# THE INCIDENCE OF THE SURGICAL-SITE INFECTIONS IN THE SURGICAL WARDS AT SIBIU ACADEMIC EMERGENCY HOSPITAL AND ASSOCIATED RISK FACTORS

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***Keywords:*** *surgical site infection, risk factors, incidence rate*

***Abstract:*** *This prospective incidence study aimed to determine the surgical site infection (SSI) rate and associated risk factors and was carried in surgical wards at Sibiu Academic Emergency Hospital. A total of 8469 patients admitted in these surgical wards from April 2007 to September 2008 were included in this study. The cases were evaluated for postoperative fever, redness, swelling of wound margins and collection of pus. Cultures were taken from the cases with any of the above findings.The overall rate of surgical site infection was 1,48%. In conclusion, surgical site infection causes considerable morbidity and important economic burden. The routine reporting of SSI rates stratified by potential associated risk factors is highly recommended.*

***Cuvinte cheie:*** *infecție de plagă chirurgicală, factori de risc, rata incidenței*

***Rezumat:*** *Acest studiu prospectiv de incidență şi-a propus să determine rata infecțiilor de plagă chirurgicală (IPC) şi factorii de risc asociați şi a fost realizat în secții chirurgicale din Spitalul Clinic Județean de Urgență Sibiu. Au fost incluşi în studiu un număr total de 8469 de pacienți care au avut internări în aceste secții chirurgicale în perioada aprilie 2007 – septembrie 2008. Cazurile au fost evaluate pentru febră postoperatorie, roşeață şi tumefacție a plăgii operatorii şi apariția de colecții purulente. Au fost prelevate culturi bacteriene pentru cazurile care au avut oricare din semnele precizate mai sus. Rata incidenței infecției de plagă chirurgicală a fost de 1,48%. În concluzie, infecțiile de plagă chirurgicală cauzează o morbiditate considerabilă şi costuri economice importante. Este recomandabilă raportarea de rutină a ratelor IPC stratificate după potențialii factori de risc asociați.*

## THE AIM OF THE STUDY

We intend to investigate the incidence of the surgical site infection after the surgery act at the patient hospitalized in surgical wards of different profiles and analyze the potential associated risk factors involved in the occurrence of the surgical site infection.

## MATERIAL AND METHOD

The prospective study was conducted during April 2007 - September 2008 in Sibiu County Emergency Hospital and consisted in monitoring of the patients hospitalized in the following surgical wards: ENT, General Surgery and Orthopaedics. The hospital has a total of 1172 beds from which 197 beds are found in the mentioned sections. It was centralized the total number of surgeries suffered by these patients, dividing them into surgery categories as: ENT, digestive surgery, thoracic surgery and orthopaedic surgery and the number of patients discharged from these wards.

The subjects who had infectious complications at the level of the surgical site were the study group, which consisted of 126 patients. The study methodology included a weekly collection of a data set of interest which was recorded in a form. The following data were recorded: age, sex, total hospital days, number of days of preoperative hospitalization, surgery date, date of onset of wound infection, score of anaesthesia risk (ASA), Altemeier contamination class, duration of intervention, microbiological diagnosis of infection.

The diagnosis of surgical site infection (SSI) was based on the case definition of CDC Atlanta and has been put into three categories: superficial incision SSI, supra-aponeurosis, SSI deep incision, sub-aponeurosis; organ infection (with the organ damage and of some areas different from the incision one, which were opened during surgery).

**The Methodology of Statistical Processing** It was used Excel programme, data being then exported to statistical processing program Medcalc, in order to achieve the database.

**Results** During the studied period, a number of 126 patients developed surgical site infections, from the total of 8469 hospitalised patients. The incidence of SSI at the level of the study group was of 48%. The SSI incidence according to the surgery ward from where the cases were taken is centralized in table no.1.

**Table no. 1. SSI Index According to the Surgical Department from Where the Cases Are Originated**

| Wards | SSI Number | Number of Discharges on Wards | SSI Incidence |
|---|---|---|---|
| **General Surgery** | 86 | 4341 | 1,98% |
| **Orthopaedics** | 34 | 2477 | 1,37% |
| **ENT** | 6 | 1651 | 0,36% |

Because not all patients were hospitalized and operated, we calculated the SSI incidence reported to the total

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Articol received on 12.07.2010 and accepted for publication on 18.10.2010
ACTA MEDICA TRANSILVANICA December 2010; 2(4) 279-281

number of performed interventions (6367 surgeries), which was of 1.98%. This indicator was also calculated for the interventions in each type of the practiced surgery (table no. 2).

