Maternal height, shoe size, and outcome of labour in white primigravidas: a prospective anthropometric study

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Abstract

A total of 563 white primigravid patients at Raigmore Hospital, Inverness, were recruited in a prospective study to examine the association between maternal height, shoe size, and the outcome of labour. There was a significantly increased caesarean section rate in women of short stature but no association between mode of delivery and shoe size. Babies born vaginally had heavier birth weights with increasing height and shoe size. Babies born by caesarean section were heavier than those born vaginally, but their birthweight showed no relation with either height or shoe size.

Shoe size is not a useful clinical predictor for the probability of cephalopelvic disproportion, and, although maternal height is a better clinical guide to pelvic adequacy in labour, 80% of mothers less than 160 cm tall delivered vaginally. A well conducted trial of labour should be considered in all primigravid patients with cephalic presentation irrespective of maternal height or shoe size if no obstetric complication exists.

Introduction

A pregnant woman's height has routinely been recorded on her obstetric case record since studies showed a relation between maternal height, pelvic dimension, and the outcome of pregnancy.[1-5] Another piece of routinely recorded information is the woman's shoe size. In a series of 75 patients of mixed parity Kennedy and Greenwald claimed that a shoe size of 5½ or more was a surrogate measure of pelvic adequacy, especially when the mother was less than 1·52 metres tall,[6] but their analysis and conclusions have been criticised.[7] In a larger study of 351 women of mixed parity and of different ethnic origin Frame et al found an incidence of caesarean section of 21% when the woman's shoe size was less than 4½, 10% when it was 4½ to 6, and only 1% when it was 6½ or more,[8] but in their series the woman's height was not a useful predictor of ceasarean section. Pelvic dimensions and shapes vary between ethnic groups,[9] however, and the incidence of ceasarean section differs between primigravidas and parous patients.

We therefore performed a prospective study among a homogeneous group of primigravidas to assess the value of recording height and shoe size as predictors of the outcome of labour.

Patients and methods

Six hundred consecutive white primigravid patients who booked for confinement at Raigmore Hospital, Inverness, were recruited. All patients underwent ultrasonic gestational assessment before 20 weeks' gestation. At the booking visit the patient's height and shoe size were recorded. In the absence of obstetric complications a spontaneous onset of labour was awaited. In those patients who failed to go into labour by 12 days after their expected date of delivery induction of labour using prostaglandin vaginal pessaries (3 mg) was carried out; when in labour forewater amniotomy was performed. Intravenous oxytocin augmentation was started if progress in labour was less than satisfactory (cervical dilatation less than 1 cm/hour). Cervical scoring was carried out either at the time of forewater amniotomy or at the time of first vaginal examination in patients admitted in spontaneous labour. A cervical score of less than 4 was considered to be "unfavourable."[10]

After delivery a record was made of duration of labour, mode of delivery, and birthweight.

Cephalopelvic disproportion was diagnosed when there was evidence of either (a) a prolonged first stage (>12 hours) in spite of effective uterine activity or (b) failure of the head to descend or evidence of severe moulding or fetal distress in late first stage with secondary arrest or prolonged second stage. In patients with a prolonged second stage Kielland's forceps delivery was attempted only in theatre with facilities at hand for an immediate caesarean section.

All patients delivered using forceps (whether rotational, non-rotational, or low cavity) were included in the vaginal delivery group.

Both shoe size and height were grouped in five subsets—≤3½; 4-4½; 5-5½; 6-6½; ≥7 and ≤153 cm, 154-159 cm, 160-165 cm, 166-171 cm, ≥172 cm. This gave a fairly symmetrical set of frequencies. Statistical analyses were carried out using the Minitab statistical package.

Results

Of the 600 patients, 37 (6%) were excluded from the final analysis because they did not meet our criteria for inclusion (singleton pregnancy, cephalic presentation, and pregnancy progressing beyond 34 weeks) or for other reasons (table I). Of the remaining 563 patients, 489 delivered vaginally (433 spontaneously, 42 (9%) with non-rotational forceps and 14 (3%) with rotational forceps), and 74 (13%) required emergency caesarean section with a diagnosis of cephalopelvic disproportion in the course of labour.

