

Original Research Article

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Surveillance of Surgical Site Infection in Surgical Hospital Wards in Bulgaria, 2015-2016

Y. Mitova¹, V. Doycheva¹, S. Angelova¹, R. Konstantinov²,
A. Kircheva^{2*} and K. Stoyanova³

¹Department of Epidemiology, Medical University - Sofia, Bulgaria

²Department of Hygiene and Epidemiology, Medical University – Varna, Bulgaria

³Department of Infectious Diseases, Parasitology and Dermatovenerology, Medical University – Varna, Bulgaria

*Corresponding author

ABSTRACT

Keywords

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Surgical site infections (SSIs) are a leading infectious pathology in surgical hospital wards with broad variance of the incidence depending on the profile. The ratio of SSI as part of all healthcare associated infections registered in the hospital wards of general and abdominal surgery wards in Bulgaria for the period 2015-2016 is 63.83%. The highest occurrence of the superficial SSIs is registered in urology sectors- 91.28%, deep tissue SSIs are predominant in neurosurgery wards- 31.29 % and SSIs of a specific organ and/or body space are with highest rate in thoracic surgery sectors- 34, 24%. *E. coli* is the primary etiological pathogen in all SSIs classification categories especially in the General and Abdominal surgery wards. In Thoracic-, Cardio-, Vascular-, Orthopaedic and Neurosurgery sectors the leading cause of superficial SSIs is *S. aureus*.

Introduction

Defined by consensus as a surgical site infections (SSIs) the post-operative communicable complications of the operative wound remain one of the major problems of modern surgery (Horan *et al.*, 1992; Horan *et al.*, 2008). SSIs are priority issues regarding patient safety and often the life of the operated patient depends on their successful management (WHO, 2008; Haynes *et al.*, 2009; Brown *et al.*, 2007). The incidence of

the registered cases varies widely - from 2% to 40.0 % (Mangram *et al.*, 1999; Haley *et al.*, 1975-1976). According to the Centers for Disease Control and Prevention (CDC) in 2010 in United States' hospitals for active treatment over 16 million surgery-procedures are performed, with SSIs accounting for of up to 31% of all healthcare associated infections (HCAI) (National Hospital Discharge Survey 2010; Magill *et al.*, 2012). Our previous research among 52 330 patients in several hospitals for active treatment in Bulgaria

revealed SSIs' incidence between 35.3 % and 51.1 % of all HCAI (Kircheva, 2004). An alarming fact is that the rate of these infections is constant, and even increases in some surgical procedures despite the success of antibiotic therapy and advanced aseptic and antiseptic methods (Magill *et al.*, 2014; Mu *et al.*, 2011; Centers for Disease Control and Prevention, 2014; Awad, 2012; European Centre for Disease Prevention and Control, 2016; Health Protection Agency, 2012). This makes SSIs an up to date and challenging problem of modern surgical theory and practice.

The aim of the current study is to estimate the incidence of SSIs in different type of surgical wards in Bulgaria for 2015-2016 according to the CDC's classification types and to determine the leading causative pathogens in those sectors.

Materials and Methods

The data was acquired from the Bulgarian computerized registration system for healthcare-associated infections for the period 2015-2016 in following sectors: General and Abdominal Surgery (GAS), Thoracic Surgery, Cardio- and Vascular Surgery, Neurosurgery, Orthopaedic, Urologic and other surgery wards (purulent-septic; facial; children's; burns, reconstructive and plastic surgery sectors). The data was analysed with complex epidemiological method and alternative statistical analysis was performed.

Results and Discussion

Surgical site infection is a problem typical for hospital wards with invasive profiles. According to European Centre for Disease Prevention and Control (ECDC) for the period 2013-2014 in 16 European countries the incidence of SSIs varies between 0.6% and 9.5% of the operated patients, depending on

the type of the surgical procedure (European Centre for Disease Prevention and Control, 2016). The data from an equivalent study conducted in 198 hospitals in England for the period April 2011-March 2016 shows that the incidence of SSIs in colon surgeries is 9.8%, in the small intestine surgery - 7.2%, and in biliary tract, liver and pancreas operations is 5.6% (Health Protection Agency, 2012).

