Size at birth, maternal nutritional status in pregnancy, and blood pressure at age 17: population based analysis

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Abstract

Objective: To assess the effect of size at birth, maternal nutrition, and body mass index on blood pressure in late adolescence.

Design: Population based analysis of birth weight corrected for gestational age, mother's weight before pregnancy and weight gain in pregnancy, obtained from the Jerusalem perinatal study, and blood pressure and body mass index at age 17, available from military draft records.

Setting: Jerusalem, Israel.

Subjects: 10 883 subjects (6684 men and 4199 women) born in Jerusalem during 1974-6 and subsequently drafted to the army.

Main outcome measures: Systolic and diastolic blood pressures measured at age 17 and their correlation with birth weight, size at birth, mother's body mass index and weight gain during pregnancy, and height and weight at age 17.

Results: Systolic and diastolic blood pressures were significantly and positively correlated with body weight, height, body mass index at age 17, and with mother's body weight and body mass index before pregnancy, but not with birth weight or mother's weight gain in pregnancy.

Conclusion: Variables reflecting poor intrauterine nutrition, including low maternal body mass index before pregnancy, poor maternal weight gain in pregnancy, and being born small for gestational age, were not associated with a higher blood pressure in late adolescence.

Introduction

Several studies have shown a significant inverse relation between blood pressure and birth weight,¹⁻⁶ which may be a result of fetal adaptations to an adverse environment, particularly undernutrition.⁷ Data showing a strong association between maternal nutritional status in pregnancy and blood pressure at 10-12 years of age support this contention,⁸ and further confirmation comes from study of the influence of mother's diet in late pregnancy on their offspring's adult blood pressure.⁹ However, not all investigators have confirmed this association.¹⁰⁻¹³ In addition, the hypothesis that high blood pressure has early nutritional origins was not supported by a study assessing the effect of poor nutrition in infants born before term on later high blood pressure.¹⁴

Previous studies examining prenatal effects on blood pressure defined intrauterine growth retardation as birth weight below 2500 g.¹⁵ A more accurate assessment of intrauterine growth is provided by size at birth considered in relation to gestational age, rather than birth weight alone. Also, in this study we assessed maternal nutritional status during pregnancy on the basis of body weight before pregnancy corrected for height and weight gain in pregnancy.

We aimed to evaluate the effects of being born small or large for gestational age, and of the mother's nutritional status, on systolic and diastolic blood pressure at 17 years of age. The large computerised dataset allowed adjustment for height and weight of the subjects and their mothers as well as for birth order, ethnic origin, and socioeconomic factors.

Subjects and methods

Data on 11 428 infants born between November 1974 and February 1976 were obtained from the computerised records of the Jerusalem study on oral contraceptive use,¹⁶ one of the interlocking epidemiologic studies making up the Jerusalem perinatal study, the design and methods of which have been reported.¹⁷ Variables included birth weight and gestational age recorded at the time of delivery, as well as detailed socio-demographic information. Socioeconomic status was assessed by area of residence (classified by municipal tax level areas¹⁷) and mother's educational attainment (years of schooling). Ethnic origin was defined according to father's country of birth. Gestational age was determined, in women with regular menstrual cycles,¹⁸ according to the date of the last menstrual period acquired through individual interviews with all mothers on the day after delivery.¹⁹ The perinatal data were matched to measurements made at age 17 obtained from the computerised records of the Israel defence forces' draft medical examination, using the subject's seven digit identification number assigned at the time of draft.²⁰ The adequacy of the match was confirmed by comparing sex and mother's identity number. Complete information on all variables was available on 10 883 (95.2%) of the subjects. Only 38.6% of our study population (4201 subjects) were women, as women who declare themselves to be orthodox religious are exempted from military service.²⁰ We thus analysed and presented the results separately for men and women. Only a negligible minority (124, <2%) of male subjects (those in hospital

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Table 1 Correlation (Pearson coefficients) with systolic and diastolic blood pressure at age 17 of birth weight; weight, height, and body mass index at age 17; mother's weight and body mass index before pregnancy; and weight gain in pregnancy

	Women (n=4199)		Men (n=6692)	
	Systolic	Diastolic	Systolic	Diastolic
Birth weight (g)	0.011	0.009	-0.009	0.003
Body weight (kg)	0.171***	0.135***	0.219***	0.158***
Height (cm)	0.081***	0.040*	0.066*	0.054***
Body mass index (kg/m ²)	0.143***	0.125***	0.211***	0.149***
Mother's weight before pregnancy (kg)	0.084***	0.058***	0.075***	0.069***
Mother's body mass index before pregnancy (kg/m ²)	0.053***	0.049**	0.053***	0.060***
Mother's weight gain in pregnancy (kg)	0.019	0.018	0.002	0.001

*P<0.01, **P<0.001, ***P<0.0001.

because of severe chronic and psychiatric disease and long term prisoners) were not examined and consequently were excluded from the study.

