

A STUDY OF BACTERIURIA IN PREGNANCY

by

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Introduction

Infection of the urinary tract—so called 'The Problem Tract', is one of the commonest of all infections, next to those of upper respiratory tract. The gravity of the urinary tract infection can better be imagined in the wake of its complications into which it imperceptibly terminates and the lack of response to chemotherapy, once a chronic process is established.

There is increasing evidence that severe renal damage may be initiated by apparently trivial or even unrecognised infections of the urinary tract. The existence of an asymptomatic stage in the history of pyelonephritis before hypertension and uraemia develop has necessitated the need of accurate bacteriological investigation. Chronic pyelonephritis can be prevented if the initial signs of urinary tract infection are detected and treated early. (Kass, 1960; Pinkerton *et al*, 1961 and Kinacaid-Smith & Bullen, 1965).

There is much to encourage urinary tract infection during pregnancy when

several anatomical and physiological changes take place in the urinary tract. Ureters and renal pelvis get dilated and urinary stasis develops. These effects are due to mechanical pressure exerted by the enlarging gravid uterus and hormonal influences during pregnancy. Urinary stasis is greatest between the 20th and 24th weeks and lessens in the second half of pregnancy partly due to muscular hypertrophy of the ureteric walls and partly due to change in the axis of enlarging uterus (Donald, 1961). All these modifications of the urinary tract during pregnancy lead to an environment conducive to the occurrence of bacteriuria which may be transient in nature (Low *et al*, 1964).

Bacteriuria is the most consistently reproducible finding in urinary tract infection. Kass (1955) found that counts of 100,000 or more bacteria per ml. (significant bacteriuria) were usually due to bacteria multiplying in the urine within the urinary tract, whereas lower numbers of organisms were contaminants which had entered the urine from the urethra or external genitalia while the specimen was being voided. Bacteriuria is now generally accepted to mean the presence of 100,000 or more bacteria in one ml. of freshly voided urine.

Apart from the dangers of acute and chronic pyelonephritis, various other complications have been found to be associated with bacteriuria of pregnancy, such as

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increased prematurity rate, perinatal mortality, toxæmias of pregnancy, hypertensive disease and anaemia. Early treatment of bacteriuria not only could avert the occurrence of acute or chronic pyelonephritis but it could also diminish the risk of prematurity and perinatal mortality (Kass, 1960 and Schamadan, 1964).

Material and Methods

The material for the present study comprised of, (a) 250 cases of pregnancy at any stage of gestation from different age and parity groups, (b) 50 apparently normal non-pregnant women selected at random. These cases served as control. The work was conducted at Rajendra Medical College Hospital, Ranchi.

After taking the full clinical history and detailed clinical examination, the patient was instructed to wash her vulva and perineum with soap and water thoroughly and then to void urine by holding the labia apart. Midstream urine was collected in sterilized test tube by the patient under supervision.

Each sample of urine was inoculated on McConkey's agar medium as well as on Blood agar medium. The inoculated plates were then incubated aerobically at 37°C for 24 hours.

Routine and microscopic examination of urine and study after Gram's staining of centrifugaised urinary deposit was done.

After 24 hours incubation, bacterial counting was done with the help of colony counter. A count of 10^5 or over per ml. of urine was regarded as significant and under 10^4 and 10^5 per ml. of urine was considered to be of doubtful significance and these cultures were repeated. Pure forms of the organisms were obtained by subculture from a single colony on the primary culture. The biochemical reactions, the character of growth, motility and staining reaction helped the identification and differentiation of the Gram negative bacilli.

One hundred and seventy-two pregnant cases were followed up during pregnancy, labour and puerperium. In each case, a record was kept of the patient's blood pressure, haemoglobin level, gestation period, mode of delivery, birth weight of the baby, complications during pregnancy, labour and puerperium.

Results

Among the 250 pregnant cases under study, only 31 (12.4%) were found to have significant bacteriuria, whereas only 2 out of 50 control cases (4%) had it.

It is evident from Table I that the incidence of bacteriuria is almost similar in the age groups 16 to 20 years and 21 to 30 years. However, in the age group 31 to 40 years the incidence of bacteriuria is slightly higher (15.9%).

TABLE I
Showing Relation of Bacteriuria to Age

Age in years	Total attendances	Bacteriuric		Non-bacteriuric	
		Number	Percentage	Number	Percentage
16 to 20	43	5	11.6	38	88.4
21 to 30	162	19	11.7	143	88.3
31 to 40	44	7	15.9	37	84.1
More than 40	1	Nil	—	1	—

Table II shows increasing incidence of bacteriuria with increasing parity.

As evident from Table III there has been a meagre rise in the incidence of bacteriuria from 10.0% in the first trimester to 13.1% in the third trimester.

As evident from Table IV the incidence of toxæmia of pregnancy as well as anaemia was higher in the bacteriuric group as compared to the non-bacteriuric.

The incidence of premature delivery and abortion was more in the bacteriuric

group as compared to the non-bacteriuric group.

