



EVALUATION OF THE SERUM CALCIUM AND GLUCOSE LEVEL IN MODERATE AND SEVERE BIRTH ASPHYXIA: A CASE CONTROL STUDY IN SCB MEDICAL COLLEGE CUTTACK, ODISHA

Pediatrics

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ABSTRACT

A prospective case control study was conducted in Department of Pediatrics, Newborn ward of S.C.B. Medical College & Hospital and SVPPGIP, Cuttack, Odisha from September 2017 to September 2019 by taking 202 newborns having history and clinical features of moderate & severe hypoxic ischemic encephalopathy and they were evaluated for their serum calcium and blood glucose levels. In the present study mean serum calcium level was found to be low in babies with moderate birth asphyxia and severe birth asphyxia as compared to control. Again it was also found to be low in severe birth asphyxia as compared to moderate birth asphyxia. The percentage of hypo calcemic babies was found to be more in babies with moderate birth asphyxia and severe birth asphyxia as compared to control. Again it was also found to be more in severe birth asphyxia as compared to moderate birth asphyxia. In this study percentage of hypoglycemic babies was found to be more in babies with moderate birth asphyxia and severe birth asphyxia as compared to control. Again it was also found to be more in severe birth asphyxia as compared to moderate birth asphyxia. All the comparison was significant statistically ($P < 0.05$). This study showed that risk of hypocalcemia and hypoglycemia increased with severity of birth asphyxia. The present study showed that survival was more with normal serum calcium level as compared to low serum calcium level (95.5% vs 74.7%) whereas fatal outcome was more with low serum calcium level as compared to normal serum calcium level (22.2% vs 2.3%). Low serum calcium level was associated with more fatal outcome. The difference was statistically significant as $P < 0.05$. The present study showed that survival was more with normal blood glucose level as compared to low blood glucose level (92.5% vs 44.6%) whereas death was more with low blood glucose level (48.2% vs 6.2%). Low blood glucose level was associated with more fatal outcome. The difference was statistically significant ($P < 0.05$). Although the study result has resemblance to previous studies, as there is no such type of study has been done previously in this institution, where patient burden is much more higher than resources and where emphasis on prevention, this study will establish an cost effective management protocol of birth asphyxia babies in my institution.

KEYWORDS

Birth Asphyxia, Hypoxic Ischemic Encephalopathy, serum calcium, blood glucose

INTRODUCTION:-

Perinatal asphyxia has an incidence of 1 to 6 per 1,000 live full-term births, and represents the third most common cause of neonatal death (23%) after preterm birth (28%) and severe infections (26%).

According to World Health Organization estimates, in the developing countries 3% of all infants (3.6 millions) suffer from moderate to severe birth asphyxia, of which 23% (840,000) die and approximately the same number develop serious sequelae. Perinatal asphyxia is a threat to fetus or newborns due to lack of oxygen and/or perfusion to brain and other organs. It is often associated with multiple pathophysiological consequences, which lead to multiorgan dysfunction. Calcium is an important second messenger in our body and also helps carrying out muscle function and acts as cofactor for several enzymatic activities.

Hypocalcemia triggers seizure activity and deleterious cardio vascular sequences in asphyxiated newborns. It is difficult to differentiate the seizure activity due to hypocalcemia and asphyxia. Therefore monitoring of serum calcium levels assumes the importance in birth asphyxia.

Perinatal stress including neonatal asphyxia is one of important cause of hypoglycemia.^(1,2) Recurrent hypoglycemia may impair brain function and child development, later on. Long-term sequelae of severe hypoglycemia were recurrent seizure and mental retardation. Permanent defect of the brain may develop after hypoglycemia.⁽³⁾ Nowadays, early diagnosis and treatment of neonatal hypoglycemia is considered to be the best choice in preventing further brain damage.⁽⁴⁾ As prevention is more important than treatment and there is no such type of study that has been done previously in this institution, SCB medical college Cuttack, Odisha where the patient burden is much more higher than resources in comparison to health facilities of other states or that of national or international standards, this study was conducted to find out the changes in serum calcium & blood glucose

level in newborns with moderate & severe birth asphyxia and also the outcome and hence to formulate an effective management protocol in my institution.

