Determination of bacterial etiological agents and Antibiotic Susceptibility pattern using blood culture of infective endocarditis

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Abstract

Infective endocarditis occurs worldwide; Endocarditis is usually caused by an infection. Bacteria, fungi or other microorganisms get into the bloodstream and attach to damaged areas in the heart. Infective endocarditis is a relatively uncommon disease with a high mortality rate. Things that make you most likely to get endocarditis are artificial cardiac valves, damaged cardiac valves or congenital cardiac disease, we analyzed 57 cases including 11 cases were males and 6 cases of females   from MAY 2021 to OCT 2023.variables were collected from the patients included age, gender and blood culture which recorded (19.2%), among of the positive samples were males with (10.5%), Negative samples were recorded in 40 patients, at a rate of 70.1%, as the number of female cases was 23 and males were 17. The rate of isolates was higher among the age group (46-56), (57-67), was 5 patients with similar percentages (8.7%). while an age group (35-45) don't record any case of isolates. the isolated Gram-positive bacteria were (82.3%) Staphylococci species which amounted to (76.5%) as the most common cause of infective endocarditis, Staphylococcus aureus

was more bacteria isolated than patient samples with percentage (23.5%), followed by Gram-negative bacteria Klebsiella pneumonia, which amounted to (17. 6%).The bacteria have recorded high sensitivity to Azithromycin, Impienem, Meropenem, Augmantin ,teicoplanin and vancomycin which was the drug of choice. while the highest bacterial resistance was recorded to Cephalothin,Cefoxitin, Ticarcillin Erthromycin and penicillin.

تحديد العوامل البكتيرية ونمط الحساسية للمضادات الحيوية باستخدام مزرعة الدم لالتهاب الشغاف المعدي

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الخلاصة

يحدث التهاب الشغاف المعدي في جميع أنحاء العالم. عادة ما يحدث التهاب الشغاف بسبب عدوى تدخل البكتيريا أو الفطريات أو الكائنات الحية الدقيقة الأخرى إلى مجرى الدم وتلتصق بالمناطق المتضررة في القلب. التهاب الشغاف المعدي هو مرض غير شائع نسبيا مع ارتفاع معدل الوفيات. الأشياء التي تجعلك أكثر عرضة للإصابة بالتهاب الشغاف هي صمامات القلب الاصطناعية، أو صمامات القلب التالفة أو أمراض القلب الخلقية. أجريت هذه الدراسة لحالات التهاب الشغاف المعدية من خلال السجلات الطبية الإلكترونية لمركز بنغازي الطبي، وقمنا بتحليل 57 حالة من مايو 2021 إلى أكتوبر 2023. وتم جمع المتغيرات من المرضى بما في ذلك العمر والجنس وثقافة الدم والتي سجلت (29.8%). وسجلت الذكور أعلى نسبة (19.2%)، وسجلت العينات السلبية لـ 40 مريضاً بنسبة 70.1%، كما بلغ عدد الحالات للإناث 23 والذكور 17. وكانت نسبة العزل أعلى بين الفئة العمرية في (46–56)، (57–67)، كان 5 مرضى بنسب مماثلة (8.7٪). بينما لم تسجل الفئة العمرية (35–45) أي حالة، وكانت البكتيريا موجبة الجرام المعزولة (82.3%) من المكورات العنقودية والتي بلغت (76.52%) باعتبارها السبب الأكثر شيوعاً لالتهاب الشغاف المعدي. كما تم عزل المكورات العنقودية الذهبية (23.5%)، والتي كانت أكثر عزلا للبكتيريا تليها بكتيريا سالبة الغرام والتي بلغت

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(17.6%). سجلت البكتريا حساسية عالية للازثرومايسين   الوقمانتين ، امبينيم،الميروبينيم، الفانكومايسين والتيكوبلينين بينما سجلت البكتريا اعلى مقاومة للسيفالوثين، تيكارسيلين، الارثرومايسين والبنسلين.   .

الكلمات الرئيسية:ا لتهاب الشغاف،العدوى البكتيرية، مرض القلب، صمامات القلب.

