

**HISTORICAL NOTES****THE HISTORY OF ANTIBIOTICS IN SURGERY****Gina Lupașcu<sup>1</sup>, Georgiana Radu<sup>1</sup>, Cristina Veronica Andreescu<sup>1</sup>, Alexandra Bolocan<sup>1,2</sup>**<sup>1</sup>Carol Davila University of Medicine and Pharmacy Bucharest, Romania<sup>2</sup> Bucharest University Emergency Hospital, Romania

Corresponding author: Alexandra Bolocan  
Phone no. 0040722579776  
E-mail: bolocan.alexa@gmail.com

**Abstract**

*Selman Waksman is an important name that introduced for the first time the idea of some natural compounds with visible effects in treatment of diseases called- antibiotics. Its continuous and irrational utilization has been proven to make the body resistant to a future need of the antibiotic administered. This aspect did not stop the studies to shown the importance of this biosynthesized medicines in prophylaxis of surgery. During the years there were identified a lot of these natural compounds with positive results in different types of surgery. The purpose of this article is to bring to attention the evolution of antibiotics during the years, especially in surgery field, how its usage influenced the prophylaxis and which are the main principles to be respected in administration of antibiotics.*

**Keywords:** *antibiotics, history***Introduction**

Acute abdominal pathologies with non- The history of antibiotics starts in 1941 when Selman Waksman gives the name of antibiotic to a microorganism that selectively inhibits the growth of another[1]. Due to their natural origin from , and their low toxicity, these compounds are the perfect choice in treating infectious diseases[2]. As time passed by, antibiotics develop[1] and almost one thousand compounds are biosynthesized but with a low success in replicating it chemically. These substances have different proprieties and structures, making them hard to be included in a chemical classification; the spectrum or the toxicity is a better way to separate them [2]. Even if some important human pathogens become resistant to the effect of the antibiotics, the studies discovered new types and these compounds

continue to be a very important key in human treatment, for example – the surgery field.

History of medicine was really marked by the appearance of the very important compounds called antibiotics which were and continue to be responsible for the treatment of infectious diseases that in the past have led to death. The best example in this case is tetracycline, identified in bones remains from our ancestors that lived in Egypt and it decrease the frequency of infectious diseases among population. Being provided by the diet, this antibiotic is very different from the others, forming with the mineral substances of bones or teeth and in this way is very easy to be identified.

As bacteria can be found everywhere, it means that there is a very high chance to produce antibiotics. It is the case of actinomycin produced by the Actinomycetes which could be found for the first time in the red soils from

Jordan and has a very important role in DNA transcription[3].

Regarding the field of surgery, it was also marked by the appearance of antibiotics. To make the operations safer and more complex, the people who worked in operating rooms considered the anesthetic techniques which had been however helpful two hundred years. Before insufficient awareness of the importance of handwashing which decreased the bacteria count, as time passed by, surgeons discovered the vital role of surgical antibiotic prophylaxis [4]. It was proven with the help of pigs about half a century ago [5]. It was a remarkable discovery which made to the morbidity caused by the infections as a result from surgical procedures to decrease drastically [4]. The dose must be depending on the duration of surgery because, otherwise the costs will be higher or maybe it will be the beginning of resistance to certain bacteria and other adverse events. Also, any antibiotic allergy must be noted in the patient's history. Today, a fairly large percentage of antibiotic use is responsible for prevention of and disease occurrence among patients who need surgery[5].

According to the reason the surgery is needed, the period, type and quantity of antibiotics administered should be adapted in order to avoid the surgical site infections (SSIs). Even if the word prophylaxis defines the measures designed to preserve health and prevent the spread of disease, sometimes the antibiotic prophylaxis (ABP) is prolonged. It is the case of cardiovascular surgery, where studies made with the usage of cefazolin, vancomycin, ceftriaxone or a combination of these, revealed that the administration extended to more than 48 hours brings no benefits. Not only that this procedure does not decrease the possibility of SSIs but also this can result in antimicrobial resistance. This practice is common between surgeons involved in coronary artery bypass graft (CABG) and when they were asked for an explanation it was related to the fact that as long as the drains or catheters are still connected these can cause secondary infection [6]. Also, studies proved that cefazolin or cefuroxime and vancomycin or clindamycin as alternative in allergy to  $\beta$ -lactams in allergic individuals are the most suitable antibiotics for cardiothoracic interventions [7-12].

The prophylaxis in colorectal surgery is assured by an oral administration of neomycin and erythromycin or the first one in combination with metronidazole; it must be effected with maximum of 24 h before the start of the operation. The parenteral prophylaxis, which can be performed in order to avoid SSIs, consists of cefotetan or cefoxitin [7-12]. In comparison with the cardiovascular surgery, where the prolonged administration time of prophylactic antibiotics does not make the SSI rates to go down, a study suggested that the opposite can be possible with the administration of oral and parenteral compounds [7,13]. Clindamycin in combination with aztreonam, gentamicin or ciprofloxacin, or metronidazole combined with the last two substances, are the recommended choices in case of allergy to  $\beta$ -lactams. [7]

The most common antibiotics used in surgery to play a joint stiff movements, are cefazolin and cefuroxime[7-12]. As previously mentioned, vancomycin or clindamycin represent the  $\beta$ -lactams substitutes in the treatment of arthroplasty, also. To know the optimal duration of antimicrobial administration, some studies were developed that have concluded the absence of a positive influence on reducing the postoperative infections in the prolonged prophylaxis [7,14-20]. Once the surgeon initiates the administration, it is not suggested be used to last for more than 24 h after the surgery ends [7-12,14-20]. The probability of SSI occurrence can be significantly decreased by the usage of antibiotics included in structure of the bone cement necessary for the arthroplasty remedy. Unfortunately, most people disagree with this idea and give no information about how to apply it.

Cefotetan is the prophylactic antimicrobial used when hysterectomy is needed and it can be sometimes replaced with cefazolin or cefoxitin [7-12, 21]. When patients present an allergy to  $\beta$ -lactams, it is recommended to start the surgery with a combination of clindamycin with gentamicin, ciprofloxacin or aztreonam; metronidazole in association with ciprofloxacin or gentamicin; also, using clindamycin as a single dose, can be very useful [7, 22]. Patients who need cesarean are not given prophylactic antibiotics before the umbilical cord is clamped. This unproven practice is common among

American surgeons in order to avoid the possible masking of septic events in newborns [23].

## Conclusion

Due to its properties, antibiotics went only up during the history bringing benefits constantly to the medical world. Their evolution and effects in different diseases were the main points that decreased the morbidity between human. A very important field marked by the appearance of antibiotics was and still is the surgery that has as an aim the reduction of the postoperative infections. There is not only one antibiotic available in any type of surgery; this is a field that has to respect a lot of principles before the administration of a prophylactic antibiotic, having as a main recommendation to use firstly an antibiotic with a narrow spectrum.

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