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Antimicrobial Activities of neonatal Umbilical Cord Infection

(Original Research Article)

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Abstract: The infection of the umbilical stump. It typically presents as a superficial cellulitis that can spread to involve the entire abdominal wall and may progress to necrotizing fasciitis, myonecrosis, or systemic disease. Omphalitis is uncommon in industrialized countries outside the setting of umbilical vessel catherization; however, it remains a common cause of neonatal mortality in less developed areas. It is predominantly a disease of the neonate, with only a few cases having been reported in adults. Risk factors for omphalitis included septic delivery, unplanned home delivery, maternal chorioamnionitis, and prolonged rupture of membranes, low birth weight, and umbilical vessel catheteri. This study is about the underlying causes of infection that cause umbilical cord inflammation in newborns. The information of this study was collected from Tobruk Medical Center, Department of Microbiology, for files between 2018 to 2020, and it recorded the causes of infection and the antibiotic used for treatment, and where we tried to know the most infectious bacteria, A variety of the following types of bacteria, including Staph aureus, Eshrsha coli,Staph epidermis, proteus, klebsiella, Klebsiella spp ,Enterobact, Streptococcus pyogen ,Candida albicans fungi.

Keywords: Umbilical cord care, Bacterial infections, Antibiotic resistance, Uumbilical cord inflammation.

Introduction

The umbilical cord is a tube that connects you to your baby during pregnancy. It has three blood vessels: one vein that carries food and oxygen from the placenta to your baby and two arteries that carry waste from your baby back to the placenta. A substance called Wharton's jelly cushions and protects these blood vessels. The

umbilical cord starts to form at about 4 weeks of pregnancy and usually grows to be about 22 inches long.The umbilical cord, lifeline of the fetus, is very much undervalued and certainly not being studied sufficiently frequently (Benirschke et al,.2000).

The umbilical cord, which connects the baby and placenta in the uterus, is made of blood vessels and connective tissue. It is covered by a membrane that is normally bathed in amniotic fluid. After birth, cutting the cord physically and symbolically separates the mother and her baby. The cord stump dries and falls off, and the wound heals The World Health Organization estimates that a quarter of the world's neonatal deaths are due to infection; 75% of these occur in the first week of life, with the umbilical cord being the gateway.The umbili-cal cord is an important bacterial colonisation site. A possible consequence of bacterial colonisation is cord stump infection, a factor that can greatly increase morbidity and mortality. The risk of infection increases until the stump detaches The newborn's skin and umbilical cord begin to colonise with saprophytic bacteria provided by the mother through skin contact.

The umbilical cord is colonised by microorganisms of the vagina, skin, and hands of the birth attendant. Umbilical cord rot becomes an excellent growing medium for microbial flora. Omphalitis is an infection of the umbilical cord stump. Tracking bacteria along the umbilical

vessels may lead to septicaemia, which can result in neonatal morbidity and mortality. The average age of presentation of omphalitis is the third or fourth day of life of the newborn.Omphalitis can be extremely serious, causing sepsis, due to the permeability of the umbilical vessels that persists until approximately 20 days of age of the newborn

Prevention of this disease and its associated neonatal mortality is of great public health importance.The exact incidence of cord infections is unknown. They appear to be relatively rare in developed countries, but they are probably under-reported.

Overall, omphalitis risk varies substantially and depends on the level of direct and indirect exposures to the stump (e.g.,absence of hand washing and other hygiene practices by carers), variation in definition, standardisation, and frequency of measurement . Estimated that the incidence of omphalitis in newborns in developed countries is around 0.7% and rises to 6–8% in developing countries. Even with the low incidence of omphalitis, the open wound of the umbilical stump remains an entry point for pathogenic bacteria, and the undetached cord stump ofte worries mothers. Rapid healing of the cord is an important aspect of infection prevention (Redline, R. W.et al,. 2006,).

