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Height and Weight Adjusted Dose versus Fixed Dose of Bupivacaine for Spinal Anaesthesia for Caesarean

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Abstract
Spinal Anaesthesia is the preferred choice of anaesthesia for caesarean sections. It avoids the risks associated with general anaesthesia like the risk of aspiration, incidence of difficult airway etc. However it is not without problems. At present a variety of dosage regimens are employed irrespective of patient characteristics. This may result in unwarranted hypotension in some cases due to overdosing and inadequate anaesthesia in some other cases due to under dosing. In this study we compared two dosage regimens for spinal anaesthesia for elective caesarean sections. One was the fixed dosage regimen and the other one, an adjusted dosage regimen based on the patient's height and weight. It was found that the adjusted dosage regimen significantly reduced the incidence of side effects due to overdosing like hypotension without compromising on the efficacy of intraoperative anaesthesia
Keywords: *Spinal Anaesthesia, Caesarean Sections, Bupivacaine.*

Introduction

Caesarean sections are most commonly done under spinal anaesthesia. It may also be performed under general anaesthesia or under epidural block. However general anaesthesia is associated with increased risk for aspiration, chances of difficult airway etc due to the so called dynamic airway of pregnancy etc. Epidural anaesthesia is technically more complicated and requires higher dose of the drugs and significant delay in the onset time for analgesia. So the preferred technique for caesarean section is spinal anaesthesia.

However spinal anaesthesia in caesarean section has its own problems. It may lead to unwanted side effects like hypotension and bradycardia due to increased sensitivity of the parturient to local anaesthetic drugs. Dosage regimens for spinal anaesthesia in caesarean sections can lead to inadequate analgesia in some cases due to under dosing and may cause side effects like hypotension and bradycardia in some other cases due to overdosing. In this study we compared two dosage regimens for spinal anaesthesia in caesarean section. One was a fixed dosage regimen in which the parturients were given a fixed dose of 2 ml of 0.5% bupivacaine .The other group were given a height and weight based adjusted dose of bupivacaine {Reference: Harten JM, Boyne I, Hannah P, Varveris D, Brown A. Effect of a height and weight adjusted dose of local anesthetic for spinal anesthetic for elective caesarean}. We compared the adequacy and side effects in both groups.

Objectives

To test whether adjusting the dose of intrathecal bupivacaine according to the patient's height and weight would provide adequate surgical anaesthesia for elective caesarean sections, without producing significant adverse effects, compared to a fixed dosage regimen.

Materials and Methods

A comparative study involving 150 parturients were conducted in a tertiary care teaching hospital after the approval by the ethics committee of the institution.

Inclusion criteria: Pregnant women of age 20-40 years undergoing elective caesarean section, and having weight between 40-100 kg

Exclusion criteria: 1) Those undergoing emergency caesarean section, 2)Multiple pregnancy, 3)Associated medical illness that would require general anaesthesia

Procedure

The study population would be randomized into two groups based on the methods of simple randomization. Each group had a minimum of 75 parturients.

We will preload the patients in both groups with normal saline solution 500 ml before inducing spinal anaesthesia. The baseline heartrate and blood pressure of the parturients would be measured.

After strict aseptic precautions spinal anaesthesia given with 23 guage spinal needle.

Patients in the fixed dose group will be given 0.5% 2ml hyperbaric bupivacaine in addition to Fentanyl 10mcg, intrathecally. Patients in the adjusted group would be given 0.5% hyperbaric bupvacaine with a volume based on height and weight adjustment as given by the chart below, along with fentanyl 10mcg.

Parturients would then be assessed for adequacy of anaesthesia based on the dermatological level of loss of cold sensation.

They would also be assessed for side effects like hypotension, bradycardia, nausea and vomiting , requirement for vasopressors, conversion to general anaesthesia etc. Hypotension may be considered when the systolic blood pressure is below 30 % of the baseline value and would be treated with ephedrine in bolus doses of 6 mg. Bradycardia would be treated with atropine injection.

After the delivery of the baby, intravenous oxytocin 2.5 unit bolus would be given followed by an infusion of 20 u in 500ml normal saline. The regression of blockade would also be assessed.

Table 1: Height and Weight Adjustment Chart (Values Are in Millilitres)

Table 1: Height and Weight Adjustment Chart (Values Are in Millilitres)

Patient weight; kg	Patient height; cm								
	140	145	150	155	160	165	170	175	180
50	1.5	1.7	1.8	1.9					
55	1.5	1.6	1.8	1.9	2.0				
60	1.4	1.6	1.7	1.8	2.0	2.1			
65	1.4	1.5	1.7	1.8	1.9	2.1	2.2		
70	1.3	1.5	1.6	1.8	1.9	2.0	2.2	2.3	
75		1.4	1.6	1.7	1.9	2.0	2.1	2.3	2.4
80		1.4	1.5	1.7	1.8	2.0	2.1	2.2	2.4
85			1.5	1.6	1.8	1.9	2.1	2.2	2.3
90			1.4	1.6	1.7	1.9	2.0	2.2	2.3
95				1.5	1.7	1.8	2.0	2.1	2.3
100				1.5	1.7	1.8	1.9	2.1	2.2
105					1.6	1.7	1.9	2.0	2.2
110						1.7	1.8	2.0	2.2

Reference: Harten JM, Boyne I, Hannah P, Varveris D, Brown A. Effect of a height and weight adjusted dose of local anesthetic for spinal anesthetic for elective cesarean section. Anaesthesia.2005;60(4):348-53

Statistical Analysis

Data will be entered in MS EXCEL and analysed using SPSS 23 software.

