



## Original article

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## PREVENTION OF THE OSSEOUS - JOINT INFECTIONS IN THE WORKING CONDITIONS OF THE GENERAL SURGERY WARD

## SUMMARY

The treatment of osseous-joint infections presents a problem in all conditions due to the character, duration and consequences of this complication. In the conditions of general surgery ward, there are numerous aggravating factors.

Osseous-joint infections belong to the group of nosocomial infections (NI) defined as infections a patient is exposed to during hospitalization. Most infections which manifested 48 hours after the hospitalization are regarded as nosocomial infections. The patient can be affected by nosocomial infection after leaving the hospital if microorganism is passed on during treatment or hospitalization. Postoperative infection of surgical wounds or infection of the site of surgical intervention is an example of such nosocomial infection.

In accordance with the aforementioned, we have undertaken the following preventive actions: isolated hospitalization of the patient, early surgical intervention in the isolated operating theatre, administration of antibiotic therapy intraoperatively and four to five days postoperatively. We have paid special attention to surgical technique: removing a tissue of suspicious vitality, cleansing wounds, and avoiding dead tissues in wounds. We have reduced patient's hospitalization to the shortest possible time.

*Keywords:* osseous-joint infections, treatment of nosocomial infections

## INTRODUCTION

Osseous-joint infections i.e. infections of the sites of surgical intervention (SSI) are serious complications which occur in all medical institutions. National Committee for supervision of nosocomial infections in the USA, according to the observation of NI since 1970, issued a notice based on which it was proven that the most frequent NI are infections of urinary tract, then pneumonia and infections of the sites of surgical intervention (1). Although it was published that infections of the surgical wounds make 19% of NI, it is difficult to estimate the real

incidence of postoperative wounds' infections, particularly when hospitalization of most patients is rather short. Observing the patients after discharge from the hospital, it was proven that the real rate of SSI in all kinds of surgery is higher than it is published. SSI rate varies from 4.6% to 8.2% in non-university hospitals, i.e. in big university hospitals (1).

In most hospitals, supervision is made over NI and the results, received and examined, expressed in percentage are of small value unless they are connected with the site of infection, population of patients and exposure to risks. Complete clarifica-

tion of the infection rate is meant by the number of patients exposed to a specific risk (in our case – a number of infections of the surgical wounds with the patients operated due to some orthopedic or casualty problem). Occasionally, it is necessary to control trends of these rates and compare them with regional and national norms, if applicable. However, even in the National system for NI supervision in the USA, which collects the data from 270 hospitals which apply standardized definitions, NI are not analyzed independently and represent a random sample of hospitals (2). Inter-hospital comparisons are often confusing due to a big number of risk factors, difficulties in grouping of diseases and a considerable number of possible causes.

Due to an increase of immunity-compromised patients, elderly patients suffering from chronic diseases (diabetes mellitus, cerebral-vascular insults, malignant diseases, cardio-pulmonary diseases) antibiotic resistance of bacteria, viral and fungal superinfections as well as increasing number of indications for insertion of osteosynthetic materials and prosthesis, the efforts to reduce the risks from NI are growing and they have been the subject of the increasing scientific research for the last four decades.

Treatment costs of NI are high. It was established that NI cost 4.5 billion dollars and they are the cause of 88,000 deaths annually in the USA (3).

Most medical institutions take necessary measures of supervision and preventions to mitigate this problem. (4) Those measures are: removal of the infections' sources which is very difficult and uncertain, prevention of ways for the infections' spreading which is also uncertain as well as the strengthening of immunity in the immunity-compromised patients (4).

The price of the infection treatment of the place of surgical intervention is more than 1 billion US dollars annually according to the American College of Surgeons and Centre for Disease Control (5). Incidence in some hospitals is very different. As far as the osseous-joint postoperative infections are concerned, it ranges from 0.08% (arthroscopy) to 7.4% (joint alloplastics). Administration of antibiotics reduces the number of infections by 50% (5).

