

TIME AND LATERAL TILT AT CAESAREAN SECTION

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SUMMARY

One hundred and fifty "clinically acceptable ideal cases" undergoing elective Caesarean section under a standardized regimen of general anaesthesia were studied. In 87 cases the patient was supine throughout the procedure and in 63 cases she was tilted laterally by means of a wedge. Statistical analysis of the data derived from assays of maternal and cord blood, and of the Apgar-minus-colour scores indicated that: there was among the non-tilted patients a higher incidence, and greater degree, of birth asphyxia and of low A-C scores than in the tilt series, and that this disparity was emphasized by prolongation of the I-D interval; there was a greater variance among the results obtained from the non-tilt series, suggesting that the introduction of a tilt led to a more stable situation. It is suggested that the contrasts reflect the effect of caval occlusion by the gravid uterus, and the introduction of the terms "revealed caval occlusion" and "concealed caval occlusion" is advocated. Possibly, drug-induced depression was observed among infants who were delivered within 10 minutes of induction, but no other neonatal effects referable to the drugs used could be identified.

Neonatal depression is, with few exceptions, either drug-induced or reflective of biochemical disturbance (most commonly, asphyxia, and hereafter termed "biochemical depression"), or a combination of these two. The obstetric anaesthetist is concerned to reduce to a minimum the likelihood that an infant delivered by Caesarean section will be depressed either by the drugs given to the mother before delivery or by biochemical changes caused by the anaesthetic technique. The use of regional block should virtually eliminate the danger of drug-induced depression but, because of its effects upon maternal cardiovascular dynamics, and hence upon the efficiency of uteroplacental perfusion, it does not preclude the prospect of inducing biochemical depression (Crawford, 1966). The use of general anaesthesia invites the hazard of drug-induced depression and, as has recently been claimed (Teramo, 1968; Lumley et al., 1970; Fox and Houle, 1971), might invoke the danger of biochemical depression. When the technique of thiopentone induction, nitrous oxide-oxygen maintenance, and intermittent positive pressure ventilation under continuous muscle relaxation is used, the incidence and extent of drug-induced depression is unlikely to be formidable. It is possible that, when the induction-delivery (I-D) interval is prolonged, some slight degree of depression due to nitrous oxide might occur (Stenger, Blechner and Prystowsky, 1969; Kalappa et al., 1971), but few anaesthetists would consider this to be a problem of importance.

The writer has for many years considered that neither birth asphyxia nor clinical evidence of depression was directly correlated with the duration of the I-D interval in cases of Caesarean section when the thiopentone-nitrous oxide-relaxant sequence of anaesthesia was used (Crawford, 1962), a view which has been supported by other investigators (Cosmi and Marx, 1968; Stenger, Blechner and Prystowsky, 1969; Shnider, 1970). However, each of these reported series, including that of the present writer, was rather small.

Recently we have been perturbed by the number of infants who, after delivery by elective section, required vigorous resuscitation and provided evidence of a considerable degree of asphyxia. During the same period it has become apparent to the writer that British obstetric surgery has adopted a much more leisurely pace than was its characteristic a decade ago—possibly as a reflection of increased confidence in the standards of anaesthesia and of neonatal resuscitation. It seemed likely that the conjunction of a longer I-D interval and an increased incidence of neonatal depression was at least in part reflective of asphyxia, and thus the problem could first be attacked from this point of view.

Much has been written, especially by investigators from Edinburgh (Scott, 1968), respecting the formid-

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able effects upon maternal cardiovascular dynamics of pressure on the inferior vena cava imposed by the gravid uterus when the patient is supine. Some attention has been paid to the proposition that this disturbance might be one of the causes of neonatal asphyxia at Caesarean section (Ansari et al., 1970; Colon-Morales, 1970; Goodlin, 1971a), but the results have been equivocal. It has, however, been demonstrated that in the non-anaesthetized pregnant patient, a change of position from supine to sitting leads to an increase in the oxygen tension and a decrease in the carbon dioxide tension of arterialized capillary blood (Ang et al., 1969), and the deleterious effect upon the foetus which can result from caval occlusion has been commented upon (Goodlin, 1971b).

In view of the problem with which we were faced, and of the published observations referred to above, we decided to investigate the effect of tilting the patients laterally during Caesarean section.

