PREVALENCE OF ASYMPTOMATIC BACTERIURIA AMONG PREGNANT WOMEN ATTENDING THE TERTIARY CARE CENTER

Dissertation

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M.S OBSTETRICS AND GYNAECOLOGY

BRANCH VI

MAY 2018

CERTIFICATE

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DECLARATION

In the following pages is presented a consolidated report of the study **"Prevalence of asymptomatic bacteriuria among pregnant women attending the tertiary care center**" a cross sectional study, on cases coming to Obstetrics and Gynaecology outpatient Department at Sree Mookambika Institute of Medical Sciences, Kulasekharam from 2016-2017. This thesis is submitted to the Dr. M.G.R. Medical University, Chennai in partial fulfilment of the rules and regulations for the award of MS Degree examination in Obstetrics and Gynaecology.

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Sandhiya R

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ABBREVIATION USED

AIDS – Acquired Immune Deficiency Syndrome

ARDS – Acute Respiratory Distress Syndrome

ASB – Asymptomatic Bacteriuria

CLED – Cystine Lactose electrolyte deficient medium

CRP – C Reactive Protein

DIC – Disseminated Intravascular Coagulation

f-PAF – Fetal Placental Activating Factor

GBS – Group B Streptococci

G6PD – Glucose-6- Phosphate Deficiency

HIV – Human Immunodeficiency Virus

HLA – Human Leukocyte Antigen

IGA – Immunoglobulin A

IL – Interleukin

IUGR – Intrauterine Growth Restriction

LPS – Lipopolysacarides

LBWs – Low Birth Weight

NK – Natural Killer

PMNs - Polymorphonuclear Neutrophils

PROM – Premature Rupture of Membrane

PG – Prostaglandins

RBC – Red Blood Cells

TNFα – Tumour Necrosis Factor α

TTC test – Triphenyl Tetrezolium Chloride test

TxA_2 – Thromboxane A_2

UTI – Urinary Tract Infection

ABSTRACT

The aim of our study is to find out prevalence of asymptomatic bacteriuria in pregnant women. This study also helps to find out the most common organism involved, the antibiotic susceptibility, and risk factors associated with asyptomatic bacteriuria.

Method:

Over an year, urine samples were collected from 121 pregnant women with varying gestational periods attending the antenatal clinic first visit. A clean catch mid stream urine specimens were collected in a sterile container and processed within one hour. In case of delay, the samples were refrigerated at 4°C.Screening tests such as wet mount, gram staining, hanging drop test were done. Culture of urine samples were done by a semiquantitative method, Nutrient agar, Blood agar, MacConkey agar and cystine lactose electrolyte deficient medium (CLED) agar plates and incubated at 37^{o}C for 24 hours. Significant bacteriuria with $>10^{5}$CFU/ml of urine was confirmed by colony count. Organisms were identified and antibiotic sensitivity test of the isolates were performed.

Results

Out of the total number of 121 pregnant women included in our study, 22(18.18%) patients were identified by culture to have significant bacteriuria. Maximum numbers of patients belong to the age group (20-30 years) and

highest percentage of significant bacteriuria (50%) was identified in the same age group. This study shows high percentage of asymptomatic bacteriuria in 2^{nd} (45.45%) trimester and in primigravidas (63.64%). The percentages of positives with significant bacteriuria were high among the upper lower socio-economic group (36.36%). E. coli (50%) was the most common organism followed by K. pneumonia and Staphylococcus saprophyticus (13.64%). Prevalence of Gram-negative organism was 72.73%. The drug sensitivity revealed that 81.81% of isolates were sensitive to Amikacin followed by Cephalexin (68.18%). 77.27% of patient had previous history of UIT before one yr and was treated. Past history of catheterizaion and anemia was present in 68.18% of patient. Highest number of positive culture in patient with BMI >30 kg/m^2 (40.91%).

Conclusion:

Prompt treatment of ASB early in pregnancy significantly reduces the chances of adverse pregnancy outcome.

Thus, screening for ASB should ideally be done in all pregnant in the 1^{st} trimester, and should be treated aggressively with suitable antibiotics and promptly followed up.

Key Words: Asymptomatic bacteriuria; UTI in pregnancy; Pyelonephritis; preterm labor; uro-pathogens.

Introduction

INTRODUCTION

Urinary tract infection is one of the most frequent bacterial infections.[1] It is the second most common bacterial infection seen during pregnancy.[2] The bacterial infection can be symptomatic or asymptomatic.

The symptomatic urinary tract infection can be uncomplicated or complicated. Uncomplicated urinary tract infection is also called as symptomatic urinary tract infection which is characterized by urgency, dysuria, frequency or supra pubic pain in a woman with a normal genitourinary tract.[3] Complicated urinary tract infection, is also a symptomatic urinary infection in a women with functional or structural abnormalities of the genitourinary tract which involve either the bladder or kidneys.[4]

UTI is predominantly a disease of females.[5] In women, the short length of the urethra and sexual intercourse facilitate the ascent of bacteria into the bladder.[6] During pregnancy specific physiologic and anatomic changes do occur and, the net effect of these changes results in infection of the urinary tract to develop.[7]

The asymptomatic urinary tract infection is a persistent, actively multiplying bacteria within the urinary tract without any symptoms of infection.[8] The prevalence in pregnancy varies from 2 to 7% and it depends

on parity, race, and socioeconomic status.[9] If asymptomatic bacteriuria is not treated, approximately 25% of women will subsequently develop acute symptoms of an infection during pregnancy.[10]

Asymptomatic bacteriuria (ASB) is an entity with possibly serious consequences in the form of fetal and maternal morbidity.[11] It can cause maternal anemia, acute pyelonephritis recurrent infection, preterm labour,[12] septicemia and even death of the mother.[13] It can cause intra uterine growth restriction[14] prematurity and low birth weight of the fetus[15] and fetal mortality.[13]

Screening of asymptomatic subjects for bacteriuria is appropriate as bacteriuria has adverse outcomes that can be prevented by antimicrobial therapy.[16] Apart from that, even the progression of the asymptomatic bacteriuria to the symptomatic UTI in the later life can be prevented, which emphasizes the fact that, “prevention is better than cure” as is believed from the time immemorial, which mandates early detection and treatment of asymptomatic bacteriuria, in pregnant women.

Aims & Objectives

AIMS AND OBJECTIVES

- To find out the prevalence of asyptomatic bacteriuria in pregnancy in OBG OPD - SMIMS.
- To find out the commonest isolates in urine from these pregnant women attending OBG OPD in SMIMS.

Hypothesis & Scientific Justification

HYPOTHESIS

Asymptomatic bacteriuria is a common infection. Pregnant women with asymptomatic bacteriuria are at an increased risk for adverse maternal and fetal outcomes which could be prevented by antimicrobial treatment of asymptomatic bacteriuria. This study will help in assessing the prevalence of asyptomatic bacteriuria in pregnant women in the Kanyakumari district of Tamil Nadu.

Review of Literature

REVIEW OF LITERATURE

HISTORICAL REVIEW

History of asymptomatic bacteriuria and diagnostic methods

In 1550 BC, Hearst Papyrus had stated "sending forth heat from the bladder may be a reference to urinary tract infection".[19]

In 1941, Marple pointed out that colony counts were imperative in order to differentiate contamination from significant bacteriuria and applied the pour-plate technique for the quantitative culture.[20]

In 1957, Kass, through his pioneer work in this field established the validity of quantitative urine culture and documented that significant bacteriuria can occur in the absence of symptoms or signs of UTI.[20,21] The initial observations that ASB contributes to chronic renal failure, hypertension, and toxaemia of pregnancy, generated a series of population based screening programmes for ASB.[22]

The development of new, solid, culture medium that prevented the swarming of proteus by restricting the electrolyte was reported by Sandys in 1960.[23]

In 1962, Simmons and Williams introduced TTC test.[24]

The semiquantitative bacteriological procedures most widely used were the standard loop technique of Guttmann and Stokes (1963) and the filter paper strip method of Leigh and Williams (1964).[19]

In 1989, Flangan et al. recommended screening by dipstick tests for nitrite and leukocyte esterase.[25]

In 1990, Michael D.D. McNeely stated that urine analysis was the oldest of all clinical laboratory examination.[26]

In 1996, Zion Hagay, Roni Levy, Avraham Miskin et al. stated that Uriscreen test (Catalase test) was a reliable alternative to culture screening of all pregnant patients.[18]

In 1998, Betty A Forbes, Daniel F Sahm, Alice S Weissfeld stated that many screening methods have been advocated for use in detecting bacteriuria and/or pyuria, and these include microscopic methods, colorimetric filtration, bioluminescence, electrical impedence, enzymatic methods, photometric detection of growth and enzyme immune assay, automated and semi automated systems. [27]

History of organisms associated with asymptomatic bacteriuria

Escherichia coli:

In 1885, German Paediatrician Theodore Escherich first identified E. coli.

In 1919, Castellani and Chalmers defined the genus Escherichia and established the type species E. coli.[20]

Klebsiella pneumoniae:

In 1983, Friedlander first isolated this bacillus from fatal cases of pneumonia, also known to cause UTI.[20,28]

Staphylococcus species:

In 1880, Sir Alexander Ogston, a Scottish surgeon gave the name Staphylococcus.[20]

In 1884, Rosenbach provided the first formal description of the genus Staphylococcus and divided the genus into two species, Staphylococcus aureus and Staphylococcus albus.[29]

In 1965, Baird-Parker, recognised the species S. aureus, S. epidermidis and S. saprophyticus.[20]

Pseudomonas aeruginosa:

In 1850, Sedillot observed that the blue discolouration of surgical wound dressing was due to a transferable agent.

In 1862, Lucke was the first to associate rod-shaped organisms with the pigment but these organisms were not isolated in pure cultures until the classical studies of Gessard (1882).[20]

Enterococci species:

In 1899, Thiercelin used the term Enterococci.

In 1906, Andrews and Horder used the name Streptococcus faecalis. In 1919, Orla Jensen described S. faecium.[20]

Acinetobacter species: In 1911, Beijerinck described the first recognizable member of the group which was a soil organism.

In 1954, Brisou and Prevot proposed the original concept of the genus Acinetobacter.[20]

EMBRYOLOGY OF URINARY TRACT

Development of kidney and ureter:

The nephrons of the kidney arise from the metanephros, collecting part of the kidney develops from ureteric bud (mesonephric duct). Ureteric bud gets capped by the metanephric tissue and forms ureter. Soon it dilates to form renal pelvis and divides and subdivides to form major and minor calyces and 1-3 million collecting tubes.

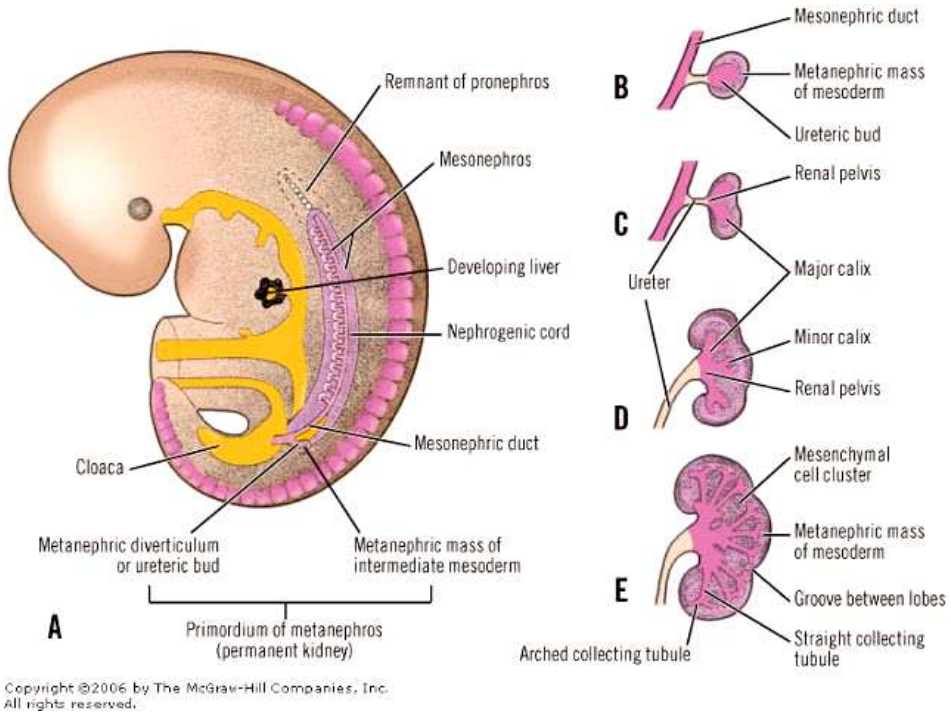


Figure 1: Development of kidney and ureter

Development of urinary bladder:

The cranial and largest part of primitive urogenital sinus called the vesico urethral canal forms most of the urinary bladder. Trigone of bladder is formed by the absorption of mesonephric ducts and is mesodermal in origin.[30]

Development of urethra:

The epithelium of most of the male urethra and the entire female urethra is derived from the endoderm of the urogenital sinus. The epithelium of the terminal part of the urethra is derived from the surface ectoderm. The connective tissue and smooth muscle of the urethra in both sexes are derived from the splanchnic mesenchyme.[31]

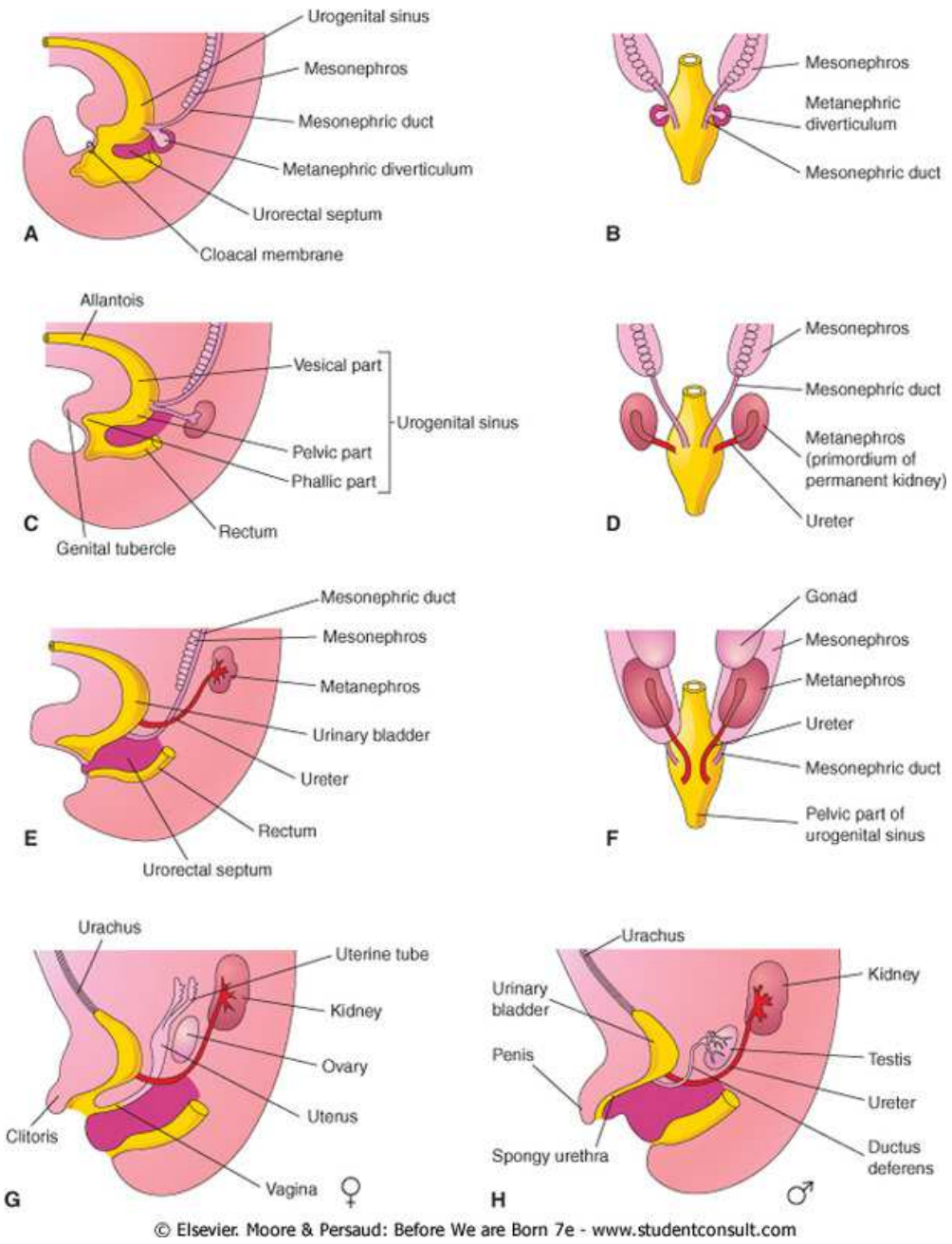


Figure 2: Development of Urinary bladder and urethra

ANATOMY OF URINARY TRACT

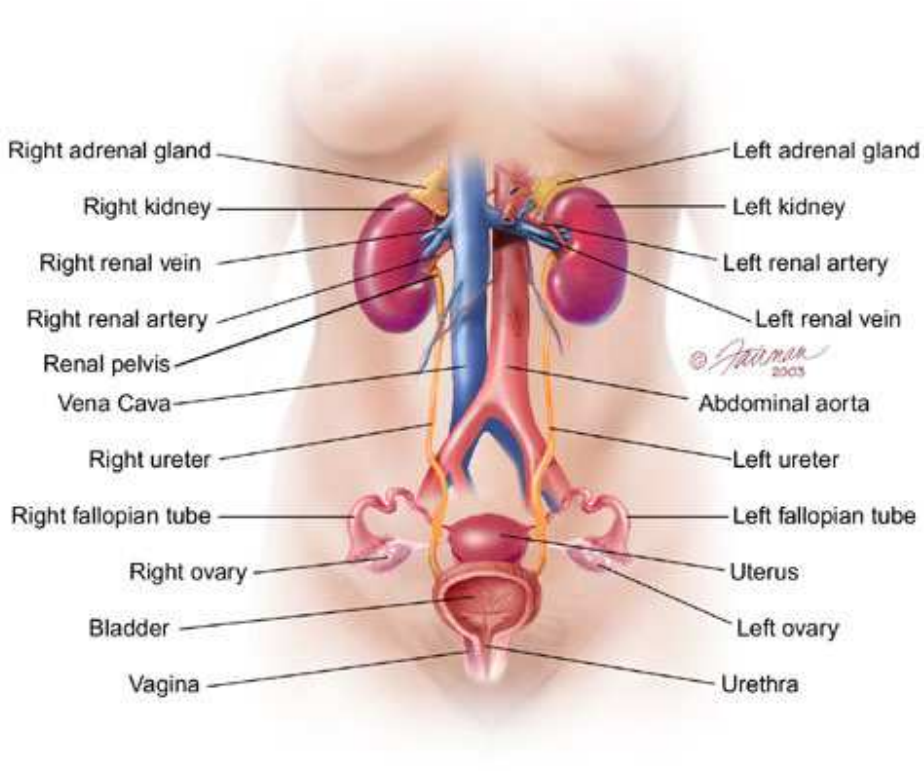


Figure 3: Anatomy of urinary tract

The urinary tract consists of kidneys, ureters, bladder and urethra.

