For Debate

Increased Frequency of Neonatal Jaundice in a Maternity Hospital

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Summary

The frequency of "significant" jaundice of the newborn at this hospital increased from 8·1% of all live births in 1971 to 12·1% in 1972 and 15·4% in 1973. This coincided with an increased use of oxytocic agents and epidural anaesthetics in labour, and a change in the artificial feed given to normal infants.

A retrospective study of jaundiced infants born in 1972 failed to explain the increase in jaundice. Though the use of oxytocic agents was not the direct cause, since their use results in the delivery of many more infants before 40 weeks of gestation it may be a contributory factor. The use of epidural anaesthetics was statistically related to the development of jaundice but the nature of the association was not clear. Mothers of infants who became jaundiced had a significantly higher frequency of poor past obstetric histories, but once again the association was not clear. The change in artificial feeds was excluded as a possible cause.

Introduction

Though mild jaundice of the newborn is accepted as normal severe jaundice is a serious potential cause of permanent brain damage. As the number of factors influencing perinatal bilirubin metabolism increases, so does the number of mechanisms which could theoretically lead to severe jaundice. Furthermore, probably some of the new methods being introduced into obstetric and newborn care will affect neonatal bilirubin metabolism. For example, increases in the frequency and severity of neonatal jaundice have been linked with the increased use of oxytocic agents for the active management of labour.[1 2]

A sharp increase in the frequency of "significant" jaundice of the newborn occurred at this hospital in 1972-3. During that period there were also major changes in obstetric and paediatric practice, including an increased use of oxytocic agents and epidural anaesthesia.

The changing frequency of neonatal jaundice from all causes except rhesus isoimmunization at this hospital during January 1969 to December 1973 is shown in table I. Though the number of live births each year changed little the numbers of infants with peak total serum bilirubin concentrations over 206 μmol/l (12 mg/100 ml) more than doubled, as did the numbers with concentrations over 290 μmol/l (17 mg/100 ml). In this report we call a peak total serum bilirubin concentration over 206 μmol/l "significant" jaundice. This level is generally accepted as the upper limit for so-called "physiological jaundice of the newborn" higher levels in mature infants suggest an underlying pathological process.[3] The figures in table I refer to infants of all gestational ages. We have arbitrarily called peak total serum bilirubin concentrations over 290 μmol/l "severe" jaundice to highlight the fact that the increase in the frequency of jaundice is the same at high levels.

TABLE I—*Changing Incidence of Jaundice during 1969-73 (Excluding all Cases of Rhesus Isoimmunization)*

Year	Total No. of Live Births	Infants with Peak Serum Bilirubin >206 μmol/l		Infants with Peak Serum Bilirubin >290 μmol/l	
		No.	%	No.	%
1969	3793	236	6·2	56	1·5
1970	3695	264	7·1	68	1·8
1971	3499	284	8·1	60	1·7
1972	3769	454	12·1	105	2·8
1973	3575	554	15·5	143	4·0

Conversion: SI to Traditional Units
Bilirubin: 100 μmol/l ≈ 6 mg/100 ml.

Monthly analysis of the frequency of significant jaundice showed that the increase began in the first months of 1972. Both its size and the suddenness suggested that a single new aetiological agent might be involved. The fact that major changes in the management of labour and in newborn care coincided with the increase provided further suggestive evidence. To test this hypothesis a study involving three fields of inquiry was performed: a review of the hospital's non-medical functions where these might be relevant to jaundice; a review of obstetric and paediatric routines, looking especially for recent changes in patient care that could conceivably be linked with jaundice; and a retrospective study of all infants born in 1972 who developed peak serum bilirubin concentrations over 206 μmol/l.

Materials and Methods

HOSPITAL ENVIRONMENT

Recent changes in the environment to which patients are subjected when admitted to hospital were sought. Discussions were held with ancillary services including the engineering department, the catering department, and the domestic staff and their activities reviewed. Such factors as water supply, food supply, heating, ventilation, and lighting (and its exclusion from nurseries) were considered.

