Short-term complications of anesthetic technique used in hip fracture surgery in elderly people

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Abstract

Postoperative complications of fracture are one of the main problems in older patients with hip fracture. In this study, complications were observed 48 hours after surgery in different anesthetic procedures. This prospective cross sectional study was carried out over a 12-month period. All subjects over 55 years of age undergoing hip fracture surgery were selected for study with ASA class (American Society of Anesthesiology: one, two and three). After determining the vital signs in the operating room, anesthesia type (general, spinal and epidural) and various variables were recorded. It was observed that the spinal anesthesia method had the lowest level of postoperative disturbances of consciousness and had the shortest duration in terms of duration of time. On the other hand, general anesthesia was the least in terms of blood transfusion. Finally, epidural anesthetic method showed the least amount of pain 48 hours after operation and the least changes in blood pressure and heart rate.

Key Words: Hip fracture, general anesthesia, neuraxial anesthesia.
compared with each other. If it is determined which anesthetic method is associated with less stress during the surgery for the age group > 55 years, this method can be recommended in patients who need anesthesia. In this prospective cross-sectional study, all patients undergoing general anesthesia or neuraxial anesthesia are evaluated for the frequency of complications during and after hip surgery for up to 48 hours.

Materials and Methods
This prospective cross-sectional study was conducted over a 12-month period. The population studied was all people over the age of 55 who needed surgical treatment due to hip fractures and had to undergo anesthesia. The sample size was selected by census method for estimating related observations. Patients over the age of 55 with ASA class 1, 2 and 3 were candidates for hip fracture surgery in Vali-e-Asr Hospital of Arak, Iran. Patient exclusion criteria included an allergic reaction to a blood transfusion, severe cement reaction, a very long surgery, changes in surgical plan during operation, and lack of patient collaboration and patient satisfaction. All patients were followed up prior to surgery, where Hb and systemic blood pressure (systolic and diastolic), BMI, age, sex, history of underlying disorders, and class (ASA) and inclusion criteria were recorded in the checklist. Moreover, in the operating room after the registration of vital signs, the type of anesthesia (general, spinal and epidural) was recorded. General anesthesia involves three different methods, and the medications and procedures used were also written in the checklist for each patient. The researcher was the only observer of the anesthetic method and anesthesia was performed by anesthesiology team at Vali-e-Asr Hospital in Arak. The variables examined are as follow: 1. Type of anesthesia, 2. Drugs and the type of needle and catheter, 3. Amount of prescribing fluid during the operation, 4. In case of hypotension, type and amount of prescribed medications, 5. Amount of blood lost during the operation based on the number of gas and liquefied natural gas (LNG) consumed (each fully wet gas is 10 cc and LNG 50 cc), 6. Amount of blood in the suction, 7. Amount of injected blood during surgery, 8. Time of surgery (the onset of anesthesia or numbness before the end of the surgery), 9. Amount of Hb before and 6 hours after the operation, 24 and 48 hours later, 10. Severity of pain, which was assigned using a VAS ruler (0 to 10) at end of recovery, and 6 hours, 24 hours and 48 hours after operation, 1. Dose of opioid and injecting painkillers were divided in 6, 24, 48 hours after operation, and total amount of opiate and painkillers used, 12. Awareness of

| Table 1. Average duration of hip fracture surgery based on type of anesthesia |
|--------------------------------------------------|----------------|----------------|----------------|----------------|
| **Type of anesthesia** | **Average length of operation** | **Standard deviation** | **Less time** | **Most time** |
| Spinal cord | 39.88 | 21.94 | 30 | 180 |
| General | 67.33 | 51.45 | 40 | 180 |
| Epidural | 70.92 | 41.96 | 25 | 150 |
| Total | 54.25 | 38.14 | 25 | 180 |

