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Original Research Article

Comparative study of effect of placing bolsters versus no bolsters for percutaneous nephrolithotomy surgeries

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Abstract: Prone positioning of patients during anaesthesia is required to provide operative access for a wide variety of surgical procedures. It is associated with predictable changes in physiology but also with a number of complications, and safe use of the prone position requires an understanding of both issues. Percutaneous nephrolithotomy (PCNL), a minimally invasive method for removal of renal calculi, but gained popularity about two decades later and has now become standard practice for management. Bolsters are regularly placed when patients are positioned prone. This study was conducted to find out whether placing bolsters make any difference in the respiratory and haemodynamic parameters when patients are positioned prone in healthy, young non obese adults. Patients were randomly allocated into 2 groups of 20 each. Bolsters and non-bolsters group. Statistically there was no significant differences between both the groups in the various parameters that were compared. The authors conclude that placing bolsters make no difference in young, healthy non obese patients.
Keywords: Prone positioning, anaesthesia, nephrolithotomy.

INTRODUCTION:

Prone positioning of patients during anaesthesia is required to provide operative access for a wide variety of surgical procedures. It is associated with predictable changes in physiology but also with a number of complications, and safe use of the prone position requires an understanding of both issues [1]. Percutaneous nephrolithotomy is a minimally invasive technique, wherein an endoscope is introduced into the lower calyx of the kidney under fluoroscopy, aided by radioopaque dye in the pelvi-calyceal system; and using laser or ultrasound probes, the calculi are fractured under vision and the fragments are irrigated through a channel in the scope, using saline. This procedure is performed under general anesthesia [2]. Various surgeries are performed in the prone position. There are a variety of modifications described for different types of surgeries. Percutaneous nephrolithotomy (PCNL) is most invariably done in the prone position. Bolsters are routinely placed under the chest and the pelvis to prevent abdominal compression when the patient is positioned prone. Given the nature and duration of surgery, currently PCNL surgeries are routinely being done without placing the bolsters in healthy young patients. However no studies have been done to evaluate the same.

The main objectives of this study was to study and compare the effects of placing bolsters versus no bolsters in patients undergoing PCNL under general anaesthesia in healthy young non obese adults and to document the complications if any.

METHODOLOGY:

After obtaining the approval for the study from the institutional research committee, 40 ASA 1 patients were randomly allocated into 2 groups of 20 each. The patients were matched and divided appropriately in 2 groups. The obese patients were excluded from this study as this study was carried out to test the role of bolsters in prone positioning in normal and healthy patents. The group 1 patients had standard soft silicone bolsters placed under the chest and abdomen when they were positioned prone for the surgery. For the patients in group 2, no bolsters were placed when they were positioned prone for the surgery.

In the operation table the following monitoring parameters were attached ECG, NIBP, SpO2, and

EtCO2. IV line was secured with 18G cannula in the upper limb. Patients were preloaded with 1 litre of RL. General anaesthesia was induced with inj. Midazolam, Inj. Fentanyl, Inj. Propofol, Inj. Vecuronium. Appropriate sized Endo tracheal tube was inserted and anaesthesia maintained with O2, N2O and isoflurane. Patients were reversed with inj. neostigmine+glycopyrolate and extubated at the end of the procedure. All the monitoring parameters were recorded continuously and noted specifically with respect to changes in position of the patient.

The patient was monitored till they were discharged from the hospital.

The following parameters were compared between the two groups

- Haemodynamics- heart rate, NIBP, SpO2, ECG changes
- Respiratory mechanics- Lung compliance, Airway pressures, EtCo2

Any adverse events were recorded and documented.

RESULTS:

The patients were matched similarly with respect to Age, sex and weight in both the groups.

There were no significant differences in Heart rate in both the groups in the various positions. Tables 1 & 2, Fig 1.

There is no significant difference in the mean value between the two groups i.e. With Bolsters and Without Bolsters in HR Prone (Table-2).

There is no significant difference in the mean value between the two groups i.e. With Bolsters and Without Bolsters in HR after Surgery(Table-2).

The mean arterial blood pressures (MAP) were slightly more in the patients without bolsters than the patients with bolsters. Table 3& 4, Fig 2.

There is a significant difference in the mean value between the two groups i.e. With Bolsters and Without Bolsters in MAP Prone.

There is a significant difference in the mean value between the two groups i.e. With Bolsters and Without Bolsters in MAP after Surgery.

There were no significant differences in End Tidal Carbon di oxide (EtCO2) in both the groups in the various positions. Tables 5 & 6, Fig. 3

There is no significant difference in the mean value between the two groups i.e. With Bolsters and Without Bolsters in EtCO2 Prone.

There is no significant difference in the mean value between the two groups i.e. With Bolsters and Without Bolsters in EtCO2 after Surgery.

