bered that in a condition of such complexity good results are only likely to be obtained by a judicious selection of various therapeutic measures in the same case.

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INDUCTION OF LABOUR

THE COMBINED METHOD OF PREMEDICATION
WITH CASTOR OIL AND QUININE, AND
ARTIFICIAL RUPTURE OF
MEMBRANES

BY

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Artificial rupture of the membranes as a means of inducing labour has been employed for so many years that its value as an obstetric manœuvre might well be expected by now to be precisely established. Goodwin (1937) reports its use 150 years ago, and states that Denman in 1793 was one of its earliest advocates. Yet it has not gained general approval, largely on account of the traditional association of "dry labour" with delay and difficulty. It seems possible that confusion has arisen from a failure to distinguish sufficiently clearly between the course of labour when the only abnormal feature is the early loss of liquor amnii, and the course when its escape is associated with other factors which really play the major and responsible part in producing difficulty. If the early escape of fluid could be fairly exonerated from the drawbacks for which it is commonly blamed, and if, further, its artificial production could be established as a reliable means of inducing labour, a valuable point would be reached for practical guidance. There are many situations in obstetrics where reliable control over the start and completion of labour can be calculated to lessen risk to mother and child or both. The difference in effort required to expel a foetus of, say, 6½ lb. and one of 8 lb. may be of vital service to a woman with morbus cordis. The same difference may save the foetus where contraction of the maternal pelvis exists. Many other instances occur to the mind, of which mention may perhaps be made of the great advantage of being able to prevent gestation from continuing beyond the normal period of forty weeks.

Many opinions could be quoted both in favour of and against this method of inducing labour. A good sample in British and American literature is contained in the writings of Drew Smythe (1931), Drew Smythe and Thompson (1937), FitzGibbon (1931), Tennent (1938), Guttmacher and Douglas (1931), Jackson (1934), Wilson (1934), and Goodwin (1937). Drew Smythe (1931) recommends induction of premature labour by artificial rupture of the membranes for all cases in which the foetus presents

by the vertex. He includes in his list of indications pyelitis of pregnancy, cardiac disease, and disproportion. This last condition he considers to be one above all others in which induction of labour is indicated. Eden and Holland (1937) are in favour of the method, describing it as both safe and reliable.

Indications for Induction in the Present Series

This method has been employed 681 times during the last six years at the British Hospital for Mothers and Babies, and with the experience gained, and as certain points in technique have been improved, a high appreciation of its value has grown. The cases chosen for analysis number 287, and they comprise all those in which the method has been used over a period of two years. It may be regarded as the routine policy of election at this hospital in the obstetric conditions presently to be described. The indications for induction in this series of cases were: disproportion, 100 cases; at term to prevent post-maturity, seventy-one cases; toxæmia of pregnancy, forty cases; chronic bronchitis and various states of ill-health classified as maternal debility, twenty-six cases; post-maturity, twenty-five cases; morbus cordis, seventeen cases; hydramnios and twins, five cases; ante-partum hæmorrhage, three cases. Total cases 287.

Method of Induction

Once the decision to induce labour was reached the method employed was carried out in the following stages. (1) A course of early continuous premedication with sulphate of quinine. (2) Preliminary admission to hospital. (3) The use of castor oil and an increase in quinine medication. (4) Artificial rupture of the membranes followed by an immediate and deliberate expulsion of liquor amnii.

Early Quinine Medication.—All primigravidae and those multigravidae with a history of defective uterine action in previous labours received 1½ grains of quinine sulphate three times daily during the last three weeks for which the pregnancy was allowed to continue.

Preliminary Admission to Hospital.—The routine for primigravidae selected for induction was admission to hospital five days before the anticipated date of artificial rupture of the membranes. For multigravidae this period was reduced to three days.

The Use of Castor Oil and Increased Quinine Medication.—At 6 a.m., castor oil 1 oz.; at 10 a.m., 2 p.m., and 6 p.m., quinine sulphate powders 10 grains; and at 5 p.m., a simple enema and a hot bath were administered to primigravidae on the day after admission (second day) and repeated on the fourth day; to multigravidae they were given on the second day.

Artificial Rupture of the Membranes.—This was performed on the fifth day in primigravidae, and on the third day in multigravidae. The operation was carried out in the labour theatre with all the usual antiseptic and aseptic precautions. The patient being in the lithotomy position, the operator passed the first two fingers of the right hand into the vagina, and then a finger through the os until the foetal head was reached. In some cases in which the cervix was very posteriorly placed it was necessary to hook it forward with the examining finger. A long stylet or vulsellum forceps was passed along the hand into the vagina and guided through the os until it was in contact with the foetal head. The membranes were ruptured and the liquor allowed to drain off. This was

facilitated by slightly pushing up the foetal head and by abdominal pressure made by an assistant. A good flow of liquor is considered essential. Preliminary dilatation of the cervix was never required. The cervix was not exposed by a speculum previous to the introduction of the stylet or grasped with vulsellum forceps. Occasionally nitrous-oxide-and-air analgesia was used to allay nervousness in a primigravida, and on one occasion chloroform-and-ether was required. For the rest no form of anaesthetic was called for. In both primigravidae and multigravidae, if labour had not started within forty-eight hours after rupture of the membranes, the medication with castor oil and quinine powders was repeated. It is our experience that the part played by premedication in this method is of the utmost value. Preliminary contractions which are usually quite painless occur. The absence of pain in the early stages of labour in these cases is very striking. At the time of artificial rupture of the membranes it is almost invariably observed that the cervix is softened and "taken up," often completely, and in many cases there is commencing dilatation of the os.

