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RESEARCH ARTICLE

To study the effect of mode of delivery on umbilical cord cortisol level.

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Abstract

perinatal stress and pain. The mode of delivery results in specific amounts of cortisol in blood samples taken from the umbilical cord immediately at birth. Stress of cortisol may trigger HPA axis which may have percussions later in life as infants develop.

Aims and Objectives: To study the response of umbilical blood cortisol and anthropometry in newborns with respect to mode of delivery that is Cesarean section (CS) and Vaginal delivery.

Materials and Method: The study was conducted between July 2014 and March 2015,written consent was obtained from 35 pregnant subjects at the time of admission to the ward, were divided into two groups based on mode of delivery, vaginal delivery and section, and blood cortisol was analysed on cord blood sample at the SKNMC and General Hospital, Pune.

Result:: Out of total 35 new borns were studied there was no significant difference in anthropometry parameters like age, weight, head circumference, chest circumference, lenghth, abdominal circumference , however the levels of cortisol was significantly more in vaginal delivery 356.92 (± 188.27) ng/ml as compared with caesarean section. 164.87 (± 113.24) ng/ml (P vakue = 0.002)

Conclusion: Human fetus mounts a cortisol response during the partition and this response is highest during the section as compared to the vaginal delivery. The cortisol may trigger HPA axis which may have percussions in adult life.

Introduction: Cortisol is released in response to

INTRODUCTION

Cortisol is glucocorticoid class of hormone, and is produced in humans by the zona fasciculata of the adrenal cortex within the adrenal gland.[1] It is released in response to stress and low blood-glucose concentration. There is increasing evidence that perinatal stress and pain can have a long term effects [2,3,4]. Birth is a process which is most stressful experience undergone by most babies. [5]. It is well known that partiution is associated with a large increase in the levels of fetus stress hormones such as cortisol and catecholamines [6,7,8] Birth is a painful process for the mother and that during the late gestation fetus is able to feel pain, birth may be painful to the fetus.[5] Several studies have shown that caesarean section (CS) are less painful to the fetus than the spontaneous vaginal

deliveries, in which cord blood cortisol , beta endorphin and catecholamines levels are much lower.[9-13] The hormones present in the fetal circulation have a few main sources. hormones in fetal plasma may be derived from circulating precursor molecules by fetal or placental tissues metabolism [14,15], nutritional challenges increase cata- bolic hormone concentrations (e.g. cortisol). [14,15,16] Gluco- corticoid concentrations in the fetus throughout most of the gestation period are low and are derived from the mother following maternofetal concentration gradient. This transplacental concentration gradient is maintained by placental enzyme 11b-hydroxysteroid dehydrogenase type 2 (11b-HSD-2) which plays a pivotal role in controlling fetal exposure to high levels of maternal glucocorticoid by converting cortisol into its inactive metabolite, cortisone. [14,15,17-20] This enzyme is the key factor in limiting fetal and placental exposure to maternal glucocorticoids. [21,22,23] Once the fetal adrenal cortex is activated in late gestation, the fetus becomes the primary source of circulating glucocorticoids. The result is a progressive increase in both: the basal cortisol levels and the adrenocortical responsiveness to adverse conditions.[14,16,24] Increased fetal glucocorticoid exposure can therefore occur as a result of increased maternal cortisol levels, decreased placental 11b-HSD-2 activity or increased cortisol output by the fetal adrenal. The mode of delivery results in specific amounts of cortisol in blood samples taken from the umbilical cord immediately at birth. [25-29]
We planned to undertake the study in order to find out whether there is any difference in the levels of cortisol in full term infants with respect to mode of delivery.

Objectives:-

1. To study the response of umbilical blood cortisol in newborns with respect to mode of delivery that is Cesarean section (CS) and Vaginal delivery.
2. To study anthropometry in new borns delivered by Cesarean section (CS) and Vaginal delivery.

Materials and Method:-

This research was granted ethics approval by the institutional ethical committee. The study was conducted between July 2014 and March 2015, written consent was obtained from 35 pregnant subjects at the time of admission to labor and delivery at the SKNMC and General Hospital, Pune. No attempt was made to assess ethnicity or socioeconomic status. The catchment area for this hospital was predominantly middle class and suburban.

