Study of Some Bacterial Isolates Associated with Leukocytospermia in Asthenospermic Patients in Hilla City, Iraq

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Abstract

One hundred asthenospermic seminal fluid specimens were collected from 100 infertile males who referred to Babylon maternity and children hospital-infertility center. It was found that 70 seminal fluid specimens had asthenospermia with leukocytospermia (First group). The rest 30 seminal fluid specimens had asthenospermia without leukocytospermia (Second group). Regarding semen cultures the results showed that 61(87.1%) of specimens of First group revealed positive bacterial culture, whereas 9(12.9%) specimens of First group showed no bacterial growth even after incubation of 48 hours. All semen specimens of Second group revealed negative bacterial culture. Gram positive bacteria constituted 44(62.9%) while gram negative bacteria constituted 26(37.1%) of isolates. Coagulase negative staphylococci (CoNS) represented by Staphylococcus epidermides and Staphylococcus saprophyticus were the common type of bacterial isolates 25(35.7%) followed by Staphylococcus aureus 19(27.2%), Escherichia coli 12(17.1%), Enterobacter aerogenes 8(11.4%), Acinetobacter spp 4(5.7%) and Moraxella spp 2(2.9%). The virulence factors of bacterial isolates were investigated. The results showed that all S. aureus isolates, 18(72%) isolates of CoNS and 5(41.7%) of E. coli isolates and 4(50%) of E. aerogenes isolates produce hemolysin. Colonization factor antigens (CFA/III) were detected in all isolates of S. aureus, CoNS, E. coli, E. aerogenes, Acinetobacter spp. and Moraxella spp. (CFA/I) were expressed in 10(52.6%) isolates of S. aureus, 8(32%) isolates of CoNS, 8(66.7%) isolates of E. coli, 6(75%) isolates of E. aerogenes, 2(50%) isolates of Acinetobacter spp. and 1(50%) isolate of Moraxella spp. Lipase produced by 15(78.9%) and 7(28%) isolates of S. aureus and CoNS isolates respectively, while 9(75%) isolates of E. coli, 7(87.5%) isolates of E. aerogenes and 1(50%) isolate of Moraxella spp. produce lipase. Only 7(36.8%) isolates of S. aureus and 5(41.7%) isolates of E. coli were found to be protease producers. The effects of some antibiotics on bacterial isolates were investigated. The results showed that, the bacterial isolates were highly susceptible to imipenem, meropenem and ciprofloxacin whereas exhibited moderate resistance to amikacin, gentamycin and norfloxacin. On the other hand bacterial isolates revealed high rate of resistance to amoxicillin, ceftizoxime, cefazidime, cefamandole, cefepime, amoxicillin–clavulanic acid and tobramycin.

Keywords: Bacteriospermia, Asthenospermia, leukocytospermia, CoNS, colonization factor antigens.

Introduction

Male urogenital tract infection is one of the most important causes of male infertility, worldwide since genital tract infection and inflammation have been associated with 8-35% of male infertility cases. Bacteriospermia is defined as the presence of bacteria in seminal fluid samples. Bacteriospermia may play a major role in infertility. Male accessory sex glands infection is a major risk factor in infertility. The significance of pathophysiology of bacteriospermia has been seriously discussed in recent years. Some possible pathomechanisms of the development of infertility linked with infection are considered: direct effect on sperm function (motility, morphology), deterioration of spermatogenesis, autoimmune processes induced by inflammation and dysfunction of accessory sex glands. Hence, microbiological investigation of male partners in infertile couple can be useful to detect the male urogenital tract infection, especially asymptomatic infections.

The isolation of microorganisms from seminal fluid especially of infertile men had been widely reported. It is always recommended that microbiological study of semen can be performed in asymptomatic infertile men with leukocytospermia. Aerobic and anaerobic culture of semen can detect a wide range of urogenital pathogens. The most widely studied genital microorganism in relation to male infertility is Escherichia coli, which is also the principal microorganism that causes prostatitis and epididymitis. Infections in the reproductive tract of infertile men have been acknowledged for decades. Until recently, the condition of leukocytospermia was used as an indicator of genital tract infection. However, a relatively large number of men who attend fertility clinics exhibit leukocytospermia without symptoms of genital infections, indicating that there is not a necessary relationship between infections in the genital tract and the amount of leukocytes or antisperm antibodies in semen. This study was suggested and designated to Investigate the relationship between bacteriospermia and leukocytospermia in infertile male with...
Asthenospermia and Studying some of the virulence factors and antimicrobial susceptibility patterns of the isolated bacteria.

