SURGICAL INDUCTION FOR SUSPECTED PLACENTAL INSUFFICIENCY

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In recent years there has been a marked increase in the number of surgical inductions of labour carried out at Hammersmith Hospital. The indications for induction have been widely extended to include all cases in which continuation of pregnancy may endanger the life of the foetus.

Evidence has been accumulating that impaired uterine and placental circulation, with consequent reduction in oxygen supply to the foetus, occurs in certain circumstances. Recently it has been the policy of this department to induce labour in these circumstances, in the belief that the impairment of circulation is progressive and in the expectation that early release from this unfavourable environment will save some infants who would otherwise have perished. In pursuit of this policy more than 70% of the inductions in 1956 were carried out for post-maturity, mild hypertension, or a history of bleeding during pregnancy.

The object of this paper is to consider the value of surgical induction in these cases.

Present Series

In the six years 1951 to 1956, there were 12,047 deliveries and 999 surgical inductions of labour. During this period the induction rate rose from 2.1 to 14.6%. Table I shows the indications for induction in 1953, when the rate was 7.5%, and in 1956, when it was 14.6%. The figures of Parker (1957) and Tennent and Black (1954) have been included for comparison.

TABLE I.—Indications for Surgical Induction

	Hammersmith Hospital		Parker 1950-2	Tennent and Black 1950-2
	1953	1956		
Total no. of inductions	140	325	1,099	1,585
Induction rate	7.5%	14.6%	19.8%	18.3%
Hypertension				
pre-eclampsia	95 (68%)	193 (59%)	41%	32%
post-maturity	32 (23%)	48 (15%)	19%	40%
Disproportion	2 (1.5%)	22 (7%)	11%	12%
Rhesus iso-immunization	1 (1%)	14 (4%)	—	1%
Others	10 (6.5%)	48 (15%)	29%	15%

In the Hammersmith series most of the cases of hypertension and pre-eclampsia were mild and the indication for induction was suspected placental insufficiency. As a blood pressure of 120/80 has been regarded as the upper limit of normal, many cases have been included under the heading of hypertension which others might have included under the heading of post-maturity. Tennent and Black record post-maturity as the indication for induction in 40% of their cases.

One-third of the cases placed under the heading of "others" in this series were also induced for suspected placental insufficiency—for example, slight bleeding during pregnancy and twin pregnancy at term.

Method of Induction

The method of induction used was rupture of the membranes preceded by castor oil, an enema, and a bath. In most cases hindwater puncture was combined with rupture of the forewaters, but on a number of occasions one or the other method alone was employed. On six occasions labour was induced by the insertion of a soft rubber tube into the lower segment.

If labour did not ensue within 24 hours, a high vaginal swab was sent for bacteriological examination and antibiotics were given prophylactically. Until the middle of 1955, caesarean section was carried out if labour had not become established within 48 hours. Since then the period has been extended to 72 hours, and within this period an attempt has been made to bring the patient into labour with an intravenous oxytocin drip.

Is the Method Safe?

Maternal Mortality.—In this series there was one maternal death, a 2-para aged 38 who had mitral stenosis. Following an accidental haemorrhage at the 38th week, the membranes were ruptured and she was delivered by forceps nine hours later. The total blood loss was 57 oz. (1,620 ml.). She was given 1 pint (570 ml.) of dextran and 3 pints (1,700 ml.) of blood. On the second day of the puerperium she developed cardiac failure, and in spite of treatment she died on the 15th day. Permission for a post-mortem examination was refused. There was no evidence to suggest that death was attributable to the surgical induction.

Maternal Injury.—No injuries due to surgical induction were recorded during the period under review.

Maternal Morbidity.—The morbidity rate for all causes following surgical induction of labour was 9.1% compared with 5.3% for all deliveries during the same period. The criterion of morbidity employed was the Ministry of Health definition of puerperal pyrexia.* The higher morbidity rate in the induced group was associated with the higher caesarean section rate in that group—14.5% compared with the overall section rate of 5.4%. The morbidity rate associated with vaginal delivery was actually lower after induced labour than after spontaneous labour (Table II). With

TABLE II.—Puerperal Pyrexia (Ministry of Health Standard)

	Total No. of Cases	With Pyrexia	
		No.	%
Vaginal delivery without surgical induction	11,193	430	3.8
Vaginal delivery after surgical induction	854	28	3.3
Caesarean section without surgical induction	499	132	26.5
Caesarean section after surgical induction	145	42	28.9

prophylactic antibiotic therapy, therefore, it is apparent that the maternal risk associated with surgical induction is the increased liability to caesarean section. An increase of 9.1% in the caesarean section rate has been demonstrated in the induced group, but this figure probably exaggerates the risk, because a higher section rate would in any case be expected in the group selected for induction.

Is the Method Effective?