According to the surveillance results in Bulgaria the incidence of SSIs for the period 2015-2016 is relatively low – 0.81% of the discharged patients in the GAS wards (Table 1). For the same period the ratio of SSIs from all HCAI occurring in GAS sectors in Bulgaria is the highest - 63.83%.

The results for the other surgical departments during the studied period also revealed low incidence numbers: 0.16% SSIs in Urology and 0.65% in Thoracic Surgery. As for the proportion of all HCAI these complications are 9.64% for the Urology and 76.67% for the Thoracic sectors (Table 1).

The comparative analysis of the SSIs' incidence for 100 discharged patients discloses the highest numbers in the GAS and lowest in Urology wards (Figure 1).

Figure 2 shows the results for the SSIs distribution (%), depending on the location (the affected organs and tissues) according to the CDC's classification system, in various surgical departments in Bulgaria.

The fraction of the superficial SSIs is highest in the Urology - 91.28%, GAS - 70.80%, Cardiovascular – 79.48% and Orthopedic wards - 72.32%. The deep SSIs are dominant in Neurosurgery - 31, 29% and in the sectors with other profiles - 29.58%. SSIs of a specific organ and/or body space are prevalent in Thoracic wards – 34.24% and rarity in Neurosurgery sectors – 1.23%.

Table.1 SSIs in Bulgaria by surgical category, 2015-2016

Surgical Category	No. Operations	No. Nosocomial Infections	No. SSIs	Incidence/ 100 operations, (95% CLs)	SSIs/ HCAI (%)
General and Abdominal Surgery	366 565	4 667	2 973	0,81 ± 0,03	63,83
Thoracic Surgery	28 153	240	184	0,65 ± 0,09	76,67
Cardiac and Vascular Surgery	66 713	667	424	0,64 ± 0,06	63,57
Neurosurgery	36 331	714	164	0,45 ± 0,07	22,83
Other Surgical Wards	51 375	1 066	311	0,61 ± 0,07	29,17
Trauma and Orthopedics	192 465	1 600	925	0,48 ± 0,03	57,81
Urological Wards	124 749	2 023	195	0,16 ± 0,02	9,64

Table.2 Distribution of identified pathogens causing superficial/deep/organ-space SSIs, by surgical category in Bulgaria, 2015-2016

Surgical Category	Superficial SSI	Deep SSI	Organ- space SSI
General and Abdominal Surgery	<i>E. coli</i> , <i>S. aureus</i> , <i>Enterococcus spp.</i>	<i>E. coli</i> , <i>P.aeruginosa</i> , <i>S.aureus</i>	<i>E. coli</i> , <i>P. aeruginosa</i> , <i>Klebsiella spp.</i>
Thoracic Surgery	<i>S. aureus</i> , <i>E. coli</i> , <i>P. aeruginosa</i> ,	<i>E. coli</i> , <i>P. aeruginosa</i> <i>S. aureus</i>	<i>E. coli</i> , <i>S. aureus</i> , <i>Enterococcus spp.</i>
Cardiac and Vascular Surgery	<i>S. aureus</i> , CNS*, <i>Enterococcus spp.</i>	<i>E. coli</i> , <i>S. aureus</i> , <i>P. aeruginosa</i> ,	<i>S. aureus</i> , <i>Enterococcus spp.</i> , <i>Serratia spp.</i>
Neurosurgery	<i>S. aureus</i> , CNS*, <i>Acinetobacter spp.</i>	<i>S. aureus</i> , CNS*, <i>Acinetobacter spp.</i>	<i>Acinetobacter spp.</i> , <i>Klebsiella spp.</i>
Other Surgical Wards	<i>Acinetobacter spp.</i> , <i>E.coli</i> , <i>P. aeruginosa</i> ,	<i>Proteus spp.</i> , <i>Acinetobacter spp.</i> , <i>E.coli</i> ,	<i>Acinetobacter spp.</i> , <i>E.coli</i> , <i>Proteus spp.</i>
Trauma and Orthopedics	<i>S. aureus</i> , CNS*, <i>Acinetobacter spp.</i>	<i>S. aureus</i> , CNS*, <i>Acinetobacter spp.</i>	<i>Enterobacter spp.</i> , <i>Streptococcus spp.</i> , <i>S.aureus</i>
Urological Wards	<i>Enterococcus spp.</i> , CNS*, <i>E.coli</i>	CNS*, <i>Enterococcus spp.</i>	<i>Enterobacter spp.</i> , <i>Klebsiella spp.</i>