KIDNEYS:

Each kidney is about 11 cm long, 6 cm broad, and 3 cm thick. The left kidney is a little longer and narrower than the right kidney. On an average, the kidney weighs 150 gms in males and 135 gms in females.[30]

Blood supply

Arteries: A pair of renal arteries, branch of the aorta. Accessory renal arteries are present in 30% of individuals and they arise commonly from the aorta.[30,31]

Veins: Pair of renal veins drain into the inferior venacava.

Lymphatic drainage: Lateral aortic lymphnodes around the origin of the renal artery.[33]

Nerve supply: Renal sympathetic plexus.[33]

URETERS:

Each ureter is about 25 cms (10 inch) long, of which the upper half (5 inch) lies in the abdomen, and the lower half (5 inch) in the pelvis. It measures about 3 mm in diameter but it is slightly constricted at three places.[33]

Blood supply

Arteries: Upper end, the renal artery; middle portion, the testicular or ovarian artery; inferior end, the superior vesical artery.

Veins: Veins that correspond to the arteries.

Lymphatic drainage: Lateral aortic and iliac nodes.

Nerve supply: Renal, testicular or ovarian and hypogastric plexuses.[33]

URINARY BLADDER:

The bladder varies in its size, shape and position according to the amount of urine it contains.[30]

Blood supply

Arteries: Superior and inferior vesical arteries, branches of the internal iliac artery.

Veins: Vesical veins form a plexus which drains into the internal iliac vein.

Lymphatic drainage: Lymphatics drain to the iliac and then para-aortic nodes.[34]

Nerve supply: Sympathetic and parasympathetic fibres from the inferior hypogastric plexus.[33]

FEMALE URETHRA:

It is only 4 cms long and 6 mm in diameter.

Blood supply

Arteries: Vesical and vaginal arteries, principally the latter.

Veins: Veins drain to the vesical plexus and the internal pudendal veins.

Lymphatic drainage: Lymphatics drain into internal and external iliac nodes.[30]

Nerve supply: Fibres reach the urethra from the inferior hypogastric plexus and from the perineal branch of the pudendal nerve.[35]

NORMAL FLORA OF URINARY TRACT

All areas of the urinary tract, above the urethra in a healthy human are sterile. Urethra hosts a resident microflora that colonizes its transitional epithelium, consisting of coagulase negative Staphylococci, viridans and non-haemolytic Streptococci, Lactobacilli, Diphtheroids (Corynebacterium species), non-pathogenic Neisseria species, transient gram negative aerobic bacilli (including Enterobacteriaceae), anaerobic cocci, Propionibacterium

species, anaerobic gram negative cocci and bacilli, commensal Mycobacterium species, commensal Mycoplasma species and occasional yeasts.[32]

Many anatomical,[36] hormonal,[37] mechanical[38] and immunological changes occurring during pregnancy greatly predispose to UTI.

CLASSIFICATIONS OF URINARY TRACT INFECTIONS

Anatomic designations divide UTIs into lower tract infections (cystitis, urethritis, prostatitis and epididymitis) and upper tract infections (pyelonephritis).

UTIs may also be categorized as uncomplicated or complicated.

The uncomplicated UTI includes cystitis in nonpregnant adult women, without any structural or neurological dysfunction.

Complicated UTIs include infection at any site other than the bladder and those that occur in children, men, and pregnant women. They also include infections associated with structural or neurological abnormalities.[54]

Table.1: Criteria for classification of urinary tract infections by clinical syndrome[27]

Category	Criteria	
	Clinical	**Laboratory**
1. Acute uncomplicated UTI in women.	Dysuria, urgency, frequency, suprapubic pain. No urinary symptoms in last four weeks before current episode, no fever or flank pain.	> 10 WBC/mm^3 > 10^3 CFU/ml in CCMS urine
2. Acute uncomplicated pyelonephritis	Fever, chills, flank pain on examination. Other diagnosis excluded. No history or clinical evidence of urologic abnormalities.	>10 WBC/mm^3 > 10^4 CFU/ml in CCMS urine
3. Complicated UTI and UTI in men	Any combination of symptoms listed above one or more factors associated with complicated UTI	> 10 WBC/mm^3 > 10^5 CFU/ml in CCMS urine
4. Asymptomatic bacteriuria	No urinary symptoms	> 10 WBC/mm^3 10^5 CFU in two CCMS cultures > 24 hours apart

BRIEF ACCOUNT OF ORGANISMS ASSOCIATED WITH ASYMPTOMATIC BACTERIURIA

Escherichia coli: They are gram negative, straight rods measuring 1-3 x 0.4-0.7 µm arranged singly or in pairs. They are motile, though some strains may be non-motile.[28] Many strains produce polysaccharide capsules or microcapsules.[20] They are non-sporing, aerobes and facultative anaerobes, grow at a temperature range of 10-40^{o}C, optimum temperature for growth being 37^{o}C. They grow on ordinary media (nutrient agar) producing colonies which are large, thick, grayish white, moist, smooth, opaque or partially translucent colonies. On MacConkey medium, colonies are bright pink due to lactose fermentation. Many strains are haemolytic on blood agar. They are catalase positive, oxidase negative, reduce nitrates to nitrites, indole and MR positive, VP and citrate negative. They form acid/acid on TSI medium with production of gas. They ferment glucose, lactose, mannitol and maltose with production of acid and gas. Typical strains do not ferment sucrose. They are lysine decarboxylase positive, arginine dihydrolase and ornithine decarboxylase negative.[28]

Virulence factors in E. coli

Strains of E. coli are identified by three different surface antigens – O, K and H – as well as by pili or fimbriae (also known as adhesins) and their cytoplasmic enzymes.

O Surface antigens: In a survey from British antenatal clinics, about 55% of > 300 E. coli urinary tract isolates belonged to O groups 1, 2, 4, 6, 7, 11, 18 and 75. In the United States, Maiztegae and Kass (1965) found that O groups 4, 6, 62 and 75 were more prevalent. Furthermore, Stenquist et al. (1987) reported that 'O' antigens 1, 2, 6, 16, 21 and 75 accounted for 71% of all isolates from a group of Swedish patients with pyelonephritis. However, these same 'O' antigens were expressed by only 19% of the patients with cystitis or asymptomatic bacteriuria.

P fimbriae (Pili): Although O antigens are important predictors of nephrotogenicity, certain pili of E. coli are more specific determinants of bacterial virulence. Since cell- membrane glycolipids Gal α1-4 Gal β which function as receptors for the pili of pyelonephritogenic E. coli, are also antigens on the P blood group system, the ability of bacteria to attach to human uroepithelial cells correlates with their ability to agglutinate human erythrocyte containing the Pk, P and P1 antigen (hence termed P fimbriae). Kallenins et al. (1981) discovered that P fimbriae were present in 91% of the urinary bacterial strains causing acute pyelonephritis. Among strains causing cystitis and asymptomatic bacteriuria, these pili were found in only 19% and 14% of cases respectively.[54] The data on ribosomal RNA typing show that the identical E. coli strains can cause either asymptomatic bacteriuria or symptomatic UTI in the same woman.[88]

In addition to pili, other virulence properties of E. coli are, K capsular material, endotoxins, haemolysin and Pap G, the gene that encodes the tip adhesin on P fimbriae.[88]

Klebsiella pneumoniae: They are gram negative, short, plump, straight rods, measuring about 1-2 x 0.5-0.6 µm in size, capsulated, non-motile and non-sporing. They grow well on ordinary media (nutrient agar) forming large, dome shaped, mucoid colonies of varying degrees of stickiness. On MacConkey agar bright pink colonies are produced due to lactose fermentation. They are aerobes and facultative anaerobes. They are catalase positive, oxidase negative, reduce nitrates to nitrites, indole and MR negative, VP, citrate and urease positive. They produce acid/acid on TSI media with abundant gas. They ferment glucose, lactose, sucrose and mannitol with production of acid and abundant gas. They are lysine decarboxylase positive, ornithine decarboxylase and arginine dihydrolase negative.[28]

Virulence factors include urease enzyme, endotoxins, capsule, adhesion proteins, aerobactins and resistance to multiple antimicrobial agents.[20,27]

Staphylococcus aureus: They are gram positive, spherical cocci of about 1 µm in diameter, arranged characteristically in grape-like clusters. They may also be found singly, in pairs and in short chains of three or four cells. They are non-motile and non- capsulated. They are aerobes and facultative anaerobes. They grow readily on ordinary media within a temperature range

of 10-42^{o}C, the optimum being 37^{o}C and pH 7.4-7.6. On nutrient agar they form colonies which are large (2-4 mm diameter), circular, convex, smooth, shiny, opaque and easily emulsifiable. They produce non- diffusible golden yellow pigment. They grow on MacConkey medium, producing smaller colonies that are pink due to lactose fermentation. They are haemolytic on blood agar.

They are catalase positive and oxidase negative, reduce nitrates to nitrites, indole negative, MR and VP positive. They ferment number of sugars, producing acid but no gas. Mannitol is fermented anaerobically.[28]

Virulence factors include exopolysaccharide, protein A, teichoic acids, production of catalase, free and bound coagulase, fibrinolysins, hyaluronidase, lipases, phosphatidylinositol-specific phospholipase C, haemolysins, and various toxins.[89]

Staphylococcus saprophyticus: They are similar to Staphylococcus aureus in morphology, and colonies on solid media are similar to those of S. aureus although often smaller, and are slightly pigmented, usually cream or yellow.[90] They are catalase positive and oxidase negative. They are slide and tube coagulase test negative and ferment mannitol. They are Novobiocin resistant and urease positive.[28]

Virulence factors include production of Ssp (S. saprophyticus, surface associated protein), urease and slime.[89]

Pseudomonas aeruginosa: They are gram negative, slender bacilli 1.5-3 µm x 0.5 µm in size, actively motile, non-sporing and non-capsulated. They are obligate aerobes (but can grow anaerobically if nitrate is available).24 Growth occurs at a wide range of temperatures, 6-42^{o}C, optimum being 37^{o}C. They grow at 42^{o}C.[90] They grow well on ordinary media (nutrient agar) producing large, opaque, irregular colonies, with a distinctive, musty, mawkish or earthy smell and iridescent patches with a metallic sheen and bluish green diffusible pigment. They grow on MacConkey medium, forming non-lactose fermenting colonies. They produce haemolysis on blood agar. They are catalase positive, oxidase positive, reduce nitrates to nitrites, indole, MR and VP are negative and citrate positive. They produce alkaline/no change reaction in TSI medium. They are oxidative but not fermentative on O-F test. They are arginine dihydrolase test positive, but lysine and ornithine decarboxylase tests negative.

Virulence factors include proteases, haemolysins, lipase, extracellular toxins, siderophores – pyochelin, pyoverdin and ferribactin, pyocyanin and endotoxin.[20]

Enterococcus faecalis: They are gram positive cocci, occur in ovoid pairs or short chains and are non-motile and non-capsulated. They grow readily on ordinary media and on MacConkey agar they form small (0.5-1 mm), magenta-coloured colonies. They are usually non-haemolytic, but sometimes α or β-haemolytic.[90] They are catalase negative and are able to grow in the

presence of 40% bile, 6.5% sodium chloride, at pH 9.6 and at 45°C. They are relatively heat resistant, surviving 60°C for 30 minutes. They form black colonies on tellurite blood agar and are bile esculin hydrolysis positive.[28]

Virulence factors include production of haemolysin, aggregative substance and adhesins.[20]

Enterobacter aerogenes: They are gram negative straight rods, 0.1-1.0 µm wide x 1.2-3.0 µm long, capsulated motile and non-sporing. They produce mucoid colonies on ordinary media, non-haemolytic and produce pink colonies on MacConkey media due to lactose fermentation. They are aerobes and facultative anaerobes with growth at optimum temperature 30-37°C. They are catalase positive, oxidase negative, reduce nitrate to nitrite, indole negative and MR negative, VP and citrate positive, and urease negative. They produce acid/acid reaction in TSI medium with gas production. They ferment glucose, lactose, sucrose, maltose, mannitol, arabinose and xylose with production of acid and gas. They are lysine and ornithine decarboxylase test positive and arginine dihydrolase test negative.[27]

Virulence factors include endotoxins, capsule, adhesion proteins, and resistance to multiple antimicrobial agents.[27]

Proteus mirabilis: They are gram negative, pleomorphic rods 0.4-0.8 µm x 1-3 µm in size. They are motile, non-sporing and non-capsulated. They produce characteristic swarming growth with a 'fishy' or 'semen' odour on

nutrient and blood agar. They grow as discrete pale non-lactose fermenting colonies on MacConkey agar. They are aerobes and facultative anaerobes, catalase positive, oxidase negative, reduce nitrate to nitrite, indole negative, MR positive, VP negative and citrate positive. They hydrolyze urea very rapidly. They produce alkaline/acid reaction with H2S production in TSI medium. They are phenyl alanine deaminase test (PPA) positive. They ferment glucose, trehalose and xylose with gas production. Lactose, mannose, adonitol, maltose are not fermented. Sucrose fermentation is variable.[91] They are ornithine decarboxylase test positive, arginine dihydrolase and lysine decarboxylase test negative.[28,90]

Virulence factors include production of urease, haemolysin, proteinase, fimbriae, motility and swarming.[20]

Acinetobacter species: They are gram negative or gram variable bacilli or coccobacilli, aerobic, short, stout, non-motile, non-sporing and often capsulated. They grow well on simple media producing colonies which are white or cream coloured, smooth, circular and opaque. They are non-haemolytic on blood agar. On MacConkey agar they produce a faint pink tint. They are catalase positive, oxidase negative, do not reduce nitrates to nitrites, indole negative, produce alkaline/no change in TSI medium. They utilize citrate. They do not ferment sugars. They are only oxidative on O-F test.[28,90]

Virulence factors include polysaccharide capsule, fimbriae, lipopolysacchride component of the cell wall, lipid A, endotoxin, slime production, aerobactin, and iron- repressible outer membrane receptor proteins.[20]

Group B Streptococci: These are gram positive cocci, spherical or ovoid, 0.5 to 1 µm in diameter and are arranged in chains. They are non-motile, non-sporing and capsulated.[27,90] They are aerobes and facultative anaerobes grow at 35^{o}C. Growth is stimulated by increased CO2.[20,89] They require complex media enriched with blood for the growth.[20] They grow on 5% sheep blood agar forming colonies which are grey, mucoid and larger (about 2 mm) than those of other Streptococci,[90] with a narrow zone of beta-haemolysis; some strains are non- haemolytic.[27] They will not grow on MacConkey media. They appear orange on some media, but pigment is most reliably formed on Islam's medium.[90] They are catalase negative, oxidase negative, VP positive, alkaline phosphatase positive. They hydrolyse arginine and hippurate. Esculin and PYR are not hydrolyzed. They produce acid from ribose and trehalose. Acid production from lactose and salicin are variable.[89] Growth in 6.5% NaCl broth is variable.[27] Both sensitive and resistant strains to bacitracin are noted.[89] They are CAMP reaction positive and are susceptible to vancomycin.[28] They grow in the selected media consisting of Todd-Hewitt broth supplemented with Colistin and Nalidixic acid, Gentamicin and Nalidixic acid or Trimethoprim and Sulfamethoxazole.[20]

Virulence factors are uncertain. Capsular material interferes with phagocytic activity and complement cascade activation.[27]

Citrobacter species: They are gram negative straight rods, 1 µm x 2-6 µm in size, motile and non-capsulated. They are aerobes and facultative anaerobes. They grow well on ordinary media producing smooth, convex colonies 2-4 mm in diameter on nutrient agar. They are non-pigmented, rough or mucoid forms sometimes occur.[20] On MacConkey media they produce light pink colonies due to late lactose fermentation.[27] They are catalase positive, oxidase negative, reduce nitrates to nitrites. Indole production variable in C. freundii, positive in C. koseri. They are MR positive, VP negative, grow on Simmons' citrate medium and may or may not hydrolyse urea.[20] They ferment glucose, sucrose, maltose, xylose and mannitol with production of acid and gas. C. freundii produce H2S and do not ferment adonitol and arabitol. C. koseri do not produce H2S and ferments adonitol and arabitol. They do not decarboxylate lysine. Many strains produce a dihydrolase for arginine and most strains decarboxylate ornithine.[20]

Virulence factors include endotoxins, adhesion proteins, and resistance to multiple antimicrobial agents.[27]

PHYSIOLOGICAL CHANGES IN PREGNANCY PREDISPOSING TO UTI

Many anatomical,[36] hormonal,[37] mechanical[38] and immunological changes occurring during pregnancy greatly predispose to UTI.

1] CHANGES IN THE KIDNEYS:

- Enlarges by 1cm[38] due to increase in renal vascular bed and interstitial space.[39]
- Dilatation of the pelvicalyceal system starts as early as 7th week and progresses till term.[38] Average capacity of the renal pelvis is increased from a base line of 5 ml to an average of 40 ml,[40] resulting in physiological hydronephrosis of pregnancy.[41]
- Physiological hydronephrosis of pregnancy is more common on the right side.[41]

Table 2: Grading of hydronephrosis and their prevalence in either kidney

Grade	RT KIDNEY	LT KIDNEY	P VALUE
Grade-0 (hydronephrosis)	56	93	<.0001
Grade-1 (mild hydronephrosis)	53	30	<.003
Grade-2 (severe hydronephrosis)	16	2	<.009

- It also implies that, hydronephrosis in the left kidney and bilateral hydronephrosis are more frequently associated with renal tract abnormalities and demand a careful work up.
- Renal Blood Flow (RBF) increases by 40% and Glomerular Filtration Rate increases by 65% due to increase in the cardiac output, hyper-volemia, increased aldosterone, prolactin, cortisol and human Placental Lactogen.[42,43]
- Increase in Glomerular filtration rate leads to faster elimination of few drugs via kidneys. This along with polyuria, decreases the duration for which hydrophilic drugs stay in urinary tract, necessitating alterations of drug doses.[44]
- A hypertonic, hypoxic environment is created in the renal medulla, due to relative decrease in blood flow and concentrating ability of medullary nephrons. This inhibits leukocyte migration, phagocytic activity, complement activity and immune function.[44] Thus, renal medulla is particularly prone for infections.[41,46]

2] CHANGES IN THE URETERS PREDISPOSING TO ASB:

- Ureters undergo dilatation especially in the upper 2/3rds. This is called as *'hydroureter of pregnancy'* can contain up to 200 ml of urine.[41,7]
- Uretric tone decreases significantly, even in 1st trimester.[7]
- Peristaltic rate gradually decreases to minimal at 7th and 8th month of gestation.

