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Original Research Article

Unilateral Spinal Anesthesia Versus Conventional Spinal Anesthesia in Elderly Patient Undergoing Surgery for Upper Extremity of the Femur

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Abstract: ***Aim of the study:*** To compare unilateral spinal anesthesia (USA) and conventional spinal anesthesia (SA) in elderly patient undergoing surgery for upper extremity of the femur fracture. ***Methodology:*** It was a prospective descriptive analytical randomized study of 16 months including 42 patients carried out in the departments of anestesiology and orthopedics-traumatology of the National Hospital of Niamey. The patients were randomized in two groups: the first group unilateral spinal anesthesia (USA) received a dose of 7.5mg of Bupivacain with 25ɤ of Fentanyl; the second group conventional spinal anesthesia (SA) received 12.5mg of Bupivacain with 25ɤ of Fentanyl. The choice of the administrated dose of Bupivacain were random and alternated half the time. ***Results:*** During the time of our study, we registred 42 patients we divided in two groups of 21. In the intraoperative period, the mean arterial pressure (MAP) and the mean heart rate (HR) were comparative in the two groups of patients. There was no difference in the time to installation of the sensory and motor block (7mn and 9mn in USA group vs 7mn and 8mn in conventional SA, P-value=0.79) and neither in it's duration (153.1mn and 162.8mn in USA group vs 176.5min and 182.81mn in conventional SA group, P-value=0.1 and 0.14). The dose of ephedrine used intraoperative was 14.40mg in conventional SA group and 19.20mg in USA group, the difference were not statistically significant (P-value=0.36). Fluid replacement was done in the two groups with an average of 1.74L in USA group and 1.62L in conventional SA group, with no statistically significant difference (P-value=0.87). The pain was also comparative in the two groups up to 18hours postoperative. The difference in the intensity of this pain was statistically significant between 18hours and 24hours, it was more important in USA group however releived by analgesics of level 1 (P-value=0.002). Intra and postoperative complications were comparative in the two groups without a statistically significant difference. ***Conclusion:*** USA provide a good peroperative hemodynamic stability as well as an efficient analgesia in spite of a reduced dose of Bupivacain. The postoperative complications were similar in both groups.

Keywords: upper extremity of the femur fracture, elderly patient, uniltateral spinal anesthesia (USA), conventional spinal anesthesia (SA).

INTRODUCTION

Traumatic fracture of the hip is a public health issue especially as it involves elderly population. The old age of the patients and the frequent association with others health issues increase the risks related to anesthesia in this population. There are various possible techniques of anesthesia but none has been demonstrated to be better than another in terms of mortality and morbidity [1]. All technics of anesthesia including target-controlled infusion (TCI) can lead to important drop in blood pressure that can be harmful for the patient. Among the technics of locoregional anesthesia, spinal anesthesia (SA) is more likely to cause sudden and important drop in blood pressure in elderly patients with an incidence varying between 25 and 69% [2]. In this context, continuous spinal anesthesia (CSA) is the reference technique as far as it allows to maintain a stable hemodynamic state because of a progressive installation of the sympathic bloc. However, this technique exposes to a risk of infection and is not recommended in patients treated with Acetyl Salicylic Acid (Aspirin) [2].

Unilateral spinal anesthesia (USA), discovered in 1959 by the German Harder is a variant of

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« conventional » spinal anesthesia. This technique is particularly appropriated in orthopedics and traumatic surgery of inferior limbs because it permits to only anesthesiate the limb concerned while providing less side effects compared to conventional spinal anesthesia [3].

As well as USA is widely performed in occidental countries [3], this technique is less practiced in Niger; hence the aim of our study to compare unilateral spinal anesthesia to conventional spinal anesthesia in elderly patient for surgery of upper extremity of the femur.

PATIENTS AND METHODS

It was a retrospective descriptive analytical study carried out from March 20th, 2020 to July 20th, 2021 (ie 16 months) in the departments of anesthesiology and orthopedics-traumatology of National Hospital of Niamey. Were included in the study all patients with at least 60 years with an isolated fracture of the upper extremity of the femur who underwent programmed surgery with spinal anesthesia during the period of the study.

