Comparative Study of Bacterial Flora among Diabetic and Nondiabetic Perimenopausal and Postmenopausal Women

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Authors’ contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Bacterial vaginal infections are one of the least understood infections in perimenopausal and postmenopausal age group. This is the cross sectional study undertaken done to determine the prevalence of bacterial flora perimenopausal and postmenopausal diabetic and non diabetic women attending Sree Balaji medical college and Hospital. *Escherichia coli* and *Staphylococcus aureus* were significantly more in poorly controlled diabetics than those who were under control. Our present study provided important information regarding the vaginal ecology of perimenopausal and postmenopausal women with and without diabetes. The relative depletion of lactobacilli among the women with increased prevalence of pathogens like E.coli, staph aureus supports the importance of lactobacilli as a potential barrier against pathogens.

Keywords: Diabetes type-2; postmenopausal women; recurrent urinary tract infection; estradiol hormone; risk factors for UTI.
1. INTRODUCTION

The vaginal mucous membrane has normal physiological mechanism to prevent invasion by pathogenic microbes. Lactobacilli, a normal flora of vagina, protect the vagina from the invasion of various pathogens. Despite the defense mechanism, vaginal microflora is often disturbed due to various reasons. The vaginal microbiota also changes during the lifecycle of the female. Finer details of the composition and role of vaginal flora are still a matter of debate. Any inflammation or infection of the vagina is called vaginitis [1]. Vaginitis is very common disease for women of reproductive age all over the world but children and postmenopausal women could also be affected. As vaginal infections and symptoms greatly impact women's quality of life and vaginitis have been associated with serious public health sequences, it is essential to diagnose and treat the condition correctly [2]. Hence, there is a great need of diagnosing these conditions. There are number of factors which influence the growth of organisms in the vagina. These include pH, glycogen content, vascularity and hormonal status.

Urinary tract infections (UTIs) and vaginal infections, including candidal vaginitis and bacterial vaginosis (BV), collectively represent perhaps the most common affliction in women such infections occur with greater frequency after menopause. Although there have been some bacteriological studies of vaginal flora [1] these studies have not led to new therapeutic options. Postmenopausal women have decreased estrogen production with thinning and inactivity of vaginal epithelium, together with reduction in acidity and rise of pH [3]. An estrogen deficient vagina can result in obvious problem, such as discomfort and dyspareunia, and also can lead to an environment that promotes the growth of abnormal flora, which may lead to variety of infections, including frequent urinary tract infections and potential for renal compromise. Type 2 diabetes is another very important cause for increase in the occurrence of vaginal infections in the perimenopausal age group. Poor glycemic control in diabetics is also thought to result in impaired action of polymorphonuclear leucocytes resulting in decreased ability to resist infection from opportunistic organisms [4].

The two most common cause of vaginitis are bacterial vaginosis and candida vaginitis. Bacterial vaginosis is caused by decrease of lactobacilli concurrent with overgrowth of several fastidious bacterial species which normally could be present in low concentration in the vagina [5]. Candida vaginitis is a vaginal yeast infection where candida albicans is commonly the cause for the disorder [4]. In diabetic women, vulvovaginitis is more common and it is often treated with antifungal agents on the assumption that the causative organism is only candida albicans. But it is not only candida, some bacteria and other organisms may cause infection. No prospective data on risk of microbiologically confirmed bacterial vaginal infection in relation to diabetes and its characteristics exist.

Recent advances molecular bacterial diagnostics have demonstrated many novel bacterial species that interact with other organisms and the menopausal vagina. A study [6] used vaginal cytology to document menopausal status and compared vaginal bacterial isolates obtained from postmenopausal women receiving Estrogen replacement therapy (ERT) with the isolates obtained from a separate postmenopausal population not receiving exogenous estrogen. Very few studies have evaluated the prevalence of bacterial vaginosis and vaginal microbial diversity in postmenopausal women and the prevalence of bacterial vaginal infections in perimenopausal women has not been studied. To our knowledge, there has been no study which demonstrates an association between diabetes and the risk of bacterial vaginal infections in peri and post menopausal women. Therefore it was determined to analyse the prevalence of bacterial vaginal infections in peri and post menopausal type 2 diabetic women and compare the results with that of non diabetic women of similar category [7].