MATERIALS AND METHODS:-

A prospective case control study was conducted in Department of Pediatrics, Newborn ward of S.C.B. Medical College & Hospital and SVPPGIP, Cuttack, Odisha from September 2017 to September 2019 by taking 202 newborns having history and clinical features of moderate & severe hypoxic ischemic encephalopathy and they were evaluated for their serum calcium and blood glucose levels.

SAMPLE SIZE CALCULATION:-

Sample size was calculated using following formula :-

$$n = \frac{Z^2 P(1-P)}{d^2}$$

Where n= Sample Size

P= Expected population diseased

(1-P)= Population not diseased

Z=A value of standard normal variate=1.92

d=deviation or absolute tolerable error=0.05

Inclusion Criteria

Term AGA newborn admitted to the dept. of Pediatrics at SVPPGIP & SCBMCH, Cuttack, with diagnosis of moderate and severe birth asphyxia as per **SARNAT & SARNAT** staging of Hypoxic ischemic encephalopathy (**CASE**).

Term AGA newborn admitted to the dept. of Pediatrics at SVPPGIP & SCBMCH, Cuttack, without birth asphyxia (**CONTROL**).

Exclusion Criteria:

1. Preterm babies (<37 weeks of gestational age)
2. Babies with severe congenital Malformations

3. Suspected inborn errors of metabolism
4. Congenital infections
5. Babies receiving diuretics prior to evaluation
6. IUGR babies
7. Septicemia
8. Low birth weight babies
9. LGA babies

METHODOLOGY:

Clearance was taken from institutional ethics committee and written informed consent from the parents of all the enrolled subjects as per inclusion criteria. Moderate & severe birth asphyxia cases were diagnosed clinically by neurological examination (consciousness, impaired responses to stimuli such as light, touch or even noxious stimuli, brainstem reflexes, including pupillary, corneal, oculocephalic, cough and gag reflexes, abnormal eye movements, weak or absent suck and swallow with poor feeding, apnea or abnormal respiratory patterns, motor abnormalities like hypotonia, hypertonia, weakness, abnormal posture, seizures) and categorized as per SARNAT & SARNAT staging. Clinical presentations of hypocalcemia (neuromuscular irritability- myoclonic jerks, jitteriness, exaggerated startle, and seizures) and hypoglycemia (stupor, jitteriness, tremors, apathy, episodes of cyanosis, convulsions, intermittent apneic spells or tachypnea, weak and high pitched cry, limpness and lethargy, difficulty in feeding and eye rolling) if present were noted. The analysis was done in all the cases & control wherever indicated as per standard protocol. In all newborn relevant information were collected in a predesigned proforma. Blood samples were collected with aseptic measures and sent for investigations.

Ionized serum Ca was estimated at the time of admission, at 24hr, 48hr and 72hr by using electro analyzer on the basis of ion selective electrodes. Blood glucose was also estimated at the time of admission, at 24hr, 48hr, 72hr by glucose oxidase method.

The comparison of levels of serum calcium and blood glucose between neonates with asphyxia and non asphyxia and between moderate and severe asphyxia was made, which was analyzed with outcome.

Statistical Analysis:

Statistical analysis was done by statistical software SPSS for windows version 21. P values were calculated using chi- square test and ANOVA (Analysis Of Variance) test. $p < 0.05$ was considered as significant and $p < 0.01$ as highly significant.

RESULTS & DISCUSSION:-

In the present study 202 newborns were selected, **147 newborns were asphyxiated & 55 served as control group**. Out of 147 asphyxiated newborns, 109 (74.14%) were of moderate birth asphyxia & 38 (25.86%) of severe birth asphyxia. Various clinical and biochemical parameters and results were analyzed and statistically scrutinized and compared.