Continuous data between the groups will be compared using independent sample t-test or Mann-Whitney U test. Categorical variables will be tested using Chi square/Fisher`s exact test. For all test P value <0.05 is considered as statistically significant.

Observations and Results

Patients were randomized into two groups and one group received adjusted dose and the other group received fixed dose.

1. Dose of Bupivacaine

Table 2: Table comparing the dose of 0.5% bupivacaine in adjusted and fixed groups

	Fixed	Adjusted
Mean	2.0	1.8
SD	0.0	0.1
Median	2.0	1.8
Minimum	2.0	1.6
Maximum	2.0	2.2

t = 16.24**, p = 0.000

In the fixed dose group we have given 0.5% bupivacaine 2.0 ml. It was observed that the median dose required in the adjusted group (1.8 ml) was significantly lower than the dose of 2.0 ml given in the fixed group. (p value < 0.001)

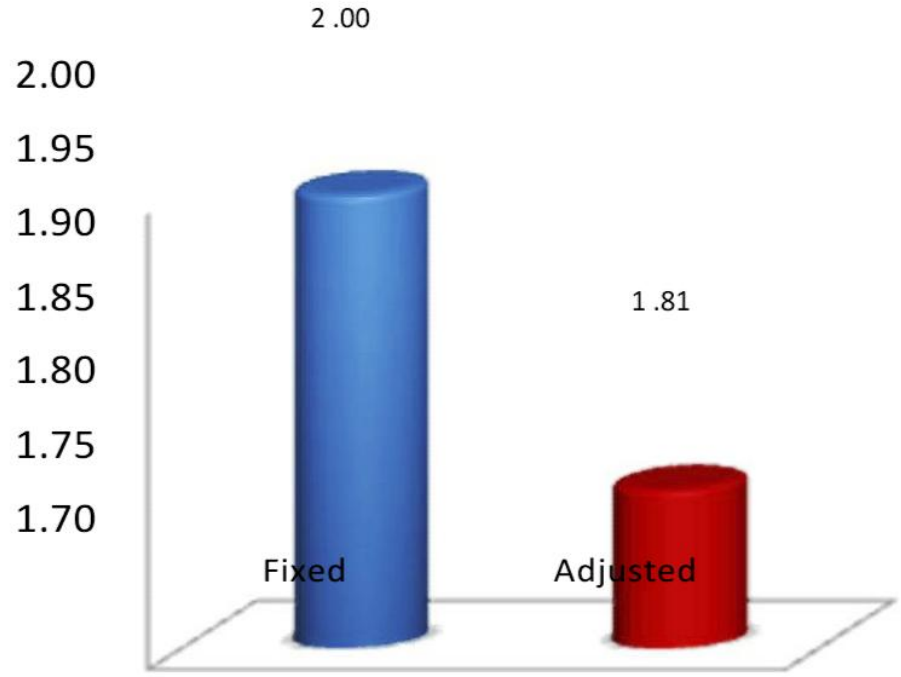

Figure 1: Comparison of Dose of Bupivacaine Required In the Two Groups

2. Age

Table 3: Comparison of Age between the Two Groups

	Fixed	Adjusted
Mean	29.0	29.2
SD	4.9	5.5
Median	29.0	29.0
Minimum	20.0	19.0
Maximum	39.0	44.0

t = 0.22, p = 0.825

The average age in the adjusted group was 29.2 with a SD of 5.5 and that in the fixed dose group was 29 with a SD of 4.9. The difference in the age between the two groups is not statistically significant (p value >0.05) showing that the age of the patients, a possible confounding factor was distributed equally between the groups.

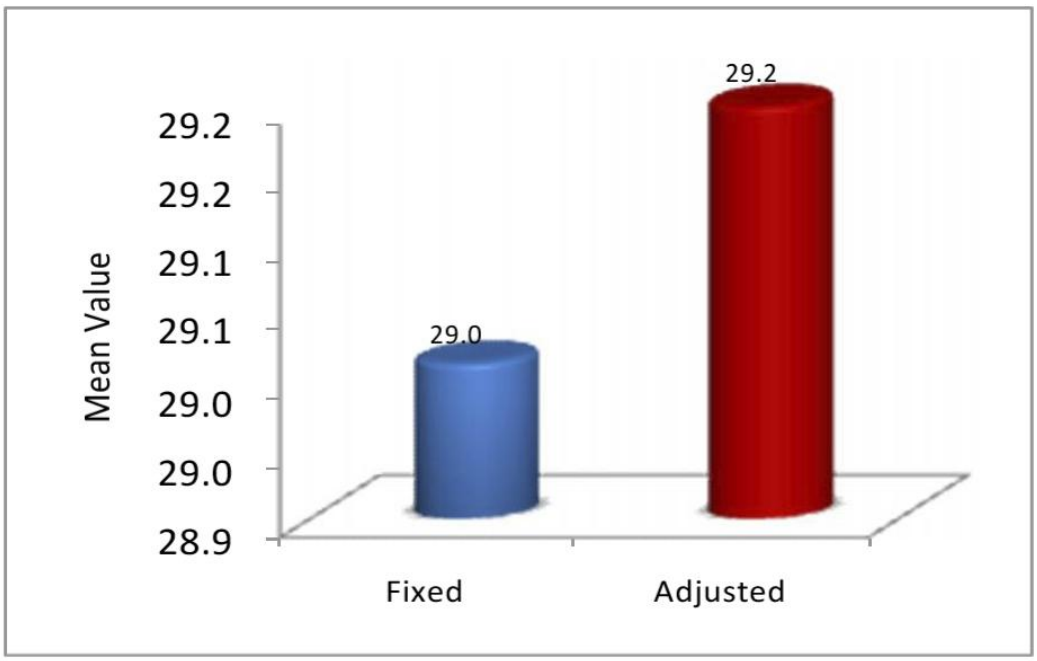

Figure 2: Comparison of Age between the Two Groups

3. Comparison of Weight and Height

Table 4: Comparison of Weight between the Two Groups

	Fixed	Adjusted
Mean	67.3	66.7
SD	8.5	9.8
Median	67.0	66.0
Minimum	50.0	48.0
Maximum	88.0	95.5