Two groups were constituted:

- The one, ie conventional spinal anesthesia (SA) group, receiving a normal dose of 12.5mg of Bupivacain with 25ɤ of Fentanyl according to the protocole of the service.
- The other, ie unilateral spinal anesthesia (USA) group, receiving a dose of 7.5mg of Bupivacain with 25ɤ of Fentanyl and installed as described in the technique of unilateral anesthesia.

The choice of administration of the one or other dose of Bupivacain was random and alternated half the time.

The data were processed with SPHYNX software version 5 and then exported and analyzed with SPSS software (Statical Pakage for Social Science) version 22. Data entry, tables and graphics conception was done with Word and Excel 2013 software. Statistical descriptive analysis and comparison tests (PEARSON Khi², FISCHER test, STUDENT test) were used as data comparative analysis model. The significant threshold retained was P-value <0.05.

RESULTS

During the time of our study, 42 over 303 cases of fracture of upper extremity of the femur were operated in elderly patients of 60 years and more, ie a frequency of 13.85%.

Male gender was minority with 16 males vs 26 females, ie a sex ratio H/F of 0.61 in favor of female gender. There were 9 males and 12 females in the USA group vs 7 males and 14 in the conventional SA group, the difference were not statistically significant.

The patients age is ranging from 60 to 90 years. The age group of 70-79years represented the majority with 42.9% in both groups. The average age was 76.86 ± 8.6 years in the USA group vs 75.29 ± 8.22 years in the conventional SA without a significant statistical difference, P-value= 0.2.

In both groups (USA and conventional SA), pertrochanterian fractures represented the majority with 10 patients in each group, followed up by femoral neck fracture, P-value= 0.69 (Table I).

Table I: Distribution of the patients according to the type of fracture

Type of fracture	USA	Conventional SA	Total	Percentage (%)
Pertrochanterian	10	10	20	47.6
Anatomical neck	6	8	14	33.3
Neck of the femur	4	3	7	16.7
Head	1	0	1	2.4
Total	21	21	42	100

P-value=0.69

In our study, 17 patients had comorbidities represented by hypertension in 9patients in the USA group vs 8patients in conventional SA group, and 1patient was diabetic in the conventional SA group (Table II).

Table II: Distribution of the patients according to comorbidities

Pathologies	USA	Conventional SA	Total	Percentage (%)
None	12	12	24	57.1
Hypertension	9	8	17	40.5
Diabete	0	1	1	2.4
TOTAL	21	21	42	100

The majority of the patients were classed ASA II, ie 16patients in each group.

We noted a high mean heart rate in the conventional SA group in comparision of the USA group from admission to operating room to the end of surgery, with a statistically significant difference at admission to operating room, P-value= 0.002 (Figure 1).

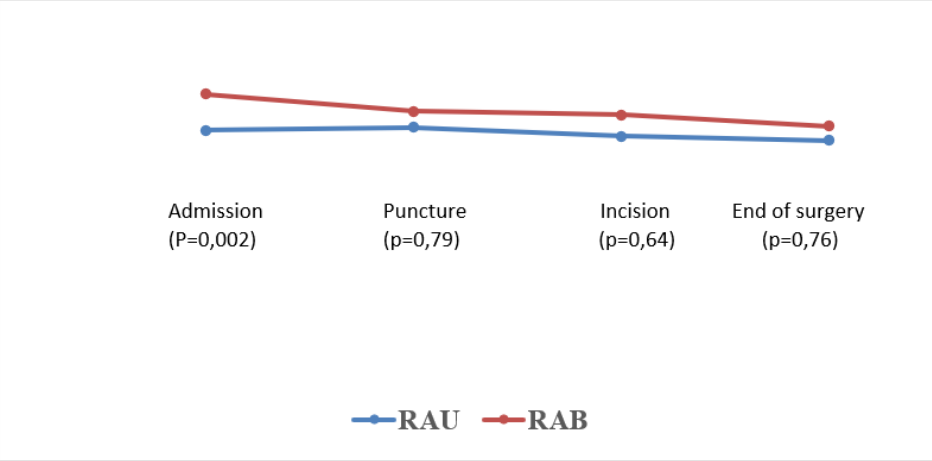

Figure n°1: Intraoperative mean heart rate of the patients

The MAP were similar in both groups during peroperative period, we noted one case of hypertension at admission to operationg room, while ponctioning the SA and at the time of surgical incision in conventional SA group; without a statistically significant difference (Figure 2).

