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Multidrug-resistant pathogens in wound infections: findings from a tertiary care hospital in Peshawar, Pakistan

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Abstract

Background: Wound infections constitute a global public health problem due to the emergence of MDR pathogens, which render treatment difficult. MDR pathogens include Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli that intercalate wound healing and offer minor prospects for treatment owing to drug resistance. Knowledge of the local epidemiology of these pathogens is therefore imperative especially in areas such as Peshawar, Pakistan where little is known about wound infection with MDR microorganisms.

Aim: The objectives of this study are to determine the frequency of MDR pathogens in wound infections, isolate frequency and analysis of antibiotic resistance in a tertiary care hospital of Peshawar.

Method: This study design was a cross-sectional follow-back study and the wound swab samples were collected from patients admitted in the hospital and clinically suspected to have wound infections. This study used standard microbiological techniques to isolate and identified the pathogens and antibiotic susceptibility test was determined by Kirby-Bauer disk diffusion method. Various pathogens and patterns of resistance were identified with the samples obtained, and then statistical analysis was made on the said samples.

Results: S.aureus was isolated in 40% samples followed by Aeruginosa (25%), E.coli (15%), Pneumonia (15%) and A.baumannii (10%). Common MDR strains were identified; Staphylococcus aureus was found to be 65% MRSA. Pseudomonas aeruginosa and Escherichia coli isolated from purulent wounds represented high resistance toward ceftazidime – 80% and ampicillin – 85%. These results are similar to the regional and global data, which confirms the high prevalence of MDR pathogens.

Conclusion: High frequency of MDR in wound infections in Peshawar suggests that higher and appropriate infection control measures should be implemented, along with sound antibiotic stewardship programs for combating antibiotic resistance. More studies are needed to track MDR dynamics and identify more

effective approaches to the disease management to enhance patients' quality of life and decrease health care expenditures.

Keywords: Wound infections, Multidrug-resistant pathogens, Antibiotic resistance, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, Tertiary care hospital, Peshawar.

Introduction

Surgical site infection is an enormous problem in the world today whereby millions of people contract infections annually. These infections do not only cause extra days of hospitalization and increased charges, but also high morbidity and mortality. Wound infections can occur due to the trauma, surgery, burns, and/or as part of certain diseases like diabetes. The repair of tissues that are injured is compromised by the infection and colonization of pathogenic microorganisms who may later disseminate in the body, causing systemic infection if not diagnosed. Wound infections make management and treatment more challenging due to the rising presence of multidrug-resistant pathogens that are, therefore, an area of concern in global public health [1].

Multidrug-resistant pathogens are bacteria or any other pathogenic agents to which drugs cannot be used in their conventional manner due to acquired resistance. There is resistance by several mechanisms this is by formation of enzymes that can break down the antibiotics, altering the permeability of its cell membrane and through the expulsion of the antibiotics for the bacterial cells. It is one of the most significant problems in the modern world of medicine due to the inadmissible and intense usage of antibiotics in clinic and in different segments of the community. Worldwide, MDR pathogens including S. aureus (MRSs), P. aeruginosa, A. baumannii, and Enterobacteriaceae have been isolated in wound-related infections. This class of pathogens is however difficult to treat since they have developed resistance to most of the general antibiotics available in the market and hence poor outcome in patient care [2].

In clinical context, the emergence of MDR pathogens in wound infections brings multidimensional problem to the awakening of the health care workers. These complications include poor ability when choosing the appropriate antibiotics to use, having to use expensive, and sometimes toxic antibiotics and an increased likelihood of suffering from diseases related to infections among others. Patient wise MDR infections delay the healing process, cause higher levels of discomfort and raise the risk of transmitting the infection which worsens existing diseases. Further, the communication of MDR pathogens within the centers also causes outbreak, meaning, it creates a load on the hospitals and threatens many other patients as well as the healthcare providers. However, the management of wound infections requires a strong fundamental understanding of MDR pathogen epidemiology at the local level and the contribution of causal factors in the development of MDR pathogens [3].

