatient 3-4 weeks before the planned admission to the hospital. In the department of anaesthesiology, all patients were clinically examined, laboratory findings were accessed, and the patient's history was taken with regard to cardiorespiratory, kidney and liver diseases. Preoperative laboratory findings were in the referent range for all patients. Upon admission to the hospital, based on clinical status, laboratory and anamnestic data, patients were classified according to the American Society of Anaesthesiologists (ASA) classification into one of the IV groups. The research included patients of ASA status I, II and III. Exclusion criteria were allergy to morphine preparations, history of respiratory depression and history of nausea, vomiting after

opioid administration and ASA status IV. All patients signed consent to participate in the study.

The patients who met the research criteria were grouped into one of the two examined patient groups. One group of patients received a systemic combination of opioid and non-opioid analgesics as part of postoperative analgesia, and the other group received morphine intrathecally, as well as standard therapy based on the patient's needs. The preparation of all patients who are planned to have a primary hip endoprosthesis was the same, regarding premedication, antibacterial prophylaxis and thromboprophylaxis. Patients were divided in 2 groups: test group and control group in total 100 patients. In the test group, 27 patients have received 200 µg of morphine, and 20 patients have received 250 µg. In the examined group intrathecal morphine was administered. That is an invasive procedure and involves the administration of the drug into the subarachnoid space by inserting an atraumatic sterile spinal needle. The application was part of the same procedure that applies spinal anaesthesia, only morphine was added to the local anaesthetic which was 0.5% Chirocaine (Levobupivacaine, Abbott), which was performed with atraumatic spinal needles (Becton Dickinson). During the first 24 postoperative hours the VAS scale was monitored (0-no pain, 10-the strongest possible pain). In cases where the VAS score was greater than 4, the patients received additional analgesic therapy intravenously. The pain scale was recorded for a total of 24 hours. There were 10 measurements in total. Student's t test was used for statistics.

RESULTS

Average VAS score per patient was collected in 24 postoperative hours. The results were compared in the test group and control group. In the test group there were in total 47 patients, while in the control group there were in total 53 patients. The patients in the test group were later divided in 2 subgroups and among them 27 patients have received 200 µg morphine while 20 have received 250 µg. The results have shown that the average VAS

score per patient per hour (during 24 postoperative hours) in the group who have received 200 µg morphine was 1,09 and in the other group who have received 250 µg was 0,64. The VAS score in the control group was 2,39. The results suggest that the least

pain was felt by patients in the group who have received 250 µg. The p-value in the 250 µg group was 0.001 compared to the control group (Figure 1).

