

# A Comparative Study of Spinal Anaesthesia with Levobupivacaine and Hyperbaric Bupivacaine for Cesarean Sections

Amio Kumar Deori<sup>1</sup>, Arnav Das<sup>2</sup>, Dhruva Borgohain<sup>3</sup>, Diganta Bora<sup>4</sup>, Arunima Saikia<sup>5</sup>, Pradip Kumar Tiwari<sup>6</sup>

## ABSTRACT

**Introduction:** Levobupivacaine showed a lower risk of cardiovascular and central nervous system (CNS) toxicity than bupivacaine which is the most popular local anesthetic agent in obstetric practice. The aim of this study was to compare the clinical effects (sensory block, motor block, hemodynamic effects, Apgar score at 1 and 5 minutes and adverse effects if any) of intrathecal 2.5 ml 0.5% isobaric levobupivacaine with 2.5 ml 0.5% hyperbaric bupivacaine in spinal anaesthesia for lower segment caesarean section.

**Material and Methods:** 150 pregnant women in ASA I - II group scheduled to have elective caesarean operation were allocated into the study. Patients were randomly divided into two groups. The combinations 12.5 mg levobupivacaine (0.5%) for Group L (n = 75) patients, 12.5 mg hyperbaric bupivacaine (0.5%) for Group B (n = 75) patients were intrathecally administered a total of 2.5 cc. Sensory and motor block characteristics of the groups were assessed with pinprick and Modified Bromage scale; observed hemodynamic changes and side effects were recorded.

**Results:** The time to reach maximum dermatome for the sensory block, time to regression by two dermatomes and time to regress to T12 dermatome was found to be significantly long in Group B. It was observed that in Group B the evolution of the motor block was faster and lasted longer. Ephedrine was required in more amount in group B.

**Conclusion:** Levobupivacaine with less side effect can be a good alternative to bupivacaine.

**Keywords:** Spinal Anesthesia; Levobupivacaine; Bupivacaine; Fentanyl; Cesarean Section

## INTRODUCTION

Spinal anaesthesia was pioneered in humans by a German surgeon Dr August Bier on August 15<sup>th</sup> 1898 using Quinke method of entering the intrathecal space.

The technique has been refined since then and has evolved into the modern concept of spinal anaesthesia. It provides simple, effective and safe analgesia in the peri-operative period. Current obstetric anaesthesia requires satisfactory analgesia and adequate muscle relaxation while minimizing the maternal and fetal side effects of the drug used. Caesarean delivery with bupivacaine is now popular.

Hyperbaric bupivacaine 0.5%, an amide local anaesthetic is presently the most common drug used for obstetric anaesthesia. Hyperbaric bupivacaine in 8% glucose is often used. Bupivacaine is hyperbaric in comparison with human CSF.<sup>1,2</sup> Clinically, this manifests as an unpredictable median sensory block height with a large inter-individual spread and is occasionally associated with block failure when the spinal block has not spread high

enough for surgery.<sup>3</sup> Lateral position can be favoured in lateral position.<sup>1</sup> Isobaric solutions are better in terms of cardiac complications as compared to hyperbaric solution.<sup>4,5</sup> Therefore we cannot ascribe the difference of sensory and motor block between the two groups in our study to the difference of baricity only.

Levobupivacaine are less toxic to heart and CNS. When administered for caesarean section it has been shown to have motor blockade of lesser intensity when compared to bupivacaine. It is considered more potent than ropivacaine due to its greater lipid solubility. The plain levobupivacaine has been shown to be truly isobaric with respect to CSF of pregnant women. Its use in this setting may therefore offer special advantages because this property may translate into a more predictable spread.

In this randomized study, the plan is to evaluate the influence of levobupivacaine on the quality of the block and the incidence of side effects, particularly hypotension and compare with the clinical effect of hyperbaric bupivacaine in spinal anaesthesia for caesarean sections. The aim of this study was to compare the clinical effects (sensory block, motor block, hemodynamic effects, Apgar score at 1 and 5 minutes and adverse effects if any) of intrathecal 2.5 ml 0.5% isobaric levobupivacaine with 2.5 ml 0.5% hyperbaric bupivacaine in spinal anaesthesia for lower segment caesarean section.

## MATERIAL AND METHODS

After obtaining ethical clearance 150 in-patients of Assam Medical College Hospital belonging to ASA I and II posted for elective lower segment caesarean section in the year 2014 will be included in this study. Sample size was based on inclusion and exclusion criteria.