The mean gestational age at delivery was 39·8 (SD 1·49) weeks, the mean maternal height 161·63 (6·11) cm, and mean shoe size 5·08 (1·13). Linear regression analysis confirmed as expected a strong correlation between maternal height and shoe size (r=0·649; height=144+3·50 shoe size).

Outcome of labour by maternal height—Maternal height in those delivering vaginally (mean 162·02 (6·03) cm) was significantly greater than in those requiring caesarean section (mean 159·03 (6·07) cm; t=3·98; p<0·001). With increasing maternal height there was a significant decline in the proportion of patients delivering by caesarean section but no significant difference in the rates of induction or unfavourable cervix in labour (table II). Table III gives

TABLE I—*Details of patients excluded from analysis*

Total No (%) of patients	600 (100)
No (%) excluded from analysis:	37 (6)
Spontaneous abortion	3
Preterm labour	8
Intrauterine growth retardation	3
Elective section for severe pre-eclamptic toxaemia, failed induction, abnormal cardiotocograph	3
Emergency caesarean section for fetal distress (abruptio, cord prolapse, intrauterine growth retardation) in early labour	6
Twins	4
Breech, oblique lie	8
Placenta praevia	2
Total analysed	563

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the mean duration of labour for those delivering vaginally and the mean birthweights for both delivery groups by maternal height. Analysis of variance indicated that the length of labour did not vary with maternal height. As expected, the mean birthweight was higher as height increased among those delivering vaginally, although this was not so in those requiring caesarean section. The birthweights of babies born by caesarean section were greater than those of the babies delivered vaginally.

Outcome of labour in relation to shoe size—There was no significant difference ($t=1\cdot53$) in mean shoe size between the vaginal delivery group (mean $5\cdot11$ ($1\cdot4$)) and the caesarean section group (mean $4\cdot90$ ($1\cdot05$)), and there was no significant differences by shoe size in the rates of caesarean section, induction of labour, or unfavourable cervix (table II). Table III gives the mean duration of labour for those delivered vaginally and the mean birthweights for both delivery groups by shoe size groups. Analysis of variance indicated that the mean length of labour did not vary with shoe size. The babies were significantly heavier with increasing shoe size among those delivering vaginally, but those delivered by caesarean section did not show this pattern.

Postnatal pelvimetry—Of the 74 patients delivered by caesarean section 70 had postnatal radiographic pelvimetry carried out. Since the number of patients in subgroups of shoe size were small they were therefore grouped together as $\leqslant4\frac{1}{2}$, $5\text{-}5\frac{1}{2}$, and $\geqslant6$. Similarly, there were very few women in the upper two height groups and they were combined into one group (166-178 cm). Table IV confirms that there were significant correlations between maternal height and shoe size and pelvic measurements, although not with all. With grouped data for both height and shoe size (table V), however, no differences were apparent.

Discussion

This study was designed to assess the value of recording maternal shoe size and height in obstetric case records. We studied only healthy white primigravidas, thereby overcoming the problems in earlier studies. We excluded those patients who had an elective caesarean section carried out because of obstetric complications and also those delivered by emergency caesarean section in early labour where cephalopelvic disproportion did not appear to be an underlying cause. Women going into preterm labour and also those with intrauterine growth retardation were excluded because of the increased inherent risk of emergency sections owing to smaller fetal size and placental factors. Similarly, women with breech presentation were excluded because their management is still controversial, some obstetricians attempting vaginal delivery and others performing elective caesarean section.

The data from our series, which is the largest reported to date, suggest that patients less than 160 cm tall are at increased risk of undergoing caesarean section for cephalopelvic disproportion. No such trend was obvious when shoe size alone was used as a predictor of the outcome of labour; our findings thus disagree with those of Frame et al.[8] Although maternal height is a more useful guide to the outcome of labour even in mothers less than 160 cm tall most (80%) would deliver vaginally.

Although only 70 patients underwent postnatal radiographic pelvimetry, maternal height was more strongly associated with pelvic inlet measurements whereas shoe size showed a significant relation with one diameter of both pelvic inlet and outlet. These observations are clinically important because Schwartz et al reported a stronger correlation between inlet disproportion and mode of delivery than between midplane disproportion and outcome.[11] Isolated pelvic outlet contraction is extremely rare.[12] Furthermore, the pelvic outlet increases up to 30% in the squatting position.[13] Therefore these data further support our earlier conclusion that maternal height is a better indicator than shoe size.

