in the number of lactobacilli. In both, case-control and prospective studies, bacterial vaginosis has been associated with preterm deliveries[9].

The present study was carried out to detect abnormal bacterial colonization of the genital tract, indicative of bacterial vaginosis in pregnancy and assess its association with adverse outcome of pregnancy such as preterm low-birth-weight babies.

Methods:

This prospective cross-sectional study was carried out in the Department of Obstetrics and Gynaecology in collaboration with Department of Microbiology and Immunology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, during January 2005 to December 2006.

One hundred (100) pregnant women who fulfilled inclusion and exclusion criteria attending outpatient Department of Obstetrics and Gynaecology of BSMMU Hospital were selected. Inclusion criteria were; age 15 to 35 years, between 28 to 36 weeks of gestation, with abnormal vaginal discharge, and clinically suspected of bacterial vaginosis. Exclusion criteria were ruptured membrane, prior tocolysis, placenta praevia, cervical cerclage, presence of purulent cervical mucous plug on speculum examination, history of vaginal douche on the day of examination and history of sexual intercourse within last 72 hours.

Women enrolled in the study were explained about the nature and purpose of the study, and only those who gave written/verbal consent were included in the study. The selected women were divided into two groups based on clinical Amsel criteria[4]: (a) culture negative (n=63) and (b) culture positive (n=37) for BV.

Specimen collection:

A clean unlubricated speculum was placed in the vagina and the vaginal pH was measured with pH strip. Sterile cotton swabs were used to obtain materials from the posterior fornix for a vaginal smear. Vaginal swab samples were collected from each patient.

Vaginal swab sample: Swab collected from the posterior fornix of vagina was rolled on two glass slides; the smears were air-dried and then fixed with methanol for gram-stain. This swab was also used to prepare wet-mount and then examined microscopically for clue cells, trichomonads, yeast, pseudohyphae and pus cells.

Swab sample from all cases were subjected to wet-film, gram-stain, and amine test for diagnosis of bacterial vaginosis by applying Amsel clinical criteria[4].

Laboratory procedure:

Measurement of vaginal fluid: The pH level was determined by placing litmus paper against the lateral vaginal wall. The colour was then compared with the colours and corresponding pH value on a standard chart.

Amine test or Whiff test: Amine odour was smelled by placing the vaginal secretion on the glass slide by adding 10% KOH to the sample.

Wet-mount preparation: The swab sample was mixed with a drop of normal saline on a slide and a cover-slip was placed over it. The slide was then examined under light-microscope at X400 for observation of clue cells. The presence of *Trichomonas vaginalis, Candida* species, pus cells and epithelial cells were also noted.

Gram-stain preparation: Methanol fixed dried smear were stained with Koploff's modification of gram-stain for detection of clue cells and evaluation of bacterial morphotype under light-microscope at X1000.

All relevant data for each individual study subjects were recorded on a predesigned data collection sheet and appropriate statistical analyses were done using computer based software, Statistical Package for Social Science (SPSS).

Results:

Table-I shows characteristics of the study population. Mean (±SD) age of BV negative and BV positive cases were 24.59±5.18 (range 15-35) and 23.89±4.77 (range 15-33) years (statistically no significant difference). Sociodemographic status of BV negative and positive cases showed no significant difference, and most of the women of both the groups were from low and middle class families. Educational status of BV negative and positive cases also showed no significant difference. Gravidity was not significantly associated between BV negative and positive cases. In BV positive and negative groups, respectively, 29 (46%) and 20 (54.1%) were primiparous, and 34 (54%) and 17 (45.9%) were multiparous. Mean (±SD) gestational age at delivery were 37.49±2.53 (range 32-41) and 35.24±2.33 (range 32-39) weeks in BV negative /and positive group, respectively (highly significant difference, $P<0.001$).

