Comparison Of Maternal And Fetal Outcome Following Caesarean Section In Pre-Eclamptic Patients Under General And Spinal Anesthesia

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Abstract: Background: Pre-eclampsia is a multi-system disorder in pregnancy associated with significant maternal morbidity and mortality and also affects neonatal outcome. Choice of anesthesia technique and skillful management is equally important for maternal and fetal well-being. So, this study was designed to compare the maternal and fetal outcome following cesarean section in pre-eclamptic patients under general and spinal anesthesia. Material And Methods: This prospective, randomized observational study was carried out in 60 parturients age between 18 to 40 years divided in two groups 30 parturients in each. ASA Physical Status II and III who delivered after 34 weeks of gestation with criteria of mild pre-eclampsia by means of Elective/emergency C-section were included. After giving pre medication Group G received thiopentone, succinylcholine intravenously before intubation followed by oxygen, sevoflurane and atracurium (after delivery of baby). Group S received spinal anesthesia by using 2 ml of 0.5% heavy bupivacaine. Heart rate, blood pressure, SpO2 of mother and neonate were recorded at specific time points. Also post of ICU shifting of mother for maternal outcome and APGAR score at 1,5,7 minutes, ABGA, resuscitation requirement and NICU admission data were recorded for fetal outcome. Result: After induction maternal heart rate and blood pressure were higher side (still within 30% from baseline) in group G as compared to group S. APGAR score, ABGA and NICU shifting requirements had favorable outcome in group S. Conclusion: Spinal anesthesia is first choice as it is more safe, simple and with better maternal and fetal outcome. [Vaghasia A Natl J Integr Res Med, 2021; 12(6): 68-80]

Key Words: Pre-Eclampsia, Spinal Anesthesia, General Anesthesia, ABGA, APGAR Score, NICU

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Introduction: First priority for planning of anesthesia for caesarean section is maternal and fetal wellbeing. Pre-eclampsia is one of the conditions that complicates 5-8% pregnancies and demands utmost care and skill from obstetrician and anesthesiologist[1] It is a hypertensive disorder of pregnancy characterized by hypertension after 20 weeks of gestations and proteinuria[2,3]. It is still listed as one of the top three causes of maternal morbidity and mortality[4]. As a result, patients often present for an emergency caesarean section.

So there is limited time for pre-operative optimization of clinical condition. The choice of safe anesthetic technique is very important for the best possible maternal and fetal outcome[1]. Although understanding of the pathophysiology of pre-eclampsia has improved, management has not changed over the years[5]. For many years general anesthesia was preferred for caesarean section. It has many advantages of faster induction, better cardiovascular stability with lower incidence of hypotension and good control over ventilation but it has disadvantages those drugs cross placental barrier, cause neonatal depression and also complications such as maternal aspiration syndrome, intubation failure and increased chances of maternal morbidity[6,7,8].

Recently regional anesthesia mostly spinal anesthesia has become preferred anesthesia technique to avoid both maternal and fetal complications but it has also disadvantage of hypotension due to sympathetic blockade and it may affect neonatal outcome by impairing utero-placental circulation. Moreover, CSF leakage may cause intra operative or post-operative headache, nausea and vomiting[9]. Although general anesthesia can be used safely in pre-eclampsia women, it is associated with greater maternal morbidity and mortality[8]. Currently, the safety of regional anesthesia techniques is well established and they can provide better obstetrical outcome when chosen properly and if used judicially[10]. The benefits of epidural

analgesia in preeclampsia are well recognized and an early epidural is recommended in labor. If a working epidural is already present this should be extended for surgery. The disadvantages of epidural anesthesia are that onset of block is longer than that of spinal anesthesia and that the spread of the block is patchy, often giving poor anesthesia for caesarean delivery.

There is documented evidence of conversion of epidural to GA due to patchy anesthesia or complete failure. Previous study showed that spinal anesthesia was controversial in PET[12]. The anticipated potential risks of pulmonary edema, profound cardiovascular instability from a fall in cardiac output and the consequent recourse to IV fluids and vasoconstrictors suggested that it was not a technique to be recommended in PET[13].

However, after the advent of pencil point spinal needles and newer local anesthetic agents, spinal anesthesia is now being used as anesthesia of first choice for pre-eclamptic patients[14-17].

Some nonrandomized retrospective studies suggest that early markers of neonatal compromise, such as fetal acidemia, may be less favorable in spinal than in general anesthesia for elective cesarean delivery[24]. No studies have prospectively addressed the problem as to whether fetal outcome is influenced by the method of anesthesia in pre-eclamptic patients requiring emergency caesarean delivery. In this scenario where there is a still dilemma whether a spinal anesthesia is better for parturient with PET than general anesthesia, we planned this study to assess the effect of anesthetic technique on the feto-maternal outcome in pre- eclamptic patients undergoing caesarean section.

In this study, patients with preeclampsia requiring caesarean section were randomized into two groups, receiving either spinal or general anesthesia for caesarean delivery. Maternal outcome in the form of hemodynamic variations and need for shifting to ICU was assessed. Fetal outcome was assessed using APGAR score, umbilical arterial blood gas analysis, requirement for resuscitation and requirement for shifting to neonatal ICU.

Material & Methods: This prospective, randomized observational study was carried out after approval from Institutional Ethical Committee and informed written consent from patient and her first relative. After thorough pre-anesthetic evaluation, following group of parturients age between 18 to 40 years with ASA Physical Status II and III who delivered after 34 weeks of gestation with criteria of mild pre-eclampsia by means of Elective/emergency C-section were included.