Menopause is defined as permanent cessation of menstruation at the end of reproductive life due to loss of ovarian follicular activity. It is the point of time when last and final menstruation occurs. Postmenopause is the phase of life that comes after the menopause [8]. Perimenopause is the part of the climacteric when the menstrual cycle is likely to be irregular. Climacteric is the period of time during which a woman passes from the reproductive to the non-reproductive state. This phase covers 5-10 years on either side of menopause [9-10]. Evaluating the prevalence of vaginal infection may throw light on the nature of infections; need for prompt investigations and management of vaginitis m
diabetic perimenopausal women and possibly any changes in the recommendations for treatment protocol in such patients would be very useful in determining the microbial sensitivity of such patients.

2. MATERIALS AND METHODS

Our Study was Single Centre, Cross sectional and analytical study included randomly selected Diabetic and Non- Diabetic women of age 45-60 years attending the Gynecology out patients department and Diabetology OPD of Sree Balaji Medical College Hospital, Chennai. The exclusion criteria were Age less than 45 years & more than 60 years, Pregnancy, Recent Hospitalization or Surgery (4 months), Use of Antimicrobials & Antifungals in the last 14 days and having any Malignancies. High vaginal swab samples from lateral or posterior wall of the vagina using sterile cotton swabs. Women with type 2 diabetes who were 45-60 years of age attending the outpatient department of Gynaecology and Diabetology of Sree Balaji medical college and Hospital were taken for this study. They were treated with oral hypoglycaemic agents or Insulin or Both. All were reported with symptoms like abnormal vaginal discharge, vaginal itching, vaginal dryness and painful sexual intercourse (Dyspareunia). The following laboratory data were analysed at the time of study Fasting Blood Sugar (FBS), Post Prandial Blood Sugar (PPBS). Women without Diabetes were selected randomly from the patients who attend the Gynaecology OPD for various reasons. Their non diabetic status was confirmed by laboratory tests such as Fasting Blood Sugar and Postprandial Blood Sugar values. First swab was used for preparing direct smear and wet mount. Second swab was inoculated into culture media. Nutrient Agar, Blood Agar, Mac conkey Agar and Columbia Agar plates were incubated aerobically. Third swab was inoculated in Robertson's cooked meat medium and incubated anerobically. The first swab was used for direct microscopic examination by Gram stain. Gram stained smear was examined under oil immersion to look for the presence of gram positive cocci, clue cells of Bacterial vaginosis, candidal hyphae, spores, epithelial cells and Leucocytes.

3. RESULTS

This cross sectional study was carried out in Sree Balaji Medical College and Hospital, Chennai. 100 participants in the study group (Diabetic) and 100 participants in the control group (Non Diabetic) were enrolled in the study. In this study 94 women were Perimenopausal and 106 Postmenopausal (categorized according to the menstrual status). Vaginal discharge was collected by using sterile cottons high vaginal swabs and sent for culture and sensitivity. The discharge was cultured by using different culture media. The women who are all diabetic (study group) were in the mean age group of 51.0 with standard deviation 12.26.In control group, the mean age group is 51.2 with standard deviation 11.27 Table. 1 and 1a, Fig. 1. In the study group 45 women were in perimenopausal age group and 55 in the postmenopausal age group. In the control group 55 women were in perimenopausal age group and 51 in the post menopausal age group Table. 2 and Fig. 2).

Fig. 1. Age wise Distribution of the studied patients
In the study group 45 women were in perimenopausal age group and 55 in the postmenopausal age group. In the control group 55 women were in perimenopausal age group and 51 in the post menopausal age group.

Table 2 and Fig. 2.

This table shows distribution of menstrual status of diabetic women according to duration of diabetes. Perimenopausal women, 0 to 5 years-28 women, 5 to 10 years-16 women, >10 years-1 woman, Postmenopausal women, 0 to 5 years-23 women, 5 to 10 years-23 women, >10 years-9 women.

