PAPERS AND SHORT REPORTS

Impact of sex ratio on onset and management of labour

MARION H HALL, ROY CARR-HILL

Abstract

In a study of 52 266 live singleton deliveries in a total population male babies were delivered at earlier gestations than female. This difference was not due to induction or elective caesarean section. Female babies were more likely to present and be delivered by the breech. When the presentation was cephalic, male babies were much more likely to be delivered by forceps or caesarean section and female babies to deliver spontaneously.

Introduction

During studies on the distribution of birthweight for gestation in 19 000 women living in Aberdeen City District and giving birth between 1973 and 1979, boys were significantly more likely than girls to be delivered between 37 and 39 completed weeks of gestation, whereas girls were relatively more likely to be delivered between 40 and 42 weeks (Knox, unpublished data). This phenomenon had previously been reported, but not commented on, by Butler and Bonham¹ and by Chamberlain *et al.*,² but these workers did not distinguish between induced and spontaneous labour. Certain pathological conditions such as eclampsia are more common in women carrying male babies (unpublished data) and might affect the time at which labour was induced or delivery performed surgically. To elucidate further the consistency of, and reasons for, the finding of earlier delivery in boys we decided to study the sex ratio in a larger series of births in the same geographical area with special reference to whether or not labour was induced and to relate the sex ratio to factors such as parity, birthweight, and mode of delivery.

Subjects and methods

The records of all 52 266 live singleton deliveries for the total population in Aberdeen City District between 1961 and 1979 were studied. When analysed by gestational age only the 41 456 deliveries with certain gestations (± 1 week) were included. Stillbirths were, therefore, excluded because of the difficulty of attributing an exact gestation to a fetus which may have been dead in utero for an unknown time. Similarly, multiple births were excluded because of the possibility of mixed sex pairs. Coding of gestation was performed by experienced clerical staff supervised by senior medical staff. These records form part of the Aberdeen maternity and neonatal data bank.⁴ Certain items of information such as elective or emergency caesarean section and fetal presentation at delivery were available only for the 9117 women delivered between 1976 and 1979.

Results

GESTATION AT DELIVERY

Among the 52 266 deliveries the overall male-to-female sex ratio (the number of male per 100 female births) was 105.6, and the variation according to parity was small (105.6 for para 0, 104.9 for para 1, and 106.7 for para 2 or more). The sex ratio in 41 546 deliveries of certain gestation was 104.5, whereas among the 10 720 of uncertain gestation the sex ratio was 110.1.

The previous observation that boys were more likely to be delivered at earlier gestation than girls was confirmed and was true of all parities. Table I shows the cumulative percentage of boys and girls delivered by each week of gestation. Male births were statistically less likely to be induced than female ($p < 0.05$ using a t test for the differences between two percentages), the sex ratio in all induced labours being 100.9 compared with 105.0 in spontaneous labours. Female births were more likely to be induced after term, partly because they were still undelivered. The difference between boys and girls in gestation at delivery was present whether or not labour was induced but was only statistically significant for the spontaneous labours, using the Kolmogorov-Smirnov test for the comparison of two cumulative percentage distributions ($p < 0.01$); for induced labours, not only was the difference not significant ($0.50 < p < 0.20$) but the cumulative percentages crossed over at 39/40 weeks.

Seven hundred and fifty-six elective and emergency caesarean sections (this information being coded since 1976) were studied and included with induced labours, since the gestation at delivery is determined by the decision to perform caesarean section. The overall sex ratio in caesarean sections was high—that is, more boys were delivered by caesarean section than girls (table II). This was accounted for, however, by an extremely high sex ratio in emergency caesarean

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TABLE I—Cumulative percentages of male and female deliveries (all parities) by week of gestation for spontaneous and induced labours

	No (%) at gestation (weeks):													Total
	1-27	28-30	31-32	33-34	35	36	37	38	39	40	41	42	43+	
Spontaneous labours:														
Male	35 (0.2)	111 (0.6)	242 (1.3)	521 (2.9)	779 (4.3)	1232 (6.8)	2302 (12.7)	4696 (26.0)	9 416 (52.1)	15 690 (81.4)	17 513 (97.0)	18 013 (99.8)	18 056 (100.0)	18 591
Female	23 (0.1)	87 (0.5)	182 (1.1)	367 (2.1)	588 (3.4)	982 (5.7)	1872 (10.9)	4016 (23.4)	8 430 (49.0)	13 607 (79.1)	16 607 (96.6)	17 124 (99.6)	17 192 (100.0)	17 699
Induced labours:														
Male	0 (0.0)	1 (0.1)	3 (0.1)	16 (0.6)	34 (1.3)	77 (2.9)	189 (7.2)	507 (19.2)	994 (37.7)	1 693 (64.2)	2 358 (89.4)	2 635 (99.8)	2 639 (100.0)	2 640
Female	0 (0.0)	1 (0.1)	4 (0.2)	15 (0.6)	36 (1.4)	71 (2.7)	169 (6.5)	480 (18.3)	947 (36.2)	1 702 (65.1)	2 359 (90.2)	2 612 (99.8)	2 616 (100.0)	2 616
All labours:														
Male	35 (0.2)	112 (0.5)	245 (1.2)	537 (2.6)	813 (3.9)	1309 (6.3)	2491 (12.0)	5203 (25.1)	10 410 (50.3)	16 383 (79.2)	19 871 (96.0)	20 648 (99.8)	20 695 (100.0)	21 231
Female	23 (0.1)	88 (0.4)	186 (0.9)	382 (1.9)	624 (3.2)	1053 (5.3)	2041 (10.3)	4496 (22.7)	9 377 (47.3)	15 309 (77.3)	18 966 (95.7)	19 736 (99.6)	19 808 (100.0)	20 315