We considered other factors that may adversely

TABLE II—*Outcome of labour according to maternal height and shoe size. Results are numbers (and percentages) of women*

	Total No (%)	Caesarean section	Induction of labour	Unfavourable cervix
Height (cm):				
≤153	53 (9·4)	10 (18·9)	13 (24·5)	15 (28·3)
-159	144 (25·6)	32 (22·2)	20 (13·9)	45 (31·3)
-165	227 (40·3)	20 (8·8)	33 (14·5)	51 (22·5)
-171	104 (18·5)	9 (8·6)	12 (11·5)	18 (17·3)
≥172	35 (6·2)	3 (8·6)	5 (14·3)	12 (34·3)
χ^2 value		18·128 (df 4); p<0·01	4·984 (df 4)	8·965 (df 4)
Shoe size:				
≤3½	49 (8·7)	7 (14·3)	8 (16·3)	12 (24·5)
-4½	147 (26·1)	21 (14·3)	24 (16·3)	36 (24·5)
-5½	177 (31·4)	29 (16·4)	23 (13·0)	44 (24·8)
-6½	139 (24·7)	14 (10·1)	20 (14·4)	32 (23·0)
≥7	51 (9·1)	3 (5·9)	8 (15·7)	17 (33·3)
Total	563 (100)	74 (100)	83 (100)	141 (100)
χ^2 value		5·356 (df 4)	0·872 (df 4)	2·205 (df 4)

TABLE III—*Mean duration of labour in infants delivered vaginally and birthweights of those delivered vaginally and by caesarean section according to maternal height and shoe size. Results are means (and standard deviations)*

	Duration of labour (hours) for vaginal delivery only		Birthweight (kg) of babies delivered vaginally		Birthweight (kg) of babies delivered by caesarean section	
	Mean (SD)	No	Mean (SD)	No	Mean (SD)	No
Height (cm):						
≤153	9·30 (3·29)	32	3·20 (0·56)	43	3·68 (0·64)	10
-159	10·21 (3·99)	112	3·34 (0·42)	112	3·60 (0·47)	32
-165	9·11 (3·74)	207	3·44 (0·46)	207	3·70 (0·37)	20
-171	9·37 (3·77)	95	3·52 (0·43)	95	3·86 (0·62)	9
≥172	9·96 (3·79)	32	3·52 (0·55)	32	3·89 (0·59)	3
Analysis of variance (F)	1·61		4·83 (p<0·001)		0·67	
Shoe size:						
≤3½	8·88 (3·28)	42	3·29 (0·45)	42	3·63 (0·45)	7
-4½	9·34 (3·79)	126	3·28 (0·45)	126	3·50 (0·53)	21
-5½	9·35 (3·51)	148	3·43 (0·44)	148	3·79 (0·43)	29
-6½	9·54 (3·99)	125	3·51 (0·45)	125	3·78 (0·57)	14
≥7	10·42 (4·34)	48	3·59 (0·54)	48	3·57 (0·33)	3
Analysis of variance (F)	0·33		6·92 (p<0·001)		1·26	

TABLE IV—*Correlation coefficients (r) between pelvic dimensions and maternal height and shoe size*

Variable	Anteroposterior inlet	Transverse inlet	Bispinous	Anteroposterior outlet
Height	0·246*	0·321†	0·046	0·248
Shoe size	0·108	0·280*	0·066	0·292‡

*p<0·05; †p<0·01; ‡p<0·02.

