Study of Arterial Blood Gas, Acid Base Balance and its CorelationwithFetomaternal Outcome inPregnancy Induced Hypertention

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Abstract:

Background &Method: To evaluate the maternal outcomes through ABG index and its influence on new-borns through Apgar scoring. Role of arterial blood gas values and their implications to patient management.A total of 130 women with PIH syndrome were treated in Department of Obstetrics and Gynaecology of IMCHRC, Indore, over a period of 12 months

Result: In this study, 66.10% PIH patients improved by conservative management, whereas 33.88% required ventilatory support of which 5.08% died on mechanical ventilation. Amongst which maximum patients which succumbed showed decompensated metabolic acidosis at 0 hr ABG.In this study, the mean pH value, PO2, HCO3 in severe PIH cases were lower than the mild PIH cases, whereas the mean PCO2 and BE levels in severe PIH cases were higher than the mild PIH cases. Therefore, with the exerbation of the disease,the differences of indexes from normal values became larger.

Conclusion: It has been observed that PIH cases with lower pH, pO2 and bicarbonate and higher lactate, pCO2 and BE at presentation are to be considered as high risk patients (metaboic acidosis) and should be monitored intensively to avoid maternal and perinatal mortality. Moreover, there was a positive correlation between arterial blood pH of PIH patients and neonate's Apgar score at 1 min after birth. With the decline in the pH value, the neonate's Apgar score became lower and the risk of asphyxia increased.With the exacerbation of the maternal disease in the study, the differences of indexes from normal values became larger also the incidence rate of neonatal asphyxia became higher.

Therefore, Regular monitoring of ABG parameters can provide early warning of deterioration and one can judge the effectiveness of therapeutic intervention, combined with neonatal Apgar score which could make countermeasures against neonatal asphyxia during delivery in advance, help monitoring and intervention of infants to be born, thus can predict the outcome, prognosis and duration of hospital stay and improve the fertility quality.

Keywords:arterial blood gas, fetomaternal outcomes, pregnancy,hypertention& ABG Analysis.

Study Designed: Observational Study.

1. INTRODUCTION

Pregnancy-induced hypertension (PIH) occurs after 20 weeks of pregnancy resulting in 12% of maternal deaths globally.

PIH may develop into eclampsia in severe cases, causing convulsions which not only affects the vital organ functions but also coagulation dysfunction and placental abnormalities causing fetal growth retardation and asphyxia constituting to maternal and perinatal mortality[1].

With the advanced medical technology, Arterial Blood Gas (ABG) analysis in pregnancy has been clinically applied which reflects the lung respiratory function and acid-base balance of the body[2].

According to relevant studies, PIH can cause respiratory depression and acid-base imbalance in patients, resulting in abnormal ABG index. Evaluation of new-born's clinical condition is based on Apgar scoring which is preferred for judging neonatal asphyxia and is of great significance in early monitoring and intervention of neonates[3].

Arterial Blood Gas Analysis

The term 'blood gas' refers to the measurement of the tension or partial pressure of oxygen and carbon dioxide in blood and determination of acid base balance is an integral part of blood gas measurement.

For cellular process to occur efficiently, the H+ concentration must be maintained within tight limits. Failure to maintain pH balance leads to inefficient cellular reactions and ultimately death[4].

Blood gas analysis detects pH value,PO_2, PCO_2, HCO_3, and BE in the blood and is used to determine the acid base poisoning and degree of hypoxia.

Imbalance in Acid Base

An Acidosis is any process that acts to lower blood pH. If it is due to rise in $PaCO_2$, it is called a Respiratory Acidosis. If it is due to any other cause, then HCO_3 is reduced and it called as Metabolic Acidosis.

An Alkalosis is any process that acts to increase blood pH, if it is due to fall in $PaCO_2$, it is called Respiratory Alkalosis. If it is due to any other cause, then HCO_3 is raised and it called as Metabolic Alkalosis[5].

2. MATERIAL & METHOD

A total of 130 women with PIH syndrome were treated in Department of Obstetrics and Gynaecology of IMCHRC, Indore, over a period of 12 months.

INCLUSION CRITERIA
- All the patients who agreed and signed the informed consent.
- Patients with BP more than 140/90mmHg
- Singleton pregnancy
- ANC patients of more than 20 weeks of gestation.

EXCLUSION CRITERIA
- Pregnant females with comorbidities like heart disease, severe anaemia, hypoxic diseases, placental abnormalities.
- Patients who didn't give consent.
- Patients were graded and grouped according to the clinical diagnostic criteria of PIH syndrome
- 80 patients with mild PIH (mild group)
- 28 patients with moderate PIH (moderate group)
- 22 patients with severe PIH (severe group)

- In this study ABG analysis was performed for all the pregnant women at 36 weeks of gestation and apgar scoring was performed for all newborns at 0,1 and 5 min after maternal delivery.

3. RESULTS

Table 1. PIH cases according to pregnancy stages.		
STAGES	**No. of PIH cases**	**Percentage**
ANTEPARTUM	90	**69.2%**
INTRAPARTUM	5	**3.8%**
POSTPARTUM	35	**26.9%**
TOTAL	130	

In this study of 130 cases, 69.2% patients of antepartum PIH were admitted.

