

respectively. With saline the corresponding deteriorations were 16 and 38 points, the deterioration at one year not being significantly different from zero. In the L.P. group the two very large changes mentioned previously obscured the expected pattern of mean deterioration increasing with time. In view of the non-homogeneity of variances, the changes in Alexander score were analysed by a number of methods (including ranking tests and t-test on homoscedastic pairs), none of which indicated any significant differences between results on the three treatments. Nor was there any significant difference in the number of new symptoms and signs occurring during the trial.

**Patients' Subjective Assessment.**—At each review each patient was asked for his opinion of the change in his condition since he was last seen. In Table II these results are summarized by showing those who consistently reported an improvement, those who consistently reported that they were worse, and the remainder who either remained unchanged or reported an improvement at one review and a deterioration at another. Seven patients, evenly divided amongst the treatments, reported improvement, and 37 reported a deterioration. Eight of these were in the L.P. group, 12 in the S. group, and 17 in the P.P.D. group. Again there is no significant difference between the groups.

**Acute Exacerbations.**—A significant difference was found in the number of acute exacerbations. One and five occurred in the L.P. and S. groups respectively, but 10 among those receiving P.P.D. ( $\chi^2=6.45$ , d.f.=2,  $P<0.05$ ). The numbers of patients suffering these acute exacerbations were one, three, and seven respectively for L.P., S., and P.P.D.

It was mentioned earlier that four of the seven patients with rapidly progressive disease were admitted by chance to the P.P.D. group. Although the number of patients is not statistically significant, some comment is called for to indicate that they did not invalidate the results. These four patients showed no change in functional grading in the course of the trial, and their average change in Alexander score was slightly less than that for the remainder of the P.P.D. group. Exclusion of these patients would change none of the conclusions of the trial: they have therefore been retained in the analysis.

### Conclusions

The findings lend no support to the suggestion that intrathecal P.P.D. has a beneficial effect on the course of multiple sclerosis. There were no significant differences between the three treatment groups by the following criteria: change in functional grading, change in Alexander score, number of new symptoms or signs, or the patients' own assessment of improvement or deterioration. There was, however, a significant increase in the number of acute exacerbations experienced by patients in the P.P.D. group. Smith, Hughes, and Hunter (1961) claim that if a rise of spinal fluid protein of 550 mg./100 ml. or more is induced the chance of relapse during the next year is lessened. In the present trial such high levels of spinal protein were not reached, but the study of Colover *et al.* (1962), in which protein rises of the order recommended by Smith *et al.* were produced, did not reveal that the clinical course in patients with marked spinal-fluid-protein reactions was more favourable than that of patients with a smaller increase in protein content.

### Summary

The intrathecal administration of P.P.D. to patients with multiple sclerosis failed to exert any favourable influence on the course of the disease; it appeared to induce an increased number of exacerbations during the succeeding one to three years; and it evoked an immediate reaction which was always uncomfortable and sometimes alarming. Such findings hardly serve to establish it as an acceptable form of treatment.

We thank Dr. G. S. Turner for help in the treatment of cases, and the Board of Governors of the Infirmary, the North-east Multiple Sclerosis Trust, and the National Multiple Sclerosis Society for generous financial support.

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## CONTROLLED CORD TRACTION IN MANAGEMENT OF THE THIRD STAGE OF LABOUR

BY

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### The Third-stage Problem

Complications in the third stage of labour remain the major unpredictable hazard facing an expectant mother. Nixon (1955) stated that "in England to-day a conservative estimate would be that one in five thousand mothers dies from haemorrhage." The Report of Confidential Enquiries into Maternal Deaths in England and Wales, 1955-57 (Ministry of Health, 1960), found that haemorrhage was the fourth most common cause of maternal death. Avoidable factors were thought to be present in 37 of the 70 records examined where the patient died from post-partum haemorrhage.