TABLE II—Sex ratio by type of labour and caesarean section (1976-79 cases)

Type of labour and induction	No of births		Sex ratio (male per 100 female births)
	Boys	Girls	
Elective section	159	165	96.4
Induced labour and emergency section ..	139	93	147.3
Spontaneous labour and emergency section	110	92	119.6
Total	408	350	116.6

sections; in fact the sex ratio in the elective caesarean sections was low (consistent with the relatively low ratio in all induced labours).

Birthweight analysis by gestation for spontaneous labours (in 250 g categories) showed that the sex ratio of 967 low birthweight babies (< 2500 g) was 92.2 while that of 871 large babies (> 4000 g) was 178.3. Gestation analysis showed that for the 165 deliveries at ≤ 32 weeks the sex ratio was 146.3 and for the 446 deliveries after 42 weeks the sex ratio was 93.9. Combined analysis of birthweight and gestation (table III) showed that at any given birthweight the difference in gestation at delivery remained. If the cumulative percentage of boys born in a given birthweight category were compared with the cumulative percentage of girls born in the adjacent lighter birthweight category the differences, however, disappeared. For example, in the birthweight categories 3500-3749 g and 3750-3999 g, there were maximum differences of 6.6% at 39 weeks and 4.3% at 40 weeks; both these differences were significant using the Kohnogorov-Smirnov test at the 5% level. But the maximum difference between girls of 3500-3749 g and boys of 3750-3999 g was only 0.4% at 37 weeks; this difference was not significant using the same test (table III).

MODE OF DELIVERY

Analysis of the sex ratio by mode of delivery showed (table IV) that boys were much more likely to be delivered by forceps or emergency caesarean section and less likely to be delivered spontaneously or by vaginal breech delivery. An analysis of fetal presentation at delivery for women delivered between 1976 and 1979 showed that breech presentation was commoner in pregnancies with girls (4%) than with boys (3%). There was no significant difference in the mode of delivery in those presenting by the breech (table V), which means that the excess of breech deliveries in girls was due to the fact that more girls presented by the breech. The higher rate of breech delivery in girls could not be accounted for by the preponderance of girls in low birthweight categories, and the higher rate of forceps and caesarean section delivery in boys was not attributable to the preponderance of boys in high birthweight categories. In primigravid women, however, there was a higher rate of operative and instrumental delivery in

babies over 4000 g whether boys or girls. Rates for caesarean section and forceps and breech delivery were higher in preterm births, but this did not account for the differences in mode of delivery between boys and girls.

TABLE IV—Sex ratio and mode of delivery

Mode of delivery	No of births		Sex ratio (male per 100 female births)
	Boys	Girls	
Spontaneous	20 790	20 391	102.0
Forceps	3 825	3 005	127.3
Caesarean section	1 846	1 570	117.6
Breech	388	451	86.0
Total	26 849	25 417	105.6

TABLE V—Sex ratio and mode of delivery in breech presentations (1976-79 cases)

Mode of delivery	No of births		Sex ratio (male per 100 female births)
	Boys	Girls	
Vaginal delivery	78	97	80.0
Caesarean section	60	73	82.0
Total	138	170	81.0

Discussion

The interesting finding that boys tend to be delivered at earlier gestation than girls can be confirmed by scrutiny of Scottish Morbidity Record 11 data from 1973 to 1979.⁵ These data are based on only 38.7% of all live births in Scotland at that time. This may account for the rather high overall sex ratio since data is more likely to be collected in units with special baby care facilities, which include almost all the preterm labours, whereas our data is from a total population. Nevertheless, in large numbers the sex ratio was very high in preterm births but considerably lower at and after term (table VI). We can offer no explanation for the high sex ratio in cases of uncertain gestation in our study.

