

Resilient bacteria making our antibiotics ineffective

By Editorial Staff

Even after a successful operation, the risk of postsurgical complications is still very real, particularly those complications that are caused by infection.

Post-surgical infections can run the spectrum from mild to life threatening. They can be localized, as in the case of wound infections, or wide-spread, as in peritonitis (infection of the lining of the abdomen), or septicemia (an infection of the blood). They may even progress to cause gangrene and necrosis (tissue death).

An important factor in limiting morbidity and mortality due to infection is prevention. Good sterilization and slavish adherence to aseptic technique, as every O.R. nurse knows, are the foundation of infection prevention. Other factors, such as the screening of the patient for a mild infection in an unrelated area can make a significant difference in avoiding a full-blown infection after surgery is performed.

Despite the best efforts of everyone on the surgical team, infections remain a frequent reality; and although all post-surgical infections are of concern, some of the most troubling are those caused by antibiotic-resistant bacteria.

Today, modern medicine is experiencing a high incidence of bacterial resistance to certain antibiotics. Though the phenomena of resistant bacteria is not a new one, its manifestation today is causing much concern for the entire world medical community.

Special symposium

The alarming ability of bacteria to develop rapid resistance against most of the newer antibiotics was discussed at a special symposium held in Toronto late last year.

The symposium, held during the Annual meeting of the Royal College of Physicians and Surgeons, featured Dr. Robert Moellering, professor of Medicine at Harvard University. His address focused on the number of bacteria that are now resistant to a growing number of anti-microbial agents. Bacterial resistance to anti-microbial agents is not a new phenomena. It was initially observed following the discovery of antibiotics in the 30s.

Resistance pools

However, of real concern are "resistance pools" where bacterial resistance (invulnerability) to anti-microbials has been documented not only against the drug being used to treat the infection, but against other antibiotics as well. Bacterial resistance pools would be found in those areas or situations where potential infections are or could be endemic: burn units, during certain surgical procedures, intensive care units and patients with chronic illnesses.

Widening circle

Not surprisingly, drug resistant organisms can make it extremely difficult to rid patients of their infections. This may necessitate the use of more potent combinations of anti-microbial agents. In turn, this increases the potential for more bacterial resistance against a widening circle of antibiotics.

In focusing closer on the phenomena of treatment-resistant bacteria, Dr. Moellering specifically addressed the issue of plasmid-mediated resistance against antibiotics.

Plasmids are extrachromosomal pieces of DNA, or particles in a cell that have a genetic function, but are not found in the nucleus. Dr. Moellering

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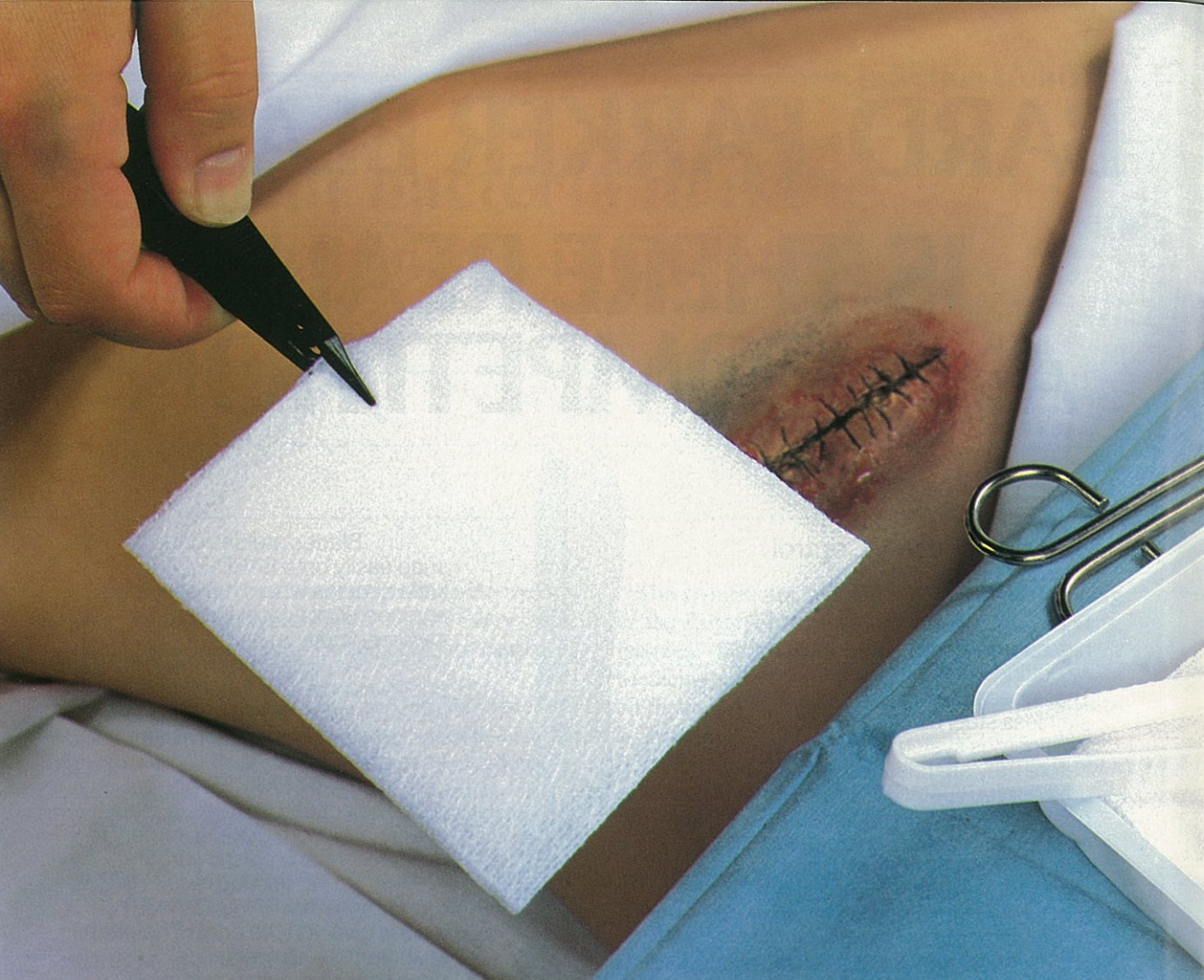
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Reference: 1. Birdsell DC, Davidson JSD: A Report on Clinical Trials of NU GAUZE* Rayon Sponges, Including In Vitro and In Vivo Comparisons with Conventional Cotton Gauze Sponges. July 1986.