**Material and Methods**

**Patients:** Asthenospermic seminal fluid specimens were collected from (100) infertile males. The asthenospermic specimens were divided into two groups according to the presence of leukocytes in their specimens (leukocytospermia):

**First group:** this group included 70 asthenospermic specimens with leukocytospermia (>1×10⁶ pus cell/ml of seminal fluid).

**Second group:** this group included 30 asthenospermic specimens without leukocytospermia (<1×10⁶ pus cell/ml of seminal fluid).

Infertile male age range from (25-44) years with mean age of (32.11) years. Abstinence time range from (72-120 hrs.). The specimens of patients who treated with antibiotic were excluded.

**Methods:** Seminal fluid specimens were collected from infertile patients by masturbation, under aseptically conditions. They were also asked to pass urine first and then wash and rinse hands and penis before the specimens were collected¹¹. The specimens were collected into clean wide-mouthed 15ml sterile plastic vials and incubated at 37°C for 30 minutes for liquefaction and then seminal fluid analysis (SFA) was done to diagnose asthenospermia and leukocytospermia. Swabs were inserted into the specimens and then directly inoculated on blood agar, chocolate agar and MacConkey agar. All plates were incubated aerobically at 37°C for 24-48 hrs.

**Seminal fluid analysis (SFA):** In this experiment SFA method was used to investigate leukocytospermia and asthenospermia. According to World Health Organization criteria asthenospermia was defined as less than 50% of spermatozoa with forward progression or less than 25% of spermatozoa with rapid progression within 60 min after semen collection. Leukocytospermia was defined as more than 1x10⁶ pus cell/ml of seminal fluid¹¹.

According to the diagnostic procedures recommended by Collee and his colleagues (1996)¹²; MacFaddin (2000)¹³ and Forbes and his colleagues (2007)¹⁴, the isolation and identification of G+ve and G-ve bacteria associated with bacteriospermia in asthenospermic patients were done.

**Virulence factors tests:** Blood agar medium was streaked with a pure culture of bacterial isolate to be tested and incubated at 37°C for 24-48 hrs. The appearance of a clear zone surrounding the colony is an indicator of β- hemolysin while the greenish zone is an indicator of α- hemolysin¹⁴. Haemagglutination test (HA) was performed to show the ability of bacterial isolates to produce colonization factors antigen (CFA). Lipase test was carried out in egg-yolk agar medium to determine the ability of microorganisms to produce lipase enzyme. After inoculation of the medium agar, plates were incubated for overnight at 37°C. The appearance of opaque pearly layer around the colonies indicated for a positive result¹⁵. Antimicrobial susceptibility test was performed according to CLSI (2010)¹⁵.

**Statistical analysis:** The χ² (Chi-square) test was used for statistical analysis. P<0.01 was considered to be statistically significant.

**Results and Discussion**

**Asthenospermia and leukocytospermia:** One hundred asthenospermic seminal fluid specimens were diagnosed using seminal fluid analysis (SFA). Motile spermatozoa in all specimens were ranged 10-40% with mean motile spermatozoa (25%) and this result revealed asthenospermia according to world health organization criteria. Asthenospermic seminal fluid specimens were divided into two groups according to leukocytospermia, 70 specimens, first group, who had leukocytospermia and 30 specimens, second group, who had no leukocytospermia. White blood cells (WBCs) in seminal fluid specimens were counted and the results showed that, all specimens of first group had more than 1x10⁶ pus cell/ml of seminal fluid revealed to leukocytospermia which indicates an infection¹¹, while all specimens of second group had no leukocytospermia as shown in table.1.