Subjects' birth weights were stratified in fifths for gestational age, on the basis of growth curves determined for our entire study population, to avoid a bias that may be caused by use of growth curves developed for a different population.

Blood pressure was measured in the sitting position in the right arm with a Bauman sphygmomanometer with appropriate cuff size. The end point for diastolic blood pressure was the disappearance of the Korotkoff sounds (phase V). The examiners were not aware of the perinatal data. Standing height was measured without shoes to the nearest centimetre, and body weight without clothes was determined to the nearest 100 g.

Regression coefficients with 95% confidence intervals were calculated by multiple linear regression analysis (SAS Institute, Cary, NC) to control for the effects of the studied independent variables. The variables included in the regression model were birth weight corrected for gestational age, birth order, ethnic origin, social status, height and body mass index (kg/m²) at 17 years of age, and mother's educational attainment, body mass index, and weight gain in pregnancy.

Results

Systolic and diastolic blood pressure at age 17 correlated significantly with body weight and height, body mass index, and mother's body weight and body mass index before pregnancy, but not with birth weight or mother's weight gain in pregnancy (table 1). After adjustment for birth weight, mother's body mass index, body weight at age 17, and ethnic origin by a multiple regression analysis model, systolic and diastolic blood pressure and body weight were positively associated (table 2). Birth weight and Western and Israeli ethnic origin were negatively associated with blood pressure (table 2). Birth order, social status, and mother's and

father's educational attainment were not included in the final regression model as they did not influence blood pressure significantly.

The mean systolic and diastolic blood pressures increased with adolescent body mass index group in young women and young men (tables 3 and 4). The fifth of birth weight for gestational age was not associated the mean systolic or diastolic blood pressure at age 17 (tables 3 and 4). Adjustment for body weight at age 17 and mother's weight before pregnancy, body mass index, weight gain in pregnancy, and ethnic origin in a multiple regression model did not change these associations.

After adjustment for the above variables, mother's body mass index was positively associated with blood pressure while weight gain in pregnancy had little influence on blood pressure at age 17 (for details, see extra tables available on the internet at www.bmj.com). Furthermore, subjects born to women with low body mass index before pregnancy, or those who gained little weight in pregnancy, did not have a higher mean systolic or diastolic blood pressure.

Discussion

Adverse intrauterine conditions, suggested by small size for gestational age, were not associated with high blood pressure at age 17. Birth weight was positively, rather than negatively, correlated with blood pressure. This finding is in agreement with our previous study on 33 545 subjects born a decade earlier, in which low birth weight was poorly correlated with blood pressure in late adolescence.¹⁰ The present study has an advantage over the previous series, because an accurate estimation of gestational age was available, better reflecting intrauterine growth than birth weight alone. More importantly, maternal nutritional status during pregnancy could be assessed, and low weight and body mass index before pregnancy, as well as poor weight gain in pregnancy, were not associated with high blood pressure. In fact, the mother's body mass index before pregnancy and weight gain in pregnancy had an independent positive effect on blood pressure at 17 years of age.

Conflicting findings

Since we first reported, in 1991, that intrauterine environment, as shown by birth weight, has little effect on blood pressure in 17 year old subjects,¹⁰ additional studies have confirmed our observation in 15, 16, and 18 year olds.¹¹⁻¹³ The weak association between birth weight and blood pressure in teenagers has subsequently been attributed to perturbation of blood pressure tracking during this period of rapid growth,⁷ but

Table 2 Mean regression coefficients (95% confidence interval) for systolic and diastolic blood pressure at age 17

