Review Article Pol J Public Health, Vol. 134 (2024): 77-80

ALICJA SODOLSKA[1], KAMIL FATYGA[2], MIKOŁAJ PORZAK[1], MATEUSZ SOBCZYK[1], PAULINA OLEKSA[1], DARIA ŻURAW[1], KACPER JASIŃSKI[1], MONIKA SIEŃCZYK-MOSKWA[1]

Methods of postoperative pain treatment and evaluation of the analgesic effect of ropivacaine in local infusions

Abstract

Postoperative pain, resulting from tissue damage, poses a significant challenge, especially in surgeries involving tissue disruption. Effective management is crucial as uncontrolled pain can hinder rehabilitation, limit mobility, and delay wound healing. Local anesthetics like ropivacaine, administered in continuous local infusions, have gained attention for managing postoperative pain through continuous infusion, targeting sensory nerves over motor nerves.

A study at the Orthopedics and Traumatology Clinic of the Medical University in Lublin evaluated ropivacaine's efficacy in patients undergoing total hip and knee arthroplasty. Total number of 99 patients (38 men, 61 women) were assessed postoperatively in 2018 and 2019. Forty-one patients received 300 ml of 0.25% ropivacaine in continuous infusion at 5 ml/h for 60 hours with on-demand analgesics, while 58 received only conventional analgesics (morphine, ketoprofen, metamizole). Pain management was evaluated over three days post-surgery.

All patients required pain management during the initial three days. Ropivacaine patients needed fewer additional analgesics compared to the non-ropivacaine group. For hip arthroplasty with ropivacaine, the average doses of ketoprofen were 3.6, metamizole 3.36, and morphine 2; for knee arthroplasty, the averages were ketoprofen 6, metamizole 2.31, and morphine 1.43. Non-ropivacaine patients had higher doses. Overall, ropivacaine modestly reduced additional pain relief needs.

Ropivacaine modestly reduces the demand for additional analgesics postoperatively. Knee surgery required more ketoprofen than hip surgery, with similar requirements for other analgesics in both procedures. Further research is needed to refine pain management strategies and improve postoperative outcomes.

Keywords: postoperative pain, ropivacaine, opioids, nonsteroidal anti-inflammatory drugs (NSAIDs), local anesthetics, arthroplasty.

DOI: 10.12923/2083-4829/2024-0017

INTRODUCTION

Pain is a negative and subjective sensation resulting from tissue damage. It is a particularly significant medical problem, especially in surgical specialties involving tissue disruption. For years, there have been ongoing efforts to find the most optimal approach to intra-operative and postoperative pain. Effective management of postoperative pain not only improves patient comfort but also contributes to faster rehabilitation and shorter hospitalization [1,2].1,2.

One of the ways to treat postoperative pain is ropivacaine, a derivative of bupivacaine [3]3. It causes a slower blockade of motor nerves than sensory nerves. Ropivacaine is typically administered locally through continuous wound infusions at concentrations ranging from 0.2% to 0.5%. It can also be given as a bolus, with a single dose ranging from 250 mg to 300 mg. The cumulative daily dose should not exceed 675 mg [4,5].4,5 Other examples of postoperative pain treatment are opioid drugs, used in analgesic therapy which include morphine, tramadol, fentanyl, and oxycodone. Undesirable effects may occur during opioid use, such as nausea, vomiting, dizziness, drowsiness, or respiratory problems [6]6. Therefore, it is important to monitor the patient and adjust the dose as needed. Opioids have an addictive potential, meaning their use can lead to the development of both physical and psychological dependence [7,8]7,8. Regular opioid use can result in physical dependence, where the body becomes accustomed to the presence of the substance. As a result, discontinuation or reduction in dosage may cause withdrawal symptoms such as pain, nausea, tremors, and sleep disturbances. In addition to physical dependence, opioids can also lead to psychological dependence [9]9. Individuals may experience a strong desire to continue using the substance due to its psychoactive effects and its ability to alleviate pain. Not everyone who uses opioids becomes addicted, but the risk of addiction increases with prolonged and regular use, especially at higher doses. Individuals addicted to opioids often exhibit characteristic behaviors, including excessive focus on obtaining the substance, loss of control over its use, and continued use despite negative health, social, or professional consequences [10,11].10,11. Individuals addicted to opioids are at an increased risk of progressing to drug abuse, especially if they begin to use the substances through non-oral routes. Therefore, the use of opioids requires close monitoring by healthcare professionals, and patients should be informed

[1] Student Scientific Association at the Chair and Department of Epidemiology and Clinical Research Methodology, Medical University of Lublin, Poland
[2] Department of Orthopaedics and Traumatology, Independent Public Clinical Hospital No. 4 in Lublin, Poland

about the potential risks of addiction [12].12. In the case of pain management with opioids, it is recommended to use them according to the doctor's recommendations, with regular assessments and monitoring of the patient [13,14].13,14.

