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Original Research Article

Unilateral Hypobaric Rachianesthesia: Practice at the Reference Hospital of Maradi

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Abstract: Unilateral hypobaric spinal anesthesia is an anesthetic technique that provides hemodynamic stability, indicated for subumbilical surgery, especially in elderly subjects. The aim of this work was to demonstrate the effectiveness of this technique, which is very commonly practiced at the reference hospital in Maradi, through a descriptive and cross-sectional retrospective study over three years. Only patients who underwent surgery and had a complete file were included. A total of 56 patients were included, with a female predominance and a mean age of 78.03±5.4 years. The age group [60-70 years] represents 50%. The types of surgeries performed were traumatic and vascular. Surgical indications were dominated by pelvic limb trauma in 60.71% of cases. More than half of our patients (57.14%) had at least one comorbidity, with diabetes and hypertension at the forefront, accounting for 40.66% and 37.51%, respectively. At admission, patients presented a diverse hemodynamic state. Indeed, 10 had hypotension and 7 had hypertension. Bupivacaine was the only local anesthetic administered. Fentanyl and clonidine were the associated adjuvants. Osteosynthesis was the main surgical indication followed by amputation with respective rates of 51.78% and 28.57%. After anesthesia, patients were positioned in the lateral decubitus position, with the limb to be operated on positioned above, for 15 minutes. After this period, a failure rate of 8.20% was observed. Conversely, success was noted in 51 patients, 11 of whom had received a blood transfusion for intraoperative bleeding. However, no use of vasopressors was reported. The average duration of surgery was 64±11 minutes. No major incidents or conversions were reported intraoperatively. The average stay in the post-anesthesia recovery room was 43±12 minutes. The average anesthesia duration was 87±13 minutes. No incidents were reported postoperatively. This study allowed us to highlight the contribution of hypobaric unilateral spinal anesthesia in orthopedic-traumatological surgery, particularly in a resource-limited hospital.

Keywords: Spinal Anesthesia, Hypobaric, Unilateral, Elderly.

INTRODUCTION

Spinal anesthesia (SA) is a regional anesthesia technique (RA) that involves injecting a local anesthetic (LA) into the subarachnoid space via a lumbar puncture. It is the most commonly used anesthetic technique in surgery below the umbilicus. However, it exposes patients, especially elderly subjects, to sudden and significant drops in blood pressure, with an incidence ranging from 25 to 69% [1]. In 1959, Harder described unilateral spinal anesthesia in a German journal [2]. Today, this practice is of interest in two specific areas: outpatient anesthesia and anesthesia in elderly patients, in whom maintaining hemodynamic stability is important [3]. By placing patients in the lateral decubitus position and using low doses of local anesthetic, it limits the hemodynamic effects of sympathetic block, preserves control of the contralateral limb in 70 to 90% of cases, and therefore allows patients to walk more quickly [4]. Unilateral spinal anesthesia is particularly suitable for outpatient anesthesia and elderly patients. This technique is increasingly used in elderly patients admitted to the operating room at the Maradi referral hospital. The aim of our study is to evaluate the efficacy and safety of unilateral hypobaric spinal anesthesia in patients undergoing orthopedic trauma surgery. The

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objective of our work is to evaluate the efficacy and safety of unilateral hypobaric spinal anesthesia in patients undergoing trauma-orthopedic and vascular surgery of the pelvic limb in the operating room of the Maradi referral hospital.

MATERIALS AND METHODS

This was a retrospective, descriptive, cross-sectional study conducted in the Anesthesia and Intensive Care Unit of the Maradi referral hospital in Niger over a three-year period (January 1, 2022, to December 31, 2024). The study population consisted of all patients aged 60 years and older who underwent unilateral hypobaric spinal anesthesia in the operating room during the study period. Patients with incomplete medical records were excluded. The parameters studied were: demographic characteristics (age, gender, ASA class, body mass index), medical and surgical history, preoperative clinical status (preoperative blood pressure, preoperative blood count and hemostasis), surgical parameters (indication and duration of surgery), course of spinal anesthesia (products and doses administered, time taken for sensory-motor block to take effect), tolerance of spinal anesthesia (intraoperative incidents, postoperative complications, use of postoperative analgesics), intraoperative incidents, and postoperative complications. The effectiveness of anesthesia was assessed based on the onset of sensory-motor block and the absence of intraoperative and postoperative anesthetic complications. A pre-established survey form was used as the basis for data collection. The latter were entered using Word 2016 software and analyzed using SPSS®v.22 software. Correlation analysis was performed using the Chi2 test. A p-value of less than 0.05 was considered significant. Prior authorization from the hospital administration was obtained before conducting this work. Patient confidentiality was ensured by anonymizing the survey forms.

