

## PREVALENCE OF ADVERSE EVENTS FOLLOWING SPINAL ANESTHESIA AND ITS ASSOCIATIONS IN A SELECTED BASE HOSPITAL; SRI LANKA

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### ABSTRACT

Although spinal anaesthesia is a popular medical practice worldwide for surgical procedures, it can be associated with numerous adverse events. They may be due to anaesthetic agents, procedures, techniques and coincidental events as well. Descriptive cross sectional study design was conducted among patients admitted to Base Hospital Thambuththegama to undergo surgery under spinal anaesthesia. Patients who were treated with immunosuppressive medicines as a prophylactic measure to prevent drug allergies were excluded from the study. Systematic random sampling technique was applied to recruit 397 patients. Interviewer administered structured questionnaire was used as the study instrument in all three languages. Data was analyzed by using standard statistical software. No conflicts of interests to be declared. Age of the participant were ranged from 18 years to 86 years (Mean=39.8 yrs:SD=16.6 yrs). Majority of the participants were below 45 yrs (n=287:72.3%). Female predominance were observed in the study sample. Prevalence of the detection of adverse events following spinal anesthesia was 60%(n=238:95%CI=55.1-64.3). Highest number of participants were experienced Hypotension during surgery. Bradycardia and shivering were the other prominent presentations. Majority of adverse events were observed during surgery and occurrence of adverse events in post operative period was relatively less. Female gender, Lower Segment Cesarean Sections were significantly associated with the occurrence of adverse events following spinal anaesthesia. The findings in present study align with much of the published research on spinal anesthesia, especially regarding the high rate of hypotension, bradycardia, and shivering during surgery, particularly in female patients undergoing LSCS. However, the reported overall prevalence of adverse events (60%) seems slightly elevated compared to some other studies, likely due to the inclusion of obstetric surgeries where complications are more frequent. It would be valuable to compare results with other populations, including non-obstetric patients, to further understand the nuances of adverse events following spinal anesthesia

## INTRODUCTION

At the beginning of the 19<sup>th</sup> century, there were significant improvements in the surgical techniques. But surgery remained as the treatment of last resort, because of the associated pain during and following surgery. Many patients with surgical disorders chose death rather than surgery. In the 20<sup>th</sup> century, safety and efficiency of general anaesthesia was improved by the advanced airway management techniques. Development of monitoring and new anaesthetic agents with improved pharmacokinetic and pharmacodynamic characteristics also contributed to this trend. With time the concept of regional anaesthesia was developed to generate local insensitivity to pain. It is blocking neural pathways centrally or peripherally in many situations such as Caesarean sections, Inguinal hernia corrections etc. It is considered safer and there for preferred than general anaesthesia.

Although spinal anaesthesia is a popular medical practice worldwide for surgical procedures, it can be associated with numerous adverse events. They may be due to anaesthetic agents, procedures, techniques and coincidental events as well. Sometimes spinal anaesthetic agents go to higher levels of the spinal cord than expected and may affect the ability to breath by paralysing respiratory muscles. Adverse events may associate with factors specific to the patient such as allergies, psychological factors, age, sex and sociocultural factors. So identification and studying the pattern is very important these days, as spinal anaesthesia is becoming a more popular option to anaesthetize patients, especially pregnant mothers for caesarean sections. Even though it is a widely used technique, there is very limited amount of data published regarding adverse events following Spinal anaesthesia in Sri Lanka. Results of a study related to regional anaesthesia can be used for expanded studies regarding general anaesthesia as well. Findings of a single hospital data will infer to the population to a certain degree.

In 2013, at Base Hospital Wathupitiwala, 11920 surgeries were done and among those 1488 were done under spinal anaesthesia (12.5%). Out of them 77.8% were caesarean sections. ( N=1118). It reflects the general workload and service provided by a ground level base hospital in Sri Lanka. It is located in the northern margin of the Western province and drains parts of Sabaragamuwa and North western provinces which represent a large variety of patients with different sociocultural back grounds.