Nonsteroidal anti-inflammatory drugs (NSAIDs) are often used in the treatment of postoperative pain due to their ability to reduce inflammation, lower fever, and alleviate pain. The most commonly used drugs in this group are paracetamol, ketoprofen, and metamizole [15,16]15,16. The use of these drugs is associated with the risk of hypertension and edema due to weakened renal perfusion. Another unwanted effect of NSAID use is the disturbance of blood platelet function, which can lead to prolonged blood clotting time [17,18].17,18. It should also be taken into account that the mentioned oral drugs may interact unfavorably with other drugs taken chronically by patients, such as glucocorticoids, antidiabetic drugs, and beta-blockers [19].19. Special attention should be paid to patients at risk, who are most susceptible to adverse effects of analgesic drugs. These include patients with cardiovascular diseases, gastrointestinal tract disorders, kidney and liver function disorders, a history of hypersensitivity to analgesic drugs, and patients over 65 years of age [17,20].17,20. Individual adjustment of treatment to the patient's needs and a thorough clinical assessment are crucial. Patients should strictly follow the doctor's recommendations, especially in the case of prolonged use of these drugs.

AIM

The aim of the study was to discuss methods of postoperative pain treatment and evaluate the effectiveness of ropivacaine's analgesic action in the treatment of postoperative pain in patients after total hip arthroplasty and total knee arthroplasty.

MATERIAL AND METHODS

A total of 99 patients treated at the Orthopedics and Traumatology Clinic of the Medical University of Lublin in 2018 and 2019 were included in the assessment. The group of participants is described in Table 1. Among the evaluated individuals, there were 38 men aged 38 to 87 years (mean age 62 years) and 61 women aged 51 to 85 years (mean age 69 years). Fifty subjects underwent total hip arthroplasty, and 49 patients underwent total knee arthroplasty. In the postoperative period, 41 patients received 300 ml of 0.25% ropivacaine in continuous infusion at 5 ml/h for 60 hours and additional analgesic drugs as needed, while 58 patients were treated only with conventional analgesics such as a single dose of 10 mg morphine, a single dose of 100 mg ketoprofen, and a single dose of 1g metamizole. The number of patients of consumed doses of morphine, ketoprofen, and metamizole was compared to the ropivacaine-treated group and the group without ropivacaine. Ropivacaine was administered from the first day after surgery in an infusion to the postoperative wound suprafascially, following the manufacturer's recommendations. Pain perception assessment was conducted on the first, second, and third days after surgery, estimating the quantitative demand for additional analgesics beyond ropivacaine on those days after surgery.

Characteristics of the study population

The medical records of patients from the Department of Orthopaedics and Traumatology were analysed.

TABLE 1. The group of patients with and without ropivacaine according to gender.

Gender	Amount (n)	With ropivacaine	Without ropivacaine
Women	61	23	38
Men	38	18	20

TABLE 2. The group of patients in relation to the type of surgical procedure and use of ropivacaine.

		Ropivacaine					
		Without		With		Total	
		Count	Amount %	Count	Amount %	Count	Amount %
Type of surgery	Hip arthroplasty	25	43.1%	25	61.0%	50	50.5%
	Knee arthroplasty	33	56.9%	16	39.0%	49	49.5%
	Total	58	100.0%	41	100.0%	99	100.0%

The table 2 presents the numerical and percentage count of patients undergoing hip arthroplasty and knee arthroplasty indicating how many received ropivacaine and how many did not.

