

## INVESTIGATION OF THE BACTERIAL CONTENT OF THE URINE IN NORMAL PREGNANCY.

By MURIEL BARTON HALL, M.D.

(*John W. Garret International Fellow in Bacteriology, Liverpool University.*)

COMPARATIVELY little work has been published upon the bacteriological investigation of the urine in the healthy woman either normally or during pregnancy and the puerperium, and the findings in such work as has been published are contradictory. In 1912, Leith Murray, Stenhouse Williams and A. J. Wallace, working together upon the coliform organisms in the female urinary tract, came to the conclusion that typical *Bacillus coli* is found in a considerable percentage of all female urines taken under conditions precluding all sources of contamination, and that ordinarily they have no apparent pathological significance. John Hewitt, in 1923, published a report upon 34 cases of urinary infection during pregnancy and the puerperium. He agreed with Leith Murray and other workers who had quoted figures to show that healthy pregnant women may have *B. coli* in the urine in the absence of pus cells.

Hewitt's figures for 100 healthy pregnant women are as follows:

Organisms present	%
<i>B. coli</i>	30
<i>Staphylococcus albus</i>	35
Sterile	32

Hewitt also stated that a mixed infection is comparatively common and gave the following figures:

Organisms present	%
<i>B. coli</i> alone	24
<i>B. coli</i> and <i>Staphylococcus</i>	2
<i>B. coli</i> , <i>Staphylococcus</i> and <i>Streptococcus</i>	1
<i>B. coli</i> and <i>Streptococcus</i>	2
<i>B. coli</i> , <i>Streptococcus</i> and Diphtheroid	1

Danforth, on the other hand, in 1916 gave the results of an investigation of 50 specimens of urine taken with all due precautions from 50 normal pregnant women:

Organisms present	Cases
<i>Staphylococci</i> alone	32
<i>B. coli</i> alone	2
<i>B. coli</i> and <i>Staphylococci</i>	3
No growth	13

Later he worked out a further 14 cases with even greater precaution against contamination, and no *B. coli* occurred. He concludes with the statement that it may be justly questioned whether some contamination may not have occurred in his first series. He adds that the *Staphylococcus* must be looked upon as a frequent inhabitant of the bladder of pregnant women.

Gough, in 1923, examined specimens of urine from 100 unselected gynaecological cases in which no complaint of urinary symptoms had been made. The

specimens were obtained by routine catheterisation of patients before operation.

His results were as follows:

30 sterile	
70 growth obtained	{ 39 less than 10 colonies
	{ 21 less than 100 colonies
	{ 10 more than 100 colonies

The organisms found were

<i>Staphylococcus albus</i>	56
<i>S. aureus</i>	1
Streptococci	1
Diphtheroid bacilli	17
Coliform bacilli	12
<i>B. proteus</i>	1

If those cases with more than 100 colonies are taken alone, the results were

<i>Staphylococcus albus</i>	1
Coliform bacilli	8
<i>B. proteus</i>	1

If we analyse Gough's cases a little more fully we find that 10 of his series of 100 cases showed more than 100 colonies, and of these 10 cases pus cells were found to be present in 6 cases, and a pure growth of *B. coli* in 8 cases. We are, therefore, justified in excluding from his figures 6 per cent. of the cases in which there was a *B. coli* infection of the urine, which leaves us with 6 per cent. in which there was no evidence of infection, but in which the *B. coli* was grown. Gough himself considers that more than 100 colonies on his plates indicated an infection which reduces his figure for *B. coli* as a contamination still further to 4 per cent.

The types of cases examined by the four workers cited, were as follows:

- (1) Murray took 30 gynaecological cases, including cases of infection, innocent and malignant tumour, and displacement of the genital organs.
- (2) Gough took 100 gynaecological cases with no urinary symptoms.
- (3) Hewitt took 100 cases of healthy pregnant women.
- (4) Danforth took 64 cases of healthy pregnant women.

The results obtained by the four authors are incorporated in Table I (p. 412).

From the point of view of this investigation, we are justified in excluding Murray's figures, as they are incomplete, based upon 30 cases only, and the specimens of urine were obtained from cases which included carcinoma of the uterus and other malignant tumours, and in which there may have been bladder involvement by extension of the growth. Murray's work is referred to because it is quoted by Hewitt and others in support of the view that *B. coli* is present normally in the female urinary tract.

Gough, Hewitt and Danforth are in agreement with regard to the percentage of sterile urines (26–32 per cent.). Their figures for *Staphylococcus albus* and *B. coli* vary considerably, as will be seen by reference to Table I.