	Women (n=4199)		Men (n=6692)	
	Systolic	Diastolic	Systolic	Diastolic
Birth weight (kg)	-0.73 (-1.51 to 0.05)	-0.27 (-0.82 to 0.28)	-0.94 (-1.54 to -0.33)	-0.31 (-0.73 to 0.11)
Body weight at age 17 (kg)	0.19 (0.15 to 0.23)	0.12 (0.09 to 0.15)	0.24 (0.21 to 0.27)	0.12 (0.10 to 0.14)
Mother's weight before pregnancy (kg)	0.09 (-0.006 to 0.18)	0.02 (-0.04 to 0.09)	0.03 (-0.05 to 0.1)	-0.02 (-0.07 to 0.03)
Mother's body mass index (kg/m ²)	-0.12 (-0.37 to 0.14)	0.001 (-0.18 to 0.18)	-0.03 (-0.23 to 0.18)	0.11 (-0.03 to 0.25)
Mother's weight gain (kg)	0.02 (-0.06 to 0.11)	0.02 (-0.03 to 0.08)	-0.03 (-0.09 to 0.04)	-0.01 (-0.06 to 0.04)
Western ethnic origin	-1.73 (-2.57 to -0.89)	-0.42 (-1.01 to 0.17)	-2.47 (-3.14 to -1.8)	-0.32 (-0.79 to 0.14)
Israeli ethnic origin	-0.9 (-1.73 to -0.06)	-0.02 (-0.61 to 0.57)	-0.94 (-1.65 to -0.24)	-0.01 (-0.50 to 0.47)

Table 3 Mean (SEM) blood pressure and corrected mean (95% confidence interval)* in women at age 17 by size at birth and body mass (lower 10th, intermediate categories, and upper 10th)

Birth weight corrected for gestational age (fifth)	Body mass index (kg/m ²)				Total #
	<17.6 *	17.6-20.5 *	20.6-25 *	>25 *	
Systolic blood pressure (mm Hg)					
1 (up to 20th centile):					
Crude	108.5 (1.1) (n=110)	110.8 (0.6) (n=332)	111.8 (0.7) (n=290)	115.8 (1.2) (n=89)	111.4 (0.4) (n=821)
Corrected	110.7 (108.5 to 113.0)	112 (110.7 to 113.3)	111.5 (110.2 to 112.9)	112.7 (110.1 to 115.3)	111.8 (0.4) (n=111 to 112.6)
2 (20th up to 40th centile):					
Crude	109.6 (1.1) (n=116)	110.3 (0.6) (n=398)	111.7 (0.6) (n=334)	113 (1.2) (n=84)	110.9 (0.4) (n=932)
Corrected	111.5 (109.3 to 113.7)	111.4 (110.3 to 112.6)	111.4 (110.2 to 112.7)	110.3 (107.6 to 113.0)	111.4 (110.6 to 112.1)
3 (40th up to 60th centile):					
Crude	109 (1.1) (n=97)	111.6 (0.6) (n=314)	112.6 (0.6) (n=306)	115.2 (1.3) (n=76)	112 (0.4) (n=793)
Corrected	111.2 (108.8 to 113.6)	112.6 (111.3 to 113.9)	111.9 (110.6 to 113.2)	112.1 (109.4 to 114.9)	112.1 (111.3 to 112.9)
4 (60th up to 80th centile):					
Crude	106.5 (1.3) (n=78)	109.3 (0.6) (n=333)	111.7 (0.6) (n=341)	114.4 (1.3) (n=88)	110.5 (0.4) (n=840)
Corrected	108.3 (105.7 to 110.9)	109.7 (108.4 to 110.9)	111 (109.8 to 112.3)	111 (108.4 to 113.7)	110.2 (109.4 to 111)
5 (80th centile or higher):					
Crude	108.5 (1.2) (n=89)	110.7 (0.6) (n=353)	112.3 (0.6) (n=419)	114.7 (1.0) (n=130)	111.7 (0.4) (n=991)
Corrected	110.6 (108.0 to 113.1)	111.4 (110.2 to 112.7)	111.4 (110.3 to 112.6)	110.8 (108.4 to 113.2)	111.2 (110.5 to 112)
Diastolic blood pressure (mm Hg)					
2 (up to 20th centile):					
Crude	67.5 (0.9) (n=110)	69.8 (0.4) (n=332)	70.4 (0.5) (n=290)	72.9 (0.8) (n=89)	70 (0.3) (n=821)
Corrected	68.6 (67.0 to 70.2)	70.4 (69.5 to 71.3)	70.3 (69.3 to 71.2)	71.1 (69.3 to 73.0)	70.2 (69.6 to 70.8)
2 (20th up to 40th centile):					
Crude	69.9 (0.8) (n=116)	70 (0.4) (n=398)	71.3 (0.4) (n=334)	71.5 (0.8) (n=84)	70.6 (0.3) (n=932)
Corrected	70.6 (69.0 to 72.1)	70.6 (69.7 to 71.4)	71.1 (70.3 to 72.0)	70 (68.1 to 71.9)	70.7 (70.2 to 71.3)
3 (40th up to 60th centile):					
Crude	69.3 (0.8) (n=97)	70.2 (0.4) (n=314)	70.7 (0.5) (n=306)	71.1 (0.9) (n=76)	70.4 (0.3) (n=793)
Corrected	70.5 (68.8 to 72.2)	70.7 (69.8 to 71.6)	70.3 (69.4 to 71.3)	69.5 (67.5 to 71.4)	70.4 (69.9 to 71.0)
4 (60th up to 80th centile):					
Crude	68.1 (0.9) (n=78)	69.3 (0.4) (n=333)	70.7 (0.4) (n=341)	73.2 (0.9) (n=88)	70.2 (0.3) (n=840)
Corrected	69.1 (67.3 to 70.9)	69.6 (68.7 to 70.5)	70.3 (69.4 to 71.2)	71.5 (69.6 to 73.3)	70 (69.5 to 70.6)
5 (80th centile or higher):					
Crude	68.3 (0.8) (n=89)	69.5 (0.4) (n=353)	70.8 (0.4) (n=419)	72.5 (0.7) (n=130)	70.3 (0.3) (n=991)
Corrected	69.2 (67.4 to 71.0)	69.9 (69.0 to 70.8)	70.4 (69.6 to 71.3)	70.8 (69.1 to 72.5)	70.2 (69.6 to 70.7)