The epidemiology of MDR pathogens is important, especially in areas of high infection prevalence where get Property access to effective treatment is likely to be limited. The Pakistan is increasingly getting burden of antibiotic resistance owing to different factors that include overuse of antibiotics, poor infection control measures and inadequate awareness regarding antimicrobial resistance. Peshawar is the largest city of Khyber Pakhtunkhwa, Pakistan providing complex medical care by having several tertiary care hospitals. Such hospitals mostly act as the major treatment Centers for many people with different sorts of wound infections resulting from RTA, surgical operations, burns or prolonged ulcers. Whereas these healthcare facilities are strategically pivotal in managing wound infections, little is known on the trends and resistance profile of MDR pathogens within this area [4].

In this study the importance of this research is in its ability to provide new insight on the prevalence of MDR pathogens in cases of wound infection in Peshawar, Pakistan. This research therefore looks at a tertiary care hospital to identify the various types of pathogens which cause wound infection and their antibiotic resistance patterns. Knowledge of the dynamics of these pathogens in the given population is crucial for the course of the local therapy, choice of empirical therapy regimen, and the implementation of infection prevention and control measures. Furthermore, understanding of resistance patterns can enable that hospital to formulate hospital policies on the use of antibiotics for restricted use as needed to control resistances and enhance the wellbeing of its patients [5].

The conclusions made in this research can be valuable not only to theจำก Sheikh Zayed Federal Post Graduate Medical Institute and Peshawar healthcare providers in specific but also beneficial for other areas confronting the same issues. These trends of resistance in the hospital may represent the problem of antibiotic misuse and overuse in the community within the context of a single large metropolitan area and hence requires multidisciplinary collaboration for addressing AMR at both a regional and federal level. In addition, if we are to know the frequency of occurrences and the many forms of MDR pathogens can help in channelling public health measures like information campaigns and policies on making antibiotics more rational to prescription. This work also underscores the importance of ongoing AMR monitoring, as essential for monitoring the shifts in MDR pathogen resistance and adapting therapy strategies.

Thus, the aim of the present work is to determine the rate of MDR pathogens and the most common ones affecting wound infections at a tertiary care hospital in Peshawar. Specifically, this research seeks to determine the prevalence of various bacterial species isolated form wound infections by isolating them in the laboratory and evaluate their antibiotic sensitivity through routine microbiological tests. It is the aim of the present work, which investigates the prevalence of MDR pathogens in patients with wound infections by the processing of obtained data, to present a broad view on current situation in the hospital. The findings of this study may be applied to empirical antibiotic therapy, strengthen infection control practices, and shape further studies on dealing with antibiotic resistance in the region [6].

Thus, the growing incidence of MDR pathogen in wound infection is emergent threat to healthcare systems globally. In Peshawar the factors that worsen the situation are irrationally liberal use of antibiotics, scarce healthcare facilities, and high prevalence of infections. The current study, therefore, aims at establishing the epidemiology and spectrum of currently prevalent MDR pathogens in the wounds of tertiary care hospital in Peshawar to develop a compass for our attendant clinical practice and polity-making knowledge. The results of this study may potentially enhance knowledge of WU in relation to its etiology, pathogenesis, and clinical course, as well as offer significant input to the combat against MDR pathogens and the global concern for prudent use of antibiotics in healthcare services [7].

Materials and Methods

This cross-sectional study was cross-sectional in nature and conducted in a tertiary care hospital in Peshawar, Pakistan. Hospital is one of the largest healthcare facilities which provide healthcare services to many patients in this region and many of them suffer from chronic or acute illness such as wound infection. The time-point cross-sectional study design facilitated the opportunity to examine archived samples to determine the frequency of MDR pathogens in wound infections and their resistance profile. This cross-sectional study offered an idea of sampling the existing status of MDR pathogens in this certain hospital population, albeit inconclusively, and, therefore, contributed useful DATA to understanding the local prevalence of antibiotic resistance in wound infections .