In the present study mean serum calcium level was found to be low in babies with moderate birth asphyxia (0.85 ± 0.12 mmol/l) as compared to control (1.06 ± 0.15 mmol/l).

Table-1:- Showing Mean Serum Calcium Levels Of Babies With Moderate Birth Asphyxia In Comparison To Control At Different Time Periods

TIME PERIOD	HIE-2	CONTROL	P value
At 0 hr	0.85 ± 0.12	1.06 ± 0.15	0.0001
At 24 th hr	0.92 ± 0.11	1.19 ± 0.08	0.0001
At 48 th hr	1.07 ± 0.13	1.25 ± 0.06	0.0001
At 72 nd hr	1.20 ± 0.10	1.29 ± 0.05	0.0001

Mean serum calcium level (mmol/l); ANNOVA test & Post hoc Bonferroni test Mean serum calcium level of babies with moderate birth asphyxia at the time of presentation to hospital was 0.85 ± 0.12 mmol/l, as compared to control group which was 1.06 ± 0.15 mmol/l. It gradually improved after initiation of treatment. After 24hr, 48 hr & 72 hr it was 0.92 ± 0.11 mmol/l, 1.07 ± 0.13 mmol/l, & 1.20 ± 0.10 mmol/l in babies with moderate birth asphyxia as compared to 1.19 ± 0.08 mmol/l, 1.25 ± 0.06 mmol/l & 1.29 ± 0.05 mmol/l in control group respectively. The difference was significant statistically ($P < 0.05$).

Mean serum calcium level of severe birth asphyxia group (0.74 ± 0.14 mmol/l) was found to be low as compared to control (1.06 ± 0.15 mmol/l).

Table-2:- Showing Mean Serum Calcium Levels Of Babies With Severe Birth Asphyxia In Comparison To Control At Different Time Periods

TIME PERIOD	HIE-3	CONTROL	P value
At 0 hr	0.74 ± 0.14	1.06 ± 0.15	0.0001
At 24 th hr	0.83 ± 0.10	1.19 ± 0.08	0.0001
At 48 th hr	0.91 ± 0.10	1.25 ± 0.06	0.0001
At 72 nd hr	1.03 ± 0.09	1.29 ± 0.05	0.0001

Mean serum calcium level (mmol/l); ANNOVA test & Post hoc Bonferroni test.

Mean serum calcium level of babies with severe birth asphyxia at the time of presentation to hospital was 0.74 ± 0.14 mmol/l, as compared to control group which was 1.06 ± 0.15 mmol/l. It gradually improved after initiation of treatment. After 24hr, 48 hr & 72 hr it was 0.83 ± 0.10 mmol/l, 0.91 ± 0.10 mmol/l, & 1.03 ± 0.09 mmol/l in babies with severe birth asphyxia as compared to 1.19 ± 0.08 mmol/l, 1.25 ± 0.06 mmol/l & 1.29 ± 0.05 mmol/l in control group respectively. The difference in mean serum calcium levels between babies with severe birth asphyxia & control group at different time periods after hospitalization was significant statistically ($P < 0.05$).

Mean serum calcium level of severe birth asphyxia group (0.74 ± 0.14 mmol/l) was found to be lower than moderate birth asphyxia group (0.85 ± 0.12 mmol/l).

Table-3:- Showing Mean Serum Calcium Levels Of Babies With Moderate Birth Asphyxia & Severe Birth Asphyxia At Different Time Periods

TIME PERIOD	HIE-2	HIE-3	P value
At 0 hr	0.85 ± 0.12	0.74 ± 0.14	0.0001
At 24 th hr	0.92 ± 0.11	0.83 ± 0.10	0.0001
At 48 th hr	1.07 ± 0.13	0.91 ± 0.10	0.0001
At 72 nd hr	1.20 ± 0.10	1.03 ± 0.09	0.0001

Mean serum calcium level (mmol/l); ANNOVA test & Post hoc Bonferroni test.