The Exclusion Criteria in this study were as follows: Any absolute or relative contra-indication to spinal anesthesia, Parturient with criteria of severe pre-eclampsia, <34 weeks of gestation, patient with previous history of medical disorder like Diabetes, Cardiovascular and/or pulmonary diseases, obesity, HELLP syndrome (patients with coagulopathy, thrombocytopenia with platelets count less than 80,000/cm3).

Sixty parturients with mild pre-eclampsia scheduled for caesarean section were randomized into two groups of thirty for either spinal (Group S, n=30) or general (Group G, n=30) anesthesia. All patients had taken their ongoing antihypertensive (oral tablet Labetalol and/or tablet Nifedipine) treatment dose on the day of surgery at 6 am in the morning. In the pre-anesthetic preparation room, monitoring consisting of Heart Rate (HR), Non-invasive blood pressure (NIBP) and peripheral oxygen saturation (SpO2) was established and baseline vital parameters were recorded.

A wide bore intravenous line was secured in all patients. Patients in group S received pre-medication consisting of inj. Ondansetron 0.15 mg/kg and inj. Ranitidine 1 mg/kg intravenously while Patients in group G received pre-medication consisting of inj. Ondansetron 0.15 mg/kg, inj. Glycopyrrolate 4 µg/kg and inj. Paracetamol 15 mg/kg intravenously 15 minutes before shifting to operation theatre.

Pre-loading was done using 8-10 ml/kg crystalloid (Ringer Lactate solution). Spinal anesthesia group (Group S) - Received 10 mg of 0.5% hyperbaric bupivacaine intrathecally in L3-L4 interspace in left lateral position with using 23-gauge quinke spinal needle under full antiseptic precautions.

Surgery was started after achieving T6 sensory level. Patients received 4-6 L/min oxygen from simple oxygen mask throughout the surgery.

General anesthesia group (Group G) - After pre-oxygenation with 100% O2 at 6-8 L/min through Bain's breathing system for 5 minutes, Thiopentone 4-5 mg/kg and Succinylcholine 2 mg/kg were administered intravenously. After oral endotracheal intubation, atracurium 0.5 mg/kg loading dose was given intravenously and Maintenance of anesthesia was achieved with 50% Oxygen, 50% nitrous oxide (after delivery of baby till then 100% oxygen was used), 0.8 to 1.0 % sevoflurane and 0.125 mg/kg atracurium intravenously.

End tidal CO2 was kept between 35-40 mm mmHg by adjusting ventilatory rate. After delivery of the baby and cord clamping, 5 units of oxytocin were injected slowly through intravenous route followed by 5 units diluted in 500 ml normal saline given intravenously. For analgesia, Fentanyl 1 µg/kg intravenously (after delivery of baby) was given. After the end of surgery, muscle relaxation was reversed with glycopyrrolate 8 µg/kg intravenously and Neostigmine 0.05 mg/kg intravenously. Patients were extubated after fulfilling extubation criteria.

Throughout the procedure, all the paramaters selected (HR, SBP, DBP, SpO2 in group S and also etCO2 in group G) was recorded at baseline, after 5 minutes of pre medication, at the time of induction, at 5,10,20,25,30 and 60 minutes after induction. After shifting of patient from operation theatre to post anesthesia care unit (PACU) monitored vitals were recorded at immediately after shifting to PACU, at every 30 minutes for 2 hours, at every hour for next 2 hours and then at 8, 12, 18, 24 hour post-operatively. Morbidity parameters observed were incidence of peri operative hypotension and hypertension, changes in heart rate during anesthesia, post-operative complications like convulsions, pulmonary edema, acute renal failure, aspiration pneumonitis and delayed recovery from anesthesia. More than 30% fall or rise in blood pressure (BP) from the baseline, was considered as hypotension or hypertension respectively.

Hypotension was treated with Ephedrine 5-10 mg intravenously and hypertension was treated with Labetalol 5-15 mg bolus intravenously. In both the groups, patients with high blood pressure (beyond accepted range of mild pre-eclampsia) were shifted to ICU for post-operative observation.Similarly, more than 30% rise in heart rate (HR) from the base line was considered as tachycardia and HR < 60 was considered as bradycardia. Tachycardia was managed with increasing sevoflurane concentration between 1-1.5% and bradycardia was treated with Atropine 0.5 mg intravenously. All the newborns were managed by pediatrician.

For fatal outcome analysis, umbilical cord blood of fetus from umbilical artery was collected just before clamping of the cord and was sent for arterial blood gas analysis. The Arterial Blood Gas values (pH, PO2, pCO2 and HCO3) were recorded. APGAR score of fetus at 1,5 and 7 minutes after birth was counted and noted. Vital parameters (HR, NIBP and SpO2) of newborn were recorded at 0,30,60,90 minutes after birth followed by at 2,3,4, 8,12,18 and 24 hours post birth. The newborns with APGAR score <8 at 1 minute were shifted to neonatal ICU for observation and further management.

Quantitative data collected were analyzed using medcalc statistical software. Mean and SD was calculated for all the quantitative variables. Intra group comparison was made using paired student t test and intergroup comparison between the two groups was done using unpaired t test. P value <0.05 was considered to be statistically significant.

Results: Results are as follows.