In study group Staphylococcus aureus, E.coli, Diptheroids and Beta haemolytic Streptococci were found to be more prevalent and no growth was observed in 27 subjects. In control group, micrococci, Enterococci, klebsiella, pseudomonas were found to be more prevalent and no growth was observed in 41 subjects.

Table 1. Age wise distribution of the studied patients

| Age (years) | Study Group (Diabetic) | Control Group (Non Diabetic) |
|-------------|------------------------|------------------------------|
| 45-50       | 48                     | 49                           |
| 50-55       | 34                     | 28                           |
| 55-60       | 18                     | 23                           |
| Total       | 100                    | 100                          |

Table 1A. Mean age distribution of the studied patients

| Group         | Mean (years) | S.D. | p value |
|---------------|--------------|------|---------|
| Study Group   | 51.0         | 12.26| 0.08    |
| Control Group | 51.2         | 11.27|         |

Table 2. Distribution of cases based on menstrual Status

| Menstrual status | Study Group (Diabetic) | Control Group (Non Diabetic) |
|------------------|------------------------|------------------------------|
| Peri Menopause   | 45                     | 49                           |
| Post Menopause   | 55                     | 51                           |
| Total            | 100                    | 100                          |

Fig. 2. Distribution of cases based on menstrual status
Table 3. Distribution of menstrual status of diabetic women according to the duration of diabetes

| Duration of Diabetes | Peri menopause | Post menopause | Total | p value |
|----------------------|----------------|----------------|-------|---------|
| 0-5 years            | 28             | 23             | 51    |         |
| 5-10 years           | 16             | 23             | 39    |         |
| > 10 years           | 1              | 9              | 10    | 0.0716  |
| Total                | 45             | 55             | 100   |         |

Fig. 3. Distribution of menstrual status of diabetic women

The prevalence of *Staphylococcus aureus* and *E. coli* was found to be similar in both perimenopausal and postmenopausal women and mixed growth was found only in postmenopausal women Table. 5 - 6 a, Figs. 5-7.

*Staphylococcus aureus, Pseudomonas, Diptheroids* were found to be more prevalent if diabetes is under control. The prevalence of mixed growth like *Diptheroids* and *candida albicans*, *E.coli* and *Candida albicans* were found to be same both in women whose diabetes is under control or not under control.

4. DISCUSSION

The vaginal ecology plays a vital role in the pathogenesis and prevention of any vaginal infection in women especially with diabetes. For this reason, the vaginal microbial flora has been studied in younger women. However a little is known about the vaginal flora of community dwelling perimenopausal and postmenopausal diabetic women. Our study demonstrates the prevalence of vaginal commensals as well as the potential pathogens in the perimenopausal and postmenopausal women and compares it with diabetic women of same age category.

The microorganisms isolated in the present study were predominantly bacteria with candida and trichomonas contributing to the rummage. The bacterial isolates included *E.coli, Klebsiella, Staphylococcus aureus, Microoccus Enterococcus, streptococcus viridians, Diptheroids*, Beta hemolytic streptococci. Ross [11] reported similar spectrum of vaginal microflora in pregnant women. The common pathogenic bacteria isolated were *Staphylococcus aureus, E.coli and Diptheroids*. Our study showed diabetic women are significantly more prone to develop vaginitis than the non diabetic women in correlation with the study by Rahman et al. [12].

Like the earlier study 9 we also found Eschericia coli to be the most pathogenic bacteria isolated from the culture. However the prevalence of E.coli among the perimenopausal and postmenopausal women was found to be similar. Our study correlates well with the study of Jeremy P Barton and Gregor Reid [13] which reported E.coli in 21% of postmenopausal
women. Diabetic Women have higher prevalence of E.coli than the non diabetic in non diabetic in accordance with the study by wendy similar to the previous studies [14]. We also found that the diabetic women with the recent history of UTI were at the high risk of vaginal colonization. This may be because of the fact that the typeI fimbiated E.coli adhere in significantly higher numbers to the uroepithelial cell of the diabetic women than the non diabetic women, as demonstrated by several studies [15-19].