t = 0.41, p = 0.685

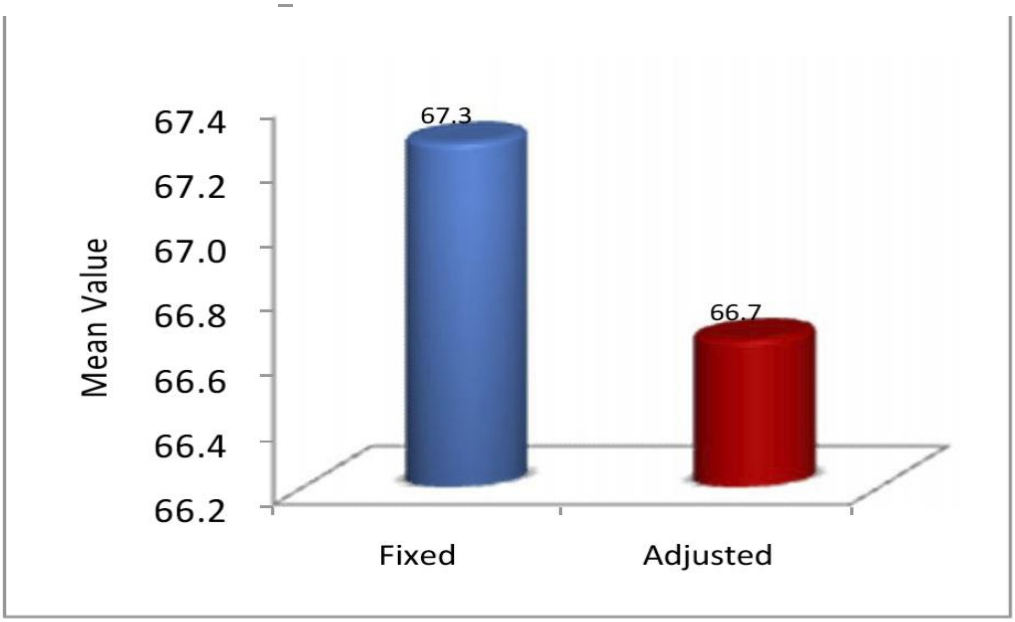

Figure 3: Comparison of Weight between the Two Groups

Table 5: Comparison of Height between the Two Groups

	Fixed	Adjusted
Mean	156.9	155.2
SD	5.3	4.7
Median	157.0	155.0
Minimum	146.0	145.0
Maximum	170.0	166.0

t = 2.08*, p = 0.089

The adjusted and the fixed dose groups appear to be similar in terms of the weight and height of the patients, with p values 0.685 and 0.089 respectively

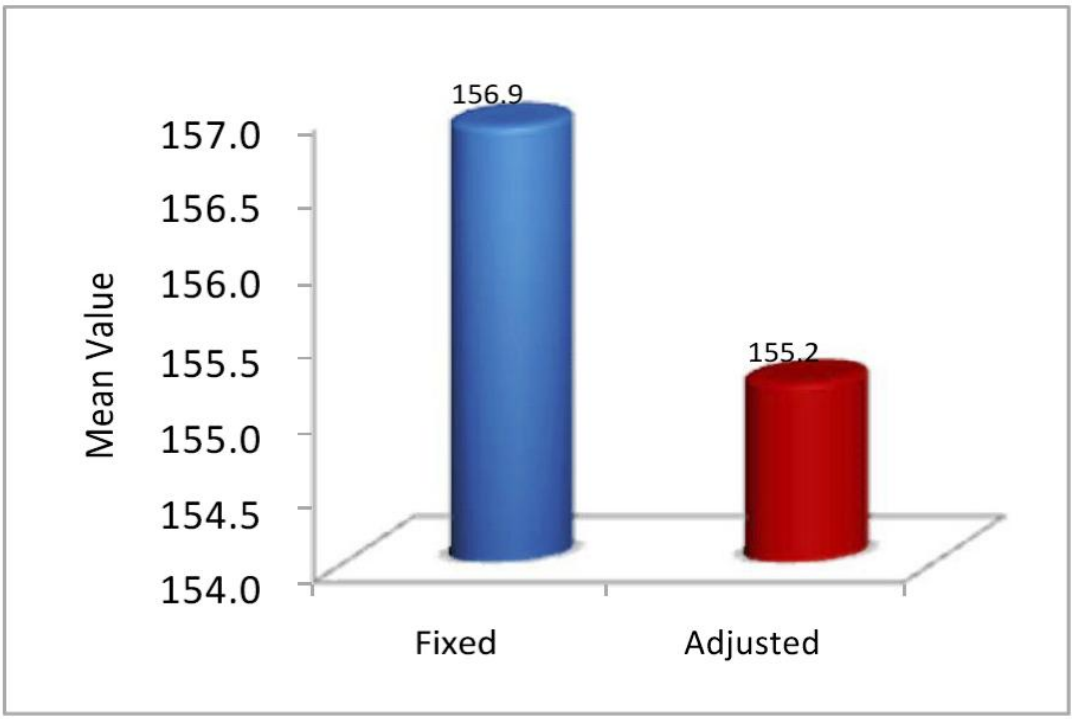

Figure 4: Comparison of Height between the Two Groups

4. Time to Loss Cold Sensation at T4 Level

Table 6

	Adjusted (min)	Fixed (min)
Mean ± SD	3.1±1.0	3.2 ± 1.2
Median	1	1.2
Inter Quartile range	0	0
Minimum	3	3
Maximum	6	8