Consent addressed access to labor and delivery chart records and approval for additional umbilical cord blood sampling, immediately after the standard clinical practice of obtaining umbilical cord samples for to quantify corticosteroid hormones was obtained. All newborns were delivered in term, vaginally, in less then 8 hours from the beginning of the active phase of the first stage of delivery, and between 8 The gestational age was calculated according to the first day of the last menstrual period and was corrected by ultrasonic assessment when a discrepancy exceeded one week. In all cases APGAR score was rated as greater or equal to eight in the first and fifth minute.

Multiple pregnancies, pregnancies complicated by preeclampsia or diabetes, stillborns and malformed newborns were excluded from the study. Tobacco, alcohol, or medications other than ferrous sulfate during pregnancy were not taken.Other deliveries were included in the study. Care was taken to see that vasoactive and anal- gesic drugs were not administered to the mother in the labor before delivery of the fetus. The data of maternal age and parity, gestational age, newborns gender and birthweight were collected during and after delivery. 2 ml of cord blood samples were taken from the umbilical vein into plain tubes immediately after newborns delivery when the umbilical cord was clamped and before delivery of the placenta.
Samples were immediately refrigerated, and allowed to stand for at least one hour before being centrifuged (4000 G for 5 min).Serum was separated, stored at 2–8°C and afterwards all samples were analyzed all at the same time for serum cortisol levels,using automated Immuno analyser, Mini Vidas® at Department of Biochemistry, SKNMC and GH, Pune. Results were coded by author and hormone analyses in the research setting were blind to patient name and mode of delivery.

Result:-

A total of 35 new borns were studied , they were divided into two groups those delivered by vaginal delivery and those delivered by section,

Table 1 illustrates the anthropometry study between both the groups.

The mean age of mothers in case of vaginal delivery was 22.9 years as compared to caesarean section which was 23.7 years , statistically this was not significant.

Mean weight of new borns in case of vaginal delivery was 2659 grams as compared to caesarean section which was 2680 grams, statistically this was not significant.

Head circumference of new borns in case of vaginal delivery was 34.7 cms as compared to caesarean section which was 35 cms , statistically this was not significant.

Chest circumference in case of new borns in case of vaginal delivery was 32.9 cms as compared to caesarean section which was 33.1 cms , statistically this was not significant.

Length of new born in case of vaginal delivery was 44.6 cms as compared to caesarean section which was 46.7 cms , statistically this was not significant.

Abdominal Circumference of new borns in case of vaginal delivery was 26.4 cms as compared to caesarean section which was 26.2 cms , statistically this was not significant.

Table no 1 : Comparision of Anthropometry details of new borns.

Sr No	**Age (Years)**	**Weight (Grams)**	**HC (Cms)**	**CC (Cms)**	**Length (Cms)**	**Abd Circum (Cms)**
Vaginal Delivery	22.9 (± 3.49)	2659 (± 380)	34.7 (± 2.7)	32.9 (± 2.07)	44.6 (± 3.4)	26.4 (± 2.5)
Caesarean Section	23.7 (± 3.19)	2680 (± 450)	35 (± 2.7)	33.1 (± 2.6)	46.7 (± 2.9)	26.2 (± 1.98)
P Value	NS	NS	NS	NS	NS	NS

Table 2:- Comparision of Cortisol details of new borns.

Sr No	**Umbilical Cord blood Cortisol**
Vaginal Delivery (n=27)	356.92 (± 188.27) ng/ml
Caesarean Section(n=8)	164.87 (± 113.24) ng/ml
P Value	0.002 (less than 0.01, so significant)

If P is < 0.001 it is significant.

Table 2 Illustrates the comparision of level of cortisol in both the groups. The level of umbilical cord blood cortisol in case of Vaginal Delivery was 356 ng/ml compared to Caesarean Section which was 164 ng/ml. this figure was statistically significant .

FIGURE 1 : SCATTER DIAGRAM OF DISTRIBUTION OF CORTISOL

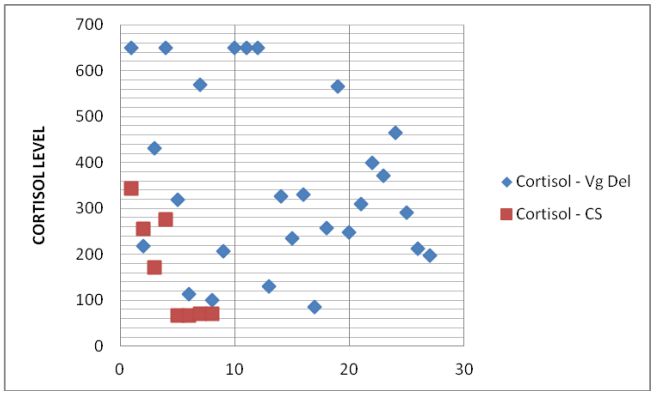

Figure 1 shows the scatter distribution of cortisol (ng/ml) levels in both the groups.

