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Effects of General and Neuraxial Anesthesia on Newborn Via Caesarean Section in Al-Jala Hospital, Tripoli, Libya

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ABSTRACT

There is no standard anesthesia technique for caesarean section. Some would say that general anesthesia has been associated with higher possibility of acquiring complications to the extent that it would lead to the death of the parturient as well as to the newborn. However, several studies seem to disagree with such statement. Hence, this gave the researchers the idea to explore the effects of general anesthesia and neuraxial anesthesia on fetus via caesarean section in Al-Jala Hospital, Tripoli, Libya.

This study utilized a cross-sectional observational type of design. A total of sixty uncomplicated pregnant women at term (>37 completed weeks) were scheduled to undergo elective caesarian section participated in this study, within the age range of 20-38 years old. They were allocated and grouped into two, according to their anesthesia type preference either General Anesthesia (GA, N=30) and Neuraxial Anesthesia (NA, N=30). Based on the results of the study, the following conclusions were drawn: GA group have more newborns with abnormal clinical signs. Blood count of the newborns in GA group are higher than NA in terms of WBC, Hemoglobin and platelet. NA born newborns had slight acidosis while GA born newborns had high PCO_2 and HCO_3. Both groups have normal rectal temperature and respiratory rate except heart rate of the newborns in NA group, which resulted to higher than normal range. The average mean of WBC, hemoglobin and platelet are in normal range across both groups. Aside from slight acidosis of NA born newborns, PCO_2 and HCO_3 have high average mean across both groups. Overall, large number of participants would guarantee significant neonatal effects of both anesthesia. Individualization of results would significantly guarantee the specific factors such as immediate measures like neonatal ventilation and support that alters the apparent findings.

Key words- *General anesthesia; Neuraxial anesthesia; Caesarian section.*

INTRODUCTION

The well-being of the infant is a major criterion for evaluating the anesthetic management of pregnant women on caesarian section. Many tools exist to assist with this determination for the fetus, whereas few are available to evaluate the newborn.[1] Caesarean requires effective obstetric anesthesia which can either be neuraxial or a general anaesthetic. Neuraxial refers to local anesthetics placed around the nerves of the central nervous system, such as spinal anesthesia, caudal anesthesia, and epidural anesthesia. This type of anesthesia has the benefit of an awake mother at delivery and minimal anesthetic exposure to the neonate, avoids the risks of maternal aspiration and difficult airway associated with general anesthesia.[2] General anesthetics have been linked to "developmentally regulated increases in perinatal apoptosis and long term deleterious behavioral changes, neuraxial anesthetics and analgesics are associated with fewer systemic adverse effects.[3] Common practice in the United States is the increased use of neuraxial techniques instead of general anesthesia for Cesarean delivery has improved maternal safety. Prevention of gastric aspiration and hypotension from neuraxial techniques, have improved maternal care.[1] A support to this data was a review to this general practice in the Western world, to induce neuraxial anaesthesia for most women undergoing caesarean delivery, unless contraindicated by maternal disease or because of the emergency nature of the procedure.[4] This showed neuraxial anesthesia as widely considered safer than general anesthesia for cesarean delivery, though serious complications of general anesthesia are rare. This goes to say that GA for CSD is occasionally essential but best avoided.[5]

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Objective of the study: To determine the influence of general and neuraxial on neonatal outcomes as to the clinical signs and blood investigation. Specifically, this study answered the following:

1.Demographic profile of the parturients in terms of age and gravidity.

2.Neonatal outcomes of general anesthesia group and neuraxial anesthesia group in terms of: a) clinical signs as to presence of asphyxia, rectal temperature, heart rate and respiratory rate, and b) blood investigation result as to complete blood count and umbilical artery blood gas for pH; and

3.General versus neuraxial anesthesia group with the highest average mean according to: 1.) Clinical signs and 2.) investigation result.

MATERIALS AND METHODS

Methods:

This study utilized a cross-sectional observational type of design. Setia (2016), defined cross-sectional as a type of observational study design in which the researchers employed 60 participants selected based on the inclusion and exclusion criteria set for the study.