- The above factors favour slowing of urinary flow in the tract.[44] Thus, the normally thin, muscular, peristaltic tubes are converted into static columns of urine, which greatly predispose the woman towards UTI.[47]

Factors responsible for the changes in the ureters during pregnancy:

Mechanical factors- compression of enlarging uterus on the ureter favors development of vesicouretral reflux[39] and compression of the ureters by the engorged ovarian veins favour formation of hydroureters of pregnancy.[46]

Hormonal factors - progesterone,[38] relaxin,[48] and estrogen[7] decrease the smooth muscle tone, resulting in hydroureters of pregnancy and pelvic floor relaxation.

Lower 1/3rd of ureters dilates lesser than the upper 2/3rd because:

- Hypertrophy of Waldeyer's sheath (longitudinal musculature of ureter) in the lower 1/3rd of the ureter, prevents uretric dilatation below pelvic brim.[7]
- Compression of lower 1/3rd of ureters by the growing uterus.[38]

Hydroureters are more common on the right side because:

- Dextrorotation of the uterus leading to compression over the right ureter.
- Right ureter turns with a sharper angle during its entry into the pelvic brim.[7]
- Placentation is more common on the right wall of the uterus leading to additional compression on the right ureter.[7]
- Cushioning effect of the sigmoid colon protects the left ureter.[40]

- Greater hypertrophy of the ovarian and uterine plexus on the right side, through which the ureter passes, leads to compression effect on it.[40]

3] CHANGES IN THE BLADDER WHICH PREDISPOSES TO ASB -

- Bladder tone progressively decreases from 12th week onwards.[37]
- Bladder capacity increases gradually, right from the 1st trimester.[38] By term, the bladder can hold twice its maximum non-pregnant capacity without discomfort.[7]
- Bladder starts rising from the pelvis; by term, it is placed anteriorly and superiorly, such that, it becomes an abdominal organ[38]
- Incomplete emptying of bladder during pregnancy leads to increasing volumes of residual urine.[41] Presence of residual urine of > 5 ml is a risk factor for UTI.[49]
- Generalized hyperemia and edema of the bladder mucosa is seen due to estrogenic stimulation in pregnancy.[39]

4] CHANGES IN THE URINE WHICH PREDISPOSES TO ASB -

Glucose and amino acids are excreted more readily during pregnancy,

- leading to a good environment for bacterial growth.[50]
- Increased excretion of urea and uric acid favors bacterial growth.[50]

OTHER PREDISPOSING FACTORS IN CAUSATION OF ASB

Complex interactions among the host, environment and agent leads to ASB.

Host factors-

(a) UTI is much more common in the females,[51] due to:

- A shorter urethra (3-4cms) when compared to males.
- External urethral orifice being close to the anus, is constantly contaminated.[51]
- Females usually do not empty their bladders as completely as men.
- Bacteria enter the bladder due to urethral massage during coitus. About 25% of UTIs occurred in women with a h/o coitus in the last 24 hrs.
- Existence of warm and moist conditions in the peri-urethral region of women.[37]

(b) Presence of urinary tract abnormalities predispose to UTI.[52]

- The congenital urinary tract abnormalities are- Urethral diverticula, Ectopic ureter, Medullary sponge kidney,[52] Vesico urinary reflux,[53] Congenital polycystic kidneys and Non-functioning segment of kidney.[5]
- Acquired urinary tract abnormalities are- Stones anywhere in the urinary tract, strictures, papillary necrosis, atrophic pyelonephritis, significant anterior vaginal wall descent,[53] Renal scarring,[36] Major

perineal surgeries,[53] Hydronephrosis of pregnancy and Hydroureter of pregnancy.[45]

(c) Afro-Americans, Native Americans & Asians are more prone for ASB.[51]

(d) Increasing age predisposes to ASB by 1 to 1.5 % per decade of life.[54]

(e) Multiparity and pregnancies in rapid succession predispose to ASB.[7]

(f) Chronic perineal pain reflexly decreases frequency of micturition to cause ASB.[53]

(g) Working women with busy schedules, who do not get to micturate frequently,

(h) Those using public toilets frequently, are more prone.[53]

(i) Sexual behavior - UTIs are related to frequency, recency of coitus and lack of a habit to empty the bladder after coitus.[53]

(j) Neurological conditions like spinal cord injury and neurogenic bladder.[36]

(k) H/o childhood UTI, Recurrent UTI, Previous h/o pyelonephritis and UTI during pregnancy predispose to ASB.[55]

(l) Maternal medical disorders like Sickle cell disease, Diabetes Mellitus, Gouty Nephropathy; Immuno-compromised states like Diabetes Mellitus, HIV/ AIDS with CD4 counts <200 cells/mm^3, transplant recipients, patients on long term chemotherapy, and use of high doses of corticosteroids for prolonged duration.[55]

(m) Use of tocolysis increases the chances of ASB and UTI.[51]

(n) Genetic factors- blood groups P-1, AB, B and HLA A3, 54 presence of genetically mediated bacterial receptors on the uro-epithelium predispose to UTI.[57]

Environmental factors:

a. Socio-economical factors- women from lower socio-economic status are prone for UTI by 5 times than in the general population.[36] There is a 2 to 3 fold increase in UTI in the pregnant women attending public health services than those attending private set-ups.[47]
b. Poor personal hygiene is associated with ASB and UTI s.[40]
c. UTI is more common in pregnant women hospitalized for long periods are prone for nosocomially acquired UTI.[51]

Agent factors:

a. Virulence mechanisms such as-
    - Adhesins - give the bacteria an ability to attach to the mannose receptors and glycolipid receptors of the uro-epithelium, favoring colonization.[6]
    - Flagellae- help in the motility and ascent of the bacteria.[36]
    - Slimy capsules- Provide resistance against the antimicrobial agents.[36]
    - Presence of K-Ag in the bacteria prevent phagocytosis, makes the patient more prone for pyelonephritis and less prone for cystitis.[58]

- α–Hemolysins- provide resistance against serum anti bacterial factors.[59]
- P-Antigen- is a survival advantage to the P-fimbriated organisms.[45]
- Bacterial toxins-like lipopolysaccharides and hemolysins help further spread of an already established infection.[60]
- Aero-bacterium provides survival advantage to the organism.[51]
- Pili- favor adherence of the organism to the uro-epithelium.[46]

b. Inoculum size: Larger the size, greater are the chances of infection.[52]

INNATE HOST DEFENCE MECHANISMS AGAINST ASB

Innate defence factors provide resistance against UTI in the host. When this delicate balance between defensive and offensive factors alters, results in UTI. They are:

1] ANATOMICAL FACTORS:

- Intactness of the uro-epithelium.[37]
- The urethral sphincter is usually closed. This prevents the ascend of organisms to some extent.[53]
- Vesicoureteric valve prevents reflux of urine from the bladder into the ureters.[61]

2] PHYSIOLOGICAL FACTORS:

Constant flushing of contaminated urine by the act of micturition is the key defence mechanism to prevent UTI.[38]

- Relatively dilute urine in pregnancy does not favor growth of organisms.[45]
- High estrogen levels in pregnancy increases glycogen levels in the uro-epithelium, favoring colonization with lactobacillus. This creates an acidic pH, which is unfavorable for most of the pathogenic organisms.[53]
- The normal resident urethral flora located in the distal half of urethra prevents colonization and multiplication of exogenous organisms. These usually occur in numbers not more than 10^3 to 10^4.[62]
- Existence of higher oxygen in the urine prevents growth of significant anaerobes in the distal urethra.[52]

3] IMMUNOLOGICAL FACTORS:

Several anti-bacterial properties in the mucosa of urinary tract prevent infections.[37]

- Pus cells (leucocytes or PMNs) - these are secreted from the urinary epithelium. Their function is to engulf and eliminate the bacteriae.[45]
- Tamm Horsfall proteins also called uro-modulins, are secreted from the renal tubules. They act in many ways to keep the urinary tract sterile:
    - Bind to Type -1 fimbriae of E coli and facilitates its removal
    - Activates local immune response in a non specific manner
    - Binds to the leucocytes and increase its phagocytic function

- Increases complement expression
- Enhances arachidonic acid pathway.[45]

- Secretory immuno-globulins (IgA) are derived from the uro-epithelium.
- These bind to the organisms, decrease their virulence and increase phagocytic activity of leucocytes.[45]
- Muco-polysaccharides from the bladder act as opsonins to leucocytes.[45]
- Release of cytokines and inflammatory mediators limit infection.[51]
- Lymph node clusters in the bladder wall are involved in specific, nonspecific, humoral and non-humoral immunity.[53]

4] GENETIC FACTORS:

- Certain HLA types are associated with increased incidence of UTI.
- People who possess Lewis blood group; i.e., Le (a + b+) and Le (a- b+) are called as 'Le positive or Secretors'. Incidence of UTI is significantly lower in secretors, due to decreased bacterial binding sites in uro-epithelia.[37]

ROUTES OF ASB

Hematogenous- rare (<5%). It needs a large bacterial inoculum and involves virulent organisms. It is more common in immuno-compromised.

The agents are M. Tuberculosis, Salmonella sp, Leptospira sp., and Staph. aureus.[37]

Ascending route is the most common one (95%). It is because of proximity of bacterial reservoirs to urethra (i.e., anus and vagina) It is more common in hospitalized and catheterized patients.[37]

Lymphatic route – is very rare. Source is usually from the ascending colon, which is in direct communication with the right kidney through lymphatics.[65]

NATURAL HISTORY OF ASB

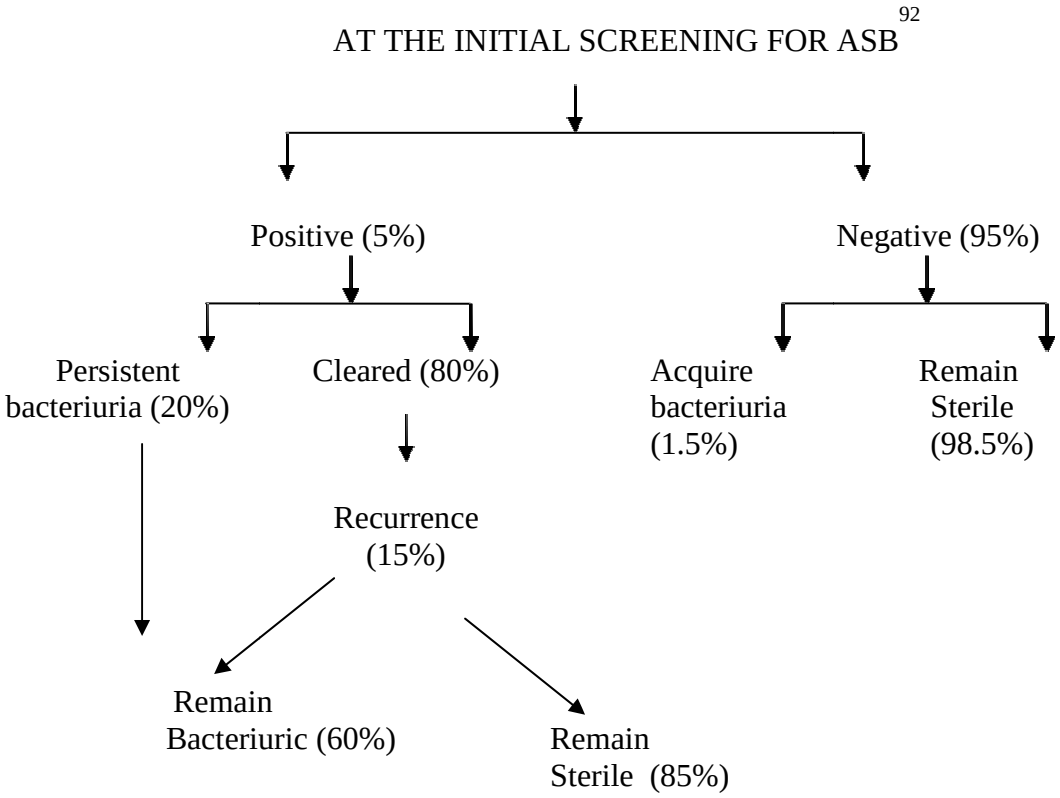
Depending on the delicate host defence-offence balance; bacteria bind, multiply, colonize, invade and spread in the mentioned order to cause UTIs.

At every point, there is a complex interaction between the host and the agent to either progress the infection or to abort at some stage.

To complete the colonization process, the bacteria should reach a critical mass, after which, the invasion is more likely.[45]

Thus, ASB may represent a chronic silent infection of the urinary tract, i.e., Sub-clinical pyelonephritis, or Chronic sub-clinical cystitis.[40]

Recurrences are more common in patients with renal bacteriuria.[38] Thus, ASB may remain so, get cleared or may spread to become symptomatic.[36]



ON THE WHOLE:

Host factors
Environmental factors
Bacteriological factors

Enhanced colonization of vagina, vestibule and periurethral areas with uropathogens.

↓

BACTERIURIA

↓

ADVERSE MATERNO-FETAL EFFECTS.

PATHOPHYSIOLOGY

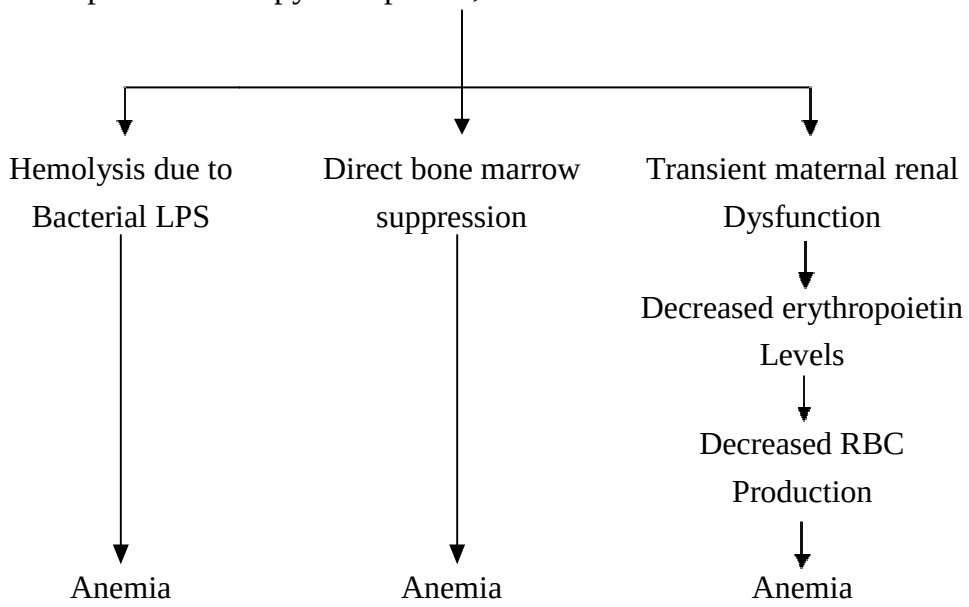
Bacterial products initiate a complex immunological, endocrinological and biochemical processes, culminating in adverse maternofetal outcome.[63]

MECHANISMS OF ADVERSE MATERNAL OUTCOME:

1] Maternal anemia:

In patients with ASB, bacterial endotoxins and lipopolysaccharides are chronically released. This leads to a continuous and sustained damage to the red cell membranes, causing early cell destruction and anemia. It is seen that, anemia of ASB promptly resolves on treatment with anti-microbials.[38]

In patients with pyelonephritis, bacterial endotoxins.[56]



- IL-1 directly decreases erythropoietin secretion.
- IL-1 and TNF-α act through interferon-γ, to suppress the response of the erythroid marrow to erythropoietin.

- Hepcidin is a protein synthesized by the liver in chronic infection and inflammation. It suppresses iron absorption from the gut and release of iron from its storage sites.[64]

2] Maternal hypertensive complications:

A possibility that, ASB during childhood or long standing ASB results in subtle renal injuries, especially if the source of bacteriuria is the kidneys. This is either unmasked by pregnancy, or incidentally diagnosed during Antenatal care. Such renal scars are seen to be increasingly associated with ASB, symptomatic UTIs and adverse pregnancy outcome.[63]

3] Maternal systemic manifestations :

Endotoxins released from the bacteria directly alters milieu interior of the host by causing changes in the vascular bed, increasing permeability, vasodilatation and decreased cardiac output, leading to systemic manifestations.