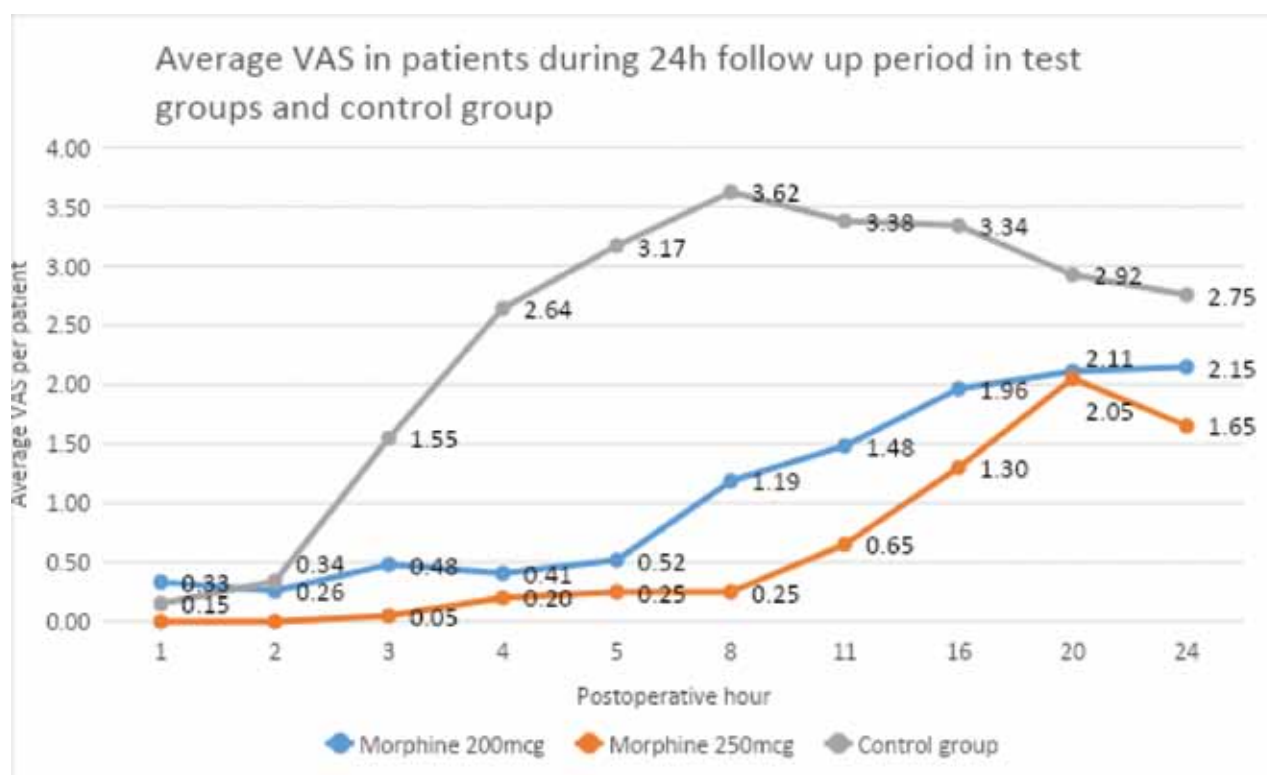


Figure 1. Comparison of average VAS scale in both test ($n=47$) and control group ($n=53$)

DISCUSSION

The first intrathecal injection of morphine was performed in 1979 to achieve pain relief (2), and since then, this intervention has been successfully used in many surgical operations including lower limb arthroplasty (3). While hip arthroplasty is performed on almost daily basis with a short hospital stay, anaesthesiologists still hesitate to administer intrathecal morphine despite its expected analgesic effect, partially for fear of potential side-effects, especially postoperative nausea, and vomiting (PONV) and eventual respiratory depression (4). The results of meta-analysis (5) that was published in 2022 including 29 trials with 1814 patients have concluded that dose of 100 mcg is 'ceiling' dose for analgesia and a threshold dose for increased rate of postoperative nausea and vomiting. Many studies have used intrathecal

morphine doses that ranged from 35 µg (6) to 500 µg (7), while the most frequently investigated dose was 100 µg (8,9). They recommend an intrathecal dose of 100 µg for improving patient comfort without increasing the risk of PONV. One area worthy of discussion is the risk of postoperative hypoventilation. Even more if patients demonstrated a greater degree of sedation in the intrathecal morphine group, there was no effect on the rates of hypoxaemia or respiratory depression. This is important, as many physicians believe that continuous monitoring is necessary, following recommendations from the American Society of Anaesthesiologists (10).

While respiratory depression might have been a clinical problem within intrathecal morphine doses of 250 µg, as reported in the late 1980s (11), recent evidence highlights the absence of respira-

tory depression with doses below 150 µg (12), even in older people undergoing hip arthroplasty. Thus, an intrathecal morphine dose of 100 µg for lower limb arthroplasty seems to warrant no more than standard postoperative care. Notably, the duration of effect of intrathecal morphine is estimated to be up to 16 h (13) which may be the underlying reason for clinically unimportant differences in analgesic outcomes at 24 hr. However, intrathecal morphine was associated with an increased risk of PONV, worse pruritus and more urinary retention, but without impact on hospital length of stay. Therefore, these above-mentioned analyses concluded that there was a dose threshold of 100 µg, above which the rate of PONV statistically increased, with an absolute risk of 12% (5). With all said, they finally recommend an intrathecal dose of 100 mcg for improving patient comfort without increasing the risk of PONV. In our study, we have decided to administer doses between 200 µg and 250 µg because lower doses have shown to have less analgesic effect. VAS score was lower in the test group in comparison to the control group. To compare with research done by Sibanyoni et al (14), they have administered doses of 150 µg and had average VAS scale score of 1, while in our test group of 250 µg average VAS scale score was 0.64 vs 1.09 in the group who have received 200 µg. We have not encountered adverse effects such as respiratory depression, hypoventilation, urinary retention, and PONV incidence was

13% while meta-analysis (5) had shown PONV incidence of 12% when 100 µg dose administered.