The earlier delivery of boys did not seem to be due to induction or elective caesarean section and thus was unlikely to be due to any antenatal pathology. On the contrary, boys were delivered spontaneously more frequently, perhaps because of their greater weight and greater fetal production of cortico-

TABLE III—Cumulative percentages of gestations of male and female spontaneous deliveries in adjacent birthweight categories (all parities)

Birthweight category (g)	Sex	No (%) at gestation (weeks):									
		≤34	35	36	37	38	39	40	41	42	43
3500-3749	M	7 (0.3)	15 (0.5)	46 (1.5)	172 (5.4)	522 (16.4)	1453 (45.8)	2523 (79.5)	3095 (97.6)	3168 (99.9)	3172 (100.0)
3500-3749	F	5 (0.2)	14 (0.5)	25 (1.0)	89 (3.5)	347 (13.5)	1008 (39.2)	1939 (75.2)	2474 (96.2)	2566 (99.7)	2573 (100.0)
3750-3999	M	4 (0.2)	14 (0.5)	32 (1.2)	100 (3.9)	356 (13.8)	1010 (39.0)	1942 (75.1)	2497 (96.5)	2584 (99.9)	2587 (100.0)
3750-3999	F	7 (0.4)	11 (0.6)	22 (1.2)	77 (4.1)	205 (11.0)	667 (35.7)	1321 (70.8)	1793 (96.1)	1862 (99.9)	1866 (100.0)

TABLE VI—Sex ratio by gestation in 169 631 deliveries in Scotland, 1973-79. (SMR 11 data, known gestation only)

Gestation (weeks):	≤27	28-30	31-2	33-4	35	36	37	38	39	40	41	42+	Total
Male births	97	344	415	834	785	1991	3488	9618	18 467	33 106	15 461	3351	87 957
Female births	71	250	342	711	683	1674	2904	8261	16 792	31 652	15 292	3042	81 674
Sex ratio (male per 100 female births)	136.6	137.6	121.3	117.3	114.9	118.9	120.1	116.5	110.0	104.6	101.1	110.1	107.7

steroids and oestrogen precursors which may affect the onset of labour. The cumulative percentage according to weeks of gestational age of boys born in a given birthweight category was more similar to the cumulative percentage of girls born in the adjacent lighter birthweight category than the cumulative percentage born in the same birthweight category. Thus at any given gestational age there appeared to be a fetal weight which was, by itself, able to trigger the spontaneous onset of labour. Alternatively, specific hormonal differences between male and female fetuses, such as increased male testosterone concentrations,⁶ may have been responsible. Although we do not know why girls are more likely to be induced, it may be because they are more likely to remain undelivered after term.

Female babies are more likely to present by the breech and are therefore over-represented among breech births. Easier delivery due to lower birth weight seems not to be a factor. When the fetal presentation is cephalic, however, female babies are much more likely to be delivered spontaneously whereas male babies are more likely to deliver either by forceps or by caesarean section. There has in recent years been a policy of operative or instrumental delivery in preterm births, but this is not the reason for the higher forceps and caesarean section rate in boys, although they do deliver preterm more often. Cephalopelvic disproportion may occur more often because of the greater weight of male babies or the male fetal hormonal contribution to the progress of labour may be less effective than

the female, thus resulting in maternal uterine dysfunction. Furthermore, male babies may show fetal distress in labour more often or more severely than female. This seems the most likely explanation and is consistent with the fact that neonatal mortality from difficult labour is higher in boys,⁷ as is stillbirth from difficult labour. This cause of death showed a higher sex ratio than any other cause of stillbirth.⁸

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(Accepted 1 June 1982)

Blood pressure and contraceptive use

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Abstract

In a survey of 461 women routinely attending family planning clinics those taking oral contraceptives had significantly higher mean systolic and diastolic blood pressures than those using non-hormonal contraception. There appeared to be a dose-response relation of blood pressure to the progestogen component of two oral contraceptives with an identical 30 µg ethinyloestradiol component. This supports the idea that the progestogen as well as the oestrogen component has an aetiological role in the rise in blood pressure. There was a significant correlation of blood pressure with duration of current use of oral contraceptive but not with total duration of use. There was also a significant negative correlation of blood pressure with time since oral contraceptives were last taken, and women who had stopped using oral contraceptives over a month previously

had similar blood pressures to those who had never taken them. In women taking oral contraceptives those who had either a history of hypertension in pregnancy or a family history of hypertension had significantly higher mean blood pressures than those who did not. Both systolic and diastolic blood pressures correlated independently with weight and body mass index, but controlling for the effect of this and age did not affect the above relations. No significant differences in mean blood pressures were found between different ethnic groups, and there was no relation of blood pressure to reported marital state, social class, parity, smoking, or alcohol use.

Any oral contraceptive that has a less adverse effect on blood pressure has implications for general prescribing policy; thus even small differences in the progestogen contents of low-dose oestrogen pills may be important.

Introduction

It is generally accepted from cross-sectional and longitudinal studies that use of oral hormonal contraceptives is aetiological associated with a rise in blood pressure.¹⁻⁸ The precise nature of this relation, however, is not clear: neither the component in the oral contraceptive responsible nor any groups who might be

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