Infection → release of endogenous pyrogens from circulating monocytes and tissue macrophages → phagocytosis of bacteria and formation of antigen-antibody complexes → elevation of hypothalamic thermostat → fever and rigors in an attempt to generate more heat; as per the newly set thermostat.[65]

4] Maternal pyelonephritis:

Few mechanisms have been discussed in the natural h/o UTI. The other mechanism is by attachment of fimbria and pili to uroepithelium → sloughing

and necrosis of uroepithelial cells → endocytosis of organisms by the newly exposed cells → spread of infection → pyelonephritis.[53]

5] Maternal CRF:

Repeated such episodes of ASB, pyelonephritis and scarring → shrinkage of the renal parenchyma → CRF.[53]

6] Maternal ARF:

Acute severe infection of the kidneys → transient renal dysfunction → ARF.[36]

7] Sub involution of the uterus:

- ASB → PROM→ amnionitis and endometritis → Subinvolution
- ASB → anemia → subinvolution.[36]

8] Mechanisms causing shock, DIC, ARDS and respiratory insufficiency:

- Gram negative bacteremia → endotoxemia → injury to capillary endothelium → decreased vascular resistance, mediated through prostaglandin-E2, Prostacyclins, Nitric oxide, Endothelium derived growth factor, and prolactin → decreased cardiac output → shock.[65]
- Release of Endotoxin Lipid-A into the maternal circulation → cascade of pro- inflammatory cytokines, histamine, bradykinins and complement pathways→ septic shock, DIC, ARDS and respiratory insuffiency.[65]

MECHANISMS OF ADVERSE NEONATAL OUTCOME

ASB and PROM:

a) Direct effect of bacterial products:

Release of bacterial protease, collagenase,[66] matrix metalloproteinase, and muco-polysaccharides directly act on the collagen I and III of membranes, weaken them and favor easy rupture.[66]

b) Cellular and biochemical host mechanisms:

- Bacterial endotoxins activate macrophages , which release inflammatory mediators like IL-1, IL-6, IL-8, IL-10, TNF-α, colony stimulating factors, IL-6 soluble receptors, IL-1 receptor antagonist (IL- ra), transforming growth factor β, and Fetal platelet activating factor(f-PAF) weaken the membranes.[66]
- IL-1 stimulates prostaglandin production from amnion, decidua and myometrium, which weakens the membranes.[66]
- TNF-α from decidua acts synergistically with IL-1 in prostaglandin production.[66]
- IL-6 hastens release of acute phase proteins like CRP; activates T cells, NK cells and B cells. These dissolve microfibrills of the membranes, favoring PROM.[66]

ASB and Threatened preterm and preterm labor:

- Bacterial endotoxins have a direct oxytocic effect on the uterine myometrium.[41]

- Bacterial endotoxins result in an increase in prostaglandins, which act in a cascade manner to increase Na-K pump activity, which inturn increases the amplitude of uterine contractility.[36]
- IL-6, an endogenous pyrogen and IL-8, a neutrophill chemo-attractant, which are constantly raised in patients with ASB, stimulate uterine contractions.[36]
- Infections lead to an immune response, which raises cytokine, prostaglandin and metalloproteinase levels. These result in progressive cervical changes.[67]
- UTI increases ureteric contractions which increase uterine contractions reflexly.[41]
- ASB causes PROM, which hastens PG release and causes uterine contractions.[41]

Mechanisms behind abortions, still births, IUGR, and LBW in ASB:

- ASB → endotoxemia → release of Tx A2 and Leukotrienes → cause local circulatory disturbances in the placenta.[62]
- Infection → inflammatory process → release of free radicals and micro- circulatory compromise → cellular injury and death of cells in the placenta.[62]
- ASB leads to DIC in mother; similarly in the placenta also. When DIC super- imposes on already hypoxic, acidotic, hypo-perfused placenta,

their results gross placental insuffiency leading to abortions, still births, IUGRs and LBWs.

Mechanisms causing neonatal sepsis and infections:

- Bacterial products like mucinases and pro-inflammatory factors promote break down of the cervical plug and spread of infection to the fetus.[69]
- ASB causes PROM and spread of infection to the fetus.[69]
- As the fetal-neonatal immunological system is less developed, the fetus is readily prone to infections and acts as a 'culture media' for organisms.[36]
- Thus, organisms of low virulence, commensals and otherwise non-pathogenic organisms readily colonize and multiply in the fetus; causing septicemia.[70]

Mechanisms in long term sequelae of ASB in the fetus:

Adinolfi was among the first to propose that, cytokines produced in relation to maternal infections were harmful to the developing fetal brain.[67] Increase in IL-6 is associated with long term neurological consequences and broncho-pulmonary complications in the fetus. Amniotic fluid infection leads to peri-ventricular leukomalacia and broncho-pulmonary dysplasia in the neonate.[69]

PREVENTIVE MEASURES

GENERAL MEASURES:

- Adequate hydration in all pregnant women
- Empty bladder regularly and frequently
- Make it a habit to empty the bladder after coitus
- Empty the residual urine adequately[49]
- Wash from front to back to avoid fecal contamination of urethra after defecation[53]
- Good standards of perineal hygiene
- Avoid irritant vaginal deodorants, bubble baths and pool baths in un-hygienic areas
- Emphasize on double micturition in patients with significant residual urine
- Routine urine analysis, colony count and culture sensitivity should be a part of pre-pregnancy counseling to diagnose ASB and treat them adequately; so that the women can enter the state of pregnancy with an un-infected urinary tract.[71]
- Every woman should be screened for ASB in the first trimester and positive cases should be treated adequately and followed up subsequently.

CATHETER CARE:

- Avoid unnecessary catheterization[72]
- Follow sterile procedure when dealing with urinary catheters.[72]
- Avoid un-necessary manipulations of the catheter[52]
- Encourage closed, gravity assisted drainage.[72]
- Monitor urine levels in the bag for at least once in four hours to ensure drainage.[52]
- Disconnect the catheter from the bag only when you need a sample for urine analysis or, when there is an obstruction.[72]
- No role of routine prophylactic antibiotics for patients with urinary catheter.[72]
- Exchange the catheter once in 8 to 12 weeks or when there is a suspicion of infection.[52]
- Use supra-pubic catheterization when ever prolonged drainage is required.[72]

ANTIBIOTICS AND UTI

Susceptibility of the organisms to the antibiotics has been changing from time to time and region to region; but not their prevalence patterns.[36] It becomes crucial that the drugs used in pregnancy are safe and effective.[44] No single agent / no single regimen seems to be better than the other.[45]

β-LACTAMS:

One of the oldest antibiotic used against UTI.[36] Pharmaco-kinetics of pregnancy decreases β-Lactam concentration by 50%; such that the dose needs to be increased, particularly in 2nd trimester.[44] Increasing resistance, especially in E.Coli strains is limiting its use.[36] Generally well tolerated and produces mild, self limiting side effects. None of the β-Lactam antibiotics are teratogenic.[44] E.g. Penicillins - Ampicillin, Amoxicillin, Mecillinam; Cephalosporins - Cephelaxin, Ceftriaxone.

NITROFURANTOIN:

This is specifically as urinary anti-septic, as it attains therapeutic concentrations only in the urinary tract.[44] Its use is limited to un-complicated UTI.[36] It is a first line drug, and most commonly used drug against UTI by obstetricians all over the world. It is non-teratogenic and can be used during embryogenesis.

Limitations: Effective against E Coli, but not Proteus sp.[44]

Side-effects: Nausea, vomiting and anorexia exist, but decreased by macrocrystaline formulation.[44] Rare serious side effects on liver, lungs and CNS have been described. In patients with G6PD deficiency, hemolytic anemia may be precipitated.[36]

TRIMETHOPRIM-SULFAMETHOXAZOLE:

Is the primary agent against UTI in general population. Contra-indicated in first trimester due to antifolate activity and risk of teratogenisis

(NTDs).[36] Side effects are more common when given as fixed drug combinations with sulfanomides.[36]

SULFONAMIDES:

These are not recommended during pregnancy due to increasing resistance to the drug by E. Coli also this inhibits folate metabolism and can be teratogenic to the fetus when administered in 1st trimester, frequent allergic reactions[40] and increased risk of kernicterus when administered in 3rd trimester[36] have also been described.

FLUROQUINOLONES:

This is the first line drug in non-pregnant women with UTI as it attains high concentrations in the kidney.[44] In pregnancy, its use is limited to complicated UTIs and pyelonephritis when they do not respond to other drugs. It causes arthropathy and staining of teeth in the neonate; CNS toxicity and hemolytic anemia in women with G6PD deficiency.[44] Thus, generally not recommended in pregnancy.[36]

LINCOSAMIDES:

Clindamycin is used in patients with penicillin allergy and GBS infections. Is non-teratogenic. No need to alter the drug dose during pregnancy.[44]

AMINOGLYCOSIDES:

These attain high concentrations in the kidney during pregnancy. It is effective against a wide spectrum of uro-pathogens. It can be nephrotoxic;

hence, limited use is advocated in patients with already compromised renal function. There is a theoretical risk of oto-toxicity to the fetus.[44]

FOSFOMYCIN TROMETAMOL:

This is a newer anti-microbial agent, a derivative of Phosphonic acid, for use in the treatment of un-complicated UTIs. It can be used both parentrally and orally. Trials have shown that single dose of the drug is as effective as 7-10 days treatment with Nitrofurantoin, Norfloxacillin or Cotrimoxazole. It is well tolerated with lower side-effects. Teratogenic effects has not been noted in humans or animals. In spite of these advantages, caution is advocated during pregnancy, as it is a new drug and more experience will be beneficial before clinical use.[44]

ANTIBACTERIAL TREATMENT REGIMENS

Various regimens with various antibiotics and combination therapies have been recommended for short term and long term courses. They are –

1) Post coital single dose
2) Single dose regimens
3) 3 days regimen
4) 7 days regimen
5) 14 days regimen
6) prophylactic therapy
7) suppressive therapy.[36]

SINGLE DOSE REGIMEN:

Amoxicillin 3 gm; Ampicillin 2 gm; Cephalexin 2 gm; Nitrofurantoin 200 mg; Sulfisoxazole 2 gm, or Cotrimoxazole 320/1600 mg are used depending on anti-biotic sensitivity pattern in that region or after sensitivity reports.

3 DAY REGIMEN:

These are to be used in un-complicated UTIs. Recently shorter course antibiotic treatment is favored because,[46]

- Duration of initial treatment does not affect the recurrence rate.
- Shorter courses minimize side-effects of the drug on both mother and the fetus.
- Emergence of resistant strains are discouraged.
- Cost-effective
- Patient acceptance of the treatment is better.

The drugs which can be used are Cephalexin 500 mg po qid; Nitrofurantoin macrocrystals 100 mg po as bd or qid; Amoxicillin 500 mg po qid or Ampicillin 500 mg po qid after checking the sensitivity pattern / arbitrarily.[36]

7 DAY COURSE:

Is used for complicated UTIs including pregnancy. Amoxicillin 500 mg po tid; Cephalexin 250-500 mg po qid; Nitrofurantoin 50 – 100 mg qid or

100 mg bd and Cotrimoxazole 160/800 mg bd can be used after checking the sensitivity pattern/ arbitrarily.[36]

14 DAY COURSES : Reserved for upper urinary tract infections.[36]

- Ampicillin + Gentamycin 2 gm i.v. q6h
- Ceftriaxone 1 gm i.v. / i.m q24h
- Cefazolin 1 – 2 gm i.v. q6-8 h
- Gentamycin 2 mg / kg loading dose, then 1.7 mg / kg in 3 divided doses.
- Ampicillin – Sulbactum 3 gm i.v. q6h
- Cefuroxime 0.75 – 1.5 gm i.v. q8h
- Mezlocillin 3 gm i.v. q6h
- Pipercilliln 4 gm i.v. q8h.
- Antibiotic treatment to be modified depending on the culture and sensitivity pattern.

SUPPRESSIVE THERAPY / PROPHYLACTIC THERAPY:

Tab. Nitrofurantoin 100 mg po od to be continued into postpartum period or Cotrimoxazole 160/800 continued into postpartum period. **Indications:** when a patient has 2 episodes of ASB within 6 months, this therapy should be started. Otherwise she will have 65% chances of another episode of ASB in next 6 months. [73]

Current standard practice to treat ASB in pregnancy:

- Treatment with antibiotics for 7 days according to culture sensitivity pattern.
- Repeat culture or colony count at the end of the antibiotic regimen.
- Presence of persistent bacteriuria demands a 2nd course of antibiotic for 7-14 days with the same or different drug, as per culture and sensitivity.[36]

IDSA guidelines for management of UTI :

Following meta-analysis the following guidelines were given –

- 3 day oral antibiotic therapy is effective
- Persistent bacteriuria and reinfection rates are similar with the short courses and current standard practice.
- Single dose regimens are associated with higher rates of early recurrence by the original strain, when compare to 7-14 days therapy due to failure to eradicate uropathogens from their reservoirs.
- 3 day course is better than single dose regimen in preventing re-infection.
- Short course therapies are preferable due to lesser side effects, decreased health care costs and increased patient compliance.[36]

General measures in UTI:

1) Role of Cranberry juice: Since time immemorial, Cranberry juice was used in certain communities against UTI. This has been a topic of extensive research and debate since then. Recent Cochrane analysis has proved that, consumption of cranberries decrease the risk of UTI over a 12 month period, when compared to placebos. **Mechanism of action**-these contain proanthrocyanidins which prevent adherence of the pathogens to the uroepithelium.[36]

2) Acidification of urine: Vitamin C 500 mg po bid; Ammonium chloride 12 gm / day in divided doses; Apricot juice, plum juice, prune juice and cranberry juice have been experimented with some amount of success.

3) Urinary analgesics: Phenazopyridine 200 mg po bid for 2-3 days.

4) Adequate rest.

Supportive measures in patients with pyelonephritis :

- Ensure adequate hydration with intra-venous crystalloids.
- Correct electrolyte imbalances
- Close intake-output charting.[36]
- General measures and nursing care like antipyretics, analgesics, cooling blankets and tepid sponging.[40]
- Pulse, BP, respiratory rate, temperature, fetal well being and uterine contractions.[40]

- Early chest X-ray if any respiratory symptoms like dyspnea or tachypnea develop due to increased risk of ARDS in this patients.[74]
- Consider in-dwelling catheter.[74]
- Avoid drugs that exacerbate renal insufficiency (e.g. Aminoglysides, Gentamycin etc).[36]
- Change-over to oral antibiotics when the patient becomes afebrile for 24 hours.[74]
- With the above management, 75% of patients with pyelonephritis become asymptomatic and afebrile within 48 hours; 95% defervesce in 72 hours.[36] When there is a failure to respond by 72 hours, think of resistant pathogens, urinary tract abnormalities like stones,[36] strictures, abnormal uretric and pyelocalyceal dilatation, hydronephrosis, intrarenal and perinephric abscess.[74]

Follow up after treatment of ASB:

- Repeat urine culture at the end of antibiotic therapy.
- Repeat urine culture every month till postpartum period.
- When it recurs, 2nd full course of antibiotics to be started based on culture and sensitivity.
- Complete evaluation of the patients with recurrent UTI in the postpartum period to detect the underlying cause.[36]

OPD management of pyelonephritis:

This has been introduced recently to decrease cost and increase convenience of the patient.

- Patient selection-
    - Pregnancy < 24 weeks gestation
    - Patients compliant in following the given instructions
    - No associated co-morbid diseases (like diabetes mellitus)
    - No features of sepsis
    - No recurrent upper UTI
    - Inability to tolerate oral intake
    - No features of threatened abortion or preterm labor.
- Ensure 24 hour observation to confirm maternal and fetal well being during which the patient receives i.v. antibiotics, hydration therapy and laboratory evaluation.
- On discharge the patient should adhere closely or follow up daily for a week and weekly for a month.
- Patient should visit emergency room immediately if features of sepsis, respiratory insufficiency or uterine contractions appear.
- Urine culture to be repeated after 2 weeks.
- Night suppression therapy is mandatory for all the patients with an episode of pyelonephritis during pregnancy.[36]

Materials & Methods

MATERIALS AND METHODS

Study design: Cross sectional study.

Study setting: Obstetrics & Gynaecology department, Sree Mookambika Institute of Medical Science, Kulasekharam.

Duration of the study: 12 months

No of Groups: 1 group

Detailed description of the group:

Pregnant women attending Obstetrics and Gynaecology outpatient department, Sree Mookambika Institute of Medical Science Kulasekharam, who fulfill the inclusion and exclusion criteria are selected.

Total sample size of the study: 121

Scientific basis of sample size used in the study:

$$(n) = 4pq/d^2,$$

P is prevalence of asymptomatic bacteriuria in pregnant women = 45.322

$$Q = 100 - P$$

$$= 100 - 45.3$$

$$= 54.7$$

$$d = 20\% \text{ of } P = 9.06$$

$$\text{Sample size} = 120.75$$

$$= 121$$

Sampling technique used in the study: Convenient sampling.

Inclusion criteria:

- Antenatal patients for regular antenatal checkups in SMIMS.
- Antenatal women who does not have any urinary complaints.

Exclusion Criteria:

- Patients with history of UTI in the past one year or during this pregnancy.
- Patients who had taken antibiotics in last 6 months
- Patients who are not willing for participating in this study.

Parameters studied:

- Urine routine examination
- Urine culture and sensitivity

Methods/technique/instrument/reagent used

Clean catch method:

Patient is instructed to clean periurethral area with soap and water, next to spread the labia and then to collect 30 ml of mid stream urine specimen in a sterile bottle. The samples were immediately transported to the laboratory and were processed within one hour. In case of delay, the samples were refrigerated at 4°C. Firstly, 0.02 ml of potassium nitrate was added to 1 ml of the urine sample and incubated. After culturing the urine specimen for quantitative bacterial count, microscopic examination was carried out for the detection of leucocytes.

Microscopic examination for pus cells : Unspun urine is examined directly under microscope and pus cells per high power field were calculated. A count of 10 or more pus cells per high power field is an indication of urinary tract infection.

QUANTITATIVE BACTERIOLOGY

Calibrated loop direct streak method:

Using a flame sterilised and cooled 4 mm platinum loop delivering 0.01ml, one biconvex loop full of well mixed uncentrifuged urine specimen was deposited on blood agar plate and Mac conkeys agar plate. Both plates were streaked by passing loop through inoculum downwards to the lower edge of the plate in a T pattern from the inoculum site. Both plates were incubated overnight at 35° C and read next morning.

Colonies were examined and counted on both plates. Total counts were estimated from blood agar plate and Mac conkeys agar plate. In each case colonies were multiplied by 100, to give an estimate of the number per millilitre of urine. Thousand colonies on Mac conkeys agar plate i.e. 10^5 bacteria per ml and 100 colonies on blood agar plate i.e. 10^4 per ml were taken as significant bacteriuria. After determining the plate count, organisms present were identified and the susceptibility to antibiotics was determined by modified Kirby Bauer Disc diffusion method. Mixed growth of two or more organisms was considered as contamination and the sample was repeated. If no growth occurred, specimens were held for another day in incubator, and if still negative reported as no growth after 48 hrs.

Identification of organisms:

A smear was prepared from the culture selecting a single colony and stained by grams method. In case if gram positive cocci were found in clusters a coagulase test was performed by tube method to differentiate between pathogenic and non pathogenic staphylococci. When gram positive cocci in pairs were isolated from Mac conkeys agar plate, bile solubility heat resistance and mannitol fermentation tests were carried out to confirm enterococci. When pink coloured or pale colonies on Mac conkeys agar plate were seen gram's staining was done. Motility was examined similarly a set of bioclinical investigations were carried out to identify various gram negative bacteria.

Antibiotic sensitivity

This is done by Disc-Diffusion method of Kirby Bauer. In case of urinary infection the suitable antibiotic drug was found out by the sensitivity of organisms in vitro. The organisms were grown on nutrient broth for 18 hrs. Mueller Hinton Agar plates were then inoculated uniformly by flooding the surface with 2 ml of broth cultures. The excess removed, discs were then placed at suitable distance from each other. And were incubated overnight at 37°C. Antibiotic sensitivity zones were read in the zone reader, and compared to a standard chart with specified zone diameters for each antimicrobial disc to determine either sensitivity or resistance of the bacterium in question.

