Original Article

Comparison of Hemoglobin and Sodium Levels after Percutaneous Nephrolithotomy by Two Methods of Prone and Supine under Spinal Anesthesia

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Abstract:

Introduction: Percutaneous nephrolithotomy (PCNL) is widely used as a minimally invasive procedure. On the other hand, during the PCNL surgery, there are many changes, especially in the electrolyte level. Bleeding can also be a complication of this procedure. This study aimed to compare two positions of supine and prone surgery effect on the amount of hemoglobin and sodium after surgery in the PCNL with spinal anesthesia.

Methods: This study was a clinical trial on 200 patients in 4 groups (group A: 3 cc Marcaine 0.5% spinal in supine position, group B: 2 cc Marcaine 0.5% spinal + 20 micrograms fentanyl in Supine position, group C: 3 cc Marcaine 0.5% spinal in the prone position, group D: 2 cc Marcaine 0.5% spinal + 20 micrograms fentanyl in the prone position). The patient's heart rate and blood pressure before anesthesia and performing Spinal anesthesia, after anesthesia and 10 and 15 minutes later during the operation were recorded. Also in recovery and after leaving the recovery room, these variables were recorded. The patient's hemoglobin and sodium levels were recorded before surgery and 24 hours after surgery. Data were analyzed using SPSS.

Findings: there was no significant difference between the two methods of supine and prone position with different doses of Marcaine in terms of sodium content before the change of position ($p < 0.05$). However, there was a significant difference between the two methods of supine and prone position with different doses of Marcaine in terms of sodium level after the change of position ($p < 0.05$). The highest amount of sodium was observed in group A and the lowest amount of sodium was observed in group B. Also, there was no significant difference between the amounts of hemoglobin between the groups. The highest mean systolic blood pressure was in the prone position followed by group D. the lowest mean systolic blood pressure was in the supine position and group A, after anesthesia. The heart rate between the two supine and prone position with different doses of Marcaine at different times had not any significant difference before the change of position until after recovery.

Conclusion: The results of this study showed that there is no relationship between hemoglobin level, blood pressure, heart rate, and PCNL surgery position, but in the case of two methods of supine and prone position with different doses of Marcaine, sodium levels may have differences after a position change. So monitoring of sodium levels is more important in PCNL surgery.

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Introduction:

Urinary system stones are a very common problem that affects up to 10% of the total population during their lifetime. About 10 to 30 percent of these patients require urological interventions (1, 2). Percutaneous nephrolithotomy (PCNL) is a standard treatment for the group of kidney stones that cannot be treated by shock wave lithotripsy (SWL). There are many benefits of PCNL, including postoperative pain relief, reduced hospital stay, and minor post-operative scarring (3, 4). PCNL is usually performed in the prone position, but in the completely supine position (csPCNL) it has advantages over the prone position. Supine and Letral positions have been reported to be safe in high-risk patients as well as in other cases. Patients in a completely supine position are on the edge of the bed. There are no rolls under the patient's side and flank, and there is no change in the position of the foot in the csPCNL. This endoscopic technique (csPCNNL) can lead to serious complications (5). One of the most important side effects is the leakage of large amounts of water into the retroperitoneal space, which increases the risk of septic shock (9-6). There are few studies on hemodynamics, electrolytes, and acid and base changes in PCNL practice, and different views have been expressed on this issue (10). In some studies, changes due to PCNL have been more likely to look at hypernatremia and metabolic acidosis than hypertension (11-12). To prevent the side effects of water absorption to the body spaces, normal saline is a liquid that is commonly recommended for irrigation (11, 5). A study has shown that increasing the length of PCNL surgery reduces the amount of hemoglobin. This reduction could increase the risk of nephropathy (13). Another study showed that the use of distilled and normal saline water could reduce hemoglobin levels (14). Given that studies on changes in the sodium and hemoglobin level during PCNL surgery are limited, while sodium and hemoglobin level have a significant role in body hemostasis, monitoring these factors seems necessary. In the present study, the research team compared two positions of Supine and prone in terms of hemoglobin and sodium levels after PCNL surgery with spinal anesthesia.