Table 1: Demographic Profile Of Patients In Two Groups

Demographic Parameters Of Patients	Groups		P Value
	Group G (N = 30)	Group S(N=30)	
	Mean ± SD	Mean ± SD	
Age (Years)	27.20 ± 6.22	27.53 ± 5.24	0.823
Weight (Kg)	67.03 ± 14.92	67.80 ± 15.98	0.848
Height (Cm)	155.30 ± 3.62	155.30 ± 3.62	0.824
Gestational Age (Weeks)	35.77 ± 1.10	36.30 ± 1.06	0.061
ASA Physical Status	II	II	-

Table 2: Age Wise Distribution Of Patients In Two Groups

Age Group (Years)	Groups				Total	
	Group G (N=30)		Group S (N=30)			
	Number Of Patients	Percentage	Number Of Patients	Percentage	Number Of Patients	Percentage
18 To 20	04	13.3	03	10.0	07	11.7
21 To 25	10	33.3	08	26.7	18	30.0
26 To 30	07	20.2	08	30.0	15	25.0
31 To 35	06	20.0	09	30.0	15	25.0
36 To 40	03	10.0	02	6.70	05	8.30
P Value	**0.873**					

Table 3: Weight Distribution Of The Patients In Two Groups

Weight Of The Patient (Kg)	Groups				Total	
	Group G(N=30)		Group S(N=30)			
	Number OfPatients	Percentage	Number Of Patients	Percentage	Number Of Patients	Percentage
41-50	03	10.0	03	10.0	06	10.0
51-60	11	36.7	09	30.0	20	33.3
61-70	07	23.3	09	30.0	16	26.7
71-80	03	10.0	02	6.67	05	8.30
81-90	03	10.0	03	10.0	06	10.0
91-100	02	6.67	03	10.0	05	8.30
101-110	01	3.33	01	3.33	02	3.33
P Value	**0.848**					

Table 4: Diagnosis Of The Patients In Two Groups

Diagnosis	Groups				Total	
	Group G		Group S			
	Number Of Patients	Percentage	Number Of Patients	Percentage	Number Of Patients	Percentage
Pre-Eclampsia With Vertex Presentation	26	86.7	28	93.3	54	90
Pre-Eclampsia + Breech	00	0.0	01	3.3	01	1.7
Pre-Eclampsia + PreviousLSCS	03	10	01	3.3	04	6.7
Pre-Eclampsia + Twins	01	3.3	00	0.0	01	1.7
Total	30		30		60	
P Value	**0.380**					

Demographic profile and diagnosis of the patients in two groups were comparable.

Table 5: Changes In Maternal Heart Rate/Min In Two Groups

Different Follow Up Time Period		Heart Rate/Minute						Inter Group P Value
		Group G (N=30)			Group S (N=30)			
		(Mean ± SD)	% Change From Baseline	Intra Group P Value	(Mean ± SD)	% Changes From Baseline	Intra – Group P Value From Baseline	
Baseline		87.27 ± 7.71	-	-	87.33 ± 7.52	-	-	0.973
5 Minutes After Premedication		88.90 ± 7.07	+1.86	0.3969	88.23 ± 8.09	+1.03	0.6570	0.735
At The Time Induction		88.97 ± 7.36	+1.94	0.3860	89.17 ± 8.72	+2.10	0.3851	0.924
After Induction	5 Min	101.33 ± 5.18	+16.11	<0.0001	77.70 ± 8.49	-11.02	<0.0001	<0.001
	10 Min	100.37 ± 5.97	+15.01	<0.0001	74.57 ± 6.43	-14.61	<0.0001	<0.001
	15 Min	100.73 ± 5.64	+15.42	<0.0001	73.20 ± 7.55	-16.18	<0.0001	<0.001
	20 Min	100.67 ± 5.39	+15.35	<0.0001	72.23 ± 5.99	-17.29	<0.0001	<0.001
	25 Min	100.67 ± 5.81	+15.35	<0.0001	72.10 ± 5.93	-17.43	<0.0001	<0.001
	30 Min	100.73 ± 5.63	+15.42	<0.0001	73.27 ± 6.41	-16.09	<0.0001	<0.001
	60 Min	99.93 ± 5.72	+14.50	<0.0001	81.37 ± 6.77	-6.82	0.0021	<0.001
Immediately After Shifting To PACU		95.20 ± 3.84	+5.64	<0.0001	82.80 ± 6.36	-5.18	0.0145	<0.001
After Shifting To PACU	30 Min	95.43 ± 4.21	+9.35	<0.0001	82.43 ± 5.73	-5.61	0.0062	<0.001
	60 Min	94.23 ± 2.89	+7.97	<0.0001	83.37 ± 6.33	-4.53	0.0313	<0.001
	90 Min	92.80 ± 3.23	+6.33	0.0006	84.17 ± 5.92	-3.61	0.0757	<0.001
	2 Hours	92.13 ± 3.63	+5.56	0.0028	86.30 ± 5.95	-1.17	0.5586	<0.001
	3 Hours	90.47 ± 4.48	+3.66	0.0541	85.30 ± 7.22	-2.32	0.2906	0.002
	4 Hours	90.10 ± 6.57	+3.24	0.1314	84.17 ± 6.22	-3.61	0.0814	0.002
	8 Hours	89.63 ± 6.32	+2.70	0.1999	86.67 ± 7.25	-0.75	0.7305	0.096
	12 Hours	88.07 ± 7.01	+0.91	0.6757	87.40 ± 7.42	+0.08	0.9712	0.722
	18 Hours	89.13 ± 6.87	+2.13	0.3280	88.67 ± 6.49	+1.53	0.4630	0.788
	24 Hours	87.93 ± 6.49	+0.75	0.7211	86.17 ± 7.72	-1.32	0.6710	0.341

On comparing group G and S, increase in heart rate in group G after induction were statistically significant but was within acceptable range (30% from baseline).