Statistical methods of analysis:

- Significance level decided before starting of study: 95%
- Statistical tests to be used for data analysis: mean, standard deviation, t-test, logistic regression
- Software to be used for statistical analysis: SPSS statistical package Trial Version 20.0

Results

RESULTS

Table 3: Number of patient with significant bacteriuria

Study population – 121		
Significant bacteriuria	22	18.18%
Without bacteriuria	99	81.82%
Total	121	100%

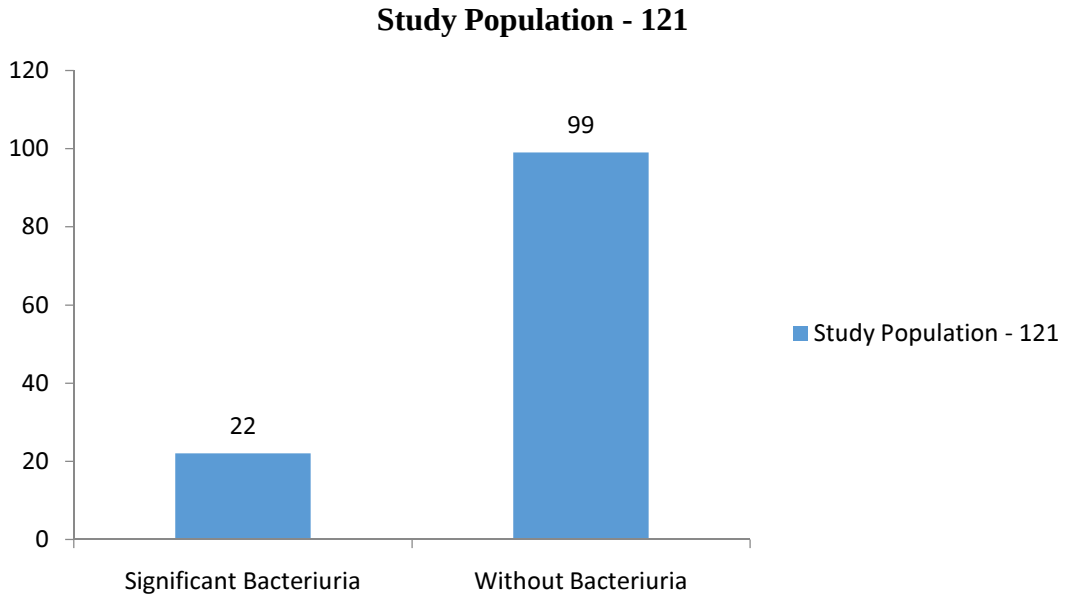


Figure 4: Number of patient with significant bacteriuria

Out of 121 cases, 22 cases (18.18%) had significant bacteriuria, 99 cases (81.82%) had no significant bacteriuria.

Table 4: Age distribution of patient

Age in years	No of cases	Percentage %	Significant bacteriuria	Percentage %
<20	18	14.87	4	18.18
20-30	65	53.72	11	50
>30	38	31.41	7	31.82
Total	121	100	22	100

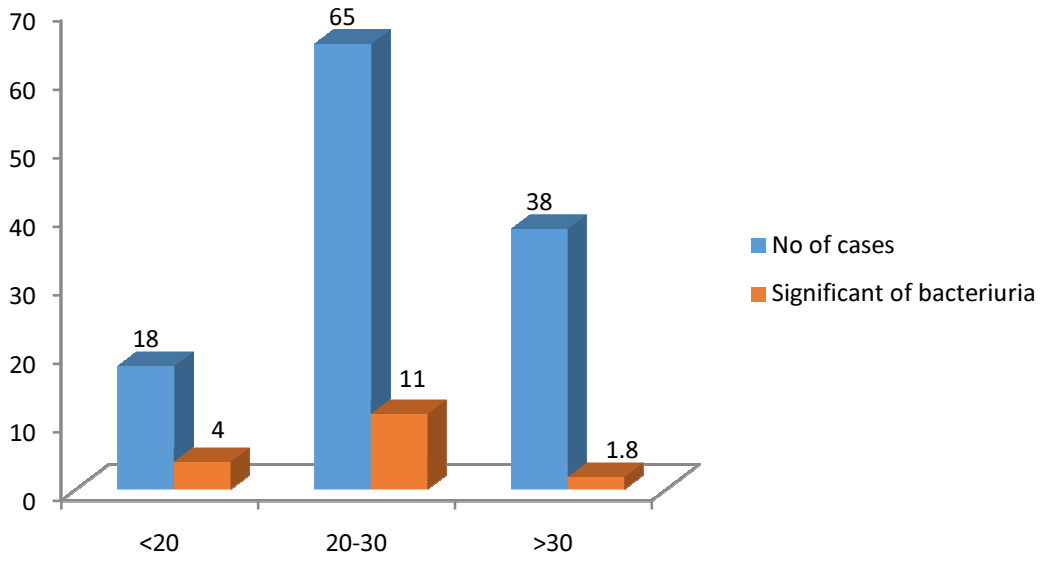


Figure 5: Age distribution of patients

According to above table maximum number of patients belongs to the age group of II (20-30years) i.e., 65 patients, highest percentage of significant bacteriuria 50% was identified in the same age group. Lowest percentage 18.18% of positive cases were seen in patients age less than 20 years.

Table 5: Distribution of patient according to period of gestation

Trimester	No of cases	Percentage %	No of positive cases with significant bacteriuria	Percentage %
1st Trimester	39	32.23	5	22.73
2nd Trimester	53	43.80	10	45.45
3rd Trimester	29	23.97	7	31.82
Total	121	100	22	100

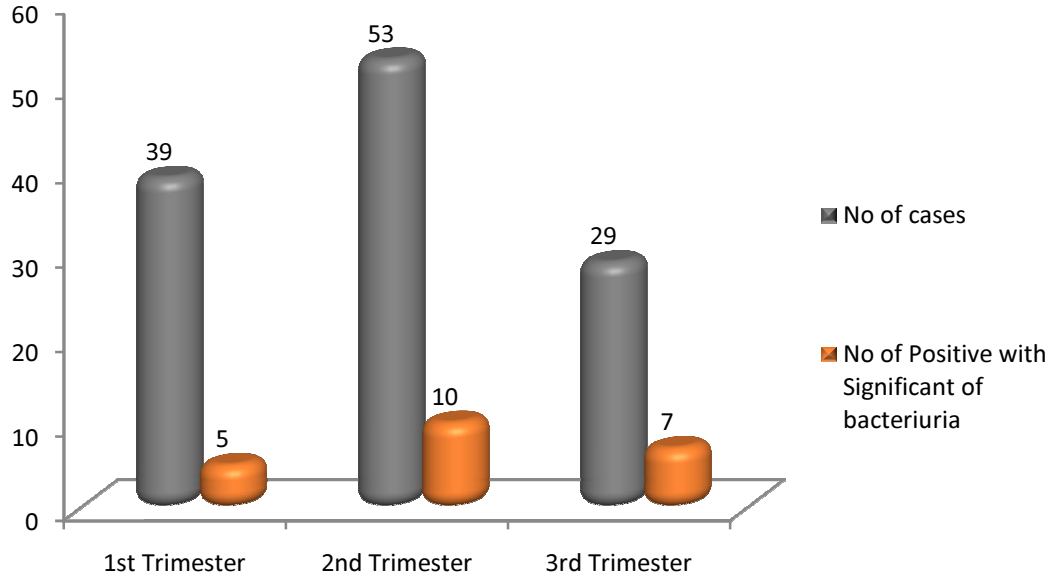


Figure 6: Distribution of patient according to period of gestation

Above table shows the distribution of ASB patients according to period of gestation. High percentage of ASB was seen in 2nd (45.45%) and 3rd (31.82%) trimester in contrast to 1st trimester (22.73%).

Table 6: Parity distribution

Parity	Total cases	Percentage %	Significant bacteriuria	Percentage %
Primigravida	72	59.50	14	63.64
Multigravida	49	40.50	8	36.36
Total	121	100	22	100

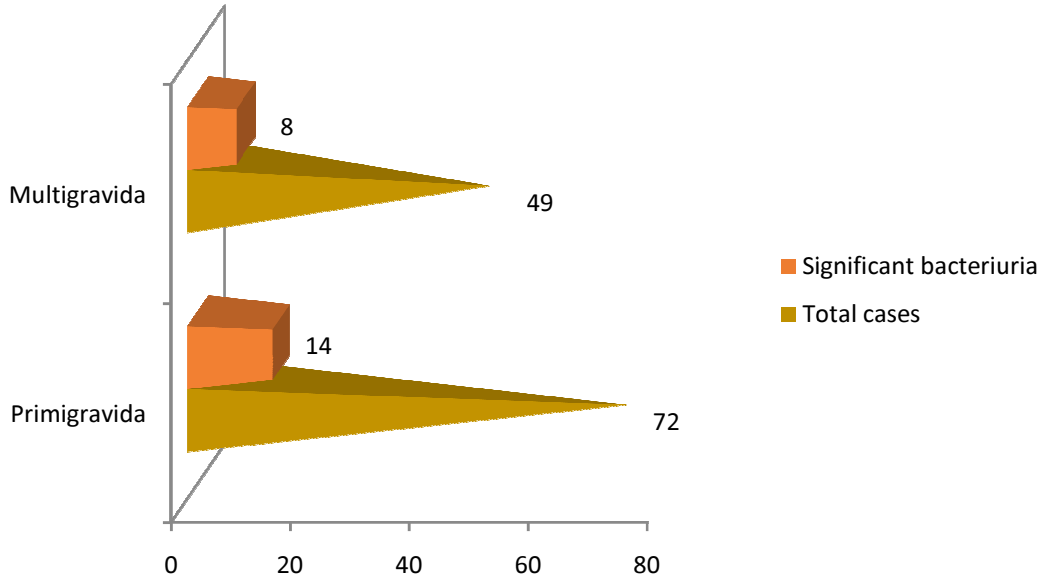


Figure 7: Parity distribution

Above table shows the distribution of the patient in relation to parity. Highest number of ASB patients were seen in primigravidas. 14 (63.64%).

Table 7: Distribution of patient according to socioeconomic status

SES	No. of cases	Percentage %	No. of positive cases	Percentage %
Upper	13	10.74	1	4.55
Upper middle	33	27.27	3	13.64
Lower middle	40	33.06	7	31.81
Upper lower	29	23.97	8	36.36
Lower	6	4.96	3	13.64
Total	121	100	22	100

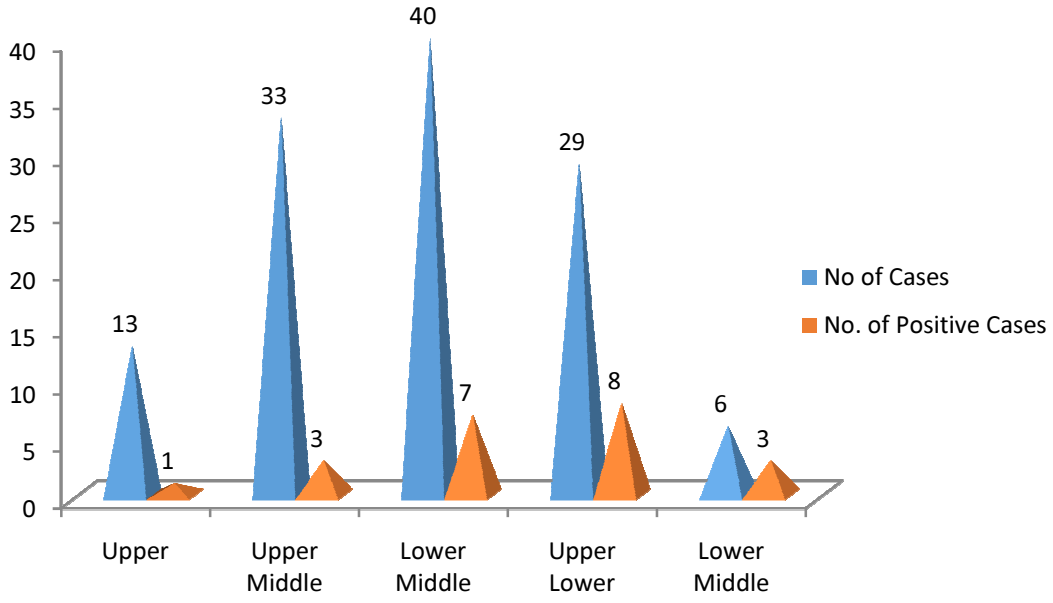


Figure 8: Distribution of patient according to socioeconomic status

Above table shows the distribution of ASB patients according to the socioeconomic status. The percentage of positives with significant bacteriuria were high among the upper lower socioeconomic group, 36.36%. Only 4.55% were positive among the high socioeconomic group.

Table 8: Causative organism

Organism	Number	Percentage %
Escherichia coli	11	50
Klebsiella pneumonia	3	13.64
Staphylococcus saprophyticus	3	13.64
Staphylococcus aureus	2	9.10
Enterococcus fecalis	1	4.54
Pseudomonas aeruginosa	1	4.54
Acinetobacter species	1	4.54
Total	22	100

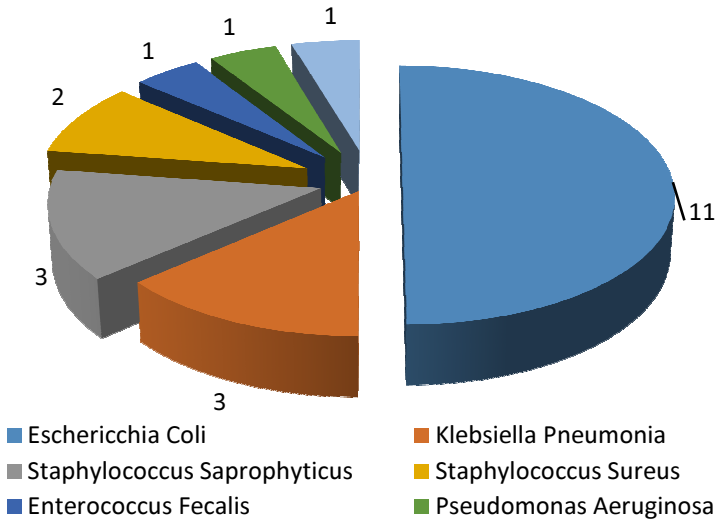


Figure 9: Causative organism

Above table describes the pattern of isolates. Out of the total 22, E. coli was the predominant organism isolated 50% followed by Klebsiella pneumonia and Staphylococcus saprophyticus 13.64%, Staphylococcus aureus 9.10%, Enterococcus fecalis, Pseudomonas aeruginosa, Acinetobacter species 4.54%

Table 9: Prevalence of gram positive and gram negative isolates

Organism	Number	Percentage %
Gram- negative	16	72.73
Gram- positive	6	27.27
Total	22	100

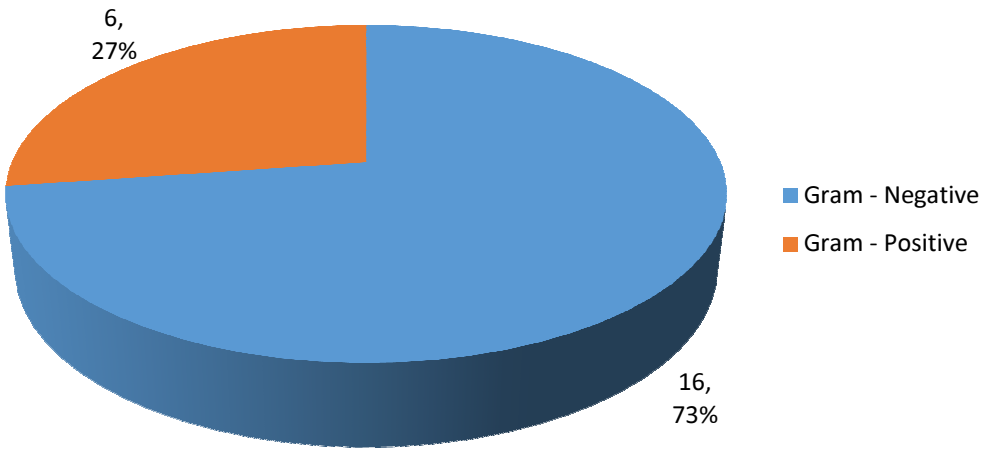


Figure 10: Prevalence of gram positive and gram negative isolates

Above table shows the distribution of Gram-negative organism to be 72.73% as against Gram-positive organism 27.27%.

Table 10: Antibiotic sensitivity

Antibiotics	No. Of cases	Percentage %
Nitrofurantoin	13	59.09
Cephalexin	15	68.18
Cefotaxim	13	59.09
Norfloxacin	9	40.90
Amikacin	18	81.81
Ciprofloxacin	10	45.45
Cotrimoxazole	7	31.81
Gentamicin	5	22.72

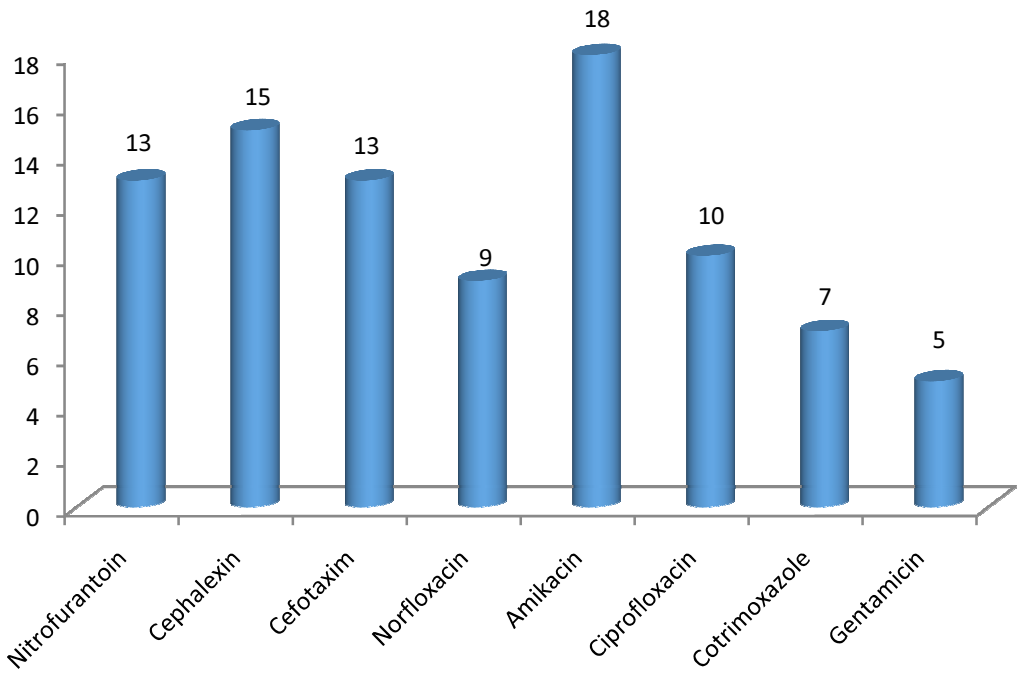


Figure 11: Antibiotic sensitivity

Above table reveals the antibiotic sensitivity of the 22 bacterial isolates. It is seen from the table that 18 (81.81%) strains were sensitive to amikacin followed by Cephalexin (68.18%).