**Bacterial isolates from asthenospermic specimens:** The results of this experiment showed that 61(87.1%) specimens of first group revealed positive bacterial culture as shown in table.1 whereas 9(12.9%) specimens of first group showed no bacterial growth even after 48 hours, which may be due to the presence of another type of causative agents that might need special technique for their detection such as viruses, *Chlamydia* or *Mycoplasma*. These results were corresponding to those results being reported by Shefi and Turek¹⁶. However the results were higher than those reported by Jiao and his colleagues¹⁷, who found that (5-15%) of samples, gave positive culture. All specimens of second group gave negative bacterial culture. The results in table.1 were statistically analyzed by using χ² test showed that there was a strong relationship between the bacteriospermia and asthenospermia (P<0.01). This result agreed with that result being reported by Golshani and his colleagues¹⁸ who declared that semen specimens of infertile men, especially those contain high number of *E. coli* and *Enterococcus* isolates, had high rate of non-motile and morphologically abnormal sperms. Philip and Folsad¹⁹ confirmed that there was a significant positive effect of antibiotic treatment for the following sperm parameters: sperm volume, sperm concentration, sperm motility, and sperm morphology. Antibiotic treatment also significantly reduced the number of leukocytes in ejaculates of male infertility patients. Thus, in general, males treated with antibiotics were relieved from leukocytospermia and produced ejaculates of high quality. Also there was a strong relationship between bacteriospermia and leukocytospermia (P<0.01).
Table 1: Illustration of asthenospermia, leukocytospermia and bacteriospermia

<table>
<thead>
<tr>
<th>Cases</th>
<th>Specimens</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>First group n(%) n=70</td>
</tr>
<tr>
<td></td>
<td>Second group n(%) n=30</td>
</tr>
<tr>
<td>Asthenospermia</td>
<td>70(100%)</td>
</tr>
<tr>
<td></td>
<td>30(100%)</td>
</tr>
<tr>
<td>Leukocytospermia</td>
<td>Positive 70(100%)</td>
</tr>
<tr>
<td></td>
<td>Negative 0.0</td>
</tr>
<tr>
<td>Bacteriospermia</td>
<td>Positive 61(87.1%)</td>
</tr>
<tr>
<td></td>
<td>Negative 9(12.9%)</td>
</tr>
</tbody>
</table>

Table 2: Distribution of bacterial isolates from patients with asthenospermia according to the isolates

<table>
<thead>
<tr>
<th>Bacterial species</th>
<th>Single isolates n</th>
<th>Mixed isolates n</th>
<th>Total isolates n (%)</th>
<th>Total n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoNS S. saprophyticus</td>
<td>14</td>
<td>*4</td>
<td>25 (35.7)</td>
<td>44 (62.9)</td>
</tr>
<tr>
<td>S. epidermides</td>
<td>7</td>
<td>0</td>
<td>8 (11.4)</td>
<td>26 (37.1)</td>
</tr>
<tr>
<td>S. aureus</td>
<td>14</td>
<td>5</td>
<td>19 (27.2)</td>
<td></td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>9</td>
<td>**3</td>
<td>12 (17.1)</td>
<td></td>
</tr>
<tr>
<td>Enterobacter aerogenes</td>
<td>6</td>
<td>2</td>
<td>8 (11.4)</td>
<td></td>
</tr>
<tr>
<td>Acinetobacter spp.</td>
<td>4</td>
<td>0</td>
<td>4 (5.7)</td>
<td></td>
</tr>
<tr>
<td>Moraxella spp.</td>
<td>2</td>
<td>0</td>
<td>2 (2.9)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>56</td>
<td>14</td>
<td>70 (100)</td>
<td>100%</td>
</tr>
</tbody>
</table>

*Four isolates of S. saprophyticus were mixed with Four isolated of S. aureus. **Three isolates of E. coli were mixed with one isolate of S. aureus and two isolates of E. aerogenes

A total of (70) bacterial isolates were obtained from the (61) seminal fluid specimens in which gram positive bacteria constituted 44(62.9%) of the total isolates and were considered as the largest etiological agent of bacteriospermia compared with gram negative bacteria which constituted 26(37.1%) as indicated in table-2 and this might be due to the fact that grams positive bacteria are commensals of mucosal surfaces of urogenital tract and these results were similar to those results being reported by Chimura and Saito who found that G+ve bacterial strains constituted (78.4%), while G-ve bacterial strains constituted (21.6%).