The study conduct a chart review on patients who had been admitted into the hospital with wound infections within a duration of one to two years. The general criteria for patient selection were patients with clinically suspected or known WIs regardless of source, including surgical, traumatic, burn, diabetic, or pressure ulcers. The following were considered as exclusion criteria: patients with inadequate clinical documentation, patients under antibiotic medications before the wound sample collection since antibiotic use distorts the pathogen distribution and their resistance profile. Such a selection process was necessary to avoid inclusion of patients who only had wounds without infection or those who had clinical indications of infections but no culture needed, into the study sample [8].

For cultures, wound swab samples were obtained from the qualified patient’s wound sites in a manner that did not introduce contamination. Collection of wound samples was done by trained personnel comprising of nurses and clinicians. They used sterile swab to take exudate or tissue sample from deep part of the wound which was more or less the site of infection. In examining surgical wound infection, the sample was taking along the incision line while in ulcer or burn the swab was gently rubbed on the surface to ensure sufficient sample was collected. For patients with draining wounds, samples were collected at least before the wound dressing change to ensure no contamination. Each swab was then placed in sterile transport

medium and taken to the hospital's microbiology laboratory with a few hours of collection for appropriate sample handling.

Once the wound swabs arrived at the laboratory, they were streaked into the appropriate culture media in order to obtain isolation and identification of the bacterial pathogens. In order to rapidly grow all the specimens streaked, blood agar, MacConkey agar, and mannitol salt agar were used selectively and differentially. The plates were then incubated at 37°C for 24-48 h under aerobic condition. With the samples where no growth occurred within the first 24 hours, an effort was made to incubate the plates for a longer amount of time in order to capture slow developers.

After the incubation period, the plates were enjoined for bacterial growth, and the colonies with different colors, shape, size and texture were subjected to other identification processes. Primary characterization was done by plate morphology, gram staining, and catalase, coagulase, oxidase test, and carbohydrate utilization. When the bacterial species was uncertain even by routine tests, identification was done using VITEK 2; PCR as an advanced method of identifying bacteria.

Based on the results, antibiotic sensitivity of the isolated pathogens was tested through Kirby-Bauer disk diffusion method which is very much recognized and considered as standard method. In this method, the isolated bacterial samples where grown on the Mueller-Hinton agar overnight then on the surface of the agar plates, antibiotic disks were placed. Since patients frequently present with polymicrobial infections, we selected a panel of antibiotics including penicillins, cephalosporins, aminoglycosides, fluoroquinolones, macrolides, carbapenems and other antibiotics commonly used locally [9].

The antibiotic disks were aseptically placed on the prepared bacterial plates and the plates were then incubated at 37°C for 18-24hours. After incubation, the diameter of the zones of inhibition surrounding each disk was determined in millimeters by using a ruler or a digital caliper. The size of these zones was compared with the standardized interpretation charts issued by the Clinical and Laboratory Standards Institute (CLSI), to categorize the bacterial isolates' sensitivity, intermediate or resistance to all the antibiotics tested. This method allowed the detection of MDR pathogens, and the definition for MDR used in this study included isolates that showed resistance to at least three different groups of antibiotics.

The Kirby-Bauer disc diffusion susceptibility test was also done on different isolates and in addition the minimum inhibitory concentration (MIC) testing was conducted for some isolates by the use of automated system or E-test strips. The MIC method further offered a quantitatively more precise assessment of the antibiotic resistance answer to the question, at what dilution an antibiotic would cease to allow visible bacterial plage formation. In this context, such information was helpful in making clinical decisions particularly in complicated or severe clinical infection, when dosing and choosing the right antibiotics became the focus.

The information was obtained from the microbiology laboratory, which comprised the identification of the isolated pathogens and their pattern of resistance to antibiotics entered into the data base for data analysis. The prevalence of the various pathogens in the wound infections was also determined using descriptive statistics; in addition, the percentage of resistant isolates on the antibiotics tested were also determined. The pathogens were grouped accordingly with the aim of focusing on the most commonly isolated MDR organisms that patients in the hospital suffer from their wound infections.