During the years 1952-5, A. F. Bushby (personal communication) studied the induction-delivery interval in 517 cases in this department. He found that over 75% were delivered vaginally within 48 hours. He also confirmed a previous observation made by J. C. M. Browne and

*During 1951 the old standard applied—that is, "a temperature of 100.4° F. (38° C.) or over, maintained for 24 hours or recurring during that period, in the first 21 days after delivery, but excluding the first 24 hours." During 1952-6 the new Puerperal Pyrexia Regulations (1951) definition was used—that is, "a temperature of 100.4° F. (38° C.) or over occurring at any time within 14 days after delivery."

TABLE III.—Induction-Delivery Interval (After Bushby) 1952-5 (517 Cases). Percentage of Women Delivered Vaginally Within 48 hours.

Method of Induction	Primi-gravidae	Multi-gravidae	Total	Total No. Induced
Rupture of fore- and hind-waters	76.3%	85%	77.5%	346
Rupture of forewaters	89.7%	93%	89.8%	86
„ „ hindwaters	72.7%	81.8%	75.3%	85

D. Meagher (1952, unpublished data) at Hammersmith Hospital that rupture of the forewaters gave better results than rupture of the hindwaters. The combined method gave results intermediate between the two (Table III).

J. Walker (1956, personal communication) found that 85% of women induced by rupture of the membranes were in labour within 72 hours. Of the remaining 15%, a considerable number had a further prolonged delay before the onset of labour. This observation led to a change in the policy in this department, and now patients who are not in labour after 72 hours are delivered by caesarean section. Walker also confirmed Browne's (1952) observation that the induction-delivery interval was not seriously prolonged when the cervix was unripe. Comparison between primigravidae with a ripe cervix and those with an unripe cervix, in regard to the percentage in labour within 72 hours of induction, showed a difference of only 7% (Walker).

Caesarean Section

Caesarean section was carried out on 145 occasions after surgical induction during the period reviewed, an incidence of 14.5%. Table IV shows the annual increase in the number of sections carried out after induction.

Although the number of caesarean sections after surgical induction has increased, the overall caesarean section rate in the hospital has scarcely altered (Fig. 1). An attempt

TABLE IV.—Caesarean Section after Surgical Induction

	No. of Deliveries	No. of Surgical Inductions	Caesarean Section After Surgical Induction	
			No.	%
1951	1,858	40	5	12.5
1952	1,797	123	14	11.4
1953	1,921	140	16	11.4
1954	2,096	151	24	16.0
1955	2,151	220	40	18.2
1956	2,224	325	46	14.1

FIG. 1.—Surgical induction and caesarean section rates.

was made to classify the indications for caesarean section after surgical induction, but it proved impossible to dissociate failure to deliver on the one hand from the original indication for induction on the other. The indication for caesarean section was foetal distress in 28% of the cases, and one section was carried out for prolapsed cord.

Tennent and Black (1954) did not advocate routine caesarean section after 72 hours. They thought that in the hypertensive and post-mature groups they lost seven babies by this policy, but in order to save those seven they calculated that they would have had to perform 113 caesarean sections. Gibson (1952) reported a very high foetal mortality (25%) when the latent period after induction exceeded 72 hours.

Is the Method Worth While?

As a result of the increasing use of surgical induction for the indications stated, a steady reduction in the overall still-

FIG. 2.—Foetal loss in relation to surgical induction.

birth and neonatal death rates might have been expected. The significance of such a reduction would, of course, be modified by any marked changes in the hospital population during these years.

The hospital population has, in fact, shown little change during the six years. During 1956 the numbers of Jamaican and other coloured women increased slightly, but this group still represents less than 5% of the population. The number of unbooked admissions has always been small at this hospital, and during this period it decreased still further, from 3.5% in 1951 to 2% in 1956.

An analysis of the stillbirths and neonatal deaths into clinical groups, as suggested by Baird and Walker (1955) shows only minor changes during these years (Table V).

TABLE V.—Grouping of Stillbirths and Neonatal Deaths Under Clinical Causes (after Baird and Walker)

	1951-3 (All Cases)	1954-6 (All Cases)	1951-6 Induced Group
Premature, cause unknown	52	65	3
Mature, Trauma (including stress asphyxia and cord)	21	16	4
Hypertension and pre-eclampsia	24	31	5
Ante-partum haemorrhage (without toxæmia)	27	21	10
Foetal abnormality	24	24	6
Maternal disease	32	39	13
Others—haemolytic disease	3	6	2
Others	28	25	8
Total	211	227	51

The number of babies lost in the hypertension and pre-eclampsia group was seven in each of the three years 1954 to 1956 compared with an average loss of nine in the preceding three years. The "mature, cause unknown" group was reduced from seven to five. There was, however, a

corresponding increase of two in the number of deaths from trauma, stress asphyxia in labour, and cord entanglement, and an increase of three in the "premature, cause unknown" group. The number of deaths due to antepartum haemorrhage (unrelated to hypertension and pre-eclampsia) has not altered.