1. Introduction

Endocarditis is a disease characterized by inflammation or infection of the inner surface of the heart (the endocardium). Endocarditis usually affects heart valves and may also involve non-valvular areas or mechanical devices that are implanted in the heart, such as artificial heart valves, pacemakers, or implantable defibrillators. Infective endocarditis is an uncommon, but not rarely [1]. Although uncommon, endocarditis is important because, in spite of antimicrobial therapy, it can result in serious complications such as stroke, the need for open-heart surgery or even death. When endocarditis occurs, small masses called vegetations form at the site of infection. When vegetations are watched under a microscope, usually one sees the microorganism that causes the infection embedded in a meshwork of fibrin and other cellular material like that used by the body to form blood clots. White blood cells that the body uses to fight infection are uncommon, a finding which describe the need to give antibiotics over many weeks to kill the infecting organism and cure endocarditis.

Endocarditis occurs when bacteria enter the bloodstream (bacteremia) and adhere to a damaged portion of the inner lining of the heart or abnormal heart valves. Not all bacteria entering the bloodstream are having the ability of causing endocarditis. Only those bacteria that are able to pole to the surface lining of the heart and to abnormal valves tend to cause endocarditis. The potential of these bacteria to pole to the surface lining is aided by a preexisting microscopic clot that often forms at these abnormal sites. Endocarditis most predominating occurs in people with preexisting heart disease which may or may not be known to patients or their physicians and rare in people with normal hearts. [2].

Bacteria can enter the bloodstream as a result of small injury during routine daily activities like brushing teeth. so, the mouth is a common source of bacteremia, and perfect oral hygiene appears to lower the risk of bacteremia and attached endocarditis. Certain invasive medical procedures are also known to cause bacteremia, particularly if they injure sites where bacteria are normally found. For people with heart conditions that are associated with endocarditis, it has been recommended that antibiotics be given before these procedures in an effort to limit bacteremia, to prevent bacteria from sticking to the heart, and to protect against endocarditis [3].

2. Methods
2.1. Study design area and period:
In this study, we conducted an analysis of the retrospectively recorded databases from the Benghazi Medical Center laboratory and medical registry. 57 patients were suspected infective endocarditis admitted in CCU ward from period MAY 2021 to OCT 2023. Data included age, gender and blood culture results.

2.2. Diagnostic techniques:
Blood culture is the most important primary laboratory test to diagnosis of IE.

57 body fluid samples were inoculated into BACTEC™ peds Plus™/F vials, incubated in BACTEC™ machine. Direct plating of sample onto blood agar, chocolate agar, MacConkey agar and incubated aerobically at 37°C for 48 h. Organisms isolated were identified using standard microbiological procedures.

Antibiotic susceptibility in vitro susceptibility of Gram positive bacteria and Gram negative bacteria isolates against antibiotics were determined by The Phoenix™ Automated Microbiology System (BD Diagnostics[4] Commercially prepared antibiotic discs (Oxoid, UK). (6 mm in diameter) belonging to different groups antibiotics were used: penecillin (10 µg), FOX-cefoxitin (30 µg), AMC-Amoxacillin Clavulonic Acid (30ug), TEC- Teicoplanin (30µg), Va-Vancomycin (30 µg), AK-Amikacin (30µg), CAR-Carbencillin (10µg), E-Erythromycin (5 µg), AZ-Aztronam (30µg), Ox-Oxacillin

(1 μg), RIF-Rifamycin (30μg), TE-Tetracyclin (30μg), Cip-ciprofloxacin (5μg), Ch- chloramphenicol (30μg), K-Kanamycin (30), AMX- amoxicillin (25μg),MEM Meropenem (10μg),AZM Azithromycin (30μg),IPM-impienem(10μg) The diameters of inhibition zone around the discs were measured and interpreted as sensitive, intermediate or resistant as per the guideline set by (Bauer *et al*., 1966) [4].

3.Results:

Fifty seven (57) cases were examined using culture in bacteriology department, Benghazi medical center. Table (1) shows the distribution of cases according to bacterial growth.