MATERIAL AND METHODS

The study concerned 150 cases of elective Caesarean section, that is, Caesarean section undertaken on patients who were not in labour and whose membranes were intact. Each patient conformed to the definition of the "clinically acceptable ideal case" (Crawford, 1965): there was no evidence of placental transfer insufficiency, such as would be indicated by pre-eclamptic toxæmia, renal disease, hypertension, diabetes, rhesus incompatibility with antibodies, or intrauterine malnutrition (based on the evidence of maternal urinary excretion of oestriol), the infant was a singleton and the gestational age was more than 36 weeks and less than 42 completed weeks.

The anaesthetic technique was the same for each case. The patient was given chlorthalidone 20 mg orally early on the morning of operation, and magnesium trisilicate mixture BPC (15 ml) just as she was about to leave the ward for theatre. Once in the anaesthetic room, she was placed on the operating table and the pulse rate and blood pressure were recorded. An intravenous infusion of 5 per cent dextrose in water or 5 per cent laevulose in water was started. After a 3-4 min period of preoxygenation, the patient was given hyoscine 0.6 mg intravenously, followed by thiopentone 250-300 mg and then by suxamethonium 100 mg. An endotracheal tube was passed and after its cuff had been inflated the cricoid pressure (which had been applied before the start of injection of thiopentone) was released.

Ventilation was maintained with the aid of a Howells ventilator set to deliver a tidal volume of 800-900 ml, using a mixture of nitrous oxide 8 l./min and oxygen 4 l./min. The infusion bottle was changed for one containing suxamethonium (1 mg/ml of the original type of solution), the operating table was manoeuvred into the theatre and the operation proceeded. No nitrous oxide washout was performed before delivery. The time between the start of the injection of thiopentone and the completion of delivery of the infant was noted in minutes (I-D interval). Two laboratory timers were started at the latter instant, ringing respectively 1 min and 5 min later, at which time the Apgar score of the infant was evaluated. Scoring was performed by a second anaesthetist or by a paediatrician. Attention has been paid to the Apgar-minus-colour (A-C) scores, as the writer believes that this provides a more discriminatory evaluation of the condition of the infant than does the total Apgar score (Crawford, 1965). Thus the maximum score is 8.

At the time of delivery, a sample of maternal arterial (MA) blood was collected, a loop of umbilical cord was double-clamped, and samples of umbilical artery (UA) and umbilical vein (UV) blood were promptly drawn. The metabolic and respiratory acid-base values in each of these samples were derived by application of the Astrup micro electrode technique and the Siggaard-Andersen nomogram, the necessary corrections for haematocrit, oxygen desaturation (Radiometer OSM.1) and barometric pressure being made.

The study series, consisting of 63 patients, differed from the control series (87 patients) in only one particular: when a patient in the study series was placed upon the operating table (that is, before induction of anaesthesia) she was provided with a lateral tilt by means of a wedge. This wedge* consists of a piece of sorbo rubber covered by antistatic rubber. The approximate dimensions are: length 22 in. (56 cm); width 12 in. (30 cm); thickness at one edge 4 in. (10 cm) and thickness at the other edge 1 in. (2.5 cm). The angle of the upper plane when the wedge is placed on the table, is approximately 15 degrees to the horizontal. The wedge, wrapped in a pillow-slip for comfort and to reduce soiling, is slipped under the patient, its upper end being under the lower costal region and its lower end under her pelvis. The patient is placed right on the wedge to take full advantage of the tilt.

* Manufactured by Richardson's Antistatic (Bootle) Ltd, Liverpool.

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In order to reduce the embarrassment to the obstetricians, most of whom stand on the right side of the patient when operating, the majority of the patients were tilted to the right, despite the fact that anatomically this is the poorer choice.

RESULTS

The mean duration of the I-D interval was 15.65 min (range 7-30) in the tilt series and 16.46 min (range 7-29) in the non-tilt series.

Biochemical studies.

Examination of the correlations between the various biochemical attributes of maternal and cord blood and the respective I-D intervals, revealed the data presented in table I. Each of the correlations was small, and in the majority there was no signifi-

cant difference from zero. However, a correlation significantly different from zero was reached in respect to the relationship between UA base excess (UA.BE) and I-D interval in each series, but whereas among the tilt cases the UA.BE tended consistently to increase with increasing duration of the I-D interval, in the non-tilt series the UA.BE tended to decrease with lengthening of the interval between induction and delivery. The transplacental gradient of base excess (MA minus UA and MA minus UV) tended to increase with increasing I-D interval in the non-tilt series.