Operational Definition

The hypobaric solution is the local anesthetic solution obtained after dilution with the same volume to achieve a 50% reduction in concentration. In this case, 0.5% bupivacaine was the local anesthetic used. The concentration is 5 mg/ml. After dilution, we obtained a concentration of 2.5 mg/ml.

RESULTS

A total of 56 patients were included in this study, including 37 women. The average age was 78.03±5.4 years, with extremes of 60 and 90 years. The [60, 70] age group was the most represented, as illustrated in Figure 1.

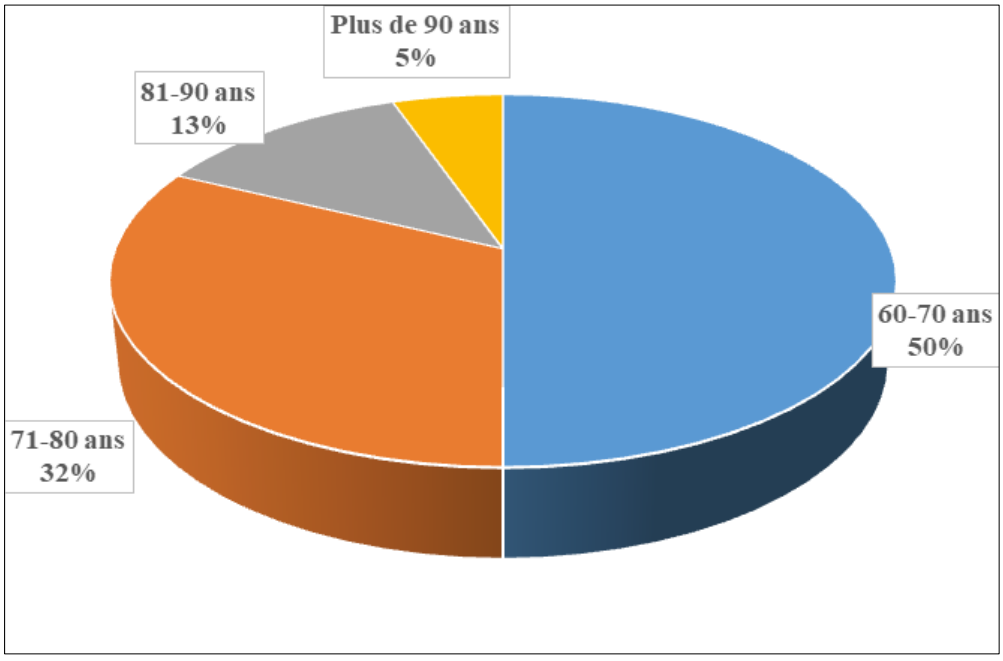

Figure 1: Distribution of patients by age group.

Apart from the Maradi region, patients came from neighboring regions and Nigeria. The following figure shows the distribution of patients by region of origin.

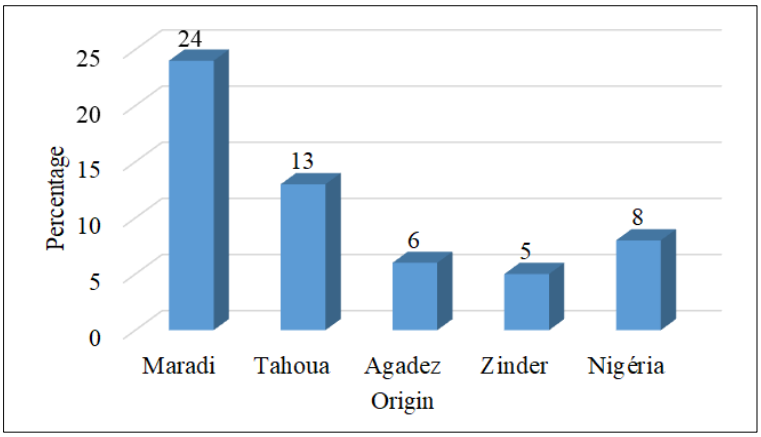

Figure 2: Distribution of patients by origin

In 57.14% of cases, patients resided outside the Maradi region. Traumatic and vascular surgeries were the types performed. Femur fractures were the most common surgical indication, with a rate of 28.57%. Table I shows the distribution of patients according to indications.

Table I: Distribution of patients according to surgical indications

Therapeutic indications	Number	Frequency %
Femoral neck fracture	**16**	**28,57**
Leg fracture	**15**	**26,78**
Knee osteitis	4	7,14
Knee fracture	1	1,78
Foot ischemia	4	7,14
Diabetic foot	**12**	**21,42**
Foot trauma	2	3,57
Chronic wounds	2	3,57
Total	**56**	**100**

Surgical indications were dominated by pelvic limb trauma in 60.71% of cases.