Analysis of the Series

The following is the analysis of the series of 287 cases. Primigravidae and multigravidae are throughout grouped separately. Table I gives the *duration of the latent period*. The latent period is the time elapsing between artificial rupture of the membranes and the starting of labour.

TABLE I

Duration of Latent Period	Primigravidae		Multigravidae	
	No. of Cases	Per cent.	No. of Cases	Per cent.
0-6 hours ..	88	51.5	84	72.5
6-12 " ..	26	15.2	13	11.1
12-18 " ..	16	9.4	5	4.3
18-24 " ..	5	2.9	4	3.5
24-48 " ..	19	11.1	3	2.6
Over 48 hours ..	17	9.9	7	6
Failures	0		0	
Total	171		116	

No failures were recorded—that is, in no case was it found necessary to proceed to further surgical treatment to effect delivery. The *efficiency rate*—that is, the latent period being under twenty-four hours—was in primigravidae 78.9 per cent. and in multigravidae 91.4 per cent.

Table II summarizes the *latent period in relation to the duration of pregnancy*.

TABLE II

Duration of Pregnancy	Primigravidae			Multigravidae		
	No. of Cases	Latent Period less than 24 Hours	Per cent.	No. of Cases	Latent Period less than 24 Hours	Per cent.
30-32 weeks	2	1	50	0	0	
32-36 " "	5	5	100	11	10	90.9
36-40 " "	142	110	77.4	102	93	91.2
Over 40 weeks	22	19	86.3	3	3	100
Total	171			116		

It would appear from this table that the method is reliable during the whole of the last eight weeks of pregnancy, showing a greater efficiency in multigravidae.

Table III gives the *duration of labour* in this series.

TABLE III

Duration of Labour	Primigravidae		Multigravidae	
	No. of Cases	Per cent.	No. of Cases	Per cent.
0-6 hours ..	6	3.5	38	32.8
6-12 " ..	58	33.9	49	42.2
12-24 " ..	74	43.3	28	24.1
24-48 " ..	27	15.8	1	0.9
Over 48 hours ..	6	3.5	0	
Total	171		116	

The average duration of labour was: 171 primigravidae, 16 hours; 116 multigravidae, 8 hours 17 minutes. For comparison a series of 171 normal primigravidae and 116 normal multigravidae, all of whom had spontaneous deliveries, had received no premedication, and were not induced, was collected and the average duration of labour calculated in each group. In the primigravidae it was 15 hours 2 minutes and in the multigravidae 8 hours 46 minutes. Taking into account the considerable proportion of cases in the induced series in which prolongation of labour might be anticipated—for example, in cases of disproportion—the extra duration involved is negligible, and in the case of multigravidae labour was actually shortened.

Mode of Delivery

Labour terminated in the present series as follows:

Primigravidae (171 Cases).—Spontaneous delivery, 120; delivery by forceps, fifty-one cases. The indications for forceps were: persistent occipito-posterior, nineteen cases; prolonged second stage, nine cases; prolapsed funis, one case; maternal distress, six cases; toxæmia, six cases; cardiac disease, nine cases; foetal distress, one case.

Multigravidae (116 Cases).—Spontaneous delivery, 110 cases; delivery by forceps, six cases. The indications for forceps were: maternal distress, three cases; first child born by Caesarean section, two cases; toxæmia, one case.

Foetal Mortality

Primigravidae.—There were 173 infants (two sets of twins); of these, seven were stillborn and one died. The causes of stillbirth were: post-maturity, maceration, spontaneous delivery, two cases; post-maturity, forceps delivery, two cases; hydrocephalus, one case; prolapsed funis, two cases. The cause of death in the fatal case was ante-partum haemorrhage, toxæmia, and prematurity. Of the stillbirths due to post-maturity in which there was instrumental delivery, one followed a long labour and forceps delivery. There was no disproportion. The presentation was vertex-posterior, and the head was deep in the pelvis at the beginning of labour. The other was a large (10 lb. 9 oz.) post-mature child. Of the two cases of prolapsed funis one occurred early in labour, the other at second stage. In the latter case the presentation was vertex-posterior, and prolapse of the cord occurred when manual rotation was performed. There was no disproportion in either case.

Multigravidae.—There were 119 infants (three sets of twins). Of these, one was stillborn and two died. The cause of the stillbirth was prolapsed funis; the deaths were due in one case to intracranial haemorrhage and in the other to atelectasis. In the stillbirth the cord prolapsed early in labour. There was no disproportion. The

two cases where death of the infant occurred were induced at thirty-six and thirty-seven weeks respectively on account of disproportion. Both had spontaneous deliveries. The gross foetal mortality was 3.8 per cent.; the corrected foetal mortality was 3.1 per cent.—that is, excluding hydrocephalus and ante-partum haemorrhage.