It is very likely that for every maternal death due to haemorrhage there are many instances where death is averted by efficient treatment. The obstetric flying squad is called to most of the serious third-stage complications that occur at home. Lloyd (1949) showed a steady fall in maternal deaths in Birmingham during the years in which the flying squad had operated in the city. Dewhurst (1952) reviewed 489 calls dealt with by the Manchester squad: 79% were to patients with third-stage complications. He wrote: "Many of the patients treated were near to death—so near in fact as to cause the gravest concern to even the most experienced of the flying squad." In London 62% of the calls to St. James's Hospital, Balham (Fraser and Tatford, 1961), in Edin-

burgh 79% of the calls (Adamson *et al.*, 1960), and in Newcastle 75% of the calls (Stabler, 1957) were for third-stage complications. During the last three years, 1959-61, the flying squad based on University College Obstetric Hospital was summoned to 118 patients, 68 (57.6%) of whom had a third-stage complication.

There is clearly an urgent need for improved methods of conducting the third stage of labour.

**Present Trial.**—At a staff conference of the Obstetric Unit of University College Hospital in May, 1958, it was decided to organize a trial in which the placenta was delivered by a modification of the Brandt-Andrews (cord traction) method. The term "Brandt-Andrews manoeuvre" has been replaced by that of controlled cord traction (C.C.T.), as the method used at University College Obstetric Hospital is not the same as that described by Brandt (1933) or Andrews (1940).

### Material and Method

This preliminary trial was conducted on 1,000 consecutive normal patients delivered per vaginam. Cases excluded from the trial were: operative deliveries, breech and other abnormal presentations, multiple pregnancies, patients with fibroids, patients who had had an ante-partum haemorrhage or previous third-stage complication, and grand multiparae. The third stage was conducted as follows.

1. Intravenous ergometrine (0.5 mg.) was given with delivery of the anterior shoulder. The baby was delivered slowly. The cord was divided and the baby passed to an assistant.

2. A sterile towel was placed over the lower abdomen and the uterus palpated to ensure that it had contracted firmly in response to the ergometrine. The placenta was then delivered by C.C.T. as follows. The attendant stood on the right of the patient. The left hand was placed on the lower abdomen so as to grasp the lower segment between the index finger and thumb, and steady pressure was exerted in an upward and backward direction. At the same time the cord was taken in the right hand and a grip secured with a pair of artery forceps at the level of the introitus. Steady tension on the cord was maintained by traction on the forceps in a backward and downward direction, exactly countered by the upward pressure of the left hand so that the position of the uterus remained unchanged. Traction was gentle at first and then was slowly increased, the placenta usually being delivered quite easily.

3. The placenta and membranes were examined carefully and intramuscular ergometrine 0.5 mg. was given before sending the patient to the ward.

4. If the attendant failed to give the ergometrine intravenously at the correct time, the drug was given intramuscularly.

5. C.C.T. was repeated every two or three minutes if the first attempt was unsuccessful.

6. If the placenta had not been delivered 30 minutes after the birth of the baby or if the blood lost was 250 ml. or more the house-surgeon was called.

All the deliveries were performed by medical students under the supervision of qualified midwives, and the injection of ergometrine was given by a second student.

### Results

Table I summarizes the results obtained by C.C.T. and intravenous ergometrine in 1,000 patients. In 973

patients the third stage was completed quickly without any serious complication.

TABLE I.—Incidence of Third-stage Complications in 1,000 Patients

Normal third stage	973
Post-partum haemorrhage	6
Manual removal of placenta	15
Post-partum haemorrhage and manual removal	6

The frequency distribution curves for the duration of the third stage and for the volume of blood lost are given in Figs. 1 and 2.

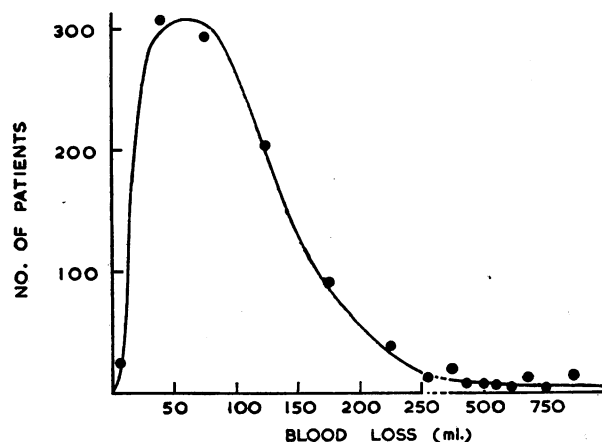


FIG. 1.—Frequency distribution curve for volume of blood lost. Mean loss of blood, 90 ml.