Table-II shows effect of BV on preterm delivery. Out of 63 BV negative women, there were 16 (25.4%) preterm

Table-I

Characteristics of the study subjects

Parameters	BV negative (n=63)		BV positive (n=37)		P value
Age (years)	24.59±5.18		23.89±4.77		>0.50^{ns}
Mean±SD	15-35		15-33		
Range					
	No.	(%)	No.	(%)	
Socioeconomic statusLow	24	(38.1)	15	(40.5)	>0.10^{ns}
Middle	18	(28.6)	15	(40.5)	
High	21	(33.3)	7	(18.9)	
Educational status					
Illiterate	5	(7.9)	3	(8.1)	>0.50^{ns}
Class I-V	13	(20.6)	10	(27.0)	
Class VI-X	23	(36.5)	10	(27.0)	
SSC+	22	(34.9)	14	(37.8)	
Gravidity					
Primi	29	(46.0)	20	(54.1)	>0.10^{ns}
Multi	34	(54.0)	17	(45.9)	
Duration of gestation (weeks)	37.49+2.53		35.24+2.33		<o.oor**
Mean±SD	(32.00-41.00)		(32-39.00)		
Range					

Chi-square test/Unpaired Student's 't' test, ns = Not significant, *** = Significangt

Table-II

Pregnancy outcome

Delivery	BV negative (n=63)		BV positive (n=37)		P value
	No.	(%)	No.	(%)	
Preterm	16	(25.4)	27	(73.0)	< 0.001***
Term	47	(74.6)	10	(27.0)	

Chi-square test, *** = Significant

deliveries compared to 47 (74.6%) term deliveries. However, out of 37 BV positive women, there were 27 (73%) preterm deliveries and 10 (27%) term deliveries (highly significant, P< 0.001).

Discussion:

Bacterial vaginosis (BV) is one of the most common presentation in women of reproductive age attending gynaecology outpatient department. The relatively higher prevalence of BV in the obstetric population has been held responsible for the higher incidence (10%) of preterm delivery which could be reduced by screening and treating the condition[10]. Treating BV before the women conceive is now accepted as a better way of preventing complication during pregnancy[10]. Existing data indicate a very strong association between genital tract infections and spontaneous preterm labour and preterm birth, and offers the possibility of promising

new interventions to prevent this complication of pregnancy.

The vaginal flora during pregnancy is notable for an increase in lactobacilli which along with other bacteria helps to maintain the acidity of vagina through the production of lactic acid[2]. Thus, this low pH encourages further growth of lactobacilli and other acidophilic organism and helps to prevent overgrowth with more pathogenic bacteria. This physiologic alteration of flora during pregnancy may serve to protect the fetus which becomes progressively more benign during pregnancy[11]. Alterations of this normal vaginal environment can lead to adverse outcome of pregnancy.

The first case-control study reported by Eschenbach *et al.* in 1984 showed the presence of bacterial vaginosis in high percentage of women with preterm labour (PTL), 43%)

compared to control (14%). Besides, bacterial vaginosis has also been associated with an increased risk of preterm birth (PTB), premature ruptured membrane (PROM) and intraamniotic infection".

In recent years, an increasing suspicion has led us to studies between altered vaginal bacterial flora and low-birth-weight (LEW), preterm birth (PTB) and premature rupture of membrane (PROM). Recent many reports indicate a strong association between BV with PTL and PROM[12].

A total of 100 pregnant women aged 15-35 years, between 28 and 36 weeks of gestation, with abnormal vaginal discharge and clinically suspected of bacterial vaginosis were enrolled in this study. Based on Amsel clinical criteria and culture, 37 percent women were identified to have bacterial vaginosis, which is slightly higher than that of Fule *et al.* and James *et* a/., who reported 31 and 30 percent cases of BV, respectively[13,14]. This higher incidence in the present study may be due to mandatory inclusion of clue cells on saline wet-mount as a marker of BV for every case. Depending on population studied, prevalence of bacterial vaginosis was reported to be between 10 to 40 percent among pregnant women in the United States[15].

In the present study, preterm delivery was 27 (73%) in BV positive cases, which is significantly higher than 16 (25.4%) BV negative cases. Similar studies were carried out in the United States, Scandinavia, the United Kingdom and Indonesia, where incidence of preterm delivery with BV positive cases ranged from 2 to 2.8 and 3.5 and 6.9[16,17,18].

Higher incidence in our cases was possibly due to the inclusion of cases in last trimester of pregnancy. The selection of cases in last trimester of pregnancy prevent us to analyze very early loss of pregnancy among women with BV, which may account for the lower estimated risk that we found.

In this study, high incidence was found in 27 (73%) of preterm labour in BV cases compared to 16 (25.4%) in non-BV cases, which is significantly higher compared to studies by MacDonald *et al.,* who reported 15 percent in BV cases[19]. Similar studies by McGregor reported 18.8 percent PTL in BV cases compared to 9.7 percent in non –BV cases.