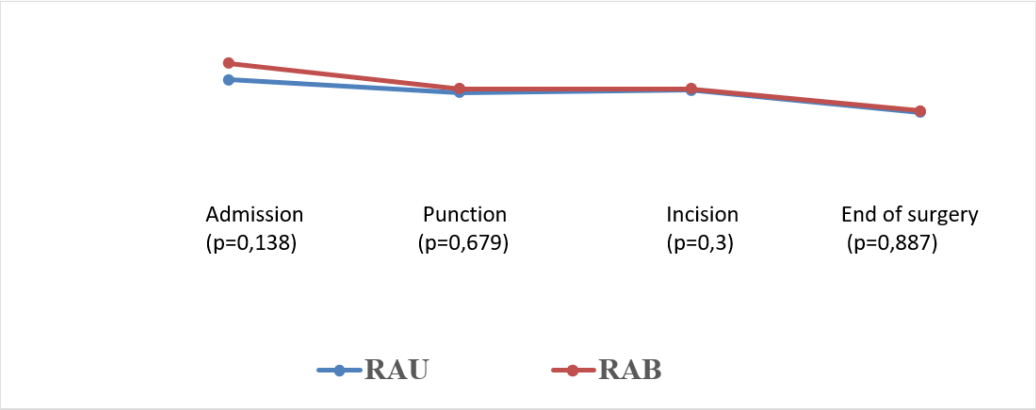

Figure n°2: Peroperative MAP of the patients

A complementary sedation was realized in 1 patient of USA group vs 2 patients of conventional SA group (P-value= 0.35).

The average time to installation of motor, sensitive and sympathic blocks was respectively 11mn, 9mn and 7mn in USA group vs 10.05mn, 8mn and 7mn in conventional SA group, P-value= 0.79 (Table III).

Table III: Distribution of the patients according to the time to installation and duration of the different blocks

Time to installation of the differents block in minutes			
Technique of Anesthesia	Sympathic block	Sensitive block	Motor block
USA	7	9	11
Conventional SA	7	8	10.5
P-value 0,79			
Average duration of motor and sensitive blocks in minutes			
Technique of Anesthesia	Motor block	Sensitive block	
USA	153.1 ± 48.63	162.8 ± 45.86	
Coventional SA	176.5 ± 40.85	182.81 ± 40.12	
P-value	0.1	0.14	

The mean amount of intraoperative fluid replacement was 1.67L ± 0.56 with extremes of 1L and 3.5L. It was 1.62L ± 0.49L in conventional SA vs 1.74L ± 0.62L in USA group, P-value= 0.87 (Figure 3).

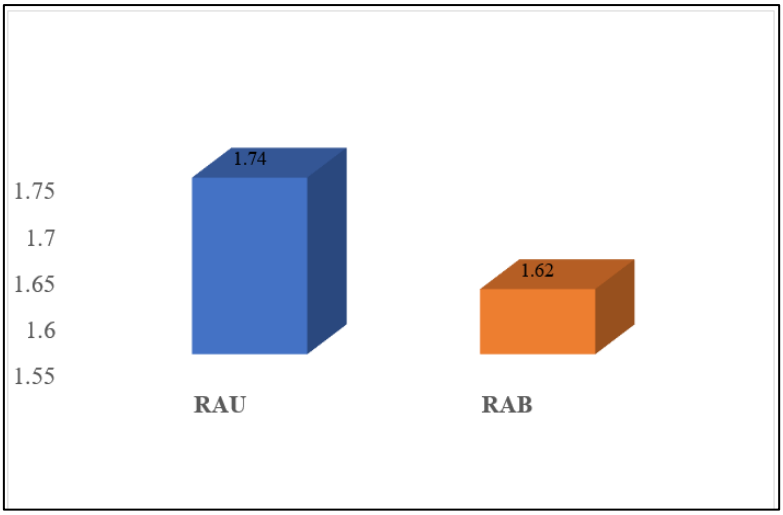

Figure n°3: Distribution of the patients according to peroperative amount of volume replacement P-value= 0.87