The mean values of the several biochemical attributes, together with a statistical evaluation of the differences between the two groups, is presented in table II. The acceptability of presenting these without reference to the I-D interval is shown by the fact that there is no significant difference between the two series in respect to the mean values of the duration of the interval. There was no significant difference between the mean values of maternal arterial pH; the mothers in the tilt group tended slightly, but significantly, to be more hypocarbic and to have a greater degree of metabolic acidosis than did the mothers in the non-tilt group. The contrasts between the mean values of pH and Pco₂ in blood from both umbilical artery and umbilical vein were marked and highly significant: the infants in the non-tilt series were more acidotic and more hypercarbic than were the infants in the tilt series. In respect to base excess, the tendency was for infants in the non-tilt series to have the greater degree of metabolic acidosis, but the differences (UA.BE and UV.BE) did not reach the level of statistical significance. However, this lack

TABLE I. Correlation of the induction-delivery interval with the values of pH, carbon dioxide tension (Pco₂) and base excess (BE) in maternal arterial blood at the time of delivery (MA), umbilical artery (UA) and umbilical vein (UV) blood, and the transplacental gradient of base excess (MA minus UA and MA minus UV), in the two series of elective Caesarean sections. The asterisks indicate those correlations which differ significantly from zero (P<0.05).

	Tilt (63)	Non-tilt (87)
MA pH	-0.12	0.07
MA Pco ₂	0.21*	-0.03
MA BE	0.12	-0.13
UA pH	0.06	-0.17
UA Pco ₂	0.10	-0.20*
UA BE	0.23*	-0.23*
UV pH	0.12	-0.08
UV Pco ₂	-0.06	-0.14
UV BE	0.12	-0.24*
(MA-UA) BE	-0.15	0.19*
(MA-UV) BE	-0.01	0.22*

TABLE II. Mean values with their respective standard errors (SE) and standard deviations (SD) of pH, carbon dioxide tension (Pco₂) and base excess (BE) in maternal arterial (MA), umbilical artery (UA) and umbilical vein (UV) blood taken at the time of delivery, and of the transplacental gradient of base excess (MA minus UA and MA minus UV) and of the induction-delivery (I-D) intervals, in the two series of elective Caesarean sections. The results of the t-test of significance of difference between the means are shown in the final column.

	Tilt (63)			Non-tilt (87)			Signif. of diff.
	Mean	SE	SD	Mean	SE	SD	
MA pH	7.455	0.005	0.038	7.459	0.006	0.055	n.s.
MA Pco ₂	26.94	0.57	4.52	28.86	0.71	6.58	P<0.05
MA BE	-3.18	0.28	2.23	-2.47	0.28	2.58	P<0.10
UA pH	7.309	0.005	0.039	7.270	0.010	0.091	P<0.001
UA Pco ₂	54.65	0.91	7.23	60.37	1.31	12.24	P<0.001
UA BE	-4.26	0.30	2.39	-4.82	0.37	3.49	n.s.
UV pH	7.369	0.005	0.040	7.340	0.009	0.085	P<0.02
UV Pco ₂	41.16	0.82	6.52	46.73	1.10	10.29	P<0.001
UV BE	-3.47	0.29	2.34	-3.66	0.38	3.53	n.s.
(MA-UA) BE	1.08	0.23	1.85	2.35	0.27	2.56	P<0.001
(MA-UV) BE	0.29	0.25	2.02	1.19	0.25	2.36	P<0.02
I-D (MIN)	15.65	0.59	4.67	16.46	0.64	5.98	n.s.

of significant difference can be attributed to the variability of MA.BE, because the values which represent the transplacental gradient of base excess (MA minus UA and MA minus UV) are very significantly different, the gradient being much greater in the non-tilt series.

A noteworthy feature of the data presented in table II is the marked extent of variability of the values contributing to the non-tilt series. The standard deviations for the non-tilt group are uniformly higher than those of the tilt group. A comparison of the standard deviations shows a significantly lower value in the tilt group ($P < 0.05$) for a number of variables, suggesting the presence of a real lower value throughout. Expressed in another way: there is a suggestion of uniformity in the tilt series, whereas the results from the non-tilt series give the impression of heterogeneity.

