INDUCTION OF LABOUR BY TRANSABDOMINAL AMNIOCENTESIS AND SUBSTITUTION OF HYPERTONIC GLUCOSE FOR LIQUOR IN MISSED ABORTION AND INTRA-UTERINE FOETAL DEATH*

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Many aspects of foetal physiology might become clear if more were known about the intra-amniotic space. Electrolyte, hormone, volume, pressure, and perhaps visual studies of the immediate foetal environment, might provide valuable information on the causes of foetal distress and intra-uterine death. The amniotic epithelium and liquor probably play a more important part in the maintenance of normal pregnancy, placental function and the onset of labour than we are now aware of.

A change in the chemical constitution of the liquor amnii by the injection of hypertonic saline or glucose solution into the sac, is followed by labour in the majority of cases.[1,6,13,14] The method is used mainly in cases of missed abortion and intra-uterine foetal death in later pregnancy. It may have a wider application if used in therapeutic abortion and termination of pregnancy for foetal abnormality.[13] It has little place, if any, among the conventional methods of medical induction if one wants to obtain a liveborn foetus. The technique is as follows:

The foetus in missed abortion and intra-uterine death is collapsed and rolled up. The liquor is usually discoloured and thick, of less than normal volume, and may be very scanty. These factors make the technique more difficult than when the foetus is alive.

An X-ray of the foetus *in utero* will give valuable information on the position of the foetus, the uterine outline in relation to its contents, and the amount of liquor. Palpation may be very misleading, and I would advise an X-ray in every case before this procedure is undertaken. If, for instance, the needle enters the foetal back in error, the procedure will fail. In most cases under discussion here, however, an X-ray had usually already been carried out to confirm the intra-uterine death.

The idea is to puncture the amniotic sac in the gap between the flexed limbs, where there is a pool of liquor. Some people are much better than others at getting into the amniotic fluid, and this is important in the success rate. The nearer the midline the needle can penetrate the better, because it is less vascular (linea alba) and the placenta is less likely to be punctured. The site is always below the umbilicus and may be directly suprapubic if the uterus is small.

The patient should empty the bladder. Percussion of the uterus may be carried out to exclude the presence of bowel at the site of puncture. However, at caesarean section and hysterotomy one has never encountered bowel in front of the uterus. In cases that have had a previous abdominal operation, bowel may be adherent to the parietes in front of the uterus. A cautious approach should be made, possibly aided by a lateral radiograph, to exclude the presence of bowel at the area of penetration.

The operation should be performed under strict aseptic technique. The site is prepared by sterilizing the skin with several applications of antiseptic solution and the area draped off. Local infiltration with anaesthetic solution is done, but not deeply to the peritoneum. My own impression is that local anaesthesia increases the chance of sepsis and has little value beyond the dermis. A lumbar-puncture needle of average size is then inserted through the abdominal wall into the uterine cavity. The depth of penetration varies with the thickness of the abdominal wall in the particular patient. On entry into the uterine cavity, liquor can be withdrawn, and if it is discoloured and brown it is confirmatory evidence of intra-uterine foetal death. In certain cases no liquor is obtained, and then careful reassessment should be made whether the needle has in fact entered the uterine cavity. A scanty tap is due to absorption of liquor or non-secretion after intra-uterine death. Occasionally, the needle becomes blocked with vernix.

Depending on the duration of pregnancy and size of the uterus, an amount of liquor is withdrawn (100—150 ml.). The same amount of 50% glucose, or even more (up to 200 ml.), is then introduced into the uterine cavity. The needle is slowly withdrawn, and firm continuous pressure is applied over the puncture site to prevent the escape of liquor from the uterus into the peritoneal cavity. The external puncture site is sealed.

The patient is usually unaware of what has been done. Penetration of the needle through the parietal and uterine peritoneum is practically painless. Occasionally reflex spasm of the rectus abdominus muscle may occur. Uterine contractions do not start immediately.

To study the uterine response to local irritation and the effect of needle puncture on the myometrium, the following observations were made at caesarean sections:

1. Needle puncture of the uterus does not cause localized or generalized contraction of the myometrium.
2. Puncture of the upper segment is frequently followed by a gush of blood, which stops suddenly. Liquor may also run out.
3. Puncture of the lower segment may be followed by draining of liquor from the hole for up to 90 seconds.

One would therefore advise that the needle should be of a bore just big enough to inject 50% dextrose solution. Furthermore, it should be withdrawn slowly, and continuous firm pressure should be applied over the area for a period.

I have used this method of induction of labour in 9 cases of intra-uterine death and foetal retention. Conventional oxytocic drugs were not used, nor was this procedure preceded by an oxytocin-infusion medical induction that failed. Oxytocin sensitivity tests of the myometrium were not done. In all cases there was low spon-

*Paper presented at the 44th South African Medical Congress, Johannesburg, July 1963.

taneous myometrial activity. Vaginal examination was made in each case. The cervix was found tightly closed in every case, and the portio vaginalis long and not effaced. After clinical diagnosis of foetal death *in utero*, a radiograph was taken for confirmation and as a guide in the technique.