There was no statistically significant difference in the time to loss cold sensation at T4 level between the two groups with a p value of 0.665

5. Time of Spinal Insertion to Incision

Table 7: Table Comparison of Time of Insertion of Spinal to Incision

	Fixed	Adjusted
Mean	7.2	7.2
SD	2.5	2.2
Median	8.0	7.0
Minimum	3.0	3.0
Maximum	14.0	14.0

t = 0.03, p = 0.972

There is no statistically significant difference in the time to incision in between the two groups as the p value is 0.972

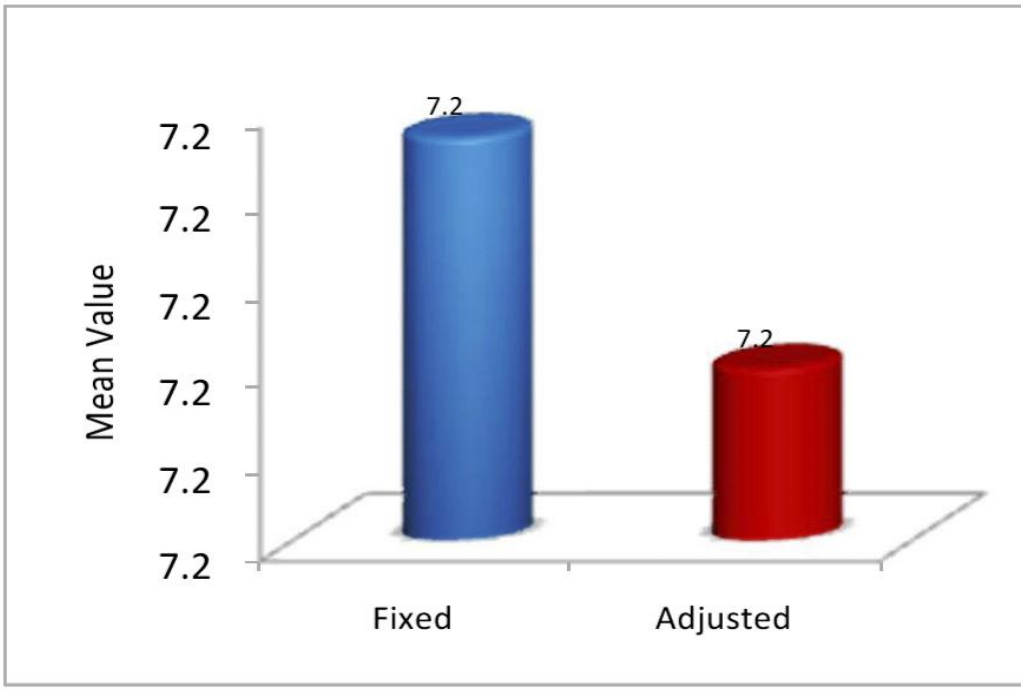

Figure 5: Comparison of Time of Insertion of Spinal to Incision

6. Hypotension

Table 8: Comparison of Hypotension between the Two Groups

Hypotension	Fixed		Adjusted		χ^2	p
	Count	Percent	Count	Percent		
Yes	38	50.7	23	30.7	6.22*	0.013
No	37	49.3	52	69.3		

*: - Significant at 0.05 level

It was observed that the incidence of hypotension was significantly higher in the fixed dose group (50.7%) compared to the adjusted dose group (30.7%) (p value 0.013)