Table 11: Past history of UTI (before 1 yr) and culture positive with significant bacteriuria

History	No. of patients	Percentage %	No. Of positive culture with significant bacteriuria	Percentage %
Past h/o UTI	23	19.01	17	77.27
No past h/o UTI	98	80.99	5	22.73
Total	121	100	22	100

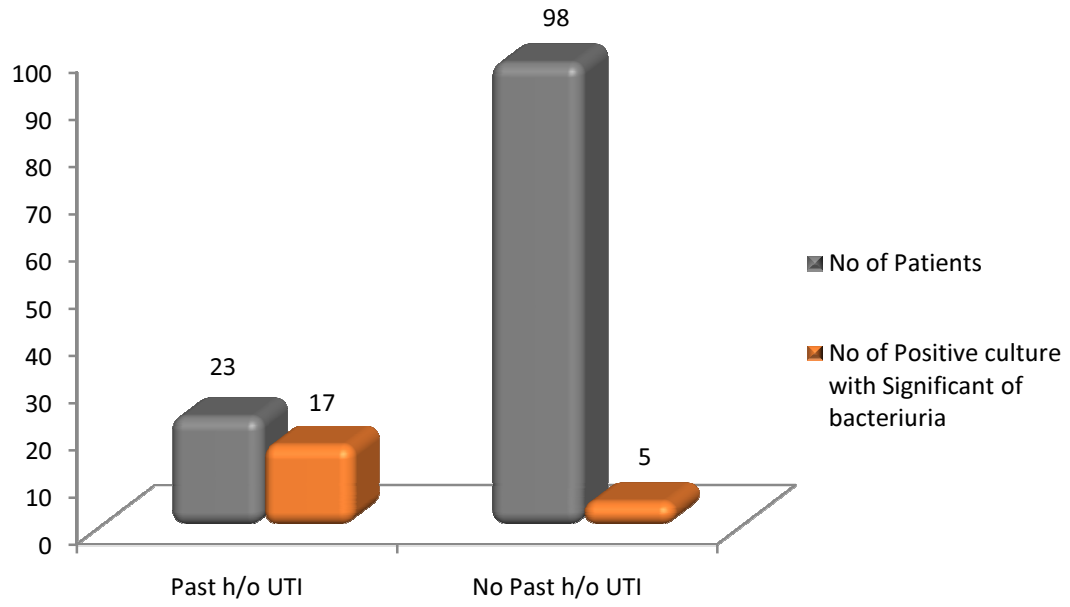


Figure 12: Past history of UTI (before 1 yr) and culture positive with significant bacteriuria

In the present study, culture positivity with significant bacteriuria was highest in the cases with past history of UTI (77.27%).

Table 12: Past History of Catheterization

History	No. of Patients	Percentage %	No. Of positive culture with significant bacteriuria	Percentage %
Past h/o catheterization	31	25.62	15	68.18
No past h/o catheterization	90	74.38	7	31.82
Total	121	100	22	100

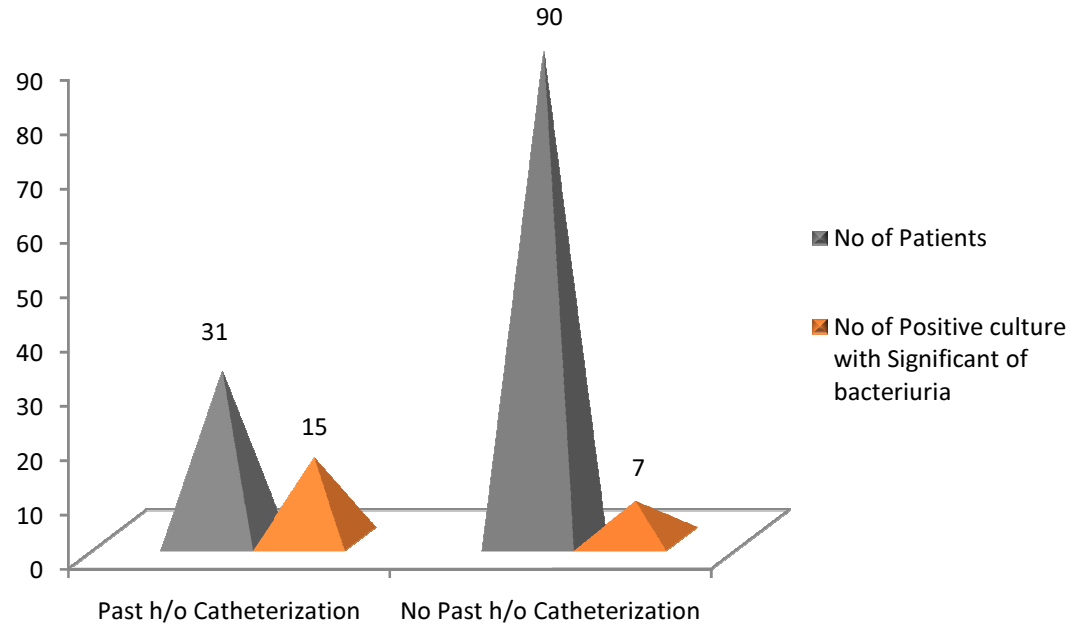


Figure 13: Past history of catheterization

The percentage of culture positivity with significant bacteriuria was more in patients with past history of catheterization (68.18%) than in those controls without past history of catheterization (31.82%).

Table 13: Past history of anemia

History	No of patients	Percentage %	No. Of positive culture with significant bacteriuria	Percentage %
Past h/o anemia	28	23.14	15	68.18
No past h/o anemia	93	76.86	7	31.82
Total	121	100	22	100

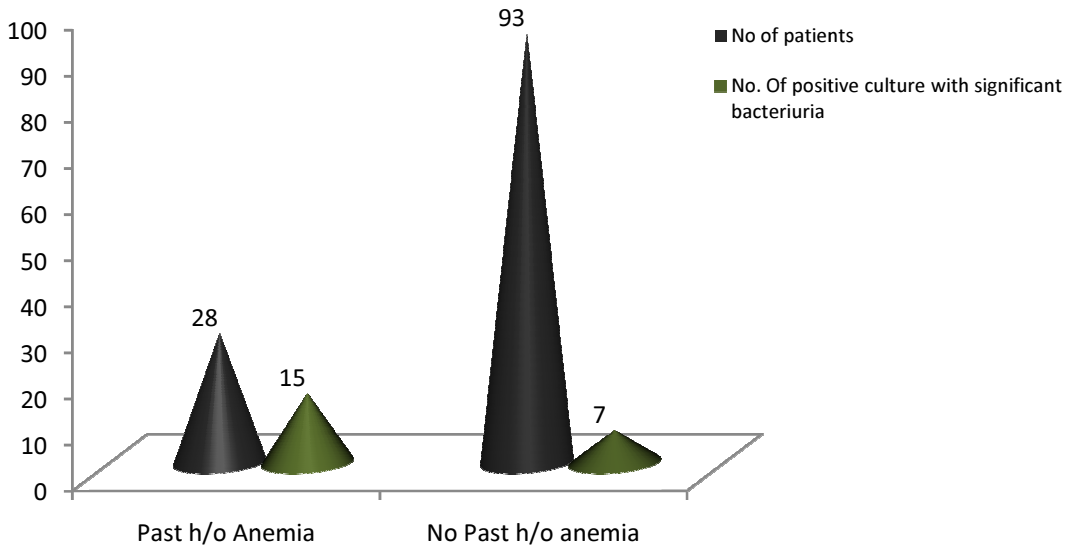


Figure 14: Past history of anemia

Above table shows 68.18% with positive culture had previous history of anemia.

Table14: BMI and asymptomatic bacteriuria

BMI kg/m2	No of patients	Percentage %	No. of positive culture with significant bacteriuria	Percentage %
<18.5	23	19.02	4	18.18
18.6-24.9	52	42.97	5	22.73
25.0-29.9	24	19.83	4	18.18
>30	22	18.18	9	40.91
Total	121	100	22	100

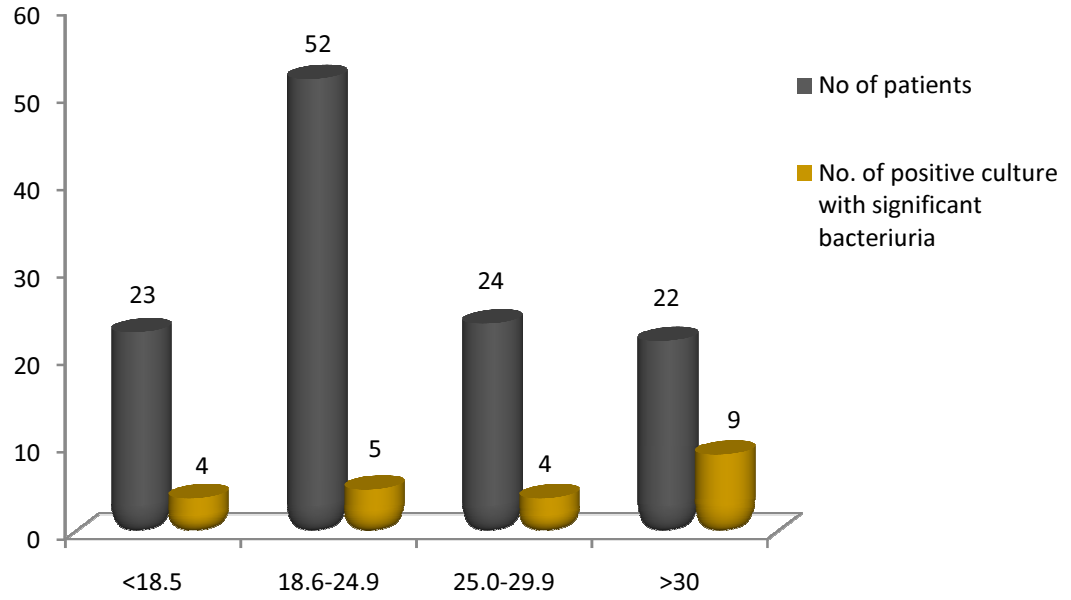


Figure 15: BMI and asymptomatic bacteriuria

Above table shows highest no of positive culture in patient with BMI >30 kg/m^2 (40.91%).

Table 15: History of IUCD use

IUCD	No of patients	Percentage %	No. Of positive culture with significant bacteriuria	Percentage %
h/o IUCD use	32	26.45	10	45.45
No h/o IUCD use	89	73.55	12	54.55
Total	121	100	22	100

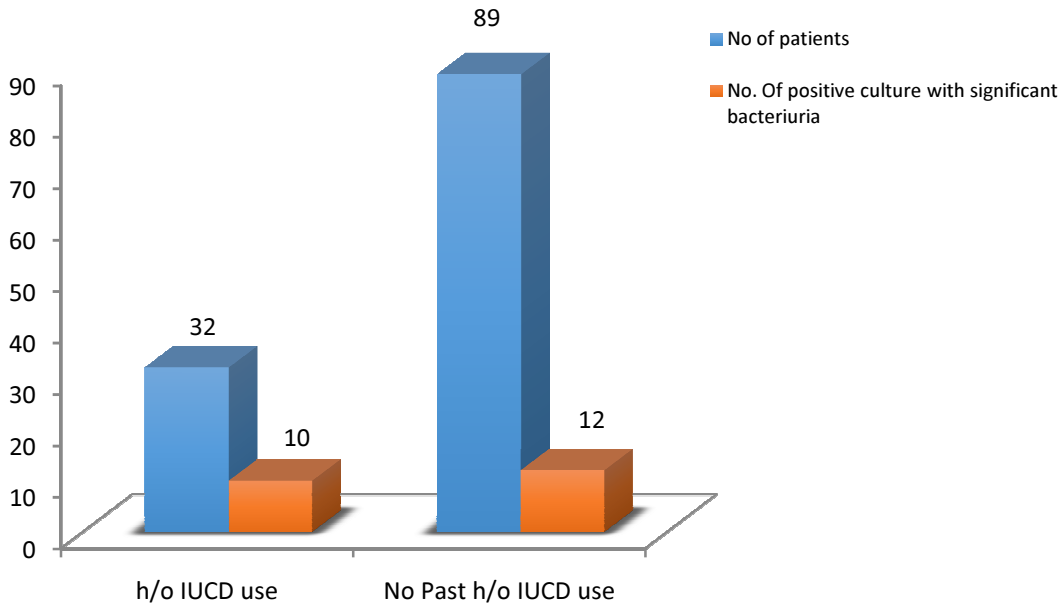


Figure 16: History of IUCD use

Above table shows highest no of positive culture in patient with history of IUCD use.

Discussion

DISCUSSION

In the present study 121 women who came to OPD for regular antenatal check up without any urinary symptoms were selected and were subjected to investigation (urine routine, urine culture and sensitivity). In this study, ASB occurred quite frequently during pregnancy with a prevalence of 18.18%. Most of the studies give a prevalence of 2 to 24% 20 which correlates well with the present study. It is known that, lower socio-economic status, poor personal hygiene and patients attending public hospitals more frequently harbor ASB.[24] Table-16 depicts prevalence of ASB as cited by various authors, in various population.

Table 16: Prevalence of ASB in various studies

Author	Year of publication	Prevalence of ASB
Dodd's et al[41]	1931	11%
Kass et al[41]	1956	6%
Wilson et al[41]	1981	2.2%
Hoja et al[41]	1999	14.3%
Katoty et al[41]	2001	25.8%
Vijayashree et al[41]	2002	24%
Goss et al[41]	2003	4.7%
Paul Erhunn	2010	45.3%
Endale Tadesse	2014	18.8%

In the present study, culture positivity with significant bacteriuria was highest in 20 to 30 years age group (50%). This result correlated with the studies of Mitra P et al. (1977)74 (68.2%).

In the present study, highest culture positivity with significant bacteriuria was noted in 2nd trimester (45.45%). However, Nath G et al. (1996)63 found highest incidence in 3rd trimester (11.95%). The increased culture positivity with significant bacteriuria reported in second trimester in the present study may be due to relatively larger sample size screened were in second trimester (45.47%). This may also be due to peaking of ureteral dilatation during the gestational weeks 22 to 24, thus leading to increased incidence of ASB.[76]

In the present study, the culture positivity with significant bacteriuria was highest in primigravidae (63.64%). This finding correlated with Nath G et al. (1996)[64] (11.47%). The higher culture positivity with significant bacteriuria noted in primigravidae in the present study may be due to the relatively larger sample size screened were primigravidae (59.50%) and physiological changes during pregnancy vary from patient to patient and are more likely to occur during first pregnancies.[44]

In the present study, culture positivity with significant bacteriuria was highest in upper lower socioeconomic status group (36.36%). The higher culture positivity with significant bacteriuria reported in cases belonging to lower socio-economic status in the present study may be due to undernutrition

and lack of hygiene in the lower socio-economic status patients which are associated with a higher incidence of ASB.[77]

In this study, E. Coli was the commonest organism causing ASB, with a prevalence of 50%. World-wide, E. Coli has been the commonest organism with a prevalence of 80%. In Rotakh of India, a study was conducted on the sub-urban population showed that, the E. Coli accounted for 62% of all cases of ASBs.[4] In this study, E. Coli was the commonest organism causing ASB, at a slightly lower with a prevalence of 50%.

Klebsiella sp. and Staphylococcus saprophyticus emerged as the second most common cause of ASB with a prevalence of 13.64%, whereas, world-wide, klebsiella sp. accounted for only 8% of all cases of ASBs, and 29% of all ASBs in Rotakh of India.[4]

In this study Gram negative isolates are seen in higher percentage (72.73%).

In our study most of the isolates are sensitive to Amikacin(81.81%) followed by cephalexin (68.18%), Nitrofureantoin and cefotaxim (59.09%).

In the present study, culture positivity with significant bacteriuria was highest in the cases with past history of UTI (77.27%). This finding correlated with studies of Chang PK et al. (1982)77 The higher culture positivity with significant bacteriuria observed in individuals with past history of UTI may be due to persistent focus of infection within the urinary tract or establishment

of rectal organisms on the mucosa of the vaginal vestibule and female urethra.[79]

In this study, culture positive with significant bacteriuria is higher in patient with past history of catheterization(68.18%) and with past history of anemia (68.18%).

In our study, culture positive with significant bacteriuria is higher in patient who are obese- BMI >30 kg/m^2(40.91%).

In our study we have found there is no association between history of IUCD use and bacteriuria, because higher percentage of bacteriuria is seen in patient who do not have previous history of IUCD use (54.55%).

Conclusion

CONCLUSION

ASB is a common bacterial infection, complicating pregnancy with a high prevalence of 18.18%.

Colony count remains the gold standard for diagnosis of ASB; counts $\geq 10^5$ CFU/ ml considered as being significant.

E. Coli is the commonest organism causing ASB (50%), followed by Klebsiella sp. and Staphylococcus saprophyticus (13.64%). ASB is also common in with primigravida, previous history of UTI, anemia and increased BMI. Mixed infections are also seen

If un-recognized and un-treated, ASB leads to adverse maternal outcome like pyelonephritis, anemia, symptomatic UTI, puerperal fever, wound infections and sub-involution of uterus; adverse fetal outcome like threatened pre-term, PROM, pre-term births, decreased mean gestational age at birth, lower APGAR scores, lower average birth weight, LBW, IUGR, neonatal infections, hypoglycemia, hyperbilirubinemia requiring photo-therapy, apnea, birth asphyxia and prolonged NICU stay.

Prompt and early treatment significantly reduces the adverse pregnancy outcome. Thus, all pregnant women are to be screened for ASB, preferably in the pre-conceptional period or at-least in the 1st trimester.

