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Superbug Infection

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Abstract

Antibiotic resistance has led to the development of so-called "superbugs" that no longer respond to the current treatment modalities. The antibiotics available to treat these infections are dwindling with very few antibiotics in the pipeline. Infectious diseases are one of the major causes of mortality in children in developing and underdeveloped countries. Limited knowledge of targets (cell wall synthesis, replication, transcription, protein synthesis) for antibiotics and lack of novel antibiotics have led to an emergence of different level of resistance in bacterial pathogens. Multidrug resistance is the phenomenon by which the bacteria exert resistance against the two or more structurally unrelated drugs/antibiotics. In this review, the key mechanisms of resistance in bacterial superbugs have been discussed as well as that how we can overcome them.

Keywords: Superbug; Bacteria; Resistance; Antibiotics; MRSA (Methicillin-resistant *Staphylococcus aureus*).

Introduction

Drug-resistant microbes, i.e. superbugs, are one of the most dangerous threats in the history of medicine. Superbugs have emerged after coming into contact with an antibiotic. Once this happens, the bacteria become more "resistant" the particular antibiotic to which they are exposed. We should be able to kill the bacteria or stop them from multiplying superbug is a word that is used to describe any microorganism that is resistant to at least one or more commonly used antibiotics [1-5]. The common causes of these are the following:

- Rational use of different types of antibiotics
- Overuse of antimicrobial medicines
- Inadequate treatment with these types of drugs
- Poor quality of drug
- Non standardize treatment of diseases
- Genetic mutation which is likely to be seen among the microorganism [6-8]

Symptoms

The various signs of a staph skin infection are red, swollen and painful area on the particular skin. These infections are mostly seen in the blood-stream, heart, lungs or other organs, and also in urine or in the area of a recent surgery. The signs and symptoms of staph will vary with different type of stages of the infections. MRSA infections in patients in health care facilities tend to be severe. Some symptoms of these severe infections are: Chest pain, Cough, Tiredness, Ill feeling, Headache, burn, Rashes [9-11].

Transmission of MRSA Infection

Physical skin contact mainly transmits MRSA in various healthy persons. MRSA infection was mainly seen in hospital acquired. The main factors which affect are the transmission of infection to the broken or to the injured skin. When the visitors come in contact with the patient then there is more occurrence of MRSA to the community. Methicillin resistant *Staphylococcus aureus* progresses substantially inside 24-48 hours of first topical symptoms. Later it resides inside for 72 hrs. MRSA resides in human tissues and eventually become resistant when not handled properly [12]. Usually first symptoms which are seen resemble pimples, spider bites or boils that may be later on they cause high fever. It is shown below that how the antibiotic resistance speards (Figure 1).

Diagnosis and Testing

MRSA is mainly diagnosed by mainly skin and soft tissue infection (SSTI) comparable with *S. aureus* infection.

- A Sample of infectious skin
- A Sample of pus from a wound
- Blood and urine, sent for Biopsy testing

Medication for MRSA

Types of antibiotic medications that may work include [13]:

- Clindamycin
- Damptomycin
- Linezolid
- Minocycling

Keflex, Bactrim, medicine is used, as new medications for MRSA and should be in regular consultation with your doctor to make sure your boil infection resolves and does not become worse over hours or days.

Preventive Measures for MRSA

- The best way to prevent the spread of *S. aureus* [14-15] is for everyone to keep their hands clean.
- We should wash our hands properly.
- Wash ones hand before and after visiting patients.