There were no significant differences in lung compliance in both the groups in the various positions. Tables 7 & 8, Fig 4

There is no significant difference in the mean value between the two groups i.e. With Bolsters and Without Bolsters in Compliance Prone.

There is no significant difference in the mean value between the two groups i.e. With Bolsters and Without Bolsters in Compliance after Surgery.

There was slight increase in the PAP in prone position with bolsters as compared to the group without bolsters. (Table 9) There were no significant differences in Peak airway pressures (PAP) in both the groups in the supine position after surgery. (Table 10), Fig 5

There is a significant difference in the mean value between the two groups i.e. With Bolsters and Without Bolsters in PAP Prone ($P<0.05$).

There is no significant difference in the mean value between the two groups i.e. With Bolsters and Without Bolsters in PAP After Surgery.

Table 1: Heart rate during prone

HR Prone	Group	Mean	Std Dev	SE of Mean	Mean Difference	t	P-Value
	With Bolsters	82.15	8.47	1.89	-2.350	-0.761	0.451
	Without Bolsters	84.50	10.91	2.44			

Table 2: HR after surgery Supine

HR After Surgery	Group	Mean	Std Dev	SE of Mean	Mean Difference	t	P-Value
	With Bolsters	81.20	7.51	1.68	-4.050	-1.417	0.165
	Without Bolsters	85.25	10.34	2.31			

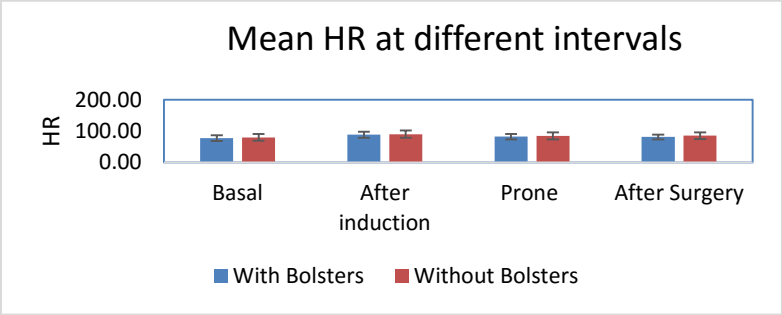

Fig 1: Heart Rate differences in various positions

Table 3: Mean Arterial Pressure in prone position

MAP Prone	Group	Mean	Std Dev	SE of Mean	Mean Difference	t	P-Value
	With Bolsters	95.75	2.53	0.57	-3.000	-3.984	<0.001*
	Without Bolsters	98.75	2.22	0.50			

*denotes significant difference.

Table 4: Mean Arterial pressure in supine after surgery

MAP After Surgery	Group	Mean	Std Dev	SE of Mean	Mean Difference	t	P-Value
	With Bolsters	97.00	1.89	0.42	-2.700	-4.239	<0.001*
	Without Bolsters	99.70	2.13	0.48			

*denotes significant difference

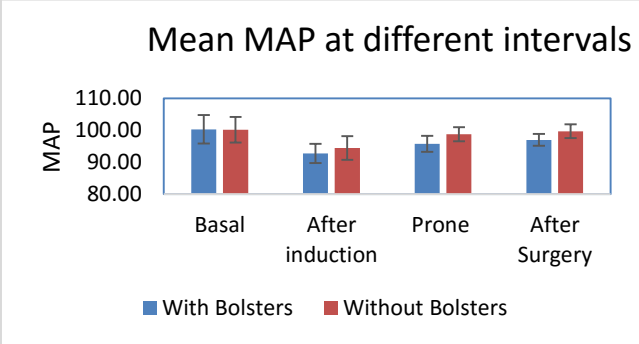

Fig 2: Mean arterial pressures in different positions

Table-5: EtCO2 in prone position

EtCO2 Prone	Group	Mean	Std Dev	SE of Mean	Mean Difference	t	P-Value
	With Bolsters	32.50	1.70	0.38	0.850	1.771	0.085
	Without Bolsters	31.65	1.31	0.29			

Table 6: EtCO2 in supine after surgery

EtCO2 After Surgery	Group	Mean	Std Dev	SE of Mean	Mean Difference	t	P-Value
	With Bolsters	30.80	1.36	0.30	0.650	1.539	0.132
	Without Bolsters	30.15	1.31	0.29			