Patients: The sixty (60) uncomplicated parturients at term (>37 completed weeks) who were scheduled to undergo elective caesarian section participated in this study were within the age range of 20-38 years old. They were allocated and grouped into two, according to their anesthesia type preference either general anesthesia (N=30) and neuraxial anesthesia (N=30). Grouped as A and B in our study, group A were the general anesthesia group while group B were the nearaxial group. All study group participants and their newborn were closely monitored with non-invasive blood pressure measurements including their heart and respiratory rate.

Ethical consideration: Our study was approved by the ethics and scientific department of Al-Jalaa Hospital in Tripoli, Libya. Written informed consent and verbal explanation were provided to the respondents regarding their rights to refuse, privacy, anonymity and confidentiality through data coding and filing based on individual information supplied.

Procedure: The anesthesia for each patient were administered by the expert anesthetists and anesthesia technicians according to the hospitals' routine protocol. Pediatricians attended the delivery of all 60 neonates who themselves assessed the clinical signs. Obstetricians were responsible for the delivery of all babies per hospital protocol. Immediately after delivery, the neonates were evaluated by the medical technologists for blood gases as pH, PCO_2, HCO_3, used as the basis to explore the effects of anesthesia between the two groups. The nurses monitored the condition of both parturients and their newborn babies.

Neonatal outcome tool: To determine the influence of the two types of anesthesia, a researcher made neonatal outcome tool checklist was used to eliminate bias of observation. The Neonatal Outcome Checklist recorded the findings of the selected inclusions based on two different neonatal outcome measurements. Clinical signs being the first and blood investigation as the second, results were interpreted as high, normal and low compared to the normal range of values as follows:

Part I. Clinical signs	Normal range
Presence of asphyxia	No
Rectal temperature	36.1 - 37.9 °C
Heart rate	120 - 160 beats/min
Respiratory rate	30-60 breaths/min
Part II. Blood investigation result	
CBC (Complete blood count) 1.1 WBC or White Blood Cells	10,000 -25,000 cells/mm^3 of blood
1.2 Hemoglobin	17 -19.3 gms/dL of blood
1.3 Platelet	103.17 -409.33 10^9/L
Umbilical artery blood gas	
2.1 pH	7.37 -7.43
2.2 PCO_2	36 - 44 mmHg
2.3 HCO_3	22- 26 mEq/L

These were evaluated by the researchers with the clinical signs classified based on the four parameters of asphyxia, rectal temperature, HR and RR. The second basis of neonatal outcome is the blood investigation, which specifically measured the blood count and umbilical gas analysis respectively. The blood count as the second neonatal outcome basis includes the (1.) complete blood count, contains the white blood cell count, hemoglobin and platelet count; and the (2.) umbilical artery blood gas comprising the umbilical artery pH, pCO_2 and HCO_3.

Locale of the study: Conducted at Al-Jala Hospital, the only government hospital specialized for maternal and newborn at Omar Al Mokhtar Street, Tripoli, Libya, a 200-bed capacity learning institution.

Statistical Treatment: Descriptive statistics such as percentage and frequency, average mean, as well as ranking treated to determine the neonatal outcome between the two subject-groups.

RESULTS

The 60 cases recruited in this study were allocated to general anesthesia (GA) group and neuraxial anesthesia (NA) group. Both groups have the same age range of 20-38 years old. One and the other just the same have

more parturients in 20-34 years old than 35-38 years old, nevertheless that multigravida parturients are more than primigravida (Table 1).

In table 2, blood investigations of both case groups found to have more newborns with asphyxia, higher rectal temperatures, higher heart and respiratory rate in general anesthesia group with 86.67%, 63.33**%,** 70% and 46.67% respectively. In terms of Blood Count as the first neonatal outcome basis of Blood Investigation, no newborn have high WBC and platelet with 20% only of n=30 have higher than normal hemoglobin general anesthesia group. Contrary to the result of the same investigation, NA group shown 6.67% only of n=30 newborns have higher White Blood Cell count. Same number of newborns kept to 90% from n=30 have higher than normal range hemoglobin and platelet count.

In our study, the neonatal biochemical parameters otherwise known to be umbilical artery gases evaluated through the three individual parameters. The pH of the GA group accounts only to 6.67% of the total N = 30 newborns which is lesser than 10% from the total n=30 of the NA. Contradictory to this result is the biochemical result of both PCO_2 and HCO_3 wherein the GA group have 27 newborns or 90% of the N = 30 have higher than normal result. This is less compared to NA group with 66.67% in PCO_2 and 76.67% in HCO_3 out of N= 30 newborns. Result of the study is in favor of NA group in terms of clinical signs and neonatal biochemical parameter of umbilical blood gas. There is a contradiction to GA group however based on the result of over-all blood count result of less number of newborns with high blood count compared to NA group.