Table 6: Changes In Systolic Bp (mmhg) In Two Groups

Different Follow Up Time Period		Systolic BP (mmhg)						Inter-Group P Value
		Group G (N=30)			Group S (N=30)			
		(Mean ± SD)	% Change From Baseline	Intra-Group P Value From Baseline	(Mean ± SD)	% Change From Baseline	Intra-Group P Value From Baseline	
Baseline		148.27 ± 5.35	-	-	148.53 ± 5.35	-		0.848
5 Minutes After Premedication		149.20 ± 5.05	+0.62	0.4915	149.60 ± 5.52	+0.72	0.4489	0.771
At The Time Induction		149.47 ± 4.87	+0.80	0.3674	149.13 ± 5.3223	+0.40	0.6648	0.801
After Induction	5 Min	161.87 ± 4.06	+9.17	<0.0001	123.07 ± 7.61	-17.14	<0.0001	<0.001
	10 Min	159.20 ± 4.05	+7.37	<0.0001	119.50 ± 10.06	-19.54	<0.0001	<0.001
	15 Min	160.20 ± 6.18	+8.04	<0.0001	120.83 ± 7.21	-18.64	<0.0001	<0.001
	20 Min	161.07 ± 5.63	+8.63	<0.0001	116.67 ± 10.47	-21.45	<0.0001	<0.001
	25 Min	159.13 ± 3.78	+7.32	<0.0001	117.43 ± 11.58	-20.93	<0.0001	<0.001
	30 Min	158.60 ± 3.29	+6.96	<0.0001	116.57 ± 10.28	-21.51	<0.0001	<0.001
	60 Min	159.47 ± 4.73	+7.55	<0.0001	143.80 ± 7.49	-3.18	0.0067	<0.001
Immediately After Shifting To PACU		154.27 ± 3.31	+4.04	<0.0001	146.20 ± 5.29	-1.56	0.0952	<0.001
After Shifting To PACU	30 Min	154.27 ± 4.19	+4.04	<0.0001	147.13 ± 4.32	-0.94	0.2694	<0.001
	60 Min	152.33 ± 3.11	+7.55	0.0007	147 ± 4.75	-1.03	0.2463	<0.001
	90 Min	152.40 ± 3.84	+12.78	0.0011	147.20 ± 3.22	-.0.89	0.2481	<0.001
	2 Hours	151.53 ± 3.39	+2.19	0.0066	144.87 ± 5.67	-2.46	0.0127	<0.001
	3 Hours	150.80 ± 3.70	+1.70	0.0374	147.13 ± 5.48	-0.90	0.3209	0.004
	4 Hours	151.33 ± 5.49	+2.06	0.0328	148.60 ± 5.36	+0.04	0.9598	0.056
	8 Hours	150.13 ± 5.19	+1.25	0.1770	149.67 ± 6.26	+0.76	0.4514	0.755
	12 Hours	150.67 ± 4.01	+1.61	0.0541	148.40 ± 4.49	-0.08	0.9192	0.044
	18 Hours	150.53 ± 4.58	+1.52	0.0841	148.13 ± 6.32	-0.26	0.7923	0.098
	24 Hours	149.93 ± 4.68	+1.11	0.2059	149.33 ± 6.61	+0.58	0.6083	0.686

On comparing group G and S, SBP was higher in group G as compared to group S after five minutes of induction to three hours post operatively, which was statistically significant but within acceptable range (30% from baseline).