PATTERNS OF CARE

Routines of patient care in all areas were reviewed, once again looking for recent changes. Such factors as "routine" drug administration (aperients, antiseptics, "night sedation," and iron and vitamin preparations), induction policy, and routine feeding were considered.

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INFANTS WITH SIGNIFICANT JAUNDICE

The case notes of all infants born in 1972 who developed peak serum bilirubin concentrations of over 206 μmol/l were reviewed. A careful search of each case, including the results of laboratory investigations, was made, and whenever a plausible diagnosis could be made the case was excluded from further consideration. At this hospital any baby who becomes jaundiced undergoes routine serum bilirubin estimation. This is repeated daily, or more often, until there has been a significant drop in level and the jaundice is fading. Investigations carried out routinely in 1972 on all infants with unexplained jaundice whose total serum bilirubin concentrations exceeded 256 μmol/l (15 mg/100 ml) are listed in table II.

There were 312 infants whose jaundice could not be explained. A control group of 312 infants born in 1972 who had not developed significant jaundice was formed for comparison. Each control infant was matched with a jaundiced infant for maternal age and parity and selected from the hospital birth register as close as possible to the entry for each jaundiced infant. Preterm infants were not included in the control group. The two groups were compared for a wide range of obstetric and paediatric factors. Some of these had little obvious direct relevance to jaundice, and only those associated with relevant findings are discussed here.

TABLE II—*Routine Investigations on Infants with Unexplained Jaundice (Serum Bilirubin >256 μmol/l)*

All Cases	When Indicated
(1) Serial serum bilirubins	(1) Red cell G-6-PD assay
(2) Maternal and infant ABO and Rh groups	(2) Red cell pyruvate kinase assay
(3) Infant's direct Coombs test in albumin and saline	(3) Blood culture, lumbar puncture, other bacteriological studies
(4) Maternal antibodies and haemolysins	(4) Viral studies
(5) Hb, reticulocyte count, red cell morphology	(5) Serological studies for toxoplasmosis, syphilis
(6) Urine-reducing substances	
(7) Urine microscopy and culture	
(8) Infant's serum IgM	

Results

HOSPITAL ENVIRONMENT

No relevant recent changes in the hospital environment were found.

PATTERNS OF CARE

Three major changes in patient care were confirmed.

Use of Oxytocic Agents.—A policy of active management of labour was introduced in December 1971.[4] Before this the induction rate was about 15%, oxytocin being given only to patients who had failed to establish labour within 12 hours of surgical induction, and to a few to accelerate labour. From December 1971 the induction rate has been about 30%, all patients receiving oxytocin immediately after artificial rupture of the membranes.

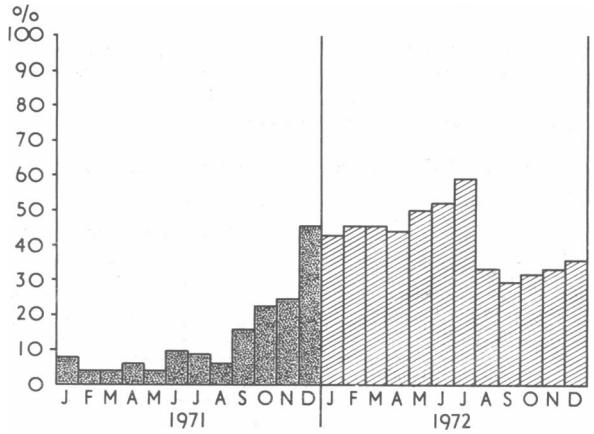
Epidural Anaesthesia.—Until August 1971, 5-10% of patients received an epidural anaesthetic, but from September onwards the frequency increased. In 1972 the monthly frequency varied from 30% to 60% (see fig.).

Infant Feeds.—Until September 1971 artificial feeds for normal infants were prepared in the hospital milk bureau from a proprietary powdered milk. They were then replaced with prepacked artificial feeds from another manufacturer.

INFANTS WITH SIGNIFICANT JAUNDICE

In 1972, 482 infants (12·8% of live births) developed significant jaundice. In 170 of these explanations were found and they were excluded. The remaining 312 (8·3%) with unexplained jaundice are considered here. The reasons leading to exclusion of the 170 cases are given in table III.