The above Table depicts that the foetal loss was more in the bacteriuric group than in the non-bacteriuric group.

There was a significant difference in the foetal birth weight in the bacteriuric and non-bacteriuric groups. 22% of the fetuses born of bacteriuric mothers weighed less than 5 pounds as compared to only 12.9% from the non-bacteriuric group of mothers.

TABLE II
Showing Relation of Bacteriuria to Parity

Gravida	Total attendances	No. with significant bacteriuria	Percentage to the total attendance
Primi	69	8	11.6
2nd to 5th (Multi)	147	18	12.2
6th & above (Grandmulti)	34	5	14.7

TABLE III
Showing the Period of Gestation When Initial Urine Was Examined

Period of gestation in weeks	Total number of cases	Bacteriurics		Non-bacteriurics	
		Number	Percentage	Number	Percentage
Less than 13	30	3	10.0	27	90.0
13 to 28	60	7	11.7	53	88.3
29 to 40	160	21	13.1	139	86.9

TABLE IV
Showing Relation of Bacteriuria to Toxaemia of Pregnancy and Haemoglobin Concentration of Blood

Cases	Bacteriuric group		Non-bacteriuric group	
	Number	Percentage	Number	Percentage
Total	31		219	
With toxæmia of pregnancy	4	12.9	20	9.1
With haemoglobin less than 10 Gms. per 100 ml. of blood.	10	32.3	47	21.4

TABLE V
Showing Proteinuria and Pus cells per High Power Field in Centrifugalised Urinary Deposit from 31 Bacteriurics as Compared to Those from 219 Non-bacteriurics

Proteinuria	Proteinuria			No. of pus cells per high power field of centrifugalised deposit	White cells		
	Bacteriuric group (31)		Non-bacteriuric group (219)		Bacteriuric group (31)		Non-bacteriuric group (219)
	No. of cases	Percent-age	No. of cases		No. of cases	Percent-age	No. of cases
Absent	21	67.7	184	Nil	Nil	21	9.6
Trace	6	19.4	26	0-5	9	177	80.8
Present	4	12.9	9	5-10	7	17	7.8
				More than 10	15	4	1.8

Proteinuria was found to be more common in bacteriurics than in the non-bacteriurics. More than 10 pus cells per high power field of the centrifugalised deposit was associated with majority (48.4%) of the bacteriurics, whereas among the non-bacteriurics the majority (80.8%) showed presence of only 0-5 pus cells per high power field of the centrifugalised urinary deposit.

TABLE VI
Showing Duration of Pregnancy in (30 followed up) Bacteriurics as Compared to (141 followed up) Non-bacteriurics

Duration of pregnancy	Bacteriuric group		Non-bacteriuric group	
	No. of cases	Percentage	No. of cases	Percentage
40 weeks & above	21	70.2	118	83.7
37 to 39 weeks	4	13.2	6	4.25
28 to 36 weeks	2	6.6	6	4.25
Abortion	3	10.0	11	7.8

TABLE VII
Showing Relation of Bacteriuria to Foetal Loss

Foetal loss	Bacteriuric group		Non-bacteriuric group	
	No. of cases	Percentage	No. of cases	Percentage
Abortion	3	10.0	11	7.8
Stillbirth	2	6.7	8	5.7
Death within one week after birth	3	10.0	5	3.5

TABLE VIII
Showing Foetal Birth Weight in Relation to Bacteriuria

Foetal birth weight	Bacteriuric group		Non-bacteriuric group	
	No. of cases	Percentage	No. of cases	Percentage
Over 7 pounds	7	26	42	31.8
5 to 7 pounds	14	52	73	55.3
Under 5 pounds	6	22	17	12.9

TABLE IX
Showing Relation of Bacteriuria to Past History of Urinary Tract Infection

Groups	Total No. of cases	Cases with past history of symptoms pointing to the urinary tract infection	
		Number	Percentage
Bacteriuric	31	5	16.1
Non-bacteriurics	219	10	4.6

It is evident from Table IX that 16.1% of patients from bacteriuric group gave a past history of urinary infection as against only 4.6% from the non-bacteriuric group. Table X shows that acute pyelonephritis occurred about three times more often in the group with bacteriuria.

TABLE X
Showing Incidence of Acute Pyelonephritis in 172 Followed-up Cases

Period when acute pyelonephritis was diagnosed	Bacteriurics (31 cases)		Non-bacteriurics (141 cases)	
	No. of cases	Percentage	No. of cases	Percentage
Antepartum	2	6.45	1	0.7
Postpartum	6	19.35	12	8.5
Total	8	25.80	13	9.2

Discussion

The incidence of bacteriuria observed in the present study was 12.4% which is higher than those reported by recent investigators in foreign countries (ranging between 2.0% and 8.7%). The higher incidence in our country may be related to the comparatively low socio-economic status of the women in our country.