Patients refusing regional anesthesia, having contraindications to spinal anesthesia, weight more than 100 kg, shorter than 150 cm and taller than 175cm, having systemic diseases, expectant mothers with fetal anomaly, placenta previa, abruptio placenta were excluded from the study.

Pre-anaesthetic checkup was done for all patients and written

<sup>1</sup>Professor and Head, <sup>2</sup>Post Graduate Student, <sup>3</sup>Assistant Professor, <sup>4</sup>Senior Resident, <sup>5</sup>Associate Professor, Department of Anaesthesiology, <sup>6</sup>Post Graduate Student, Department of Otolaryngology, Assam Medical College and Hospital, Dibrugarh, Assam, India

**Corresponding author:** Pradip Kumar Tiwari, Post Graduate Student, Department of Otolaryngology, Assam Medical College and Hospital, Dibrugarh, Assam, India

**How to cite this article:** Amio Kumar Deori, Arnav Das, Dhruva Borgohain, Diganta Bora, Arunima Saikia, Pradip Kumar Tiwari. A comparative study of spinal anaesthesia with levobupivacaine and hyperbaric bupivacaine for cesarean sections. International Journal of Contemporary Medical Research 2016;3(7):1902-1905.

informed consent were taken. On the day of surgery, patients were shifted to the operation theatre in the left lateral position with an 18 G IV cannula secured and they were preloaded with Ringer Lactate 10ml/kg approximately 20 minutes prior to the administration of spinal anaesthesia. Noninvasive blood pressure monitor, pulse oximeter and ECG leads were connected for all patients and baseline values will be recorded. Supplementary oxygen were provided at the rate of 5 litres/min via a face mask. Under strict aseptic precautions 2.5ml of the study drug were loaded by an anaesthesiologist not involved in the study. Therefore, the patient and the anaesthesiologist performing the spinal block and recording the intraoperative and postoperative data were noted. The study drug was injected into L3-L4 subarachnoid space using 25 G pencil tip spinal needle after confirming free flow of cerebrospinal fluid and the time of injection will be recorded as 0 minutes. Following this the patients will be made to lie supine immediately and a wedge of 15° will be placed below the right buttock for left uterine displacement. Surgery will commence after loss of sensation to pinprick at T6 level.

Following parameters were noted:

**Sensory Block:** Pin prick test was to assess the sensory block and patients asked about the sensation.

**Onset time for the sensory block:** Defined as the time between injection of the drug to loss of sensation at L1 level.

**Sensation at Sensory duration:** Defined as the period between injection and recovery of L1 level. The time for two dermatomal segments regression of sensory level was noted.

**Motor Block:** Assessed by using Modified Bromage Scale. This was performed every minute until complete motor blockade and then every fifteen minute until recovery of complete motor function.

**Onset Time for Motor Block and Block Duration:** Time taken for complete block and recovery were taken as onset and total block duration.

The degree of motor block was assessed using 'Modified Bromage Scale' –

**Quality of Intraoperative Analgesia:** Was assessed on a four point modified Belzarena scale

**Hemodynamic changes:** Heart rate, systolic and mean arterial pressure and oxygen saturation was recorded every 5 minutes

till delivery of the baby and following this every 10 minutes till the end of surgery. 20 units of oxytocin was added to the intravenous drip and was allowed to flow at the rate of 2ml/min. Apgar score assessed by the attending paediatrician at 1 and 5 minutes was recorded. If inadequate or failed block occurred, we switched to general anaesthesia. Patients was monitored for 2 hours and later 6<sup>th</sup> hourly to know the duration, quality, intensity of pain and any adverse effects if any. The patients were also observed for the development of PDPH and were followed up for 3 to 4 days.

## STATISTICAL ANALYSIS

Descriptive statistics were used and mean and percentage were calculated. ANOVA was used for doing comparison between two drugs levobupivacaine and bupivacaine. With 5 % significance level assessment with descriptive study was carried out.

## RESULTS

There has been no statistical difference between groups in terms of their demographic characteristics and the duration of the operation (Table-1). Equal level of anaesthesia and analgesia was seen in both groups.

Shorter time of onset seen in group B. The time taken for the sensory block to reach maximum level was longer in Group L and its maximum sensory block level was lower ( $p < 0.05$ ).