Clinical state of the neonate.

The Apgar scores of two infants, one from each series, have been disregarded in this analysis, as each infant had a cardiopulmonary congenital abnormality. The 1-minute Apgar score of one infant in the tilt series cannot be traced with certainty. In the non-tilt series, 44 of 86 infants (51 per cent) failed to score the maximum points (8) at 1 minute, as did 20 of 61 (33 per cent) of the infants in the tilt series. The incidence of failure to score 8 at 5 minutes was 15 per cent in the non-tilt series and 8 per cent in the tilt series. The incidence of failure to score 8 and of a score less than 7, in reference to the I-D interval, is presented in figures 1 and 2. It may be seen that, in the non-tilt series, the incidence of depression (both slight and moderate) at 1 minute tended to increase with an increasing duration of the I-D interval, whereas in the tilt series the tendency was, if anything, the reverse; an

increasing incidence of depression at 5 minutes correlated with increasing I-D interval is again seen in the non-tilt series (with a noteworthy high incidence of slight depression among those infants who were delivered fairly shortly after the start of anaesthesia), whereas the I-D intervals referable to the 5 cases in the tilt series in which the 5-minute score was less than the maximum present no discernible pattern.

Combined analysis of biochemical data and Apgar scores.

An analysis of the UA pH, P_{CO_2} and BE of infants grouped with reference to their (A-C) scores was undertaken. The cases in each series, tilt and non-tilt, were grouped in the following manner: those whose (A-C) scores were 8 at 1 minute and 8 at 5 minutes (denoted as 8/8); those who failed to score 8 at 1 minute but scored 8 at 5 minutes (-/8), and those who scored 8 neither at 1 minute nor at 5 minutes (-/-). No infant who scored 8 at 1 minute failed to score 8 at 5 minutes.

The standard deviations of those values (table III) confirm the observation that the variability in the non-tilt series is uniformly higher than in the tilt series. There is also a tendency, in the non-tilt series, for the variability to increase in conjunction with an

TABLE III. Standard deviations of the mean values of pH, carbon dioxide tension (P_{CO_2}) and base excess (BE) in umbilical artery blood in infants grouped according to the (A-C) scores at 1 and 5 minutes.

Umbilical artery values:		8/8	-/8	-/-
pH	Tilt	0.036	0.039	0.037
	Non-tilt	0.043	0.059	0.125
P_{CO_2}	Tilt	6.30	9.04	7.67
	Non-tilt	12.32	9.17	17.21
BE	Tilt	2.16	2.61	2.66
	Non-tilt	2.90	2.93	4.51

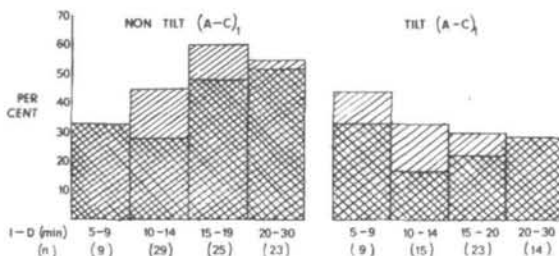


FIG. 1. Incidence of infants who failed to score 8 points out of 8 (diagonal lines) and of those who scored less than 7 points (hatched areas) in the Apgar-minus-colour score at 1 minute. Cases are considered, in each major series, in cohorts chosen with reference to the extent of the induction-delivery (I-D) interval.

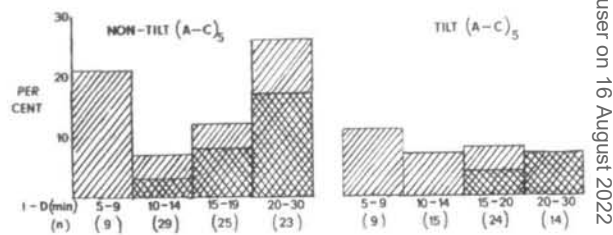


FIG. 2. Incidence of infants who failed to score 8 points out of 8 (diagonal lines) and of those who scored less than 7 points (hatched areas) in the Apgar-minus-colour score at 5 minutes. Cases are considered, in each major series, in cohorts chosen with reference to the extent of the induction-delivery (I-D) interval.

increasing degree of clinical depression, whereas such a tendency is much less apparent in the tilt series. In the non-tilt series, the tendency for pH and BE to have a higher standard deviation in the -/8 and -/- groups than in the 8/8 groups is well marked, especially in the -/- group of 14 cases. The standard deviation of the -/- group is significantly greater than that of the -/8 group in the non-tilt series for pH, Pco₂ and BE (P<0.001), although the differences between the 8/8 group and the -/8 group reaches a level of significance (P<0.05) only in respect to pH. In the tilt series, although there is an apparent tendency for the -/8 and -/- groups to have higher standard deviations and variances than the 8/8 group, a comparison of the variances by means of appropriate F tests does not establish the increase as statistically significant either with or without the -/8 and -/- groups pooled.