Pathogenicity of bacteria in asthenospermic patients: The present study showed that asthenospermia were caused by 70 bacterial isolates Table-2. Coagulase negative staphylococci (CoNS) represented by S. epidermides and S. saprophyticus which constituted 25(35.7%), S. aureus constituted 19(27.2%) were predominant in causative microorganism of bacteriospermia followed by E. coli 12(17.1%). However, each of the following bacteria E. aerogenes, Acinetobacter spp. and Moraxella spp. constituted 8(11.4); 4(5.7) and 2(2.9) respectively.

CoNS organisms were the most common bacterial group isolated from seminal fluid infections (35.7%); CoNS infections in the present study were less than those reported by other researchers who found that these infections constituted (50-89%), but they were more than those reported by Virecoulou F. et al, who reported that seminal fluid infections caused by CoNS were constituted (15.7%).

The high percentage of CoNS infections may be due to that they are common contaminant of skin and urethral meatus, and also their ability to resist antibiotics commonly used in medical therapy. These commensals bacteria may have a role as opportunistic pathogens in the presence of weakened local tissue defense when immunosuppressive agents were used, and the antibiotics had been associated with emergence of opportunistic infection by microorganisms not previously regarded as pathogenic bacteria.

S. aureus was the second in occurrence in seminal fluid specimens, which constituted 19(27.2%). This was in line with reports from other studies. S. aureus had detrimental effect of spermatozoa resulted from damage of sperm membrane lipids. The pathogenesis of S. aureus was attributed to the combined effects of extracellular factors and toxins, together with invasive properties such adhesion, biofilm formation, and resistance to phagocytosis. S. aureus may inherent nature of developing resistant strains for antibiotics. S. aureus also contains teichoic acid and lipoteichoic acid, capsular material which facilitated the adherence of these bacteria to epithelium of urogenital tract. The detection of staphylococci from seminal fluid specimens was documented. It was found that staphylococci involved in the pathogenesis of chronic pelvic pain syndrome (CPPS). They were identified in focal colonies adherent to the prostatic duct walls.
Results of this study also found that (37.1%) of bacteriospermia were caused by gram negative bacteria. *E. coli* represented the common gram negative bacteria isolated from seminal fluid specimens. They accounted for (17.1%) of total bacterial isolates of asthenospermic patients. This result was close to the finding by other researchers. In other studies *E. coli* isolates were found to be less than 10%. Immobilizing effect of certain bacteria, particularly *E. coli* on spermatozoa had been demonstrated, and this was the mechanism responsible for the asthenospermia resulted from bacteriospermia. Also, *E. coli* has the ability to cause sperm membrane lipid damage.

The other group of gram negative bacteria isolated from seminal fluid specimens were *E. aerogenes* (11.4%), Acinetobacter spp. (5.7) and *Moraxella* spp. (2.9%). This result was the highest of those reported by other studies as in Alwash (2006). *E. aerogenes* posses many factor that facilitate their pathogenicity as endotoxin, which have deleterious effect on seminal fluid; capsules and adhesion proteins that support their attachment to mucosal surfaces of urogenital and also have the ability of resistance to multiple antimicrobial agents.

**Virulence factors of the bacterial isolates:** The factors that determine the initiation, development, and outcome of an infection involve a series of complex and shifting interaction between the host and the parasite, which can vary with different infecting microorganisms. Virulence factors of the bacterial isolates demonstrated in this work included coagulase, hemolysin, capsule, siderophore, bacteriocin, lipase and extracellular protease production as well as colonization factor antigens (CFA/I, and CFA/III).