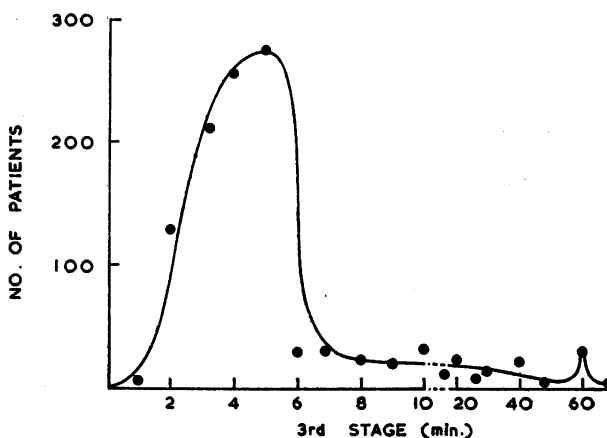


FIG. 2.—Frequency distribution curve for duration of third stage. Mean duration, 6.3 minutes.

**Blood Loss.**—The mean loss of blood in the third stage of labour was 90 ml. (S.D. 81 ml.). In 603 patients it was less than 100 ml. In only 51 patients (5.1%) did it exceed 284 ml. ( $\frac{1}{2}$  pint). The incidence of post-partum haemorrhage (568 ml. or more) was 1.2%. In six of these 12 patients the placenta was removed manually. The indication for this operation in each case was retention of the placenta. The haemorrhage in this group occurred during and immediately after the operation, and one of these patients required a blood transfusion. In five of the six remaining patients who had a post-partum haemorrhage the placenta was delivered within 10 minutes. The loss, which did not exceed 750 ml., occurred when the placenta was delivered. In the sixth patient the haemorrhage occurred two to three hours after delivery. It was approximately 900 ml., and a blood transfusion was given. The incidence of blood transfusion in the series was 0.3%.

**Duration of Third Stage.**—The mean duration of the third stage of labour was 6.3 minutes (S.D. 3.5 minutes).

If the cases where the placenta was removed manually are excluded the mean duration was 5.01 minutes (S.D. 3.4 minutes). In 817 of the 1,000 patients the third stage was complete in 5 minutes or less, and in only 63, including the 21 who had a manual removal, did the duration exceed 10 minutes.

**Retained Placenta.**—There were 24 patients in whom the placenta was retained for more than 30 minutes, and in 21 (2.1%) of these manual removal was carried out. The indication for the operation was in every instance retention of all or part of the placenta. In 3 of the 21 cases part of the placenta was delivered by C.C.T. In one of these patients the placenta was tripartite and two parts were retained. In the other two patients one lobe and two cotyledons were retained respectively. One patient was anaesthetized preparatory to manual removal of the placenta. It was then possible to deliver the placenta by C.C.T. whereas previous attempts had failed. In another patient the cord had broken and there were no "signs of separation." However, the placenta was in the vagina and was easily removed. In another patient routine examination of the placenta revealed a missing lobe, but this was removed from the cervix with sponge-holding forceps.

**Secondary Post-partum Haemorrhage.**—The incidence of secondary post-partum haemorrhage was 0.7%.

**Inversion of Uterus.**—Acute inversion of the uterus did not occur in any patient.

**Minor Complications.**—The umbilical cord snapped in 26 cases. Three of these patients had a placenta velamentosa and two a battledore placenta. Two others had a placental abnormality. Snapping of the umbilical cord is not usually a serious complication. In most of these cases "signs of separation" occurred and the placenta was delivered by fundal pressure or maternal effort. In seven of these cases signs of separation did not occur in the half-hour after the birth of the baby, and the placenta was removed manually. It was adherent in every case.

**Intramuscular Ergometrine.**—During the main trial 244 patients were given ergometrine intramuscularly, usually because of difficulty with venepuncture, and the placenta was delivered by C.C.T. Six of these patients had post-partum haemorrhage and 42 lost between 284 and 568 ml. None of these patients had a retained placenta or a secondary post-partum haemorrhage. These results are shown in Table II.