The mean dose of Ephedrine used intraoperative was 16.80mg ± 7.89mg with extremes of 6mg and 30mg. The mean dose was 14.40mg ± 3.28 in conventional SA group vs 19.20mg ± 10.73 in USA group, P-value= 0.36 (Figure 4).

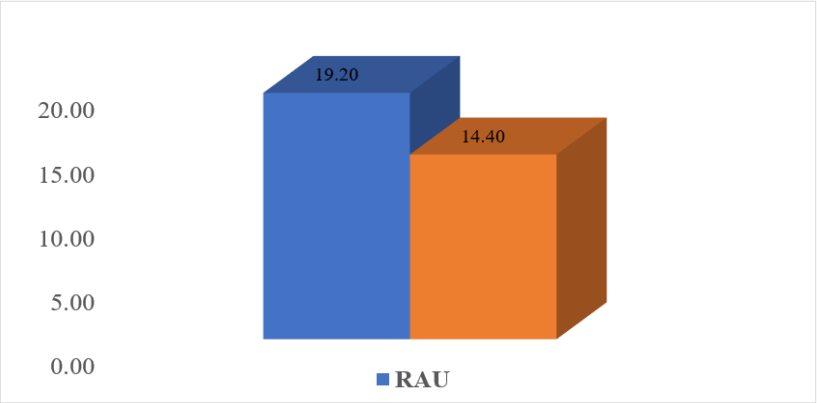

Figure n°4: Distribution of the patients according to the mean dose of Ephedrine used peroperative P-value= 0.36

The average duration of the surgery was 53.90mn ± 22.7mn with extremes of 20mn and 111mn in USA group vs 64.62mn ± 21.18mn with extremes of 22mn and 130mn in conventional SA group.

The average duration of motor and sensitive blocks in the USA group and conventional SA group was respectively 153.1 ± 48.63mn and 162.8 ± 45.86mn vs 176.5 ± 40.85mn and 182.81 ± 40.12mn. These differences were not statistically significant ; P-value= 0.1, P-value= 0.14 (Table III).

The difference in pain evaluation with VAS between 18-24h was statistically significant in the two groups, P-value= 0.002 (Table IV).

Table IV: Pain evaluation in the first 24hours postoperative

Variables	Group				P-value
	USA		Conventional SA		
	Pain		Pain		
	Yes	No	Yes	No	
VAS from 0-6H	3	18	6	15	0.55
VAS from 6-12H	8	13	8	13	0.50
VAS from 12-18H	6	15	4	17	1.56
VAS from 18-24H	4	17	5	16	0.002

Postoperative nausea and vomit was the main complication with 26.2% of the cases, of which 6 cases in USA group and 5 cases in conventional SA. We had not registered any case of death during our study.

DISCUSSION

Upper extremity of the femure fractures represented 13.86% of the fractures registered during our study. The frequency noted in our study is superior to that found by Vallean R in Burkina in 2016 who reported a frequency of 5.76% [4].

In our study, 42 patients underwent surgery for upper extremity of the femure fracture. We noted female predominance with 61.9% female vs 38.1% male ie a sex ratio H/F 0.61 in favor of female gender. There was female predominance in both groups with 14 females and 1 male in conventional SA group, and 12 females and 9 males in USA group. Our results are similar to those found by El Idrissi A in Morocco in 2020 who reported a female prediminance in USA group with a sex ratio of 1.06 in favor of female gender [5]. Various authors reported the same female gender predominance including Sandjon T in Cameroon in 1992 and Lahmini I in Morocco in 2010, who found respectively a frequency of 68% and 52% in favor of female gender [6, 7]. This could be explained by the fact that upper extremity of the femur fracture are by far very common in elderly subjects, but also postmenopausal osteoporosis exposes more women to this type of fracture. Otherwise, Maja N in Morocco in 2010 found a male gender predominance in the population under 60years [8]. This could be explained by the fact that high velocity road accidents are the main cause incriminated in upper extremity of the femur fractures in young male population.