The influence of increasing age in predisposing the pregnant patient to bacteriuria may be due to its effect on pelvic tissue support which gets lax with advancing age, thus providing easier access of organisms in the urethra and then to the bladder and upper urinary tract. In the present study, the incidence of bacteriuria was found to increase slightly with increasing parity (11.6% in primigravidae as against 14.7% in grandmultiparae). The effect of parity in predisposing the pregnant women to bacteriuria may be mediated through its effect on pelvic tissue support as occurs also in increasing age. However, it is more likely that multiparae have had more manipulations of the urinary tract with the catheter, which is an important factor in causation of bacteriuria.

The incidence of bacteriuria in the present series, was found to be 10% in the first trimester and 13.1% in the third trimester. It indicates that possibly most of the bacteriuria of pregnancy is acquired in the period before 12 weeks. This may be related to the hormonal changes found in early pregnancy prior to the onset of anatomical changes. The hormones of pregnancy may have softening effect on the dense fibrous ureter, thus creating greater susceptibility to pressure effects of the enlarging gravid uterus on the ureters.

In the present series, 16.1% of 31 bacteriurics and 4.6% of 219 non-bacteriurics

gave a history of previous urinary tract infection. According to Donald (1963), the changes of pyelitis complicating pregnancy are doubled if there has been previous infection, including attacks of pyelitis in infancy and defloration pyelitis.

The present study revealed that toxæmia of pregnancy occurred in 12.9% of bacteriurics and 9.1% non-bacteriurics. Kinacaid-Smith and Bullen (1965) suggested that bacteriuria in pregnancy is often a complication of underlying chronic renal disease and this underlying disease and associated impaired renal function account for the higher incidence of toxæmia of pregnancy in bacteriuric women. It is possible that asymptomatic infection of the urinary tract in women increasing in incidence with age and/or parity may be the factor which accounts for the accelerated rise of blood pressure with age in women as compared to men, which has been noted in most studies of the epidemiology of hypertension.

32.3% of the bacteriurics and 21.4% of the non-bacteriurics in the present series had haemoglobin content less than 10 Gms. per 100 ml. of blood. Layton (1964) gave the explanation that urinary infection interferes with the absorption of iron.

In the present study, 71% of the bacteriurics and 9.6% of the non-bacteriurics showed pyuria (pus cells more than 5 pus cells per high power field). This suggests that bacteriuria is a manifestation of active inflammation somewhere in the urinary tract.

As shown in Table V, proteinuria was associated more often in bacteriurics (present in 12.9% and trace in 19.4%) as compared to the non-bacteriurics (present in 4.1% and trace in 11.9%). The high incidence of proteinuria in the group with bacteriuria makes this routine prenatal

test assume greater importance, (Schamadan, 1964). The high incidence of proteinuria in bacteriurics may be attributed to the underlying chronic renal disease and associated impaired renal function as has been suggested by Kinacaid-Smith and Bullen (1965).

The duration of pregnancy was calculated by the menstruation-delivery interval. In the present series, a large proportion of patients from the bacteriuric group went into labour before term. The incidence of prematurity was thus significantly higher in bacteriurics as compared to that in the non-bacteriurics. Kinacaid-Smith and Bullen (1965) considered that this increased incidence of prematurity was related to impaired renal function associated with underlying chronic renal disease in bacteriurics.

There was a higher frequency of abortions as well as a high rate of foetal loss after 28 weeks' of gestation in bacteriuric women as compared to that in the non-bacteriurics.

The increased incidence of prematurity and perinatal mortality in bacteriuric group of patients suggests that urinary infection may have a detrimental effect on the foetus even when there is no severe febrile illness. Gram negative bacilli which commonly cause urinary infection, produce an endotoxin which is responsible for the Shwartzman reaction (Layton, 1964). Experiments with this endotoxin have shown a similar reaction at the borders of tumours and at the placental site. Zahl and Bjerkness (1943) produced abortion in mice by intraperitoneal injection of the endotoxin.

Acute pyelonephritis occurred in 25.8% of 31 bacteriurics (6.45% antepartum and 19.35% postpartum) and in 9.2% of 141 followed up non-bacteriurics (0.7% antepartum and 8.5% postpartum). Kass

(1960) claimed that acute pyelonephritis of pregnancy could be prevented if the cases of bacteriuria are detected and treated early enough. This was later confirmed by Kinacaid-Smith and Bullen (1965) and Williams *et al*, (1965). In the present series, no attempt was made to treat bacteriuria in absence of symptoms in order to study the clinical and obstetric course of untreated asymptomatic bacteriuria. The high incidence of pyelonephritis observed in bacteriuric women of the present series compare favourably well with the findings of the other workers mentioned above and it is assumed that if these bacteriuric cases would have been given adequate treatment early enough in pregnancy, the clinical attack of pyelonephritis might have been prevented.

Summary

It was concluded that by early detection and treatment of bacteriuria, the incidence of pyelonephritis and various other complications of pregnancy including prematurity could be reduced to a minimum, if not completely averted.

The value of screening patients for bacteriuria in pregnancy was stressed particularly as a part of routine prenatal care.

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