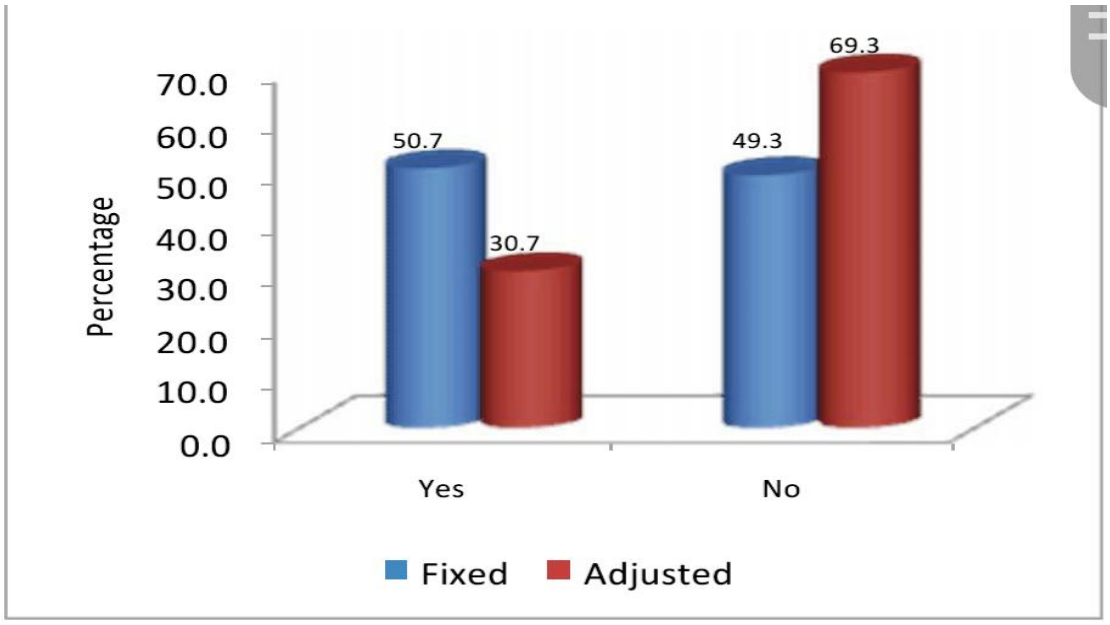

Figure 6: Comparison of Incidence of Hypotension between the Two Groups

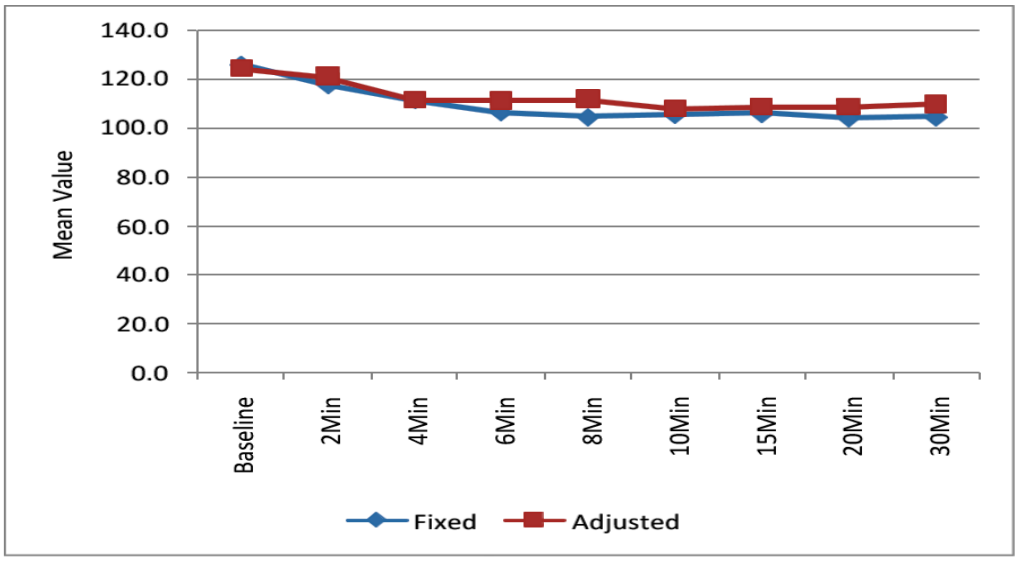

Figure 7: Comparison of SBP at Different Intervals of Time

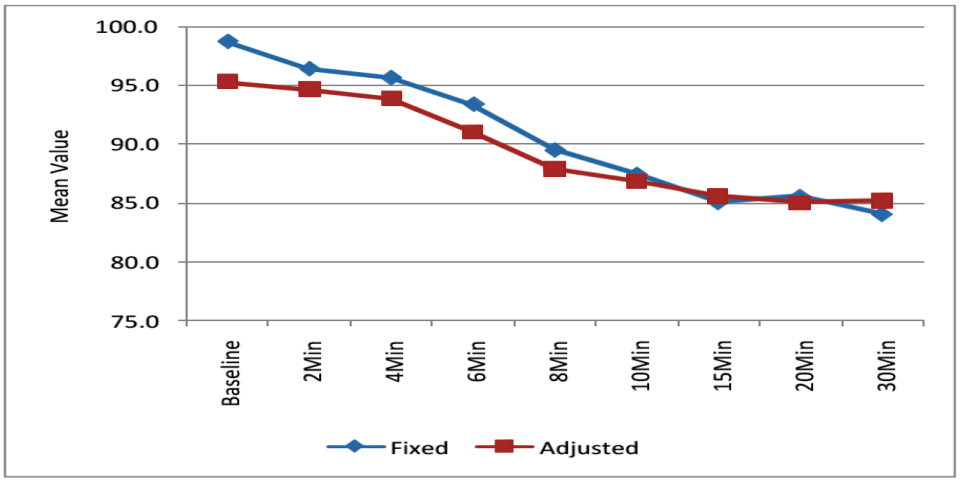

Figure 8 : Comparison of HR at Different Intervals of Time

7. Ephedrine Given

Table 9: Comparison of Ephedrine Given In the Two Groups

Ephedrine Given	Fixed		Adjusted		χ^2	P
	Count	Percent	Count	Percent		
Yes	38	50.7	23	30.7	6.22*	0.013
No	37	49.3	52	69.3		

*: - Significant at 0.05 level

Ephedrine was given to 50.7 % of patients in the fixed dose group and 30.7% of patients in the adjusted dose group. Ephedrine was given to significantly more patients in the fixed dose group than in the adjusted dose group (since ephedrine was given to all patients who developed hypotension table and p values are the same as that of hypotension)