The ages of the patients varied from 34 to 40 years, and they were all multiparous. The high age and parity in these cases can be explained by the high incidence of foetal death caused by renal and vascular diseases in the late reproductive period.

The causes of intra-uterine death were as follows:

1. Essential hypertension with or without superadded toxaemia of pregnancy—5 cases;
2. Cord complications—1 case;
3. Unknown causes—3 cases.

The period of foetal retention after death varied from 7 to 21 days. In one case (Mrs. H. G.), a missed abortion at 18 weeks, the foetus was retained for 8 weeks. At induction by this method the uterus was palpable just above the symphysis pubis. Suprapubic amniocentesis was successful, and after aspiration of 80 ml. of brown discoloured fluid 150 ml. of 50% glucose were injected into the space (see below)

The duration of pregnancy at the time of foetal death was consistent with missed abortion in 3 of the cases (16 - 18 weeks) and intra-uterine foetal death in later pregnancy in the other 6 (30 - 34 weeks).

The latent period from the time of injection of the glucose solution to the onset of contractions was 10 hours in 4 cases, 16 hours in 1 case, 20 hours in 1 case, and 24 hours in 3 cases.

The duration of labour varied from 4 to 11 hours with an average of 8 hours. In 8 cases delivery was complete, with no retention of foetal products. In the remaining 1 case, an intra-uterine foetal death at 30 weeks, labour started 10 hours after induction and the mother started to bleed vaginally and had to have a hysterotomy done for central placenta praevia. In all the cases the postpartum blood loss was very little, usually 4 - 6 oz. Depot penicillin (600,000 u. daily) was given to each case from the time of induction. There was no morbidity in any case. A typical case of missed abortion in which this method was used is as follows:

Mrs. H. G. Age 39 years. Parity 5.

Normal-term deliveries, the last 5 years previously. She had never had cardiac or renal disease and no abortions. Her last menstrual period was on 25 November 1962. She felt foetal movements at 16 weeks, and attended her house doctor, who found that she had high blood pressure. No record of urinalysis. At about the 18th week of pregnancy foetal movements ceased and the uterus did not enlarge. The blood pressure improved. There was a slight brown discharge all the time.

When referred for treatment, she had had amenorrhoea for 28 weeks. The uterine size was that of a 14-weeks pregnancy, confirmed on vaginal examination. The blood pressure was normal, there was no oedema, and the urine did not contain albumin.

On vaginal examination no foetal parts could be felt, the cervix was closed, and the portio vaginalis was 1 inch long. Haemoglobin and fibrinogen estimations were normal. No biological pregnancy test was done. An anteroposterior and lateral radiograph of the abdomen showed a small rolled-up foetus low down in the pelvis, with overlapping skull bones. There was no bowel in front of the uterus above the symphysis pubis.

Suprapubic amniocentesis was performed, with a successful tap of brown liquor, of which 80 ml. was aspirated. 150 ml. of 50% glucose was injected through the needle. After withdrawal, firm pressure was applied. Intramuscular depot penicillin was given.

Within 24 hours labour started, and the patient was delivered of a macerated foetus after 7 hours. The abortion was complete, with a blood loss of 4 ounces. Penicillin was given for 3 days more. There was no pyrexia or pelvic infection after the abortion.

DISCUSSION

Retention of a dead foetus is unacceptable to all patients. The attitude of the gynaecologist has been to leave such cases alone until spontaneous labour starts. This attitude is based on the dangers of infection following surgical induction, the failure of medical induction due to low oxytocin sensitivity, and the unacceptability of major surgery in the form of abdominal or vaginal hysterotomy to deliver a macerated foetus.

Recently the treatment of missed abortion by high-dosage intravenous infusion of oxytocin has been advocated by several writers.[5,6,8,12] This method is not free from risk. I have used it, and can recall the violent tetanic contractions invoked. If sustained, these must cause uterine ischaemia to the point of gangrene. The procedure also causes vomiting[5,15] if high doses are used. This state of induced uterine hypertonia is uncomfortable and causes severe pain. The infusion may have to be repeated over successive days and this causes great anxiety to the patient and to the gynaecologist who has committed himself to deliver the patient.

