THE PLACE OF OXYTOCIN IN LABOUR

BY

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Up to 1947 the use of pituitary extract in labour had been condemned by most obstetricians, but in that year Eastman reinvestigated the effects of the drug. He used $\frac{1}{2}$ to 1 minim (0.15 to 0.30 unit) by intramuscular injection at half-hourly intervals, and reported excellent results in cases of inertia. Theobald *et al.* (1948) used the drug by the intravenous route, well diluted by isotonic saline and given by continuous infusion. They concluded that the drug was of great value when used in this way, and declared that the optimal dosage was in dilutions of between 1 in 5,000 and 1 in 10,000. About the same time Scadron (quoted by Stone, 1950) was using "pituitrin" by the intravenous route in dilutions of between 1 in 500 and 1 in 750 and reported excellent results. This dosage Theobald *et al.* would condemn as dangerous. Hellman *et al.* (1950), using a dilution of 1 in 1,500, confirmed the value of the intravenous route in the administration of pituitary extract in labour, and subsequent workers agree. Recent work by du Vigneaud (1954) has shown that oxytocin is a safer and more effective drug than whole pituitary extract.

There is still a measure of disagreement, however, about the proper indications for the use of oxytocin in labour, and the best and safest dosage to use. In this paper the use of intravenous oxytocin ("pitocin") in labour is discussed, and the indications are summarized in Table I.

TABLE I.—Indications for Use of Intravenous Oxytocin in 100 Cases Treated

Indication	No. of Cases
Failure of labour to ensue after amniotomy	60
Induction on account of toxæmia	31
" " " " maturity	20
" " " " intrauterine death	5
" " " " oedema	3
" " " " maternal distress	1
Failure of labour to ensue after spontaneous rupture of membranes	13
Selected cases of ante-partum hæmorrhage	7
Hypotonic uterine inertia	20

(This is an incidence of 1% of all deliveries in the hospital during the period under review)

Indications for Use of Intravenous Oxytocin

Failure of Labour to Ensur after Amniotomy

The indications for the surgical induction of labour have been widened considerably in this hospital in the past 27 months. Out of 9,800 deliveries, 410 patients have had labour induced by amniotomy, usually by high puncture of the membranes, using the Drew-Smythe catheter. Of these labours, 42% were induced on account of toxæmia of pregnancy, 35% on account of maturity, 7% on account of ante-partum hæmorrhage, and the remaining 16% for a variety of reasons. Of these patients, 68% were delivered within 24 hours and 92.8% within 48 hours, but 14.5% required the use of intravenous oxytocin to bring about delivery in this time.

In general, intravenous oxytocin drip was not used until an interval of 24 hours had elapsed after amniotomy. The reason for this delay is based on Reynolds's (1949) view that one of the causes of the onset of labour is a change in the tension of the myometrium. If amniotomy is performed the tension within the uterus is altered, and time should be allowed for this factor to become effective. I regard 24 hours as a convenient time, for more than 80% of the

patients will be in labour by then, no matter for what reason the amniotomy was made.

Cocks (1955) has shown the condition of the cervix to be of great importance in determining the rapidity and ease of delivery after amniotomy. This has been confirmed here, but cases are not divided into as many categories as in Cocks's series, the decision being made on the "feel" of the cervix alone. A cervix soft as the lips suggests that delivery will be rapid, one hard as the tip of the nose suggests a long interval between the induction and the onset of "pains," and a long tedious labour.

In certain cases of pre-eclampsia termination of the pregnancy must be considered despite an "unfavourable" cervix, for the danger to the foetus *in utero* may exceed the danger of premature birth.

While some of these patients will require immediate caesarean section (2.7% in this hospital), in others a "trial induction" may be decided upon. In the United States of America, Mauzy and Donnelly (1952) and Parker and Roberts (1954) have attempted to soften an unripe cervix by intravenous infusions of dilute oxytocin, and so to avoid caesarean section. Often these infusions have to be repeated over several days before the condition of the cervix has changed sufficiently to permit amniotomy, and the procedure must be frightening to the mother and dangerous to the baby, as it is left *in utero* and subjected to the effects of severe maternal toxæmia. Faris and Kahlenberg (1954) have also used intravenous oxytocin in an attempt to soften an unripe cervix. However, they limit the use of the drip to two consecutive days.