Umbilical Cord Care

1. Before proceeding to the care of the stump wash hands thoroughly with soap and water

2. To ensure the stump heals properly only clean the umbilical stump when it becomes dirty or sticky. The best way to clean it is rub gently, around the stump and the area with gauze soaked in warm water and mild soap, whenever you notice any kind of dirt or debris.
3. In order to promote proper healing , the umbilical cord stump should be exposed to air and remain dry and clean. When putting on your baby's diaper, make sure it is folded down properly to keep the stump exposed. Covered with a clean shirt. Change the shirt when it gets dirty with secretions of the stump.
4. Do not covers umbilical cord stumps with bandages or anithing else that wil restrict airflow. Allow the stump to fall off by itself. Never pull on the stump in an attempt to remove it. Even if it looks like it would come off easely, you sholuld resist the urge to tug at it. In this way naturally heal (Stewart, D et al., 2016).

Types of Bacteria that Cause Infection to Umbilical Cord

- Normal flora are microorganisms (bacteria, fungi, protozoa, and viruses), mostly bacteria that continuously inhabited the human body (Resident Normal Flora). Under normal conditions in a healthy human they are harmless and may even be beneficial. A fetus is sterile when born (No Normal Flora), then newborn start having the normal flora from its mother, air, food and the environment .(Engelkirk, P. G et al.,2000).
- *Staphylococcus aureus* Gram positive non spore-forming non-motile, spherical cells, usually arranged in grape-like clusters single cocci , pairs, tetrads and chains are seen in liquid culturesFrequently non-pigmented after over-night incubation. Hemolytic on blood agar plate.S .aureus (coagulase positive).(de Benito, S., Alou, L et al.,2018).
- *S.epidermidis* are white colonies, non-hemolyticS.epidermidis (coagulase-negative) .Prevention and control source of infection is shedding human lesions, the human respiratory tract and skin contact spread of infection occur in hospitals.(Dumontet, V., Pelissier, F et al., 2013).
- *Streptococcus pyogenes* are non-motile, non-sporulating, gram- positive facultative anaerobes. Spherical or oval cells characteristically forming pairs or chains during growth .They are widely distributed in nature and are found in upper respiratory tract, gastrointestinal tract and genitourinary tract as normal microbial flora S. pyogenes- Shows clear zone of hemolysis in blood agar plate.S. pyogenes Lancefield group A(Hanski, E et al.,1992).
- *Escherichia Coli* (gram-negative rods) are normal flora in human and animal gastrointestinal tract. . Found in Urinary tract infection- cystitis, pyelonephritis . Wound infection- appendicitis,peritonitis . Neonatal septicemia and meningitis .

E.coli-associated diarrheal disease. Culture: Lactose-fermenting mucoid colonies on mac conkey agar and some strains are hemolytic on blood agar.

- *Klebsiella species* are non-motile, lactose-fermenting, capsulated, gram-negative rods has culture: Large, mucoid, lactose-fermenting colonies on mac conkey agar, and shows stringy type. Growth when cultured in broth medium. In healthcare settings, klebsiella bacteria can be spread through person-to-person contact.(Casewell, M et al., 1977).
- *Enterobacter species* are gram-negative lactose fermenting motile rods, and found as a commensal in the intestinal tract of humans and moist environments. Medical important species is Enterobacter aerogens. It produces mucoid colony resembling klebsiella on Mac Conkey agar.Enterobacter aerogens is associated with urinary tract infection, wound infection and septicaemia in immunocompromised and chronically deblitated patients.
- *Proteus Mirabilis* found in the intestinal tract of humans and animals, soil, sewage and water. They are gram-negative, motile, non-capsulated Culture: produce characteristic swarming growth over the surface of blood agar. Ditching of culture media prevents spread of proteus species. Non-lactose fermenting colonies in mac conkey agar.(Vediyappan, Get al.,2013)
- *Candida albicans* is an opportunistic fungal pathogen , it becomes opportunistic pathogen for immunocompromised patients, for some immunologi cally weak individuals, or even for healthy persons. The infection caused by C. ALBICANS is commonly known as candidiasis. The original with candida infection is often associated with vaginal flora from a mother with history of vaginal candidiasis. Tiraboschi, I. C. Net al.,2010).