Nosocomial pathogens have reservoirs. They are transmitted through familiar ways and require a sensitive host. Reservoirs and springs exist in the nonlive environment (e.g. water from the tap infected by *Legionella*) and live environment (e.g. health workers infected or carriers, other patients or visits). The method of transmission is, most frequently, the cross infection (indirect spreading of

pathogens from one patient to another by insufficiently washed hands of medical staff) or auto-inoculation. The most frequent cause of infection is the skin and oropharyngeal area of patients, medical staff and hospital visits which are, during different medical interventions and manipulations, brought into the surgical wound. However, the most frequent way of transmission of NI is by unwashed hands of the medical staff which is particularly possible in the working conditions of the general surgery ward because of variety of patients of different pathology such as abdominal, partly urological, gynecological and otorhinolaryngological. Bacterial causes are different and often completely resistant to antibiotics.

In order to mitigate this problem, we undertook the following measures and procedures:

1. Admittance of patients to the hospital for the planned operation a day before the operation, if possible.

2. Urgent traumatology patients were operated immediately upon their admittance and taking of the basic laboratory and rtg analyses.

3. Bedding and beds in three rooms in which we placed our patients can be neither transferred nor mixed with inventory and bedding from other rooms.

4. Operative interventions were carried out in a separate operation theater with a minimum necessary number of staff and complying with certain measures of caution (talking in the room reduced to the minimum)

5. We tried not to damage the tissue as much as possible. The wounds were rinsed with physiological solution preferring its mechanical effect. We frequently changed gloves during operations. The operation field was regularly covered with sterilized compresses in order to disable the contact between fingers and instruments with the skin of patients. Preoperative washing of hands was done using povidone iodine solution long enough (no less than 5 minutes). The wounds were regularly successively drained. We regularly shaved the operational field immediately before the operation. We tried to reduce duration of the operation as much as possible. We started with antibiotics intraoperatively, in high doses, most frequently cephalosporine of III generation and aminoglycozide. We did not place the operated patients, except in extra cases, in the intensive care units because of possible bacterial contamination.

6. Redressing of orthopedic patients was made on the fifth postoperative day, and after that we left the wounds open until the threads are pulled out except in the case of open fracture. Patients with wounds which require frequent or everyday dressing and debridement were transferred to other rooms.

Dressing was regularly made in orthopedic separated room within department trying to have our patients firstly dressed and treated.

## MATERIAL AND METHODS

The paper is a retrograde clinical study comprising 726 patients operated in the period of five years.

## RESULTS

In order to estimate the importance of this problem i.e. wound infection with osseous-joint operations in the general surgery department, we analyzed the material of our department for the period of five years.

In the general surgery department which receives all digestive and general surgery pathology and a part of urological, gynecological and otorhinolaryngological pathology, we operated 726 patients for five years. Operations were performed in a special operation theater in which other pathology is very rarely done.

Out of 726 operated patients, we had 10 infections which approximately amount to 1.4% of infections. The most frequent cause was *Staphylococcus Aureus* (6 patients), then *Pseudomonas Aeruginosa* (*Figure 1*).