This lower incidence of PTL in BV cases could be attributed to the high quality antenatal care available to pregnant women. It seems that early detection and treatment of BV cases in our society can also prevent this complication.

Conclusion:

Our findings demonstrated a significant effect of bacterial vaginosis on preterm delivery. Our finding also added to the existing evidence that bacterial vaginosis is an independent risk factor for preterm birth and suggests that the timing of this infection in gestation significantly affect this risk. Timely detection and intervention could easily prevent bacterial vaginosis-related adverse pregnancy outcome.

References:

1. Blackwell AL, Thomas PD, Wareham K, Emery SK. Health gains from screening for infection of the lower genital tract in women attending for termination of pregnancy. Lancet 1993, 342:206-10.

2. Eschenbach DA, Hillier SL, Critchlow C, Stevens C, DeRousen T, Holmes KK. Diagnosis and clinical manifestation of bacterial Ivaginosis. Am J Obstet Gynecol 1988; 158:819-28.

3. McGregor JA, French JI, Richter R, Milligan K, McKinney J, Petterson E. Bacterial vaginosis in pregnancy. Obstet Gynecol 2000; 55:1-19.

4. Amsel R, Totten PA, Spiegel CA, Chen KCS, Eschenbah DA, Homles KK. Nonspecified vagitis: diagnostic criteria and microbial and epidemiological association. Am J Med 1983; 74:14-22.

5. Blackwell AL, Phillips I, Fox AR, Barlow D. Anaerobic vaginosis (nonspecific vaginitis): clinical, microbiological and therapeutic findings. Lancet 1983; ii: 1379-82.

6. Spiegel CA, Davick; P,Totten PA. *Gardnerella vaginalis* and anaerobic bacteria in the etiology of bacterail (nonspecific) vaginosis. Scand J Infect Dis Suppl 1983; 40:41-6.

7. Masfari AN, Duerden BI, Kinghorn GR. Quantitative studies of vaginal bacteria. Genitourin Med 1986; 62: 256-63.

8. Hoist E. Reservoir of four organisms associated with bacterail vaginosis suggests lack of sexual transmission. J Clin Microbiol 1990; 28:2035-9.

9. Hillier SL, Krohn MA, Nugent RP, Gibbs RS. Characteristics of three vaginal flora patterns assessed by gram-stain among pregnant women (for the Vaginal Infection and Prematuriry Study Group). Am J Obstet Gynecol 1992; 166:938-44.

10. Hay PE. Recurrent bacterial vaginosis. Curr Infect Dis Rep 2000; 2:506-12.

11. Lament RF, Fisk NM. The role of infection in the aetiology of preterm labour. In: Studd JWW, editor, Progress in obstetrics and gynaecology, vol. 10. Edinburth: Churchill Livingstone, 1993: 135-58.

12. McGregor JA. Preterrn birth and infection: pathogenic possibilities. Am J Reprod Immunol 1988; 16:123-32.

13. Fule RP, Kalpana K, Jahagirdar VL, Saoji AM. Incidence of *Gardenerella vaginalis* infection in pregnant women and nonpregnant women with nonspecific vaginitis. Indian J Med Res 1990; 91:360-3.

14. James JA, Thomason JL, Gelbart SM. Is trichomoniasis is often associated with bacterial vaginosis in pregnant adolescents. Am 1 Obstet Gynecol 1992; 166:859-63.

15. Pheifer TA, Forsyth PS, Durfee MA, Pollock HM, Homles KK. Nonspecific vaginitis: role of *Haemophilus vaginalis* and treatment with metronidazole. N Engl J Med 1978; 298:1429-34.

16. Piot P, van Dyke E, Godts P, Vanderheyden J. The vaginal microbial flora in nonspecific vaginitis. Eur J Clin Microbiol 1982; 1:301-6.

17. Hill GB, Eschenbach DA, Holmes KK. Bacteriology of the vagina. Scand J Urol Nephrol Suppl 1985; 86:23-39.

18. van der Meijden WI, Duivenvoorden HJ, Both-Patoir HC, Hazen-Engelsman ME, Drogendijk AC. Clinical and laboratory findings in women with bacterial vaginosis and trichomoniasis versus controls. Eur J Obstet Gynecol Reprod Biol 1988; 28:39-52.

19. MacDonald HM, O'Loughlin JA, Jolley P, Vigneswaren R, McDonald PJ. Vaginal infection and preterm labour. Clin Obstet Gynecol 1991; 98:427-35.