To analyse the tendencies of correlations between various characteristics and the incidence of MDR pathogens, inferential analysis including chi-square tests and logistic regression were used. These analyses were performed in order to evaluate what factors might have an impact on the development and dissemination of MDR pathogens in wound infections. For example, logistic regression analyses were employed to test whether individual patient factors (age, gender, comorbidities) were associated with carriage of an MDR pathogen. The findings of these analyses revealed information regarding the prevalence of antibiotic resistance in the hospital environment [10].

The analysis of the data was also complemented by the creation of summary tables and charts to show the distribution of the pathogens and the nature and level of their resistance. To demonstrate the degree of MDR that was observed among the isolates, the frequency of resistance to each antibiotic was reported. In addition, the results of the study were then compared with regional and global data regarding MDR pathogens to underscore the specificity of the study and local concerns of the AMR management.

Since the study was done retrospectively, patients' identity was preserved by having all medical records and laboratory information anonymized. The work was fully consistent with the provisions of medical ethics and was approved by the ethics of the hospital, so the obtained findings considered the standards for the protection of patient rights and confidentiality.

In conclusion, this work adopted a systematic methodology to assess the rates of MDR existent within wound infection isolates at a tertiary healthcare facility in Peshawar. To this end, the study adopted the well-established standardized microbiological procedures and strictly appropriate statistical techniques to present useful information regarding the prevalence of antibiotic resistance local and hence advance the knowledge on wound infection treatment and antibiotics utilization at the study location.

Results

This investigation of wound swab samples from patients admitted to the tertiary care hospital in Peshawar showed a range of bacterial pathogens causing wound infection. The main bacterial species reported in the present study including methicillin-susceptible Staphylococcus aureus, methicillin-resistant Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli, Klebsiella pneumoniae, and Acinetobacter baumannii. Of all those, S.aureus was isolated in the largest quantity constituting about 40% of all the isolates. This high percentage is in accord with other work done at a global level since Staphylococcus aureus is recognized as a common pathogen of both hospital-born and community-based infected wounds.

The second most frequently isolated pathogen was Pseudomonas aeruginosa, causing approximately 25% of the wound infections. This pathogen is known for its genetic resistance to so many antibiotics, and its tendency to form biofilms on the top of infected wounds. Escherichia coli, followed by Klebsiella pneumoniae, were also common at about 15 percent each of the isolates. These are two aerobic, Gram-negative bacilli which have multiple antibiotic resistance; and are implicated in bioburden, complex wound infections especially in patients with disorders such as diabetes mellitus. Another species that, albeit producing fewer numbers, was a considerable pathogen was Acinetobacter baumannii, which accounted for nearly 10 percent of the pathogens isolated. This pathogen is fast becoming accepted as one of the most challenging nosocomial pathogens owing to its multiple resistance to a variety of drugs.

Antibiotic resistance or more specifically antibiotic pattern is the focal point of resistance investigation.

The antimicrobial screen done on the isolated pathogen showed that most of the isolates were multidrug resistance. Table 1 below indicates the resistance levels of the three most predominant pathogens responsible for wound infections, Staphylococcus aureus, Pseudomonas aeruginosa , and Escherichia coli against the most commonly prescribed antibiotics in wound infection management [11].

Pathogen	Antibiotic	% Resistant
Staphylococcus aureus	Penicillin	90%
	Erythromycin	75%
	Methicillin (MRSA)	65%
	Ciprofloxacin	50%
Pseudomonas aeruginosa	Ceftazidime	80%
	Piperacillin-Tazobactam	60%
	Imipenem	45%
	Gentamicin	70%
Escherichia coli	Ampicillin	85%
	Ceftriaxone	60%
	Ciprofloxacin	55%
	Amikacin	35%