Table (1) Cases distribution according to bacterial growth

Bacterial growth	Number of cases	Percentage%
Positive cases	17	29.8%
Negative cases	40	70.1%
Total	57	100%

A total of 57 blood culture, 40 (70.1%) blood culture had no bacterial Growth as illustrates in figure (1), while 17 (29.8%) blood culture showed bacterial growth.
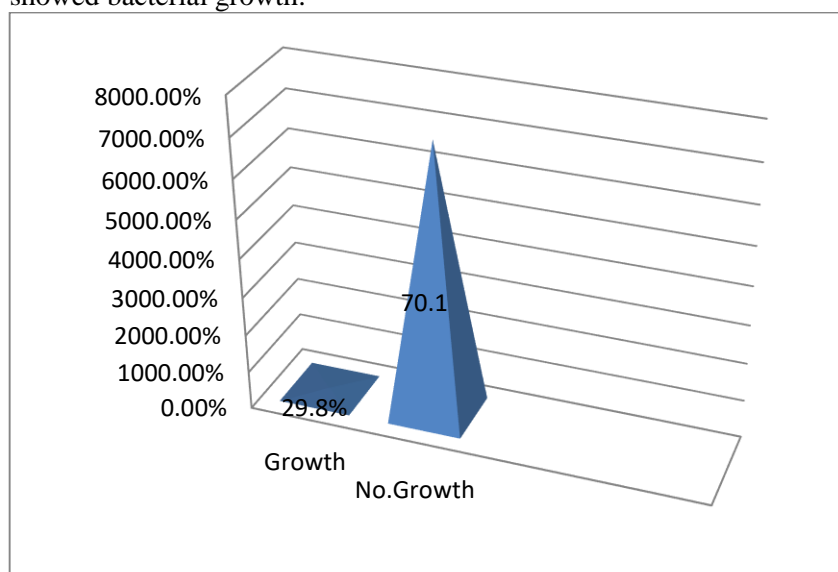

Figure 1: Cases distribution according to bacterial growth

Table (2).Distribution of affected and un affected cases according to gender

Gender	Number of positive cases	Number of Negative cases	Number of all cases
Male	11 (19.2%)	17(29.8%)	28(49.1%)
Female	6 (10.5%)	23 (40.3%)	29(50.8%)
Total	17 (29.8%)	40 (70.1%)	57 (100%)

Table (2) depicted that 11(19.2%) of male and 6 (10.5%) of female showed determined causative agents compared to 17(29.8%) of male and 23(40.3%) of female which were negative for any causative agent. Figure (2) shows the distribution of affected and unaffected cases according to gender
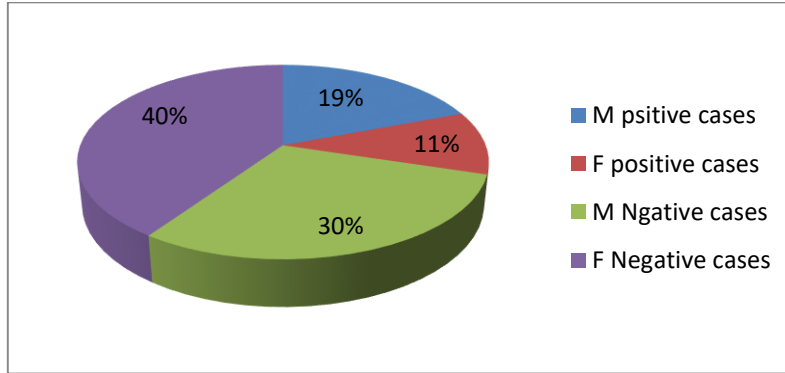

Figure 2: Distribution of affected and unaffected cases according to gender

Table (3).Distribution of cases according to age groups

Age group	Number of positive cases	Number of negative cases
(24-34)	2 (3.5%)	5(8.7%)
(35-45)	0(0%)	4(7.0%)
(46-56)	5(8.7%)	10(17.5%)
(57-67)	5 (8.7%)	12(21.0%)
(68-77)	4(7.0%)	9(15.7%)
(Above 78)	1(1.7%)	0(0%)

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In Table (3) the age of the recruited patients is depicted. They ranged between 24 to above 78 years.