*For corrected mean (95% CI) for categories of body mass index, the model included body weight at age 17 and mother's weight before pregnancy, body mass index before pregnancy, weight gain, and ethnic origin of the father, and a discrete variable with different levels for all 15 combinations of fifths of birth weight corrected for gestational age and four body mass index categories. For total population, the model included body weight at age 17 and mother's weight before pregnancy, body mass index before pregnancy, weight gain, and ethnic origin, and a discrete variable with different levels for fifths of birth weight corrected for gestational age.

subjects who are 17 and 18 years old are probably well past the pubertal growth spurt.

Law et al noted that babies who are small at birth, and not just premature, tend to have raised blood pressure during adult life.³ In contrast to the previous four studies assessing birth weight in adolescence,¹⁰⁻¹³ in the present study we were able to determine the appropriateness of size at birth in relation to the gestational age. We were also able to correct for multiple confounding factors such as body mass index and mother's body mass index, socioeconomic status, and ethnic origin. Even so, our findings do not support an inverse relationship between size at birth and blood pressure. In a previous study that found an inverse association in children 5 to 7 years of age, social class, educational attainment and mother's body mass index corrected for the child's body mass index were not related to blood pressure.²¹

The finding that girls born large for gestational age have a higher incidence of raised systolic blood pressure at age 17 may be a chance finding due to analysis of multiple subgroups. Laurer et al, though, have found that children with a high birth weight had higher blood pressure up to the age of 4 years⁴; conversely, Whincup

et al found an inverse relation between birth weight and blood pressure, especially prominent in girls.⁵

We found a strong positive association between body mass index and blood pressure, as observed in many other populations.²² However, subjects who were small at birth and became overweight were not at higher risk of high blood pressure, as has recently been suggested.²³

Limitations

Our study was limited by several factors. Firstly, as length at birth was not recorded, we were unable to calculate the body mass index at birth. A previous study using this body mass index at birth to determine symmetrical (light and short) and asymmetrical (light and of normal length) delayed intrauterine growth did not find an association with systolic or diastolic blood pressure at age 18 years.⁹ Secondly, we did not obtain placental weights. This factor has been found to be strongly related to systolic and diastolic blood pressure in adults,² but a recent study showed that birth weight, rather than placental ratio (ratio of placental weight to birth weight), is the early life factor most importantly related to blood pressure in childhood.⁵

Table 4 Mean (SEM) blood pressure and corrected mean (95% confidence interval)* in men at age 17 by size at birth and body mass (lower 10th, intermediate categories, and upper 10th)