Table 7: Changes In Diastolic Bp (mmhg) In Two Groups

Different Follow Up Time Period		Diastolic BP (Mmhg)						Inter-Group P Value
		Group G (N=30)			Group S(N=30)			
		Mean ± SD	% Changes From Baseline	Intra-Group P Value From Baseline	Mean ± SD	% Changes From Baseline	Intra-Group P Value From Baseline	
Baseline		95.27 ± 4.02	-	-	95.73 ± 4.98	-	-	0.691
5 Minutes After Premedication		93 ± 5.75	-2.38	0.0816	96.33 ± 4.64	+0.62	0.6310	0.016
At The Time Induction		93.40 ± 4.73	-1.96	0.1043	95.67 ± 4.64	-0.06	0.9617	0.066
After Induction	5 Min	100.63 ± 4.04	+5.62	<0.0001	72.73 ± 7.42	-24.02	<0.0001	<0.001
	10 Min	100 ± 4.76	+4.96	0.0001	73.47 ± 6.58	-23.25	<0.0001	<0.001
	15 Min	99.67 ± 4.49	+4.61	0.0002	71.53 ± 7.09	-25.27	<0.0001	<0.001
	20 Min	99.53 ± 4.38	+4.47	0.0002	69.67 ± 6.67	-27.22	<0.0001	<0.001
	25 Min	99.60 ± 4.21	+4.54	0.0001	70.87 ± 8.54	-25.96	<0.0001	<0.001
	30 Min	100.47 ± 4.83	+5.45	<0.0001	74.53 ± 8.19	-22.14	<0.0001	<0.001
	60 Min	99.27 ± 4.15	+4.19	0.0004	92.53 ± 4.19	-0.03	0.0092	<0.001
Immediately After Shifting To PACU		95.20 ± 2.76	-0.07	0.9376	96.47 ± 19.17	+0.77	0.8386	0.721
After Shifting To PACU	30 Min	96.27 ± 3.47	+1.04	0.3066	93.33 ± 3.42	-2.50	0.0336	0.002
	60 Min	94.80 ± 2.95	-0.49	0.6076	92.33 ± 2.73	-3.55	0.0018	0.001
	90 Min	94.27 ± 2.91	-1.04	0.2743	93.07 ± 4.29	-2.77	0.0306	0.210
	2 Hours	94.00 ± 3.02	-1.33	0.1718	95.67 ± 4.17	-0.06	0.9598	0.081
	3 Hours	93.03 ± 3.3475	-2.35	0.0225	98.67 ± 19.11	+0.03	0.4182	0.117
	4 Hours	95.33 ± 3.54	+0.06	0.9513	94.60 ± 4.01	-0.01	0.3371	0.455
	8 Hours	91.67 ± 5.87	-3.17	0.0075	93.40 ± 3.97	-0.02	0.0498	0.186
	12 Hours	93.67 ± 5.20	-1.67	0.1876	93.73 ± 4.39	-2.08	0.1043	0.957
	18 Hours	93.87 ± 4.33	-1.46	0.1995	93.40 ± 5.01	-2.43	0.0760	0.701
	24 Hours	92.27 ± 4.78	-3.14	0.0109	94.47 ± 4.13	-1.34	0.2905	0.061

On comparing group G and S, DBP was higher in group G as compared to group S after five minutes of induction to sixty minutes after induction which was statistically significant but these changes were within acceptable range (30% from baseline).

Table 8: ICU Shifting Of Mother In Two Groups

Icu Shifting	Groups				Total	
	Group G (N=30)		Group S (N=30)			
	Number Of Patients	Percentage	Number Of Patients	Percentage	Number Of Patients	Percentage
Not Required	26	86.7	29	96.7	55	91.7
Required	04	13.30	01	3.30	05	8.30
P value	0.161					

Four patients in group G and one patient in group S required shifting to ICU for post-operative monitoring because of high blood pressure (Beyond accepted range of mild pre-eclampsia).

Table 9: APGAR Score Of The Newborn In Two Groups

APGAR Score	Groups		P Value
	Group G (N=30)	Group S (N=30)	
	(Mean ± SD)	(Mean ± SD)	
1 Minutes	07.53 ± 1.07	8.10 ± .6074	0.015
5 Minutes	08.50 ± 0.94	09.03 ± 0.49	0.008
7 Minutes	09.00 ± 0.69	09.43 ± 0.57	0.011

Mean APGAR score at 1,5,7 minutes was lower in group G as compared to group S.

Table10 : APGAR Score Distribution In Two Groups

Apgar Score	Number Of Patients In Group G			Number Of Patients In Group S		
	At 1 Minute	At 5 Minutes	At 7 Minutes	At 1 Minute	At 5 Minutes	At 7 Minutes
5	01	00	00	00	00	00
6	02	00	00	00	00	00
7	03	01	00	04	00	00
8	18	04	00	16	01	00
9	06	24	23	10	24	14
10	00	01	07	00	05	16

The lowest APGAR score in group G was 5, while for group S it was 7.

Table: 11 Umbilical Cord Arterial Blood Gas Analysis In Two Groups

Cord Blood ABGA Values	Groups		P Value
	Group G (N=30)	Group S (N=30)	
	(Mean ± Sd)	(Mean ± Sd)	
pH	07.34 ± 00.06129	7.35 ± 0.04737	0.300
pO2	54.83 ± 04.43	59.60 ± 4.37	<0.001
pCO2	40.63 ± 6.60	38.67 ± 4.24	0.175
HCO3	24.49 ± 1.95	22.61 ± 1.45	<0.001
O2 saturation	90.46 ± 2.09	91.91 ± 1.42	0.003

On comparing both groups, pO_2 and oxygen saturation was lower in group G and HCO_3 was higher in group S, while pH and PCO_2 values were comparable in two groups.

Table: 12 Changes In Hr / Min Of The Newborn In Two Groups

Time Interval		Heart Rate/ Min		P Value
		Group G (N=30)	Group S (N=30)	
		Mean ± SD	Mean ± SD	
0 Minutes (At Birth)		143.43 ± 22.66	147.80 ± 13.67	0.370
After Birth	30 Minutes	143.33 ± 19.21	147.07 ± 14.39	0.398
	60 Minutes	143.90 ± 16.38	146.30 ± 13.99	0.544
	90 Minutes	142.67 ± 14.68	144.80 ± 12.47	0.546
	2 Hours	143.40 ± 15.48	145.27 ± 13.53	0.621
	3 Hours	144.17 ± 16.23	147.63 ± 13.28	0.369
	4 Hours	143.60 ± 17.24	148.33 ± 15.70	0.271
	8 Hours	145 ± 14.41	146.60 ± 14.33	0.668
	12 Hours	144.53 ± 12.75	146.63 ± 12.61	0.524
	18 Hours	144.53 ± 11.19	145.47 ± 11.14	0.747
	24 Hours	143.87 ± 8.96	142.20 ± 9.21	0.480

The mean heart rate of the new born at various time interval was comparable in two groups.