The average age of our patients was 76.07 ± 8.4 years; 76.86 ± 8.7 years in USA group vs 75.29 ± 8.2 years in conventional SA group. The two groups are similar in term of age. This average is similar to that of Chaibou MS in Niger in 2017, Lahmini I in Morocco in 2010, Laoutid J in Morocco in 2017 and El Idrissi A in Morocco in 2020 who found respectively an average age of 69.18, 70.22, 75 and 78 years; meanwhile different to that found by Maja N in Morocco in 2010 with an average age of 59years [7, 8, 5, 10]. This difference could be explained by the fact that our study only included patients over 60 meawhile the study of Maja N included adult patients of all age.

During our study, pertrochanterian fractures constituted the most frequent type of fracture with 47.6% of the cases ie 10patients in each group. Our result is similar to that of Vallean R in Burkina in 2016 who reported a frequency of 41.37% [4]. In contrast, our results are inferior to those of Bouarda. L in Marrakech (Morocco) in 2011 who found a predominance of 73% [11].

The main comorbidity was hypertension. Thus, 17 patients had hypertension of which 9 patients in USA group and 8 patients in conventional SA group. Our results are similar to that of El Idrissi. A in Morocco in 2020 who found 7patients with hypertension in USA group [5]. This similarity could be explained by the old age of our populations. Our results are different to those of Daddy H in Niger in 2020 and Rasamimanana NG in Madagascar in 2020 who reported anesthesiologic and surgical antecedents as main antecedents [12, 13]. This difference is explained by the fact that the population of study of Daddy H concerned 18 to 48 years patients undergoing programmed surgery of the femur.

In our serie, the patients were mostly classed ASA II with 16patients in each group ie a frequency of 76.2%. This difference was not statistically significant (P-value= 1). Our results are similar to those of Chaibou MS in Niamey in 2017 who found a high frequency of ASA II class patients in 56.30% but different to those of Afane E in Yaounde in 2013 who found 45 patients (81.8%) classed ASA I [10, 14]. Our results are also different to those of Zouche I in Tunisia in 2019 who found 7 patients in USA group and 8 patients in conventional SA group classed ASA II (1). This difference in the results could be explained by the fact that the population of study was constituted of elderly patients with high frequency of health defects.

In our study, MAP and mean HR were the same in both groups. Intraoperatively, we noted a case of hypertension at admission in the operating room, during the ponction of SA and at the time of surgical incision, there was no statistical significant difference regarding to the MAP. Otherwise, we noted a statistical significant difference in the mean HR at the admission in operating room (P-value= 0.002). This similarity in the MAP and mean HR within the two groups are similar to the results found by Zouche I in Tunisia in 2019 who reported a similarity in the MAP and mean HR within the two groups (1). In our context, the elevation of MAP in the time between the admission to operating to the surgical incision might be related to the stress and fear of the patient regarding the surgery.

In our study, the mean time to installation of the motor and sensitive blocks was respectively 9mn and 7mn in USA group vs 8mn and 7mn in conventional SA group without any statistical significant difference (P-value= 0.79). Those results are comparative within the two groups and show one of the advantages of USA over conventional SA; in fact, we can achieve the same result as conventional SA using a minimal dose of anesthesics in USA.

In our serie, 1 patient of the USA group received complementary sedation vs 2 patients in the conventional SA without a statistical significant difference. This prove one other advantage of USA over

conventional spinal anesthesia by providing good conditions of anesthesia without major complications.

In our study, the amount of volume replacement intraoperative was 1.67L ± 0.56 with extremes of 1L and 3.5L. It was of 1.62L ± 0.49 in conventional SA group vs 1.74L ± 0.62 in USA group without a statistical significant difference. El Idrissi A in Morocco in 2020 and Laoutid J in Morocco in 2017 also found an average amount of volume replacement of 0.84L in USA group using hypobare Bupivacain vs 1.250L in the USA group [9, 5]. Volume replacement was practiced in USA group as well as in conventional SA group and permitted to balance intraoperative loss of fluids.