RESULTS

The demographic characteristics of patients and the study results are presented in Tables 1 and 2. All patients required analgesic treatment during the first 3 days. In the ropivacaine-treated group, each patient required additional analgesic treatment. On average, each patient receiving 300 ml of 0.25% ropivacaine in continuous infusion at 5 ml/h for 60 hours after total hip arthroplasty took 3.6 doses of ketoprofen, 3.36 doses of metamizole, and 2 doses of morphine, while in the group after total knee arthroplasty, the average number of doses taken was: 6 for ketoprofen, 2.31 for metamizole, and 1.43 for morphine. In the group of patients who did not receive ropivacaine in the postoperative period, the required amount of analgesics was as follows: patients after total hip arthroplasty required 3.64 single doses of ketoprofen, 4.04 single doses of metamizole, and 2.24 single doses of morphine, while patients after total knee arthroplasty required 5.81 single doses of ketoprofen, 2.56 single doses of metamizole, and 0.93 morphine. In total, postoperative patients without ropivacaine required 277 single doses of ketoprofen, 183 single doses of metamizole, and 86 single doses of morphine, whereas patients who received ropivacaine required 174 single doses of ketoprofen, 121 single doses of metamizole, and 73 single doses of morphine.

TABLE 3. Demand for medications in relation to ropivacaine.

	Kind of medication / Operated joint	Ketoprofen	Metamizole	Morphine
With ropivacaine	Hip-joint	3.6 (mean) 78 (amount of single doses)	3.36 (mean) 84 (amount of single doses)	2 (mean) 50 (amount of single doses)
	Knee-joint	6 (mean) 96 (amount of single doses)	2.31 (mean) 37 (amount of single doses)	1.43 (mean) 23 (amount of single doses)
Without ropivacaine	Hip-joint	3.64 (mean) 91 (amount of single doses)	4.04 (mean) 101 (amount of single doses)	2.24 (mean) 56 (amount of single doses)
	Knee-joint	5.81 (mean) 186 (amount of single doses)	2.56 (mean) 82 (amount of single doses)	0.93 (mean) 30 (amount of single doses)

After comparing the demand for analgesics in the group of patients treated with ropivacaine and without ropivacaine, it was found that patients who received ropivacaine took less ketoprofen, metamizole, and morphine. It can be inferred that the analgesic effect of ropivacaine somewhat reduces the need for additional analgesics.

DISCUSSION

Local application of ropivacaine in the postoperative period slightly reduces the need for other analgesic medications [21].21. Knee surgery requires a higher amount of ketoprofen compared to hip joint surgery. The quantity of other analgesic drugs remains similar for hip and knee surgeries. However, it should be noted that the groups of patients who received ropivacaine and those who did not were different in size. Therefore, the differences in the number of doses administered may be related to the size of the groups, rather than solely to the effectiveness of ropivacaine. Nevertheless, it is clear that ropivacaine alone is an insufficient method for managing pain following hip and knee arthroplasty.

Comparing the described study with research by other authors, the conclusions are quite similar. Other studies have found that a single bolus injection of 20 ml followed by a continuous infusion of 2 ml/h with 0.75% ropivacaine after total knee arthroplasty provides only marginal analgesic effect. However, these studies initially used a single local intra-articular infusion followed by continuous ropivacaine infusion [22].22. They employed a higher concentration of ropivacaine but at a lower flow rate compared to our method.

CONCLUSION

In recent years, local anesthetics like ropivacaine, administered through continuous infusion, have gained attention for their potential in postoperative pain management. Ropivacaine offers a targeted approach to pain relief with a slower blockade of motor nerves compared to sensory nerves. The paper concludes with a summary of the main aspects of postoperative pain management, emphasizing the need for further research into new therapies and management strategies to improve the quality of care for patients undergoing surgical procedures. It also focuses on developing individualized care, considering the differences between patients and their response to analgesic therapies [23].23.

Therefore, effective management of postoperative pain is crucial not only for a rapid recovery to physical health but also for improving the quality of life for patients on multiple levels. Implementing a comprehensive approach to pain treatment, considering both pharmacological and psychosocial aspects, can significantly enhance patients' experiences. Effective communication between patients and healthcare professionals is recognized as a critical component of successful pain management.

The controversial question remains whether a slight difference in the demand for analgesics justifies the use of ropivacaine in the postoperative period. Further research in this area is crucial to refine existing strategies, minimize risks, and enhance the overall postoperative experience for patients undergoing various surgical procedures.