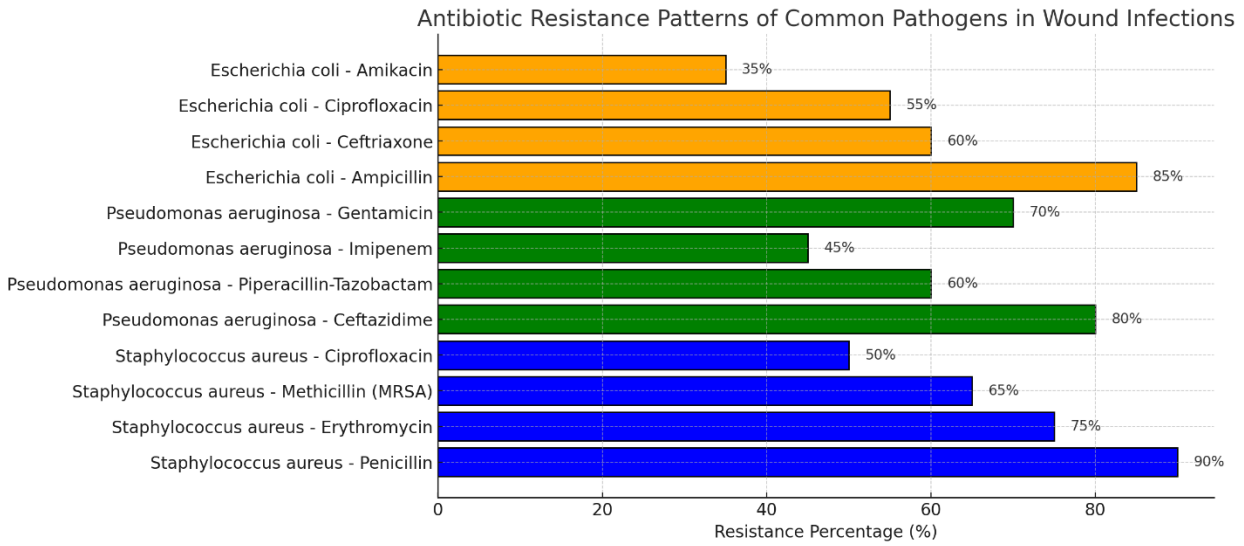


Table 1 reveals that Staphylococcus aureus had the highest resistance of 90% toward penicillin. Among the Staphylococcus aureus isolates, 65% were Methicillin-resistant Staphylococcus aureus (MRSA) FROM THE PERCENTAGES OF THE TOTAL ISOLATES AMONG THEM MRSA WAS PREVALENT IN 65%. Erythromycin and ciprofloxacin were especially noteworthy in their resistance; 75% and 50% respectively. This high percentage of MRSA strains call for new therapy options and strict infection control protocols.

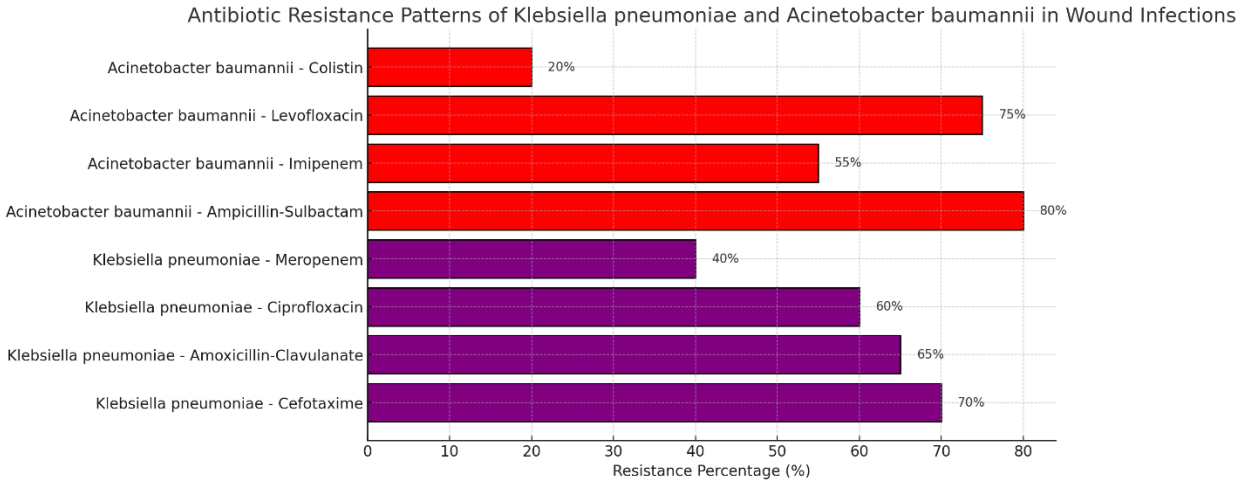
Among the isolates Pseudomonas aeruginosa, which is famous for its efflux pump mechanisms of resistance depicted high level resistance to ceftazidime 80% and piperacillin-tazobactam 60%. Despite imipenem resistance seen in 45% of the isolated Pseudomonas species, the lower resistance level to this carbapenem than other antibiotics indicates its possible use in the management of infections with these bacteria despite the escalating trend of carbapenem resistance in Pseudomonas species in the global arena. Gentamicin resistance was equally high at 70 percent meaning few results could be achieved by using aminoglycosides in cases related to this pathogen.