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| Table 2. Frequency of blood transfusion during hip fracture surgery based on type of anesthesia |
|-------------------------------------------------------------------------------------------------|----------------|----------------|----------------|----------------|
| **Type of anesthesia** | **Frequency of blood intake** | **Total** |
| | **have received** | **Have not received** | **have received** | **have not received** |
| Spinal cord | 25 | 64 | 89 |
| General | 12 | 18 | 30 |
| Epidural | 21 | 31 | 52 |
| Total | 58 | 113 | 171 |
| | %28.08 | %71.92 | %100 |
| | %40 | %60 | %100 |
| | %40.38 | %59.62 | %100 |
| | %33.91 | %66.08 | %100 |
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Results and Discussion
This study was performed on 171 patients (65 female and 106 male) over 55 years of age undergoing hip fracture surgery at Vali-e-Asr Hospital in Arak. As to their age, 35 patients were 55 to 65 years old, 30 were 66-75 years old, 54 were 76-85 years old, and 46 patients were 86-95 years old. Spinal anesthesia was also used for 89 patients (52%), general anesthesia was used for 30 patients (17.5%) and epidural anesthesia was used for 46 patients (26.9%). Spinal anesthesia was used for 30 female and 59 male patients. As to BMI of patients undergoing hip fracture surgery, 41 patients had BMI of 23, 36 patients of 24, 41 patients of 25 and 53 patients of 26. The average length of the operation in all three types of anesthesia was 54.25 minutes with a standard deviation of 38.14. The shortest operating time was 25 minutes in an epidural anesthetic type. The longest operating time was 180 minutes, which was recorded for spinal anesthesia and general anesthesia (Table 1). In all three groups 58 patients (33.91%) received blood and 113 patients (66.08%) did not receive blood (Table 2). Calculating the amount of HB before, 6, 24 and 48 hours after the hip fracture operation showed that the mean of total hemoglobin before surgery in all three types of anesthesia was determined to be 12.94 with a standard deviation of 1.98, while the mean of hemoglobin values 48 hours after surgery was achieved as 11.49 and the standard deviation was calculated to be 1.62 (Table 3). Table 4 shows the mean postoperative pain intensity during recovery (6, 24 and 48 hours after hip fracture) based on type of anesthesia. The average pain intensity during the last 6 hours after surgery in all three types of anesthesia was 5.00 with a standard deviation of 1.39. The average dose of the analgesic 6 hours after the operation in all three types of anesthesia was 6.64 +/- 5.22 SD (Table 5). Changes in blood pressure after hip fracture surgery according to the type of anesthesia showed that in all three methods, 55 patients (32.16%) had hypotension, whereas 44 patients (25.73%) showed hypertension after

Table 3. Hemoglobin value before, 6, 24 and 48 hours after hip fracture according to type of anesthesia

