Treatment of drug-resistant infections essay

Treatment of Drug-Resistant InfectionsWhen penicillin was discovered, people thought that bacterial infection had been conquered once and for all (U. S. Food and Drug Administration [FDA], 1995). However, bacteria proved themselves up to the challenge, and strains resistant to penicillin soon emerged.

As newer antibiotics were developed, so was microbial resistance to these drugs. Staphylococcal infectionsMechanisms of resistance. The ?-lactam antibiotics – the penicillins and the cephalosporins – target penicillin-binding proteins, or PBP's, which are present in all bacteria (Petri, 2001). However, ?-lactam antibiotics cannot kill or inhibit all bacteria due to various mechanisms of bacterial resistance.

One method is by bacterial destruction of ?-lactam antibiotics enzymatically. Resistance could also be attributed to structural differences in penicillin-binding proteins. The existence of penicillinase-producing bacteria gave rise to the penicillinase-resistance penicillins, such as methicillin, nafcillin, oxacillin, cloxacillin and dicloxacillin. The use of these penicillinase-resistant penicillins are supposed to be limited to the treatment of infections that are known or suspected to be caused by staphylococci that elaborate penicillinase (Petri, 2001). MRSA. Some staphylococci, however, are resistant to the penicillinase-resistant penicillins through acquisition of an additional high-molecular-weight PBP via a transposon from an unknown organism (Petri, 2001). This PBP has a very low affinity for all ?-lactam antibiotics.

The gene encoding for this new PBP is present in methicillin-resistant Staphylococcus aureus, or MRSA (Petri, 2001). Treatment of infections due to

MRSA can depend on the type of tissues involved and where the infection was acquired. For example, skin and soft-tissue infections are said to “ represent the majority of the community-associated MRSA disease burden” (Daum, 2007). For wounds where cultures are positive for community-acquired MRSA, patients are given clindamycin, trimethoprim-sulfamethoxazole or doxycycline (Grayson, 2006). Topical antibiotics such as mupirocin, retapamulin, and bacitracin – with or without neomycin and polymyxin – may also be given (Daum, 2007).

This is because MRSA infections acquired in the community are usually not multidrug-resistant. In contrast, healthcare-associated MRSA infections tend to be multidrug-resistant and are thus treated with vancomycin, linezolid, daptomycin or rifampin plus fusidic acid. In general, however, the drug of choice for infections with methicillin-resistant organisms is vancomycin (Petri, 2001). This drug is used only to treat serious infections such as pneumonia, empyema, endocarditis, osteomyelitis, and soft-tissue abscesses that are suspected to be due to MRSA. Some physicians give rifampin together with vancomycin for life-threatening infections and those involving foreign bodies.

VISA and VRSA. Some staphylococci strains are emerging that are also resistant to vancomycin. The Centers for Disease Control and Prevention (CDC, 2006) define vancomycin-intermediate S. aureus (VISA) as those having a minimum inhibitory concentration (MIC) of 4-8 ? g/ml, while vancomycin-resistant S. aureus (VRSA) have MIC of ³ 16 ? g/ml.

For these strains, the synthetic antimicrobial agent linezolid is used. The disadvantages of linezolid include its high cost, hematologic side effects and the lack of routine availability (Daum, 2007). Moreover, there is also a potential for resistance against linezolid among strains of S. aureus.

According to Petri (2001), resistance to linezolid has been reported in vitro by mutant strains of S. aureus, however, only enterococci have been reported to be resistant to linezolid clinically. Resistance in the Treatment of TuberculosisThe standard treatment regimen for new cases of tuberculosis consists of a two-month intensive phase and a four- to six-month continuation phase (World Health Organization [WHO], 2003). The intensive, or initial, phase normally utilizes four drugs: isoniazid, rifampicin, pyrazinamide and ethambutol. Isoniazid and rifampicin are the two drugs that usually make up the continuation phase.

According to the WHO (2003), isoniazid and rifampicin are the most powerful drugs that are bactericidal and are active against all populations of Mycobacterium tuberculosis. On the other hand, the most potent sterilizing drug is rifampicin. Pyrazinamide is bactericidal against the TB bacilli in an acid environment, while streptomycin is bactericidal against those TB bacilli populations that are rapidly multiplying. Although ethambutol and thioacetazone are not as powerful as these four drugs, they are added to the treatment regimen to prevent the emergence of drug resistance (WHO, 2003). Nevertheless, many cases of multidrug-resistant tuberculosis (MDR-TB) and extensively drug-resistant tuberculosis (XDR-TB) have been reported over the past few years. MDR-TB. A patient is said to have MDR-TB if the infecting bacilli are resistant at least to isoniazid and rifampicin (WHO, 2003).

Since treatment of MDR-TB tends to be more toxic than that of susceptible cases, many MDR-TB patients are initially hospitalized.

However, to prevent nosocomial transmission of MDR-TB to other patients as well as to the staff, patients are started on ambulatory treatment as soon as their cooperation and tolerance of the drug regimen have been ensured (WHO, 2003). The World Health Organization (2003) recommends that the MDR-TB treatment regimen should include at least four drugs in the intensive phase, including a fluoroquinolone and an injectable agent, to last for 6 months. This should be followed by 12 to 18 months of the continuation phase, which should consist of at least three of the most active and best tolerated drugs. While this is the standardized regimen for MDR-TB, drug susceptibility testing should be conducted as much as possible, and patients should be given individualized treatment in specialized centers (WHO, 2003). The reserve, or second-line, antituberculosis drugs that are used in the treatment of MDR-TB include amikacin, capreomycin, ciprofloxacin, cycloserine, ethionamide, kanamycin, ofloxacin, and p-aminosalicylic acid (WHO, 2003). XDR-TB. According to Mitnick et al.

(2008), extensively drug-resistant tuberculosis is “ defined as Mycobacterium tuberculosis strains with resistance to at least isoniazid, rifampin, and members of three of six classes of second-line drugs.” Since the infecting bacilli are resistant even to the reserve anti-TB drugs, the chances of achieving a cure are even lower for this type of TB. However, a programme implemented in Peru was able to achieve a cure rate of 60% in XDR-TB patients without HIV (Mitnick et al., 2008). In this treatment programme, oral agents were given for at least 18 months, and injectable agents were given

for at least 8 months after culture conversion. Resective thoracic surgery was done in patients with localized TB, after which medical therapy was continued for more than 18 months. Newer fluoroquinolones such as moxifloxacin and levofloxacin were used even in those patients whose isolates were resistant to ciprofloxacin.

When deemed necessary by attending physicians, treatment regimens were reinforced with drugs whose activity against MDR-TB have not been definitively established, such as clarithromycin, amoxicillin-clavulanate, clofazimine and rifabutin. The relative success of this aggressive treatment regimen provides proof that even the most drug-resistant infections can be conquered. ReferenceCenters for Disease Control and Prevention. (2006). Investigation and control of vancomycin-intermediate and –resistant Staphylococcus aureus (VISA/VRSA): A guide for healthdepartments and infection control personnel. Retrieved November 30, 2008, fromhttp://www.

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