provided a detailed look at how these plasmids play a role in anti-microbial resistance. It has been known for some time that bacterial resistance against a number of antibiotics can be spread from one organism to another by direct cell-to-cell contact. The agents responsible are plasmids.

These plasmids, in many cases, contain not only genes for resistance to anti-microbial agents, but also genes capable of coding for the information necessary to initiate and cause transfer of the plasmids by conjugation, that is, allowing nuclear material in the two cells to interchange.

R-factors

Plasmids containing both the genes, one for resistance to the anti-microbial agent and one for coding information to initiate a transfer of nuclear material, are known as R-factors. They have been shown to be responsible for much (but not all) of the anti-microbial resistance found in clinical isolates of bacteria throughout the world.

Recent studies show a striking homology (similar

in structure and origin but not in function) between the genetic elements of plasmids mediating resistance to anti-microbial agents found in numerous parts of the world and studies in "antibiotic virgin" populations where plasmids were present in nature prior to clinical use of anti-microbial agents.

Selective advantage

Where anti-microbial agents are heavily utilized in these antibiotic virgin populations, there is a major selective advantage to the plasmids, as they are capable of mediating or accomplishing the necessary resistance. These plasmids contain the necessary genes to induce and perpetuate a good proportion of the antibiotic resistance observed in disease-causing bacteria today. (See below on "United Nations intervention.")

However, not all resistance to anti-microbial agents is plasmid-mediated. Antibiotic resistance has also been mediated by man's flagrant abuse of our antibiotic resources. (See "MRSA" page 10)

Growth of drug resistant bacteria worldwide prompts strong United Nations intervention

Alarmed by the relentless growth of bacterial resistance to antibiotics worldwide, two influential agencies of the United Nations are preparing global guidelines imposing restrictions on the use of antibiotics and other therapy drugs.

Beyond control

The proposals, to be published shortly by the World Health Organization (WHO) based in Geneva, Switzerland and the Food and Agriculture Organization (FAO) based out of Rome, will probably be supported by Canada.

A recent authoritative discussion paper issued by the WHO argues that, as a result of over-medication, bacterial resistance to antibiotics worldwide is spreading beyond control.

The problem is particularly acute in the developing countries where most of the older and cheaper antibiotics available are rapidly losing their effectiveness against certain bacteria.

The UN is concerned with overmedication by doctors as well as veterinarians. A high percentage of the animals that are bred for human consumption are exposed to a variety of drugs, including antibiotics, tranquilizers and growth stimulants. This latter concern is the reason for the Rome-based FAO involvement.

The WHO discussion paper on worldwide bacteriological resistance to antibiotics urges governments to implement methods to avert a global emergency by banning the agricultural use of many potent drugs.

Flagrant overmedication

The discussion paper also cites cases of flagrant overmedication by doctors and argues that, unless urgent steps are taken to reverse the trend, "...one of the best weapons humanity has devised for the protection and restoration of health could be placed in jeopardy."