The time to regression by two dermatomes for the sensory block and time for complete sensory recovery were longer in Group B ( $p < 0.05$ ) (Table-2).

The time to onset of motor block in Group B was shorter than Group L ( $p < 0.05$ ). Motor block developed faster and lasted longer with the hyperbaric bupivacaine ( $p < 0.05$ ) (Table-3).

Hypotension and bradycardia were more common in the B group ( $p < 0.05$ ). In addition, nausea and vomiting were noticed more frequently in the B group though statistically insignificant ( $p > 0.05$ ) (Table-4).

Other side effects such as headache, backache and itching in the groups were similar. It was observed that the requirement of intraoperative ephedrine was higher in Group B, as incidence of hypotension was more in group B (Figure-1) and the time to first analgesic requirement was longer in Group B ( $p > 0.05$ ).

## DISCUSSION

In our study, sensory block levels required for cesarean section were achieved in both groups, and it was observed that the hemodynamic stability with levobupivacaine was better maintained.

In the study we found the mean time for onset of sensory block for group bupivacaine is 1:40 minutes  $\pm$  0:11 min and that for levobupivacaine is 1:51 minutes  $\pm$  0:13 minutes. Significant differences found between the study groups in respect to the time for onset of sensory block. Gulen Guler et al<sup>10</sup> in their comparative study in LSCS operations found onset of

	Groups	
	Group-L (Mean $\pm$ S.D.)	Group-B (Mean $\pm$ S.D.)
Age (years)	23.77 $\pm$ 4.01	24.04 $\pm$ 11.08
Height (cm)	160.33 $\pm$ 4.04	161.00 $\pm$ 2.80
Weight (Kg)	60.17 $\pm$ 4.01	60.61 $\pm$ 2.98
Gestation (weeks)	39.10 $\pm$ 0.40	38.53 $\pm$ 0.57
Surgical Time (min)	48.60 $\pm$ 2.89	47.44 $\pm$ 3.70

**Table-1:** Demographic Data

	Groups		p value
	Group-L (Mean $\pm$ S.D.)	Group-B (Mean $\pm$ S.D.)	
Time to Onset of Sensory Block (min:Sec)	1:51 $\pm$ 0:13	1:40 $\pm$ 0:11	< 0.001
Time for Two Segment Regression (min)	70.27 $\pm$ 5.69	76.13 $\pm$ 6.55	< 0.001
Time for Complete Sensory Recovery (min)	156.93 $\pm$ 16.60	167.60 $\pm$ 10.25	< 0.001

**Table-2:** Characteristics of Sensory Blocks

	Groups		p value
	Group-L (Mean ± S.D.)	Group-B (Mean ± S.D.)	
Time to Onset of Motor Block (Min:Sec)	4:22 ± 0:34	3:28 ± 0:28	< 0.001
Time for Duration of Motor Block (min)	119.33 ± 11.31	141.33 ± 9.35	< 0.001

Table-3: Characteristics of Motor Blocks

Side Effects	Group-L		Group-B		p value
	n	%	N	%	
Nausea	6	6.67	12	16.00	> 0.05
Vomiting	2	2.67	6	8.00	> 0.05
Headache	1	1.33	2	2.67	> 0.05
Itching	0	0.00	1	1.33	> 0.05
Bradycardia	0	0.00	4	5.33	< 0.05