Kalathia, M. B., et al (2013) their studies was Organisms grown in were Pseudomonas (45%, 5 out of 11), Acinetobacter (27.27%, 3 out of 11), Escherichia coli (18.18%, 2 out of 11), and Klebsiella (9%, 1 out of 11). Kalathia, M. B., et al 2013) (Kalathia, M. B., et al 2013).

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Forozeshfard., et al (2017) their studies was Organisms grown the genus Enterococcus, Staphylococcus aureus (Forozeshfard., et al 2017).

Stewart, D., et al(2016)) their studies was Organisms grown Staphylococcus aureus remains the most frequently reported organism(Stewart, D., et al2016).

Mullany, L. C., et al (2003) their studies was Organisms grown staphylococcal colonization of the umblical cord cord (Mullany, L. C., et al 2003).

Faridi, M. M., et al (1993) their study umbilicus becomes colonized with many different types of bacteria. Gram-positive cocci are present within hours, followed shortly by the presence of many enteric microorganisms (Faridi, M. M., et al 1993).

Cushing, A. H.., et al (1985) their study Aerobic bacteria are present in approximately 85% of infections, predominated by Staphylococcus aureus, group A Streptococcus, Escherichia coli, Klebsiella pneumoniae, and Proteus mirabilis.Methicillin-resistant S aureus has also been described in association with omphalitis (CUSHING, A. H.., et al 1985).The aim of our study is to know the reasons for the occurrence of umbilical cord contamination, to identify the most types of bacteria as the main cause, to know the appropriate antibiotics, and to alert on how to care for the umbilical cord to avoid contamination.

Materials and Methods

Between 2017 and 2020 obtain information of umblical cord samples were collected from microbiology labratory at the Medical Center The variables analyzed were sex, and bacteria, antibiotics with higher sensibility and with higher resistance A total of 47 antibiotics were used the cases of contamination resulting from some types of bacteria were identified in order to study and know the causes and avoid some of the causes of pollution cases. We sorted the cases according to sex to find out more cases of infection, whether females or males, and also sorted the types of bacteria that cause infection to know the most cases of contamination that occur from any type of bacteria and to provide precautions. As shown in Table 1. As well as Table 3 and 4 shows resistance and sensitivity of microbes by cultured bacteria as shown in fig 1.

Table 1. The Sex of the Infected and the Type of Microorganism causing the Infection.

Variable	Number of Cases
Sex	
Male	**18**
Female	**28**
Microbes	
No growth	6
Skin flora	2
Staph aureus	18
Eshrsha coli	3
Staph epiderms	3
Proteus	1
Klebsiella	7
Klebsiella spp	2
Enterobact	1
Streptococcus pyogen	1
Candida albicans	1

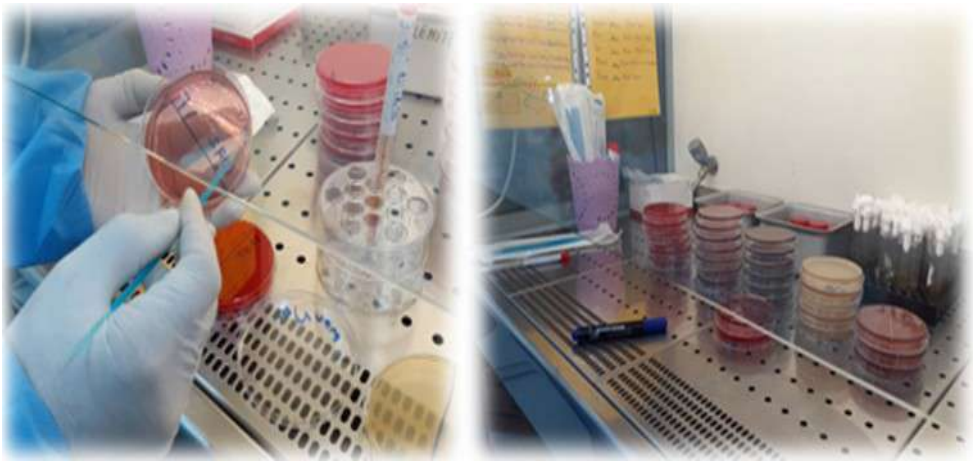

Figure 1. Culture Media of some Umbilical Cord Samples.