While there is a place for the use of intravenous oxytocin in this manner, it is a small one. In cases of toxæmia of pregnancy in which the cervix is found to be doubtfully ripe, and where delivery must be effected, the routine used here is to puncture the membranes. In some cases an intravenous oxytocin drip (1 in 5,000 dilution in 10% dextrose) is started at the time of amniotomy, but we usually delay 24 hours before using the drip (Table II). As the

TABLE II.—Use of Intravenous Oxytocin Drip in 60 Cases of Induction of Labour

Interval Before Use of Oxytocin	No. of Cases	Oxytocin-Delivery Interval	No. of Cases
Less than 12 hours	13	Less than 6 hours	25
12 to 23	6	6 to 11	22
24 " 35	21	12 " 17	5
36 " 47	13	18 " 23	5
48 or more	7	24 or more	1
		Failure or caesarean	2

induction is only a trial we are prepared to terminate the pregnancy by caesarean section should the toxæmia worsen or should any other indication arise.

In cases of amniotomy, dilute intravenous oxytocin used as described will reduce the induction-delivery interval if labour has not begun in 24 hours, but will avoid the discomfort and danger of routine oxytocin drip after surgical induction of labour.

Failure of Labour to Ensur after Spontaneous Rupture of Membranes

Most patients with spontaneous rupture of the membranes will go into labour within 24 hours without additional stimulation, as has been emphasized by Embrey (1953), but in the others the use of dilute intravenous oxytocin is most effective (Table III).

TABLE III.—Use of Intravenous Oxytocin Drip in 13 Cases of Spontaneous Rupture of Membranes

Interval Before Use of Oxytocin	No. of Cases	Oxytocin-Delivery Interval	No. of Cases
Less than 12 hours	0	Less than 6 hours	8
12 to 23	3	6 to 11	4
24 " 35	5	12 " 17	1
36 " 47	3		
48 or more	2		

Used in this way, the drug will reduce the danger to the foetus of continual drainage of liquor amnii and the possible danger of intrauterine infection.

Ante-partum Haemorrhage

Dilute oxytocin was used by intravenous drip in certain cases of accidental haemorrhage immediately after induction of labour by low amniotomy. In such cases there is an urgency to remove the child from the uterus, and, in severer grades, laparotomy may be necessary if labour does not start quickly or if severe concealed accidental haemorrhage is suspected. In these cases there may be intravascular clotting and extravasation of blood amongst the muscle fibres of the uterus, so that its physiological control is upset, and the additional stimulation of oxytocin may be necessary to bring on labour.

Similarly, the use of the drug may be indicated in some cases of placenta praevia where low puncture of the membranes does not bring on labour quickly and where bleeding continues.

Uterine Inertia

The work of Reynolds (1949), Nixon (1952), Caldeyro Barcia and Alvarez (1952), and Jeffcoate *et al.* (1952) has done much to elucidate the problems of inadequate uterine action. As Jeffcoate *et al.* (1952) have noted, it is only in hypotonic states that uterine stimulants are permissible; if they are given in hypertonic or incoordinate states they will aggravate the condition.

In hypotonic uterine inertia the use of dilute intravenous oxytocin has been shown by many workers to be of great value (Theobald *et al.*, 1948; Kaufman *et al.*, 1953; Stone *et al.*, 1955).

After a period of poor infrequent pains, during which time the patient becomes more and more disheartened and anxious, the administration of oxytocin by intravenous drip will give dramatic results, particularly if the membranes have ruptured (Table IV).

TABLE IV.—*Use of Intravenous Oxytocin Drip in 20 Cases of Hypotonic Uterine Inertia*

Interval Before Use of Oxytocin	No. of Cases	Oxytocin-Delivery Interval	No. of Cases
12 to 23 hours	2	Less than 6 hours	12
24 " 35 "	7	6 to 11 "	7
36 " 47 "	8	12 " 17 "	1
48 " 59 "	2		
60 or more hours	1		

Contraindications to Use of Intravenous Oxytocin

Pituitary extract is a powerful stimulant of uterine action, and if improperly used may lead to uterine rupture (Ferguson *et al.*, 1952) or even to maternal death (Mauzy, 1954; Lesser and Eason, 1954). Sufficient has already been written of these dangers to make further comment unnecessary.

