

## EFFECTS OF INSPIRED MATERNAL OXYGENATION ON APGAR SCORE DURING ELECTIVE CAESAREAN SECTION

by

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### Introduction

The ultimate aim of administering high oxygen concentration to the mother is to improve oxygenation of the foetal tissues. A large number of factors have been shown to influence the state of foetal oxygenation which is probably the most important environmental factor having a bearing upon the eventual well-being of the infant. Because oxygen transfer to the foetus is partly dependent upon the oxygen pressure gradient across the placenta, it might be expected that increasing maternal  $PO_2$  would increase foetal  $PO_2$ . In pregnant animals, as well as in parturient women, changes in the maternal oxygen and carbon dioxide tensions have been shown to be reflected in the foetal blood-gas homeostasis Rorke *et al* (1968). However, a rise in  $PO_2$  level in the blood perfusing the placenta may cause vasoconstriction and this influence, combined with the high oxygen consumption of the placenta (Campbell *et al* 1965) might prevent significant oxygen transfer to the foetus.

### Aims and Objects

The present report concerns itself with the observations made upon 60 newborns delivered by elective caesarean section under a standard general anaesthesia, the three different inspired oxygen concentrations (33%, 60% 100%) being the only variable. The purpose being to find out at which concentration of inspired oxygen to the mother the babies are born in best possible condition, the evaluation of the condition of the baby was carried out by Apgar scoring Method (Apgar, 1953).

### Material and Method

In order to study the effects of three different oxygen concentrations upon the neonates, a group of mothers and newborns consisting of sixty patients had been selected in such a manner, that causes of depression other than maternal oxygenation might be eliminated from consideration. Injury and distress to the foetus during labour and delivery were largely ruled out by selecting the babies born by repeat or elective caesarean sections only.

All the mothers were healthy by clinical and biochemical assessment of their cardiovascular, respiratory and urinary systems. The obstetric history and exam-

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ination warranted no suspicion of the presence of any placental insufficiency or foetal distress. All the patients were at or near term, when the surgery was contemplated. In all cases the patient was not in labour and the membranes were intact at the time of operation. All the babies, were mature by birth weight, the lowest being 2700 gm. None of them had any significant malformation that could be clinically diagnosed.

Premedication consisting of promethazine 50 mg. and Hyoscine 0.4 mg. intramuscular was uniformly administered to all the patients 30 minutes prior to the surgery. The technique of anaesthesia was standardised with the sequence of preoxygenation, an intravenous sleeping dose of 2.5% thiopentone, suxamethonium 100 mg., I.P.P.V. and endotracheal intubation. Later on, the anaesthesia was maintained with 33% O<sub>2</sub>, 66% N<sub>2</sub>O and intermittent doses of tubocurarine. Pethidine in diluted doses was given intravenously, following delivery of the baby as needed.

For the purpose of our study, all the patients were divided into 3 groups of 20 each, according to oxygen of 33% O<sub>2</sub>, 60% O<sub>2</sub> and 100% O<sub>2</sub> concentration in the anaesthesia mixture administered from the start of incision of the peritoneum until clamping of the cord of the baby, which on average, covered a period of 3½ to 4 minutes.

Each newborn was given an Apgar score at 1, 2, 5 and 10 minutes after delivery by an independent observer, employing a full account of 10. The concentration of oxygen used was not known to this observer.

In addition to the scores, the time to sustained respiration (TSR), (Apgar *et al*, 1958) was also noted. The "TSR" is defined as the time taken for the new-

born after birth to achieve a regular and apparently satisfactory respiratory activity. It was noted in seconds and a TSR of under one minute is recorded as zero. There was obviously considerable room for observer error in this measurement, but on the whole it seemed to work reasonably well.

#### Observations and Results

The incidence of various major indications for caesarean section in this series have been displayed in Fig. I. In this

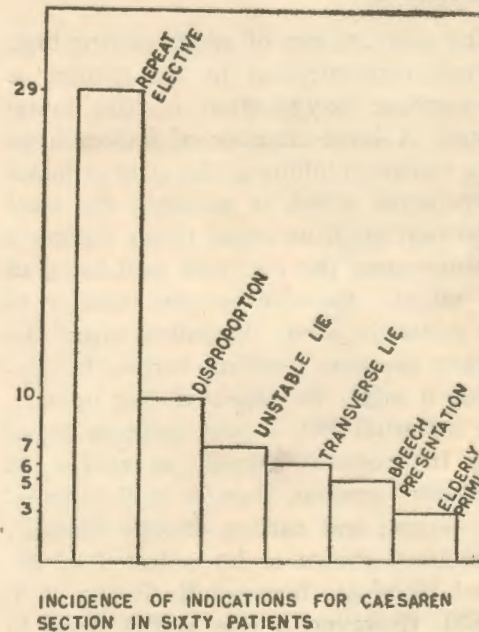


Fig. 1

group, forming the subject of main analysis, many of these indications were co-existent. However, the most commonly occurring indication was previous caesarean section, number of cases being 29.