Table 2. Antibiotic Sensitive Bacteria

Name Antibiotic	Staphyloccocus aureus	Klebsiellla	Enterobacteria	Proteus	Staphyloccocus Epidermis	Escherichia coli
Cephalothin	2	0	0	0	0	0
Cefoxitin	3	2	0	1	1	0
Vancomycin	2	0	0	0	0	0
Ceftazidime	1	0	0	0	0	0
Clindamycin	5	1	0	0	0	0
Cefuroxime	1	0	0	0	0	0
Ciprofloxacin	8	4	1	0	2	2
Cefotaxime	4	2	0	0	1	0
Imipenem	5	5	1	1	1	2
Amikacin	6	3	2	1	1	2
Cefipime	2	0	0	0	0	0
Piperacillin	0	0	0	0	0	0
Erythromycin	0	0	0	0	0	0
Tetracycline	0	0	0	0	0	0
Azithromycin	1	0	1	0	0	1
Ceftriaxone	0	1	0	0	0	0
Cefixime	1	0	1	0	0	1
Colistin	0	0	0	0	0	0
Meropenem	0	0	0	0	0	0

Table 3 Antibiotic Resistant bacteria

Name Antibiotic	Staphyloccoc us aureus	Klebsiell a	Enterobacteria ce	Proteu s	Staphyloccoc us Epidermis	Escherichi a coli
Cephalothin	3	3	0	0	0	0
Cefoxitin	5	4	0	0	0	1
Vancomycin	3	1	0	0	0	0
Ceftazidime	5	2	2	0	2	1
Clindamycin	0	0	0	0	1	1
Cefuroxime	1	5	0	0	0	1
Ciprofloxaci n	9	5	1	1	1	1
Cefotaxime	4	3	1	1	2	1
Imipenem	0	1	0	0	1	0
Amikacin	5	3	0	0	0	0
Cefipime	2	0	0	0	1	0
Piperacillin	0	1	0	1	0	0
Erythromyci n	1	0	0	0	0	0
Tetracycline	0	2	0	0	0	0
Azithromyci n	0	0	0	0	0	0
Ceftriaxone	2	1	0	0	0	0
Cefixime	0	0	0	0	0	0
Colistin	1	0	0	0	0	0
Meropene m	0	0	1	0	0	0

Table 4. Total Frequently Number of Antibiotic Resistance and Sensitivity

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Name of antibiotic	Frequently Number of Antibiotic (Resistance)	Frequently Number of Antibiotic (Sensitivity)
Cephalothin	6	2
Cefoxitin	10	7
Vancomycin	4	2
Ceftazidime	11	1
Clindamycin	2	6
Cefuroxime	7	1
Ciprofloxacin	18	17
Cefotaxime	12	7
Imipenem	2	15
Amikacin	8	15
Cefipime	3	2
Piperacillin	2	1
Erythromycin	1	0
Tetracycline	2	0
Azithromycin	0	3
Ceftriaxone	3	0
Cefixime	0	1
Colistin	1	0
Meropenem	1	0

Results and Discussion

This study on some cases of umblical cord infection in Tobruk Medical Center, Libya, Libya and Tobruk especially between 2017 to 2020. The results of our research included about 28 girls infected with Staph aureus, and boys were infected with the lowest percentage, about 18, and the Staph aureus bacteria was higher, with the number of infections about 18, followed by Klebsiella, the number of infections was 7. 46 cases in microbiology department were followed up with the hospital. We will also explain the information of our results by means of the graph for sorting the bacteria that cause umbilical cord inflammation, as well as by sorting the sex as following (figure 2).