Hewitt gives no details regarding the methods he employed either in obtaining or examining the specimens, but merely states the figures, so that

there may be some difference in this direction to account for the discrepancy between his results and those of the two other workers.

The results of Gough and Danforth are similar both with regard to the percentage of sterile cases and the percentage of cases in which *Staphylococcus albus* was grown. Their figures for *B. coli* are considerably lower than those of Murray or Hewitt.

#### THE AUTHOR'S INVESTIGATIONS.

Although the figures of Gough and Danforth appeared more accurate than Hewitt's, it seemed desirable to determine the bacterial content of the urine in a fresh series of 100 healthy women, since it might help (a) to solve any apparent discrepancy, and (b) to clear the ground for the investigation of pathological urinary states.

*Technique.* One specimen of urine was obtained from each of 100 healthy pregnant women, and in order that the results might be more uniform all the specimens were obtained during the ninth month of pregnancy. Every specimen of urine examined was collected by means of a sterile catheter, with all due precautions, directly into a sterile bottle and examined without delay.

*Cultural methods.* A fresh uncentrifuged drop of urine was first examined, and the presence or absence of pus cells and micro-organisms noted. Any case showing evidence of infection was discarded at this stage. The specimen, if showing no evidence of infection by direct examination, was then transferred to a sterile centrifuge tube and spun for 20 minutes. The supernatant fluid was removed and examined chemically. The deposit was then examined for pus cells, blood, casts and crystals. Any cases showing the presence of pus cells in the deposit were discarded. Cases showing no evidence of infection were plated on to two MacConkey's red agar plates and one plain nasgar plate. After 24 hours' incubation the plates were examined and sub-cultures made on to nasgar slant tubes, and examined in detail for their morphological and cultural characteristics.

#### RESULTS OF INVESTIGATION.

Of the 100 specimens of urine investigated 35 showed no growth on any plate; 64 showed a growth of *Staphylococcus albus*: the number of colonies varied from 1 to 30, the usual number being 3 to 10 colonies; 1 showed a growth of *B. coli* on the first red agar plate, the colonies in this case numbering 3.

These results are best compared with those of the previous workers by means of a table (see Table I).

It will be seen that my figures (Hall) compare closely with those of Gough, the greatest difference being that of 8 per cent. in the figures for *Staphylococcus*.

The comparison with Danforth's figures is not quite so striking, there being a difference of 9 per cent. in the figures for sterility, 6 per cent. in the figures for *Staphylococcus* and 6·8 per cent. in the figures for *B. coli*.

Table I.

Observer	No. of cases	Type of case	Percentages of cases in which		
			Urine found sterile	<i>Staphylococcus albus</i> isolated	Coliform bacilli isolated
Murray	30	Gynaecological	?	?	25 at least
Gough	100	Gynaecological	30	56	4
Hewitt	100	Normal pregnant	32	35	30
Danforth	64	Normal pregnant	26	70	7.8
Hall	100	Normal pregnant during ninth month of pregnancy	35	64	1

When it is remembered, however, that Danforth's figures were based upon 64 cases, while mine were based upon 100 cases, the difference would not appear to be of such significance, more particularly concerning the presence of *B. coli*.

#### CONCLUSIONS.

The conclusions arrived at by Leith Murray and his co-workers and supported by Hewitt, in which they state that the *B. coli* is a normal inhabitant of the female urinary tract, both normally and during pregnancy, have not been borne out by the present investigation. Neither can the statement by Browne (1926) be accepted in which he says "one of the functions of the healthy kidney is to excrete toxins of endogenous origin, hence the bacilluria that is found in most healthy pregnant women."

Murray's work, so far as the healthy woman is concerned, may be discarded for the reasons already given. Hewitt's work is difficult to criticise because of the absence of any account of the technique he employed.

My investigations appear to show that *Staphylococcus albus* is a normal inhabitant of the female urinary tract—this being in agreement with the conclusions of previous workers.

With regard to the *B. coli*, however, this would not appear to be the case. During the present investigation the specimens of urine were examined without delay. The urine forms an ideal culture medium for the *B. coli* and a delay of from 6 to 12 hours between obtaining the specimen from the patient and preparing the cultures suffices to allow a considerable growth to occur from a single stray bacillus contaminating the specimen. Immediate examination excludes this source of error.

This small but important point is one which has not been referred to by any of the previous workers on the subject, and it may be sufficient to account for the discrepancy between the statements made by Murray, Hewitt and F. J. Browne, and the findings of Gough, Danforth, and the present investigator.

#### REFERENCES.

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