"Preterm" was defined as delivery before 37 completed weeks of gestation. When dates were in doubt the estimated date of delivery determined by ultrasonic fetal cephalometry was used.[5]



Percentage of women given epidural anaesthetic in months of 1971-2.

TABLE III—*Reasons for Excluding 170 Jaundiced Infants from Study*

	No. of Infants		No. of Infants
Preterm	92	G-6-PD deficiency	2
Rhesus isoimmunization	28	Galactosaemia	1
ABO incompatibility	10	Congenital spherocytosis	1
Significant infection	15	Case notes lost	6
Significant bruising	16		

"Significant bruising" was recorded whenever bruising was mentioned in the case notes. Of the 16 infants excluded for this reason four had widespread petechial haemorrhages and one had bruised feet from capillary blood collections (for serum bilirubin estimations). Six had scalp trauma from ventouse extraction.

"Significant infection" included five infants with urinary tract infections, one with proved septicaemia, three with septicaemia-like illnesses not proved by culture, two with pneumonia, two with umbilical sepsis, one with salmonella gastroenteritis, and one with an infected circumcision wound.

ABO incompatibility led to exclusion in only 10 cases and was thus probably underdiagnosed. The diagnosis was made only when *(a)* the blood groups of the mother and infant were appropriate and, *(b)* a direct Coombs test in cord blood gave a positive result. All cases thus diagnosed had severe jaundice.

PATTERN OF JAUNDICE

Of the 312 infants 150 (48·1%) developed peak serum bilirubin levels between 207 and 240 μmol/l (12·1 and 14·0 mg/100 ml) (table IV). Nevertheless, 46 (15%) reached levels at which exchange transfusion had to be considered. Fifteen infants (4·8%) (0·4% of all live births) required exchange transfusions.

A total of 196 infants (63%) reached their peak levels at 4 or 5 days of age (table V); few showed the early-peak characteristic of haemolytic jaundice. At 8 days of age 55 infants (17·6%) still had levels of 207-274 μmol/l and 51 infants (16·3%) levels of 173-206 μmol/l. In 176 the levels were unknown. The overall pattern seemed to be an unconjugated jaundice, slow to peak and slow to resolve. Except when jaundice was resolving none of the infants studied developed conjugated bilirubin concentrations over 34 μmol/l (2 mg/100 ml).

TABLE IV—*Peak Total Serum Bilirubin Levels in the 312 Jaundiced Infants*

Peak serum bilirubin mg/100 ml: / μmol/l:	12·1–14·0 / 207–240	14·1–16·0 / 241–274	16·1–18·0 / 275–309	18·1–20·0 / 310–343	≥20·1 / ≥344
No. (%) of infants	150 (48·1)	83 (26·6)	33 (10·6)	25 (8·0)	21 (6·7)

TABLE V—*Age in Days (Hours) of the 312 Jaundiced Infants at which Peak Total Serum Bilirubin Levels were Attained*

Age in Days (h):	2 (48 ± 12)	3 (72 ± 12)	4 (96 ± 12)	5 (120 ± 12)	6 (144 ± 12)	≥7 (>156)
No. (%) of infants	5 (1·6)	49 (15·7)	103 (33·0)	93 (29·8)	38 (12·2)	24 (7·7)

ORAL CONTRACEPTION

Similar numbers of mothers in the jaundiced and control groups had taken oral contraceptives at some time (table VI). There were no significant differences in the numbers still on the pill at any stage during the 12 months before conception.

TABLE VI—*Use of Oral Contraceptives by Mothers of the Two Groups of 312 Infants*

	Jaundiced Group	Control Group
On pill at some time	109	124
On pill until 6 months before conception	55	66
On pill until 3 months before conception	42	47
On pill until 1 month before conception	26	19
On pill at conception	4	5
Total	136	261

PAST OBSTETRIC HISTORY

All complications occurring in previous pregnancies occurred more often among mothers of the jaundiced infants (table VII) ($\chi^2 = 11{\cdot}76$; $P<0{\cdot}001$). These mothers had also had significantly more spontaneous and induced abortions ($\chi^2 = 10{\cdot}51$; $P<0{\cdot}001$).