As our study population consisted of elderly individuals, it was characterized by the presence of comorbidities. At least one comorbidity was reported in 32 patients (57.14%). Diabetes and high blood pressure were the most common, with 13 and 12 cases, respectively. Chronic kidney failure (3 cases), chronic obstructive pulmonary disease (3 cases), and asthma made up the rest of the cases. Four patients had both high blood pressure and diabetes.

The surgical history was dominated by cataract surgery (13 cases), prostatectomies in 10 patients, 6 cases of inguinal-scrotal hernias, and 3 osteosyntheses for limb trauma.

Upon arrival in the operating room, patients presented with a variety of hemodynamic conditions. These conditions are described in the table below.

Table II: Distribution of patients according to preoperative hemodynamic status

Hemodynamic parameters upon admission to the operating room			
SBP (mmHg)	< 90	[90-145]	≥ 146
Number	**10**	39	**7**
DBP (mmHg)	< 60	[60-95]	≥96
Number	**24**	25	**7**
Heart rate	[60-89]	[90-99]	≥ 100
Number	30	**18**	**8**

Upon admission to the operating room, 10 patients presented with low blood pressure and 7 with high blood pressure.

Bupivacaine was the only local anesthetic administered. All patients with an indication for osteosynthesis or amputation received 7.5 mg, and those with an indication for joint debridement or lavage received 5 mg. Fentanyl and clonidine were the adjuvants used. The solution obtained was diluted by 50% to obtain a volume of 3 ml. The table below shows the doses of the products administered and the type of surgery.

Table III: Distribution of patients according to the local anesthetic and adjuvant administered

Indications	Number	Local anesthetic dose	Fentanyl	Clonidine
Osteosynthesis	29	7,5 mg	23	6
Amputation	16	7,5 mg	11	5
External fixator	3	7,5mg	3	0
ParageDebridement	7	5 mg	2	5
Irrigation	1	5 mg	1	0

Fentanyl was the most commonly used adjuvant in 65.57% of cases. Osteosynthesis was the main surgical indication, followed by amputation, with respective rates of 51.78% and 28.57%.

All patients received a single injection. However, in 11 patients, two to three puncture attempts were made.

After anesthesia was administered, all patients were placed in the lateral decubitus position, with the limb to be operated on above, for 15 minutes. After this period, the failure rate was 8.20%. On the other hand, success was observed in 51 patients, 11 of whom had received a blood transfusion for intraoperative bleeding. However, no use of vasopressors was reported.

The average duration of surgery was 64±11 minutes, with extremes of 30 and 95 minutes. For 58.83% of patients, surgery lasted more than one hour. Figure 3 provides more detail by showing the distribution of patients according to the duration of surgery.

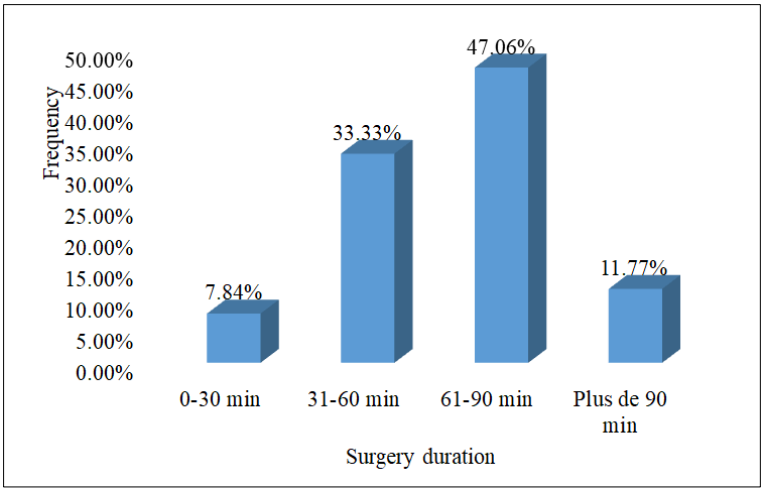

Figure 3: Distribution of patients by duration of surgery

No major intraoperative incidents or conversions were reported; all patients were admitted to the post-anesthesia care unit (PACU). The PACU stay was very brief for the majority of patients. Specifically, the PACU stay ranged from 20 to 85 minutes, with a mean of 43 ± 12 minutes. Figure 4 illustrates the data regarding the PACU stay.