Two of affected cases (3.5%) and five of unaffected were in the age group of 24-34 years, no positive cases and 4 negative cases in age group of (35 -45), whereas 5 positive cases (8.7%) were in the age group of (46-56) and in age group of (57-67),while in 4(23.53%) were in (68-77) years. The remaining 1 patient (5.88%) aged over 78 years. see figure (3)
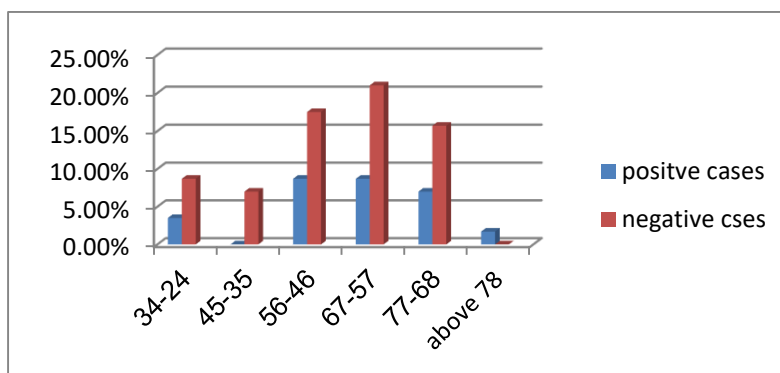

Figure 3: Distribution of cases according to age groups

Table (4) shows that, the Staphy. aureus 4 (23.5%) was more bacteria isolated than patient samples, followed by Staph. hominis ,Staph schleiferi and Klebseilla spp. 3 (17.6%). While the least isolated bacteria were Staph aureus(MRSA) and Streptococcus viridians 1(5.8%).

Table (4) Organisms isolated from blood cultures of patients with infective endocarditis

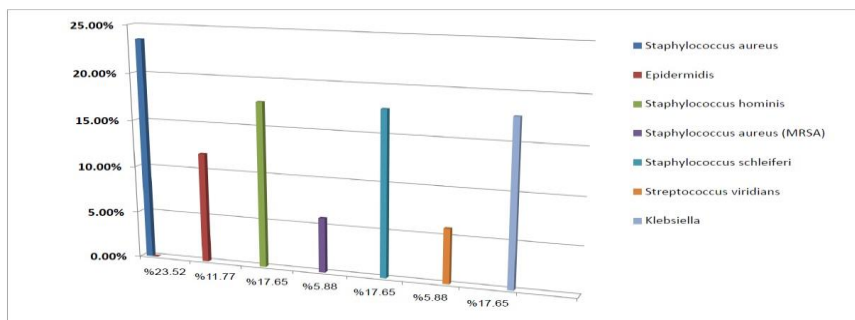| Isolated organism	Number of isolates	Percentage (%)
Staphylococcus aureus	4	23.5%
Staphylococcus Epidermidis	2	11.7%
Staphylococcus hominis	3	17.6%
Staphylococcus aureus *(MRSA)*	1	5.8%
Staphylococcus schleiferi	3	17.6%
Streptococcus viridians	1	5.8%
Gram negative bacilli Klebsiella	3	17.6%

Figure 4: Organisms isolated from blood cultures of patients with infective endocarditis

Table 5 shows Susceptibility patterns of different bacteria isolated from all positive cases which was conducted using the phoenix device. Bacteria have recorded high sensitivity to Augmantin, Zithromycin, Impienem, teicoplanin , vancomycin and Meropenem while the highest bacterial resistance was recorded to Cephalothin, Ticarcillin , penicillin, Erthromycin and Cefoxitin.

