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Use of intrathecal morphine in knee arthroplasty in patients older than 50 years. A single-center experimental study.

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Abstract

Introduction: Total knee arthroplasty causes intense postoperative pain. This study aims to evaluate the efficacy of intrathecal anesthesia with low-dose morphine hydrochloride in patients undergoing total knee arthroplasty.

Methods: The present experimental study was conducted at the Hospital Alcívar in Guayaquil, Ecuador, from January to December 2022 with patients older than 18 years who underwent total knee arthroplasty surgery and were randomized to receive an intrathecal injection of morphine at a dose of 0.1 µg/kg of weight (group 1) or morphine at a dose of 0.2 µg/kg (group 2). Analgesia was assessed using the analog pain rating scale (VAS). Side effects were measured. The proportions were compared with the chi-square test, and the medians were compared with the Mann–Whitney U test.

Results: There were 22 women (55%) and 18 men (45%). The average age was 68.9 years. Low-dose intrathecal morphine had a significantly longer analgesia time (20 hours vs. 24 hours) and a substantially shorter anesthesia time (210 minutes vs. 300 minutes). Patients receiving low-dose intrathecal morphine also had equal VAS scores for intraoperative pain (1 vs. 1), immediate postoperative pain (1 vs. 1), and 24-hour postoperative pain (2 vs. 1). . The incidence of hypotension, nausea, vomiting, and pruritus was similar in both groups.

Conclusions: Low-dose intrathecal morphine is a safe and effective option for postoperative pain control in patients undergoing total knee arthroplasty.

Keywords:

MeSH: Arthroplasty, Replacement, Knee; rotation; Tomography.

Abbreviations

ASA stands for American Society of Anesthesiologists or American Society of Anesthesiologists. The ASA classification is a system used to assess a patient's general health before surgery. The ranking goes from 1 to 6, with 1 being the highest overall health and 6 being the lowest overall health.
ASA 1: Healthy patient without significant systemic disease.
ASA 2: Patient with mild systemic disease that does not limit regular activity.
ASA 3: Patient with moderate systemic disease that limits regular activity but does not make it impossible.
ASA 4: Patient with severe systemic disease that limits regular activity and requires hospitalization.
ASA 5: Patients with terminal systemic disease with a life expectancy of 24 hours.
ASA 6: The dying patient was declared dead on arrival in the operating room.

Supplementary information

No supplementary materials are declared.

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Author contributions

Emilio Moscoso Solórzano: Conceptualization, data curation, formal analysis, fundraising, research, writing - original draft.
María Fernanda Narváez: Conceptualization, Data Curation, Formal Analysis.
All the authors have read and approved the final version of the manuscript.

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Availability of data and materials

Not declared.

Introduction

Knee arthroplasty causes severe postoperative pain for the majority of patients. The goals for pain control after knee arthroscopy are to provide excellent analgesia, early mobilization, and rehabilitation [1].

Pain is a significant problem for these patients in the postoperative period, and pain control is perhaps one of the most critical challenges facing the medical teams of these patients. This affects the patient's sense of well-being and is associated with increased morbidity and mortality, which can alter the immune response [2]. There are different alternatives for treating postoperative pain, among which we use nonsteroidal anti-inflammatory drugs (NSAIDs) and systemic opioids, anesthetics, and opioids by the epidural or intrathecal route, as well as regional nerve blocks [3].

The alternative proposed in this study is using intrathecal anesthesia with low doses of morphine hydrochloride.

The history of intrathecal and epidural anesthesia has run parallel to that of general anesthesia. The first published review of the use of opioids in "spinal" anesthesia is due to a Romanian surgeon, Racoviceanu-Pitesti, who presented his experience in Paris in 1901. Behar et al. published the first article on epidural morphine for pain treatment in The Lancet in 1979. Almost a century passed before the routine use of opioids via the spinal route as intraoperative and postoperative analgesic treatment of labor and chronic pain was achieved [4].