Birth weight corrected for gestational age(fifth)	Body mass index (kg/m ²)				
	<18.1	18.1-21.1	21.2-25.5	>25.5	Total
Systolic blood pressure (mm Hg)					
1 (up to 20th centile):					
Crude	116.2 (0.8) (n=157)	116.9 (0.5) (n=605)	119.2 (0.5) (n=510)	123.2 (1.1) (n=128)	118.2 (0.3) (n=1400)
Corrected	118.6 (116.6 to 120.6)	118.2 (117.2 to 119.2)	118.8 (117.8 to 119.9)	120 (117.8 to 122.2)	118.7 (118.1 to 119.4)
2 (20th up to 40th centile):					
Crude	114.2 (1.0) (n=129)	117 (0.5) (n=550)	119.5 (0.5) (n=515)	124.9 (0.9) (n=157)	118.6 (0.3) (n=1351)
Corrected	116.3 (114.2 to 118.4)	118.2 (117.2 to 119.3)	119.1 (118.1 to 120.1)	121.6 (119.6 to 123.7)	118.8 (118.2 to 119.4)
3 (40th up to 60th centile):					
Crude	116.1 (1.4) (n=123)	117.1 (0.5) (n=519)	120.5 (0.5) (n=535)	122.2 (1) (n=144)	118.9 (0.3) (n=1321)
Corrected	118.2 (116 to 120.4)	118 (116.9 to 119.1)	119.7 (118.7 to 120.7)	118.7 (116.6 to 120.8)	118.8 (118.2 to 119.4)
4 (60th up to 80th centile):					
Crude	112.9 (1.1) (n=105)	116.5 (0.5) (n=506)	118.4 (0.5) (n=547)	125 (1) (n=161)	118 (0.3) (n=1319)
Corrected	115.1 (112.7 to 117.4)	117.6 (116.6 to 118.7)	118 (117 to 119)	121.1 (119 to 123.1)	117.9 (117.3 to 118.6)
5 (80th centile or higher):					
Crude	114.8 (1.1) (n=117)	116 (0.5) (n=559)	119.3 (0.4) (n=739)	122.8 (0.7) (n=226)	118.3 (0.3) (n=1985)
Corrected	116.8 (114.5 to 119.1)	116.8 (115.7 to 117.8)	118.5 (117.6 to 119.4)	118.3 (116.4 to 120.3)	117.7 (117.1 to 118.3)
Diastolic blood pressure (mm Hg)					
1 (up to 20th centile):					
Crude	71.4 (0.6) (n=157)	72 (0.3) (n=605)	73.1 (0.4) (n=510)	74.8 (0.8) (n=128)	72.6 (0.2) (n=1400)
Corrected	72.7 (71.4 to 74.1)	72.7 (72 to 73.4)	72.8 (72.1 to 73.5)	73 (71.5 to 74.5)	72.8 (72.4 to 73.3)
2 (20th up to 40th centile):					
Crude	71 (0.7) (n=129)	72.6 (0.3) (n=550)	73.5 (0.3) (n=515)	75.3 (0.6) (n=157)	73.1 (0.2) (n=1351)
Corrected	72.1 (70.7 to 73.6)	73.2 (72.4 to 73.9)	73.1 (72.4 to 73.8)	73.5 (72.1 to 74.9)	73.1 (0.2) (n=72.7 to 73.5)
3 (40th up to 60th centile):					
Crude	70 (0.8) (n=123)	71.8 (0.4) (n=519)	73.4 (0.3) (n=535)	74.4 (0.7) (n=144)	72.6 (0.2) (n=1321)
Corrected	70.9 (69.4 to 72.4)	72.1 (71.4 to 72.8)	73.1 (72.4 to 73.8)	72.5 (0.8) (n=71 to 73.9)	72.4 (0.2) (n=72 to 72.9)
4 (60th up to 80th centile):					
Crude	70.9 (0.8) (n=105)	71.8 (0.3) (n=506)	72.6 (0.3) (n=547)	76 (0.6) (n=161)	72.6 (0.2) (n=1319)
Corrected	72.2 (70.6 to 73.8)	72.3 (71.6 to 73.1)	72.2 (71.5 to 72.9)	74 (72.5 to 75.4)	72.4 (72 to 72.9)
5 (80th centile or higher):					
Crude	70.8 (0.8) (n=117)	71.6 (0.3) (n=559)	73.6 (0.3) (n=739)	75 (0.5) (n=226)	72.9 (0.2) (n=1641)
Corrected	71.5 (69.9 to 73.1)	72 (71.3 to 72.7)	73.4 (72.7 to 74)	73.1 (71.7 to 74.4)	72.7 (72.3 to 73.1)

*For corrected mean (95% CI) for categories of body mass index, the model included body weight at age 17 and mother's weight before pregnancy, body mass index before pregnancy, weight gain, and ethnic origin of the father, and a discrete variable with different levels for all 15 combinations of fifths of birth weight corrected for gestational age and four body mass index categories. For total population, the model included body weight at age 17 and mother's weight before pregnancy, body mass index before pregnancy, weight gain, and ethnic origin, and a discrete variable with different levels for fifths of birth weight corrected for gestational age.

