JIDC | THE JOURNAL OF INFECTION IN DEVELOPING COUNTRIES

Original Article

Smoking increases the risk of surgical site infection after hydrocelectomy in adults: a retrospective cohort study in Brazil

Thiago Silva da Costa[1], Paulo José de Medeiros[1], Mauro José Costa Salles[2]

[1] University Hospital Onofre Lopes, Urologic Unit, Federal University of Rio Grande do Norte, Natal, Rio Grande do Norte, Brazil
[2] Division of Infectious Diseases, Department of Internal Medicine; Santa Casa de São Paulo School of Medical Sciences, São Paulo, Brazil

* All authors contributed equally to this work.

Abstract

Introduction: Surgical site infection (SSI) following hydrocelectomy is relatively uncommon, but it is one of the main post-operative problems. We aimed to describe the prevalence of SSI following hydrocelectomy among adult patients, and to assess predisposing risk factors for infection. Methodology: This retrospective cohort study was carried out at a university hospital and included hydrocelectomies performed between January 2007 and December 2014. Diagnosis of SSI was performed according to the Center for Diseases Control (CDC) guidelines. Multivariable logistic regression analysis was used to identify independent risk factors. Results: A total of 196 patients were included in the analysis. Overall, 30 patients were diagnosed with SSI (15.3%) and of these, 63.3% (19/30) were classified as having superficial SSI, while 36.7% (11/30) had deep SSI. The main signs and symptoms of infection were the presence of surgical wound secretion (70%) and inflammatory superficial signs such as hyperemia, edema and pain (60%). Among the 53 patients presenting chronic smoking habits, 26.4% (14/53) developed SSI, which was associated with a higher risk for SSI (odds ratio [OR] = 2.84, 95% confidence interval [CI] = 1.27 to 6.35, $p < 0.01$) in the univariate analysis. In the adjusted multivariable analysis, smoking habits were also statistically associated with SSI after hydrocelectomy (odds ratio [OR] = 2.84, 95% confidence interval [CI] = 1.30 to 6.24, $p = 0.01$). No pre-, intra-, or post-operative variable analyzed showed an independent association to SSI following hydrocelectomy. Conclusions: Smoking was the only independent modifiable risk factor for SSI in the multivariate analysis.

Key words: hydrocelectomy; risk factors; smoking; surgical site infection; urological surgery

J Infect Dev Ctries 2017; 11(12):950-956. doi:10.3855/jidc.9450

(Received 24 May 2017 – Accepted 08 November 2017)

Introduction

Hydrocele is the collection of fluid within the scrotum. Among adults, the most common type is non-communicating hydrocele due to excessive fluid production by the tunica albuginea or inadequate resorption of the fluid by the tunica parietalis surrounding the testis [1]. Its etiology includes trauma, infection and testicular neoplasia, although, most of the time it may remain undefined (idiopathic) [2]. Up to 1% of men aged over 40 are estimated to have some collection of scrotal fluid [3].

Surgical therapy has been indicated when increased scrotal volume is accompanied by local pain or discomfort [4]. The overall complication rates following surgery may vary substantially, ranging from 0.7% to 20% according to previous studies and include hematoma, infection, recurrence, chronic pain, and infertility [2,5-7]. Even though the majority of surgical site infection (SSI) described following hydroceles surgery has been classified as superficial, a few cases are expected to develop serious complications such as abscesses and deep tissue necrosis [8].

Hydrocelectomies have been traditionally classified as clean-contaminated surgeries (Class II) because they involve an incision in the genital tract under controlled conditions without gross contamination or significant transgression by the operative technique [9]. On the other hand, authors such as Grabe et al, have classified these procedures as clean surgeries (Class I) given the low infectious complication rates they found [10]. Hence, there has not been a consensus on the use of antibiotic prophylaxis in this surgery [11]. Additionally, few authors have evaluated the potential factors associated with infection following surgery for hydrocele, in which an elevated grade in the American Society of Anesthesiologists (ASA) Status

Classification System and the use of an indwelling bladder catheter had previously been associated [7,12]. We therefore sought to describe the prevalence of SSI following surgery for hydrocele among adult patients in a tertiary referral center; and aimed to identify pre- and intra-operative independent risk factors predisposing subjects to this complication. Identification of risk factors may help in the implementation of efficient and cost-saving control measures to reduce the frequency of infection.