Table: 13 Changes In SBP (mmHg) Of The Newborn In Two Groups

Time Interval		Systolic BP (mmhg)		P Value
		Group G (N=30)	Group S (N=30)	
		Mean ± SD	Mean ± SD	
0 Minutes		75.73 ± 4.57	76.87 ± 3.35	0.278
After Birth	30 Minutes	75.67 ± 3.79	76.13 ± 3.32	0.614
	60 Minutes	77.13 ± 2.61	77.87 ± 2.62	0.282
	90 Minutes	77.80 ± 2.64	77.33 ± 3.11	0.530
	02 Hours	77.07 ± 2.15	77.13 ± 2.50	0.912
	03 Hours	76.67 ± 2.64	76.93 ± 2.45	0.687
	04 Hours	75.93 ± 3.50	76.67 ± 3.46	0.418
	08 Hours	77.13 ± 2.81	77 ± 3.05	0.861
	12 Hours	76.40 ± 3.08	76.40 ± 3.08	1.000
	18 Hours	77 ± 2.33	76.87 ± 2.39	0.828
	24 Hours	77.20 ± 2.66	78.00 ± 1.05	0.131

The mean systolic BP of the new born was comparable in two groups at various time interval.

Table: 14 Changes In DBP (mmhg) Of The Newborn In Two Groups

Time Interval		Diastolic BP (mmhg)		P Value
		Group G (N=30)	Group S (N=30)	
		Mean ± SD	Mean ± SD	
0 Minutes		56.80 ± 7.25	58.47 ± 5.32	0.314
After Birth	30 Minutes	55.87 ± 4.95	57.53 ± 4.59	0.182
	60 Minutes	59.33 ± 4.94	60.13 ± 5.73	0.565
	90 Minutes	58.27 ± 3.01	57.87 ± 3.06	0.611
	2 Hours	57.60 ± 4.12	59.33 ± 5.16	0.155
	3 Hours	58.13 ± 3.82	57.33 ± 3.17	0.381
	4 Hours	57.20 ± 5.16	58.93 ± 5.48	0.212
	8 Hours	58.80 ± 4.86	58.87 ± 4.83	0.958
	12 Hours	58.00 ± 4.00	57.67 ± 3.72	0.739
	18 Hours	58.53 ± 4.23	58.60 ± 4.21	0.951
	24 Hours	58.60 ± 4.90	57.27 ± 0.87	0.148

The mean diastolic BP of the new born was comparable in two groups at various time interval.

Table 15: Changes In Spo2% Of The Newborn In Two Groups

Post Birth Time Interval		Spo2 (%)		P Value
		Group G (N=30)	Group S (N=30)	
		Mean ± SD	Mean ± SD	
0 Minutes		91.87 ± 2.32	93.10 ± 1.73	0.023
After Birth	30 Minutes	93.13 ± 2.27	93.80 ± 1.92	0.224
	60 Minutes	93.80 ± 2.09	94.53 ± 1.69	0.141
	90 Minutes	94.10 ± 1.77	94.63 ± 1.25	0.182
	2 Hours	94.70 ± 1.66	94.80 ± 1.19	0.790
	3 Hours	94.30 ± 1.78	94.63 ± 1.47	0.433
	4 Hours	93.57 ± 1.74	94.80 ± 1.71	0.607
	8 Hours	94.10 ± 1.63	95.23 ± 1.63	0.149
	12 Hours	94.80 ± 1.42	95.73 ± 1.08	0.126
	18 Hours	95.10 ± 1.21	95.80 ± 0.96	0.136
	24 Hours	95.70 ± 1.21	96.13 ± 0.97	0.131

Just after birth SpO_2 was lower in group G as compared to group S. This difference was statistically significant, but after that it was comparable in two groups at different time interval as shown in the table.

Table 16 Resuscitation Required In Two Groups

Resuscitation	Groups				Total	
	Group G (N=30)		Group S (N=30)			
	Number Of Patients	Percentage	Number Of Patients	Percentage	Number Of Patients	Percentage
Required	09	30	03	10	12	20
Not Required	21	70	27	90	48	80
Total	30		30		60	
P Value	0.053					

Nine new-borns in group G were required resuscitation as compared to only three in group S. This difference was statistically significant.

Table: 17 NICU Shifting Of The Newborn In Two Groups

NICU Shifting	Groups				Total	
	Group G (N=30)		Group S (N=30)			
	Number Of Patients	Percentage	Number Of Patients	Percentage	Number Of Patients	Percentage
Required	07	23.3	04	13.3	11	18.3
Not Required	23	76.7	26	86.7	49	81.7
P Value	0.317					

Seven new-borns in group G required NICU shifting as compared to only four in group S. This difference was statistically non-significant.

Discussion: Primary peripartum goals in pre-eclamptic parturients are optimization of maternal blood pressure, cardiac output, uteroplacental perfusion, prevention of convulsion and stroke. Hence, the advantages and disadvantages of spinal versus general anesthesia are to be carefully considered for each patient. Neuraxial anesthetic technique is preferable for cesarean delivery in absence of HELLP syndrome. Anesthetic management of pre-eclamptic patient for cesarean delivery depends on severity of pre-eclampsia and maternal and fetal status.