In 2 cases of failed induction by high-dosage syntocinon in which abdominal hysterotomy was done, Sonnendecker[12] found gangrene and near-rupture of the uterine wall. The poor state of the uterine muscle is given as a cause for the failure of induction; the cases in which it succeeded may have had such a degree of near-gangrene as to make subsequent pregnancy and labour hazardous. There are other immediate risks of high-dosage intravenous infusion of oxytocin: coronary ischaemia[10] and hypertension[11] may be induced by 'pitocin,' and the infusion of large quantities of fluid, associated with the antidiuretic effect of vasopressin, may cause water intoxication.[5]

The observation that labour follows a change in the chemical composition of the liquor amnii is not new. Burke,[2] in doing amniography, noticed that the injection of 'uroselectan B' was consistently followed by labour and Playfair[9] injected 10 ml. of it in 115 cases with a 96% success of labour within 29 hours. When using 10 ml. of 50% glucose, Playfair noticed that the babies were blue at birth. Peel,[7] using the method at King's College Hospital in 1933, injected uroselectan and hypertonic glucose, but abandoned the method because of a maternal death from staphylococcal septicaemia. He advised caution in the use of this method if the foetus is alive, because he had several stillbirths for which no other cause than the method of induction could be found. He came to the following conclusion in 1962 after revival of the technique: 'It may well be now that modern antibiotics can be said to give us such a genuine sense of security that we can try anew the method that many of us abandoned as dangerous in the pre-antibiotic era. The method, however, has little place, if any, amongst the methods of induction of labour where the foetus is alive.'[7]

The method has been used mainly in cases of intra-uterine foetal death and foetal abnormality incompatible with life. Wood *et al.*[14] used it in 22 cases with 100% success and no maternal deaths, all delivered within 96 hours of induction; labour was less than 13 hours in all cases; of the anencephalics alive at the onset of induction, 2 died during labour and 2 died shortly after.

Bengtsson[1] uses 20% saline by intra-amniotic injection in cases of missed abortion where the myometrium is proges-

terone-dominated as shown by measurement of the urinary excretion of pregnanediol. In his opinion the placenta is severely and rapidly damaged, which reduces progesterone production. The myometrium then becomes oestrogen-dominated and uterine activity starts within a day. The abortion is usually completed in 34 hours on an average. With the present-day use of highly potent oral progestogens in threatened abortion, missed abortions appear to be more frequent now.[15]

Fuchs,[4] in Copenhagen, has now completed two series of cases, the first with 10% saline and the second with 20%. The results of the second series were the better. Of 230 cases between 12 and 24 weeks, 90% went into labour with no other treatment than the injection of saline. Most of the failures were earlier than 13 weeks, so that one can obtain almost complete success in termination between 13 and 24 weeks. This is interesting because the uterus has negligible activity at this stage of pregnancy, and oxytocin or ergometrine infusion is not so frequently successful at this time. Fuchs had no maternal deaths, and the incidence of complications was less than after hysterotomy. In later pregnancy oxytocin may succeed, but most patients do not like to have repeated infusions. Wood[13] advises that if induction is decided upon in missed abortion, foetal death or abnormality, and the uterus does not quickly respond to oxytocin (within 1 day), then intra-amniotic injection is indicated. The reason for trying oxytocin first in these cases is that occasionally infection does occur, although the abdominal route is much safer in this aspect than artificial rupture of the membranes.

Occasionally the injection has to be repeated (Fuchs found it necessary in 1% of cases) and this may be due to (1) intra-foetal injection of the solution, particularly in a macerated foetus or missed abortion, and (2) failure to remove enough fluid if the amount is excessive. Wood[13] prefers 20% saline before 20 weeks, provided there is no hypertension or renal disease. After 20 weeks, he uses 200 ml. of 50% glucose, although smaller amounts will also work.

Why the procedure works has not been discovered. Csapo[2] thinks it is a suppression of progesterone production by the placenta with removal of the local myometrial block. His evidence for this is (*a*) histological degeneration of the placenta, (*b*) the drop in blood-progesterone level that occurs after injection, and (*c*) the delay in the labour that follows injection if parenteral progesterone is given. Bengtsson[1] is of the same opinion; he was able to delay labour by injecting 250 mg. of acetoxyprogesterone into the anterior uterine wall. It is not an irritant effect, because some delay occurs before the uterus becomes active after the injection. *In vitro* 50% glucose inhibits contractibility.[12] Nor is it a volume effect. It might be a local effect on myometrial electrolytes or some other change mediated by placental destruction, although the success in some cases of missed abortion does not support the latter idea.

SUMMARY

A method of inducing labour in cases of missed abortion and intra-uterine foetal death is described. It may be applicable to a wider field of foetal abnormality and therapeutic abortion, but has little if any place in the delivery of a liveborn foetus.

The amniotic sac is punctured by paracentesis of the uterus under local anaesthesia, a quantity of liquor amnii depending on the duration of pregnancy and size of uterus (usually 100 - 150 ml.) is withdrawn, and an equal amount or more of 50% glucose solution is introduced. Uterine contractions resulting in expulsion of the contents usually start within 10 - 20 hours and the duration of labour varies from 4 to 11 hours. Details and results of the procedure are given.

The author describes a series of 9 cases and refers to the work of others in this field. The value of other methods of induction is discussed. Little is known about the method of operation of the procedure.

My thanks go to Dr. H. Siertsema, Superintendent of the Krugersdorp Hospital, for allowing the use of some of the cases in this series for publication.

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