TABLE IV. Mean values (\pm the standard error) of pH, carbon dioxide tension (Pco₂) and base excess (BE) in the umbilical artery blood of infants grouped according to their respective (A-C) scores at 1 and 5 minutes.

Umbilical artery values:	8/8	-/8	-/-
pH			
Tilt	7.320 \pm 0.006	7.287 \pm 0.010	7.307 \pm 0.016
Non-tilt	7.295 \pm 0.007	7.248 \pm 0.010	7.218 \pm 0.033
Pco₂			
Tilt	53.34 \pm 0.98	57.49 \pm 2.33	58.14 \pm 3.43
Non-tilt	58.93 \pm 1.90	61.37 \pm 1.65	62.93 \pm 4.60
BE			
Tilt	-3.80 \pm 0.34	-5.53 \pm 0.67	-3.58 \pm 1.19
Non-tilt	-3.45 \pm 0.45	-5.59 \pm 0.52	-7.23 \pm 1.20

Examination of the means of the various values (table IV) reveals that, in the non-tilt series, an increasing degree of clinically-apparent neonatal depression is correlated directly with a progressive fall in pH and BE and a rise in Pco₂, whereas this pattern is not observed in the tilt series. However, there were only 5 cases in the -/- group of the tilt series, so not much significance should be attached to the mean values found in this group. A comparison of the means of the 8/8 and -/8 groups in the non-tilt series, using the *t*-test of significance, shows that the 8/8 group has a significantly higher pH (P<0.0005) and BE (P<0.001) than does the -/8 group, but the difference between the mean values of Pco₂ does not reach the level of significance. There are no significant differences between the means of pH, Pco₂ and BE in the -/8 and -/- groups of the non-tilt series, and this failure, despite the large differences noted in table IV, is attributable

to the very high variability observed in the -/- group (see table III). Respecting the tilt series: a comparison of the means of the 8/8 and -/8 groups shows that the former has a significantly higher pH (P<0.01) and BE (P<0.02) and a significantly lower Pco₂ (P<0.05). There are no significant differences between the means of the -/8 and -/- groups in the tilt series.

It is worth noting that, almost without exception, the infants in the non-tilt series were more acidotic than were those in the tilt series when consideration is given to grouping according to the (A-C) scores (table IV). Because of these differences, and because of the differences in the variability of the UA factors referred to previously, it is quite obviously necessary to consider the two series separately in studying the (A-C) scores and their implications. The evidence derived from this investigation also suggests, as depicted in figures 1 and 2, that the tilt series had better (A-C) scores than did the non-tilt series, firstly because of the lower incidence of cases in the -/8 and -/- groups, and secondly because the means of the (A-C) scores are higher in the -/8 and -/- groups of the tilt series, as follows:

	-/8	-/-
tilt	5.4/8	4.8/7.5
not-tilt	4.8/8	3.4/6.0

A comparison of the frequencies in each score category, by means of a χ^2 test, shows the distribution and frequencies in the tilt and non-tilt groups to be significantly different (P<0.07), and the tilt series to have significantly better scores.

DISCUSSION

Analysis of the data obtained from this study leaves little doubt that the introduction of a maternal lateral tilt during Caesarean section confers considerable benefit upon the infant: the manoeuvre abolishes, possibly reverses, the tendency to increasing foetal acidosis associated with increasing duration of the interval between induction of anaesthesia and delivery; the infants are less frequently and less severely depressed clinically at 1 and 5 minutes after delivery; and the infants have a less severe degree of acidosis when comparisons are made with respect to comparable (A-C) scores.