At the time of presentation to hospital mean serum calcium level of babies with moderate birth asphyxia was 0.85 ± 0.12 mmol/l & babies with severe birth asphyxia was 0.74 ± 0.14 mmol/l. It gradually improved after initiation of treatment. After 24hr, 48 hr & 72 hr it was 0.92 ± 0.11 mmol/l, 1.07 ± 0.13 mmol/l, & 1.20 ± 0.10 mmol/l in babies with moderate birth asphyxia as compared to 0.83 ± 0.10 mmol/l, 0.91 ± 0.10 mmol/l, & 1.03 ± 0.09 mmol/l in babies with severe birth asphyxia respectively. The difference was significant statistically ($P < 0.05$).

In this study percentage of hypocalcemic babies found to be more in moderate birth asphyxia group as compared to control group & it was significant statistically ($P < 0.05$).

Table-4:- Showing Number Of Hypocalcemic Babies In Moderate Birth Asphyxia Group In Comparison To Control Group At Different Time Periods

TIME PERIOD	HIE-2 No.(%)	CONTROL No.(%)	P value
At 0 hr	101(92.7%)	20(36.4%)	<0.001
At 24 th hr	93(85.3%)	2(3.6%)	<0.001
At 48 th hr	36(33%)	1(1.8%)	<0.001
At 72 nd hr	5(4.6%)	1(1.8%)	0.372

Hypocalcemia (sr Ca <1mmol/l); ANNOVA test & Post hoc Bonferroni test.

At presentation 101(92.7%) babies of moderate birth asphyxia group were hypocalcemic in comparison to 20 (36.4%) babies of control group.

After 24hr, 48hr & 72hr number of hypocalcemic babies in moderate birth asphyxia group were 93 (85.3%), 36 (33%) & 5 (4.6%) respectively, whereas number of hypocalcemic babies in control group were 2(3.6%), 1(1.8%) & 1(1.8%) respectively. The difference was significant statistically ($P < 0.05$), except at 72nd hr.

This study also showed that percentage of hypocalcemic babies in severe birth asphyxia group were more than control group & it was significant statistically ($P < 0.05$).

Table-5:- Showing Number Of Hypocalcemic Babies In Severe Birth Asphyxia Group In Comparison To Control Group At Different Time Periods

TIME PERIOD	HIE-3 No.(%)	CONTROL No.(%)	P value
At 0 hr	37(97.4%)	20(36.4%)	<0.001
At 24 th hr	37(97.4%)	2(3.6%)	<0.001
At 48 th hr	31(81.6%)	1(1.8%)	<0.001
At 72 nd hr	17(44.7%)	1(1.8%)	<0.001

Hypocalcemia (sr Ca <1mmol/l); ANNOVA test & Post hoc Bonferroni test.

At presentation 37 (97.4%) babies of severe birth asphyxia group were hypocalcemic in comparison to 20 (36.4%) babies of control group. After 24 hr, 48hr & 72hr number of hypocalcemic babies in severe birth asphyxia group were 37 (97.4%), 31 (81.6%) & 17 (44.7%) respectively, whereas number of hypocalcemic babies in control group were 2(3.6%), 1(1.8%) & 1(1.8%) respectively. The difference was significant statistically (P<0.05).

In the present study, number of hypocalcemic babies found to be more in severe birth asphyxia group as compared to moderate birth asphyxia group.