Microorganisms evolve a number of mechanisms for the acquisition of iron from their environments. One of them is the production of hemolysins, which acts to release iron complexed to intracellular heme and hemoglobin. Another mechanism for iron acquisition is to produce siderophores which chelate iron with a very high affinity and which compete effectively with transferrin and lactoferrin to mobilize iron for microbial use. The results of this study revealed that all isolates of *S. aureus* were able to expressed β-hemolytic mode on blood agar. Among CoNS isolates only 18(72%) exhibited α-hemolytic pattern, while the rest CoNS isolates were γ-hemolytic pattern, which no color change around the bacterial colonies Table-3. This agreed with the result mentioned by Dinges and his colleagues (2000). The production of hemolysin by *S. aureus* is well known and considered as a main virulence factor for these bacteria and it associated with increased severity of infections. In G-ve, bacterial isolates five isolates of *E. coli* and four isolates of *E. aerogenes* displayed β-hemolytic pattern. The other G-ve isolates demonstrated γ-hemolytic pattern (table 3-6). Iron can increase disease risk by functioning as a readily available essential nutrient for invading microbial and neoplastic cell. To survive and replicate in hosts, microbial pathogens must acquire host iron. Highly virulent strains possess exceptionally powerful mechanisms for obtaining host iron from health hosts.

Production of lipase were detected among bacterial isolates and the results showed that 15(78.9%) of *S. aureus* and 7(28%) of CoNS isolates were capable of lipase production (table 3-5). Results of lipase production test in G-ve bacterial isolates revealed that 9(75%) of *E. coli*, 7(87.5%) of *E. aerogenes* and 1(50%) isolate of *Moraxella* spp. were lipase producer (table 3-6). Host cell membranes contain lipids in their components; lipase enzyme will destroy these elements and aids the pathogen to penetrate the host tissue to develop the infections.

All isolates were tested for their ability to produce colonization factor antigens type (CFA/I) and (CFA/III). The results revealed that all G+ve isolates were able to produce (CFA/III) and 10(52.6%) of *S. aureus*, 8(32%) of CoNS isolates were capable to produce (CFA/I) as shown in table (3-5). These factors are considered primary factors, which cause adhesion of bacteria to the target host cell, and their presence indicates that the bacteria contain cell surface fimbrial antigens. Detection of CFA in G-ve bacterial isolates were done and the results indicated presence of (CFA/III) in all G-ve isolates, while (CFA/I) were found in 8(66.7%) of *E. coli*, 6(75%) of *E. aerogenes*, 2(50%) of *Acinetobacter* spp. and 1(50%) of *Moraxella* spp. isolates (table 3-6). The (CFA/I) contributed and aided the bacteria to adhere and multiply within eukaryotic cells. Bacterial adherence to host tissues is a complex process that, in many cases, involves the participation of several distinct adhesions, all of which may act at the same time or at different stages during infection. Many pathogenic bacteria displayed polymeric adhesive fibers termed "pili" or "fimbriae" that facilitated the initial attachment to epithelial cells and subsequent successful colonization of the

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Virulence factor</th>
<th></th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Hemolysin production</td>
<td>Lipase production</td>
</tr>
<tr>
<td><em>S. aureus</em></td>
<td>19 (100%)</td>
<td>15 (78.9%)</td>
</tr>
<tr>
<td>CoNS</td>
<td>18 (72%)</td>
<td>7 (28%)</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>5 (41.7)</td>
<td>9 (75%)</td>
</tr>
<tr>
<td><em>Enterobacter aerogenes</em></td>
<td>4 (50)</td>
<td>7 (87.5)</td>
</tr>
<tr>
<td><em>Acinetobacter spp.</em></td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Moraxella spp.</em></td>
<td>0 (0.0)</td>
<td>1 (50)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table-3</th>
<th>Virulence factor of bacterial isolate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteria</td>
<td><em>CFA I</em></td>
</tr>
<tr>
<td><em>S. aureus</em></td>
<td>19 (100%)</td>
</tr>
<tr>
<td>CoNS</td>
<td>8 (32%)</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>8 (66.7%)</td>
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<tr>
<td><em>Enterobacter aerogenes</em></td>
<td>6 (75%)</td>
</tr>
<tr>
<td><em>Acinetobacter spp.</em></td>
<td>1(50%)</td>
</tr>
<tr>
<td><em>Moraxella spp.</em></td>
<td>1(50%)</td>
</tr>
</tbody>
</table>
host. Pili are virulence factors that mediate interbacterial aggregation and biofilm formation, or mediate specific recognition of host-cell receptors (Jonsen et al., 2005). It is clear that pili play similar biological roles for commensals bacteria because they also have to colonize specific niches and overcome the host’s natural clearing mechanisms. It is thought that commensal and some pathogenic Escherichia coli strains use type I pili or curli to colonize human and animal tissues.