Methods:

This study was a clinical trial study of 200 patients (50 in each group) between the ages of 20 and 60, who were class one or two in terms of anesthesia and were candidates for PCNL surgery at Peymaniyeh Hospital in 2018. Inclusion criteria were preference for spinal anesthesia (class one or two), no chronic headaches and migraines, no cardiovascular disease such as hypertension or ischemic heart disease, no colds and sore throats, and no coagulation disorders or using medications like ASA, heart medications and anticoagulants. The exclusion criteria were the unsuccessful ejection of spinal anesthesia, the occurrence of any respiratory problems and any complication that leads to open surgery or hospitalization in the intensive care unit. After obtaining a license from the Ethics committee of Jahrom University of Medical Sciences with the code of IR.JUMS.REC.1396.159 and the start of the study, all patients underwent PCNL surgery by a surgeon. At the beginning and

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after the preliminary stages by the surgical team, the patients were randomly divided into two groups: supine and prone position. Then each group was divided into two groups receiving 3 cc Marcaine 0.5% spinal or 2 cc Marcaine 0.5% spinal + 20 microgram fentanyl.

Study groups were as following: group A: 3 cc Marcaine 0.5% spinal in supine position, group B: 2 cc Marcaine 0.5% spinal + 20 micrograms fentanyl in Supine position, group C: 3 cc Marcaine 0.5% spinal in the prone position, group D: 2 cc Marcaine 0.5% spinal + 20 micrograms fentanyl in the prone position. The patient's heart rate and blood pressure were recorded before anesthesia, after anesthesia after anesthesia, and at 10 and 15 minutes later during the operation, in recovery, and after recovery. The patient's hemoglobin and sodium levels were recorded before and 24 hours after surgery.

Recorded data were analyzed using SPSS software version 21 and to compare the variability of sex and anesthesia variables and to compare the amount of bleeding in the supine and prone groups, the distribution of the variables was tested using the Kolmogorov–Smirnov test. ANOVA, independent T-test, and Duncan's tests were used to investigate the differences between supine and prone postitons with different doses of Marcaine in terms of systolic blood pressure, diastole, and heart rate. In case of non-parametric data, tests such as Kruskal–Wallis and Mann Whitney were used. P value less than 0.05 was considered as the statistically significant.

Findings:

There was no statistically significant difference between all 4 groups of the study in term of age (p = 0.390). Also, there was not any significant differences in sex and anesthesia class between study groups (P>0.05).

There was a significant difference between the two methods of supine and prone position with different doses of marching in terms of systolic blood pressure in the post-anesthesia period (p <0.05). At the time of anesthesia, the highest mean systolic blood pressure was observed in the prone and group D states and the lowest in the supine and group A states. The results of Duncan's follow-up test showed that there was a statistically significant difference between anesthesia between groups A from supine status with group D from person status and group B from supine status with group C from person status (p <0.05). And no significant statistical difference was observed at other times. At the time of recovery, although systolic blood pressure was significantly different between group A and group B in the supine position, there was no significant difference between supine and prone groups (p = 0.94). In the post-anesthesia period, although diastolic blood pressure in group A was significantly higher in the supine position than in group D in the prone position, there was no significant difference between the supine and prone groups (p = 0.29). And no significant statistical difference was observed at other times (Table 2). Although during the change of position, the heart rate in the supine and Peron groups increased with different doses of Marcaine and then decreased, the heart rate between the two states of supine and prone with different doses of Marcaine at different times before the change of position until Withdrawal from recovery was not significant (p> 0.05) (Table 3). Table 4 shows

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the levels of hemoglobin and sodium in the two methods of supine and prone position with different doses of Marcaine. The results of the Enova test showed that there was no significant difference between the two methods of supine and prone position with different doses of marching in terms of hemoglobin levels before and after the change of position (P <0.05).

Also, there is no significant difference between the two methods of supine and prone position with different doses of marching in terms of sodium content before the change of position (p <0.05). However, there is a significant difference between the two methods of supine and prone position with different doses of marching in terms of sodium content after the change of position (p <0.05). The highest amount of sodium was observed in group A and the lowest amount of sodium was observed in group B.