Once ASB is recognized during pregnancy, it should be aggressively treated with antibiotics and promptly followed up.

Summary

SUMMARY

This cross sectional study conducted in department of obstetrics and gynaecology.

In this period 121 antenatal patients who came for OPD without symptoms of urinary tract infection as chosen and was screened for asymptomatic bacteriuria.

In our study prevalence of asymptomatic bacteriuria was 18.18%. Highest prevalence is seen in age group of 20- 30 yrs (50%).

In our study highest prevalence is seen in second trimester (45.45%), primigravida (63.64%) and in upper lower socio economic status(36.36%).

Most common organism is Escherichia coli(50%) followed by Klebsiella pneumonia, Staphylococcus saprophyticus(13.64%), Staphylococcus aureus(9.10%), Enterococcus fecalis, Pseudomonas aeruginosa, Acinetobacter species(4.54%).

Most of the organism are sensitive to amikacin(81.81%) followed by cephalexin (68.18%), Nitrofurantoin, cefotaxim (59.09%).

Asymptomatic bacteriuria is also seen in higher percentage in patient with previous history of UTI(77.27%), previous history of catheterization (68.18%), previous history of anemia (68.18%), and in obese patient (40.91%).

In our study there is no difference in patients with previous history of IUCD use and bacteriuria, because highest prevalence is seen in patients without previous use of IUCD(54.55%).

Bibliography

BIBLIOGRAPHY

1. Stamm WE, Hooton TM. Management of urinary tract infections in adults. N Engl J Med 1993;329:1328-34.
2. Sampson JE, Gravett MG, Other infectious conditions in pregnancy: James DK, Steer PJ, Weiner CP, Govik B eds. High Risk pregnancy, management options 2nd Edition, London WB Saunders, 1999: 559-98.
3. Hooton TM, Stamm WE. Diagnosis and treatment of uncomplicated urinary tract infection. Infect Dis Clin North Am 1997; 11: 551-82.
4. Nicolle LE. A practical approach to the management of complicated urinary tract infection. Drugs Aging 2001;18:243
5. Bacheller LD, Bernstein JM, Urinary Tract Infections. Med Clin North Am 1997; 8: 719-728
6. Savoia MC. Burrow & Duffy- Medical Complications during Pregnancy. 5th ed. Harcourt Asia Saunders PTE Ltd; 1999; 365-375.
7. Andriole VT, Patterson TF. Epidemiology, Natural History, and Management of Urinary Tract Infections in Pregnancy. Med Clin N Am 1991; 75: 359-371.
8. Uncu Y, Uncu G, Esmer A et al. Should asymptomatic bacteriuria be screened in pregnancy?. Clin Exp Obstet Gynecol 2002; 29:281-5.
9. Nicolle LE. Asymptomatic bacteriuria: when to screen and when to treat. Infect Dis Clin North Am 2003;17:367–94.
10. Rubenstein JN, Schaeffer AJ. Managing complicated urinary tract infections: The urologic view. Infect Dis Clin North Am 2003;17:333–51.

11. Patterson TF, Andriole VT. Detection, significance and therapy of bacteriuria in pregnancy. Infect Dis Clin North Am 1997; 1:593-608.

12. Kremery S, Hromec J, Demesova D. Treatment of lower urinary tract infection in pregnancy. Int J Antimicrobe Agents 2001; 17(4): 279-82.

13. Tayo AO, Akinola OI, Ottun TA, Onakoya JAA, Ogunsanya AO.An appraisal of asymtomatic bacteriuria in pregnancy- The Lagos State University Teaching Hospital Experience. Niger J Clin Med. 2010;3(2):1-8.

14. Sharma JB, Sharma S, Gulati N et al. Prevalence of significant bacteriuria in preterm labor. J Obstet Gynecol India 1990; 40: 336-8.

15. Meis PJ, Michielutte R, Peters TJ, et al. Factors associated with preterm birth in Cardiff, Wales. Am J Obstet Gynecol 1995; 173: 597-602.

16. US Preventive Services Task Force. Screening for asymptomatic bacteriuria. In: Guide to clinical preventive services. 2nd edition. 1996.

17. Zion H, Roni L, Avraham M, Dora M, Hadasa S, Vaclav I. Uriscreen, a rapid enzymatic urine screening test: Useful predictor of significant bacteriuria in pregnancy. Obstet Gynecol 1996;87(3):410-3.

18. Mohankumar T, Chitkara YK, Joseph PS. Detection of bacteriuria - a comparison of two methods. Indian J Pathol Bacteriol 1970;13(3):114-8.

19. Collier Leslie, Balows Albert, Sussman Max. Topley and Wilson's Microbiology and Microbial Infections. Vol. 3. 9th ed. London: Edward Arnold; 1998.

20. Deshmukh CK, Sharma KD. Quantitative culture of urine: A comparative study of semi quantitative method with the quantitative pour-plate method. Indian J Pathol Bacteriol 1970;13(1):12-6.

21. Sweet RL, Gibbs RS. Infectious diseases of the female genital tract. 4th ed. Philadelphia: Lippincott Williams and Wilkins; 2002.

22. Nicolle LE. Asymptomatic bacteriuria - important or not? N Eng J Med 2000; 343(14):1037-9.

23. Sandys GH. A new method of preventing swarming of Proteus spp. with a description of a new medium suitable for use in routine laboratory practice. J Med Lab Technol 1960;17:224-33

24. Simmons NA, Williams JD. Use of a solid reagent in the triphenyl tetrazolium chloride test for bacteriuria. J Clin Pathol 1967;20:767-9.

25. Phillips G, Fleming LW, Khan I, Stewart WK. Urine transparency as an index of absence of infection. Br J Urol 1992; 70:191-5.

26. McNeely MDD. Gradwohl's Clinical Laboratory Methods and Diagnosis. Vol. 1. 8th ed. New Delhi: BI Publications; 1990.

27. Forbes BA, Sahm DF, Weissfeld AS. Bailey and Scott's Diagnostic Microbiology. 10th ed. Missouri: Mosby; 1998.

28. Ananthanarayan R, Paniker CKJ. Textbook of Microbiology. 7th ed. Hyderabad: Orient Longman; 2005.

29. Kloos WE. Natural populations of the genus Staphylococcus. Ann Rev Microbiol 1980; 34:559-92.

30. Chaurasia BD. Human Anatomy: Regional and Applied, Dissection and Clinical. 4th ed. Delhi: CBS Publishers; 2004.

31. Persaud Moore. The Developing Human - Clinically Oriented Embryology. 7th ed. Philadelphia: Saunders; 2003.

32. Baron EJ, Finegold SM. Bailey and Scott's Diagnostic Microbiology. 8th ed. Philadelphia: CV Mosby Company; 1990.

33. Snell RS. Gross Anatomy – A little, Brown Review Book. 1st ed. USA: Little, Brown and Company; 1990.

34. Ellis Harold. Clinical Anatomy – A revision and applied anatomy for clinical students. 10th ed. UK: Blackwell Publishing; 2002.

35. Sinnatamby CS. Last's Anatomy – Regional and Applied. 10th ed. UK: Churchill Livingstone; 1999.

36. Mittal P, Wing DA. Urinary Tract Infections in Pregnancy. Clin Perinatol 2005; 32: 749-764.

37. Belty A, Daniel FF, Alice SS, Wersfeld. Urinary tract infections, Chapter 1, Bailey & Scott's Diagnostic Microbiology. 10th edition, St Louis Moren Mosby, 1998; 556-580.

38. Connolly AM, Thorp JM. Urinary Tract Infections in Pregnancy. Infections in Urology 1999; Lange publication; 94-143.

39. Salvi V. The urinary tract in pregnancy. Chapter 25, Medical and surgical disorders in pregnancy, 1st edition, Jaypee Brothers Medical Publishers (P) Ltd; 234-240.

40. Beischer and Makay. Obstetrics and New born. Chapter 37, 2nd ed. Saunders publication; 314-8.

41. Mishell DR, Murphy T, Brenner PF. Management of Common Problems in Obstetrics & Gynaecology. 4th ed. Blackwell Publishers; 2003; 336-349.

42. Cunningham FG, Gant NF, Levis KJ, Gilstrap LC, Hauth JC, Wenstroen KD.

Renal and Urinary Tract Disorders. Section 8, Chapter 48, 22nd ed. Williams Obstetrics, Mc Graw Hill publication; 1093-1110.

43. Studd J. The lower urinary tract in pregnancy, Labour and Puerperium, part one, obstetrics, chapter 12, volume 9, Progress in OBG, Churchill Livingstone publication; 195-208.

44. Christensen B. Which antibiotics are appropriate for treating bacteriuria in pregnancy? J Antimicrob Chemother 2000; 46: 29-34.

45. Neal Jr DE. Host Defense Mechanisms in Urinary Tract Infections. Infections in Urology. Urol Clin Am 1999; 94-143.

46. Resnik C. Urinary tract in pregnancy. Chapter 41, 4th ed. Saunders publication; 659-62.

47. Lucas MJ, Cunningham FG. Urinary Infections in Pregnancy. Clinical Obstetrics and Gynaecology 1993; 36(4): 855-68.

48. Browne's ANC, Urinary tract in Pregnancy, Chapter 29, 11th ed. Churchill Livingstone publication; 106-117.

49. Roitt MP, Williams W. Urinary tract infections. Chapter 23, Medical Microbiology. 1st ed. Mosby Europe Limited, England; 1993: 231-8.

50. Bent AE, Ostergard DR, Cundiff GW, Swift SE. Ostergard's Urogynaecology and Pelvic Floor Dysfunction. 5th ed. Philadelphia Lippincott Williams & Wilkins; 2003; 261-267.

51. Sweet RL, Gibbs RS. Infectious Diseases of the Female Genital Tract. 4th ed. Philadelphia. Lippincott Williams & Williams; 2002; 427-37.

52. Waltere LD, Karram MM. Lower UTI. Chapter 22, Clinical Urogynaecology.1st

ed. Mosby Year Book Inc.1993; 310-27.

53. Nesier, Anderson, Roberts, Pearsale. The Entero bacteriaceae - A human perspective. Chapter-6, 3rd ed. McGraw-Hill companies; 2001; 304-311.

54. Mittendorf R, Williams MA, Kass EH. Prevention of Preterm Delivery and Low Birth Weight Associated with Asymptomatic Bacteriuria. Clinl Infect Dis 1992; 14:927-32.

55. Rayburn WF, Zuspan FP. Drug Therapy in Obstetrics & Gynaecology. Drugs for Urogynaecological disorders, 3rd ed. Mosby Year Book Inc.1992; 425-7.

56. Partorick JG, UTI and Pyelonephritis in Pregnancy. Chapter 29, Obstetric and Gynecological infectious diseases, Raven press; 283-291.

57. Ransom SB, Dombrowski MP, Neeley S, Kamran GM, Adan SM, Munkarah R. The Urinary tract. Chapter 8, Practical strategies in Obstetrics and Gynaecology. Philadelphia: W. B. Saunders company; 2000; 389-399.

58. Ananthnarayan & Paniker. The Enterobacteriaceae. Chapter 1, Textbook of Microbiology, 7th ed. Orient Longman publishers; 2005: 254-255.

59. Gupta N, Sharma A, Saini S, et al. Disc Susceptibility and Minimum Inhibitory Concentration of Microbes in Urinary Tract Infections, Indian Assoc Med Microbiol 2002; 183.

60. Pezzlo M. Aerobic Bacteriology. Section 2, Essential Procedures for clinical Microbiology. 1st ed. Washington DC; 1998; 356-61.

61. Koneman EW, Williams SD, Jada M, Schremmer PC. Introduction to Microbiology. Part 2: Guide lines for the collection, transport, processing, analysis and reporting of cultures from specimen sources. Chapter 3, 5th ed. 1997; 136-141.

62. Chakraborthy. A Textbook of Microbiology. 2nd ed. New Central Book Agency (P) Ltd. Kolkata; 2003; 243-239.

63. Burrow and Duffy, Renal diseases in pregnancy. Chapter 12, Medical complications during pregnancy, 5th ed. W.B. Saunder's company; 235-251.

64. Nath G, Chaudhary M, Prakash J, Pandey LK, Singh TB. Urinary Tract Infection during Pregnancy and Fetal Outcome. Indian J Med Microbiol 1996;14(3):158-60.

65. Barron WM, Lindhimer MD, Davison JM. Medical Disorders during Pregnancy. Chapter 13, 2nd ed. Mosby Year Book Inc.1995; 356-361.

66. Chamberlain G. The Urinary Tract in Pregnancy. Chapter 23, Turnbull's Obstetrics, 3rd edition, Churchill Livingstone publication; 1009-1020.

67. Robert L, Jennifer G, Culhane F, Derek C, Johnson BA. Maternal Infection and Adverse Fetal and Neonatal Outcomes. Clin Perinatol 2005; 32: 523-59.

68. Mukherjee G. UTI in pregnancy and preterm labour. Chapter 17, Indian society of Perinatology and Reproductive biology, 6th ed, Jaypee publications;p.66-70.

69. Bonnar J. Advantages in use of antibiotics in prevention of preterm birth. Section 1, Chapter 3, Recent Advances in OBG, Churchill Livingstone publication; 2001;p.76-81.

70. Studd J. Role of infections in pathogenesis of preterm labour, part one-Obstetrics, chapter 9, Progress in OBG, Churchill Livingstone publication; 2002; p. 54-59.

71. Gilstrap LC, Leveno KJ, Cunningham FG, Whalley PJ, Roark M. Renal Infection and Pregnancy Outcome. Am J Obstet Gynecol 1998; 141:709-715.

72. Hacker and Moore. Essentials of Obstetrics and Gynecology. Chapter 41, Genito-urinary dysfunction, 3rd edition, W.B. Saunders Company;p.726-35.

73. Gopal R. UTI in pregnancy. Chapter 67, Contemporary therapy in Obstetrics and Gynecology, Jaypee Brothers Medical Publishers (P) Ltd; 2001;p.235-42.

74. Michelle MV, Barlow BJ. Urinary disorders in pregnancy. Current obstetrics and Gynecology, 8th edition, Lange publication, Prentice hall inc.p.428-67.

75. Mitra P, Kulkarni VA, Sengupta SR, Sathe CH. Bacteriuria in pregnancy and its treatment. J Obstet Gynecol Ind 1977; 27:711-8.

76. Delzell JE, Lefevre ML. Urinary tract infections during pregnancy. Am Fam Physician 2000; 61:713-21.

77. Fox H, Wells M. Haines and Taylor Obstetrical and Gynaecological Pathology. Vol. 2. 5th ed. New York: Churchill Livingstone; 2002.

78. Chang PK, Hall MH. Antenatal prediction of urinary tract infection in pregnancy. Br J Obstet Gynaecol 1982; 89:8-11.

79. Mulholland SG. Female urinary tract infection. Prim Care 1985;12(4):661-73.

80. Brooks GF, Bentel JS, Morse SA. Principles of Diagnostic Medical Microbiology. Janate Meluick and Adelbeig's Medical Microbiology, 21st ed. Appleton & Lange; 1998. p. 652-66.

81. Greenwood D, Slack R, Peutherer J, Barer M. Medical Microbiology. A guide to microbial infections: Pathogenesis, Immunity, Lab diagnosis & Control. 17th ed. Churchill Livingstone publication; 2007. p.356-381.

82. Mohammad M, Mahdy ZA, Omar J, Maan N, Jamil MA. Laboratory Aspects of Asymptomatic Bacteriuria in Pregnancy. Southeast Asian J Trop Med Public

Health 2002;33(3): 575-80.

83. Graham JC, Galloway A. ACP Best Practice No 167: The Laboratory Diagnosis of Urinary Tract Infection. J Clin Pathol 2001; 54:91.

84. Fihn SD. Acute Uncomplicated Urinary Tract Infection in Women. Obstet Gynecol 2003; 259-66.

85. Rouse DJ, Andrews WW, Goldenberg RL, Owen J. Screening and Treatment of Asymptomatic Bacteriuria of Pregnancy to Prevent Pyelonephritis: A Cost-Effective and Cost-Benefit Analysis. Obstet Gynecol 1995; 86(1):119-23.

86. Neelam J, Kavya M, Rungemi M, Nandita D, Meera S. Evaluation of Three Screening Methods for Detection of Urinary Tract Infection in Antenatal Women. J Obstet Gynecol Ind 2004; 267-70.

87. Jayalakshmi J, Jayaram VS. Combined Leukocyte Esterase and Nitrite Test to Screen Asymptomatic Bacteriuria in Pregnant Women. Indian J Microbiol 2002; 31-5.

88. Hooton TM, Scholes Delia, Staphton AE, et al. A prospective study of asymptomatic bacteriuria in sexually active young women. N Engl J Med 2000;343(14):992-7.

89. Koneman EW, Allen SD, Janda WM, Schreckenberger PC, Winn WC. Colour Atlas and Textbook of Diagnostic Microbiology. 5th ed. Philadelphia: Lippincott; 1997.

90. Collee JG, Fraser AG, Marmion BP, Simmons A. Mackie and McCartney – Practical Medical Microbiology. 14th ed. Edinburgh: Churchill Livingstone; 1996.

91. Monica C. District Laboratory Practice in Tropical Countries. Part 2. UK: Cambridge University Press; 2000.

92. Sweit MD. Renal diseases in pregnancy. Chapter 16, Medical disorders in Obstetric practice, 4th ed. Blackwell Publishing; p. 508-509.

Appendices

SREE MOOKAMBIKA INSTITUTE OF MEDICAL SCIENCES

KULASEKHARAM

RESEARCH COMMITTEE

CERTIFICATE

This is to certify that The Research Protocol Submitted by R. Sandhiya

Faculty / Post Graduate from Department of Obstetrics and Gynaecology *Titled* "Prevalence of Asymptomatic bacteriuria among Pregnant women attending the tertiary care Center."

is approved by the Research Committee.

Chair Person

Prof. & H.O.D.
Dept. of Bio-Chemistry
Sree Mookambika Institute of Medical Sciences
Kulasekharam 629 161

Convenor

Prof. & H.O.D.
Dept. of Physiology
Sree Mookambika Institute of Medical Sciences
Kulasekharam 629 161

Date : 04/12/15

SREE MOOKAMBIKA INSTITUTE OF MEDICAL SCIENCES

(Kulasekharam (K.K District, TN)-629161, Phone No: 04651-280866, Fax No: 280740)

Institutional Human Ethics Committee (IHEC)

{CDSCO Reg No: ECR/446/Inst/TN/2013}

Ref. No: SMIMS/IHEC/2015/A/19 **Date: 17th February 2016**

CERTIFICATE

This is to certify that the Research Protocol Ref. No. **SMIMS/IHEC/2015/A/19** entitled "Prevalence of Asymptomatic Bacteriuria among Pregnant Women Attending the Tertiary Care Center" submitted by Dr. R Sandhiya, Postgraduate of Department of Obstetrics and Gynaecology, SMIMS has been approved by the Institutional Human Ethics Committee at its meeting held on 15th December 2015.