The mean apgar scores with three different oxygen concentrations have been detailed in Fig. II. The mean scores at 1, 2, 5 and 10 minutes of infants' delivered by mothers given 60% oxygen, were all



achieved in instances of repeat caesarean sections were naturally higher than those in the overall series. In cases of repeat caesarean sections, 82.9% of the babies were born in good condition, 13.7% of the babies were born in fair condition and only 3.4% were born in poor condition. But when the indications were shared by either cephalopelvic disproportions or any other similar primary conditions, the babies were born with a distinct poorer status.

Table II shows the distribution of the

TABLE II

Neonatal Depression (1 Minute Apgar Score of 7 or Less) Related to the Induction—Delivery Interval

I-D Interval	No. of newborns	Depressed neonates
10 minutes	2	2 (100%)
10-20 minutes	43	8 (18.6%)
20-28 minutes	15	11 (73.3%)
	60 (Total)	

IDI in the group of 60 caesarean sections. The induction-delivery-interval (IDI) is defined as the time elapsed between the commencement of the intravenous thiopentone injection and the birth of baby. The babies born under general anaesthesia following induction-delivery-interval of either less than 10 minutes or more than 20 minutes showed a higher incidence of depression than those delivered between 10 and 20 minutes after induction of general anaesthesia, regardless of the concentration of oxygen administered.

#### Discussion

Complete analysis of this study shows

that the clinical condition of the neonates was improved with the elevation of inspired maternal oxygen concentration from 33% to 60% (Fig. II), although it may be pointed out that increasing the oxygen concentration from 60% to 100% did not improve the apgar score any further (Fig. II). This finding however, is in agreement with similar recent studies (Rorke *et al*, 1968; Baraka, 1970; Marx and Mateo, 1971) indicating the inspired oxygen concentration being a very important critical factor.

Increasing the concentration of inspired oxygen from 33% to 60%, in this study produced an increase in the apgar scores of the newborns (Fig. II) and shortened the "time to sustained respiration" (Fig. III), but to a variable degree. This elevated maternal oxygenation produced an increase in the oxygen levels of the foetus with consequent improved condition of the new born at birth.

Changing the inhaled oxygen concentration from 60% to 100% possibly increased maternal PaO<sub>2</sub>, but did not produce any further increase in apgar score, rather the mean apgar score was decreased (Fig. II) and time to sustained respiration was also delayed in most of the cases (Fig. III). Rorke *et al*, (1968) noted that there was an apparent critical level of approximately 300 mm. Hg. above which increase in maternal PaO<sub>2</sub> appeared to cause a decrease in foetal oxygenation. Baraka (1970) believed it to be possible that foetal PO<sub>2</sub> is determined by maternal oxygen content at the site of exchange rather than by maternal oxygen tensions.

In our present study, when allowance was made for the extent of the induction-delivery-interval (I-D-interval) the infants delivered under general anaesthesia within 10 to 20 minutes after thiopentone

induction were found to be less asphyxiated than others (Table II). Causes of depression with prolonged anaesthesia exceeding 20 minutes might be due to decreased maternal perfusion of the intervillous space resulting from compression of the inferior vena cava by the gravid uterus in the supine position, from intermittent elevation of the central venous pressure during artificial ventilation of the mother and also from surgical manipulation.

The data were further divided into infants delivered before and after 10 minutes of induction of anaesthesia (Table II). It has been shown (Hodges *et al*, 1960) that there was a statistically significant increase in mildly delayed respiratory activity at birth in infants with an IDI of 7 to 11 minutes (probably due to a minimal transient thiopentone affect) and further respiratory depression in infants with an IDI of more than 15 minutes (associated with complicated operative cases). The arbitrary division into groups in which these two factors did and did not operate would appear to be justified.

However, a statistically significant ( $p < 0.01$ ) correlation exists between the induction-delivery-interval and the apgar score of the baby, but at the same time it may be pointed out that the best possible condition of the babies were obtained when the induction-delivery-interval was limited within 10-20 minutes, provid-

ed the mother inhaled a concentration of 60% oxygen.

#### Summary

Effect on neonatal apgar score with 33%, 60% and 100% oxygen inhalations by the mother during 60 elective caesarean sections is presented. There was a statistically significant ( $p < 0.01$ ) improvement of the clinical condition of the neonate when maternal oxygenation was increased from 33% to 60%, although the further increase to 100% oxygen inhalation resulted in reduction in the apgar score. The maximum number of neonates had less than 60 seconds a "TSR" with 60% oxygen group in comparison to those with 33% and 100% oxygenation groups. The neonates delivered within 10-20 minutes after induction showed the least depression (18.6%).

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