Discussion:

Skin nephrolithiasis (PCNL) has been widely accepted as a minimally invasive method as an alternative to open surgery in the treatment of kidney stones, especially stones larger than 2 cm (14). Despite the advantages of the above operations, they have side effects. The present study compared the two conditions of supine and prone to the amount of hemoglobin and sodium after surgery in the practice of removing kidney stones through the skin with spinal anesthesia. The results of the present study indicate that the position does not affect the amount of hemoglobin in pink surgery by spinal anesthesia. No study was found on changing the position of hemoglobin. In a study by Nasseh et al., It was found that the amount of hemoglobin decreases with increasing surgical length and the patient becomes susceptible to neuropathy, but in the same study, no findings were found on the effect of position on neuropathy. Further review (13). The duration of surgery was 30 minutes, which could be one of the reasons why hemoglobin levels did not change. Also, in a study by Miri Nejad et al. (15), the results showed that distilled and normal saline water, both of which are used as irrigation, reduce hemoglobin levels. However, the use of distilled water in case of rupture during surgery is considered dangerous due to high absorption, which can cause hemolysis and have a greater impact on hemoglobin. In a study by Kuzgunbay et al., It was found that hemoglobin changes between the two groups under PCNL surgery, one group with spinal anesthesia and the other group with general anesthesia, did not differ significantly from spinal anesthesia, and spinal anesthesia is a safer method than general anesthesia (16).

In the present study, it was also found that there was no significant difference between the two methods of supine and prone position with different doses of marching in terms of sodium content before the change of position (p <0.05). However, there is a significant difference between the two methods of supine and prone position with different doses of marching in terms of sodium content after the change of position (p <0.05). The highest amount of sodium was observed in group A and the lowest amount of sodium was observed in group B. A 2006 study by Shabnam Assisi et al. At the University of Mersin in Turkey examined sodium changes in 21 kidney stones patients who were candidates for PCNL surgery with 0.9% normal saline and concluded that serum

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sodium levels decreased (14). But in a study by Miriam Nejad et al. (15), the results showed that normal and normal saline water, both of which are used as irrigation, did not change the sodium level, which is consistent with the present study. The reason for the incompatibility of the study by Atisi et al. Can be related to the type of anesthesia, the type of anesthesia, the length of the surgery, and the number of samples. In a cohort study [17], it was found that the two positions of supine and prone in people undergoing PCNL surgery did not have a significant effect on the number of sodium changes, which is consistent with the results of the present study.

The results of the present study showed that at the time of recovery, although systolic blood pressure was significantly different between group A and group B in the supine position, there was no significant difference between supine and peron groups. Although during the change of position, the heart rate in the supine and Peron groups increased with different doses of marocain and decreased after that time, the heart rate between the two states of supine and peron with different doses of marocain at different times from before the change of position to When leaving recovery, it was not significant ($p > 0.05$) in a cohort study [17] that blood pressure and systolic and diastolic blood pressure decreased during surgery and recovery. In the prone position group, the venous return decreases due to the supine position in the prone position due to abdominal pressure, and this decrease in venous return may be the reason for hypotension during surgery in the prone position. This is more than enough to compensate for the hemodynamic imbalance during surgery.

Conclusion:

According to the results of this study, it seems that sodium monitoring is more important than other electrolytes in PCNL surgery, although more studies should be done. Significant hemodynamic changes do not appear to occur in patients undergoing PCNL surgery with spinal anesthesia. However, according to other studies, it is recommended that other changes be made in relation to PCNL surgery, such as the amount of anesthesia, anesthesia, and other factors.

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Tables and Charts:

Table 1: Description of demographic variables in study groups.

		group				p-value
		Supine		prone		
		3 cc Marcaine 0.5% (A)	2 cc Marcaine 0.5% + 20 fentanyl (B)	3 cc Marcaine 0.5% (C)	2 cc Marcaine 0.5% + 20 fentanyl (D)	
		(%).N	(%) .N	.N (%)	.N Percent	
sex	**Male**	35(70)	31(34)	35(70)	33(66)	**947/0**
	Female	15(30)	16(66)	15(30)	17(34)	
anesthesia class	**I**	34(68)	32(64)	36(72)	33(66)	**450/0**
	II	16(32)	18(36)	14(28)	17(34)	
Age *		71/12±82/45	80/12±58/49	46/12±28/48	12.76±49.74	**390/0**