Spinal Anesthesia has advantages[3] like; Relatively simple, rapid onset and superior quality of anesthesia,No effect on Apgar scores and umbilical artery pH ,Low doses of local anesthetic will reduce the risks of systemic toxicity ,Early breast feeding can be initiated,Shorter duration of hospital stay,precludes the risk of aspiration, difficult and failed intubations, laryngoscopic response of intubation but one of the frequent maternal complications of spinal anesthesia[3] is intraoperative hypotensive episodes and the potential risk factors for this are advanced age, obesity, high-level block, insufficiency of the volume of fluid given before induction and t ime consuming procedure as compared to general anesthesia.

General anesthesia with rapid sequence intubation is considered over regional anesthesia when there is an immediate threat to the mother or fetus where swift and reliable induction is needed.on the other hand, general anesthesia hasdisadvantageslike ; potentially difficult ventilation and endotracheal intubation , exaggerated hemodynamic responses to laryngoscopy, intubation and extubation ,risk of acid aspiration ,potentiation of effects of neuromuscular blocking drugs due to MgSO4,uterine atony and coagulopathy cause considerable intrapartum blood loss,iimpaired villous blood supply ,prone for rapid desaturation during induction of anesthesia ,post-operative airway management can be difficult due to laryngeal edema ,babies born to mothers receiving general anesthesia required advanced resuscitation in the form of supplemental oxygen and bag mask ventilation.

The new born with APGAR score <8 at 1 minute were shifted to NICU for observation.

Apart from specific advantages and disadvantages of specific anesthesia techniques, there are many other influences also that affect maternal and neonatal outcome after caesarean delivery in pre-eclamptic patient, which include maternal and fetal condition, severity of pre-eclampsia and gestational age of the fetus. In pre-eclampsia fetal development is affected due to chronic uteroplacental insufficiency that results in fetal growth retardation. In addition, any acute maternal deterioration may impact adversely on fetal outcome.

Although spinal anesthesia is not contraindicated in mild pre-eclampsia, such patients may have altered clotting function and are relatively hypovolemic which may cause exaggerated sympatholytic response in central neuraxial blockade resulting in severe hypotension.

Moreover, there is always a chance that pre-eclamptic patients may suddenly develop convulsion needing urgent airway control and necessity of anticonvulsant drugs. Hence, advantages and disadvantages of regional technique and general anesthesia will have to be carefully considered for each patient. Regional anesthesia is divided into two subgroups: epidural anesthesia and spinal anesthesia. A

careful examination of the relevant literature reveals that there is no difference between epidural and spinal anesthesia in terms of maternal side effects[19]. Epidural anesthesia is preferred because after putting epidural catheter, we can prolong duration of anesthesia and post-operative analgesia[20]. Spinal anesthesia, on the other hand, is preferred because of its advantages of being implemented in a shorter span of time, having faster onset of action and requiring less medication, and its capacity to form a strong sensory and motor block[19].

In present study, we preferred to evaluate the effect of spinal and general anesthetic technique in mild pre-eclamptic patients scheduled for caesarean section. Severe pre-eclamptic patients were not considered for this study as adverse maternal clinical status might have adversely affected fetus and hence neonatal outcome may not be independent of anesthetic technique alone. Furthermore, relative contraindications always existed for regional anesthesia in severe pre-eclamptic patients.

Total sixty mild pre-eclamptic parturients needing caesarean delivery were included and allocated to two groups, thirty parturients in each who received spinal anesthesia or general anesthesia as per random number sequence for each patient. Two groups were comparable in demographic profile, clinical status, gestational age of the fetus and severity of maternal disease.

Maternal pre-operative SBP and DBP were high in spite of pre-operative antihypertensive medication (Tablet Labetalol and Nifedipine).

High maternal blood pressure was in the accepted range to stamp patient as mild pre-eclamptic.

One of the most important factors in spinal anesthesia is sensory block level. The appropriate sensory level for caesarean section is T4 (Ronald and miller 2005). Higher sensory level carries a risk of hypotension in proportion to height of sensory block achieved. In present study, sensory dermatome block was restricted to T6 dermatome as our previous clinical experience of caesarean section under spinal anesthesia found T6 sensory block satisfactory for cesarean delivery. None of the patients who received spinal anesthesia up to T6 dermatome required any supplementation in the form of systemic analgesia or anesthesia due to inadequacy of neuraxial blockade.

We had observed SBP and DBP changes in each group before (baseline) and after anesthesia at different time intervals and the comparison was made from the baseline (Intra group comparison). In the spinal group, these changes were significant and all the patients developed statistically significant fall in BP from baseline.

($P<0.05$) Still, no patient developed hypotension as per defined criteria in this study (> 30% fall in BP from baseline). The maximum fall in SBP and DBP observed was 27.4% and 29.4%, which developed in 3 patients in spinal anesthesia group. But in general anesthesia group, there was statistically significant rise in BP, both systolic and diastolic from baseline ($p<0.05$) Maximum rise in SBP and DBP observed was 18.6% and 20.4% respectively and that was seen at the time of laryngoscopy and intubation. This rise in BP persisted throughout the surgery and even extended into the post-operative period up to 2-3 hours.

It can be explained on the basis of hemodynamic stress response to laryngoscopy and intubation. Continuous persistence of increase in BP suggests the exaggerated response in pre-eclamptic patients as in normal patients it usually settles down within 10-15 minutes of laryngoscopy and intubation. As the increase in BP was within the acceptable range (< 30% rise from baseline), it is not taken as hypertension as per the defined criteria in present study.