Table 3 shows the neonatal outcome parameters as to clinical signs, blood investigations specifically divided into blood count and umbilical blood gas of the newborn babies classified under the two anesthesia. In general anesthesia group, the clinical signs as to rectal temperature, heart rate and respiratory rate falls under the normal range, unlike neuraxial anesthesia group with 10% increase in heart rate. Blood count as neonatal outcome parameter like white blood cells (WBC), hemoglobin and platelet count were normal for two groups. Lastly, as to the newborns biochemical investigations across the two groups have variations. Slight acidosis was found in neuraxial anesthesia group while normal in general anesthesia group. Together, general and neuraxial anesthesia group have high PCO_2 and HCO_3.

DISCUSSION

Table 1: Demographic profile of the parturients

Demographic profile	Category	Case group A (N = 30)		Case group B (N = 30)	
		f	%	f	%
Age	20 - 34	22	73.33	24	80
	35 - 38	8	26.67	6	20
Gravida	Primigravida	12	40	11	36.7
	Multigravida	18	60	19	63. 3

Table 2: Clinical signs and blood investigation of the newborns

Neonatal outcome parameters	Case group A/General anesthesia N = 30		Case group B/Neuraxial anesthesia N = 30	
	f	%	f	%
I.Clinical signs				
1.Asphyxia	26	86.67	20	66.67
2.Rectal temperature	19	63.33	13	43.33
3.Heart rate	21	70.00	19	63.33
4.Respiratory rate	14	46.67	8	26.67
Overall clinical signs	**20**	**66.67%**	**15**	**50%**
II. Blood investigation				
11.1 Blood count				
1.WBC	0	0	2	6.67
2. Hemoglobin	10	33.33	27	90
3. Platelet	0	0	27	90
Overall blood count	**11**	**37.03%**	**19**	**62.22%**
II.2 Umbilical artery blood gas				
1.pH	2	6.67	3	10
2.PCO_2	27	90	20	66.67
3.HCO_3	27	90	23	76.67
Overall umbilical blood gas	**19**	**62.22%**	**15.33**	**51.11%**

Table 3: Mean of the neonatal outcome parameters

Neonatal outcome parameters				
	GA	**Interpretation**	**NA**	**Interpretation**
I.Clinical signs				
1.Rectal temperature	37.83	N	37.61	N
2.Heart rate	160.4	N	166.3	High
3.Respiratory rate	51.2	N	57.8	N
Interpretation	Normal		High HR	
II. Blood count				
4.WBC	12.22	N	13.83	N
5.Hemoglobin	15.45	N	15.69	N
6.Platelet	233.9	N	244.5	N
Interpretation	Normal		Normal	
III. Umbilical blood gas				
7.PH	7.26	N	7.34	Low
8.PCO_2	60.10	High	56.43	High
9.HCO_3	29.93	High	28.73	High
Interpretation	High PCO_2 and HCO_3		Acidosis with high PCO_2 and HCO_3	

There is no enough evidence to show that one anesthesia is superior to general anesthesia in terms of major maternal or neonatal outcomes. Further research to evaluate neonatal morbidity and maternal outcomes, such as satisfaction with technique, will be useful.[6] Some improved results for regional anaesthesia group was found to have no statistical evidence that neither anaesthesia technique is superior regarding neonatal morbidity. This is contradictory to 'regional anaesthesia should be preferred whenever possible because of improved results of length of hospital stay, APGAR and morbidity and that general anesthesia was indicated for very urgent cases or regional anaesthesia contraindicated patients'.[7] A recent study in Italy claimed that numerous intrapartum risk factors for asphyxia were recognized including abnormal fetal heart rate during labor, chorioamnionitis/maternal fever, thick meconium, operative vaginal delivery with general anesthesia as one.[8] This goes to prove that the result of the study in Libya have the same result among other countries of West and North wherein general anesthesia (GA) have the most number of neonates with signs and symptoms of asphyxia than neuraxial (NA).