*CNS - coagulase-negative staphylococci

Fig.1 Cumulative SSIs incidence by surgical category per 100 operations with 95% CLs in Bulgaria, 2015-2016

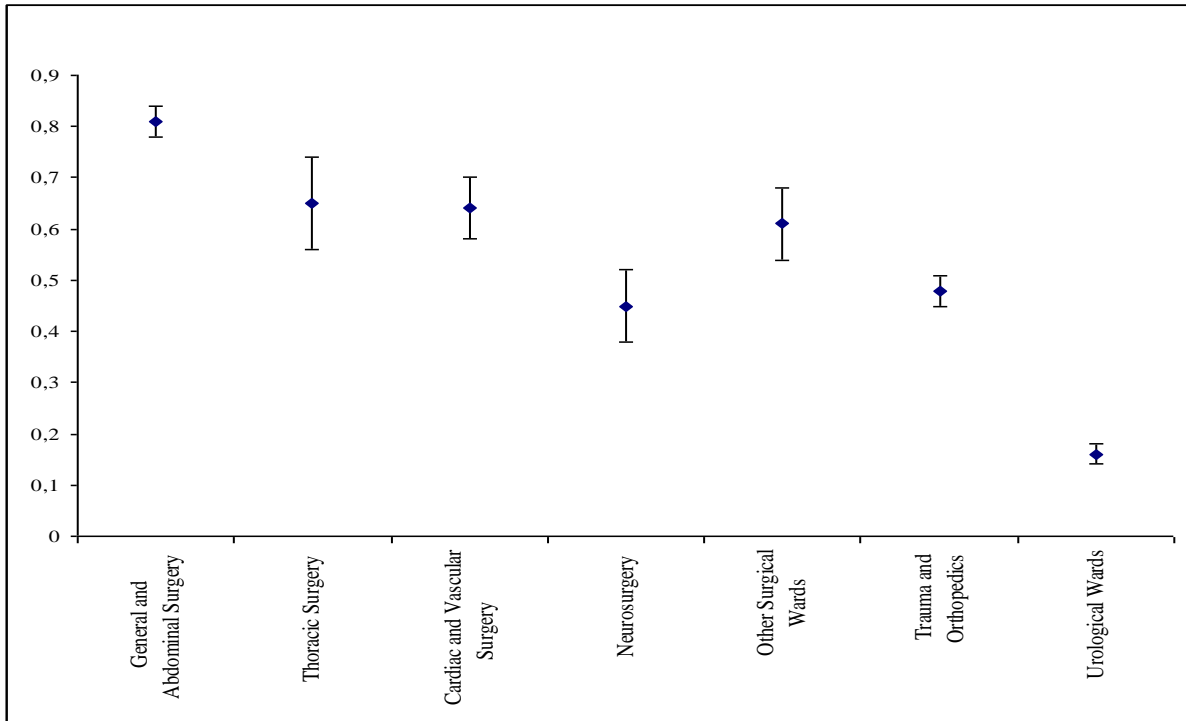
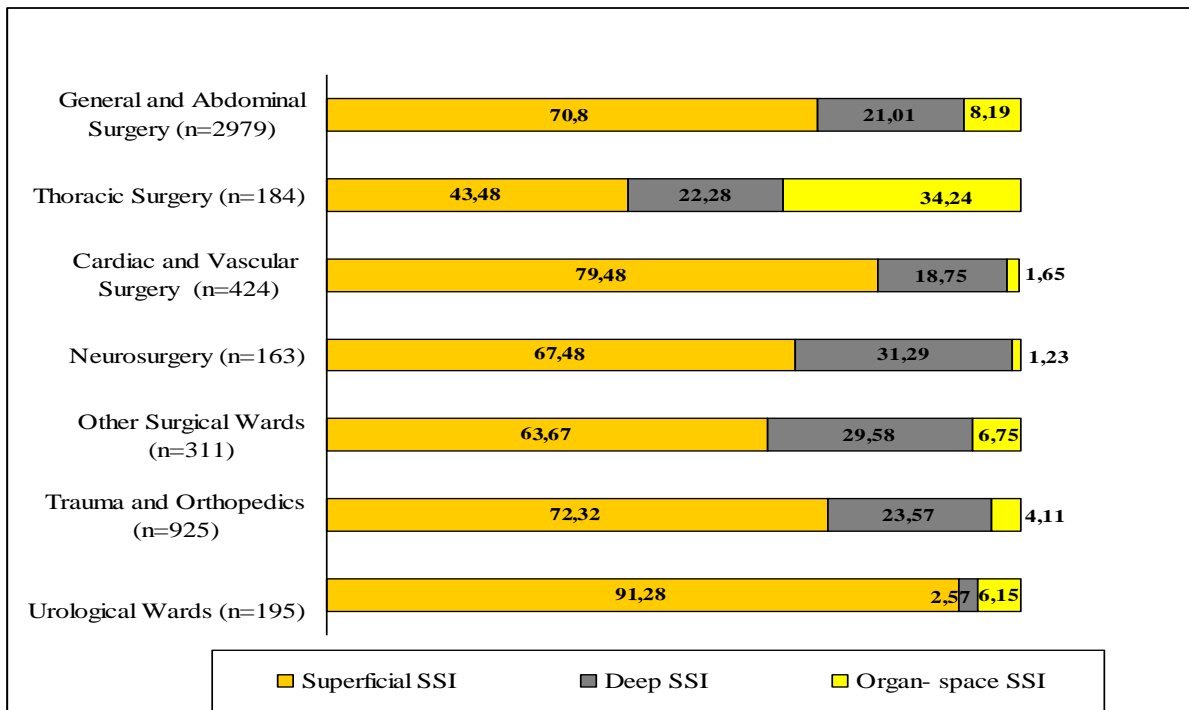