Because of the known dangers of oxytocin it is unwise to use the drug in: (1) cases where there is disproportion or contraction of the pelvis; (2) in cases where a previous hysterotomy or caesarean section has been done, particularly if the section was a "classical" one; (3) in cases of abnormal presentation; and (4) in cases of multiple pregnancy where there is much uterine distension and the membranes are unruptured.

Most authors claim that the use of oxytocin in women having their sixth or subsequent baby is unwise, and in theory this should be true, as a greater amount of connective tissue is present in the uterus.

TABLE V.—*Age and Parity in Relation to the Use of Intravenous Oxytocin Drip in Labour*

Age No. of cases	15-19 6		20-24 19		25-29 32		30-34 23		35-39 13		40 or more 7	
Parity No. of cases	0 17	I 7	II 13	III 8	IV 9	V 12	VI 7	VII 12	VIII 8	IX 2	X or more 5	

In this hospital, dilute intravenous oxytocin has been given to patients of all ages and parity, and we have had no anxiety during any labour so treated (Table V).

Dangers of Intravenous Oxytocin Drip : Foetal Loss

Intravenous infusion of any substance has intrinsic dangers, and the use of oxytocin may constitute an additional hazard, as has already been pointed out.

In the present series two foetal deaths were directly due to the method, and both were preventable. Both of these deaths occurred early in the series, and the experience led to the development of the method now used. Since the introduction of this regime there has been no further foetal death due to the method, and in the entire series there has been no maternal death.

The death of the first baby was due to an episode of severe intrauterine anoxia that occurred during a rigor. This was later proved to be due to saprophytic contamination of the dextrose-saline with which the oxytocin was diluted. Although the baby was born alive, it remained cyanosed and died on the third day of life. Necropsy showed hyaline membrane in the lungs.

In the second case, labour was induced by high puncture of the membranes for a deteriorating pre-eclampsia. Twenty-seven hours later labour had not begun and a dilute oxytocin drip was started, a dilution of 1 in 1,000 in 10% dextrose being used. Unfortunately the solution was allowed to run initially at a rate of 60 drops a minute, and a severe uterine spasm occurred. There was evident foetal distress, and, although the child was born alive three hours later, it died the same day. Necropsy showed that death was due to intracranial haemorrhage.

After this death we developed the regime in use to-day, with a much stricter control of the rate of drip. I do not think it necessary for a doctor to remain constantly with the patient, nor is this practicable here, but the patient should be attended, and it is not difficult to train a midwife to detect any abnormality which may arise.

Optimum Dosage of Intravenous Oxytocin

If it is decided to use the drug the aim should be to induce uterine contractions within a period of three hours, and to produce contractions which last for 30 to 60 seconds and recur at intervals of three to five minutes. Between contractions the tone of the uterus should not be raised. Since an intravenous drip is uncomfortable for the patient, it should rarely be continued for more than 12 hours. After this time the drip should be removed to allow the patient to sleep, but if labour is not progressing on the following day the drip may be started again.

What, then, is the best and safest dilution of oxytocin to use in order to meet these conditions? In the past 27 months we have used dilutions of 1 in 10,000, 1 in 5,000, and 1 in 1,000, and as the effects have been so variable it seems that patients differ in their sensitivity to the drug. The present regime takes this factor into consideration.

When an indication for the use of oxytocin by intravenous drip exists, a solution of 1 in 5,000 in dextrose or dextrose-saline is prepared. The drip is started at a rate of 20 drops a minute for 30 minutes, increasing by 10 drops a minute every half-hour (to a maximum of 60) until the pains are regular, last 30 to 60 seconds, and recur every three to five minutes. If the pains occur at shorter intervals, or are of longer duration, the drip is slowed.

If labour is progressing satisfactorily at this dilution, the drip is continued until delivery occurs or 12 hours has passed. If, however, no contractions or only contractions of poor quality occur when the drip is running at 60 drops a minute, the solution is replaced by one of 1 in 1,000. Initially this is run at a rate of 20 drops a minute, increasing as necessary by 10 drops a minute every half-hour to a maximum of 60.

TABLE VI.—Use of Present Regime in 30 Cases

Indication	Strength of Solution Used		
	1:5,000	1:5,000 and 1:10,000	Failure
After amniotomy	7	10	2
After spontaneous rupture of membranes	2	1	—
In ante-partum haemorrhage	2	—	—
In inertia	4	2	—

Of the two cases of failure, the first was delivered on the following day after 400 ml. of the 1 in 5,000 solution. The second was improperly selected and failed to be delivered after a second infusion. She went into spontaneous labour and gave birth to a live child three days later.