**Table no. 2. The Calculation of SSI Index According to the Number of the Types of the Performed Surgeries**

| Type of Surgery | SSI No. | Number of Surgeries | SSI Incidence |
|---|---|---|---|
| **Digestive Surgery** | 84 | 3520 | 2,38% |
| **Thoracic Surgery** | 2 | 197 | 1,01% |
| **Orthopaedic Surgery** | 34 | 1944 | 1,75% |
| **ENT Surgery** | 6 | 706 | 0,85% |

Among the patients with SSI, **53.07% were women and 46.92% were men**.

The average age of the group with SSI was **60.58 ± 13.57** years, with a minimum of 18 years and maximum of 87 years. The average age of women in the study group was higher than the average age of men, **the difference being statistically significant (P = 0.01) (table no. 3).**

**Table no. 3. The Men and Women's Age with SSI from the Study Group**

| Studied Variable | Average | Standard Deviation | Limits – Range of Values | P (test t Student) |
|---|---|---|---|---|
| **Women Age (years)** | 63,34 | 13,14 | 18 ; 87 | 0,0130 |
| **Men Age (years)** | 57,46 | 13,47 | 19 ; 77 | |

In table no. 4, we centralized the number of patients with SSI according to the type of surgery that was performed. It is noticeable that the largest percentage of infection is related to the digestive surgery, followed by the orthopaedic surgery.

**Table no. 4. The Distribution of the Study Group Patients According to the Type of the Surgery**

| | Thoracic Surgery | Digestive Surgery | ENT Surgery | Orthopaedic Surgery |
|---|---|---|---|---|
| **No. of Patients** | 2 | 84 | 6 | 34 |
| **Relative Frequency** | 1,58% | 66,66% | 4,76% | 26,98% |

**The average number of the total days of the hospitalization at the level of the study group was of 32.83 ± 17.59** days, with the limits of the interval of values of 4 and 122 days.

**The number of preoperative hospital days** in the study group had an average value of 7.63 ± 11.56 days, with the limits of the interval of values of 0 and 90 days. In the table no.5, we centralized the number of preoperative hospital days according to the type of surgery which was practiced.

**Table no. 5. Preoperative Hospital Days According to the Type of the Surgery of the Patients with SSI**

| | Thoracic Surgery | Digestive Surgery | ENT Surgery | Orthopaedic Surgery |
|---|---|---|---|---|
| **The Average Duration of the Preoperative Hospitalization (days)** | 7±9,89 | 6,58±10,34 | 2,83±2,71 | 8,02±1,06 |

**The number of the days of preoperative hospitalization** correlates positively and significantly with the presence of the orthopaedic infections **(P = 0.019)**, so with those interventions that have the highest number of preoperative hospital days. The number of the days of preoperative hospitalization correlates negatively with the presence of the ENT infections **(P = 0.20)** and digestive surgery (P = 0.05), so with those interventions that have the lowest number of preoperative hospital days.

The calculation of **the score of the anaesthetic risk (ASA)** in patients with surgical site infections pointed out the proportions shown in Figure no. 1. Most patients who had had surgical site infection had the score of anaesthetic risk 3, namely patients with associated severe systemic diseases.

**The average duration of the surgeries** in the entire group was of **117.42 ± 68.43** minutes. The average duration of the surgeries according to the type of practiced surgery is centralized in table no.6.

**Figure no. 1. ASA Score Distribution in the Study Group**

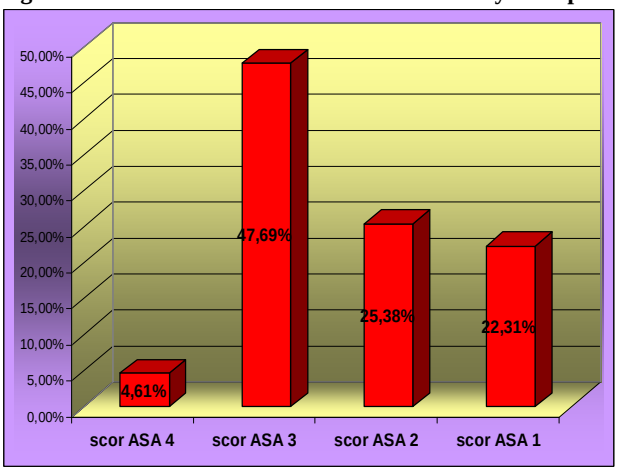


**Table no. 6. The Average Duration of the Surgeries According to the Patients' Type of Surgery**

| | Thoracic Surgery | Digestive Surgery | ENT Surgery | Orthopaedic Surgery |
|---|---|---|---|---|
| **Duration of Interventions (min)** | 117,5 ±31,81 | 131,71 ±55,97 | 233,33 ±99,98 | 89,31 ±63,5 |

**According to Altemeier classification**, most cases of infection appeared at surgeries of 2nd and 3rd classes (more than 75%), only a percentage of 16.92% being of 1st class.