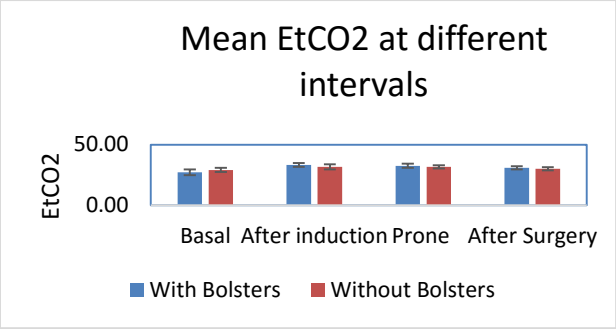

Fig 3: EtCO2 at various positions

Table 7: Patient Compliance in prone position

Compliance Prone	Group	Mean	Std Dev	SE of Mean	Mean Difference	t	P-Value
	With Bolsters	20.85	2.96	0.66	0.850	0.975	0.336
	Without Bolsters	20.00	2.53	0.57			

Table 8: Patient Compliance in Supine after surgery

Compliance After Surgery	Group	Mean	Std Dev	SE of Mean	Mean Difference	t	P-Value
	With Bolsters	26.75	4.71	1.05	-0.050	-0.042	0.967
	Without Bolsters	26.80	2.53	0.56			

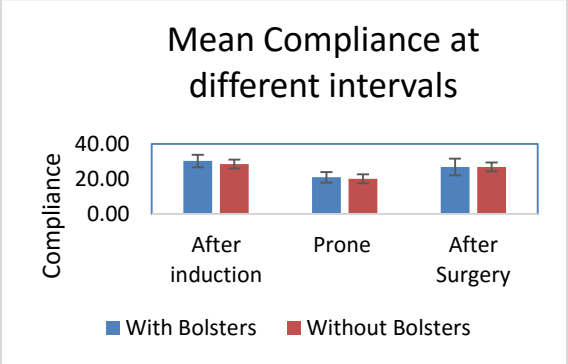

Fig 4: Mean compliance in different positions

Table 9: Patient PAP in prone position

PAP Prone	Group	Mean	Std Dev	SE of Mean	Mean Difference	t	P-Value
	With Bolsters	20.30	1.56	0.35	1.200	2.172	0.036*
	Without Bolsters	19.10	1.92	0.43			

*denotes significant difference

Table 10: Patient PAP in Supine after surgery

PAP After Surgery	Group	Mean	Std Dev	SE of Mean	Mean Difference	t	P-Value
	With Bolsters	18.05	1.39	0.31	0.750	1.483	0.146
	Without Bolsters	17.30	1.78	0.40			

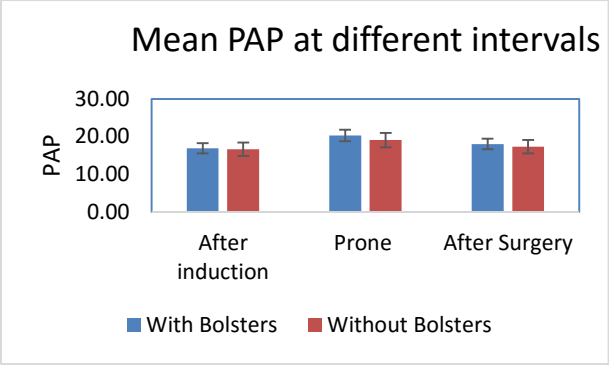

Fig 5: Peak airway pressure in different positions

DISCUSSION:

The advantages offered by GA include safety as the patient's airway is secured in prone position, feasibility to control tidal volume during percutaneous access puncture to minimise injury to the pleura and lungs, and prolonged anesthesia duration allowing the surgeon to make multiple and higher punctures with minimal patient discomfort, especially in cases with large stone load [3].

PCNL is usually done in prone position which is associated with certain physiological changes. Pooling of blood in extremities and compression of abdominal muscles may decrease preload, cardiac output and blood pressure. Compression of abdomen and thorax decreases total lung compliance and increases work of breathing. Extreme head rotation may decrease cerebral venous drainage and cerebral blood flow. Eye and nerve injuries due to pressure are common, if proper care is not taken [4].

The chest wall is usually sufficiently robust to allow the patient's weight to be supported on it without compression of the structures within. However, this cannot necessarily be assumed inthe presence of congenital anatomical abnormalities or after cardiothoracic surgery. Scoliosis often results in a reduced anterior–posterior diameter of the chest, so it is unsurprising that there are reports of the cardiac output being lost during surgical manipulations of the spine [5].

Sally *et al.;* studied the effects of pulmonary compliance in prone positioning in patients undergoing spine surgeries. They demonstrated that prone positioning during anesthesia results in a decrease in pulmonary compliance that is frame-dependent but that is not affected by body mass index [6]. The bolsters might make a difference in prone positioning of patients under anesthesia in long duration surgeries like spine surgeries. It is definitely recommended when the patients are obese. No studies were found which compared the effect of bolsters and not placing them in healthy young patients.

CONCLUSION:

We conclude that there is no major difference in placing the bolsters as compared to not placing the bolsters in healthy young, non-obese patients for surgeries like PCNL.

Conflict of Interest: Nil.

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