Table-4: Side Effects

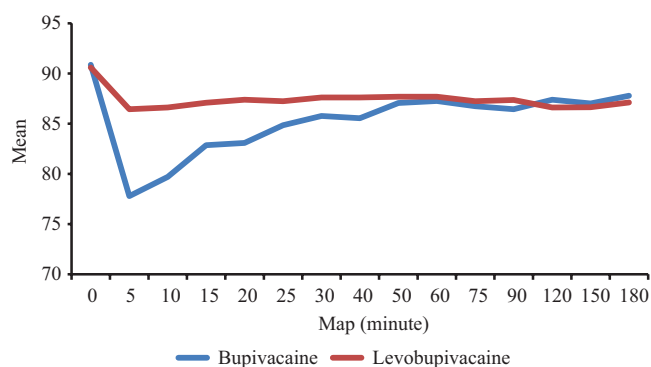


Figure-1: Mean arterial pressure

sensory block for bupivacaine was  $1.46 \pm 0.50$  minutes and levobupivacaine was  $2 \pm 0.37$  minutes which is in accordance with our study. Ayesha Goyal et al<sup>13</sup> in their study also found similar results, onset of sensory block for levobupivacaine was  $2.1 \pm 0.15$  minutes and for bupivacaine was  $1.7 \pm 0.23$  minutes. F. Fattorini and colleague<sup>7</sup> in their study on orthopaedic surgery found onset time of bupivacaine was  $9 \pm 5$  minutes and levobupivacaine was  $12 \pm 6$  minutes, similarly Thepakorn Sathitkarnmanee and their colleagues<sup>9</sup> found onset time of bupivacaine was  $17.37 \pm 7.99$  and for levobupivacaine was  $15.35 \pm 7.29$  which are longer than our study may be because our patients were pregnant and may be of methodology.

In the study we observed that total time for complete sensory recovery for bupivacaine was  $167.60 \pm 10.25$  minutes and for levobupivacaine was  $156.93 \pm 16.60$  minutes which is statistically significant ( $p < 0.05$ ). Thepakorn Sathitkarnmanee and their colleagues<sup>9</sup> in the study for lower limb surgeries found duration of sensory block for bupivacaine was  $137.02 \pm 40.01$  minutes and levobupivacaine was  $136.14 \pm 45.32$  minutes, statistically insignificant but duration were nearer to our study. In another study by Gulen Guler et al<sup>10</sup> regression time to T12 for the sensory block for bupivacaine was  $145.50 \pm 11.01$  minutes and for levobupivacaine was  $162.33 \pm 10.56$  minutes, which is statistically significant ( $p < 0.05$ ). In another study conducted by Christian Glaser and their colleagues<sup>6</sup> found duration of sensory block for levobupivacaine group was  $228 \pm 77$  and for bupivacaine group was  $237 \pm 88$ , which are longer than our study. The time for two segment regression for bupivacaine was  $76.13 \pm 6.55$  minutes and for levobupivacaine was  $70.27 \pm 5.69$  minutes, in our study which is statistically significant ( $p <$

$0.05$ ). Gulen Guler et al<sup>10</sup> found that time for two segment regression for bupivacaine is  $76.16 \pm 13.86$  minutes and for levobupivacaine is  $71.43 \pm 12.96$  minutes, which is significant ( $p < 0.05$ ) and is in accordance with our study. Ayesha Goyal<sup>13</sup> also found results similar to our study, regression for bupivacaine was  $86.35 \pm 16.72$  minutes and for levobupivacaine was  $79.34 \pm 13.86$  minutes in their study. Christian Glaser et al<sup>6</sup> noted that time for two segment regression for bupivacaine was  $155 \pm 50$  and for levobupivacaine was  $152 \pm 48$  which is longer than our study, may be because of methodology.

Quality of intra operative analgesia was satisfactory in most of the patients in both groups and the anaesthesia was well accepted by most of the patients in both groups.

In the study we observed that onset for motor block in bupivacaine group was  $3:28 \pm 0:28$  minutes and for levobupivacaine was  $4:22 \pm 0:34$  minutes, which is statistically significant ( $p < 0.05$ ). Thepakorn Sathitkarnmanee and their colleagues<sup>9</sup> found that onset for motor block for bupivacaine was  $4.45 \pm 3.25$  minutes and for levobupivacaine was  $4.70 \pm 4.56$ , which are nearer to our values. Even in the study of caesarean sections performed by Gulen Guler et al<sup>10</sup> found motor onset of bupivacaine to be  $2.36 \pm 0.61$  minutes and for levobupivacaine  $4.1 \pm 0.88$  minutes which is significant statistically ( $p < 0.05$ ). Even Ayesha Goyal et al<sup>13</sup> found results similar to our value. Onset for bupivacaine was  $2.2 \pm 0.59$  minutes and for levobupivacaine was  $3.9 \pm 0.71$  minutes. Christian Glaser et al<sup>6</sup> showed onset time motor block for bupivacaine ( $9 \pm 7$ ) and for levobupivacaine ( $10 \pm 7$ ) to be longer. Fattorini<sup>53</sup> et al in 2006 in their study for orthopaedic surgery also found onset time for motor block of bupivacaine to be  $8 \pm 4$  minutes and for levobupivacaine was  $11 \pm 6$  minutes, though statistically significant ( $p < 0.05$ ) but onset time was longer than our study may be because our study was conducted in pregnant patients.

