(23×12 cm, $+10$ (SD 8.1) mm Hg, 30×12 cm, $+7$ (SD 6.9) mm Hg) all other auscultatory measurements differed less than 5% from intra-arterial pressure.

Between subject variability for the six bladders, expressed as standard deviation of the mean difference, differed significantly only for systolic pressure in subjects with obese arms ($p < 0.01$; homogeneity of variance test). Diastolic variability was 4.3 to 6.4 mm Hg in subjects with normal arms and 5.3 to 8.1 mm Hg in those with obese arms. In the 37 subjects only for the smallest two bladders did arm circumference give positive and significant correlations with the difference between intra-arterial and auscultatory pressures ($r = 0.45$ to 0.60).

Discussion

This study confirms that the differences between auscultatory and intra-arterial blood pressure readings in subjects with obese arms are acceptable when long bladdered cuffs are used,³ that these differences cannot be predicted from arm circumference,⁵ that systolic intra-arterial pressure is invariably underestimated by the cuff method,³ and that the same long bladdered cuffs estimate intra-arterial pressure as accurately as the standard 23×12 cm cuff in subjects with normal sized arms.

Which cuff, then, should be recommended? In the obese subjects differences in accuracy among the four largest cuffs were very small and clinically irrelevant, and there was even less to choose among all six cuffs in subjects with normal arms. Hence other, more practical

considerations may be weighed. On the largest arms only the two longest cuffs remained properly closed without strapping during inflation, and of these the conical cuff was too wide for most arms to allow measurement without the subject undressing and is not generally available. We therefore recommend our longest rectangular cuff of 14×38 cm. Thus our findings suggest that the size of the inflatable bladder in the cuff is less critical than usually believed and support the use of only one cuff in routine blood pressure measurement in adults.

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False positive results of tests for syphilis and outcome of pregnancy: a retrospective case-control study

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Abstract

In a retrospective case-control study 64 women yielding a false positive result to a test for syphilis in pregnancy were compared with 128 controls individually matched for age, parity, hospital of delivery, and year of delivery. There were significantly more unsuccessful pregnancies, mainly spontaneous abortions during the first and second trimesters, among women with persistent false positive results. There was no significant difference between groups in the mean birth weights of liveborn infants.

The antibodies responsible for the false positive result may

indicate the presence of an immunological disturbance. Women who give a false positive result should be carefully managed throughout their pregnancy.

Introduction

A false positive result to a test for syphilis is usually caused by polyclonal antiphospholipid autoantibodies including anticardiolipin and the lupus anticoagulant.¹ Anticardiolipin can also be detected by a more specific and sensitive radioimmunoassay² or enzyme linked immunosorbent assay,³ and lupus anticoagulant is detected by its in vitro effect on coagulation. Patients with autoimmune conditions such as systemic lupus erythematosus in which there is a wide range of autoantibodies have a high rate of pregnancy loss.⁴ The lupus anticoagulant is associated with both a high rate of pregnancy loss⁵ and a high frequency of false positive results to tests for syphilis.^{2,6}

Although tests for syphilis have been routinely performed in pregnancy for decades, there are few data about the outcome of pregnancy in women with a false positive result. Wright and Gerken recorded 11 patients with false positive results and normal term deliveries,⁷ and Hare mentioned 49 cases without recording the outcome.⁸ In patients with systemic lupus erythematosus raised titres of anticardiolipin and abnormalities of the fetal heart rate were associated.⁹ Raised titres of anticardiolipin also occurred in some patients with recurrent spontaneous abortions, stillbirths, or unexplained fetal growth retardation.¹⁰ In a preliminary review a

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high rate of fetal loss in late pregnancy in patients with false positive results was noted.¹¹ We report a study comparing women who had false positive results with matched controls.

Subjects and methods

The records of the Yorkshire Blood Transfusion Service were searched for the 10 years 1974-83 for pregnant patients who had had a test for syphilis that gave a false positive result. The Venereal Disease Research Laboratory test, Wasserman reaction, and Reiter protein reaction were the screening tests used at various times in the series. A patient (case) was included if any of the above tests gave a positive result and one of the specific tests for syphilis (treponemal haemagglutination, fluorescent treponema antibody, or *Treponema pallidum* immobilisation test) gave a negative result.

The first pregnancy in which a false positive result was detected was taken as the index pregnancy. Two control pregnancies from the transfusion service records were matched to each index pregnancy for maternal age within five years, parity (zero, one to three, four or more previous pregnancies), hospital of delivery, and expected date of delivery within four years. Obstetric details, including fetal outcome, gestational age at booking, and birth weight of liveborn infants, were abstracted from hospital records for both the index and any other pregnancies. Cases for which no matching controls could be found were excluded, and only one control was found for three cases.