TABLE VII—*Past Obstetric History in Mothers of the Two Groups of 312 Infants*

	Jaundiced Group	Control Group
1 or 2 Abortions	55	37
More than 2 abortions	9	3
Therapeutic abortions	31	20
Stillbirth	9	4
Neonatal death	7	2
More than one complication	8	1
Total	111 (36%)	66 (21%)

Poor post obstetric history: $\chi^2 = 11{\cdot}76$; $P<0{\cdot}001$.

ONSET OF LABOUR

Labour was induced in 109 mothers in the jaundiced group (34·9%) and in 101 mothers in the control group (32·4%), All but eight of the jaundiced group mothers and four of the control group mothers were induced by artificial rupture of the membranes followed immediately by intravenous oxytocin.

The indications for induction were different in each group. In general, indications leading to earlier induction predominated in the jaundiced group; 31 such inductions (28·4%) were for pre-eclampsia and 15 (13·8%) for "social" or psychiatric reasons. The only indication in which the difference approached significance was "post-term" ($\chi^2 = 5{\cdot}01$; $0{\cdot}05>P>0{\cdot}01$). Altogether 77 of the jaundiced group mothers (71%) were induced before 40 weeks of gestation compared with 32 (29%) induced afterwards; in the control group 46 mothers (45%) were induced before 40 weeks compared with 55 (54%) afterwards. The difference between the two groups was significant ($\chi^2 = 13{\cdot}60$; $P<0{\cdot}001$).

USE OF OXYTOCIN

A total of 162 of the jaundiced group mothers (52%) and 147 of the control group mothers (47%) were given oxytocin. In the jaundiced group 105 (64·8% of those given oxytocin) were given oxytocin to induce labour, the remaining mothers having it to accelerate labour after spontaneous onset. Of the control group mothers 99 (67·3%) were induced with oxytocin, the others having it for acceleration. Thus there were no significant differences between the groups in the numbers given oxytocin nor in how it was used. The maximum dose ranges and durations of administration between the groups were the same.

Comparison of peak total serum bilirubin concentrations in the jaundiced group showed no difference between those whose mothers received oxytocin and those whose mothers did not (table VIII).

TABLE VIII—*Peak Serum Bilirubin Levels in Jaundiced Infants in Relation to Oxytocin Administration*

Peak Serum Bilirubin (μmol/l)	Infants of Mothers Given Oxytocin (n = 162)	Infants of Mothers Not Given Oxytocin (n = 150)
207–	69	79
241–	50	33
275–	18	17
310–	15	11
⩾344	10	10

EPIDURAL ANAESTHESIA

Altogether 170 of the jaundiced group mothers (54·5%) and 141 of the control group mothers (45·2%) were given an epidural anaesthetic. This difference was probably significant ($\chi^2 = 5{\cdot}39$; $0{\cdot}025>P>0{\cdot}01$). The numbers of "top-up" doses given in each group did not differ significantly. The number of "top-ups" reflects the total dose of the local anaesthetic used and the duration of anaesthesia.

As mothers who receive oxytocin are also likely to have an epidural anaesthetic those in whom this combination occurred were compared with 100 control group mothers. The difference was not significant. The numbers of mothers in each group given an epidural anaesthetic alone or oxytocin alone or neither were not significantly different.

MODE OF DELIVERY

The methods of delivery in each group related to the use of epidural anaesthetics are shown in table IX. Abnormal deliveries occurred significantly more often in the jaundiced group (42%) than in the control group (33%) ($\chi^2 = 6{\cdot}11$; $0{\cdot}025>P>0{\cdot}01$). Ventouse deliveries were three times commoner in the jaundiced group even though some cases had been excluded because of clinically apparent bruising (table III).