It is reasonable to assume that the advantages conferred by a lateral tilt reflect a relief of the compression of the inferior vena cava caused by the uterus when the mother lies supine. The tendency to diminishing acidosis among the infants in the

tilt series with increasing duration of the I-D interval could well reflect the fact that many of the mothers had been lying supine in bed for some time before being placed upon the operating table, and that recovery of the foetus from intrauterine asphyxia thus caused was proceeding as the operation progressed. There is an obvious need to investigate the rapidity with which a foetus can recover from an insult so offered.

The relatively low correlations obtained, within these fairly large series, between the I-D intervals and the various biochemical attributes of cord blood need occasion little surprise. Although the patients fell within the classification of the "clinically acceptable ideal case", blood was sampled on only one occasion in each case, and it is to be expected that the range of values referable to cases even within a closely defined class would obscure the effects of what we consider to be a dynamic process. Only serial determinations of foetal acid-base status during the course of operation, as undertaken by Teramo (1968) in supine patients, would be likely to provide contrasting correlations of a high degree of significance. Indeed, the fact that levels of significance were reached in respect to the correlations, in each series, between UA.BE and the I-D interval, suggest that caval occlusion is an extremely potent factor in the determination of the intrauterine condition of the foetus.

The marked extent of variance observed in almost every analysis of the data from the non-tilt series suggests that either the degree of caval occlusion or the floridity of response to it, associated with the supine position, varies between patients. This conclusion, which makes good sense, is supported by the observation that when the patients are tilted, and the factor of caval occlusion is thus removed, the extent of variance between patients is much reduced. This contrast again serves to emphasize the importance of caval occlusion in the determination of foetal well-being.

It is worthwhile at this point to consider how the position of the mother can influence the condition of the foetus. Scott and his colleagues (1969), in several papers published during the past decade, have repeatedly drawn attention to the fact that a degree of compression (up to and including occlusion) of the inferior vena cava invariably occurs in the patient in the third trimester when she lies supine. The result of this compression is a marked reduction in cardiac output and a compensatory rise in peripheral resistance. The latter maintains approxi-

mate stability of the systemic blood pressure, but this can fall sharply as a result of any of several coincidental factors including:

- abruptly developing bradycardia (akin to a vasovagal attack, and the classic way in which the "supine hypotensive syndrome" presents);
- sudden and severe haemorrhage;
- iatrogenically-induced significant loss of vasomotor tone (as occurs when a regional block is given for the relief of pain in labour or for Caesarean section).

It is unfortunate that the term "supine hypotensive syndrome" has become so pervasive, for it has detracted from the impact of the observations quoted above. It is essential to appreciate that occlusion of the inferior vena cava occurs whenever a pregnant patient close to term lies on her back, irrespective of how well she appears to be. The writer proposes that the terms "revealed caval occlusion" and "concealed caval occlusion" be admitted to the general parlance. Caval occlusion becomes "revealed" when the maternal systemic blood pressure falls owing to one or other of the events noted above. It is much the less serious form of the syndrome, for although the threat to the well-being of both mother and infant is great, the fact that it is present is so obvious that remedial action is taken at once (more frequently than not by the mother herself). Concealed caval occlusion is of a much more serious nature as far as foetal welfare is concerned. Its presence might be made apparent by a narrowing of the maternal pulse pressure, but it is rarely recognizable clinically. In this situation there are two factors mitigating against the foetus: the generalized maternal peripheral vasoconstriction which will involve the vessels supplying the placental site; and obstruction to the venous outflow from the placenta and uterus. (It is interesting in this context that our obstetricians have occasionally remarked that venous bleeding from the uterus at section appears to be less when the patient is tilted, a point commented upon also by others (Goodlin, 1971a); we are in the process of investigating this further.) Each of these impositions will reduce the efficiency with which the foetus can exchange its respiratory gases. It would appear, therefore, that this provides a satisfactory explanation for the contrasting results obtained from this study. Several of the patients in the non-tilt series did indeed develop hypotension, nausea and pallor (revealed caval occlusion) shortly after being placed upon the operating table, and were as a result turned laterally for induction of anaesthesia. Usually, however, such a patient

was returned to the supine for the start of the operation, when a previous observation (Crawford, 1962) was confirmed, to the effect that the hypotensive crisis did not recur.