Dr. Rema Menon. N
Member Secretary
Institutional Human Ethics Committee
Professor and HOD of Pharmacology
SMIMS, Kulasekharam (K.K District)
Tamil Nadu-629161

[This Institutional Human Ethics Committee is organized and is operating according to the requirements of ICH-GCP/GLP guidelines and requirements of the Amended Schedule-Y of Drugs and Cosmetics Act, 1940 and Rules 1945 of Government of India.]

CONSENT FORM

PART – 1 OF 2

INFORMATION FOR PARTICIPANTS OF THE STUDY

Dear Participants,

We welcome you and thank you for your keen interest and participation in this research project. Before you participate in this study it is important for you to understand why this research is being carried out. This form will provide you all the relevant details of this research .It will explain the nature, purpose, the benefits, the risks, the discomforts, the precautions, and the information about how this project will be carried out. It is important that you read and understand the contents of the form carefully. This form may contain certain scientific terms and hence if you have any doubts or if you want more information, you are free to ask the study personnel or the contact person mentioned below before you give your consent and also at any time during the entire course of the project.

1. **Name of the principal investigator:** Dr. R.Sandhiya.
Designation: Post graduate student
Department: M. S. Obstetrics and Gynaecology
Institute and place: Sree Mookambika Institute of Medical Sciences, Kulasekharam.

2. **Name of the Guide:** Dr. Rema V Nair
Designation: Professor
Department: Obstetrics & Gynaecology
Institute and place: Sree Mookambika Institute of Medical Sciences, Kulasekharam.

3. **Name of the Co-Guide:** Dr. Sreelakshmi Ajay
Designation: Asst. Professor
Department: Obstetrics & Gynaecology
Institute and place: Sree Mookambika Institute of Medical Sciences, Kulasekharam

4. **Institute details with Address:** Sree Mookambika Institute of Medical Sciences, Padanilam, Kulasekharam, Kanyakumari District, Tamilnadu

5. **Title of the study:**

Prevalence of asymptomatic bacteriuria among pregnant women attending the tertiary care centre.

6. Background information:

Urinary tract infections (UTIs) are one of the commonest of all infections. Asymptomatic bacteriuria is one of the clinical manifestations of UTI. It is defined as persistently and actively multiplying bacteria in significant numbers i.e., 10^5 bacteria per milliliter (ml) within the urinary tract without any obvious symptoms. It is also known as Covert bacteriuria. The term asymptomatic bacteriuria of pregnancy refers to the presence of a positive urine culture in an asymptomatic pregnant female. Females are more susceptible for these infections because of short urethra. The pregnant females are two times more commonly affected than age matched non pregnant females. The reason behind is urinary stasis due to progesterone effect in pregnancy in addition to different anatomical changes occurring during pregnancy. Various studies from the west have documented the prevalence of asymptomatic bacteriuria in pregnancy to be between 2 and 7% while in India it was found to be on higher side i.e., between 5 and 12%. Commonest organisms responsible is Escherichia coli (80–85%).

7. Aims and objectives:

- To identify the pervalence of asyptomatic bacteriuria in pregnancy.
- To study the commonest isolates from pregnant mother attending OPD in SMIMS.

8. Scientific justification of the study:

Asymptomatic bacteriuria is a common infection. Pregnant women with asymptomatic bacteriuria are at an increased risk for adverse maternal and fetal outcomes which could be prevented by antimicrobial treatment of asymptomatic bacteriuria. This study will help in assessing the prevalance of asyptomatic bacteriuria in pregnant women in the Kanyakumari district of Tamil Nadu.

9. Procedure of the study:

Pregnant women attending Obstetrics and Gynaecology outpatient department, Sree Mookambika Institute of Medical Science Kulasekharam, who fulfill the inclusion and exclusion criteria are considered for the study. Total 121 women are included in the study.

A detailed history will be taken which will include the patient's education, occupation, socio-economic status, menstrual history, obstetric history, past medical and surgical history and personal history. A thorough general physical examination will be done. Vitals signs and all systems will be examined.

The Gold standard investigation for detection of asymptomatic bacteriuria is urine culture. Therefore, urine culture at first prenatal visit or between 12 and 16 weeks of gestation is done in all antenatal patient without urinary complaints.

10. Expected risks for the participants: No risk

11. Expected benefits of research for the participants: This study will help in timely diagnosis and intervention in gravid women who are found to have asyptomatic bacteriuira and hence help improve

the pregnancy outcome. This study will also be beneficial for the betterment of the Health Sector in Kanyakumari district of Tamil Nadu.

12. Maintenance of confidentiality: Yes

13. Why have I been chosen to be in the study?

You have been chosen to be a part of this study because you are a pregnant woman who has presented to the Obstetrics Outpatient department for antenatal checkup

14. How many patients will be in the study? 121

15. Agreement of compensation to the participants (in case of a study related injury): Not applicable

16. Anticipate prorated payment, if any to the participants of the study? Not applicable

17. Can I withdraw from the study, at any time during the study period? Yes

18. If there is any new findings / information, would I be informed? Yes

19. Expected duration of the participant's participation in the study: One time visit.

20. Any other pertinent information? Nil

21. Whom do I contact for further information?

For any study related queries you are free to contact:
R. SANDHIYA
Post Graduate - M. S. (OBSTETRICS AND GYNAECOLOGY),
Department of OBSTETRICS AND GYNAECOLOGY,
SREE MOOKAMBIKA INSTITUTE OF MEDICAL SCIENCES,
KULASEKHARAM
Mobile number: 09751571677
Email.id: sandhiyaramalingam@rocketmail.com

Place: Kulasekharam

Date:

Signature of Principal investigator **Signature of participant**

PART – 2 OF 2

PARTICIPANTS CONSENT FORM

The details of the study have been explained to me in writing and the details have been fully explained to me. I am aware that the results of the study may not be directly beneficial to me but will help in the advancement of medical sciences. I confirm that I have understood the study and had the opportunity to ask questions. I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without the medical care that will normally be provided by the hospital being affected. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s). I have been given an information sheet giving details of the study. I fully consent to participate in the study titled "PREVALENCE OF ASYMPTOMATIC BACTERIURIA IN PREGNANCY"

Serial no/Reference no:

Name of participant:

Address :

Contact no: **Signature of the participant**

Witness

1.

2.

Date :

Place : Kulasekharam

SREE MOOKAMBIKA INSTITUTE OF MEDICAL SCIENCES

Padanilam, Kulasekharam, K.K. Dist, Tamilnadu – 6291 61

DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY

Title : Prevalence of asyptomatic bacteriuria among pregnant women attending tertiary care centre

CASE RECORD FORM

Name: …….. OP No.:……

Age : ……. Contact number:……..

Address: …….

Demographic Data

Name: IP no:

Age: Address:

Education:

i) Illiterate ☐ ii) Primary education ☐ iii) Pre degree ☐

iv) Graduate ☐ v) Postgraduate ☐

Occupation:

i) Unemployed ☐ ii) Unskilled ☐

iii) Unskilled ☐ iv) Professional ☐

Socio Economic Status:

LMP: ……. EDC: ……..……

1. H/O SYMPTOMS OF BACTERERIURIA

Burning micturition	Yes	☐	No	☐
Fever	Yes	☐	No	☐
Increased frequency of micturition	Yes	☐	No	☐
Lower abdominal pain	Yes	☐	No	☐

2. PAST OBSTETRIC HISTORY :

Obstetric Score: G ☐ P ☐ L ☐ A ☐

Antenatal period …….. . Intranatal period ……..

Postnatal period ……

Mode of delivery:

i)Normal vaginal ☐ ii)Vaccum/forceps ☐ iii)Caesarean ☐

3. PAST HISTORY

Diabetes mellitus	☐	Hypertension	☐
Tuberculosis	☐	Bronchial asthma	☐
Thyroid disorder	☐	Surgery	☐
Hospitalization	☐	H/o UTI in past	☐

H/o use of antibiotics with in a period of last 6 month. ☐

4. FAMILY HISTORY

Diabetes mellitus	☐	Thyroid disorder	☐
Hypertension	☐		
Tuberculosis	☐	Bronchial asthma	☐

5. PERSONAL HISTORY

Diet:	Veg	☐	Mixed	☐
Sleep:	Adequate	☐	Inadequate	☐
Appetite:	Increased	☐	Good	☐
	Decreased	☐		

Bowel and bladder habits:

Burning micturation ☐ Increased frequency of micturation ☐

Addictions : ……

EXAMINATION OF THE PATIENT:

Height : …….cm Weight : ……Kg BMI: …..…kg/m^2

Pallor Present ☐ Absent ☐

Icterus Present ☐ Absent ☐

Cyanosis Present ☐ Absent ☐

Clubbing Present ☐ Absent ☐

Lympahadenopathy Present ☐ Absent ☐

Pedal edema Present ☐ Absent ☐

Breast …… Spine …… Thyroid ……

Temp: …….°F Pulse: ……/min BP: ……..….mmHg

CVS …… RS ….…… CNS …….

P/A Fundal height …… Presentation ……. FH ……/min

INVESTIGATIONS:

1) Urine routine examination:

Albumin …….. Sugar ……

Deposites:

Pus cell: ……./HPF Epithelial cells: ……./HPF

RBC's: ……./HPF Others : ……./HPF

2) Culture /Sensitivity report : …….

Date: Signature

MASTER CHART

Sl. No	AGE	(+) FOR BACTERURIA	POG	PAUCITY	SES	ORGANISM	GRAM (+),(-)	SENSITIVITY	PAST H/O UTI	H/O CATHETERISATION	H/O ANAEMIA	BMI	H/O IUCD
1	22	2	2	1	3	0	0	0	2	2	2	2	2
2	26	2	1	1	1	0	0	0	2	2	2	3	2
3	32	2	3	2	2	0	0	0	1	2	2	2	1
4	23	1	2	1	3	1	1	1,2,4,5,6	2	1	2	2	2
5	19	2	3	2	4	0	0	0	2	2	2	4	1
6	30	2	2	1	3	0	0	0	2	2	2	2	2
7	31	2	1	2	4	0	0	0	2	1	2	3	2
8	31	2	2	1	3	0	0	0	2	2	2	4	2
9	27	2	3	2	1	0	0	0	2	2	2	2	2
10	34	1	1	2	4	3	2	2,3,5,6,7	1	2	1	4	1
11	24	2	2	1	3	0	0	0	2	2	2	4	2
12	28	2	3	2	2	0	0	0	2	1	2	3	1
13	17	2	1	1	5	0	0	0	2	2	2	1	2
14	21	2	1	1	1	0	0	0	2	2	2	4	2
15	32	2	2	2	2	0	0	0	2	2	1	2	2
16	20	2	1	1	3	0	0	0	2	2	2	4	2
17	32	2	3	2	4	0	0	0	2	2	2	2	1
18	19	1	3	1	3	1	1	1,2,5,8	1	1	2	1	2
19	22	2	1	1	3	0	0	0	2	2	2	4	2
20	34	2	2	2	2	0	0	0	2	1	1	2	2
21	23	2	2	1	3	0	0	0	2	2	2	4	2

22	32	1	1	2	1	2	1	3,4,6	2	1	1	4	1
23	27	2	2	2	2	0	0	0	2	2	2	3	1
24	19	2	1	1	4	0	0	0	2	2	2	2	2
25	29	2	1	2	1	0	0	0	2	1	2	4	1
26	31	2	2	1	2	0	0	0	2	2	2	2	2
27	22	1	2	1	4	1	1	1,2,5	1	1	2	3	2
28	32	2	2	2	3	0	0	0	2	2	1	2	2
29	33	2	1	1	2	0	0	0	2	2	2	3	1
30	20	2	2	2	5	0	0	0	2	2	2	1	2
31	31	2	2	2	3	0	0	0	2	2	1	2	2
32	18	1	3	1	2	1	1	1,3,5	2	2	1	3	2
33	32	2	1	1	3	0	0	0	2	2	1	2	2
34	18	2	2	2	4	0	0	0	2	2	2	3	2
35	21	2	3	1	3	0	0	0	2	2	2	2	2
36	32	2	1	2	2	0	0	0	1	2	1	4	1
37	23	2	2	1	4	0	0	0	2	2	2	1	2
38	31	2	3	2	2	0	0	0	2	1	2	3	2
39	23	2	1	1	3	0	0	0	2	2	2	1	2
40	18	2	2	1	5	0	0	0	2	2	2	2	2
41	24	2	1	2	4	0	0	0	2	2	2	4	1
42	31	1	2	2	4	1	1	1,2,5,6	1	1	1	4	1
43	27	2	2	1	3	0	0	0	2	2	2	2	2
44	32	2	3	2	4	0	0	0	2	2	2	1	2
45	25	2	2	1	1	0	0	0	2	2	2	4	2
46	31	2	1	2	2	0	0	0	2	2	2	2	1
47	27	2	2	1	3	0	0	0	2	2	2	3	2

48	31	2	2	1	3	0	0	0	2	2	2	2	2
49	17	2	1	2	4	0	0	0	2	2	2	1	2
50	21	1	3	1	3	4	2	3,4,5,7,8	1	2	1	2	2
51	31	2	3	2	2	0	0	0	2	1	1	3	1
52	25	2	2	1	3	0	0	0	2	2	2	1	2
53	35	1	1	2	4	1	1	1,2,5,6,7	1	1	2	1	1
54	24	2	2	2	4	0	0	0	2	2	2	2	2
55	32	2	3	1	2	0	0	0	2	2	2	2	2
56	22	2	1	2	3	0	0	0	2	2	2	2	1
57	23	2	2	1	1	0	0	0	2	2	2	4	2
58	19	2	3	2	4	0	0	0	2	1	2	1	2
59	21	2	1	1	2	0	0	0	2	2	2	2	2
60	20	1	2	1	3	5	2	2,3,5,7	1	1	2	3	2
61	26	2	2	2	2	0	0	0	2	2	2	4	1
62	31	2	3	1	3	0	0	0	2	2	1	1	2
63	27	2	1	2	2	0	0	0	2	1	2	3	1
64	17	2	2	1	4	0	0	0	2	2	2	2	2
65	29	2	3	2	1	0	0	0	2	2	2	1	1
66	33	1	2	2	4	6	1	1,2,5,6	1	1	1	4	1
67	28	2	2	1	2	0	0	0	1	2	2	2	2
68	22	2	1	1	3	0	0	0	2	2	2	3	2
69	21	2	2	1	2	0	0	0	2	2	2	2	1
70	18	2	1	1	4	0	0	0	2	2	2	1	2
71	36	1	3	2	3	3	2	2,3,5	2	1	1	4	1
72	27	2	2	1	3	0	0	0	2	2	2	2	2
73	26	2	3	1	4	0	0	0	2	2	2	1	2

74	36	2	1	2	1	0	0	0	2	1	1	2	2
75	31	2	2	1	3	0	0	0	1	2	2	3	2
76	25	2	2	2	2	0	0	0	2	1	2	2	2
77	19	2	1	1	4	0	0	0	2	2	2	1	2
78	24	2	2	2	1	0	0	0	2	2	2	3	2
79	36	2	1	1	3	0	0	0	2	2	2	2	2
80	25	1	2	1	4	1	1	1,3,5,7	1	2	1	4	2
81	31	2	3	2	2	0	0	0	2	2	2	2	1
82	27	1	1	1	5	4	2	1,2,4,5,7	1	1	1	2	2
83	19	2	2	1	4	0	0	0	2	2	2	3	2
84	23	2	3	1	3	0	0	0	2	2	2	2	2
85	32	2	1	2	2	0	0	0	2	1	1	2	1
86	22	2	2	1	3	0	0	0	2	2	2	2	2
87	18	1	3	1	2	1	1	2,3,5	1	2	1	1	2
88	21	2	2	1	3	0	0	0	2	2	2	2	2
89	34	2	1	2	1	0	0	0	2	1	1	3	2
90	18	2	1	1	4	0	0	0	2	2	2	1	2
91	24	2	1	2	2	0	0	0	2	2	2	2	1
92	28	1	2	1	4	2	1	1,3,4,6,8	1	1	1	2	1
93	31	2	2	1	3	0	0	0	2	2	2	3	2
94	22	2	1	2	2	0	0	0	2	2	1	2	1
95	21	2	2	1	3	0	0	0	2	2	2	1	2
96	32	1	2	2	2	1	1	2,4,5,8	1	1	1	4	1
97	22	2	3	1	2	0	0	0	2	2	2	2	2
98	21	2	1	1	2	0	0	0	2	2	2	2	2
99	22	2	2	1	3	0	0	0	2	2	2	2	2

100	25	1	3	1	5	3	2	1,2,5,6	1	1	1	4	2
101	18	2	3	2	4	0	0	0	2	1	2	1	2
102	24	2	2	1	4	0	0	0	2	2	2	1	2
103	23	1	2	1	3	7	1	3,4,5,8	1	2	2	3	1
104	32	2	3	2	2	0	0	0	2	2	2	3	1
105	27	2	1	1	1	0	0	0	2	2	2	2	2
106	28	2	2	1	3	0	0	0	2	2	2	2	2
107	29	2	3	1	4	0	0	0	2	2	1	1	2
108	19	1	3	1	5	1	1	1,2,3,6	1	2	2	1	2
109	32	2	1	2	2	0	0	0	2	1	2	2	2
110	24	2	2	1	3	0	0	0	2	2	2	3	2
111	21	2	3	1	2	0	0	0	2	2	2	2	2
112	31	2	1	2	2	0	0	0	1	2	2	2	2
113	22	2	2	1	3	0	0	0	2	2	2	3	2
114	30	1	1	2	4	2	1	3,4,5,6	2	1	2	4	1
115	23	2	3	1	3	0	0	0	2	2	2	2	2
116	19	2	2	2	4	0	0	0	2	1	2	1	2
117	21	2	1	1	1	0	0	0	2	2	2	3	2
118	22	1	2	1	3	1	1	1,2,3,4,7	1	1	1	2	2
119	31	2	2	2	2	0	0	0	2	2	1	2	2
120	24	2	1	1	3	0	0	0	2	2	2	2	2
121	31	2	2	1	2	0	0	0	1	1	2	2	1