TABLE II.—Incidence of Third-stage Complications in 244 Patients given Intramuscular Ergometrine

Normal	196 (80.4%)
Post-partum haemorrhage	6 (2.5%)
250 ml.—500 ml.	42 (17.1%)

**Abnormal Deliveries.**—During the time that the 1,000 normal cases were collected, 183 abnormal cases were delivered per vaginam. The mean duration of the third stage (including the patients that had manual removal) was 5.5 minutes. The mean blood loss was 267 ml. In this group 12 patients had manual removal of the placenta and 18 had post-partum haemorrhage. During the trial 99 patients were delivered by lower-segment caesarean section.

**Previous Third-stage Complication.**—There were 39 patients who had previously had a third-stage complication. The mean blood loss was 152 ml. and the mean duration of the third stage 6.6 minutes. There were two cases of manual removal of the placenta and two cases of post-partum haemorrhage in this group.

**Grand Multiparae (para 4 or greater).**—In the 31 grand multiparae the mean blood loss was 103 ml. and the mean duration of the third stage 6.4 minutes. There were no complications.

### Discussion

Traction on the umbilical cord is not a new method of delivering the placenta. Aristotle understood the dangers of the third stage of labour and advised the use of cord traction to deliver the placenta. Whitridge Williams (1924) wrote that "up to 1861 the management of the third stage varied greatly and delivery of the placenta was often effected by traction upon the umbilical cord or by passing the hand into the vagina or uterus and bringing it away." The teachings of Credé and Ahlfeld then became widely known and cord traction fell into disrepute. The fundal-pressure method of delivering the placenta is now generally accepted, and is advocated in most British textbooks to-day.

The recent history of cord traction began in 1933 when Murray L. Brandt published a paper entitled "Mechanism and Management of the Third Stage of Labour." He had studied the mechanism of separation of the placenta by radiological means in 30 patients by injecting sodium iodide into the umbilical vein and taking an x-ray film within three minutes of delivery of the baby. In every case he found the placenta separated and lying in the lower segment. He advised that after the baby is born the cord be clamped close to the vulva and held with one hand, the other hand being used to push the uterus gently upwards towards the umbilicus. If the placenta had separated there was slight tension only on the cord and the uterus was pushed up over the placenta, delivery of the placenta being completed by suprapubic pressure. In 800 patients in whom this method was used the average duration of the third stage was eight minutes and an excessive loss of blood occurred in only 10 of them. Andrews (1940), working independently, described a similar method and obtained good results with it.

Greenhill (1960) states that fundal pressure "is not without danger." He has used the Brandt-Andrews method of management of the third stage for some years and describes the technique in detail in his current textbook. He also mentions a technique similar to C.C.T. as an alternative to the Brandt-Andrews method.

Picton (1951) advocated the routine use of the Brandt-Andrews method for delivery of the separated placenta, as he was of the opinion that the method caused minimal discomfort and put little or no strain on the uterine supports. Kimbell (1958) has had an extensive experience with this technique: in 4,651 patients who were given ergometrine 0.5 mg. with hyalase intramuscularly when the foetal head crowned, the manual removal rate was 10 and the post-partum haemorrhage 19 per 1,000 cases.

References to cord traction and the Brandt method in British textbooks are few. Some British authors will allow the use of traction upon the umbilical cord in association with fundal pressure when there is clear evidence of separation and descent of the placenta. Brews (1957) writes: "When it is certain that the placenta has left the uterus, pressure upon the fundus may be aided by gentle traction upon the umbilical cord: this must never be done, however, while the placenta remains attached to the uterus." Browne and McClure Browne (1955) advise a similar method when prophylactic



ergometrine has been given. The late Mupro Kerr also commended this technique, and Chassar Moir (1956) approves the method although he does not consider it a suitable one to teach to students.

Morris (1959) mentions the use of the Brandt method in a discussion on the management of patients with retained placentae. He still advocates the use of Credé expression as a routine in these cases, but suggests that if this fails an attempt may be made to deliver the placenta by cord traction or by the Brandt method.