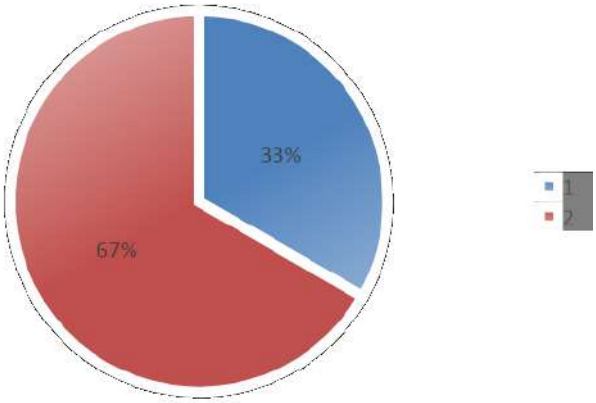

Figure 2. Number of Females and Males with Infected Umblical Cord.

The graph describes number of females was 28 while, number of males was 18. They infected with umblical cord.

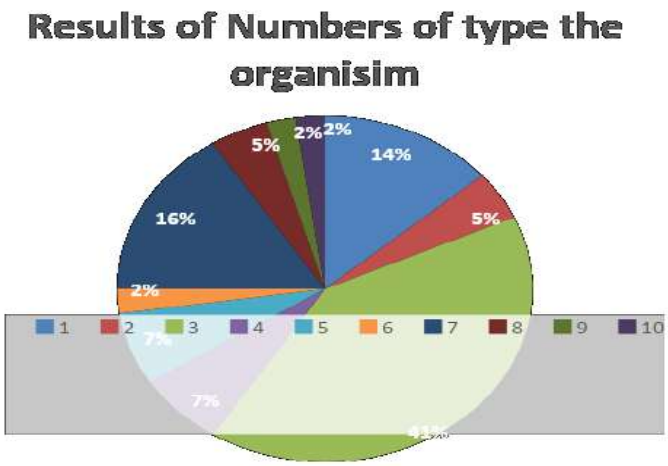

Figure 3. Total of Organisms cause Umblical Cord Infection and the Most Organism Causing Infection.

This diagram explains the total organisms cause umblical cord infection and describes bacteria causes most infection. The *Staphylococcus aureus* bacteria was higher, with the number of infections about 18, followed by *Klebsiella,* the number of infections was 7 .