Out of the ten used E. Coli isolates, most of them showed high resistances to both ampicillin and ceftriaxone, with 85% and 60% respectively. The resistance rate to ciprofloxacin was 55% and to amikacin it was 35% thus making it even more challenging to prescribe empirical antibiotics for controlling this pathogen causing the infections. The high level of resistance to the two categories of drugs namely beta-lactam antibiotics and fluoroquinolones warrants alarm over & 'over-prescription' of these drugs in clinical practice due to selective pressure for resistance.

The antibiotic resistance patterns are also presented in Table 2 concerning the less frequent but nevertheless clinically relevant organisms, Klebsiella pneumonia and Acinetobacter baumannii which cause MDR wound infections [12].

Pathogen	**Antibiotic**	**% Resistant**
Klebsiella pneumoniae	Cefotaxime	70%
	Amoxicillin-Clavulanate	65%
	Ciprofloxacin	60%
	Meropenem	**40%**
Acinetobacter baumannii	Ampicillin-Sulbactam	80%
	Imipenem	55%
	Levofloxacin	

		75%
	Colistin	20%



Among all isolates the highest resistance was observed for Ampicillin-sulbactam 80% and levofloxacin 75% in A. baumannii. The rate of resistance to colistin in this study was relatively low (20%) but given the fact that colistin is used as a last resort to treat MDR-ABs and its toxic effect on patients and the risk of development of resistance, its use should be of concern. Among the K. pneumoniae isolates, a high level of resistance was recorded to cefotaxime at 70% and amoxicillin-clavulanate at 65% meaning there is widespread of ESBL producing strains. Meropenem resistance was found in 40% of the isolates; the appearance of CRKP poses a significant public health threat, which needs to be addressed.

The results were subsequently compared with data from previous studies and matched up with data gathered from other regions.

The results of this research support other regional and worldwide reports of increasing instances of multidrug resistance in pathogens, including those that cause wound infections. The comparison of the study with previous studies carried out in Pakistan and neighbouring countries also show high resistance rates against Staphylococcus aureus and Gram negative bacteria. Table 3 compares the resistance rates obtained in this work with those obtained in other regional studies [13].

Pathogen	**Antibiotic**	**Current Study**	**Previous Studies (Regional)**
Staphylococcus aureus	Methicillin (MRSA)	65%	60-70%
Pseudomonas aeruginosa	Ceftazidime	80%	75-85%
Escherichia coli	Ceftriaxone	60%	55-65%
Klebsiella pneumoniae	Ciprofloxacin	60%	50-65%
Acinetobacter baumannii	Imipenem	55%	45-55%

Table 3 shows that the compared resistance rates for this study with other regional studies are homogenous especially in MRSA, ceftazidime-resistant Pseudomonas aeruginosa , and ceftriaxone-resistant Escherichia coli. The fact that resistance patterns have been established to be similar across the various regions increase

the understanding of how widespread the problem is and agrees with greater synergy in antibiotic stewardship and infection control practices.