Use of body mass index

Godfrey et al found a link between maternal triceps skinfold thickness and the blood pressure in 77 children at 10-12 years of age.⁸ They speculated that

fetal undernutrition may lead to adaptive changes, with long term consequences that initiate higher blood pressure. We did not find that the mother's low body mass index and poor weight gain in pregnancy was associated with a higher mean systolic or diastolic blood pressure at late adolescence. Body mass index may be a less accurate measure of nutritional status than skinfold thickness. However, maternal body mass index and weight gain in pregnancy are positively and significantly associated with birth weight.²⁴ Furthermore, a recent longitudinal study showed that in non-obese women the correlation between body mass index and percentage of body fat remains during pregnancy.²⁵ In addition, our results are based on a much larger population and a longer follow up period. Therefore, it seems that the hypothesis that the initiating effect of adult high blood pressure is fetal nutrition in utero still demands more epidemiological evidence.²⁶

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Conflict of interest: None

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Key messages

- Several studies have shown a significant inverse relation between blood pressure and birth weight, though the finding is not consistent
- In 10 883 Israelis blood pressure measured at age 17 was related to their birth weight adjusted for gestational age, their current body mass index, and their mother's weight before pregnancy and weight gain during pregnancy
- Blood pressure was significantly and positively correlated with body mass index at age 17 and with mother's weight before pregnancy but not with birth weight or mother's weight gain during pregnancy
- Variables reflecting poor intrauterine nutrition were therefore not associated with higher blood pressures in late adolescence

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Management of chronic hepatitis C: clinical audit of biopsy based management algorithm

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Abstract

Objective: To assess the attendance, outcome, compliance with treatment, and response to interferon alfa in patients with chronic hepatitis C who attended during 1995 and were treated according to a biopsy based algorithm.

Design: Retrospective audit of all patients with chronic hepatitis C attending outpatient clinics over one year.

Setting: The liver unit at a London teaching hospital.

Subjects: 255 patients with chronic hepatitis C.

Main outcome measures: Patient survival, attendance, and compliance with diagnostic and therapeutic regimens. Response to interferon alfa treatment, based on loss of viraemia three months after cessation of treatment.

Results: A large proportion of patients (39%) with newly diagnosed chronic hepatitis C infection do not want to undergo further investigation. Of those patients who do attend for further treatment, a large proportion with severe hepatic fibrosis (42%) do not want to undergo currently available treatment. The response rate to interferon (21%) in treated patients was similar to that previously reported in a trial setting. There was no significant difference in response rates in patients with or without severe fibrosis not amounting to cirrhosis. In patients with cirrhosis there was a high incidence of hepatocellular carcinoma (18%) over a follow up period of 20 months.

Conclusion: Current strategies aimed at investigating and treating patients with chronic hepatitis C are not acceptable to a large proportion of patients. Many patients with cirrhosis related to hepatitis C infection develop hepatic neoplasms, and management strategies to deal with this problem are urgently required.

Introduction

The true prevalence of chronic infection with hepatitis C virus in the United Kingdom is unknown, with current estimates suggesting that between 0.01% and 1% of the population are infected.¹⁻² The treatment requirements of these patients and the proportion who want to undergo investigation and treatment have not been studied. The optimal management of infected patients is unknown. Long term follow up studies indicate that up to 30% of infected patients will develop cirrhosis and liver tumours within 30-40 years of infection.³ Hence a large proportion of infected patients may not develop important disease and, as transmission of hepatitis C to non-sexual and sexual partners is rare,⁴ it is not clear whether these patients require intervention.

The only licensed treatment for chronic hepatitis C is a 6-12 month course of interferon alfa, which is associated with considerable side effects⁵ and costs. In clinical trials only 20% to 25% of treated patients show a sustained response.⁶⁻⁸ A balance must therefore be struck between treating all patients, resulting in side effects in patients who are unlikely to develop serious disease, or treating none, leading to an increase in mortality in those with progressive disease. Although

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