* Mean and standard deviation

Table 2: Comparison of systolic and diastolic blood pressure in two supine and prone states with different doses of morphine at different times.

		group				p-value *
		Supine		Peron		
		3 cc Marcaine 0.5% (A)	2 cc Marcaine 0.5% + 20 fentanyl (B)	3 cc Marcaine 0.5% (C)	2 cc Marcaine 0.5% + 20 fentanyl (D)	
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
Systolic blood pressure	**Before anesthesia**	32/21±66/139	57/22±46/145	01/19±92/137	56/21±06/145	0.72
	After anesthesia	a 48/19±72/106	b 40/19±96/126	a 04/15±24/114	b 29/16±32/131	0.04

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	10 minutes	77/16±16/121	77/21±76/122	46/15±22/123	90/16±08/128	0.15
	15 minutes	95/15±94/120	19/22±56/123	9/14±37/125	18/15±05/126	0.18
	In recovery	90/18±08/123	70/17±38/127	19/15±88/122	23/16±58/128	0.84
	Get out of recovery	a 69/13±39/123	b 05/14±18/130	ab 35/12±62/124	ab 99/10±30/129	0.94
Diastole blood pressure	**Before anesthesia**	2/11±74/85	8/11±02/87	8/11±36/87	59/10±18/86	0.81
	After anesthesia	a 96/13±20/70	a 75/12±68/78	ab 83/11±42/72	c 99/9±30/80	0.29
	10 minutes	07/14±80/75	36/12±88/78	47/12±08/76	23/11±24/79	0.86
	15 minutes	87/11±04/77	73/14±28/78	70/11±96/78	45/9±41/77	0.72
	In recovery	11/13±02/78	15/13±26/79	79/10±68/76	81/9±80/77	0.40
	Get out of recovery	95/10±69/77	33/9±36/79	52/7±66/77	27/8±78/78	0.81

The non-common letters indicate a significant difference between the groups.

* Comparison of blood pressure in two methods, supine and Peron

Table 3: Comparison of heart rate in two conditions, supine and perone with different doses of Marcaine at different times.

		group				**p-value***
		Supine		**Peron**		
		3 cc Marcaine 0.5% (A)	2 cc Marcaine 0.5% + 20 fentanyl (B)	3 cc Marcaine 0.5% (C)	2 cc Marcaine 0.5% + 20 fentanyl (D)	
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
Heart rate	**Before anesthesia**	66/12±82/82	02/13±70/83	07/16±58/80	37/13±64/83	58/0
	Then	14/19±32/91	35/13±98/87	31/19±16/93	40/19±96/126	92/0
	10 minutes	88/17±14/91	17/15±22/83	98/17±62/87	77/21±76/122	23/0
	15 minutes	12/16±34/88	47/14±81/81	72/16±33/82	19/22±56/123	11/0
	In recovery	72/14±32/80	09/16±04/81	12/15±82/78	70/17±38/127	57/0
	Get out of recovery	20/11±41/78	28/12±08/76	37/13±56/76	05/14±18/130	76/0

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* Comparison of heart rate in two methods, supine, and Peron

Table 4: Investigation of hemoglobin and sodium levels in two methods: supine and preposition with different doses of morphine.

		group				**p-value**
		Supine		**Peron**		
		3 cc Marcaine 0.5% (A)	2 cc Marcaine 0.5% + 20 fentanyl (B)	3 cc Marcaine 0.5% (C)	2 cc Marcaine 0.5% + 20 fentanyl (D)	
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
hemoglobin	**Before surgery** **24 hours after surgery**	97/1±**32/**14 76/1±24/13	46/1±33/14 47/1±20/13	47/1±26/14 39/1±21/13	07/2±03/14 2±18/13	**./812** **./999**
Sodium	**Before surgery** **24 hours after surgery**	13/3±78/140 25/4±50/137	48/4±36/142 21/4±20/139	06/3±66/140 43/2±90/137	30/3±84/140 17/4±48/139	**./055** **./026**

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