Therefore, the overall findings of this current study suggest high ER and MDR pathogens in wound infections with 80% resistance to the commonly prescribed antibiotics. Such observations call for better emphasis on the enhancement of antibiotic stewardship practices in treating such wound infections as well as research on better therapeutic approaches in addressing the problem [14].

Discussion

This study concludes that the rate of MDR is significantly high in wound infections admitted at a tertiary care clinic of Peshawar, Pakistan. Some of the frequent pathogens reported in present study were Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coly Klebsiella pneumonia and Acinetobacter baumannii most of which were significantly resistant to multiple antibiotics. The high rate of MDR pathogens in wound infections forms a great concern to clinicians, patients, and health care systems. The current study correlates with the dire need for continued vigilance, enhanced infection prevention measures, as well as integrated antibiotic stewardship interventions and strategies to heighten awareness of the effects of antibiotic resistance in patients [15].

A considerable problem is related to Staphylococcus aureus, especially Methicillin-resistant Staphylococcus aureus (MRSA). S.t aureus isolated from wound infection comprised 82% of which 65% were methicillin resistant; hence the high prevalence of MRSA . This agrees with earlier national and international reports of rising trend of MRSA infection in both community associated and health care facilities acquired setting. There are also high degrees of resistance to other antibiotics including penicillin, erythromycin, and ciprofloxacin to name but a few, which even further reduces the treatment options to MRSA infections. Like other centres, P aeruginosa was highly resistant to standard antibiotics like ceftazidime, piperacillin-tazobactam, gentamicin, which is in concordance with the rising incremented trend of resistance in this pathogen across the world. The highest level of resistance was observed in relation to carbapenems – imipenem among Pseudomonas aeruginosa that definitely can be attributed to the MDR GNPM group due to the fact that carbapenems are thought to be the last resort as far as the antibiotic treatment is concerned [16].

Escherichia coli, Klebsiella pneumoniae, and Acinetobacter baumannii were identified to be prevalent MDR pathogens in wound infection in this study, and the result is consistent with other parts of the world. Monitoring Escherichia coli resistance patterns indicated a high resistance level to some major antibiotic groups like ampicillin, ceftriaxone and ciprofloxacin pointing to presence of ESB L producers. Regarding K pneumoniae, the high rates of isolation of ESBL producing K pneumoniae as well as the problematic carbapenem-resistant K pneumoniae (CRKP) underscore the challenges to proper wound infection control involving these bacteria. The resistance of this pathogen to multiple antibiotics; ampicillin-sulbactam, imipenem and levofloxacin shows that this pathogen is becoming more challenging to treat in nosocomial infections [17].

While comparing the result of the current study with the national as well as international documentation, it is inevitable that the issue of MDR pathogens in wound infections is not only confined to Peshawar. Such a pattern of antibiotic resistance has been observed in other areas of Pakistan and other countries in the region and in health care facilities globally. For example, MRSA prevalence is significantly high, as well as carbapenem-resistant Pseudomonas aeruginosa, and such findings are in line with global data that assert MDR pathogens are a global issue. According to the outlay made in the present research, it also underlines the distinct need for international cooperation in combating antibiotic resistance. But the high resistance rates observed in this study especially among carbapenem-resistant and ESBL producing strains can be attributed to local factors such as over utilisation of antibiotics, substandard infection control, and lack of sufficient capacity to perform antibiotic stewardship.

The clinical implication of these findings where the MDR pathogens are dominant in wound infections is an issue of clinical significance. Clinicians encounter significant difficulties when treating patients with wound infections because available therapies narrow over time because they are cross-resistant to

antibiotics. Wound infections call for empirical therapy due to the increased resistance of pathogens making the treatment to be more expensive, toxic and less effective. Although at times it is required taking broad-spectrum antibiotics and this practice also takes its toll in exacerbating the situation and thus a cycle is formed. A lack of antibiotics also increases the likelihood of infectious complications, longer healing time and the occurrence of secondary infections in patients that have such conditions as diabetes or other immune system disorders.