In each group abnormal deliveries were much commoner among mothers given an epidural anaesthetic. In the jaundiced group 56% of such mothers had abnormal deliveries compared with 25% of those who did not receive an epidural anaesthetic. The corresponding figures for the control group were 54% and 15%.

DRUG THERAPY

No mothers in either group were given drugs known to cause neonatal jaundice—for example, chlorpromazine, vitamin K analogues, or novobiocin. Four mothers in each group received progestational agents during pregnancy. A list of 37 drugs given at some time during pregnancy was compiled for the two groups but no single drug was given more often in one group than in the other.

GESTATIONAL AGE

There were significantly more infants of a low gestational age in the jaundiced group ($\chi^2 = 29{\cdot}05$; $P<0{\cdot}001$). Thus 73% of the jaundiced

TABLE IX—*Mode of Delivery Related to Administration of Epidural Anaesthetic*

Mode of Delivery	Jaundiced Group			Control Group		
	All Cases (n = 312)	Anaesthetic (n = 170)	No Anaesthetic (n = 142)	All Cases (n = 312)	Anaesthetic (n = 141)	No Anaesthetic (n = 171)
Normal	180 (58%)	74 (44%)	106 (75%)	210 (67%)	64 (45%)	146 (85%)
Abnormal	132 (42%)	96 (56%)	36 (25%)	102 (33%)	77 (55%)	25 (15%)
Forceps	79	64	15	65	54	11
Ventouse	30	21	9	10	6	4
Breech	7	7	0	5	5	0
L.S.C.S.	16	4	12	22	12	10
All abnormal vaginal	116 (37%)	92 (54%)	24 (17%)	80 (26%)	65 (46%)	15 (9%)
Forceps + ventouse	109	85	24	75	60	15

L.S.C.S. = Lower segment caesarean section.

TABLE X—*Gestational Ages of Infants in the Two Groups*

Gestational age (days):	260–266	267–273	274–280	281–287	288–294	295–301	Total
No. of jaundiced infants	66	79	83	56	26	2	312
No. of control infants	36	50	91	79	53	3	312

Excluding group of 295-301 days, $\chi^2 = 29{\cdot}05$; $P < 0{\cdot}001$.

TABLE XI—*Apgar Scores at One and Five Minutes in the Two Groups of Infants*

	At One Minute				At Five Minutes			
	7–10	4–6	0–3	Total	7–10	4–6	0–3	Total
No. of jaundiced infants	263	39	8	310	302	6	2	310
No. of control infants	257	37	16	310	300	11	1	312

In two infants in each group one or both scores were not recorded.

infants and 57% of the controls were delivered between 37 and 40 weeks of gestation (table X).

EVIDENCE OF ASPHYXIA

Apgar scores were estimated at one and five minutes (table XI). The apparent differences between the groups were not significant.

The results of fetal monitoring during labour and some details of resuscitation are given in table XII. "Probable terminal apnoea" was assessed using the criteria of Gupta and Tizard.[6] There was more evidence of intrapartum asphyxia in the control group infants but the differences were not significant.

TABLE XII—*Results of Fetal Monitoring during Labour and Details of Resuscitation*

	Jaundiced Group	Control Group
Monitored	70 (22·4%)	53 (17·0%)
Fetal heart rate abnormal, scalp blood pH normal	8	9
Scalp blood pH low	4 (5·7%)	6 (11·3%)
No resuscitation problem	295	286
Intubated	16	25
Probable terminal apnoea	4	5

FEEDS

All infants had their first feed before 24 hours of age. Except for 11 infants in the jaundiced group and seven in the control group all were fed within the first 12 hours of life.

The types of feeds each group received in the first four days of life all listed in table XIII. Only 13 infants in the jaundiced group and four in the control group were fed on breast milk alone. Altogether 194 (62%) of the jaundiced infants received breast milk and artificial feeds in varying proportions compared with 170 (55%) of the controls. This difference was not significant. There was no significant difference in the numbers receiving only artificial feeds.