Table 4. Comparison of the prevalence of micro organisms among the diabetic and the non-diabetic women

| Micro Organisms                        | Study Group | Control Group | p value |
|----------------------------------------|-------------|---------------|---------|
| Staphylococcus aureus                  | 20%         | 8%            |         |
| Pseudomonas sp.                        | 8%          | 7%            |         |
| E.coli                                 | 12%         | 5%            |         |
| Streptococcus viridans                 | 3%          | 10%           |         |
| Diphtheroids                           | 11%         | 1%            |         |
| Beta Haemolytic Streptococci           | 8%          | 9%            |         |
| No growth                              | 27%         | 2%            |         |
| Micrococci                             | 4%          | 41%           | 0.07    |
| Enterococci                            | 2%          | 6%            |         |
| Diphtheroids and candida albicans      | 2%          | 1%            |         |
| Staphylococcus aureus & Enterococci    | 1%          | 1%            |         |
| E.coli & Candida albicans              | 2%          | 1%            |         |
| E.coli & Beta Haemolytic Streptococci  | 0%          | 3%            |         |
| Klebsiella sp.                         | 0%          | 5%            |         |
| Total                                  | 100         | 100           |         |

Fig. 4. Comparison of the prevalence of micro organisms
Staphylococcus aureus was found to be more prevalent in diabetic women (20%) compared to the non diabetic women (8%) and also more frequent in women with uncontrolled diabetes (29%) than the women whose diabetes was not under control (15%). Klebsiella was seen only in 5 of the non diabetic women, klebsiella was surprisingly absent in the diabetic women. 10% of the women carried Beta haemolytic streptococci. A range of 5 to 40% of the vaginal carriers had been found in various studies due to difference in in the sample sites and cultural methods employed [19]. It is the organism of most concern during pregnancy and in neonatal infection. It pathogenicity in menopause is not clearly known, which require further extensive studies in future. Although not statistically significant, Beta haemolytic Streptococci was isolated more frequently from diabetic women who are under control. This doesnot agree with the study by Williams DN et al. [9] where Beta haemolytic streptococci was found to be more prevalent in poorly controlled diabetes. The prevalence was found to be same in both perimenopausal and postmenopausal women.
Table 5. Variation of micro organisms with respect to menopausal status

| Micro Organisms                  | Peri Menopause | Post Menopause | p value |
|----------------------------------|----------------|----------------|---------|
| Staphylococcus aureus            | 16%            | 12%            |         |
| Pseudomonas sp.                  | 6%             | 10%            |         |
| E. coli                          | 10%            | 12%            |         |
| Streptococcus viridans           | 2%             | 2%             |         |
| Dipheroids                       | 8%             | 12%            |         |
| Beta Haemolytic Streptococci     | 4%             | 5%             |         |
| No growth                        |                |                |         |
| Micrococi                        | 6%             | 4%             |         |
| Enterococi                       | 5%             | 3%             |         |
| Dipheroids and candida albicans  | 1%             | 2%             |         |
| Staphylococcus aureus & Enterococi | 0%          | 2%             | 0.064   |
| E coli & Candida albicans        | 0%             | 3%             |         |
| E coli & Beta Haemolytic Streptococci | 0%              | 3%             |         |
| Klebsiella                       | 1%             | 4%             |         |
| **Total**                        | **100**        | **100**        |         |

Table 6. Comparison of Prevalence of micro organism based on Fasting Blood Glucose control

| Micro Organisms                  | FBS Under Control | FBS Not Under Control | Total | p value |
|----------------------------------|-------------------|-----------------------|-------|---------|
| Staphylococcus aureus            | 10                | 10                    | 20    |         |
| Pseudomonas                      | 2                 | 6                     | 8     |         |
| E. coli                          | 7                 | 5                     | 12    |         |
| Streptococcus viridans           | 2                 | 1                     | 3     |         |
| Dipheroids                       | 6                 | 5                     | 11    |         |
| Beta Haemolytic Streptococci     | 7                 | 1                     | 8     |         |
| No growth                        | 22                | 5                     | 27    |         |
| Micrococi                        | 4                 | 0                     | 4     |         |
| Enterococi                       | 2                 | 0                     | 2     |         |
| Dipheroids and candida albicans  | 1                 | 1                     | 2     | 0.03    |
| Staphylococcus aureus & Enterococi | 1              | 0                     | 1     |         |
| E coli & Candida albicans        | 1                 | 1                     | 2     |         |
| **Total**                        | **65**            | **35**                | **100** |         |