Comment needs to be made about the operating conditions imposed by the use of the wedge. The obstetrician does initially have some difficulty in reorientation, especially in assessing the correct placing of a transverse incision in the lower uterine segment. However, after a little experience the difficulties are readily overcome and virtually no dissent is voiced. There has recently appeared (Waldron and Wood, 1971) a description of the surgical technique of conducting a Caesarean section whilst the patient is in the fully-lateral position. It probably would be more difficult to persuade an obstetrician who operated from the patient's right to allow her to be tilted to the left, but fortunately we have not yet considered this to be advisable. The wedge is withdrawn from under the patient after the infant has been delivered, so surgical closure is not affected.

A further aspect of the analyses of the (A-C) scores is of interest. As demonstrated in figures 1 and 2, there is a tendency for a relatively high incidence of low scores to be associated with an I-D interval of less than 10 minutes. This is not reflective of neonatal asphyxia, and therefore it must be considered to be "drug-induced" depression, and the most likely causative agents are thiopentone and hyoscine. Many years ago (Crawford, 1956) the point was made that when thiopentone is used solely for the induction of anaesthesia at section, the longer the I-D interval the less likely would it be that neonatal depression would result from thiopentone. The present results support this suggestion, which is directly contrary to the view recently expressed by Baraka and his colleagues (1971). There is, further, no support from the results of the present study for the suggestion that prolonged administration of 67 per cent nitrous oxide leads to drug-induced depression of the infant at delivery.

A study of this type lends itself admirably to an assessment of the significance of the Apgar score in relation to the biochemical state of the infant at delivery. This will contribute to the subject of a further communication, but herein the point may be made that a statistically significant pattern has been obtained with regard to the (A-C) 1-minute scores by comparing the UA biochemical values in the 8/8 and -/8 groups (the number of cases in the -/- groups were too small to provide information of significance), but that the usefulness of the 5-minute

score as a discriminator of biochemical state is much less, because of the great variability of the latter to be found among infants who failed to score 8 at 5 minutes.

Finally, emphasis must be given to the following. This study has been concerned with patients undergoing elective Caesarean section, and whose foetuses were, by definition, expected to be in excellent condition, because this affords the only scientifically acceptable method of investigating such matters. The variability, in absolute terms, imposed by tilt and non-tilt, and long and short I-D intervals, upon values of metabolic acidosis and Apgar scores was not great, and none of the infants was in a parlous condition at delivery. However, the conclusions derived must be extrapolated to the emergency situation. If the section, elective or emergency, is being undertaken because of suspected or diagnosed intrauterine foetal asphyxia, the imposition of a further increment of asphyxia imposed by permitting the patient to lie supine could well be highly detrimental to the foetus. In these situations, the use of the wedge, or some equally appropriate tilting device, would appear to be most advisable, if not mandatory. There seems little reason to doubt that a similar consideration is applicable to cases of Caesarean section performed under regional block analgesia. It might further be considered advisable to discourage a patient who is in labour from lying supine for more than a few minutes at a time.

ACKNOWLEDGEMENTS

We wish gratefully to acknowledge the generous financial assistance received from the National Birthday Trust Fund, and from the United Birmingham Hospitals Medical Endowment Research Fund.

Our thanks are due to the obstetricians who courteously and willingly co-operated in this study.

The anaesthetics were given, and much of the data recorded, mainly by the following anaesthetists during their appointments to this hospital, and our sincere thanks go to them: J. K. Banton; E. P. Bland; M. D. Boobyer; S. P. Choong; J. M. Davis; M. Ducrow; L. H. Grove; N. F. Harley; T. E. J. Healy; B. C. Jones; S. E. F. Jones; D. W. R. Macfarlane; J. Manser; B. D. Mukerji; M. Pabari; M. L. Pepperman; B. J. Ricci; D. J. H. Richmond; B. Roscoe; J. Shah; D. South; J. T. Styles; C. Thomas; J. M. Turner; J. B. Walpole.

Our thanks are also due to Carmen Lockwood for valuable assistance in computing the results.