Secondly, SBP and DBP changes were evaluated between the two groups (inter group comparison). There was significant change in BP observed in two groups. ($p > 0.05$) In group S, the maximum fall in systolic blood pressure was observed 21.51% while maximum rise in group G was 9.17 %. The maximum fall in diastolic blood pressure in group S was 27.22 % as against 5.62% rise in group G. These results revealed that both SBP and DBP in group S were more notable than in group G, but still, it is in the acceptable range.

On reviewing the literature, no study was found that included mild pre-eclamptic patients for evaluation of spinal and general anesthetic technique on maternal and neonatal outcome.

Hence, we are not in position to compare the results of present study with other studies. All studies included severe pre-eclamptic patients and found statistically significant fall in BP in group S as compared to group G. This is expected result of spinal anesthesia where sympathetic blockade produces fall in BP.

Restriction of sensory block to T6, 10 ml/kg of isotonic fluid as pre-loading and left lateral tilt to prevent aortocaval compression seem to be the important factor in preventing excessive fall in BP in present study.

There was statistically significant decrease in HR in group S and statistically significant increase in HR in group G from baseline. The maximum decrease in HR was 28.9 % from baseline developed in two patients in group S. Hence, none of the patient developed bradycardia as per the defined criteria in this study (HR< 60/min).

On the other hand, there is statistically significant increase in HR from baseline in Group G.

Maximum increase in HR was in the range of 35-40% which developed in 56.66 % of the patients, which came within 30% of increase (accepted range) within 10 minutes on increasing the concentration of sevoflurane from 1 % to 1.5 to 2%. HR remained high up to 3 hours post operatively but was within 30% accepted range of increase in HR.

Post-operatively more patients in group G needed observation in ICU because BP was higher from the accepted range of BP in mild pre-eclampsia (BP<160/90 mmHg). Four patients in group G needed critical care observation as against only one patient in group S. These findings were similar to other studies like Keerath K.et al[1], F. Moslemi et al[2], Suman Chattopadhyay et al and Shashi Prakash et al[7], which observed higher percentage of patients needing intensive care observation as compared to spinal anesthesia group. But again, all these studies were done in severe pre-eclamptic population.

In present study, the second important consideration in evaluation of effect of anesthetic technique was neonatal outcome. After delivery most common method to detect neonatal condition is APGAR score at 1, 5 and 7 minutes of birth.

Also, the more accurate and predictive measure especially in high-risk situation is umbilical cord arterial blood gas analysis. The most important primary outcome measure in umbilical artery blood gas analysis is base deficit. Because, variation in maternal ventilation and hypotension will alter umbilical cord blood pH and therefore umbilical artery base deficit is more specific index of metabolic component of acid base imbalance. Accepted criteria used to identify newborn at risk of fetal hypoxia is APGAR score at 1 and 5 Minutes of <7, umbilical cord blood pH <7.20 and umbilical artery base deficit >10. In current study, the minimum APGAR score at 1 minute was 5 in group G in one patient and 7 in group S in four patients.

In all the newborns APGAR score reached 8 or >8 after simple resuscitative measure (Tactile stimulation, drying, suctioning and simple supplemental oxygenation) at 5 minutes. Which shows better newborn condition in group S compared to group G. Nine newborns in group G required simple resuscitation measures as against only three newborns in group S. Hence, the newborn born under spinal anesthesia had better clinical outcome than newborn born under general anesthesia in mild pre-eclamptic patients.

Umbilical cord pH, PaCO2 were comparable in both the groups while PaO2 and SpO2 were statistically lower in group G as compared to group S. Umbilical cord HCO3 value was 24.4 m Eq/L in group G as compared to 22.6 m Eq/L in group S. In both the groups HCO3 was within the normal range (22-26 m Eq/L). Hemodynamics (HR, SBP and DBP) remained stable and comparable in all the neonates in both the groups.

In this study, we evaluated possible complications seen in post-operative period. In group G, four mothers developed hypertension that needed observation in ICU as against one in group S. No other complication was noted in either group,

Conclusion: Both the techniques of general anesthesia as well as spinal anesthesia can be used for mild pre-eclamptic patients undergoing caesarean section. Hemodynamic changes in both the techniques are acceptable and manageable during the operation. According to result of present study, we conclude that mild

pre-eclamptic parturient undergoing cesarean section in spinal anesthesia face more decrease in SBP and DBP than increase in SBP and DBP observed in group G. These changes were not severe, are transient and fall in the acceptable range and don't adversely affect maternal and neonatal outcome. On the other hand, hemodynamic stress response in the form of increase in HR was found to be exaggerated in group G. Post-operative morbidity requiring observation in ICU are more common after general anesthesia.

Neonatal outcome was also better in group S in terms of newborns needing ICU care, umbilical arterial blood gas analysis and APGAR score which was comparatively more favorable in group S than in group G.

Hence, Spinal anesthesia is an appropriate anesthetic technique of choice in parturients with mild pre-eclampsia needing cesarean section.

Furthermore, because of its simplicity and rapidity it should be considered as a method of choice for cesarean section in parturients who have been adequately prepared with judicial amount of fluid.

Therefore, it is concluded that spinal anesthesia is first choice as it is more safe, simple and with better maternal and fetal outcome.

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