Statistical comparison was limited to the index pregnancies. Fetal outcome and gestational age at booking were compared by a paired version of the Mantel-Haenszel test.¹² Comparison of birth weights was performed by examining the number of case-control triplets in which the case infant was lightest by χ^2 goodness of fit test.

Results

One hundred and ten cases were discovered (roughly one in 1800 deliveries), and records were traced and two controls found for 68. For three further cases only one control was found, making 71 cases with at least one matched control. In 39 of these cases false positive results had been documented on two occasions at least one month apart. The table shows the fetal outcome for the 71 cases and their controls. A higher proportion of pregnancies were lost among cases in the first two trimesters, but the significance of this could not be tested because of the non-independence of outcomes.

Outcome of all recorded pregnancies in cases and controls. Figures are numbers (percentages) of pregnancies

	Cases	Controls
No of women	71	139
Total No of pregnancies	203	337
Livebirths	152	297
Stillbirths and neonatal deaths	3 (1.5)	6 (1.8)
Terminations	3 (1.5)	12 (3.6)
Abortions at ≤ 12 weeks	32 (15.8)	14 (4.2)
Abortions at $>12-28$ weeks	13 (6.4)	8 (2.4)
Total pregnancy losses*	48 (23.6)	28 (8.3)

*Includes only spontaneous pregnancy losses; induced abortions are excluded.

For statistical comparison the three cases with only one matched control and four case-control triplets in which either the index pregnancy or one of the matched control pregnancies had been terminated (missing data) were excluded. This left 64 case-control triplets for analysis. Overall the proportion of index pregnancies lost was significantly greater than the proportion of control pregnancies lost (relative risk 8.5, 95% confidence interval 1.8 to 40). Among the 64 case-control triplets nine index pregnancies were lost. For eight of these neither of the control pregnancies were lost, and for the ninth one of the control pregnancies was lost. All the excess loss of pregnancy occurred in cases in whom a false positive result had been obtained on two occasions at least a month apart and before 28 weeks' gestation. Fifty five of the index pregnancies resulted in liveborn infants; for 53 of these both of the control pregnancies resulted in liveborn infants, while for two only one of the control pregnancies did so.

The gestational age at booking was available for the index pregnancy and both control pregnancies in 53 case-control triplets, the mean being 16 weeks

(SD 7, range 6-36). The cases had the earliest mean gestational age at booking (15.8 weeks) compared with 16.1 and 16.3 weeks in the two control groups; this difference was not significant. The proportion of case-control triplets in which the (liveborn) case infant had the lightest or heaviest birth weight was 35% and 27% respectively; this was not significantly different from that expected by chance. No patient had been tested for the lupus anticoagulant, but the clinical details of one case who had had five consecutive spontaneous abortions, recurrent deep venous thromboses, and pulmonary emboli were suggestive of its presence.

Discussion

This study showed that women with a false positive result of a syphilis test in pregnancy had an increased rate of loss of pregnancy in the first two trimesters, which supports our previous report.¹¹ One explanation for the excess loss of pregnancy might be that women with a false positive result, having been recognised as being at high risk, booked earlier than controls and had more early abortions recorded. In the 53 case-control triplets for which gestational age at booking was known, however, the mean difference was less than 0.5 weeks and not significant.

It is possible that patients with a false positive result were managed differently, but the records showed nothing to suggest this. False positive results either were not noted by clinicians as the repeat serological examination indicating that it was a false positive result had been performed at the instigation of the transfusion service or were apparently ignored after syphilis had been excluded. In only one case was the possible importance of the result as a sign of autoimmune disease appreciated; the patient was investigated for immunological abnormality and a previously unsuspected positive result on testing for antinuclear factor found.

With the recognition that the presence of various autoimmune antibodies may be associated with general¹³ or particular problems in pregnancy (for example, anti-Ro antibody with heart block,¹⁴ lupus anticoagulant with intrauterine death or abortion⁵) it has been suggested that screening programmes might be used.¹⁵ The frequency of finding these antibodies, however, is so low that such an approach seems unlikely to be cost effective.

The possibility that the antibodies detected as false positive results on routine syphilis testing might point to an increased pregnancy risk has been ignored. Such results should prompt both a search for other specific types of autoimmune antibodies such as the lupus anticoagulant, anti-Ro, and antiplatelet antibodies and also special vigilance in antenatal supervision.

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