Candida, an opportunistic pathogen, was isolated along with bacterial flora. The fungus was found more in diabetic women (4%). Candida was found to be significantly more in diabetic women (4%) than the non diabetic women (2%) in agreement. In the present study, candida has been reported more in the postmenopausal women than the perimenopausal women. Candida has been isolated in 5% of postmenopausal women which correlates with the other studies 6% were found by C. ROSS, and 3% by Fischer et al. [20]. Caucci et al. [21] have recently suggested that the Nugent scoring system may not be adequate for evaluating normal vaginal flora and immediate grade colonization in women more than 40 years old, because in many cases no lactobacilli or BV associated micro organisms are detected. The Nugent scoring system is based on presence or absence of lactobacilli. However, the presence of lactobacilli in postmenopausal women traditionally has been thought to be reduced or absent. In these cases, the Nugent scores would indicate that BV is present, and
Table 6A. Comparison of Prevalence of micro organism based on PostPrandial Blood Glucose control

| Micro Organisms                      | PPBS Under Control | PPBS Not Under Control | Total | p value |
|--------------------------------------|--------------------|------------------------|-------|---------|
| Staphylococcus aureus                | 6                  | 14                     | 20    |         |
| Pseudomonas                          | 2                  | 6                      | 8     |         |
| E.coli                               | 6                  | 6                      | 12    |         |
| Streptococcus viridans               | 1                  | 2                      | 3     |         |
| Diptheroids                          | 5                  | 6                      | 11    |         |
| Beta Haemolytic Streptococci        | 6                  | 2                      | 8     |         |
| No growth                            | 18                 | 9                      | 27    |         |
| Micrococi                            | 1                  | 3                      | 4     | 0.03    |
| Enterococci                          | 1                  | 1                      | 2     |         |
| Diptheroids and candida albicans     | 1                  | 1                      | 2     |         |
| Staphylococcus aureus & Enterococci | 0                  | 1                      | 1     |         |
| E.coli & Candida albicans            | 1                  | 1                      | 2     |         |
| Total                                | 65                 | 35                     | 100   |         |

Fig. 7. Comparison of Prevalence of microorganism based on PostPrandial Blood Glucose control

thus, the correlation between Nugent score and the presence of "abnormal" vaginal microflora is more difficult to substantiate. Hence the usual scoring methods of bacterial vaginosis are not followed in our study.

5. CONCLUSION

In conclusion, pathogenic bacteria are also found as frequently as the candida in diabetic women. So, in diabetic women with genital symptoms, an attempt at diagnosis should be made prior to the commencement of therapy. The practice of initiating antifungal treatment for any vaginal infection in diabetic women without taking high vaginal swabs should be reviewed. However, in busy clinics, and where investigations cannot be performed, the use of empirical antifungal therapy alone may not be appropriate for recurrent infections and consideration should be given for the use of antibiotics along with the antifungal drugs.