Table-6:- Showing Comparison Between Number Of Hypocalcemic Babies In Moderate Birth Asphyxia & Severe Birth Asphyxia Group At Different Time Periods

TIME PERIOD	HIE-2 No.(%)	HIE-3 No.(%)	P value
At 0 hr	101 (92.7%)	37(97.4%)	0.297
At 24 th hr	93(85.3%)	37(97.4%)	0.045
At 48 th hr	36(33%)	31(81.6%)	<0.001
At 72 nd hr	5(4.6%)	17(44.7%)	<0.001

Hypocalcemia (sr Ca <1mmol/l); ANNOVA test & Post hoc Bonferroni test

At presentation 101(92.7%) babies of moderate birth asphyxia group were hypocalcemic in comparison to 37 (97.4%) babies of control group. After 24 hr, 48hr & 72hr number of hypocalcemic babies in moderate birth asphyxia group were 93(85.3%), 36(33%) & 5(4.6%) respectively, whereas number of hypocalcemic babies in severe birth asphyxia group were 37(97.4%), 31(81.6%) & 17(44.7%) respectively. The difference was significant statistically at 48th hr & 72nd hr (P<0.05). The present study showed that risk of hypocalcemia increased with severity of birth asphyxia.

Jajoo *et al* (1995) study showed that asphyxiated full term (AGA) as well as full term (IUGR) infants had significantly lower serum calcium level than control infants⁽¹⁾. Similar result was found by BK Jain, Daljit Singh *et al* (2000); Seema Rai *et al* (2015). Najaf Masood *et al* (2016) observed low calcium level in asphyxiated group and concluded that hypocalcaemia showed linear correlation with severity of birth asphyxia.

Similar result was observed by Rahman F, Siddique MAB *et al* in the year 2017. Study by G Joag *et al* (2017) showed similar result of decreased mean value of serum calcium in asphyxiated newborns which had positive correlation with the severity of birth asphyxia.

Basu *et al* (2010) study showed that among the cases, hypocalcemia developed early and simultaneously and the decrease in the serum level was directly proportional to the degree of asphyxia. In the present study mean blood glucose level of babies with moderate (79.91±66.95 mg/dl) was found to be less as compared to control group (90.84±31.89 mg/dl).

Table-7:- Showing Mean Blood Glucose Level Of Babies With Moderate Birth Asphyxia In Comparison To Control At Different Time Periods

TIME PERIOD	HIE-2	CONTROL	P value
At 0 th hr	79.91±66.95	90.84±31.89	0.627
At 24 th hr	87.52±55.69	112.27±22.95	0.002
At 48 th hr	96.21±26.86	120.36±17.72	0.0001
At 72 nd hr	104.55±21.37	122.80±18.83	0.001

Mean blood glucose levels (mg/dl); ANNOVA test & Post hoc Bonferroni test

Mean blood glucose levels of babies with moderate birth asphyxia at the time of presentation to hospital was 79.91±66.95mg/dl as compared to control group which was 90.84±31.89mg/dl. It gradually improved after initiation of treatment. After 24hr, 48hr & 72hr it was 87.52±55.69 mg/dl, 96.21±26.86 mg/dl & 104.55±21.37 mg/dl in babies with moderate birth asphyxia in comparison to 112.27±22.95 mg/dl, 120.36±17.72 mg/dl, & 122.80±18.83 mg/dl in babies of control group respectively. The difference was significant statistically (P< 0.05) except at the time of presentation (P>0.05). Mean blood glucose level of severe birth asphyxia group (41.71±14.72 mg/dl) was less than control group (90.84±31.89 mg/dl).

Table-8:- Showing Mean Blood Glucose Level Of Babies With Severe Birth Asphyxia In Comparison To Control At Different Time Periods

TIME PERIOD	HIE-3	CONTROL	P value
At 0 th hr	41.71±14.72	90.84±31.89	0.0001
At 24 th hr	56.18±17.21	112.27±22.95	0.0001
At 48 th hr	72.68±15.68	120.36±17.72	0.0001
At 72 nd hr	85.00±16.77	122.80±18.83	0.0001

Mean blood glucose levels (mg/dl); ANNOVA test & Post hoc Bonferroni test.