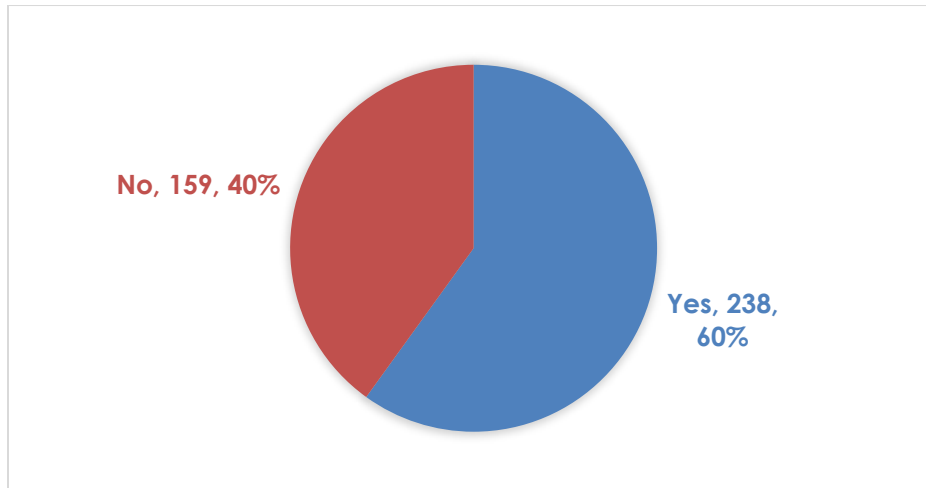
## METHODOLOGY

Descriptive cross sectional study design was conducted among patients admitted to Base Hospital Thambuththegama to undergo surgery under spinal anaesthesia. Patients who were treated with immunosuppressive medicines as a prophylactic measure to prevent drug allergies were excluded from the study. Systematic random sampling technique was applied to recruit 397 patients. Interviewer administered structured questionnaire was used as the study instrument in all three languages. Data was analyzed by using standard statistical software. No conflicts of interests to be declared.

**RESULTS**

Age of the participant were ranged from 18 years to 86 years (Mean=39.8 yrs:SD=16.6 yrs). Majority of the participants were below 45 yrs (n=287:72.3%). Female predominance were observed in the study sample (Table 1).

**Figure 1 : Prevalence of adverse events detected among study participants**



**Table 1: Distribution of age and gender of the study participants**

Parameter	Frequency(n)	Percentage(%)
<b>Age Category</b>		
< 30 Yrs	166	41.8
31-45	121	30.5
46-60	32	8.1
>61 Yrs	78	19.6
<b>Gender</b>		
Male	102	25.7
Female	295	74.3
<b>Total</b>	<b>397</b>	<b>100.0</b>

Prevalence of the detection of adverse events following spinal anesthesia was 60%(n=238:95%CI=55.1-64.3). Highest number of participants were experienced Hypotension during surgery. Bradycardia and shivering were the other prominent

presentations (Table 2). Majority of adverse events were observed during surgery and occurrence of adverse events in post operative period was relatively less.

**Table 2: Distribution of types adverse events and the time of onset**

Adverse event	Presentation n(%)	During surgery	After the surgery
Hypotension	183(46.1%)	172(93.9)	11(6.1)
Faintishness	8(2.1)	6(75.0)	2(25.0)
Shivering	32(8.1)	28(87.5)	4(12.5)
Vomiting	5(1.3)	4(80.0)	1(20.0)
Tachycardia	6(1.5)	4(66.6)	2(33.4)
Nausea	6(1.5)	1(16.6)	5(83.4)
Bradycardia	56(14.2)	51(91.1)	5(8.9)

**Table 3 ; Associations of adverse events following spinal anesthesia**

Parameter	Adverse event		OR	95% CI
	Yes	No		
<b>Gender</b>				
Male	35	64	0.24	0.15-0.41
Female	203	92		
<b>Surgery</b>				
LSCS	164	55	4.12	2.67-6.33
Others	71	98		
<b>Past Surgery</b>				
Yes	140	86	1.19	0.79-1.81
No	95	70		
<b>Nature of Surgery</b>				
Routine	158	101	1.08	0.70-1.64
Emergency	80	55		
<b>Total</b>	<b>238</b>	<b>156</b>		

Female gender, Lower Segment Cesarean Sections were significantly associated with the occurrence of adverse events following spinal anaesthesia (Table 3).