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ETUDE DU TEMPS D'INTERVENTION ET DE L'INFLUENCE D'UNE INCLINAISON LATÉRALE AU COURS DE CÉSARIENNES

SOMMAIRE

On a procédé à l'étude de cent-cinquante cas de césariennes pouvant être considérées comme idéales sur le "plan clinique", en recourant à une anesthésie générale standard. Dans quatre-vingt sept de ces cas, la parturiente était demeurée en position de décubitus dorsal tout au long de l'intervention et dans soixante-trois autres cas, elle se trouvait allongée sur un plan incliné latéralement à l'aide d'une cale. Une analyse statistique des données provenant de contrôles effectués à partir du sang maternel et du sang du cordon, ainsi que des résultats obtenus, au test d'Apgar montre ceci: Chez les parturientes n'ayant pas reposé sur un plan incliné, on a noté une incidence plus grande et un degré plus profond d'asphyxie du nouveau-né, ainsi que des chiffres plus bas A-C en comparaison

de la série comportant des malades allongées en position inclinée. Cette disparité a été accentuée par une augmentation de l'intervalle I-D. Une plus grande variabilité a été notée en ce qui concerne les résultats obtenus à partir de la série de parturientes n'ayant pas reposé sur un plan incliné, ce qui semble indiquer que l'introduction d'un plan incliné a entraîné une situation plus stable. Il est suggéré que les contrastes observés reflètent les effets d'une occlusion de la veine cave du fait de l'utérus gravide et l'on défend l'introduction de termes tels que: "occlusion cave révélée" et "occlusion cave masquée". Une dépression due au médicament a été éventuellement observée parmi les nouveau-nés dont l'extraction s'était effectuée au cours des 10 minutes de la phase d'induction anesthésique. Néanmoins, aucun autre effet imputable aux médications n'a pu être décelé chez le nouveau-né.

DAUERE UND SEITLICHE KIPPUNG BEIM KAISERSCHNITT

ZUSAMMENFASSUNG

150 "klinisch annehmbare Idealfälle", die sich einer operativen Schnittentbindung unter standardisierter Allgemeinnarkose unterzogen, wurden untersucht. In 87 Fällen lag die Patientin während der ganzen Operation auf dem Rücken, in 63 Fällen war sie zur Seite gekippt mit Hilfe eines Keiles. Die statistische Analyse der Werte aus Proben von mütterlichem und Chorda-Blut, und aus den Apgarminus-Farben Berechnungen erbrachte folgendes Ergebnis: bei den nicht gekippten Patientinnen trat Geburtsasphyxie häufiger und in stärkerer Masse auf, wie auch eine Erniedrigung der A-C Berechnungen, als bei den gekippten Patientinnen; dieser Unterschied wurde noch betont durch die Verlängerung des I-D Intervalls. Bei der Serie der nicht gekippten Patienten waren die Ergebnisse unterschiedlicher, was vermuten lässt, dass durch die Einführung der Kippage stabilere Bedingungen geschaffen wurden. Es wird angenommen, dass die Unterschiede die Wirkung des Cava-Verschlusses zum Ausdruck bringen, und die Einführung der Begriffe "bemerkter Cava-Verschluss" und "unbemerkter Cava-Verschluss" wird befürwortet. Möglicherweise wurde eine durch Medikamente induzierte Depression beobachtet bei Kindern, die innerhalb von 10 Min. nach der Einleitung entwickelt wurden, jedoch konnten keine anderen Medikamenten-Wirkungen auf das Neugeborene festgestellt werden.

TIEMPO E INCLINACION LATERAL EN LA SECCION CESAREA

RESUMEN

Fueron estudiados ciento cincuenta "casos ideales clínicamente aceptables" sometidos a sección cesárea electiva bajo un regimen estandarizado de anestesia general. En ochenta y siete casos la paciente estaba en decubito supino durante todo el procedimiento y en sesenta y tres casos fue inclinada lateralmente por medio de una cuña. El análisis estadístico de los datos derivados del análisis de sangre materno y del cordón umbilical y de los puntos Apgar-menos-color indicó que: hubo entre las pacientes no inclinadas una frecuencia más elevada y un grado mayor de asfixia en el nacimiento y de puntos A-C bajos que en la serie con inclinación y que esta disparidad fue subrayada por la prolongación del intervalo I-D; hubo mayor varianza entre los resultados obtenidos de la serie sin inclinación, lo cual sugiere que la introducción de una inclinación condujo a una situación más estable. Se postula que estas diferencias reflejan el efecto de la oclusión caval por el útero gravido y se defiende la introducción de los términos "occlusión caval revelada" y "occlusión caval escondida". Posiblemente fue observada una depresión inducida por medicamentos en infantes que nacieron a los 10 minutos de la inducción, pero no se pudo identificar otros efectos neonatales atribuibles a los medicamentos.