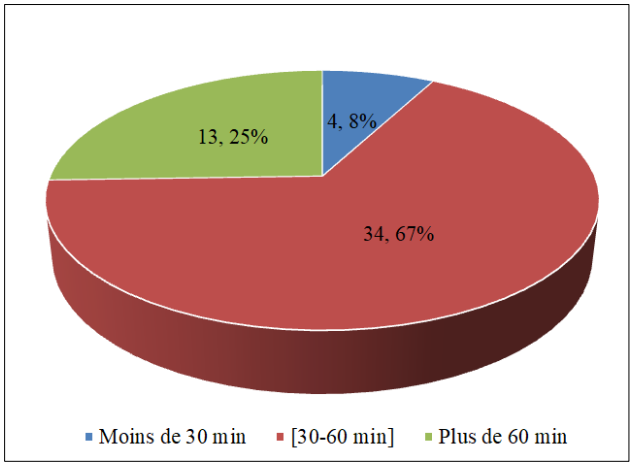

Figure 4: Distribution of patients according to length of stay in the PACU

Some patients stayed in the PACU for more than 60 minutes (25%).

The average duration of anesthesia was 87±13 minutes, with extremes of 75 and 135 minutes. For sensory block, the longest duration was 135 minutes, while for motor block it was 107 minutes. All patients were transferred to the inpatient wards. No incidents were reported in the postoperative period.

DISCUSSION

Unilateral hypobaric spinal anesthesia is particularly appropriate for orthopedic and trauma surgery of the lower limbs, and its advantages have been found to be greater than those of general anesthesia in outpatient settings [5]. This technique would therefore be beneficial in developing countries such as Niger. At the Maradi referral hospital, 56 patients underwent this technique, with a success rate of 91.80%. Our results are similar to those found in the literature. Rasamimanana in Madagascar, Casati, and Bergmann reported success rates of 94% and 100%, respectively [6-8]. This difference could be explained by the larger number of patients included in our study. Rasamimanana included only 24 patients.

Our study population was predominantly female. Indeed, the incidence of fractures increases considerably from the age of 65, with a predominance in women [9]. This may be related to osteogenesis and osteoporosis in females. The [60-70] age group was the most represented, accounting for 50% of cases in our series.

Regarding the local anesthetic administered, since the identification of transient irritation syndromes (TIS) prohibiting the use of short-acting local anesthetics (lidocaine, mepivacaine), unilateral hypobaric spinal anesthesia has made it possible to overcome the challenge of performing short-term spinal anesthesia with long-acting local anesthetics [10]. Thus, in our work, we used only bupivacaine as a local anesthetic. Similarly, I. Zouche in Tunisia and N. Dufeu in France used the same anesthetic in their studies [11, 12]. After administration of the anesthetic, patients were placed in the lateral decubitus position with the limb to be operated on above for 15 minutes.

Trauma surgery is very common in our region given the high frequency of accidents and incidents. It is essentially functional surgery.

Fractures of the lower limbs are common in trauma and orthopedics. These fractures affect a large number of elderly patients, who are often frail, have multiple fractures, and are on multiple medications. Thus, the main indication is primarily orthopedic. Our study involved elderly patients. All underwent trauma and orthopedic surgery. They had comorbidities in 57.14% of cases. Arthroscopy is the most frequently described indication in the literature, with some authors recommending the use of only 4 mg of hyperbaric bupivacaine without adjuvants [13].

Unilateral hypobaric spinal anesthesia provides good hemodynamic stability in these types of patients. Khatouf M *et al*., studied unilateral hypobaric spinal anesthesia in elderly subjects undergoing traumatic hip surgery and showed that it provides satisfactory operating conditions without inducing major hemodynamic changes in these subjects [14]. In our study, hemodynamic stability was perfect in 78.43% of cases. In the remaining 21.57%, hemodynamic instability related to bleeding was observed and managed by intraoperative blood transfusion. The remarkable benefits of unilateral hypobaric spinal anesthesia were highlighted in 2020 by Rasamimanana in orthopedic trauma surgery at the Antananarivo University Hospital Center [6].

In our study, anesthesia lasted an average of 87±13 minutes, with extremes ranging from 75 to 135 minutes. This duration was comparable to that found in the literature. Indeed, the duration of this unilateral block is limited in time: the lower the dose, the shorter the duration. After anesthetic induction, the block lasts an average of 90 minutes with low doses of hyperbaric bupivacaine. It is therefore important to carefully select surgical indications, the duration of which is also operator-dependent [15]. This could explain why we did not report any cases of conversion. Unilateral hypobaric spinal anesthesia allows for better control of the extent and duration of the block and makes the technique more adaptable to outpatient surgery.

CONCLUSION

Unilateral spinal anesthesia performed with a hypobaric solution is a simple technique that provides satisfactory operating conditions without inducing major hemodynamic changes in very elderly patients. This study has enabled us to highlight the benefits of this technique in orthopedic trauma surgery, particularly in a hospital with limited resources. Certain adverse effects of conventional spinal anesthesia could be avoided by following the rules of this technique.

Conflict of Interest: None

Authors' Contributions: all of the above-mentioned authors contributed to this work.

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