Mean blood glucose levels of babies with severe birth asphyxia at the time of presentation to hospital was 41.71±14.72 mg/dl as compared to control group which was 90.84±31.89mg/dl. It gradually improved after initiation of treatment. After 24hr, 48hr & 72hr it was 56.18±17.21 mg/dl, 72.68±15.68 mg/dl & 85.00±16.77 mg/dl in babies with severe birth asphyxia in comparison to 112.27±22.95 mg/dl, 120.36±17.72 mg/dl, & 122.80±18.83 mg/dl in babies of control group respectively. The difference was significant statistically (P< 0.05). Mean blood glucose level of severe birth asphyxia group (41.71±14.72 mg/dl) was less than moderate birth asphyxia group (79.91±66.95 mg/dl).

Table-9:- Showing Mean Blood Glucose Level Of Babies With Moderate Birth Asphyxia In Comparison To Severe Birth Asphyxia At Different Time Periods

TIME PERIOD	HIE-2	HIE-3	P value
At 0 th hr	79.91±66.95	41.71±14.72	0.001
At 24 th hr	87.52±55.69	56.18±17.21	0.001
At 48 th hr	96.21±26.86	72.68±15.68	0.001
At 72 nd hr	104.55±21.37	85.00±16.77	0.001

Mean blood glucose levels (mg/dl); ANNOVA test & Post hoc Bonferroni test.

At the time of presentation to hospital mean blood glucose level of babies with moderate birth asphyxia was 79.91±66.95mg/dl & babies with severe birth asphyxia was 41.71±14.72 mg/dl. It gradually improved after initiation of treatment. After 24hr, 48 hr & 72 hr it was 87.52±55.69 mg/dl, 96.21±26.86 mg/dl & 104.55±21.37 mg/dl in babies with moderate birth asphyxia as compared to 56.18±17.21 mg/dl, 72.68±15.68 mg/dl & 85.00±16.77 mg/dl in babies with severe birth asphyxia respectively. The difference was significant statistically (P<0.05).

In this study percentage of hypoglycemic babies found to be more in moderate birth asphyxia group as compared to control group.

Table-10:- Showing Number Of Hypoglycaemic Babies In Moderate Birth Asphyxia Group In Comparison To Control Group At Different Time Periods

TIME PERIOD	HIE-2 No. (%)	Control No. (%)	P value
At 0 hr	20 (18.3%)	6(10.9%)	0.218
At 24 th hr	1(0.9%)	0(0%)	0.476
At 48 th hr	0(0%)	0(0%)	1
At 72 nd hr	0(0%)	0(0%)	1

Hypoglycemia (RBS<45 mg/dl)

At presentation 20(18.3%) babies from moderate birth asphyxia group were hypoglycemic in comparison to 6(10.9%) babies from control group. After 24 hr 1 baby (0.9%) from moderate birth asphyxia group & no baby from control group were hypoglycaemic. The difference

was not significant ($P>0.05$). This study showed that percentage of hypoglycemic babies found to be more in severe birth asphyxia group as compared to control group.

Table-11:- Showing Number Of Hypoglycaemic Babies In Severe Birth Asphyxia Group In Comparison To Control Group At Different Time Periods

TIME PERIOD	HIE-3 No.(%)	Control No.(%)	P value
At 0 hr	30(78.9%)	6(10.9%)	< 0.001
At 24 th hr	10(26.3%)	0(0%)	< 0.001
At 48 th hr	0(0%)	0(0%)	1
At 72 nd hr	0(0%)	0(0%)	1

Hypoglycemia (RBS<45 mg/dl)

At presentation 30(78.9%) babies from severe birth asphyxia group & 6(10.9%) babies from control group were hypoglycemic. After 24hr, 10(26.3%) babies from severe birth asphyxia group & no baby from control group were hypoglycemic. The difference was significant statistically ($P<0.05$). In between severe & moderate birth asphyxia group percentage of hypoglycaemic babies were more in severe birth asphyxia group.