We found the total duration of motor block for Bupivacaine group was  $141.33 \pm 9.35$  minutes and for Levobupivacaine group was  $119.33 \pm 11.31$  minutes in our study. Gulen Guler et al<sup>10</sup> also found similar results where total duration of motor block for bupivacaine was  $99 \pm 9.13$  minutes and for levobupivacaine was  $132.66 \pm 7.15$  minutes. Feroz A Dar et al<sup>12</sup> also found results in accordance with our study, total duration of motor block in levobupivacaine group was  $135 \pm 15.6$  minutes and in bupivacaine group was  $145 \pm 20.5$  minutes, ( $p < 0.05$ ). Fattorini et al<sup>7</sup> found total duration of motor block in bupivacaine was  $245 \pm 86$  minutes and for levobupivacaine was  $256 \pm 86$  minutes. Thepakorn Sathitkarnmanee et al<sup>9</sup> in their study also found motor duration longer than our study where motor duration of bupivacaine was  $353.42 \pm 82.41$  minutes. and for levobupivacaine was  $340.41 \pm 80.61$  minutes, may be because of slight difference in methodology.

Gulen Guler et al<sup>10</sup> observed complete motor block in all patients receiving either bupivacaine or levobupivacaine for caesarean sections. We also found complete motor block in all patients of both groups receiving bupivacaine and levobupivacaine.

In our study hypotension occurred in both the groups but more fall in blood pressure was observed in bupivacaine group ( $p < 0.05$ ) with more need for inj ephedrine ( $p < 0.05$ ), which were statistically significant.

Gulen Guler et al<sup>10</sup> also showed similar results with 5 out of 30 for group Levobupivacaine and 11 out of 30 for group Bupivacaine showed hypotension, which was significant ( $p < 0.05$ ) with more need for ephedrine. Herrera R et al<sup>11</sup> in their study of haemodynamic effect on patients aged 65 yrs for sub arachnoid anaesthesia showed similar results with the incidence of hypotension was statistically significantly higher ( $p < 0.05$ ) in group BUPI (38.3%) compared to group LEVO (13.3%). Our results were also similar to Ayesha Goyal et al<sup>13</sup> where they found hypotension more in the group of bupivacaine. But in the study conducted by Thepakorn Sathitkarnmanee et al<sup>9</sup> observed hypotension in 5 out of 35 in Levobupivacaine group, and 1 out of 35 in Bupivacaine, though not significant. Also study conducted by Feroz A Dar et al<sup>12</sup> did not find any significant differences in both the groups when hypotension was compared. In the study we did not observe much changes at heart rate in both groups except for 4 patients in bupivacaine group who had bradycardia and were treated with atropine.

9 out of 30 patients in bupivacaine group and 2 out of 30 patients in levobupivacaine group had bradycardia in the study of Gulen Guler et al<sup>10</sup>, which was statistically significant ( $p < 0.05$ ). Incidence was high may be because of fentanyl, which was used as adjuvant intrathecally in their study. F Fattorini et al<sup>7</sup> in study of spinal anaesthesia for orthopaedic surgery did not find any significant changes in heart rate. Herrera R et al<sup>11</sup> found that heart rate (HR) decreased at 30 minutes after anaesthesia onset (5% in group BUPI versus 9% in group L)

Ayesha Goyal et al<sup>13</sup> in their study for caesarean sections also found APGAR scores at 1 min and 5 min and umbilical cord gas analysis showed no significant difference between the two groups which were similar to our study.

Incidence of side effects like nausea, vomiting, bradycardia, itching, were more in bupivacaine group though all got treated with no sequelae. Gulen Guler et al<sup>10</sup> in also found incidence of nausea and vomiting higher in bupivacaine group whereas headache, itching and others had similar incidence in both groups. Incidences of side effects were more in bupivacaine group.<sup>13,14</sup> M. Mantaouvalou et al<sup>8</sup> found little differences in incidence of side effects in both the groups which were not significant. In regional anaesthesia for caesarean sections, nausea and vomiting can occur due to a few factors. Decrease in cerebral blood flow can be a cause for it. Other reasons are related to the level where block reaches. In our study the doses we administered developed adequate blocks, and caused less hypotension.

## CONCLUSION

We conclude that single-shot spinal anaesthesia performed with both local anesthetic drugs provides fast and effective induction of surgical anaesthesia for elective caesarean section. Levobupivacaine with less motor block time is a better alternative for caesarean section.