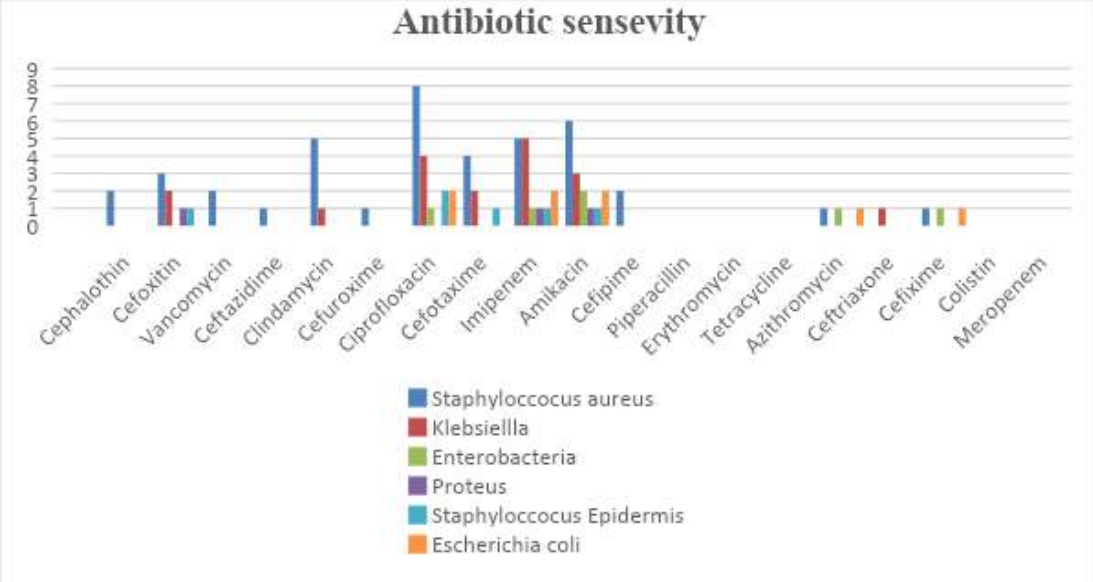

Figure 4. Good Sensitivity Profile for Antibiotics

Good sensitivity profile for antibiotics showed that most sensitivie antibiotic in this study was Ciprofloxacin. The bacteria Staphylococcus has higher rate. The general sensitivity report was: good sensitivity profile for antibiotics like Ciprofloxacin ,Amikacin ,Imipenem and Clindamycin as previously The most sensitivity antibiotic in this study was Ciprofloxacin (Table 2).

The resistance for all the samples reported was as follows Ciprofloxacin, Ceftazidime ,Cefoxitin , Amikacin in infection with Staphylococcus and Cefuroxime ,Ciprofloxacin in Klebsiellla infection. The most resistant antibiotic in this study were Ciprofloxacin, Ceftazidime and the most sensitivity antibiotic in this study were Ciprofloxacin, Amikacin and Imipenem (Table 2).

The results in this research reveal that due to their good sensitivity profile for antibiotics like Ciprofloxacin ,Amikacin ,Imipenem and Clindamycin therapy in Staphyloccocus aureus in patient umblical cord infection always personalizing trying to avoid the development of antibiotic resistance.Also prove all of Imipenem as previously (figure 4).Amikacin the good sensitivity in the case Klebsiellla, Escherichia coli .

Other sensitive or resistant antimicrobials, which without altering the results, leaves out some antibiotics that could be resistant or sensitive than those presented in this study. In the following (graph 5) explain antibiotic resistance:

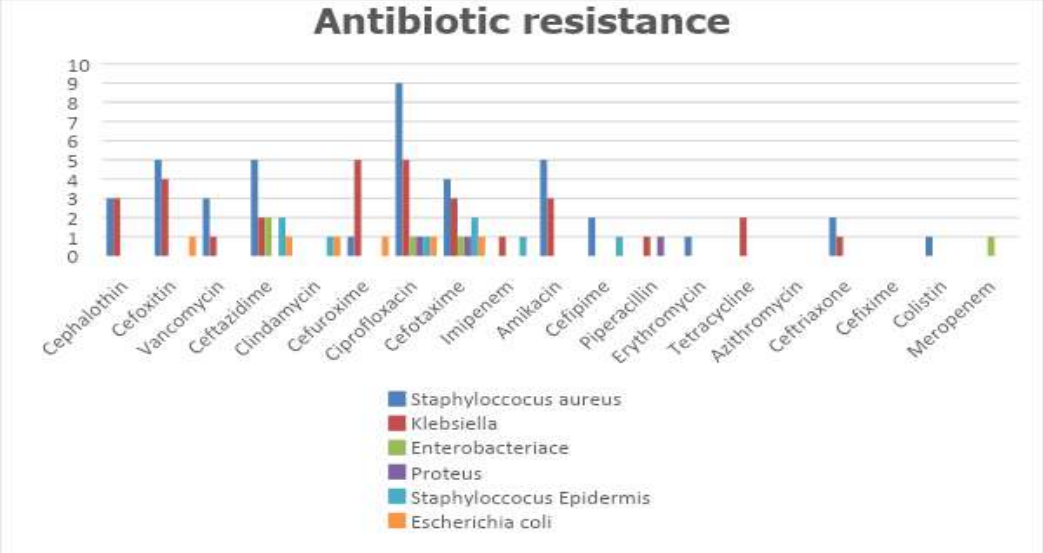

Figure 5. Antibiotic Resistance Bacteria.