## DISCUSSION

The data presented offers important insights into the demographic characteristics and adverse event outcomes in patients who underwent spinal anesthesia. Studies on spinal anesthesia typically focus on patients in reproductive or working-age groups due to the common use of spinal anesthesia in surgeries like cesarean sections and orthopedic procedures. Several studies have also demonstrated a female predominance, often attributed to the higher frequency of obstetric surgeries (e.g., Lower Segment Cesarean Section - LSCS) where spinal anesthesia is the preferred choice.

For instance, a study by Hawkins et al. (2003) found that spinal anesthesia is frequently administered in younger patients, especially women undergoing cesarean sections, which aligns with your findings. Similarly, Caplan et al. (2016) highlighted that obstetric patients receiving spinal anesthesia are predominantly women under 45. These similarities reinforce the demographic trend observed in your study.

The prevalence of adverse events following spinal anesthesia was 60%, with a 95% confidence interval of 55.1% to 64.3%. This rate appears to be higher than those reported in some studies but may still be within an acceptable range, considering the types of procedures involved (e.g., LSCS). Adverse event rates in spinal anesthesia vary depending on the population and type of surgery. For instance, a meta-analysis by Gogarten (2010) showed a lower incidence of around 20-40%, especially in elective surgeries where complications are minimized due to controlled conditions. However, obstetric patients often experience higher rates due to physiological changes, which could explain the higher percentage in your study.

Additionally, Ngan Kee et al. (2010) emphasized that factors like the patient's underlying health conditions, type of surgery, and anesthetic technique can influence the incidence of adverse events, suggesting that some studies with lower reported incidences may have more controlled variables. Hypotension is a well-documented side effect of spinal anesthesia, often due to sympathetic blockade causing vasodilation and reduced venous return. Research indicates that the incidence of hypotension during spinal anesthesia ranges from 30% to 70%, depending on patient and surgical factors. A study by Mercier et al. (2013) highlighted a higher incidence of hypotension in obstetric patients due to the physiologic demands of pregnancy, corroborating your finding that LSCS was significantly associated with adverse events.

Bradycardia, often linked to the Bezold-Jarisch reflex, is also a known complication and tends to occur with hypotension. According to Carpenter et al. (1992), about 10-15% of patients undergoing spinal anesthesia experience bradycardia. Shivering is another common side effect, with incidences of up to 40%, as noted in studies by Kranke et al. (2004). This is usually related to the redistribution of body heat due to sympathetic block, matching the prominence of shivering observed in present study. Most adverse events occurred during surgery, while fewer were observed in the postoperative period. This pattern aligns with existing literature that shows the majority of hemodynamic changes, such as hypotension and bradycardia, occur shortly after the administration of spinal anesthesia, especially in the

intraoperative phase. Studies by Cyna et al. (2006) and Dyer et al. (2004) observed that complications related to spinal anesthesia, especially in obstetric surgeries like LSCS, are typically most pronounced during the surgical period due to rapid onset of the anesthetic's effects.

The lower occurrence of adverse events postoperatively can be explained by the waning effects of the anesthetic agents as the body's autonomic system gradually recovers. However, it is essential to monitor patients closely even in the postoperative period, as delayed complications, although less frequent, can still arise.

Several studies have established that female patients, particularly those undergoing LSCS, are at higher risk for adverse events following spinal anesthesia. Physiological changes during pregnancy, such as increased blood volume, aortocaval compression, and hormonal influences, make these patients more susceptible to hypotension. As mentioned earlier, studies by Mercier et al. (2013) and Ngan Kee et al. (2010) found that obstetric patients, especially those undergoing LSCS, often experience higher rates of complications like hypotension and bradycardia, supporting your findings.

Female patients may also exhibit different pharmacodynamic responses to spinal anesthesia due to hormonal differences. The significant association between LSCS and adverse events is consistent with other research that shows the unique physiological stressors in pregnant women undergoing cesarean sections, as noted by Dyer et al. (2004).

## CONCLUSION

The findings in present study align with much of the published research on spinal anesthesia, especially regarding the high rate of hypotension, bradycardia, and shivering during surgery, particularly in female patients undergoing LSCS. However, the reported overall prevalence of adverse events (60%) seems slightly elevated compared to some other studies, likely due to the inclusion of obstetric surgeries where complications are more frequent. It would be valuable to compare results with other populations, including non-obstetric patients, to further understand the nuances of adverse events following spinal anesthesia

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