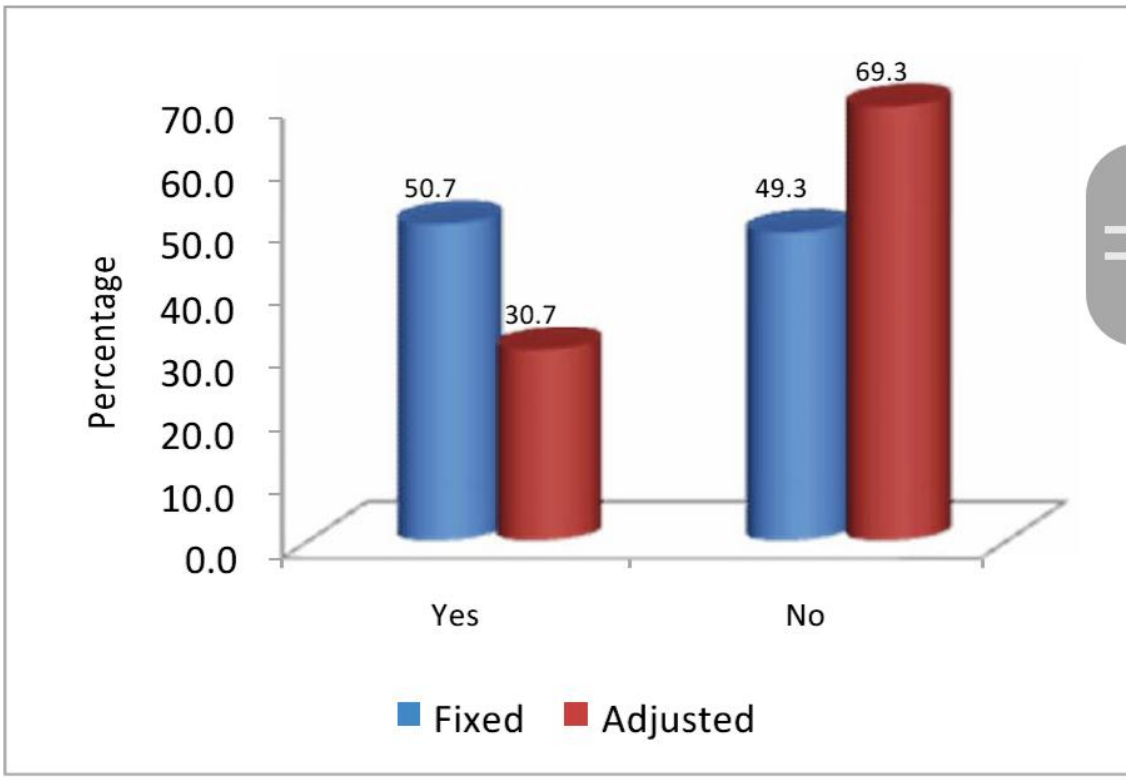

Figure 9: Comparison of Ephedrine Given In the Two Groups

8. Ephedrine Dose Required

Table 10: Table Comparison of Ephedrine Dose Required

	Fixed	Adjusted
Mean	8.1	7.1
SD	4.8	3.7
Median	6.0	6.0
Minimum	3.0	0.0
Maximum	24.0	18.0

t = 0.88, p = 0.384

There was statistically no significant difference between the dose of ephedrine given in the fixed dose group and the adjusted dose group. (p value 0.384) Median dose required was 6mg each in either groups.

9. Head Down Tilt Required

Table 11: Comparison of Head Down Tilt

Head Down Tilt	Fixed		Adjusted		. 2	P
	Count	Percent	Count	Percent		
Yes	3	4.0	5	6.7	0.53	0.467
No	72	96.0	70	93.3		

4 % of patients in the fixed dose group and 6.7 % of the patients in the adjusted dose group required head down tilt. With a p value of 0.467, the difference was found to be statistically not significant.

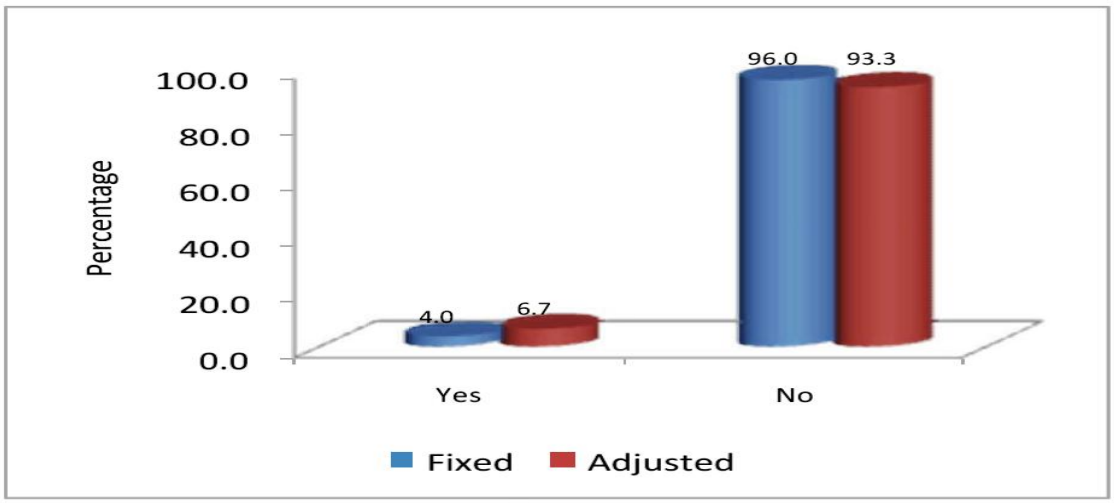

Figure 11: Head Down Tilt Required In between the Groups

10. Supplementary Analgesia

Table 12: Comparison of Supplementary Analgesia

Supplementary Analgesia	Fixed		Adjusted		χ^2	P
	Count	Percent	Count	Percent		
Yes	2	2.7	2	2.7	0	1.000
No	73	97.3	73	97.3		

2.7 % of patients in both the groups required supplementary analgesia, the difference was nil between the two groups