From the surgeries in the study group, a percentage of **23.07% were emergencies**, which did not allow an adequate preoperative preparation of the cases. The remaining percentage of 76.92% is scheduled surgeries.

In 95 cases **(75.4%) was performed antibiotics prophylaxis prior to the surgery** and the remaining 31 cases (24.6%) did not receive antibiotics before the surgery.

## DISCUSSIONS

The surgical site infection, assessed by developed countries like the UK, has prevalence between 1.27 and 5.35% according to the type of surgery, but also the national surveillance system used (1.2), is an important issue of postoperative morbidity and sometimes can be fatal. Treating these infections can be difficult and requires significant

consuming from the financial resources of the hospitals (3). The risk of infection is related to the host patient's physiological status, to the pathogen micro-organism and the surgical procedure itself.

The preoperative patient preparation, according to the well-defined protocols is a very important measure, so the emergency surgery where the situation does not allow the steps recommended is an additional risk. The actual length of duration of the surgery is an important risk factor, the surgeries that extend over 120 minutes being considered at risk. The duration of the preoperative hospitalization should be as short as possible because the hospital environment is full of germs whose density is greater than in the community and the patient, once hospitalised, becomes a sort of "germ chameleon" settling down with the germs from its new living environment. The presence of the preoperative infections must be treated with targeted antibiotics and in appropriate doses.

This study started from the assumption that in Romania the surgical site infections are underreported, although the risk of infection, which is the host and the micro-organism is similar to the risk from other countries, and regarding the conditions in the hospitals, the risk is still significant.

This prospective study evaluated the incidence of SSI for a period of one year and a half in an academic emergency hospital. The aim of the study was not to assess the magnitude and the relationships with the associated risk factors, this objective being achieved only by adding such a case-control study in those sections.

During the studied period, the surgical site infections occurred in a number of 126 cases from 8469 discharged patients and at a number of 6367 surgical interventions. This represented an incidence of 1.48% if we compare the number of discharges and 1.98%, if we compare the total number of surgical interventions. Generally, most cases and the highest incidence rate were in wards of surgery (1.98%), followed by the orthopaedic interventions that have resulted in an incidence rate of 1.37%. At the patients discharged from ENT department, the SSI incidence was of 0.36%, the rate being of 0.85% when it is strict reported at the number of interventions from the studied period.

The antibiotics prophylaxis was present in 75% of people who subsequently developed SSI. Although the percentage is high, it was proved that it could not prevent the appearance of such infections. A possible explanation could be the reduce percentage of the following of the rules of the antibiotic prophylaxis in hospital (the choice of the antibiotics and especially the start and the duration of their administration), being in concordance with the results of a study on the subject conducted in hospital during the year 2006 (4). The same explanation appears in other studies (5). Even if the antibiotics prophylaxis is done correctly, not all the micro-organisms are destroyed (the catalytic incision is not "sterilized") and the antibiotic itself is less effective if it does not respect the other recommendations to prevent the SSI.

**The score of anaesthetic risk** was for the majority of the cases which developed the SSI of 3 or 4, so the patients had other severe systemic diseases which have increased the risk of infection.

In the study group, about 25% of cases were **emergency surgery**, cases where the preoperative preparation could not be respected at the recommended level.

88% of the infections were superficial, limited to skin and supra-aponevrotic tissue. The deep site infections, with important potential and very serious consequences, were present only in 22% of cases, especially in patients with ENT and orthopaedic surgeries.

## CONCLUSIONS

1. The surgical site infection is not such a rare complication as it is stated in Romania; according to our study 1.48% of the patients may be affected, the variations depending on the type of practiced surgery.
2. The infection is a complication that leads to the prolongation of the operated patient's hospitalization, in this study the hospitalization being over 30 days.
3. During the period studied, the men's percentage that developed the SSI was lower than that of the women. The average age of men who have suffered infections after surgery was less than of women, the difference being statistically significant.
4. Over 50% of the patients with SSI had the score of the anaesthetic risk 3 and 4, namely, patients with associated severe systemic disease.
5. About 25% of the SSI cases were emergencies, which did not allow the adequate preoperative preparation of the cases. The digestive surgeries were most of the emergencies.
6. It is necessary the realisation and the compliance of some protocols of prevention of SSI and of adequate antibiotics prophylaxis.

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