Intrathecal administration of morphine at 100-200 µg produces analgesia lasting up to 24 hours. In the literature, the use of intrathecal morphine doses is described, which varies between 250 and 2500 µg, and the usual dose ranges between 250 and 500 µg. Ziegeler et al. demonstrated that 400 µg doses have a sufficient analgesic effect, with a low rate of complications and no severe complications [5]. Adjusting the dose according to the patient's weight is controversial. Cerebrospinal fluid volume is inversely proportional to body mass index; however, various diseases can modify this volume.

On the other hand, Eisenach et al. identified that the distribution of intrathecal morphine did not correlate with cerebrospinal fluid volume, weight, or patient height [6]. Thus, adjusting the dose according to the patient's weight would not ensure a predictable clinical effect. However, the distribution may not correlate with this approach since the pharmacodynamic and pharmacokinetic effects of drugs by the different routes of administration cannot be denied since, in the end, they pass into the bloodstream, where they must be metabolized and eliminated [7].

This study is designed to demonstrate the efficacy of low-dose intrathecal morphine hydrochloride combined with bupivacaine in a group of patients undergoing total knee arthroplasty surgery at a referral hospital in Guayaquil.

Materials and methods

Study design

The present study is experimental. The source is prospective.

Scenery

The study was conducted in the Alcívar Hospital anesthesia service in Guayaquil, Ecuador. The study period was from January 1, 2022, to December 31, 2022.

Participants

Patients of legal age diagnosed with ASA I, II, and III surgical risks who underwent surgical treatment for total knee arthroplasty were included. Patients with ischemic heart disease, congestive heart failure, allergy to morphine, and severe spinal disorders with the impossibility of performing the neuraxial technique were excluded.

Study groups

Group 1: intrathecal anesthesia was administered with morphine hydrochloride at a dose of 0.1 µg/kg of weight plus 0.75% hyperbaric bupivacaine at a dose of 0.2 mg/kg of patient weight.

Group 2: intrathecal anesthesia was administered with morphine hydrochloride at a dose of 0.2 µg/kg of weight plus hyperbaric bupivacaine 0.75% at 0.2 mg/kg.

Assignment to each group was performed in a simple random fashion in order of participation. Simple masking was performed.

Variables

The variables were demographic, such as age and sex. The dependent variable was pain perception using the analog pain assessment scale (VAS) during the operative period. Anesthesia time and analgesia time were measured. Side effects such as nausea, vomiting, hypotension, and pruritus were quantified.

Data sources/measurements

The source was direct; an electronic form was filled out from the data collected during the study period. The information was treated confidentially; personal data that would allow the

identification of the study subjects were not included. The patients signed informed consent to participate in the study.

Procedures

All patients preoperatively underwent a peripheral vein with a 16 or 18 G trocar saline solution administered intraoperatively and prophylactic antibiotic, gastric protector, and tranexamic acid before the intervention.

Noninvasive blood pressure monitoring, heart rate, electrocardiographic tracing, and pulse oximetry were performed.

All patients underwent a lumbar puncture for intrathecal drug administration. This puncture was made between L3 and L4 with a pencil point needle no. 25. During the intraoperative period, dexamethasone 8 mg, paracetamol 1 g, and ondansetron 8 mg were administered as a protocol in these patients.

Biases

The principal investigator kept the data with a guide and records approved in the research protocol to avoid interviewer, information, and memory biases. Observation and selection bias was avoided by applying the participant selection criteria. Two researchers independently analyzed each record in duplicate, and the variables were recorded in the database once their concordance was verified.

Study size

The sample was nonprobabilistic, of the census type, where all possible cases of the study period were included.

Quantitative variables

Descriptive statistics were used. The results are expressed as frequencies (categorical variables) and medians (numerical variables). Categorical data are presented in proportions.