| Type of anesthesia | Hemoglobin before surgery | Hemoglobin 6 hours later | Hemoglobin 24 hours later | Hemoglobin 48 hours later |
|--------------------|---------------------------|--------------------------|---------------------------|--------------------------|
| Spinal cord        | HB Average                | 13.34                    | 11.89                     | 11.40                    | 11.59                    |
|                    | Standard deviation        | 1.91                     | 2.52                      | 2.48                     | 1.26                     |
|                    | Least                     | 10.70                    | 7.70                      | 7.90                     | 8.90                     |
|                    | the most                  | 16.90                    | 17.80                     | 18.50                    | 13.60                    |
| General            | HB Average                | 12.74                    | 11.96                     | 11.30                    | 11.56                    |
|                    | Standard deviation        | 1.92                     | 1.26                      | 1.61                     | 2.10                     |
|                    | Least                     | 10.80                    | 10.80                     | 9.80                     | 8.30                     |
|                    | the most                  | 15.90                    | 14.20                     | 14.30                    | 14.80                    |
| Epidural           | HB Average                | 12.37                    | 11.12                     | 10.28                    | 11.28                    |
|                    | Standard deviation        | 2.00                     | 1.77                      | 2.20                     | 1.86                     |
|                    | Least                     | 10.40                    | 8.90                      | 6.70                     | 8.70                     |
|                    | the most                  | 15.90                    | 14.90                     | 13.30                    | 14.00                    |
| Total              | HB Average                | 12.94                    | 11.64                     | 11.04                    | 11.49                    |
|                    | Standard deviation        | 1.98                     | 2.15                      | 2.31                     | 1.62                     |
|                    | Least                     | 10.40                    | 7.70                      | 6.70                     | 8.30                     |
|                    | the most                  | 16.90                    | 17.80                     | 18.50                    | 14.80                    |
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The hip fracture is very common in the elderly and usually requires surgical treatment, which in most cases is associated with a high incidence of complications. The current study aimed to compare the short-term complications of anesthetic procedures used in hip fracture surgery in the elderly, in which various variables were measured. It has been observed that hemoglobin levels in people with pelvic bone fracture severely decrease. This causes the person to sustainably develop bleeding and anemia after the fracture. Previous studies have shown that low levels of hemoglobin in patients lead to poor prognosis. However, we still do not have accurate information on bleeding and hemoglobin levels in a variety of fractures. In this study, the mean of hemoglobin in patients who underwent spinal anesthesia before surgery was determined to be higher (13.34), followed by the group under general anesthesia (12.74) and the group under epidural anesthesia (12.37). The mean hemoglobin of patients 6 hours after operation under spinal anesthesia was 11.89, while determined as 11.86, 6 hours after operation under general anesthesia and 11.12, 6 hours after surgery under epidural anesthesia. According to the results, the mean hemoglobin of patients was recorded at the rate of 11.40 24 hours after operation. While this rate was determined as 11.30 and 10.28, 24 hours after operation under general anesthesia and epidural anesthesia, respectively. It was also determined to be 11.59 48 hours after operation under spinal anesthesia, 11.56 under general anesthesia and 11.28 under epidural anesthesia. It was observed that the highest mean hemoglobin drop in the group under spinal anesthesia occurred 6 hours after operation while after 24 hours; the highest mean hemoglobin drop was in the group under general anesthesia, as well as after 48 hours in the group under spinal anesthesia. Heidari et al. compared two methods of general anesthesia (GA) and anesthesia (NA) in pelvic fracture patients. The mean of hemoglobin before surgery in both groups was 12.4, which decreased by 1.4 after the operation in both groups. In the present study, the average length of operation in spinal anesthesia was 39.88 minutes, but it reached to 67.33 and 70.92 minutes in the general and epidural anesthesia, respectively. Parker et al. found that the duration of the operation was 187 minutes in general anesthesia and 189 minutes in regional anesthesia (189 minutes). In another study, the duration of surgery in

| Type of anesthesia | Pain level 6 hours after surgery | Pain level 24 hours after surgery | Pain level 48 hours after surgery |
|--------------------|----------------------------------|----------------------------------|----------------------------------|
| Spinal cord        | Average pain                     | Standard deviation               |                                  |
|                    | 4.73                             | 1.29                             | 1.22                             |
|                    | Standard deviation               | the most                         | Least                            |
|                    | 3                                | 2                                | 0                                |
|                    | Least                            | 8                                | 6                                | 4                                |
| General            | Average pain                     | Standard deviation               |                                  |
|                    | 6.80                             | 0.99                             | 0.99                             |
|                    | Standard deviation               | the most                         | Least                            |
|                    | 6                                | 4                                | 2                                |
|                    | Least                            | 8                                | 6                                | 4                                |
| Epidural           | Average pain                     | Standard deviation               |                                  |
|                    | 4.44                             | 0.83                             | 0.63                             |
|                    | Standard deviation               | the most                         | Least                            |
|                    | 4                                | 2                                | 0                                |
|                    | Least                            | 6                                | 4                                | 3                                |
| Total              | Average pain                     | Standard deviation               |                                  |
|                    | 5.00                             | 1.39                             | 1.35                             |
|                    | Standard deviation               | the most                         | Least                            |
|                    | 3                                | 2                                | 0                                |
|                    | Least                            | 8                                | 6                                | 4                                |

