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Research Article

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Antimicrobial Resistance Profiles of Bacterial Pathogens Causing Surgical Site Infections among Post-Operative Mothers at Kawempe National Referral Hospital, Uganda

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Abstract

Surgical site infections (SSIs) significantly contribute to maternal morbidity and mortality, with antimicrobial resistance (AMR) complicating effective management. This study assessed the bacterial profiles and antimicrobial susceptibility patterns, emphasizing AMR, among post-operative mothers at Kawempe National Referral Hospital. Swab samples from infected surgical sites were cultured and tested against a panel of antibiotics using the Kirby-Bauer disk diffusion method. Results revealed predominant pathogens, notably Staphylococcus aureus and Escherichia coli, with varying susceptibility profiles. Notably, multidrug-resistant strains, including methicillin-resistant Staphylococcus aureus (MRSA), exhibited resistance to commonly used antibiotics such as penicillins and aminoglycosides, but remained susceptible to vancomycin and imipenem. These findings underscore the urgent need for antimicrobial stewardship and routine susceptibility testing to curb AMR in this setting.

1. Introduction

Antimicrobial resistance (AMR) poses a global health threat, undermining the efficacy of antibiotics and complicating the treatment of infections, including surgical site infections (SSIs). In Uganda, the prevalence of SSIs post-cesarean delivery remains high, with bacterial pathogens demonstrating diverse susceptibility patterns. Understanding the local antimicrobial resistance profiles is vital for guiding empirical therapy and implementing effective infection control measures [1].

2. Materials and Methods

Swab specimens from post-operative maternal surgical sites were cultured on Blood, Chocolate, and MacConkey agar plates. Incubation was performed at 37°C for 24-48 hours. Bacterial identification involved colony morphology, Gram staining, and biochemical tests, including catalase, coagulase, indole, urease, citrate utilization, and triple sugar iron tests. Antimicrobial susceptibility testing was conducted using the Kirby-Bauer disk diffusion method on Mueller-Hinton agar, with antibiotics selected based on local guidelines: Imipenem, Vancomycin, Clindamycin, Ciprofloxacin, Gentamicin, Ceftriaxone, and Ceftazidime. Zones of inhibition were measured and interpreted following CLSI standards.

3. Results

3.1. Prevalence of Surgical Site Infection in Post-Operative Mothers at Kawempe National Referral Hospital

This data was obtained from the culture plates which showed growth of significance during the study as in table 1 below

Sepsis (n=202)	Freq.	Percent(%)
No Growth	140	69.3
Growth	62	30.7
Gram stain reaction (n=62)		
Positive(only)	51	82.2
Negative(only)	4	6.5
Mixed Growth	7	11.3

Table 1: Showing the Prevalence of Surgical Site Infection in Post-Operative Mothers at Kawempe National Referral Hospital

In the study comprising 202 participants, 30.7% were diagnosed with post-Caesarean wound sepsis with gram positive, gram negative, and mixed gram reaction having the prevalence of 82.2%, 6.5% and 11.3% respectively.

3.2. Possible Bacterial Species from Exudates on Wounds of Post-Operative Mothers at Kawempe National Referral Hospital

This data was obtained from the culture plates which showed growth of significance during the study and isolates identified as shown In Table 2.

Isolated Organism (n=70)	Freq.	Percent(%)
Staphylococcus aureus	30	42.9
Coagulase Negative Staphylococuss	29	41.4
Escherichia coli	3	4.3
Klebsiella species	3	4.3
Others	5	7.1

Table 2: Showing Possible Bacterial Species from Exudates on Wounds of Post-Operative Mothers at Kawempe National Referral Hospital

A total of 70 bacterial isolates were identified from SSIs, with Staphylococcus aureus (42.9%) and coagulase-negative Staphylococci (41.4%) being the most prevalent. Gram-negative bacteria included E. coli (4.3%) and Klebsiella spp. (4.3%).

3.3 Antimicrobial Activity of Isolated Bacterial Profiles Causing Surgical Site Infections among Postoperative Mothers at Kawempe National Referral Hospital

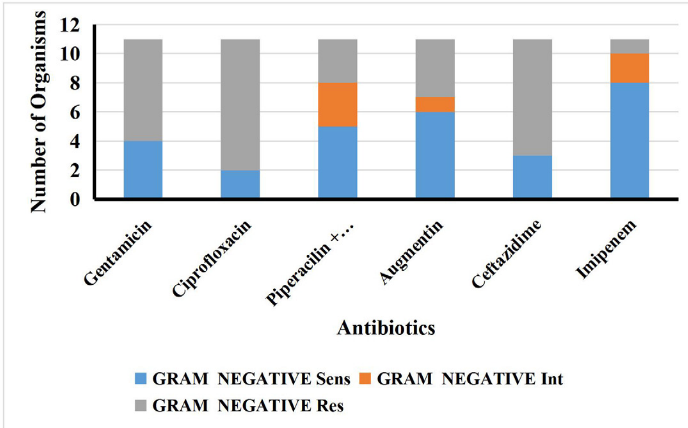

Figure 1: Bar graph showing gram negatives susceptibility testing to antibiotics in post ceasarean wound infections among mothers attending Kawempe National Referral Hospital (Number of organisms against Antibiotics)