REFERENCES

1. Wordliczek J, Dobrogowski J. Pain treatment. Warszawa: Wyd. Lek. PZWL; 2017.p.1-29.
2. Wordliczek J, Zajączkowska R, Woroń J, et al. Post-traumatic pain management. Anastezjologia i ratownictwo. 2019;13(2):149-59.
3. Wordliczek J, Zajączkowska R, Dziki A, et al. Postoperative pain relief in general surgery –recommendations of the Association of Polish Surgeons, Polish Society of Anaesthesiology and Intensive Therapy, Polish Association for the Study of Pain and Polish Association of Regional Anaesthesia and Pain Treatment. Pol Surg Rev. 2019;91(1):47-68.
4. Balcerkiewicz M, Wyrwiński M. Ropivacaine drug interactions. Farm Pol. 2010;66(6):415-24.
5. Knudsen K, Suurküla MB, Blomberg S, Sjövall J, Edvardsson N. Central nervous and cardiovascular effects of iv infusions of ropivacaine, bupivacaine and placebo in volunteers. Br J Anaesth. 1997;78(5):507-14.
6. Misiołek H, Zajączkowska R, Daszkiewicz A. Postoperative pain management – 2018 consensus statement of the Section of Regional Anaesthesia and Pain Therapy of the Polish Society of Anaesthesiology and Intensive Therapy, the Polish Society of Regional Anaesthesia and Pain Therapy, the Polish Association for the Study of Pain and the National Consultant in Anaesthesiology and Intensive Therapy. Anaesthesiol Intensive Ther. 2018;50(3):173-99.
7. KuKanich B, Wiese AJ. Opioids. In: Veterinary anesthesia and analgesia: the fifth edition of Lumb and Jones. John Wiley & Son; 2015. p. 207-26.
8. Gutstein HB, Akil H. Opioid analgesics. Goodman & Gilman's the pharmacological basis of therapeutics. New York: McGraw-Hill; 2006. p.547-90.
9. Chan BKB, Tam LK, Wat CY, et al. Opioids in chronic non-cancer pain. Expert Opin Pharmacother. 2011;12(5):705-20.
10. Zaporowska-Stachowiak I, Oduah MTA, Celichowska M, et al. Opioids in clinical practice. Varia Medica. 2020;4(1):43-51.
11. Leppert W, Majkowicz M. The impact of tramadol and dihydrocodeine treatment on quality of life of patients with cancer pain. Int J Clin Pract. 2010;64(12):1681-7.
12. Dumas EO, Pollack GM. Opioid tolerance development: a pharmacokinetic/pharmacodynamic perspective. AAPS J. 2008;10:537-51.
13. Zaporowska-Stachowiak I, Oduah MTA, Celichowska M, et al. Opioids in clinical practice. Palliat Med Pract. 2019;13(4):221-8.
14. Gommers D, Bakker J. Medications for analgesia and sedation in the intensive care unit: an overview. Crit Care. 2008;12(3):1-5.
15. Samborski W, Niklas A, Filipiak KJ, et al. Non-steroidal anti-inflammatory drugs and cardiovascular and gastroenterological complications: algorithm of choice. Choroby serca i naczyń. 2017;14(5):238-48.
16. Misiołek H, Cettler M, Woroń J, et al. The 2014 guidelines for post-operative pain management. Anaesthesiol Intensive Ther. 2014;46(4):221-44.
17. Szkutnik-Fiedler D, Kaznowska P., Szałek E, Grześkowiak E. Pain and opioids – gender differences. Farm Współcz. 2010;3:186-91.
18. Synoweć J, Pogorzelczyk K, Robakowska M, et al. Consequences of using generally available non-steroidal anti-inflammatory drugs (NSAIDs). Med Rodz.2018;3:281-91.
19. Woroń J, Kostka-Trąbka E. „Practical aspects of drug interactions in the pharmacotherapy in otolaryngology, or the seven cardinal sins of pharmacological treatment in otolaryngological practice" Polish Journal of Otorhinolaryngology, 2016;70(4), 1-9.
20. McCartney CJ, Nelligan K. Postoperative pain management after total knee arthroplasty in elderly patients: treatment options. Drugs Aging. 2014;31:83-91.

21. Kaczmarska A, Myśliwiec U, Muca A, Pasztelan M. Treatment of post-operative pain with ropivacaine. Improvements in medical diagnostics. Lublin: Instytut Promocji Kultury i Nauki; 2020. p.31-40.
22. Lee HJ, Woo YK. The efficacy of intra-articular infusion of ropivacaine after total knee arthroplasty. Korean Journal of Anesthesiology. 2007;53(4):486-90.
23. Bonnet F, Marret E. Postoperative pain management and outcome after surgery. Best Pract Res Clin Anaesthesiol. 2007;21(1):99-107.

Corresponding author
Dr Daria Żuraw
Student Scientific Association at the Chair and Department of Epidemiology and Clinical Research Methodology, Medical University of Lublin
11 Radziwiłłowska St., 20-080 Lublin
e-mail: dariazuraw19@gmail.com