Hyperthermia among newborns is defined as body temperature above 37.3°C or 37.5°C by Acute Care of at-Risk Newborns Neonatal Society (ACoRN 2012) and World Health Organization (WHO 2003). This condition is caused by several factors and maternal factors as one is due to maternal hyperthermia and maternal epidural anesthesia with central nervous system disorder specifically asphyxia.[13] This is incongruent to the result of the study wherein hyperthermia is common among neonates born to mothers who received general anesthesia instead of epidural otherwise classified as neuraxial. As to the heart rate and respiratory rate, several authors concluded that 'other drugs given to the mother and general anesthesia can depress respirations in newborn' which makes another concern.[17] This is not the case in this study. More neonates born to mothers with general anesthesia revealed higher HR and RR.

The result of hemoglobin and platelet count among case group B is an opposition to a result of the study from Turkey that 'both groups (general and spinal anesthesia group, otherwise classified under neuraxial anesthesia in this study) had no significant statistical difference between the hemoglobin and platelet values before and after the caesarian operation.[9] For the third time, the present study have the opposite result from another study, specifically from Bangalore, India: "The neonatal cord blood parameters across the two groups were biochemically similar. There were no significant differences noted in pH, PCO_2, HCO_3, and base excess across the two groups of neonates".[10] Needless to say, other studies laid basis of agreement to this study as 'spinal anesthesia has become the preferred anesthesia for cesarean section'. Internationally, obstetric anesthesia guidelines recommend spinal and epidural over general anesthesia for most caesarean sections.[11] To add, several studies like Krishnan et al. concluded that delivery should be completed within 6-8 minutes after GA induction to prevent neonatal respiratory depression due to inhalant gas.[10] Studies noted the incidence of respiratory depression in children born of a general anesthesia attributed it to the effect of nitrous oxide crossing the placenta in case of a delay in delivery.

Some study parameter specifically Apgar score defines

the total outcome of the newborn status in relation to heart rate.[10] Other neurobehavioural scoring systems may be more relevant than conventional Apgar Scoring in this regard. Reflecting on heart rate interpreted as 'high' in the case group B in neuraxial anesthesia group, this is supported by the study which found lesser depressed newborns 1.1% in the spinal group compared to 25.9% in the general anesthesia group.[12] This is in favor of the spinal anesthesia otherwise the neuraxial anesthesia for caesarian delivery use. Walker et. al[3] through their findings has now on advocate for the use of neuraxial drugs with the widest demonstrable safety margin. They suggest minimum standards for preclinical evaluation before adoption of new analgesics or preparations into routine clinical practice.[3] A study from Egypt recommends the combined spinal-epidural anesthesia (classified under the neuraxial anesthesia by recent studies) as safer on the newborn than general anesthesia regarding the APGAR scores and acid–base balance.[14] Furthermore, a review from Ethiopian authors, concluded that regional anesthesia is superior over general anesthesia in certain neonatal outcomes as depicted by the pooled analysis of individual trials. However, there should be further review with individual trials having high power and similar dosage and techniques as most of the individual trials. The different types of outcome assessment techniques would be beneficial to make clear of the neonatal outcome measurement.[15] Lastly, regarding the evaluation on the influence of the type of anesthesia used in cesarean delivery on short term neonatal outcome in Iraqi population, the author concluded that the spinal anesthesia significantly influence the short term neonatal outcome compared with general anesthesia for elective repeated cesarean section delivery specially in near term pregnancies.[16]

CONCLUSION

Blood count of the newborns in GA group are higher than Group B in terms of WBC, Hemoglobin and platelet. Group B (NA) newborns had slight acidosis while group A newborns had high PCO_2 and HCO_3. Both groups have normal rectal temperature and respiratory rate except heart rate of the newborns in Group B, which resulted to higher than normal range. The average mean of WBC, Hemoglobin and platelet are in normal range across both groups. Aside from slight acidosis of group B, PCO_2 and HCO_3 have high average mean across both groups.

RECOMENDATIONS

Based on the findings of our study, it is best to associate and compare the significant differences between the two groups. Noted that high PCO_2 and HCO_3 across both groups, slight acidosis in Group B develops. Higher rectal temperature was also observed in Group B.

Overall, large number of participants would guarantee significant neonatal effects of both anesthesia. Individualization of results would significantly guarantee the specific factors such as immediate measures like neonatal ventilation and support that alters the apparent findings.

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