CONSENT

As per international standard or university standard, patients’ written consent has been collected and preserved by the author(s).
ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Hillier SL, Lau RJ. Vaginal microflora in postmenopausal women who have not received estrogen replacement therapy. Clin Infect Dis. 1997;25(suppl):123-126.
2. Ling Z, Kong J, Zhu H, Chen X, Wang Y et al. Molecular analysis of the Diversity of vaginal microbiota Associated with Bacterial vaginosis. BMC Genomics. 2010;11:488.
3. Vitali B, Pugliese C, Biagi E, Candela M, Turroni S, Bellen G, et al. Dynamics of vaginal Bacterial Communities in women Developing Bacterial Vaginosis, Candidiasis, or No Infection, Analyzed by PCR-Denaturing Gradient Gel Electrophoresis and Real-Time PCR Appl Environ Microbiol. 2007;73(18):5731-5741.
4. Sobel JD, Faro S, Force RW, Foxman B, Ledger WJ, Nyirjesy PR, et al. Vulvovaginal Candidiasis: Epidemiologic, Diagnostic and Therapeutic Considerations. Am J Obstet Gynecol. 1988;178(2):203-211.
5. Gupta K, Stapleton A E, Hooton T M, Roberts P L, Fennell C L, and Stamm W E. Inverse association of H2O2-producing lactobacilli and vaginal Eschericia coli colonization m women with recurrent urinary tract infection. J Infect Dis. 1988;178(2):446-450.
6. Larsen B, Goplerud CP, Petzold CR, Ohm-Smith MJ, Galask RP. Effect of estrogen treatment on the genital tract flora of post-menopausal women. Obstet Gynecol. 1982;60:20-24.
7. Hyman RW, FukushimaM, Diamond L, kumm J, Giudice LC, Davis R W. Microbes on the vaginal epithelium. Proc Natl Acad Sci USA. 2005,10222;7952-7957.
8. Zhou X, Brown C JZ, Abdo, Davis C, Hansmann MA, Joyce P, et al. Differences in the compositions of vaginal Microbial Communities Found in Healthy Caucasian and Black Women. ISME J. 2007;121-133.
9. Anukam KC, Osazuwa E O, Ahonkhai I, and Reid G 165 RNA gene sequence and phylogenetic tree of Lacotobacillus species from the vagina of healthy Nigerian Women. Afr J Biotechnol. 2005;4[11];1222-1227.
10. Oakley BB, Fielder TL, Marrazzo JM, Fredricks DN. Diversity of human vaginal bactericaal communities and associations with clinically defined bacterial vaginosis. Appl Environ Microbial. 2008;74[15];4989-4909.
11. Ross CC. Postmenopausal Vaginitis. J Med Microbial. 1978;11.
12. Rahman T, Khan IH, Begum J. High vaginal swab (HVS). Routine microscopy and culture sensitivity in diabetic and non diabetic, a comparative retrospective study of five years, Indian J Med Sci. 1991;45:212-214.
13. Burton JP, Reid G. Evaluation of the Bacterial vaginal flora of 20 postmenopausal women by direct (Nugent score) and molecular (polymerase chain reaction and denaturind Gel Electrophoresis) techniques. J Infect Dis. 2002;186 (12):1770-1780.
14. Rahman T, Khan IH, Begum J. High vaginal swab (HVS). Routine microscopy and culture sensitivity in diabetic and non diabetic, a comparative retrospective study of five years, Indian J Med Sci. 1991;45:212-214.
15. Wendy L Pabich, Stephan D Fihn, Walter E, Stamm, Delhia Scholes, Edward J, Boyko, Kalpana Gupta. Prevalence and determinants of vaginal flora Alterationa in postmenopausal Women. J Infect Dis. 2003;188:1054-1058.
16. Starney TA, Sexton CC. The role of vaginal colonization with enterobacteraeaeae in recurrent urinary tract infections. J Urol. 1975;113:214-217.
17. Hooton TM, Stamm WE. The vaginal flora and urinary tract infections. In: Mobley
HLT, Warren JW ed. Urinary tract infections: molecular pathogenesis and clinical management. Washington, DC: American Society for Microbiology press. 1996;67.

18. Geerlings SE, Meiland R, Van Lith EC, Brouwer EC, Gaastra W, Hoepelman AI. Adherence of type 1-fimbriated Escherichia coli to uroepithelial cells: more diabetic women than m control subjects. Diabetes Care. 2002;25:1405-1409.

19. Fischer Gayle, Bradford Jennifer. Vulvovaginal candidiasis in postmenopausal Women the Role Hormone Replacement Therapy. J Low Genit Tract. 2011;15(4):263-267.

20. Fischer Gayle and Bradford Jennifer. Vulvovaginal candidiasis in postmenopausal Women the Role Hormone Replacement Therapy. J Low Genit Tract. 2011;15(4):263-267.

21. Sabina Cauci, Silvia Driussi, Davide De Santo, Paolo Lanzafame, et al. prevalence of Bacterial vaginosis and vaginal Flora changes in peri- and postmenopausal women. J Clin Microbiol. 2002;40(6):2147-2152.

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