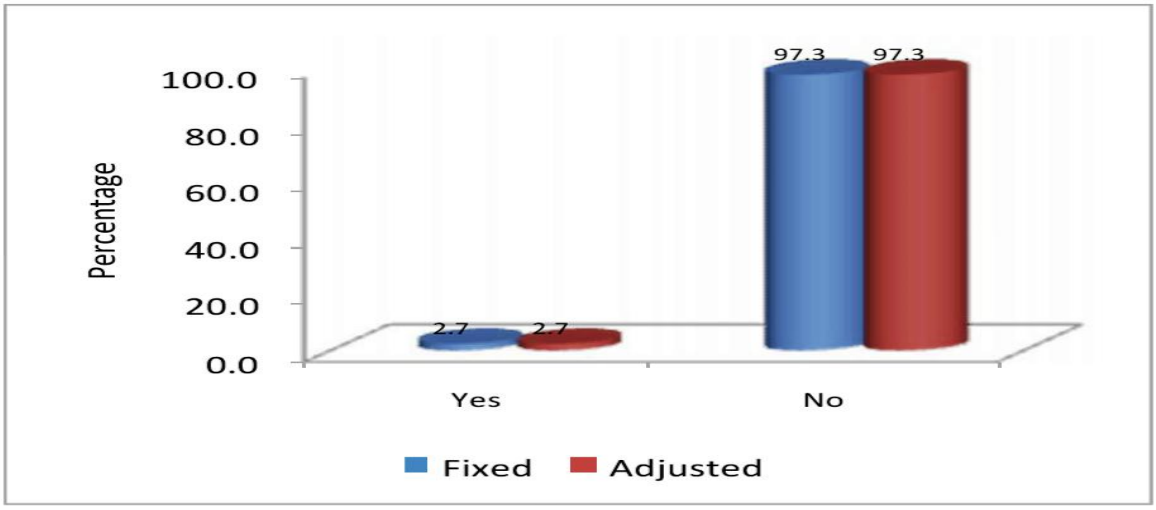

Figure 12: Supplementary Analgesia Requirement between the Two Groups

11. Conversion To GA

Table 13: Comparison of Conversion to GA

Conversion to GA	Fixed		Adjusted		. ²	p
	Count	Percent	Count	Percent		
Yes	0	0.0	0	0.0	-	-
No	75	100.0	75	100.0		

There was no incidence of conversion to GA in either of the groups.

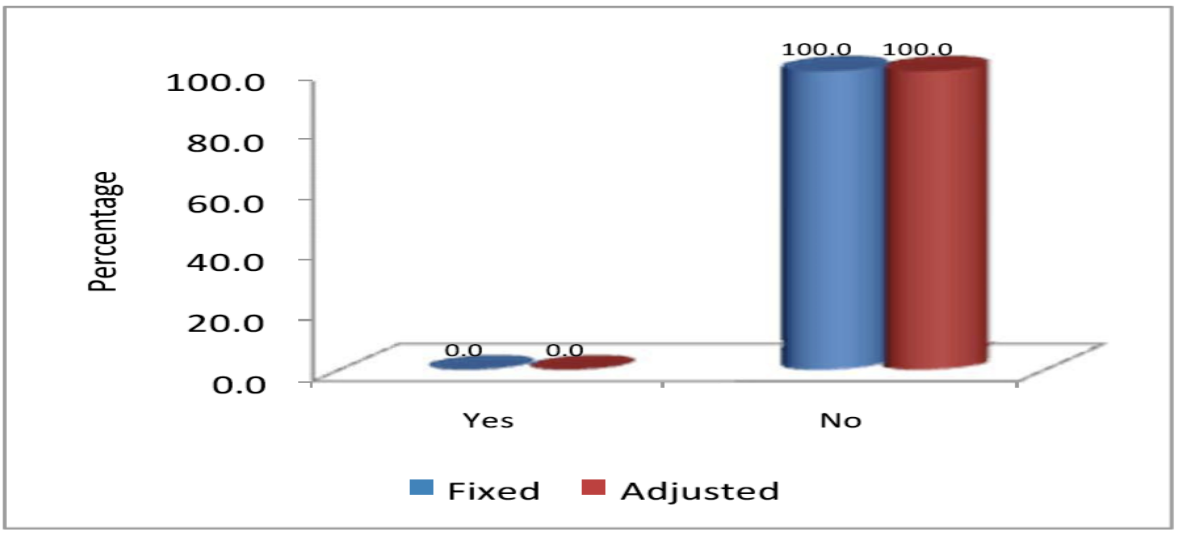

Fig 13: Comparison of Conversion to GA

12. Nausea and Vomiting

Table 14: Comparison of Nausea/Vomiting

Nausea/Vomiting	Fixed		Adjusted		□²	p
	Count	Percent	Count	Percent		
Yes	3	4.0	2	2.7	0.21	0.649
No	72	96.0	73	97.3		