Table (5). Susceptibility patterns of different bacteria isolated from blood cultures

Antimicrobial agents	Staph- aureus (4)	Staph –epidermids (2)	Staph –homonis (3)	Staph –schleiferi (3)	MRSA (1)	Strep-viridans (1)	Klebsiella (3)
AMX	1(25%)S 3(75%)R	2(100%)R	2(66.6%)R 1(33.3%)I	2(66.6%)R 1(33.3%)S	1(100%)R	1(100%)S	2(66.67%)R 1(33.33%)S
AUG	4 100%)S	2(100%)S	3(100%)S	2(66.6%)S 1(33.3%)I	1(100%)S	1(100%)S	2(66.6%)S 1(33.3%)I
ATM	4(100%)S	1(50%)S 1(33.3%)I	2(66.6%)S 1(33.3%)I	2(66.6%)S 1(33.3%)R	1(100%)S	1(100%)S	2(66.6%)R 1(33.3%)I
AZM	3(75%)S 1(25%)R	2(100%)S	3(100%)S	3(100%)S	1(100%)S	1(100%)S	3(100%)R
CAR	4(100%)S	2(100%)I	2(66.6%)S 1(33.3%)R	2(66.6%)S 1(33.3%)R	1(100%)R	1(100%)R	2(66.6%)S 1(33.3%)R
FOX	3(75%)R 1(25%)S	1(50%)R 1(50%)I	3(100%)S	2(66.6%)S 1(33.3%)I	1(100%)R	1(100%)S	2(66.6%)S 1(33.3%)I
CF	4(100%)R	2(100%)R	2(66.6%)S 1(33.3%)I	3(100%)R	1(100%)R	1(100%)I	3(100%)R
CAZ	4(100%)R	2(100%)I	3(100%)S	2(66.6%)I 1(33.3%)S	1(100%)R	1(100%)S	2(66.6%)R 1(33.3%)S
CT	3(75%)S 1(25%)R	2(100%)S	2(66.6%)I 1(33.3%)R	3(100%)S	1(100%)S	1(100%)R	2(66.6%)R 1(33.3%)S
E	3(75%)I 1(25%)S	2(100%)R	3(100%)R	2(66.67%)R 1(33.33%)I	1(100%)R	1(100%)R	2(66.6%)S 1(33.3%)I
IPM	(100%)S 4	2(100%)S	3(100%)S	2(66.6%)I 1(33.3%)S	1(100%)R	1(100%)S	3(100%)S
K	3(75%)R 1(25%)S	2(100%)I	2(66.6%)S 1(33.3%)I	3(100%)S	1(100%)S	1(100%)S	2(66.6%)R 1(33.3%)I
LZD	3(75%)S 1(25%)R	1(50%)S 1(50%)I	3(100%)S	2(66.6%)R 1(33.3%)I	1(100%)S	1(100%)S	2(66.67%)S 1(33.33%)I
MEM	(100%)S4	2(100%)S	3(100%)S	3(100%)S	1(100%)S	1(100%)S	2(66.67%)R 1(33.33%)S

Antimicrobial agents	Staph- aureus (4)	Staph –epidermids (2)	Staph –homonis (3)	Staph –schleiferi (3)	MRSA (1)	Strep-viridans (1)	Klebsiella (3)
NOR	(100%)R4	2(100%)S	2(66.6%)S 1(33.3%)I	2(66.6%)S 1(33.3%)I	1(100%)I	1(100%)I	3(100%)R
OX	(100%)R4	2(100%)S	3(100%)R	2(66.6%)R 1(33.3%)S	1(100%)R	1(100%)S	3(100%)S
P	(100%)S4	2(100%)R	3(100%)R	2(66.6%)R 1(33.33%)I	1(100%)R	1(100%)R	2(66.6%)R 1(33.3%)I
RIF	3(75%)R 1(25%)I	1(50%)S 1(50%)I	2(66.6%)R 1(33.3%)S	2(66.6%)R 1(33.3%)S	1(100%)S	1(100%)S	2(66.6%)R 1(33.3%)S
TE	2(50%)S 1(25%)I 1(25%)R	2(100%)S	2(66.6%)S 1(33.3%)I	2(66.6%)S 1(33.3%)R	1(100%)R	1(100%)I	2(66.6%)S 1(33.3%)R
TEC	3(75%)S 1(25%)I	2(100%)S	2(66.6%)S 1(33.3%)R	3(100%)S	1(100%)S	1(100%)I	2(66.6%)R 1(33.3%)I
TIC	3(75%)R 1(25%)I	2(100%)R .	3(100%)	2(66.6%)R 1(33.3%)I	1(100%)R	1(100%)R	2(66.6%)R 1(33.3%)I
TCC	3(75%)S 1(25%)I	2(100%)I	2(66.6%)R 1(33.3%)S	3(100%)S	1(100%)S	1(100%)S	2(66.6%)R 1(33.3%)R
NN	3(75%)S 1(25%)I	2(100%)S	2(66.6%)S 1(33.3%)I	2(66.6%)S 1(33.3%)R	1(100%)R	1(100%)S	3(100%)S
VA	(100%)S 4	2(100%)S	3(100%)S	3(100%)S	1(100%)S	1(100%)S	2(66.6%)I 1(33.3%)S
C	(100%)R 4	2(100%)I	2(66.6%)I 1(33.3%)R	2(66.6%)I 1(33.3%)R	1(100%)S	1(100%)S	3(100%)R
CIP	(100%)S 4	2(100%)I	2(66.67%)I 1(33.33%)R	2(66.67%)I 1(33.33%)S	1(100%)I	1(100%)S	2(66.6%)R 1(33.3%)I
AK	3(75%)R 1(25%)I	2(100%)S	3(100%)S	3(100%)R	1(100%)I	1(100%)S	2(66.6%)R 1(33.3%)S