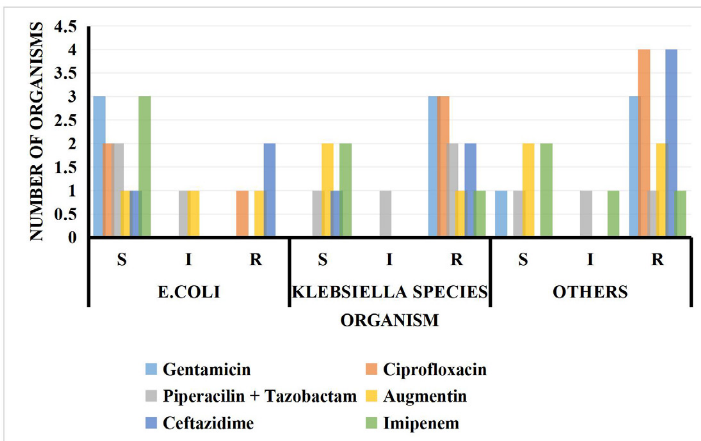

Figure 2: Bar graph showing gram negative isolates susceptibility testing to antibiotics in post ceasarean wound infections among mothers attending Kawempe National Referral Hospital (Number of organisms against Antibiotics)

- **E. coli and Klebsiella spp.:** Demonstrated high susceptibility to Imipenem (92-100%) but showed resistance to Ceftriaxone and Ceftazidime (resistance rates >50%), indicating extended-spectrum beta-lactamase (ESBL) production.

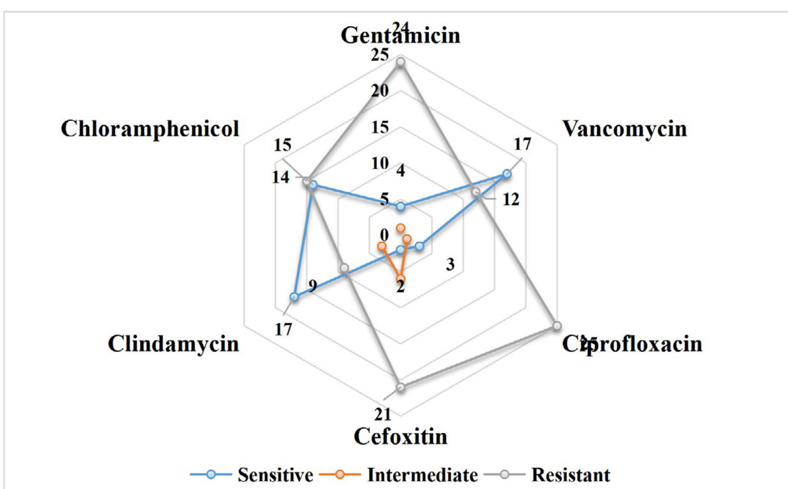

Figure 3: A Radar Chart showing Staphylococcus aureus susceptibility testing to antibiotics in post ceasarean wound infections among mothers attending Kawempe National Referral Hospital (Number of organisms against Antibiotics)

Staphylococcus Aureus: High susceptibility to Vancomycin (100%) and Clindamycin (86.7%), but notable resistance to Ciprofloxacin (40%) and Gentamicin (33.3%). MRSA strains exhibited resistance to beta-lactams, with susceptibility retained to Vancomycin and Imipenem.

The resistance patterns indicate a rising prevalence of multidrug-resistant organisms, particularly MRSA and ESBL-producing gram-negatives.

4. Discussion

In the study, coliforms showed high susceptibility to Imipenem and this is comparable to a study done in Mbale Regional Referral Hospital, Eastern Uganda, as well as in the study conducted from Hoima Regional Referral Hospital [1,2]. In the same study, Staphylococcus aureus showed high susceptibility to Clindamycin and Vancomycin which is contrally to other studies from Hoima and Mbale regional Refferal hospital which showed high sensitivity to Ciprofloxacin [3]. Furthermore, the study also showed that Staphylococcus aureus was resistant to Ciprofloxacin, Gentamycin, and Cefoxitin while coliforms were resistant to Ciprofloxacin, Ceftazidime, and Gentamicin. This could be attributed to the fact that these drugs were the most erroneously prescribed medications among the study population in Kawempe National Referral Hospital. These findings are similar to those found in Hoima [1].

The detection of MRSA and ESBL-producing gram-negative bacteria underscores the growing challenge of AMR in the hospital setting. Resistance to first-line antibiotics such as penicillins and cephalosporins limits empirical treatment options, necessitating reliance on last-resort drugs like Vancomycin and Imipenem. These findings align with regional studies indicating high resistance rates among Staphylococcus aureus and Enterobacteriaceae. The persistence of susceptibility to Vancomycin and Imipenem offers some therapeutic options but raises concerns over potential future resistance development. The high prevalence of multidrug-resistant organisms necessitates strengthening antimicrobial stewardship programs, routine susceptibility testing, and infection control measures to prevent transmission.

5. Conclusion

AMR among bacterial pathogens causing SSIs at Kawempe National Referral Hospital is increasingly problematic, characterized by resistance to commonly used antibiotics. There is an urgent need to implement routine microbial susceptibility testing, enforce antimicrobial stewardship, and adopt infection prevention strategies to mitigate the impact of resistant organisms [4-41].

Recommendations

1. Routine antimicrobial susceptibility testing for all SSI isolates to guide targeted therapy.
2. Strengthen infection prevention and control protocols.
3. Promote antimicrobial stewardship programs to optimize antibiotic use.
4. Continuous surveillance of resistance patterns to inform empirical treatment guidelines.
5. Capacity building for laboratory personnel in advanced diagnostic and susceptibility testing techniques.

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