Statistical analysis

Inferential statistics are used, using proportions and frequencies. The ratios are compared with Chi-square. Medians were compared with Mann–Whitney-Whitney's U test. The statistical package used was SPSS 27.0 (IBM Corp. Released 2020. IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp).

Results

Participants

The study included 40 patients with cemented primary total knee arthroplasty using standardized conventional prostheses from Servimedic and Biomet.

Study group characteristics

There were 22 women (55%) and 18 men (45%). The average age of the group was 68.9 years. Twenty-four left knee arthroplasties (60%) and 16 right knee arthroplasties (40%) were performed.

Main results

Analgesia time was longer in group 2, as was anesthesia time (Table 1). There were no differences in pain perception between the groups in the intraoperative and postoperative periods. There was no difference in intraoperative complications between the groups (Table 1).

Table 1. Comparative variables between the study groups.

	Group 1 n=20	Group 2 n=20	P
Analgesia time (hours)	twenty	24	<0.01
Anesthesia time (minutes)	210	300	<0.01
Intraoperative pain (VAS)	1	1	1
Immediate postoperative pain (VAS)	1	1	1
24-hour postoperative pain (VAS)	2	1	0.9
hypotension	1	5	0.076
Nausea	0	2	0.147
Threw up	0	1	0.311
Pruritus	0	1	0.311

VAS: Visual analog scale.

Discussion

The main results of this study on the use of low-dose morphine hydrochloride intrathecal anesthesia in patients undergoing total knee arthroplasty surgery are as follows:

Analgesia time: The group that received a dose of intrathecal morphine hydrochloride of 0.2 µg/kg of weight plus hyperbaric bupivacaine 0.75% at a dose of 0.2 mg/kg of weight had an average analgesia time of 24 hours, while the group that received a lower amount of intrathecal morphine

(0.1 µg/kg body weight plus bupivacaine) had a mean analgesia time of 20 hours.

Anesthesia time: The group receiving the highest dose of intrathecal morphine also had a longer anesthesia time, averaging 300 minutes, compared to the lower dose group, which had a mean anesthesia time of 210 minutes.

Pain perception: No significant differences were found between groups during the intraoperative and immediate postoperative periods (at 24 hours).

Intraoperative complications: The two groups had no significant differences in intraoperative complications.

Side Effects: No significant differences were observed in the incidence of side effects such as hypotension, nausea, vomiting, and pruritus between the two groups.

A previous study with 50 patients [8] comparing the use of low-dose intrathecal morphine and femoral nerve block for pain control after knee replacement surgery found that low-dose intrathecal morphine provided better analgesia and lower morphine consumption in the first 48 hours after surgery compared with femoral nerve block. Although some patients in the intrathecal morphine group experienced itching, there were no cases of respiratory depression. Unlike the present study comparing the usual dose with the low dose, a benefit is presented in the lower amounts of intrathecal morphine with the same clinical results. It is necessary to carry out more studies in the future since the disparity between the analgesic and surgical periods is vast, which could lead to a significant decrease in the morphine dose.

Conclusions

The study compared the effects of intrathecal morphine at low (0.1 µg/kg) and high (0.2 µg/kg) doses in 40 patients undergoing total knee arthroplasty. The results showed that low-dose intrathecal morphine provided similar pain control to high-dose morphine but with fewer side effects.

In particular, the low-dose group experienced an analgesia time of 20 hours, compared to 24 hours for the high-dose group. The two groups also had similar pain perceptions during the intraoperative and immediate postoperative periods. There were no significant differences in the incidence of intraoperative complications or side effects between the two groups. The findings of this study suggest that low-dose intrathecal morphine is a safe and effective option for pain control after total knee arthroplasty.

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Statements

Ethics committee approval and consent to participate

The ethics committee of the Alcívar Hospital approved the study.

Publication Consent

The authors have written permission to publish the images presented in this study by the patients.

Conflicts of interest

The authors declare they have no conflicts of interest.

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