4. Discussion:

Infective endocarditis, it's an infection of the endocardiac, residue an advice, disease that is associated with significant morbidity and mortality and affects both children and adults in the worldwide. (Pant 2015; Bin Abdulhak 2014; Duval 2012) [5,6.7]. the current study showed highest rate of infection in males (19.2%) That is agreement with [8],[9] in contrast to ex-infective endocarditis studies that showed worse result among females [10], but were similar in both genders [11]. In the present study, the Gram-positive bacteria (82.35%) were the highest. that was in agreement with [12]. Staphylococci were the most commonly isolated species represented the highest among the isolates, which reached to (76.4%) of total isolates bacterial, the finding of this study showed that coagulase-positive *S. aureus* was the most common causative agent in infective endocarditis with percentages (23.5%) of all cases, that was in agreement with [13],[14]. In our study Staphylococci epidermidis were (11.7%) found as a causative agent of infective endocarditis which is also in agreement with [15] The role of coagulase-negative or opportunistic staphylococci in the causation of disease has been documented in previous studies

[16,17,18,19,20]. Staphylococcus hominis is one of the pathogens which cause infective endocarditis, in this study was percentage (17.6%) found as a causative agent of infective endocarditis which is also in agreement with [21] Methicillin Resistant Staphylococcus aureus (MRSA) is the one of microorganisms causing to infective endocarditis, in this study Methicillin Resistant Staphylococcus aureus were percentage (5.8%) found as a causative agent of infective endocarditis which is also in agreement with the finding of [22],[23]. Staphylococcus schleiferi is a lately described coagulase-negative staphylococcus (CoNS) which that rarely been reported in human infections [24]. In our study Staphylococci schleiferi were (17.6%) found as a causative agent of infective endocarditis which is also in agreement with [25]. The most common pathogens causative agent of infective endocarditis are streptococci viridans [26]. In our study Streptococcus viridians were percentage (5.88%) found as a causative agent of infective endocarditis which is also in agreement with [27]. endocarditis caused by gram negative bacteria is rare though the occurrence may be increasing [28]. Klebsiella pneumoniae is one of the pathogens which cause infective endocarditis, in this study was percentage (17.6%) found as a causative agent of infective endocarditis which is also in agreement with [29].The present study reported that, Vancomycin and meropenem were the most effective for the types of bacteria significantly, the result of our study was similar to a study in which Vancomycin had a high effect on Gram positive cases.[30].

5. Conclusion

The frequency of Gram-positive organisms causing endocarditis was high. Vancomycin, Augmentin, Azithromycin and meropenem in Gram positive cases revealed better efficacy, while in Gram-negative cases, Augmentin and Teicoplanin were more effective than other antibiotics.

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