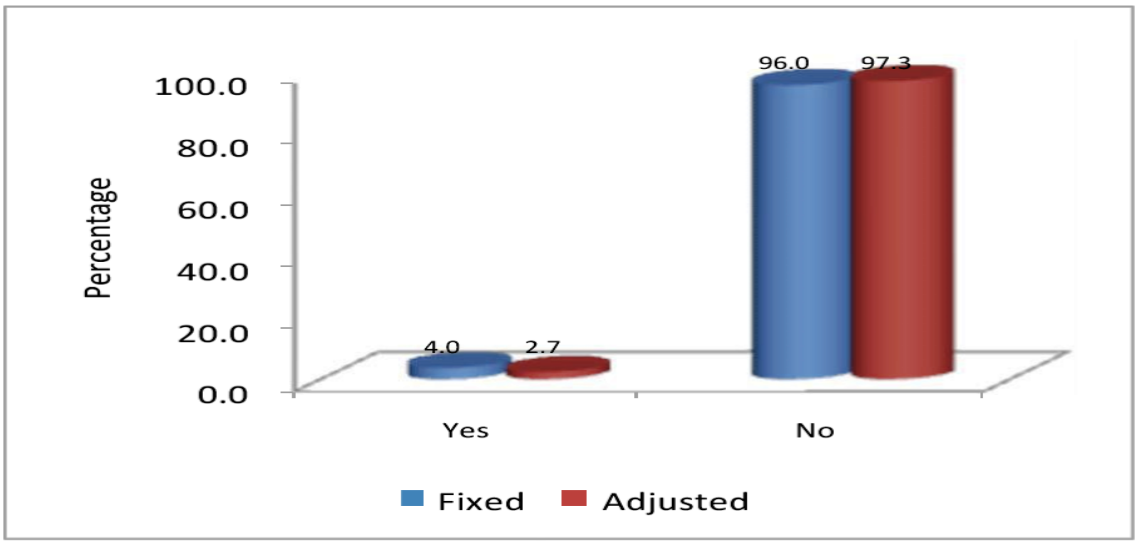

FIG 14: Comparison of Nausea/Vomiting between the Two Groups

13. Sensory Level At 25 Minutes

Table 15: Comparison of Sensory Level@25min

Sensory Level@25min	Fixed		Adjusted		χ^2	P
	Count	Percent	Count	Percent		
T4	42	56.0	4	5.3	53.97**	0.000
T5	29	38.7	40	53.3		
T6	4	5.3	31	41.3		

**: - Significant at 0.01 level

It was observed that most patients in the fixed dose group (56%) had their sensory level at T4 level, compared to the adjusted dose group (5.3%), with a p value <0.05, the difference was found to be statistically significant.

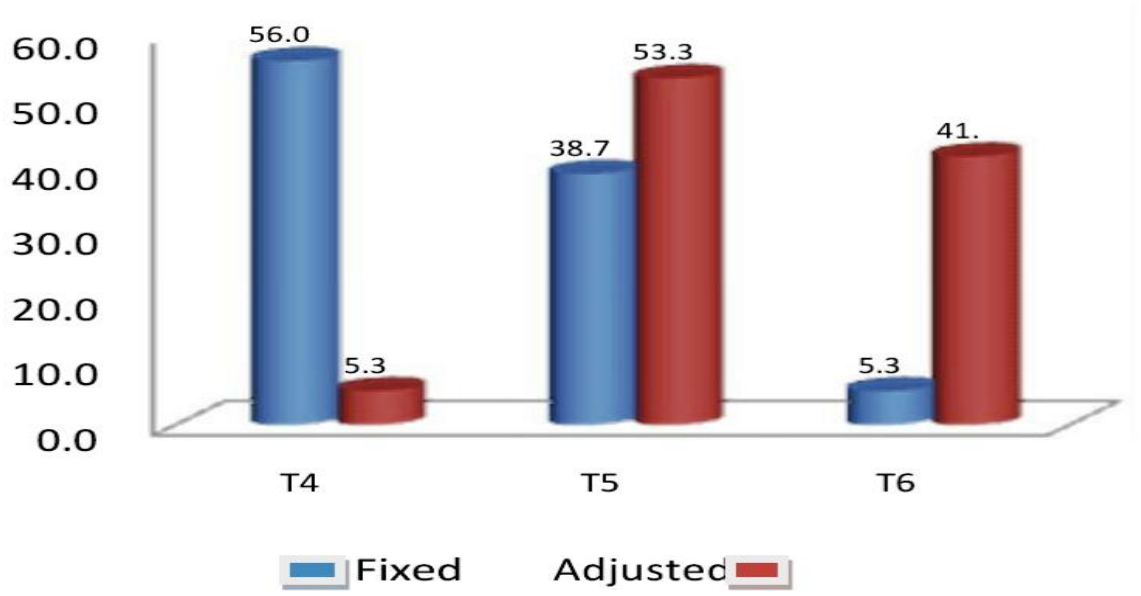

Fig 15

Discussion

The dose adjustment of intrathecal hyperbaric bupivacaine for caesarean section on the basis of the height and weight of patients significantly reduced bupivacaine requirement and the incidence of hypotension without affecting the efficacy of anaesthesia.

Dose of bupivacaine

Patients in the adjusted dose group received a median dose of bupivacaine of

1.8ml (9 mg), which was significantly smaller than the dose of 2.0ml (10mg) administered in the fixed dose group. (p value <0.001) The lowest dose was 1.6ml (8mg).

Adequacy of anaesthesia

Spinal anaesthesia was adequate in the adjusted dose group in almost all patients; two patients (2.7%) in either group required supplementary analgesia.

Hypotension

It was observed in our study that the incidence of hypotension was significantly higher in fixed dose group (50.7%) compared to adjusted dose group (30.7%), which was statistically significant.

Ephedrine requirement and dosage

In our study, as with hypotension, the number of patients who had received ephedrine was

significantly higher in the fixed dose group (50.7%) than in the adjusted dose group (30.7%). However, the median dose of ephedrine administered was the same (6mg) in either group.

Sensory level at 25 minutes

While a 56 % of patients in the fixed dose group had their sensory level at T4 at the end of 25 minutes, only 5.3% of those in the adjusted dose group had their level at T4.

Nausea/vomiting

There was no significant difference in the number of patients reporting nausea or vomiting.

Regression of block

It was found that there was no significant difference in the regression of block in between the two groups.

Conclusion

Height and weight adjusted dose of hyperbaric bupivacaine, significantly reduces the dose requirement compared to a fixed dose protocol without compromising on the efficacy of intraoperative anaesthesia.

The adjusted dose technique significantly reduced the incidence of hypotension and the requirement of ephedrine, in comparison to the fixed dose technique.

The level of spinal block at 25 minutes of administration of spinal anesthetic was significantly lower in the adjusted dose group (below T4) as compared to the fixed dose group (T4).

There were no significant differences between the two groups in the need for supplementary analgesia, head-tilt or conversion to general anesthesia, denoting that the adequacy of intraoperative anesthesia was comparable in both the groups.

There was no significant difference between the two groups in the incidence of nausea or vomiting

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