Picton (1951), Kimbell (1958), Elwin (1960), and Fraser and Tatford (1961) have all advocated the use of the Brandt-Andrews manoeuvre in cases of retained placentae. Dutton (1958), discussing a trial of ergometrine with hyalase in Sheffield, mentioned that in four of his treated cases the apparently retained placenta was delivered by cord traction and manual removal was thus avoided. He writes: "It may be that the decision to use routine ergometrine should coincide with a resolve to recognize the usefulness of cord traction."

It should be stressed that the classical "signs of separation" of the placenta are not looked for or awaited when the placenta is delivered by C.C.T. There is some evidence that the placenta separates from the uterine wall with the contraction that delivers the baby, or very soon afterwards. The work of Brandt (1933) has been mentioned. Leff (1929), who examined 1,000 cases, wrote: "By making a vaginal examination soon after the baby is born, I found that the placenta separates promptly after the baby leaves the uterus." Burton-Brown (1949) injected a radio-opaque substance into the umbilical vein and took a series of radiographs. She suggested that placental separation is usually completed  $4\frac{1}{2}$  minutes after the baby is born. None of the cases mentioned above was given ergometrine.

Davis and Boynton (1942), who wrote one of the early papers describing the prophylactic use of intravenous ergometrine, discussed the effect of this injection upon the course of the third stage. They believed that the placenta normally separated at the end of the second stage and if ergometrine was given intravenously it accelerated the phase of separation and made it more complete.

The uterus continues to contract and relax during the third stage of labour and as a result the separated placenta descends from the upper segment of the uterus to the lower segment and vagina. It is at this point that the classical signs of separation are elicited. In many instances when C.C.T. is used the placenta is delivered when it lies free in the upper segment and before it has descended into the lower segment and vagina. If the placenta is still attached to the uterine wall C.C.T. will be unsuccessful.

It may be suggested that it is not safe to exert traction on the umbilical cord in the absence of signs of separation. This is not our experience. There are two factors which ensure the safety of the method. Firstly, traction is *never* made on the umbilical cord alone: the second hand is always in position on the abdomen lifting the uterus upwards. Secondly, C.C.T. is never performed unless the uterus is well contracted. The intravenous injection of ergometrine given at the time of delivery of the anterior shoulder ensures a well-contracted uterus in almost every patient.

The success of the preliminary trial is shown by the fact that the average blood loss was 90 ml. and the third stage was complete in 6.3 minutes. The incidence

of manual removal of the placenta (2.1%) was a little disappointing. In adopting intravenous ergometrine and C.C.T. as a routine it was hoped to achieve a low post-partum haemorrhage rate without the rise in the rate of manual removal of the placenta reported from this unit by Martin and Dumoulin (1953). It has been decided that the results of the present study justify a further controlled trial of this method, and this is now under way.

Complicated cases have been excluded intentionally from the main series of 1,000 cases. It is evident that if this is not done the results of any trial will be adversely influenced to a varying extent by the proportion of patients predisposed to third-stage complications. The present method of presentation should be of particular value for those concerned with the management of the third stage in domiciliary confinements. Clearly no patient predisposed to a third-stage complication should be selected for home confinement.

It is realized that it is not possible at the present time to have a second person qualified to give an intravenous injection in attendance at many of the confinements in this country. However, an unassisted midwife can and should give an intramuscular injection of ergometrine or ergometrine with hyalase at the time of crowning of the foetal head. Kimbell's (1958) results indicate the success of this method of ergometrine administration with the Brandt-Andrews manoeuvre.

C.C.T. is used as a routine by members of this unit when they are called to a case of retained placenta. It is particularly valuable when this complication occurs in the home, and C.C.T. is successful in approximately half the cases. Our experience supports the views of the other authors mentioned who advocate the use of a similar procedure when the placenta is retained. C.C.T. has proved to be a safe and very satisfactory alternative to Credé expression. The latter procedure should be abandoned completely.

### Summary

A preliminary trial of controlled cord traction—a modification of the Brandt-Andrews manoeuvre—in the management of the third stage of labour has been completed in 1,000 patients.