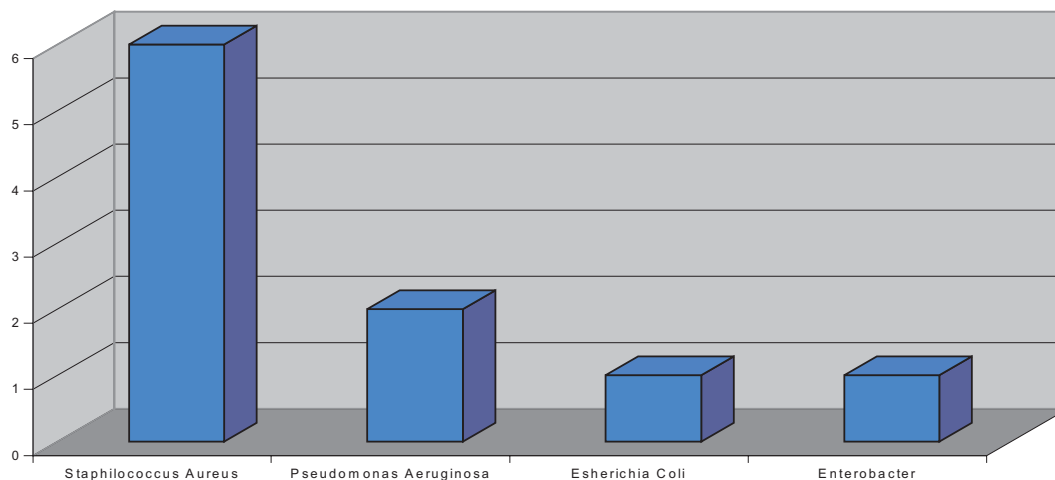


Figure 1. The cause of infections

Out of 10 patients who had infection as a postoperative complication, five of them had some of the predisposed factors such as: diabetes mellitus for many years, tumor of rectosigmoid, polytrauma patient, polio-myelitis chemiplagy and the lack of cooperation with patient (deaf and mute, pulling of the successive drains).

Out of our infections due to deteriorating of the basic disease - rectosigmoid cancer, and ileus as a complication, in both cases due to postoperative

deterioration of the basic disease (diabetes mellitus), the treatment ended lethally. Three patients were sent for further treatment to the clinical centers, while the infections were successfully cured in five patients after several months of treatment.

During the treatment of postoperative infections, we undertook the following measures:

Upon the first signs of infection, we made urgent surgical revision of the wound in three patients, huge debridement of the whole non-vital tissue, perfusion drainage with gentamycin in the physiological solution and we were regularly dressing the wounds. Having isolated the causes of infection, we included antibiotics in high doses, according to antibiogram finding, while in one case we locally administered a mixture of protheolitic enzyme "lactozine 10" from the Institute "Torlak" in the perfusion drainage.

In early postoperative period, the first two weeks after the operation, the infection occurred in eight patients which we designated as early infection, while the infections occurred in two patients in the period from three to six months after the operation. We designated all of them as postoperative infections.

## DISCUSSION

Although osseous-joint infections are, according to its incidence, in the third place of NI after urological and pulmonary ones, they represent a big problem due to long-lasting morbidity, and even mortality.

In our case, we could not compare the number of the osseous-joint infections and infections of other localizations, because the latter are not

registered. We believe that infections of the osseous-joint system are in the third or fourth place by incidence.

Control of infections which we conducted, in our opinion, was effective in our circumstances and the number of infections was decreasing, with enhanced education of the staff and their awareness of the risk of infection and reduction of the hospitalization period. Although most of authors say that perioperative application of antibiotics leads to reduction of the infection percentage, we did not know what the result in our case would be, because we were giving antibiotics to all and we only did not have the control group of patients without antibiotic therapy (4-6).

In 1970, in the Study of the Centre for Disease Control on the efficiency of control of NI, it was proved that the infection rate fell by 32% in the hospitals which had the program of supervision and appropriate measures, trained, engaged doctor for the infection control and a medical technician for the infection control per 250 beds. Contrary, in the hospitals without appropriate program, the infection rate rose by 18% (2).

Out of antibiotics, we mostly administered betalactane (cefalosporine of the III generation), and rarely only penicillin and garamycin. We do not know which ones have proven to be more efficient. We personally think that daily control of patient is very important after operation and radical surgical re-intervention in cases where it is necessary. In one of the patients, operated because of the neck fracture of the upper arm and occurrence of the infection signs, the same was cured eight months upon the operation having pulled out the osteosynthetic material. In the second patient operated because of the upper leg fracture and occurrence of femur osteitis complicated by fistula, the same was cured 18 months upon the removal of osteosynthetic material and sequestrectomy.

Types of bacterial causes in our patients were: 60% gram positive bacteria and 40% gram negative bacteria. We did not register anaerobic and fungal infections. Five-year prospective study which analyzed 23,649 patients with infections of the surgical wounds indicate that the gram-positive bacteria were causes in 73% of infections, gram-negative bacteria in 18% of infections, anaerobic bacteria in 7% and fungal in 2% (7).