Table 2. PIH Cases according to parity		
PARITY	**NUMBER OF CASES (n=90)**	**PERCENTAGE**
PRIMI	70	**77.77%**
GRAVIDA (2-4)	17	**18.88%**
GRAVIDA (>4)	3	**3.33%**
TOTAL	90	

In the study, the incidence of PIH was found to be highest amongst primigravida patients i.e. 77.77%

Table 3. PIH Cases in different trimester		
GESTATIONAL AGE	NUMBER OF CASES	PERCENTAGE
<24 weeks	2	2.22%
24-28 weeks	3	3.33%
28-32 weeks	7	7.77%
32-36 weeks	68	75.55%
>=37 weeks	10	11.11%
TOTAL	90	

In our study, highest number of PIH patients came to our tertiary care facility at 32-36 weeks of gestational age.

Table 4. Acid Base Balance at 0 Hour ABG		
ACID BASE DISORDER	NUMBER OF CASES	PERCENTAGE
METABOLIC ACIDOSIS	95	73.07%
Compensated	73	56.15%
Decompensated	22	16.92%
METABOLIC ALKALOSIS	3	2.3%
RESPIRATORY ALKALOSIS	10	7.69%
RESPIRATORY ACIDOSIS	10	7.69%

WITHOUT ANY SIGNIFICANT ABG CHANGES	12	9.2%
TOTAL	130	

In our study, the most common acid base disorder diagnosed by '0' hr ABG sampling at the time of admission is metabolic acidosis (73.07%)

Table no. 5 Outcomes of ABG at 0 Hour				
ACID BASE DISORDERS	IMPROVED CONSERVATIVELY		VENTILATORY SUPPORT	
			SURVIVORS	DEATH
1. COMPENSATED METABOLIC ACIDOSIS	60	50.84%	13	0
2. DECOMPENSATED METABOLIC ACIDOSIS	6	5.08%	13	3
3. METABOLIC ALKALOSIS	2	1.69%	1	0
4. RESPIRATORY ALKALOSIS	4	3.38%	4	2
5. RESPIRATORY ACIDOSIS	6	5.08%	3	1
TOTAL	78	66.10%	34	6
TOTAL PERCENTAGE			28.8%	5.08%

In this study, 66.10% PIH patients improved by conservative management, whereas 33.88% required ventilatory support of which 5.08% died on mechanical ventilation. Amongst which maximum patients which succumbed showed decompensated metabolic acidosis at 0 hr ABG.

Table no. 6. Comparison between survivors and non survivors by ABG parameters at 0 and 24 hour				
ACID BASE PARAMETERS	SURVIVORS		NON-SURVIVORS	
	MEAN	SD	MEAN	SD
pH (0 hr)	7.256	0.798	7.047	0.161
pH (24 hr)	7.345	0.063	7.147	0.110
PaCO2 (0 hr)	28.635	8.034	38.554	16.657
PaCO2 (24 hr)	30.026	7.318	27.775	7.213
HCO3 (0 hr)	13.993	3.144	10.254	2.554
HCO3 (24 hr)	17.144	3.635	11.075	5.710
Lactate (0 hr)	3.223	2.909	7.136	3.078
Lactate (24 hr)	1.953	1.675	7.325	5.099
BE (0 hr)	-11.773	5.257	-7.736	3.539
BE (24 hr)	-8.887	4.21	-18.25	6.628

In our study, non-survivors showed a lower mean pH, bicarbonate, and a higher lactate and base excess than survivors

Table no. 7 Comparison of ABG Parameters IN PIH group			
ABG INDEX	Mild (n=80)	Moderate (n=28)	Severe (n=22)
pH value	7.29±0.12	7.20±0.13	7.09±0.29
PO2	64.16±6.26	58.16±5.09	54.73±4.76
PCO2	45.53±5.98	50.26±6.74	53.76±6.81

HCO3	23.16±3.59	21.73±3.06	19.78±2.46
Base excess	3.16±2.53	4.21±3.07	4.97±3.58

In this study, the mean pH value, PO2, HCO3 in severe PIH cases were lower than the mild PIH cases, whereas the mean PCO2 and BE levels in severe PIH cases were higher than the mild PIH cases. Therefore, with the exerbation of the disease,the differences of indexes from normal values became larger.

4. DISCUSSION

Comparision			
Studies	**Similarity**	**Disimilarity**	**My Study**
Wang et al (2015) [6]	**PIH women- risk of neonatal asphyxia higher**	-	-
Seyom et al(2015)	**Severe PIH - max.maternal and perinatal complications**	-	-
Bridwell et al(2019) [7]	-	**0.3% maternal mortality in PIH women**	**4.6% maternal mortality**
Moodley(2007) [8]	-	**maternal deaths 50% cerebral hemorrhage. 17.2% pulmonayedema**	**Maternal deaths 33.3% HELLP synd' 16.6% cerebral hemorrhage**
Hussain N Shah N Khan N (2017)		**Perinatal mortality 17.5 % 9.2%**	**Perinatal mortality 18.18%**
Isabela et al(2012) [9]	**Severe PIH- more neonatal mortality due to prematurity**	-	-

5. CONCLUSION

It has been observed that PIH cases with lower pH, pO2 and bicarbonate and higher lactate, pCO2 and BE at presentation are to be considered as high risk patients (metaboic acidosis) and should be monitored intensively to avoid maternal and perinatal mortality. Moreover, there was a positive correlationbetween arterial blood pH of PIH patients and neonate's Apgar

score at 1 min after birth. With the decline in the pH value, the neonate's Apgar score became lower and the risk of asphyxia increased.With the exacerbation of the maternal disease in the study, the differences of indexes from normal values became larger also the incidence rate of neonatal asphyxia became higher.

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