Table-12:- Showing Comparison Between Number Of Hypoglycemic Babies In Moderate Birth Asphyxia & Severe Birth Asphyxia Group At Different Time Periods

TIME PERIOD	HIE-2 No.(%)	HIE-3 No.(%)	P value
At 0 hr	20(18.3%)	30(78.9%)	< 0.001
At 24 th hr	1(0.9%)	10(26.3%)	< 0.001
At 48 th hr	0(0%)	0(0%)	1
At 72 nd hr	0(0%)	0(0%)	1

Hypoglycemia (RBS<45 mg/dl)

At presentation 20 (18.3%) babies from moderate birth asphyxia group were hypoglycemic in comparison to 30 (78.9%) babies from severe birth asphyxia group. After 24hr 1(0.9%) baby with moderate birth asphyxia was hypoglycaemic & 10(26.3%) babies with severe birth asphyxia were hypoglycaemic. The difference was significant statistically ($P<0.05$). This study showed that risk of hypoglycemia increased with severity of birth asphyxia.

Basu P, Som S, Choudhuri, Das H. *et al* (2009)⁽⁴⁾ study showed mean plasma glucose level was significantly lower in asphyxiated babies as compared to control. Kliegman *et al* BF 2007⁽⁶⁾ showed in their study that mean plasma glucose was lower in newborns with asphyxia.

Seema Rai, Kiratpal Kaur Bhatiyani, Sharanjit Kaur *et al* in their study found that there was a significant decrease in the serum glucose in asphyxiated babies as compared to control and decrease was directly proportional to the degree of asphyxia.⁽⁷⁾ Xu *et al.* and Davis *et al.*, Xu *et al.* observed in their study, at day 1 of life, in asphyxiated neonates that temporary hyperinsulinism contributed to hypoglycaemia in these babies.⁽⁸⁾ The present study showed that survival was more with normal serum calcium level as compared to low serum calcium level (95.5% vs 74.7%) whereas fatal outcome was more with low serum calcium level as compared to normal serum calcium level (22.2% vs 2.3%).

Table-13:- Effect Of Level Of Serum Calcium With Outcome

Serum Calcium Level	SURVIVAL	DEATH
Normal (n=44)	42(95.5%)	1(2.3%)
Low (n=158)	118(74.7%)	35(22.2%)

$P=0.002$ (chi square)

Out of 44 babies with normal serum calcium level 42(95.5%) babies survived & 1(2.3%) baby died. Out of 158 babies with low serum calcium level 118(74.7%) babies survived & 35(22.2%) babies died. Low serum calcium level was associated with more fatal outcome. The difference was statistically significant. ($P<0.05$). Low serum calcium level was associated with more fatal outcome. The difference was statistically significant as $P<0.05$. It was similar to the findings observed by Mishra *et al* ; Najif Masood *et al*; Rahman F *et al* ; Pradhan *et al* in their studies.

The present study showed that survival was more with normal blood glucose level as compared to low blood glucose level (92.5% vs

44.6%) whereas death was more with low blood glucose level (48.2% vs 6.2%).

Table-14:- Effect Of Blood Glucose With Outcome

Blood glucose level	SURVIVAL	DEATH
Normal (n=146)	135 (92.5%)	9 (6.2%)
Low (n=56)	25 (44.6%)	27 (48.2%)

$P<0.001$ (chi square)

Out of 146 babies with blood glucose 135(92.5%) babies survived & 9(6.2%) babies died. Out of 56 babies with low blood glucose 25(44.6%) babies survived & 27(48.2%) babies died. Low blood glucose level was associated with more fatal outcome. The difference was statistically significant. ($P<0.05$). Jason Khay Ghim Tan *et al* in their study found early recurrent hypoglycemia was associated with increased risk of death or severe disability.

CONCLUSION

The present study concludes that serum calcium & blood glucose levels are significantly low in moderate to severe birth asphyxia babies in comparison to normal newborns. The study also shows that the serum calcium & blood glucose levels are significantly low in babies with severe birth asphyxia as compared to moderate birth asphyxia. Mortality & morbidity is very high in patient having significantly low serum calcium & blood glucose level. Early diagnosis & prompt management of hypocalcemia & hypoglycaemia can reduce the HIE related mortality & morbidity.

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