Maternal Mortality

There were two maternal deaths in this series. In one case, a primigravida induced at thirty-five weeks on account of acute toxæmia of pregnancy, the latent period was 8 hours 45 minutes, and the duration of labour 8 hours 15 minutes. She was delivered by forceps on account of her toxæmic condition. The infant weighed 5 lb. 1 oz., and did well. Uraemic symptoms appeared on the twenty-first day of the puerperium, and the patient died on the thirty-second day. In the other case, that of a multigravida, the patient had complained of headaches during pregnancy, but apart from poor general condition there were no other signs or symptoms. Labour was induced at term on account of her debility, and was spontaneous and normal, lasting 2 hours 25 minutes. The infant weighed 7 lb. 4 oz., and did well. The patient had some headache throughout the puerperium, which was afebrile; the pulse rate was 68 to 76, and blood pressure 124/90. She died suddenly on the seventh day after confinement. Post-mortem examination revealed a glioma in the region of the horn of the right lateral ventricle, enlargement of the pituitary gland, and adenomatous degeneration of the thyroid. There is obviously no connexion between these deaths and induction.

Pyrexia

In 171 primigravidae there were five cases of notifiable pyrexia (that is, a temperature of 100.4° F. recurring within twenty-four hours). These were due to urinary infection (three cases), tonsillitis (one case), and uterine sepsis following cervical laceration (one case). In 116 multigravidae there were three cases of notifiable pyrexia. These were due to influenza (febrile forty-eight hours only), two cases; uterine sepsis following exploration in a case of marginal placenta praevia and succenturiate placenta (one case). The pyrexia rate (all causes) was 2.7 per cent.; the rate in cases of uterine sepsis was 0.7 per cent.

Discussion

In the attempt to analyse the factors that influence the efficiency of the method, this series suggests that preliminary quinine medication and drug induction preceding artificial rupture of the membranes is followed by a shorter latent period than are inductions by simple rupture of the membranes. Drew Smythe and Thompson (1937) report an efficiency of 75 per cent., Tennent (1938) gives a figure of 70 per cent. in his series; in both cases no preliminary medication was administered. The higher efficiency rate of 78.9 per cent. for primigravidae and 91.4 per cent. for multigravidae reported in this paper would appear to be due to preliminary castor oil and quinine medication. Guttmacher and Douglas (1931), Jackson (1934), and Goodwin (1937) are of the opinion that efficiency of induction by artificial rupture of the membranes is increased by preliminary medication with castor oil and quinine. Wilson (1934) gives an efficiency of 80 per cent. with preliminary medication. No records were kept of the condition of the cervix or of the amount of liquor which was let off at the time of induction, but experience showed that a longer latent period was generally but not invariably to be expected where the cervix was long and where a good flow of liquor was not obtained.

In ante-natal supervision great importance is attached to the morale of the patients. Primigravidae attend a club for the purpose of social intercourse with their fellow patients and members of the staff. This promotes friendship and confidence, which greatly assists the work of the ante-natal clinics, and the good effects of overcoming apprehension are to a considerable extent already achieved in those ultimately singled out for induction. Early admission also helps towards the same end. Indeed, a familiarity with the hospital routine and personnel, and the acquaintance made of women already successfully delivered, and their babies, result in a feeling of confidence and optimism. This undoubtedly assists in obtaining the patients' co-operation throughout the stages of induction and lessens apprehension.

Conclusions

Combined premedication, drug induction, and artificial rupture of the membranes is a reliable method of inducing labour.

Labour is not appreciably prolonged by this method of induction.

Owing to the large proportion of abnormal cases in this series it is impossible to ascertain whether instrumental deliveries are increased. Practical experience indicates that this is not so.

There is no evidence that foetal mortality is increased. Prolapsed funis occurred three times, and in two of these cases artificial rupture of the membranes may have been a factor in causing the accident, though in neither case did the cord prolapse at the time of the operation. *Queen Charlotte's Textbook of Obstetrics* (1933) gives a figure of 0.89 per cent. prolapsed cord in 28,752 deliveries in sixteen years. The figure in this series is 0.7 per cent. (two cases). In cases where the head is not well approximated to or engaged in the pelvic brim there is always a possibility of this accident occurring, but its incidence in the present series does not appear to be abnormally high, and need not be taken as a contraindication to use of the method.

Providing full antiseptic and aseptic precautions are taken, the risk of sepsis is very small. Two cases of uterine sepsis occurred, of which one had had intra-uterine manipulations and one no interference beyond artificial rupture of the membranes, the cervix being lacerated in the course of spontaneous delivery.

There was no maternal death which could be attributed to induction.

Comment

It will thus be seen that our conclusions support the opinion expressed in Eden and Holland's (1937) *Manual of Midwifery*. There it is stated that rupture of the membranes is more reliable than other methods as regards certainty of onset of labour within a reasonable time, and is just as safe; and, further, that labour so induced lasts no longer and does not show a higher percentage of complications.

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