TABLE V—*Pelvic measurements (cm) by shoe size and height. Values are means (and standard deviations)*

	Anteroposterior inlet	Transverse diameter inlet	Bispinous	Anteroposterior outlet
Shoe size (n=70):				
≤4½ (n=28)	11·32 (0·86)	12·69 (0·46)	9·79 (0·53)	10·92 (0·57)
-5½ (n=25)	11·55 (0·48)	12·87 (0·44)	9·82 (0·45)	10·97 (0·63)
≥6 (n=17)	11·66 (0·62)	12·95 (0·38)	9·92 (0·50)	11·29 (0·49)
Analysis of variance (F)	1·51	2·11	0·38	2·46
Height (n=70):				
≤153 (n=10)	10·99 (0·62)	12·49 (0·26)	9·90 (0·61)	10·90 (0·26)
-159 (n=29)	11·52 (0·79)	12·81 (0·49)	9·86 (0·46)	10·97 (0·69)
-165 (n=19)	11·55 (0·56)	12·90 (0·41)	9·67 (0·39)	11·04 (0·55)
-178 (n=12)	11·70 (0·47)	12·97 (0·39)	9·97 (0·60)	11·26 (0·57)
Analysis of variance (F)	2·29	2·71	1·15	0·89

affect labour such as an unfavourable cervix and induction,[10] and found no difference in these among either height or shoe size subgroups, thus adding weight to the conclusion that the high caesarean section rates for disproportion in mothers less than 160 cm tall are real observations.

The longheld belief that maternal stature and shoe size have an important bearing on the outcome of labour should be modified. A well conducted trial of labour should be considered in all primigravidas with cephalic presentation irrespective of maternal height or shoe size unless obstetrically contraindicated.

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Changes in severity of myocardial infarction and three year survival rates after myocardial infarction in Auckland, 1966-7 and 1981-2

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Abstract

Mortality from coronary heart disease has been declining steadily over the past 20 years in Auckland. The possibility that improved survival contributed to this decline was examined in patients who survived four weeks after myocardial infarction, changes in the severity of the disease being controlled for. Patients who had had myocardial infarction in 1966-7 (191 patients) or 1981-2 (203) were compared to determine whether three year survival rates had changed and the severity of the disease altered. With a coronary prognostic index taken as the measure of severity the 1981-2 group had significantly more severe myocardial infarctions than the 1966-7 group, but despite this the three year survival was significantly better (86% in the 1981-2 group v 75% in the 1966-7 group).

These findings suggest that improved survival after myocardial infarction contributed to the decline in mortality.

Introduction

Mortality from coronary heart disease has been decreasing in New Zealand at roughly 2% a year since 1968,[1] and this could be due to a decreasing incidence of the disease or of fatal cases, or both. In Auckland during 1974-81 the rate of acute myocardial infarction did not decrease[2] and one and three year survival after infarction did not show a clear improvement,[3 4] although the rate of sudden death from coronary causes declined steadily.[2] We compared the three year survival rates after myocardial infarction in 1966-7 and 1981-2, taking into account changes in the severity of the illness over this time.

Patients and methods

1966-7—We used a subset of data from all 757 patients with acute myocardial infarction admitted to the three hospitals in Auckland between March 1966 and February 1967.[5] The severity of infarction was measured as the coronary prognostic index, which is derived from the patient's age; size of the heart and state of the lung, assessed from an x ray film of the chest at the time of infarction; and history of myocardial infarction.[6] The coronary prognostic index was calculated for each of the patients at admission. We obtained information on the patients' survival to three years from their general practitioners or by other methods.[6] Complete records from 1966-7 were available only on patients who were discharged from hospital. As the average time to discharge fell considerably between 1967 and 1981 the day of discharge was not a useful starting time for this study. Therefore we arbitrarily chose to study the patients who survived for four weeks after their myocardial infarction. This meant that 191 patients were studied.

1981-2—The patients studied in 1981-2 came from a register of all patients in Auckland aged less than 70 with definite myocardial infarction according to the criteria of the World Health Organisation.[7] We obtained information on the patients' survival to three years by contacting the patients, their relatives, or their general practitioner.[4] Information on the size of the heart and state of the lungs for estimating the coronary prognostic index was obtained by one of us (JRF), who reviewed all chest x ray films taken on the day of admission to hospital.[6] As the films were available only at one hospital, only patients admitted to this hospital who survived for four weeks were considered for study. This limitation resulted in the study group comprising 233 patients.

Survival rates were calculated by the Kaplan-Meier life table method, initially without regard to the coronary prognostic index, and the rates were compared by the log rank test. The chance of dying compared with a reference group was calculated by fitting a model with proportional hazards general linear regression.[8]

Results

Among the 233 patients with a myocardial infarction in 1981-2, the x ray film obtained at admission could not be traced for 30 (13%), and hence in these patients