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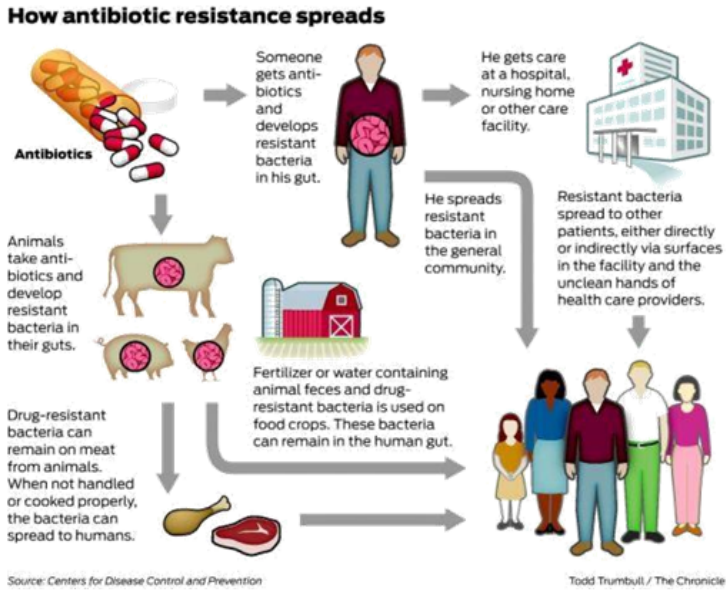

Figure 1: How Antibiotic Resistance spreads to the community.

- If we are going into hospital for an operation, ask to be protective by using mask and gloves.
- When are soiled then we should wash it with soaps or detergents.
- We should keep our hands and fingers neat and tidy.

Who is at the Risk of MRSA?

Elderly people and new born are likely to be at risk. A person having opened wound, a burn or a cut on the particular skin and various skin diseases, such as a leg ulcer or psoriasis.

Prevention of MRSA for Hospital Staffs

The standard precautions should be followed:

1. Wash hands with soap and water when they are soiled or visibly dirty.
2. Wet your hands, with water and then scrub them for at least 15 seconds and use a disposable towel.
3. During surgical hand preparations all the jewelries should be removed such as rings, watches.
4. Finger nails should be trimmed with no nail polish.
5. Avoid wearing long sleeves as it may be contaminated with micro-organisms.
6. Sterile gloves should be worn when handling surgical equipments.
7. Wear a gown to prevent soiling of clothes.
8. Remove the soiled gown as soon as possible, with care.
9. Patient's relatives should wear a mask when visiting them.
10. Disease causing micro-organisms are suspended in air.

Future Prospectus

Nanotechnology based solutions against superbug

The emergence of superbugs has made it imperative to search for novel methods, which can combat the microbial resistance. Thus, application of nanotechnology in pharmaceuticals and microbiology is gaining importance to prevent the catastrophic consequences of antibiotic resistance. Nanotechnology based approaches are advantageous to improve various preventive measures such as coatings and filtration. Similarly, diagnosis using efficient Nano sensors or probes can speed up the treatment process at an early stage of disease.

Nano-based drug carriers for existing antibiotics enhance their bioavailability and make them more targets specific. Also the combination of nanoparticles (NPs) along with antibiotics makes them more lethal for micro-organisms.

Nanotechnology based approaches for diagnosis for superbugs

Although several conventional techniques with high sensitivity and reproducibility are available to detect MDR infections, they are cumbersome and time consuming. Nano science can offer various accurate, economical and less time-consuming methods, which will help to avert microbial spread and its consequences. A team of researchers from Jackson State University, USA has developed a new popcorn-shaped iron-magnetic core gold plasmonic shell nanoparticles for surface-enhanced Raman spectroscopy (SERS) detection and photo thermal destruction of MDR Salmonella bacteria [16-18]. They have also reported that the same core-shell nanoparticle can be used in combination with near infrared (NIR) light to form light-directed Nano heaters for hyper thermic destruction of MDR.

Conclusion

Superbug resistance is increasing day by day. Nowadays most of the new drugs mainly the antibiotics are the modification of the old ones so the new antibiotics should be used very carefully and with cautiously.

Using the exact antibiotics to treat the disease will inhibit the growth of micro-organisms and thus kill it without being further multiplying, and thus bacterial resistance will be inhibited [19].

In addition to that healthcare providers should use all the medicines and treat all the infections very carefully, hand gloves, patients isolations should be used to prevent further growth of the microorganisms.

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