The mean blood loss was 90 ml. and the mean duration of the third stage was 6.3 minutes.

The post-partum haemorrhage rate was 1.2% and the rate of manual removal of the placenta 2.1%. Blood transfusion was necessary in only 0.3%.

There were no serious complications attributable to the use of cord traction in this series.

Evidence has been provided to show that Credé expression should be abandoned completely in the treatment of retained placenta and be replaced by C.C.T.

I am grateful to Professor W. C. W. Nixon for his help and advice, and I thank the members of the Obstetric Unit of University College Hospital, the medical students, and midwives who helped in this investigation.

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## SIGNIFICANCE OF SITE OF PLACENTAL ATTACHMENT IN UTERUS

BY

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Using soft-tissue radiography to determine the situation of the placenta, Stevenson (1949) and Whitehead (1953) found that the attachment of the placenta at one or other pole of the uterus may cause the foetus to lie transversely. Stevenson (1950) also stated that in breech pregnancies at or near term the placenta was always attached to the cornuo-fundal region of the uterus, and Fell (1956) confirmed that this placental site was more common in breech presentation. Torpin and Faulkner (1957) reported that occipito-posterior positions were more frequent when the placenta was anterior (47.4%) than when the placenta was posterior (21.2%). Evidence was accumulated by Ranney (1956) that retained placentae were more common when the placenta was attached to the cornual region of the uterus, and Kushnirskaya and Ivanova (1958) found a high post-partum haemorrhage rate if the placenta was large or was attached to the lower uterine segment.

An interesting theory concerning the aetiology of pre-eclamptic toxæmia was proposed by Bieniarz (1959) on the basis of his finding that toxæmia was most frequent when the placenta was attached high in the uterus. He described different vascular patterns of the pregnant uterus, the utero-placental circulation draining mainly through the ovarian veins in high-situated placentae and mainly through the uterine veins in low-situated placentae. These observations supported his hypothesis that a high draining of the utero-placental circulation might cause a pathological redistribution of blood in the renal and visceral circulation, resulting in pre-eclamptic toxæmia.

Csapo (1956) proposed a theory that the placenta gives its progesterone locally to the neighbouring myometrium rather than indirectly through the systemic circulation. The result of this would be a progesterone concentration gradient in the myometrium with a peak at the placental implantation site. Csapo (1961) has demonstrated that progesterone prevents the propagation of the excitation wave in uterine muscle and has produced evidence that this hormone is a key substance in the maintenance of pregnancy because of its blocking action on myometrial function. He suggested that if the placenta were attached at or below the middle of the uterus, then as term approached the fundus would recover first from

the progesterone block and a downward gradient of uterine activity from the fundus to the cervix would develop. If the placenta were located high, the lower uterine segment would recover first from the progesterone block and, as the activity gradient of the uterus would point in the wrong direction, prolonged labour might occur.

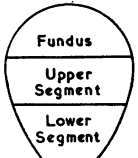
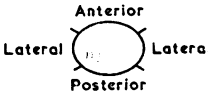
Following a suggestion by Csapo (1960, personal communication), it was decided to determine the placental site in 200 patients and attempt to correlate this information with the duration of the patient's labour. Other obstetrical features of the patients were also examined to see if they were affected by the location of the placenta.

### Material and Methods

There were 150 primigravidae and 50 multigravidae in the study. The selection of cases was determined by the presence of adequate anaesthesia or analgesia.

The placental site was determined by performing manual exploration of the uterus immediately after delivery of the foetus. In a small number of patients the placental site could not be determined because the placenta had already separated or was in the process of separating at the time of the examination. The position of the placenta was described in both the longitudinal (fundal, upper, and lower segment) and transverse (anterior, posterior, and lateral) planes of the uterus (see Table I). No complications resulted from this examination.

TABLE I.—Site of Placental Attachment in 150 Primigravidae

Longitudinal Plane		
	Fundus	2% (3)
	Fundus and upper Segment	42% (63)
	Upper Segment	47% (71)
	Upper and lower Segments	9% (13)
Transverse Plane		
	Anterior	53% (80)
	Posterior	39% (58)
	Lateral	8% (12)