The operation (Table 6). Patients undergoing spinal anesthesia were affected by 2 deaths (2.24%). Mortality rate was 13.33% (4 patients) in patients undergoing general anesthesia. No mortality was recorded in patients undergoing epidural anesthesia. The hip fracture is very common in the elderly and usually requires surgical treatment, which in most cases is associated with a high incidence of complications. The current study aimed to compare the short-term complications of anesthetic procedures used in hip fracture surgery in the elderly, in which various variables were measured. It has been observed that hemoglobin levels in people with pelvic bone fracture severely decrease. This causes the person to sustainably develop bleeding and anemia after the fracture. Previous studies have shown that low levels of hemoglobin in patients lead to poor prognosis. However, we still do not have accurate information on bleeding and hemoglobin levels in a variety of fractures. In this study, the mean of hemoglobin in patients who underwent spinal anesthesia before surgery was determined to be higher (13.34), followed by the group under general anesthesia (12.74) and the group under epidural anesthesia (12.37). The mean hemoglobin of patients 6 hours after operation under spinal anesthesia was 11.89, while determined as 11.86, 6 hours after operation under general anesthesia and 11.12, 6 hours after surgery under epidural anesthesia. According to the results, the mean hemoglobin of patients was recorded at the rate of 11.40 24 hours after operation. While this rate was determined as 11.30 and 10.28, 24 hours after operation under general anesthesia and epidural anesthesia, respectively. It was also determined to be 11.59 48 hours after operation under spinal anesthesia, 11.56 under general anesthesia and 11.28 under epidural anesthesia. It was observed that the highest mean hemoglobin drop in the group under spinal anesthesia occurred 6 hours after operation while after 24 hours; the highest mean hemoglobin drop was in the group under general anesthesia, as well as after 48 hours in the group under spinal anesthesia. Heidari et al. compared two methods of general anesthesia (GA) and anesthesia (NA) in pelvic fracture patients. The mean of hemoglobin before surgery in both groups was 12.4, which decreased by 1.4 after the operation in both groups. In the present study, the average length of operation in spinal anesthesia was 39.88 minutes, but it reached to 67.33 and 70.92 minutes in the general and epidural anesthesia, respectively. Parker et al. found that the duration of the operation was 187 minutes in general anesthesia and 189 minutes in regional anesthesia (189 minutes). In another study, the duration of surgery in