**Effect of some antibiotics on bacterial isolates:** figure (3-1) displays the resistance of all G+ve and G-ve bacterial isolates to amoxicillin and amoxicillin-clavulanic acid. The results revealed that all bacterial isolates showed high resistance (75% - 100%) to amoxicillin, but less resistance to amoxicillin-clavulanic acid (47.4% - 75%). Among G+ve bacterial isolates the resistance of *S. aureus* and CoNS isolates to amoxicillin were (100%) for both. These results are agreeable with results obtained by Dan who confirmed that the resistance of CoNS isolates to β-lactams was mediated by β-lactamase enzymes production under chromosomal control. Both *S. aureus* and CoNS isolates exhibited low level of resistance toward amoxicillin-clavulanic acid 9(47.4%), 13(52%) respectively. Addition of clavulanic acid can inhibit the action of β-lactamas enzyme. These results matched those obtained by Romolo and his colleagues who pointed out that the uropathogens resistance to amoxicillin-clavulanic acid was as high as to amoxicillin-clavulanic acid.

![Figure-1](image.png)

**Figure-1**
Resistance of bacterial isolates to amoxicillin and amoxicillin clavulanic acid. AM: amoxillin, AMC: amoxicillin-clavulanic acid.

The resistance of *Acinetobacter* to amoxicillin was (100%) and this result was higher than those reported by Alwash B.H. and Al-Shukri M.S. who clarified that the resistance rate of uropathogen *Acinetobacter* to amoxicillin was (63.6%) and (80%) respectively. Enzyme resistance was resulted from the ability of *Acinetobacter* to produce β-lactamase. Only three isolates of *E. aerogenes* were resistant to amoxicillin and this results in agreement with those results being reported by other researcher. Also Dumarche and his colleagues reported that all *E. aerogenes* isolates which produce (ESBL) had one or more of plasmids which carry multiresistance genes. Two isolates of *Moraxella* spp. were resistant to amoxicillin and amoxicillin-clavulanic acid. Mechanism of resistance exhibited by *Moraxella* was similar to those of *Acinetobacter*. Varon and his researchers (2000) found that *M. catarrhalis* were fully sensitive to amoxicillin.
Resistance of bacterial isolates to the cephalosporins was studied. Figure (3-2) reveals variable levels of resistance to different generations of cephalosporins. *S. aureus* resistance to cefamandole (2nd generation), ceftizoxime, ceftazidime (3rd generation) and cefepime (4th generation) were 73.7%, 84.2%, 100% and 68.4% respectively. This result revealed that *S. aureus* exhibited low level of resistance to 4th generation cephalosporin than other cephalosporins. This result agreed with Brooks and his colleagues. CoNS isolates displayed low level of resistance to cephalosporins (56%-80%) than those exhibited by *S. aureus*. Resistance to cephalosporins mediated by cephalosporinase production. All G-ve bacterial isolates were fully (100%) resistance to cefamandole (second-generation cephalosporin) except *E. coli* and *E. aerogenes* (91.7%, 75%) respectively. *S. aureus* and CoNS isolates exhibited less level of resistance to cefamandole than G-ve isolates. All isolates of G-ve bacteria exhibited nearly similar levels of resistance to cephalosporins. *Acinetobacter* spp. isolates were fully resistance to cephalosporins, also six isolates of *E. aerogenes* were resistant to all cephalosporins. This resistance may be resulted from combination of unusually restricted outer membrane permeability and chromosomally encoded β-lactamase. This agreed with results mentioned by Bisiklis and his workers. Figure (3-3) showed that all bacterial isolates exhibited high sensitivity to imipenem and meropenem (carbapenems) except in *Moraxella* spp. which displayed resistance to both of these antibiotics which might be due to the low number of *Moraxella* isolates in the present study. However, the result was in accordance with those reported by Watanabe and his colleagues (2000) and Nomura and Nagayama. Imipenem and meropenem are broad-spectrum carbapenem antibiotics. Beta-lactam rings of these antibiotics are resistant to hydrolysis by most beta-lactamases and the activity of meropenem against most clinical isolates was comparable with imipenem. These antibiotics pass through the outer membrane of G-ve bacteria via the water filled porin channels to reach their targets, penicillin binding proteins. Deletion or diminished production of these outer membrane proteins (porins) decreases outer membrane permeability of some G-ve bacteria for diffusion of these antibiotics and decreases susceptibility to imipenem and meropenem. Generally a distinct difference was present between β-lactamase production by G+ve and G-ve bacterial isolates, for example β-lactamase produced by staphylococci were excreted into the surrounding environment where the hydrolysis of β-lactams takes place before the drug can bind to PBPs in the cell membrane. In contrast, β-lactamase produced by G-ve bacteria remained intracellular in the periplasmic space where they were strategically positioned to hydrolyze β-lactams as they transverse the outer membrane through water filled, protein lined porin channels.
Resistance of the bacterial isolates to aminoglycosides were established in figure -4. The results revealed that *S. aureus* and CoNS isolates showed similar status of resistance to gentamycin (84.2%, 88%) respectively. The mechanism of aminoglycosides resistance by staphylococcal isolates is enzymatic modification, in which modifying enzymes alter various sites on the aminoglycosides molecule so that the ability of drug to bind the ribosome and halt protein synthesis was greatly diminished or lost. This result was agreed with Alwash B.H. 32, who found that (80%) of *Staphylococcus* spp. isolated from UTI were very sensitive to gentamycin (low level of resistance 15%). *S. aureus* and CoNS gave low level of resistance to amikacin, (36.3%, and 32% respectively) and also to tobramycin (57.9%, 36% respectively) when compared with their resistance to gentamycin.

