OBSERVATIONS ON THE BACTERIOLOGY OF THE URINE AND LIQUOR IN PREGNANCY AND LABOUR

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URINARY TRACT infections are now among the commonest bacterial infections. In England and Wales some 6,000 to 7,000 patients die every year from uraemia, about 3,000 of them between the ages of 5 and 55 years (Brit. med. J., 1967), and many of these die as the result of chronic urinary tract infection. Pregnant women are particularly prone to such infection both symptomatic and asymptomatic. These considerations have led to the recent widespread interest in the bacteriology of the urine in pregnancy. As the urine of the fetus is an important constituent of the amniotic fluid (Young and Martin, 1963), the bacteriology of the liquor amnii should reflect, to some extent, the condition of the urinary tract of the fetus.

PATIENTS AND METHODS

All the patients admitted to the Royal Maternity Hospital, Belfast are investigated for significant bacteriuria. Of the 1,300 patients admitted during the period of this study, 1,000 were antenatal and the remaining 300 were in labour.

EXAMINATION OF URINE

Early morning midstream specimens of urine were obtained from antenatal patients on the second day of admission to hospital and the specimens were examined within two hours of collection. Midstream or catheter specimens of urine were obtained on admission from patients admitted in labour and were refrigerated at 4°C until they could be cultured. Logarithmic dilutions of the urine were made in nutrient broth and 1 ml. from each dilution was transferred to a MacConkey plate which was incubated at 37°C overnight. Significant bacteriuria in this study is defined as the presence of 100,000 (10⁵) or more E. coli per ml. in two or more consecutive daily specimens of urine. The identity of E. coli was confirmed by standard biochemical tests (Cowan and Steel, 1965).

SPECIMENS OF URINE AT VARIOUS TIMES OF THE DAY

Four specimens of urine per day were obtained from each of 20 patients, 10 of whom had significant bacteriuria. As well as early morning urine, urine passed at 12 midday, 2.00 p.m. and 4.00 p.m. was examined and the count of E. coli per ml. of each specimen was recorded against its time of collection. All specimens were examined within two hours of collection.

BACTERIOLOGY OF LIQUOR AMNII

Specimens of liquor amnii were obtained from 200 Rhesus negative patients of gestational periods of 28 to 34 weeks, who had amniocentesis performed during the period of this study. Of these, 10 had significant bacteriuria at the time of amniocentesis. Logarithmic dilutions of the liquor amnii were made in nutrient broth and 1 ml. from each dilution was transferred to a MacConkey plate and 1 ml. to blood agar plate. The plates were incubated at 37°C overnight.
TABLE I

Incidence of significant bacteriuria in pregnancy and labour

|                                | Antenatal patients | Patients in labour |
|--------------------------------|--------------------|--------------------|
| Total number of patients examined | 1,000              | 300                |
| Patients with significant bacteriuria | 47 (4.7%)         | 10 (3.3%)          |
| $\chi^2$ = 1.02              | d.f. = 1           | 0.50 > P > 0.30    |

RESULTS

Out of 1,000 patients examined during the antenatal period, 47 (4.7 per cent) had significant bacteriuria and 10 (1 per cent) had a count of 100,000 or more E. coli per ml. on one occasion only and out of 300 patients examined during labour, 10 (3.3 per cent) had significant bacteriuria (table I).

The results of examination of urine at various times of the day from 10 patients with significant bacteriuria showed that the counts of early morning urine were significantly higher than those of the remaining three specimens. The latter showed no statistically significant difference between each other ($F=6.141$, $n_1=3$, $n_2=27$, $0.01 > P > 0.001$). In nine out of the 10 patients with significant bacteriuria all the four specimens examined per day showed counts above 100,000 E. coli per ml. (table II), while in the 10 patients who had no significant bacteriuria the counts in the four specimens were variable with no specific pattern and none of the counts reached 100,000 E. coli per ml.

TABLE II

Results of examination of urine passed at various times of the day by 10 patients with significant bacteriuria

| Patients | Early morning | E. Coli per ml. of urine specimen |
|----------|--------------|-----------------------------------|
|          | 12.00 midday | 2.00 P.m. | 4.00 P.m. |
| 1        | $10^8 \times 9$ | $10^7 \times 8$ | $10^7 \times 6$ | $10^7 \times 8$ |
| 2        | $10^5 \times 2$ | $10^5$ | $10^5$ | $10^5$ |
| 3        | $10^6$ | $10^5 \times 7$ | $10^5 \times 5$ | $10^5 \times 9$ |
| 4        | $10^5 \times 2$ | $10^5$ | $10^4$ | $10^4$ |
| 5        | $10^8 \times 2$ | $10^5 \times 6$ | $10^5 \times 8$ | $10^5 \times 6$ |
| 6        | $10^5 \times 7$ | $10^5$ | $10^5$ | $10^5$ |
| 7        | $10^6$ | $10^5$ | $10^5 \times 4$ | $10^5 \times 5$ |
| 8        | $10^6$ | $10^5 \times 6$ | $10^5$ | $10^5$ |
| 9        | $10^8 \times 3$ | $10^6$ | $10^5 \times 5$ | $10^5 \times 6$ |
| 10       | $10^8 \times 2$ | $10^7$ | $10^5 \times 9$ | $10^5$ |

Average square root

|          | 80.34 | 16.76 | 12.68 | 13.51 |

$F=6.141$ $n_1=3$ $n_2=27$ $0.01 > P > 0.001$
Also the 200 specimens of liquor amnii, including those from the 10 patients with significant bacteriuria, were sterile on culture.

**Discussion**

In an earlier screening survey of antenatal patients in this hospital with the tetrazolium chloride (T.T.C.) test, significant bacteriuria occurred in 4.7 per cent (Pinkerton et al., 1965). This is in complete agreement with our present results and confirms the value of the T.T.C. test as a reliable method of screening antenatal patients for significant bacteriuria as here defined.

In this study, a significant bacteriuria occurred in 4.7 per cent of antenatal patients and 3.3 per cent of patients in labour. There was no statistically significant difference between these figures (0.5 > P > 0.3). A slightly higher incidence in the antenatal period could be due to the fact that while all specimens obtained from the antenatal patients were of early morning urine, those obtained during labour were not. A study of urine passed at various times of the day shows that counts of *E. coli* are always highest in the early morning. Kass (1955) related this to a longer incubation period in the bladder, and Waters and his associates (1967) to more suitable urinary pH and osmolality.

The sterility of all specimens of liquor amnii could mean that the urinary tract of the fetus is not invaded by bacteria even when the pregnancy is associated with significant bacteriuria or, on the other hand, it could result from the inhibitory action of the liquor amnii on the growth of bacteria which was demonstrated by Gudson (1962) and Galask and Synder (1968).

In conclusion it is suggested that, as the present definition of significant bacteriuria depends on the number of bacteria in the urine, examination of early morning urine provides a more sensitive test for significant bacteriuria than examination of midday urine. Although the liquor amnii was sterile in all our patients, including those with significant bacteriuria, further studies of larger numbers including those with overt clinical infection are necessary.

**Summary**

Significant bacteriuria occurred in 4.7 per cent of antenatal patients and 3.3 per cent of patients examined during labour. Early morning urine always gave significantly by higher counts of *Escherichia coli* than midday urine and the liquor amnii specimens examined, including those from patients with significant bacteriuria, were all sterile on culture.

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