| Table 4. Average pain intensity after surgery in recovery, 6, 24 and 48 hours after hip fracture operation according to type of anesthesia |
|---------------------------------------------------------------------------------------------------------------------------------|
| Type of anesthesia | Pain level 6 hours after surgery | Pain level 24 hours after surgery | Pain level 48 hours after surgery |
|--------------------|----------------------------------|----------------------------------|----------------------------------|
| Spinal cord        | Average pain                     | Standard deviation               |                                  |
|                    | 4.73                             | 1.29                             | 1.22                             |
|                    | Standard deviation               | the most                         | Least                            |
|                    | 3                                | 2                                | 0                                |
|                    | Least                            | 8                                | 6                                | 4                                |
| General            | Average pain                     | Standard deviation               |                                  |
|                    | 6.80                             | 0.99                             | 0.99                             |
|                    | Standard deviation               | the most                         | Least                            |
|                    | 6                                | 4                                | 2                                |
|                    | Least                            | 8                                | 6                                | 4                                |
| Epidural           | Average pain                     | Standard deviation               |                                  |
|                    | 4.44                             | 0.83                             | 0.63                             |
|                    | Standard deviation               | the most                         | Least                            |
|                    | 4                                | 2                                | 0                                |
|                    | Least                            | 6                                | 4                                | 3                                |
| Total              | Average pain                     | Standard deviation               |                                  |
|                    | 5.00                             | 1.39                             | 1.35                             |
|                    | Standard deviation               | the most                         | Least                            |
|                    | 3                                | 2                                | 0                                |
|                    | Least                            | 8                                | 6                                | 4                                |
anesthesia was shorter than the duration of anesthesia surgery (55.81 minutes versus 65.36 minutes). In the present study, the duration of operation in the spinal cord was less than the general method. Blood transfusions are usually performed for patients who have lost a lot of blood. This action is also done in many patients with pelvic fracture. However, blood transfusions to the patient create many problems, including high risk of transmission of infections including AIDS, hepatitis, etc., or even other problems such as fever, increased hemodynamic load, etc. In the present study, it was found that 28.08% of patients who had spinal anesthesia had a need for blood transfusion, while 40% of patients who had general anesthesia needed blood transfusions. Moreover, 40.38% of patients who had an epidural anesthetic required blood transfusions. Another study reported that patients with general anesthesia received 100 ml of blood and 103 ml of blood was injected for patients with regional anesthetics. Another study also found that 39.34% of those who received spinal anesthesia needed blood transfusions, while 45.49% of patients needed blood transfusions for patients taking general anesthesia. Our findings also revealed that the need for blood transfusion in patients who received general anesthesia was more than those who used spinal anesthesia. Postoperative pain is one of the major problems suffered by patients after surgery and requires strong painkillers to relieve pain. It has been shown in studies that postoperative pain sensation has a direct linear relationship with anxiety status. In the current study, the mean pain score 6 hours after operation in the spinal anesthesia group was 4.73 +/- 1.29 (SD), while the mean pain sensation score at the same time in the general anesthesia group was 6.80 +/- 0.99 (SD). Mean pain score for the epidural group at the same time was 4.44 +/- 0.83 (SD). Robert et al. compared the pain sensation after lumbar plexus block with general anesthesia method in patients undergoing hip arthroplasty. They indicated that pain scores remained lower in the plexus group until 6 h after randomization 1.4 +/- 1.3 vs. 2.4 +/- 1.4 (SD). The mortality rate of patients after surgery is one of the most important unpleasant events that can be very painful for their families. In the current study, mortality rate after hip fracture surgery in a group of patients with spinal anesthesia was 2.24%, while the general anesthesia group showed 13.33% mortality and the spinal anesthesia group did not show any deaths. Rodgers et al. found that mortality rates in patients who used neuraxial anesthesia including spinal and epidural were 2.11% and 3.07% for patients who did not use this method. Our study also found that mortality rates were higher in the group.
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receiving general anesthesia. Deep vein thrombosis (DVT) is one of the most important problems that affect 2.5 to 5 percent of people throughout their lives. Its major short-term complication is pulmonary embolism and its major long-term complication is the post-thrombotic syndrome (PTS).³¹,³² In the present study, the incidence of deep vein thrombosis in the spinal anesthesia group was 11.23%, while 6.66% for general anesthesia group and 5.76% for epidural anesthetic group. Modig reported that the incidence of deep vein thrombosis in patients with epidural anesthesia was less than that of the general anesthesia group.³³ In the present study, it was also observed that the mortality rate in the group with epidural anesthesia was lower than in other groups. With regard to the results and complications of each type of anesthetic method, the appropriate approach should be chosen according to the patients. For patients with heart problems, for example, epidural anesthesia is better because of lower blood pressure and heart rate changes. Furthermore, general anesthesia is worse in these patients because it often causes changes in blood pressure and heart rate. In conclusion, it is suggested that this study be repeated in other centers, with a higher population in order to achieve more conclusive results.

List of acronyms
ASA - American Society of Anesthesiology
DVT - Deep vein thrombosis
LNG - liquefied natural gas
GA - General Anesthesia
NA - Neuraxial anesthesia
PTS - Post-thrombotic syndrome
SD - Standard Deviation

Author’s contributions
Each author contributed in equal part to the manuscript.

Table 6. Blood pressure changes after hip surgery according to the type of anesthesia

| Type of anesthesia | Increased blood pressure | Low blood pressure | Blood pressure unchanged | total |
|-------------------|--------------------------|--------------------|-------------------------|-------|
| Spinal cord       | 23                       | 37                 | 32.58%                  | 89    |
| General           | 10                       | 9                  | 36.66%                  | 30    |
| Epidural          | 44                       | 25                 | 33.33%                  | 52    |
| total             | 44                       | 72                 | 25.73%                  | 171   |

Acknowledgments
This article is a result of Ms. Fuzhan Behrouzzadeh's thesis for obtaining a doctorate from Arak University of Medical Sciences.

Funding: None.

Conflict of Interest
The authors declare no conflicts of interests.

Ethical Publication Statement
We confirm that we have read the Journal’s position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

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Submission: February 17, 2018
Revision received: February 22, 2018
Acceptance: February 23, 2018