Resistance to gentamycin had been identified in CoNS isolates. Moreover, CoNS may function as a reservoir for antibiotic resistant genes to *S. aureus*. Among G-ve bacterial isolates,
91.7% of E. coli isolates were resistant to tobramycin. Only (75%) of E. coli isolates were resistant to amikacin and gentamycin. These results agreed with those reported with Al-Muhanna\(^{6/8}\) and Al-Nuaimi\(^{54}\), who found that E. coli was fully resistant to amikacin. However, this result disagreed with other local studies as given by Alwash B.H.\(^{32}\) who found that E. coli isolated from patients with urinary tract infections (UTI) and from those with prostatitis exhibited low level of resistance to amikacin (7.7%-25%). This resistance could be interpreted depending on the fact that many strains of E. coli have acquired plasmids conferring resistance to one or more than one type of antibiotics, therefore antimicrobial therapy should be guided by laboratory result test of sensitivity\(^{55}\). Acinetobacter spp. isolates were fully sensitive to tobramycin, but they showed low resistance to amikacin (1/4) and (2/2) of them were resist gentamycin. This result was in line with those documented by Al-Shukri M.S.\(^{44}\) and Al-Hamawandi J.A.\(^{55}\) who observed that Acinetobacter was resistant to gentamycin and this resistance was produced through alteration of the ribosomal target site, and production of aminoglyside-modifying enzyme. Moreover, Hpa established that resistance of uropathogenic Acinetobacter to gentamycin and amikacin were 43% and 5% respectively. Concerning E. aerogenes resistance of aminoglycosides, the results revealed that (6/8) of E. aerogenes isolates were resistant to gentamycin (7/8) were resistant to amikacin and (3/8) of them were resisted tobramycin.

Enterobacter spp. resistance to gentamycin was (75%). Park and his colleagues had stated that the resistance rate of Enterobacter spp. to gentamycin was (33.3%) while it was (54%) for amikacin and that differ from the results in the present study. The mechanism of E. aerogenes resistance to aminoglycosides was mediated by the production of more than one type of aminoglycosidases located on the R plasmid. Other mechanism was post transcriptional modification of 16S rRNA which can confer high level resistance to all aminoglycosides except streptomycin in G-ve human pathogens including E. aerogenes\(^{34}\). Moraxella spp. isolates were fully sensitive to gentamycin and amikacin. Only (1/2) of Moraxella spp. isolates were resist to tobramycin.