DISCUSSION:

Cortisol hormone is secreted from Zona Fasciculata of the adrenal cortex .Its level in new born is different depending from the mode of delivery is the most important factor, particularly vaginal versus caesarean.n We have used mixed blood and there have been various other studies which have used mixed or venous cord blood, which contains a higher percentage and varying proportions of maternal cortisol. This could be impounding factor, Although we cannot exclude a maternal cortisol contribution (indeed there will be a component), This has demonstrated that it is not just the final passage down the birth canal that raises cortisol, but that contractions themselves which stresses the fetus and raises the cortisol levels. [30]

Birth is a stressful event and there are significant changes in the hormonal profile associated with parturition, particularly in the stress-related hormones. Plasma concentrations of catecholamines in both the fetus (predominantly norepinephrine) and mother (predominantly epinephrine) are markedly elevated during labor and delivery [31,32,33] It is thought that the characteristic elevation in the concentration of catecholamine in cord blood after an uncomplicated vaginal birth (typically 10–15 times higher than that observed in a resting adult) is advantageous to both the birthing fetus and newly born infant. A surge in catecholamines promotes normal breathing, increases blood flow to the heart and brain, mobilizes fuel, and increases infant alertness [32] . Whereas extremely high concentrations of catecholamines in cord blood are associated with severe oxygen deprivation to the fetus, no surge at all is associated with low Apgar scores [32]. This is a concern for infants born by elective cesarean delivery because they do not typically have an increase in catecholamine concentrations; infants born of mothers who begin labor but end with a cesarean delivery have catecholamine concentrations higher than those born by an elective cesarean, but lower concentrations than those born by vaginal delivery [33,34] Other hormones reportedly affected by the birth process include prolactin, insulin, adrenocorticotropin, and cortisol [33,35,36] In a study of 51 mother-infant pairs, free cortisol concentrations were significantly higher in both mothers and infants at term in 21 cases of fetal distress (persistent bradycardia resulting in vacuum or forceps delivery) than in 30 cases of uncomplicated vaginal delivery. **[36]** In our study, cortisol level was statistically highly significant in CS when compared to full term vaginal delivery . From the level of cortisol we can conclude that, there is a highly complex process involving the interaction of metabolic hormones and their roles in the regulation of glucose homeostasis weight gain and growth of newborns whether preterm or full term babies. As the time duration of vaginal delivery is longer than cesarean delivery, the neonate born by vaginal delivery is subjected to under more stressful conditions before birth. The, cortisol level was affected by low pH, maternal gravidity or parity, and vaginal delivery, which indicates that physiological responses are necessary to adapt to the changes in intrauterine circumference from the fetal period to the neonatal period [38]. According to Chernukha et al, in the course of vaginal delivery, maternal cortisol level increases significantly, the rise being higher in parturients with growth retarded fetuses [39]. The corticotropin-releasing hormone concentrations may enhance the predictive value of midgestational maternal corticotrophin releasing hormone as a screening parameter for the prediction of preterm birth. [40].

Maternal cortisol level may play an important role in intrauterine brain development (evaluated by head circumference of the neonates) [41] Stress also adversely affects milk volume and delays lactogenesis it has also been shown by animal studies that perinatal stress results in long term programming of the hypothalamic- pituatary-adrenal axis. In humans, birth is the major stressor in the perinatal period and caesarean delivery before labour is known to lower the degree of infant stress, as reflected by cord cortisol concentrations.

Summary and Conclusion:

Finally to conclude that, human fetus mounts a cortisol response during the delivery and this response is highest during the section as compared to the vaginal delivery. This stress of cortisol may trigger HPA axis which may have percussions later in life as infants develop. More detailed studies are needed . Small sample size was a major limitation of this study, we plan to undertake a bigger study, including study on maternal blood glucose concentrations, simultaneous maternal cortisol concentrations and new borns feeding behaviors as well.

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