Case notes lacked sufficient details for assessing the quantities of feeds given in most cases, so that direct assessment of the adequacy of feeding in each group was not possible. An indirect assessment was made by calculating the weight change between birth and the fourth day of life as a percentage of birth weight, assuming that this weight change at least partly reflects adequacy of feeding in the first few days. These percentage weight losses in each group are shown in table XIV. Two of the jaundiced infants and 16 of the controls were discharged before the fourth day. There were no significant differences in weight loss during the first four days between the two groups, suggesting that feeding patterns were similar.

TABLE XIII—*Types of Feeds Given in First Four Days of Life*

	Jaundiced Group	Control Group
Expressed breast milk	5	2
Breast-fed only	8	2
Breast-fed with complement	146	141
Breast-fed failed	35	25
Received breast milk	194 (62·2%)	170 (45·5%)
Artificial only	118 (37·8%)	142 (45·5%)

Received breast milk *v.* artificial only: $\chi^2 = 3{\cdot}79$; N.S.

TABLE XIV—*Weight Loss on Day 4 Expressed as Percentage of Birth Weight*

% Weight Loss	Jaundiced Group (n = 304)	Control Group (n = 291)
Weight gain or no weight loss	14	21
<3%	92	88
3-5·9%	153	143
6-9%	45	39

$\chi^2 = 1{\cdot}97$; N.S.

OTHER FACTORS

Analysis of the following factors yielded no differences between the groups: (1) maternal age and parity, matched in the study groups, did not differ from the general hospital population in the same year; (2) ethnic origins of parents; (3) socioeconomic class; (4) home address during pregnancy—there was no unusual "clustering" of home addresses of mothers in either group; (5) maternal past medical history; (6) frequencies of ABO blood groups of both mothers and infants; (7) complications of pregnancy; (8) time of admission, length of stay in labour ward, duration of labour; (9) birth weight; (10) infant's sex.

Discussion

Jaundice of unexplained aetiology is now a serious clinical problem at this hospital, involving not only a hazard to infants but also much valuable time of laboratory and medical staff.

While some of the observed increase in significant jaundice (table I) may be due simply to an increased awareness of jaundice, so that more infants had their serum bilirubin concentration measured, this could not account for the increase in severe jaundice. More infants now require exchange transfusion for unexplained jaundice than for rhesus isoimmunization.

The levels of serum bilirubin used to define significant and severe jaundice in table I are arbitrary, and the figures include preterm infants. So far we have been unable to obtain any evidence from our hospital records that the frequency of birth before term has changed in the past five years.

The pattern of jaundice (tables IV and V) suggests a delay in uptake, intracellular transport, or conjugation of bilirubin rather than haemolysis, infection, or hepatocellular damage. It was similar to the pattern of so-called "jaundice of prematurity."

Despite the attempt to exclude all cases with a recognized cause of jaundice (table III) the jaundiced group studied probably still contained cases of differing aetiologies. It was tempting, when the jaundice epidemic was first noticed, to attribute it to a single new factor and to consider the coincidental changes in patient management—for example, active management of labour—as prime suspects. We did not, however, succeed in establishing a single cause or in specifically implicating changes in the management of labour. Nevertheless, some significant differences were found between jaundiced and non-jaundiced infants. It was also possible to exclude, as contributing

significantly to the jaundice problem, certain mechanisms cited by others as causes of jaundice.

OXYTOCIN ADMINISTRATION

Ghosh and Hudson[1] reported an apparent increase in neonatal jaundice at their hospital and suggested that the increase was due to the use of oxytocin to induce labour. They further suggested that the forceful uterine contractions produced might cause intrapartum hypoxia in the fetus sufficient to damage the glucuronyl transferase system of the fetal liver.

Davies *et al.*[2] showed that infants of mothers whose labours were induced with oxytocin developed higher mean serum bilirubin levels than infants whose mothers received oxytocin to accelerate spontaneous labour or infants whose mothers had not received oxytocin at all. Gould *et al.*[7] did not find an increase in jaundice with oxytocin.