CONCLUSION

In spite of recommendations of above-mentioned meta-analysis (4), we have decided to conduct the study based on doses higher than 100 µg due to better pain reduction. We have not encountered respiratory depression or any similar hypoventilation problems, and it is worth mentioning that PONV was noted in 13% patients who have received doses of 200 µg or 250 µg. In conclusion, patients who have received intrathecal morphine of 200 µg or 250 µg had lower pain scores compared to previously reported results with lower morphine dose. Also, patients who were administered intrathecal morphine had VAS scores lower than those in the test group. Nevertheless, this topic required further randomised control trials to prove the efficacy of intrathecal morphine in different dosing regimens.

ACKNOWLEDGEMENTS

The authors have no conflicts of interest to declare. All co-authors have seen and agree with the contents of the manuscript and there is no financial interest to report. We certify that the submission is original work and is not under review at any other publication.

REFERENCES

- Gonvers E, El-Boghdadly K, Grape S, Albrecht E. Efficacy and safety of intrathecal morphine for analgesia after lower joint arthroplasty: a systematic review and meta-analysis with meta-regression and trial sequential analysis. *Anaesthesia*. 2021 Dec;76(12):1648-1658.
- Wang JK, Naus LA, Thomas JE. Pain relief by intrathecally applied morphine in man. *Anesthesiology* 1979; 50: 149–51.
- Albrecht E, Morfey D, Chan V, et al. Single-injection or continuous femoral nerve block for total knee arthroplasty? *Clinical Orthopaedics and Related Research* 2014; 472: 1384–93.
- V. Maheshwari, Y.C. Blum, L. Shekhar, A.S. Ranawat, C.S. Ranawat Multimodal pain management after total hip and knee arthroplasty at the Ranawat Orthopaedic Center *Clin. Orthop. Relat. Res.*, 467 (6) (2009), pp. 1418-1423
- Anaesthesia 2020; 75: 54–61. Gonvers E, El-Boghdadly K, Grape S, Albrecht E. Efficacy and safety of intrathecal morphine for analgesia after lower joint arthroplasty: a systematic review and meta-analysis with meta-regression and trial sequential analysis. *Anaesthesia*. 2021 Dec;76(12):1648-1658.
- Sundarathiti P, Thammasakulsiri J, Supboon S, Sakdanuwatwong S, Piangjai M. Comparison of continuous femoral nerve block(CFNB/SA) and continuous femoral nerve block with mini-dose spinal morphine (CFNB/SAMO) for postoperative analgesia after total knee arthroplasty (TKA): a randomized controlled study. *BMC Anesthesiology* 2015;16:38.
- Drakeford MK, Pettine AK, Brookshire L, Ebert F. Spinal-narcotics for postoperative analgesia in total joint arthroplasty. A prospective study. *Journal of Bone and Joint*
- Albrecht E, Bayon V, Hirotsu C, Al Ja'bari A, Heinzer R. Intrathecal morphine and sleep apnoea severity in patients

- undergoing hip arthroplasty: a randomised, controlled, triple-blinded trial. *British Journal of Anaesthesia* 2020;125: 811–7
9. Biswas A, Perlas A, Ghosh M, et al. Relative contributions of adductor canal block and intrathecal morphine to analgesia and functional recovery after total knee arthroplasty: a randomized controlled trial. *Regional Anesthesia and Pain Medicine* 2018;43: 154–60.
 10. Practice Guidelines for the prevention, detection, and management of respiratory depression associated with neuraxial opioid administration: an updated report by the American Society of Anesthesiologists Task Force on neuraxial opioids and the American Society of Regional Anesthesia and Pain Medicine. *Anesthesiology* 2016;124: 535–52
 11. Jacobson L, Chabal C, Brody MC. A dose-response study of intrathecal morphine: efficacy, duration, optimal dose, and side effects. *Anesthesia and Analgesia* 1988;67: 1082–8
 12. Crowgey TR, Dominguez JE, Peterson-Layne C, Allen TK, Muir HA, Habib AS. A retrospective assessment of the incidence of respiratory depression after neuraxial morphine administration for postcesarean delivery analgesia. *Anesthesia and Analgesia* 2013;117: 1368–7
 13. Saldman L, Cousins M, Mather L. Intrathecal and epidural administration of opioids. *Anesthesiology* 1984;61: 276–310
 14. Sibanyoni, M., Biyase, N. & Motshabi Chakane, P. The use of intrathecal morphine for acute postoperative pain in lower limb arthroplasty surgery: a survey of practice at an academic hospital. *J Orthop Surg Res* 17, 323 (2022).