In our serie, the mean dose of Ephedrine used intraoperative was 16.80mg ± 7.89 with extremes of 6 and 30mg. It was of 14.40mg ± 3.28 in conventional SA group vs 19.20mg ± 10.73 in USA group, P-value= 0.36. Although the difference is not statistically significant, we note a use of higher dose of Ephedrine in the USA group. Our results are superior to those found by El Idrissi A in Morocco in 2020 and by Zouche I in Tunisia in 2019 who reported respectively a mean Ephedrine consumption of 5.12mg in USA group with hypobare and 11 ± 15mg in continuous spinal anesthesia (CSA) group over 1 ± 4mg in USA group [1, 5]. In the study of Khatouf M in France in 2005, the mean dose of Ephedrine used in USA hypobare group was 6mg [2]. Our results are similar to the litterature according to which practicing the technique of unilateral spinal anesthesia helps reduce the use of vasopressors [15].

In our study, the average duration of the surgery was 53.9mn ± 22.7 with extremes of 20mn and 111mn in USA group vs 64.62mn ± 21.18 with extremes of 22mn and 130mn in conventional SA group without a significant difference P-value= 0.12. Our results are differents to those of Zouche I in Tunisia in 2019 who found 74mn ± 26 in USA group and 67mn ± 20 in conventional spinal anesthesia group [1]. This difference could be linked to the difference of our populations of study.

In our serie, the average duration of motor and sensitive blocks was respectively 164.8mn ± 45.89 and 173.05mn ± 43.66. In both groups, there was no significant difference in the average duration of those blocks. Our results are superior to those of Khatouf M in France in 2005 who reported respectively 118.6mn ± 24.1 and 134mn ± 26 for the motor and sensitive blocks [2]. This difference could be explained by the type of Bupivacain, the dose and the additive used in each study. Actually, in the study of Khatouf M, they used a mixture of Bupivacain isobare 0.5% transformed to hypobare by the adjunction of 1ml of distilled water and 5µg of Sufentanil (ie a mixture containing 0.12% Bupivacain).

In our study, postoperative pain concerned 28.6% of patients in USA group vs 27.8% in conventional SA group. There was no significant difference for VAS pain evalution until 18hours postoperative. Meanwhile, the VAS became statistically signifcant when evaluated between 18h and 24h (P-value= 0.002), but the pain was treated successfully by the administration of a level 1 analgesic (Paracetamol IV) as reported in the litterature by Lahmini I in Morocco in 2010 [36] and Laoutid J in Morocco in 2017 [9].

In our serie, postoperative nausea and vomits were the main complications with 26.2% of the cases which 6 in USA group and 5 in convenntional SA group, P-value= 0.66. Nausea and vomit are frequent complications occuring in postoperative period. In our study ; it occures regardless of the technique of spinal anesthesia used and sometimes requires the use of premedication.

We noted none case of decease in our patients during the time of our study.

CONCLUSION

Various studies had been interested in the advantages that can be related to USA over conventional SA. In this study comparing unilateral spinal anesthesia to conventional spinal anesthesia in elderly patients undergoind surgery for upper extremity of the femur's fracture, 42 patients were randomized which 21 benefited from a unilateral spinal anesthesia and 21 from a conventional spinal anesthesia. The two groups were similar in terms of workforce and other caracteristics such as sociodemographic, clinic, paraclinic, reason and duration of the surgery, eliminating thus selection bias. This study permitted to show unilateral spinal anesthesia as an interesting alternative to conventional spinal anesthesia in elderly patients with upper extremity of the femur's fracture. This technique provide good conditions of anesthesia without major complications and a good peroperative hemodynamic stability, with a similar duration of the motor and sensitive blocks in both techniques ; the analgesia was also similar up to more than 18h postoperative, the pain was treated with level 1 analgesics ; per and postoperative complications were also similar. Despite all its advantages, this technique is quasi unknown in the practice of anesthesia in Niger.

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