We also found no relationship between oxytocin administration, either for induction or acceleration, and the development of significant jaundice. Nevertheless, though the numbers of mothers receiving oxytocin for induction of labour were similar in both groups the indications for which it was given were quite different. In general, the indications for induction in the jaundiced group mothers were those leading to delivery before 40 weeks of gestation. In contrast, the indications for induction in the control group mothers were those tending to result in later delivery, such as postmaturity.

Many factors interact to produce so-called "jaundice of prematurity," the tendency of preterm infants to develop higher levels of bilirubin than mature infants. Obviously these factors do not cease to influence bilirubin metabolism precisely at the end of the 37th week of gestation. Possibly, while oxytocin itself does not cause jaundice its increased use has resulted in many more successful inductions before 40 weeks of gestation.

We found no evidence of a higher frequency of intrapartum hypoxia among the jaundiced infants (tables XI and XII), though the methods of assessment reflected only gross hypoxia.

EPIDURAL ANAESTHESIA

There was a significant relationship between epidural anaesthesia and the development of jaundice but its nature was not clear. The second stage of labour is longer when an epidural anaesthesia has been given, and instrumental delivery is far commoner. Instrumental deliveries associated with epidural anaesthetics are often not easy, involving cephalic rotations from posterior or transverse positions.[4]

Clinically apparent bruising of infants from difficult instrumental deliveries is known to lead to significant jaundice. We thought initially that the high instrumental delivery rate resulting from the use of epidural anaesthetics might have caused more soft-tissue trauma, which, though not clinically apparent, would contribute to the development of significant jaundice. Certainly we see infants severely jaundiced after difficult ventouse extractions, and even when such cases were excluded from the present study ventouse extraction was three times commoner in the jaundiced group. We found, however, that instrumental deliveries associated with epidural anaesthesia were not more frequent in the jaundiced group.

PAST OBSTETRIC HISTORY

Many more mothers of jaundiced infants had poor past obstetric histories, including therapeutic and spontaneous abortions. We can only speculate on the implications of this. It has been suggested that surgical dilatation of the cervix early in a pregnancy results in a higher incidence of early delivery, with or without cervical incompetence, in subsequent pregnancies.[8]

Circumstances in which cervical dilatation may have been performed occurred twice as commonly in the past obstetric histories of the jaundiced group mothers. These mothers delivered, in general, earlier than the control group mothers (table X), and this was partly because of early inductions.

ORAL CONTRACEPTION

Numerous reports have linked use of the "pill" with increasing neonatal jaundice.[9] We found no evidence that the pill is contributing substantially to the jaundice epidemic, though an effect in individual cases cannot be excluded.

INFANT FEEDING

Smallpiece and Davies[10] suggested that infants who are fed late or inadequately in the first few days have higher serum bilirubin levels than those fed early and adequately. There was no evidence in our study that feeding was delayed in many infants. Judging from patterns of weight loss in the first days of life (table XIV) feeds seemed adequate or at least similar in both groups.

Possibly different types of feeds might lead to different degrees of jaundice in newborn infants. For example, some mothers secrete substances in their breast milk which are thought to inhibit bilirubin conjugation, and infants receiving such breast milk become severely jaundiced.

The types of feeds given to the infants studied were human breast milk or prepacked artificial milk. The numbers of infants receiving each type were similar in each group, and no association between a particular feed and the development of jaundice emerged.

A prospective study was performed in 1973 in which the infants in one nursery were fed with artificial milk used before the major feed change in 1971, the rest of the hospital continuing with the artificial feed used throughout 1972. The frequency of significant jaundice remained the same in each group.

No single explanation for the jaundice epidemic was found. It appears that it may be due in part to a shift in the distribution of gestational ages, many more infants now being born before 40 weeks of gestation. This shift is partly due to more early inductions of labour as a result of a policy of active management of labour; it may also be due partly to earlier delivery because of previous cervical dilatation. The association between epidural anaesthesia and jaundice remains obscure.

Continuing investigations include (*a*) a prospective study in which infants from labours managed actively are being compared with infants from labours managed conservatively, and (*b*) retrospective studies to establish whether the frequency of preterm delivery has changed. Close follow-up of all severely jaundiced infants including audiometric assessment is under way.

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