From Figure 5, the resistance for all the samples reported was as follows Ciprofloxacin,Ceftazidime ,Cefoxitin ,Amikacin in infection with Staphylococcus and Cefuroxime ,Ciprofloxacin in Klebsiellla infection . The most resistant antibiotic in this study was Ciprofloxacin as shown in fig 6.The most sensitivity antibiotic in this study was Ciprofloxacin, imipenem and Amikacin.

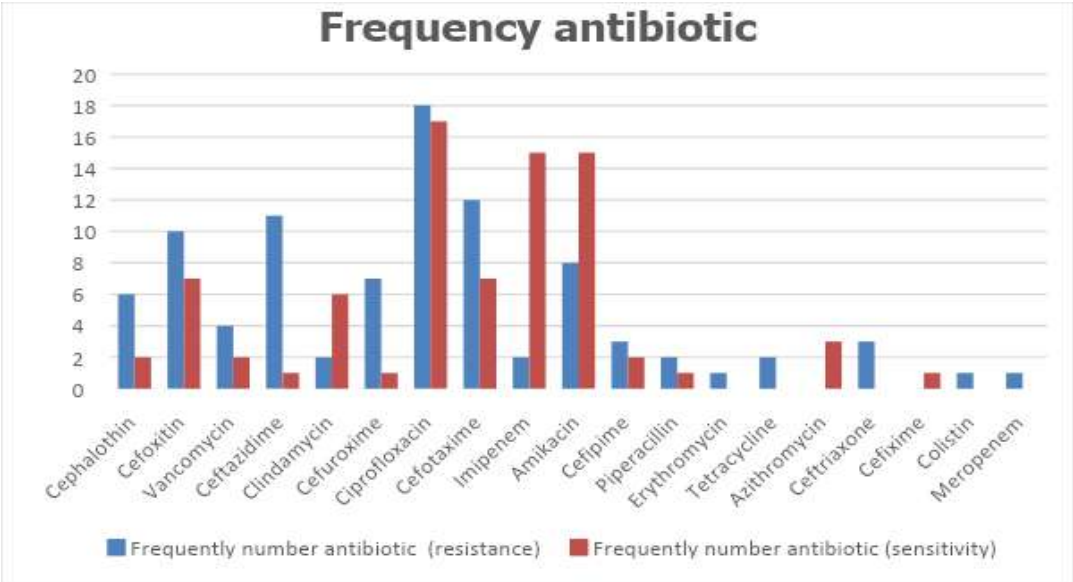

Figure 6. Total Frequently Number of Antibiotic Resistance and Sensitivity.

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46 cases in microbiology department were followed up with the hospital. The bacteria were Staphylococcus higher rate general sensitivity reported was: good sensitivity profile for antibiotics like Ciprofloxacin ,Amikacin ,Imipenem and Clindamycin .

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Conclusion

We conclude from our study of bacteria responsible umblical cord infection at Tobruk Medical Center and although it is considered the first of its kind. the Staphylococcus aureus remains the most frequently reported organism.

The results in this research reveal that due to their good sensitivity profile for antibiotics like Ciprofloxacin ,Amikacin ,Imipenem and Clindamycin therapy in Staphyloccocus aureus in patient umblical cord infection always personalizing trying to avoid the development of antibiotic resistance.Also prove all of Imipenem ,Amikacin the good sensitivity in the case Klebsiellla ,Escherichia coli. The most resistant antibiotic in this study was Imipenem and most sensitivity antibiotic in this study was Ciprofloxacin.

Through this study, so we recommend maintaining and caring for umblical cord to ensure the stump heals properly only clean the umbilical stump when it becomes dirty or sticky. The best way to clean it is rub gently, around the stump and the area to the care of the stump wash hands thoroughly with soap and water. With gauze soaked in warm water and mild soap, whenever you notice any kind of dirt or debris In order to promote proper healing, the umbilical cord stump should be exposed to air and remain dry and clean. When putting on your baby's diaper, make sure it is folded down properly to keep the stump exposed. Covered with a clean shirt. Change the shirt when it gets dirty with secretions of the stump.

Acknowledgement

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