Fig.2 Distribution of SSI-types in inpatient cases (% of total SSIs) by surgical category in Bulgaria, 2015-2016



The leading etiological agents according to the profile of the surgical department and the type of SSIs in Bulgaria for the period 2015-2016 are presented on Table 2. *Escherichia coli* is the principal pathogen in all three localizations in GAS. It has highest occurrence in deep and organ/body space SSIs in Thoracic wards and in deep infections of the cardiovascular hospital departments in Bulgaria.

Staphylococcus aureus is the impact etiological agent of the superficial SSIs in the Thoracic, Cardiovascular, Orthopedic and Neurosurgery sectors of the country. In the last two sectors *S. aureus* is detected with highest rate in deep SSIs as well. *Coagulase-negative staphylococci* have important significance as causative agents in Neurosurgery and Orthopaedic wards. Gram-negative bacteria are also part of the etiological spectre: *Acinetobacter spp.* is present in the Neurosurgery and Orthopedy. In Urology besides *E. coli*, other members of the *Enterobacteriaceae* family are isolated. *Enterococcus spp.* are surgical wound pathogens in GAS, Cardiac, Vascular Surgery and Urology. *Pseudomonas aeruginosa* is another important pathogen in GAS, Cardiac and Vascular wards.

SSIs are the most important clinical forms of HCAI in hospital wards with invasive profiles.

The SSIs' incidence among operated patients in the surgical wards with different profile in Bulgaria for 2015-2016 varies between – 0.16% for Urology up to 0.81% for the GAS sectors.

The distribution according to the type of SSIs differs depending on the sector's profile. The occurrence of the superficial SSIs is highest in Urology – 91.28%, deep SSIs are prevalent in Neurosurgery – 31.29 % and

organ and body space SSIs are more common in Thoracic wards – 34.24%.

E. coli is the leading etiological pathogen in all three categories SSIs in General and Abdominal Surgery sectors.

S. aureus is the foremost bacterial agent in superficial SSIs in Thoracic, Cardiac, Vascular, Orthopaedic and Neurosurgery sectors.

In SSIs of organs or body space the main significance have *Acinetobacter spp.*, *S. aureus*, *E. coli* and other pathogens of *Enterobacteriaceae* family.

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