## REFERENCES

1. Løvstad R, Granhus G, Hetland S. Bradycardia and asystolic cardiac arrest during spinal anaesthesia: A report of five cases. *Acta Anaesthesiologica Scandinavica*. 2000;44:48-52.

2. Huang Y, Pryor M, Mather L, Veering B. Cardiovascular and Central Nervous System Effects of Intravenous Levobupivacaine and Bupivacaine in Sheep. *Anaesthesia and Analgesia*. 1998;86:797-804.
3. Vercauteren M, Coppejans H, Hoffmann V, Saldien V, Adriaensen H. Small-Dose Hyperbaric Versus Plain Bupivacaine During Spinal Anaesthesia for Caesarean Section. *Anaesthesia and Analgesia*. 1998;86:989-993.
4. Richardson M, Collins H, Wissler R. Intrathecal Hypobaric Versus Hyperbaric Bupivacaine with Morphine for Caesarean Section. *Anaesthesia and Analgesia*. 1998;87:336-340.
5. Sarvela P, Halonen P, Korttila K. Comparison of 9 mg of Intrathecal Plain and Hyperbaric Bupivacaine Both with Fentanyl for Caesarean Delivery. *Anaesthesia and Analgesia*. 1999;89:1257-1262.
6. Glaser C, Marhofer P, Zimpfer G, Heinz M, Sitzwohl C, Kapral S et al. Levobupivacaine Versus Racemic Bupivacaine for Spinal Anaesthesia. *Anaesthesia and Analgesia*. 2002;94:194-198.
7. F. Fattorini, Z. Ricci, A. Rocco, R. Romano, M. A. Pascarella, G. Pinto. Levobupivacaine versus racemic bupivacaine for spinal anaesthesia in orthopaedic major surgery. *Minerva Anestesiologica*. 2006;72:637-44.
8. Mantouvalou M, Ralli S, Arnaoutoglou H, Tziris G, Papadopoulos G. Spinal anaesthesia: Comparison of plain ropivacaine, bupivacaine and levobupivacaine for lower abdominal surgery. *Acta Anaesth. Belg*. 2008;59:65-71.
9. Thepakorn Sathitkarnmanee, Cattleya Thongrong, Sirirat Tribuddharat, Maneerat Thananun, Khochakorn Palachewa, Radda Kamhom "A Comparison of Spinal Isobaric Levobupivacaine and Racemic Bupivacaine for Lower Abdominal and Lower Extremity Surgery" *J Med Assoc Thai*. 2011;94:716-20.
10. Guler G, Cakir G, Ulgey A, Ugur F, Bicer C, Gunes I et al. A Comparison of Spinal Anaesthesia with Levobupivacaine and Hyperbaric Bupivacaine for Caesarean Sections: A Randomized Trial. *Open Journal of Anesthesiology*. 2012;02:84-89.
11. Herrera R, De Andrés J, Estañ L, Olivás F, Martínez-Mir I, Steinfeldt T. Hemodynamic impact of isobaric levobupivacaine versus hyperbaric bupivacaine for subarachnoid anaesthesia in patients aged 65 and older undergoing hip surgery. *BMC Anesthesiol*. 2014;14:97.
12. Dar F, Mir I, Bhat H. Comparison of intrathecal hyperbaric bupivacaine and levobupivacaine for Caesarean section. *Ain-Shams Journal of Anaesthesiology*. 2015;8:89.
13. Ayesha Goyal, P. Shankaranarayan, and P. Ganapathi. A randomized clinical study comparing spinal anaesthesia with isobaric levobupivacaine with fentanyl and hyperbaric bupivacaine with fentanyl in elective caesarean sections. *Anesth Essays Res*. 2015;9:57-62.
14. Deepa Ravindra Shriyan, Bhaskar Murlidhar Patil, Pinakin Gujjar, Nikhil Kamble. A Prospective Randomized Study to Compare ProSeal LMA and Laryngeal Tube with Suction in Patients Posted for Short Duration Surgeries Under General Anaesthesia with Controlled Ventilation. *International Journal of Contemporary Medical Research*. 2016;3:1235-1238.

**Source of Support:** Nil; **Conflict of Interest:** None

**Submitted:** 07-05-2016; **Published online:** 13-06-2016