In the induced group a relatively large number of foetal deaths were attributed to maternal hypertension and pre-eclampsia. However, the number was no higher than would be expected as a result of the high incidence of these conditions in women who were induced.

Fig. 2 shows that the overall foetal death rate has remained virtually static, despite the marked increase in the induction rate. The combined stillbirth and neonatal death rate in the induced group fell gradually until, in 1955, it was actually lower than the total figure for all deliveries. No doubt this fall is due to the increasing number of inductions performed for minor indications; nevertheless the conditions for which induction was performed constitute a distinct danger to the baby. It may be misleading to draw any firm conclusions from this trend, but a balance sheet can be drawn up summarizing the points which have been made for and against induction.

For Induction

1. Reduction of the stillbirth and neonatal death rate in the induced group to that of the whole group.
2. The overall caesarean section rate has not increased.

Against Induction

1. Overall stillbirth and neonatal death rate has not apparently improved.
2. 10-15% risk of caesarean section after induction.
3. Slightly increased morbidity rate.
4. Psychological trauma.

Until the placental reserve can be measured, a large number of women with adequate placental function will be induced to save a few infants from placental insufficiency. A number of hospitals have reported induction rates of over 20%. They have achieved caesarean section rates after induction of under 5% by allowing the latent period to exceed 72 hours in many cases. They are thus submitting many infants to a danger far greater than that of allowing pregnancy to continue. Once surgical induction has been performed, delivery should be effected within three days.

Summary

An analysis has been made of the effect of the seven-fold increase in the rate of surgical induction of labour at Hammersmith Hospital during the period 1951 to 1956. The risk to the mother is that of caesarean section. The caesarean section rate after induction was 14.5% against an overall rate of 5.4%. Caesarean section was carried out when labour was not established within 72 hours. In spite of this policy and the rising induction rate, the overall caesarean section rate did not increase.

The incidence of puerperal pyrexia was 9.1% against the overall rate of 5.3%. This increase was entirely associated with the higher caesarean section rate.

The increased induction rate has not apparently effected a reduction in the overall foetal mortality during the period under review.

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TUBELESS GASTRIC ANALYSIS

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Gastric test-meal examinations are now carried out mainly for two purposes. One is to see whether the patient is capable of secreting free hydrochloric acid, as in the diagnosis of pernicious anaemia and carcinoma of the stomach. The other is to see whether the patient secretes free hydrochloric acid in excessive amounts or concentrations, as in the study of duodenal ulcer and stomal ulceration. Segal *et al.* (1950a, 1950b) introduced a method of tubeless gastric analysis depending on the use of cation exchange resins which are dissociated in the presence of free hydrogen ions in the stomach, so that the cation is absorbed and appears in the urine. Two compounds have been used, both marketed under the trade name "diagnex." Quininium is used as the exchange cation in the one method, and the dye azure A in the other. This paper reports our results with the quininium and azure A resins used as screening tests for achlorhydria. We have compared the results with those of histamine test meals on the same patients.

Patients Studied.—We investigated 124 patients. The majority were in-patients requiring gastric analysis who had been admitted to the Radcliffe Infirmary under the care of one of us (L. J. W.). The remainder had diagnex tests as out-patients and were admitted to hospital for the histamine meal, usually for one morning only. In the latter group there was a high incidence of achlorhydria, since the patients were being investigated as part of a study of the relation between achlorhydria and anaemia.

Procedure of Diagnex Tests

The basis of the two tests is similar. The patient is requested to fast overnight for at least eight hours. He then empties his bladder, discards the urine, and takes a capsule containing caffeine sodium benzoate, 500 mg., as gastric stimulant. One hour later he again empties his bladder, this time saving the urine as a control sample. Immediately afterwards he takes 2 g. of granules by mouth—a carbacrylic cation exchange resin, "amberlite RXE-96," in reversible combination with either quininium or the orthoquinoid salt of azure A. Free hydrogen ions in the stomach liberate quininium or azure A, which is then absorbed into the blood stream and excreted in the urine. Maximum excretion normally occurs within two hours. The total urine passed in the two hours after the granules have been taken is analysed for its content of quininium or azure A.

The time limit of two hours is imposed to avoid errors due to later displacement of the test cation in the intestine by cations such as magnesium, sodium, or potassium. Drugs such as kaolin, alkalis, barium, and magnesium salts should for the same reason not be taken for 24 hours before the test.

Methods of Estimation

Urinary quininium is estimated by an ether/sulphuric acid extraction method (Kelsey and Geiling, 1942). The control urine serves as a check on any extraneous fluorescent substances present. The urine specimens are made alkaline and