We did not have a mixed infection in any patient, although some authors often state it in their books (8).

Lidwell stated in a big study that a number of NI may be reduced from 2.3% to 0.6% or four times if antibiotics are applied.

Gustilo reduced the number of infections

from 9% to 4% by using antibiotics. We would like to emphasize that it is the twenty-year-old result and the situation is much better today. (6)

Having in mind that the most frequent cause of the wound infection, in our patients, was *Staphylococcus Aureus*, we would like to emphasize the selection of antibiotics and order of their use in the infection treatment:

- betalactane antibiotics are still the most important in the therapy of staphylococcus infections
- cephalosporine of the first and second generation for the parental application
- carbapenem groups, first of all, Imipenem
- glycopeptids, vancomycin and teikoplanim are without any doubts the safety medicines in the therapy of staphylococcus infections
- aminoglycosic antibiotics are used in combination with betalactane antibiotics and glycopeptids
- lincozamines (klindamicyn and lindamycine) and others

Anti-staphylococcus penicillin, cephalosporine of the first and second generation and, occasionally, lincozamine (clindamizine) are the most applied medicines in the therapy of the staphylococcus infections. After parental therapy which lasts for four weeks, there is a peroral treatment which lasts up to 12 months.

It is irrational to remove the persons "carrying" staphylococcus in nose from their work having in mind that this is a very frequent phenomenon. It obliges the health worker, particularly in the maternity wards, surgical theater or intensive care units to wear the masks and take local treatment with the antibiotic Mupirocinom improving the hospital hygiene measures at most (10,11).

## CONCLUSION

A number of osseous-joint infections may be controlled in the hospitals and general surgery wards with the following measures:

1. Increasing awareness of the medical staff on the importance of this complication;
2. Washing hands as one of the most important preventive measure in hospitals;
3. Preoperative antibiotic treatment of the active infections as well as the application of the antimicrobial prophylaxis at the beginning of high-risk surgical procedures;
4. Careful application of the asepsis regarding surgical equipment and operating theater;
5. Isolating the patients in separate rooms;
6. Separating suspiciously infected patients from others;

7. Careful operation technique (sterile wound protection, reduction of the operation intervention, frequent wounds cleansing and gloves

changing, removing a tissue of suspicious vitality and avoiding dead tissues).

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### PREVENCIJA KOŠTANO-ZGLOBNIH INFEKCIJA U USLOVIMA RADA ODJELJENJA OPŠTE HIRURGIJE

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#### SAŽETAK

**Prevenција koštano zglobnih infekcija predstavlja problem u svim uslovima zbog samog karaktera, trajanja i posljedica ove komplikacije. U uslovima odjeljenja opšte hirurgije postoje brojni otežavajući faktori.**

**Koštano zglobne infekcije spadaju u grupu nozokomijalnih infekcija (NI) koje se definišu kao infekcije stečene u toku hospitalizacije bolesnika. Većina infekcija koje postanu manifestne poslije 48 sati od prijema u bolnicu smatraju se nozokomijalnim infekcijama. Bolesnik može dobiti nozokomijalnu infekciju i nakon otpuštanja iz bolnice ukoliko je mikroorganizam stečen tokom liječenja i boravka u bolnici. Postoperativna infekcija hirurških rana ili infekcija mjesta hirurške intervencije primjer je takve nozokomijalne infekcije.**

**U skladu sa gore navedenim, preduzimali smo slijedeće mjere prevencije: odvojen prijem i smještaj bolesnika, rano izvođenje operativne intervencije u izdvojenoj operacionoj sali, početak antibiotske terapije intraoperativno i četiri do pet dana postoperativno. Posebnu pažnju smo posvećivali hirurškoj operativnoj tehnici u smislu uklanjanja tkiva sumnjive vitalnosti, ispiranju rana i izbjegavanju mrtvih prostora u ranama. Boravak bolesnika u bolnici svodili smo na najkraće moguće vrijeme.**

***Ključne riječi:* koštano-zglobne infekcije, prevencija nozokomijalnih infekcija**