This regime has been used 30 times, and in only two patients has it been necessary to repeat the infusion on the following day. The patients were then delivered, but these cases are considered failures.

Summary and Conclusions

From experience of dilute intravenous oxytocin drip I am convinced that it is a valuable addition in selected cases. However, since any intravenous infusion has potential dangers, and since pituitary extract has particular dangers, the method should be used with care. There is no place for its use as a routine in the initiation or stimulation of labour; and there is little place for its use alone in the induction of labour.

If used after the induction of labour by amniotomy, or in order to start labour pains after spontaneous rupture of the membranes, it is of great value. But in order to allow for changes in the mechanical, and perhaps hormonal, control of the uterus which follow amniotomy, I believe that, in general, its use should be delayed for about 24 hours. If this method is followed it will be found that a dilute intravenous oxytocin drip is needed in about 15% of cases induced; the remaining 85% will be in strong labour before the 24 hours has passed.

In certain cases of ante-partum haemorrhage the use of a dilute intravenous oxytocin drip is advisable as soon as amniotomy is performed.

In hypotonic uterine inertia the use of intravenous oxytocin is valuable, but once again the contraindications must be noted, and if there is any doubt it is better not to use the method.

Experience in this hospital shows that the drug is best used in a dilution of 1 in 5,000 to 1 in 1,000; the regime employed is described.

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COMPARISON OF MILK AND SOYA BEANS IN THE TREATMENT OF KWASHIORKOR IN UGANDA.

BY

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The value of soya protein in improving the growth of undernourished children and in feeding infants and toddlers has been investigated by a number of workers. Autret and Behar (1954), who have recently reviewed this work, concluded that the results were good, although there was still some doubt whether the protein of soya was as efficient as that of milk. Dean (1952) considered that feeds based on soya beans fortified with vitamin B₁₂ (cyanocobalamin) gave encouraging results in the treatment of moderately severe and uncomplicated kwashiorkor. It is, however, possible that soya protein may be less well utilized than milk protein (Dean, 1954), and there is stated to be support from animal experiment for the need to add vitamin B₁₂ to soya diets.

A comparison of the results of a more extensive trial of feeds made from soya beans with those of milk treatment in kwashiorkor may therefore be of value. This study includes the results of feeding some children entirely on soya and banana (*Musa* sp.) without the addition of vitamin B₁₂ or other food factors.

Certain practical problems in the treatment of children with kwashiorkor are also examined.

Materials and Methods

All the children in the series had oedema (not accounted for by causes other than protein malnutrition) or a low serum protein level, together with changes in colour or texture of the hair and skin lesions, and they had been under my care as in-patients within a period of eight months. For practical nursing reasons milk or soya was given to two groups of children admitted during different periods rather than to alternate children. Children whose condition was regarded as dangerous were always given milk treatment.

Cow's milk protein in the form of skim-milk powder, preceded by or reinforced with a concentrated milk protein (calcium caseinate—"casilan") was given to 35 children. No attempt was made to assess the value of these two products separately. "Milk" is used throughout the rest of this paper to indicate skim milk or casilan, or a mixture of both, and never refers to whole cow's milk. Soya beans were prepared as described by Dean (1952, 1954) and given to 42 children. "Vipac,"* 1–2.5 g. daily, as a source of vitamin B₁₂, was added to the feeds of 31 children. Methionine, 5 g. daily, was given in addition to eight children in this group. Supplements of sweet banana (*Musa sapientum*) or cooked plantain (*Musa* sp.), either alone as supplied in the ward diet or mixed with the soya-bean preparation in a Waring blender, were given to all children as soon as they were taking their full ration of high-protein food. Bread was also given to a few children. Records were kept of the composition of the feeds and

*Vipac contains per gramme: vitamin A, 2,000 U.S.P. units; vitamin D 400 U.S.P. units; vitamin B₁, 0.6 mg.; vitamin B₂, 0.9 mg.; niacin, 6.0 mg.; calcium pantothenate, 1.0 mg.; pyridoxine hydrochloride, 0.3 mg.; folic acid, 0.6 mg.; vitamin C, 20 mg.; vitamin B₁₂ activity=6 µg.