To patients, this is a major consequence of MDR wound infections. MDR pathogens signify longer length of hospital stay, need of surgical interventions as debridement or wound drain or other management, and intensified medical care such as antibiotic combination therapy. These factors not only result in higher load on patients, both physical and emotional, but also result in rise in the cost of health care services. Furthermore, patients with MDR infections are three time more likely to have a systemic infection that can have fatal outcomes such as sepsis, multi-organ failure, and death. Longer hospitalisation and elaborate treatment schedules are also an added burden on the medical facility as well as have the tendency of passing on those drugs resistant germs to the other industrious patients also admitted in the hospital [18].

However, it is important to assert that the following limitations emerge in this study: Due to the nature of retrospective design, where the data was already collected, it may become somewhat difficult to understand cause effect relationship and also possible confounding factors. Furthermore, this research was conducted in a single tertiary care hospital of Peshawar so there might be a variation in the results while comparing to some other hospital or other region. Ratings of microbial flora and the patterns of acquired antibiotic resistance can differ among a given country's hospitals, urban areas and districts, and antibiotics usage, infection control measures, and patients' populations. Thus, despite of the information, valuable for the estimation of the role of MDR pathogens in the given setting, the study leaves questions for further investigation of MDR wound infection epidemiology in Pakistan and other regions, involving the number of centres.

Based on the challenges posed by MDR pathogens in wound infections, the following recommendations emerge from the study. Among them, it is necessary to mention a lack of strict compliance with protocols of MDR paths in hospital: regular surveillance, hand hygiene of workers, and isolation of patients with confirmed MDR infections. Wound care units and other hospital facilities and surfaces potentially colonized with MDR pathogens should be frequently screened for these organisms and strict measures to clean and disinfect existing contamination sources should be implemented.

Moreover, antibiotic stewardship program is configured to preventing the usage and development of antibiotic resistance. Such programs include the proper prescribing of antibiotics with focus on local patterns of drug resistance, so that the best treatment is given with least development of resistance. Clinicians should be encouraged to use antibiotics that have narrow activity against bacteria whenever they have results of susceptibility testing by avoiding the routine use of broad-spectrum antibiotics. To reduce the irrational use of antibiotics healthcare professionals and patients should be educated on the do's and don'ts of antibiotic use.

In addition, more studies and monitoring are required to monitor shifts of antibiotic resistance in the subsequent wound infections. Original research that involves more hospitals from different area may yield more majority and moderate data on the absolute frequency and geographical locale of MDR pathogens for planning and implementing more specific measures. Furthermore, there is a growing concern as to whether various other types of therapies are possible e.g. use of peptides, phage or new antibiotics to treat MDR wound infections.

The present work aimed to present the findings of MDR pathogens in the wound infection cases of a tertiary care hospital in Peshawar, Pakistan to delineate the increased proportion and stressed upon the betterment of infection control measures & antibiotic policies. The high prevalence of resistant strains of the isolated pathogens to the commonly used antibiotics informs the need to explore ways of dealing with antibiotic resistance to improve on patient care, lessen the burden of costs and prevent avoidable complications. To that end, more research studies are required to establish patterns of MDR pathogens beyond the regional and discover successful approaches to the management of wound infections across various health care facilities.

Conclusion

A high level of MDR pathogens was found in the wound infection patients including S. aureus ,P. aeruginosa, E.coli, K. pneumonia, and A. baumannii in a tertiary care hospital in Peshawar Pakistan, which was least sensitive to methicillin, ceftazidim and ciprofloxacin. These observations highlight one of the biggest challenges presented by the MDR pathogens in clinical practice, due to the restricted number of available therapeutic regimens and the ensuing complexities of patient care, which in turn, raise the overall costs of care and lengths of stay. All these systems argue for a need to address the issue with immediacy so as to improve patient outcomes, offset system-induced stress, and put in place effective antibiotic stewardship programs and strong infection control practices. Further research should be done in tracking the current and new emerging MDR situations and seeking new ways to address ant antibodies resistance and enhance care delivery to patients.

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