In the present study the results of fluoroquinolones (ciprofloxacin and norfloxacin) resistance are displayed in figure (3-5). G-ve isolates exhibited low resistance to both ciprofloxacin and norfloxacin, (42.1%) of S. aureus and (12%) of CoNS isolates were resist to ciprofloxacin, while resistance to norfloxacin was (36.8%, 32%) respectively.

This result agreed with other local studies as given by Khoshed P.A.\(^{52}\) who found that only (20%) of staphylococcus spp. isolated from patients with UTI were resistant to ciprofloxacin. Also, Alwash\(^{32}\) found that (33.3%) of S. aureus and (11.1%) of CoNS isolates were resisted ciprofloxacin. Similarly, Rachid and his group (2000)\(^{57}\) observed that there were an increased number of strains resistant to ofloxacin and ciprofloxacin. Kurt and Naber (2001)\(^{58}\) document that the ciprofloxacin was the first choice for seminal fluid tract infection. Moreover, Donnell and Gelone, (2000)\(^{59}\) reported that the resistance to fluoroquinolones was through chromosomal mutations or alterations affecting the ability of fluoroquinolones to permeate the bacterial cell wall. Fortunately, separate isomerases were required to produce this form of resistance\(^{41}\). Forbes and his colleagues\(^{54}\) stated that staphylococci had two mechanisms to resist fluoroquinolones; the first one was efflux mechanism in which an activation of efflux pump that removes fluoroquinolones before intracellular concentration sufficient for inhibiting DNA metabolism can be achieved. The other mechanism (target alteration) included changes in DNA gyrase subunits decrease ability of fluoroquinolones to bind this enzyme and interfere with DNA processes.

![Figure-5](image-url)  
Resistance of bacterial isolates to Fluoroquinolones. CIP: Ciprofloxacin, NOR: norfloxacin
Flouroquinolones resistance among G-ve bacterial isolates were also studied. (25%) of E. coli isolates were resistant to both ciprofloxacin and norfloxacin. This result was in line with results obtained by (32,52) who found that, the resistance rate of E. coli to ciprofloxacin was (36.4%), and differed from Klligore and his colleagues60 who demonstrated that the resistance rate of uropathogenic E. coli to ciprofloxacin was (0.4%, 13%) respectively. (4/4) and (2/4) of Acinetobacter spp. isolates were resistant to ciprofloxacin respectively. Resistance of G-ve isolates to flouroquinolones occurred by one of the two strategies, either by alteration in the outer membrane led to diminishes uptake of drug, or by changes in DNA gyrase subunits which decreases ability of flouroquinolones to bind this enzyme and interfere with DNA processes14. In addition to that, Jacoby and his colleagues (2006)61 stated that Enterobacter has plasmid-mediated quinolones resistance gene which confer their resistance to the flouroquinolones.

From the data gathered above we can conclude that, There is a significant relationship between asthenospermia and bacteriospermia. Staphylococcus aureus (CoNS) represented by Staphylococcus epidermidis and Staphylococcus saprophyticus, Escherichia coli, Enterobacter aerogenes, Acinetobacter spp. and Moraxella spp. seem to be the most common bacteria associated with bacteriospermia. There is a significant relationship between leukocytospermia and bacteriospermia and leukocytospermia can be used as predictor of bacteriospermia. The bacterial isolates associated with bacteriospermia showed resistance to many antibiotics but they were highly susceptible to imipenem, meropenem and ciprofloxacin. All bacterial isolates in this study have the ability to possess more than one virulence factors such as coagulase, capsule, siderophile, hemolysin, extracellular protease, lipase and adherence factors to produce asthenospermia.

Conclusion

In conclusion, there is a significant relationship between asthenospermia and bacteriospermia. The most common bacteria closely associated with bacteriospermia are Staphylococcus spp., Acinetobacter spp., Moraxella spp., E. coli, and Enterobacter aerogenes. Most of these bacterial types are resistant to antibiotics but in general, they are highly susceptible to Imipenem, Meropenem, and Ciprofloxacin

References