Methodology

Study population

We conducted a single-center, retrospective cohort analysis with 205 patients who had undergone urologic surgeries, either for hydrocele surgery only or combined with another surgery, in the urology department of a university hospital, between January 2007 and December 2014. Patients with unavailable medical records, as well as those whose scrotal surgical procedure was indicated for treating local neoplasia (radical orchiectomy) or controlling hormone-sensitive metastatic tumors (subcapsular orchiectomy), were excluded. The Institutional Review Board of the Onofre Lopes University Hospital approved the study. Institutional authorization was granted to use patients' records.

Diagnostic Criteria for Surgical Site Infection (SSI) Associated with Scrotal Surgeries

According to the criteria proposed by the Center for Disease Control and Prevention (CDC-USA/2017) [13], SSI is classified as either superficial or deep, and defined as infection occurring within 30 days of the procedure. The subgroup of individuals undergoing the procedure and diagnosed with SSI were considered as cases, and those without infection were considered as the study controls.

Potential risk factors

Patient and surgery variables were identified by reviewing the medical records for potential risk factors associated to SSI. We searched for demographic variables (age) comorbidities (diabetes and hypertension), previous history of local or systemic infection, smoking habits, alcohol consumption, American Society of Anesthesiologists (ASA) classification. Variables associated to pre-, intra- and post-operative procedures included hair removal (removal using a razor compared to no removal), , the type of antiseptic (iodopovidone or chlorhexidine) applied to the incision site, whether prophylaxis with cefazolin was given at the moment of anesthetic induction, the time of surgery, the type of surgery (hydrocele repair surgery was sometimes performed with some other type of surgical intervention, which we categorized as minor, medium or major surgeries), use of a post-operative drain, and use of an indwelling or intermittent urinary catheter. Other conditions also assessed were the length of hospital stay and the number of days between discharge and outpatient return.

Statistical analysis

Qualitative variables were described as means and percentages; whereas the quantitative variables, as median and standard deviations. The association between qualitative variables was assessed using the chi-squared test and Fischer's exact test, as indicated. For the associations between quantitative variables, we used bivariate logistic regression. Relative risk estimates for the variables associated with the risk factors for infection following hydrocelectomy were calculated with a 95% confidence interval (CI). For infection, we used the multiple logistic regression model, selecting the variables of the bivariate analysis tests when the levels of significance were lower than 0.10 ($p < 0.10$); only those variables whose significance was lower than 0.5 ($p < 0.05$) were kept in the final models. We used Epi-info software version 3.22 (Center for Diseases Control and Prevention, Atlanta, USA), with data tabulation and SPSS (version 20.0, IBM CORP. Amoncarmonk, USA) in the statistical analyses.

Results

Study population

During the study period from 2007 to 2014, a total of 205 surgical procedures for treating hydrocele were performed and analyzed. Of these, 4.3% (9/205) were excluded from the subsequent analysis, seven due to a diagnosis of neoplasia and two due to missing information. Thus, a total of 196 patients were included in the study; the demographic variables and clinical characteristics of this population are described in Table 1. Notably, heavy tobacco consumption and hypertension were detected in 27% and 30% of study group, respectively. Overall, 15.3% (30/196) of patients presented any type of surgical wound infection, whereas 84.6% (166/196) were categorized as controls. Of interest, the annual SSI rate during the study period was 10.3%, with exception of 2013, when the SSI rate reached 32.3% (11/34). With regard to the demographic data, the mean age was 52.5 years (16 – 89 years of age). Microbiological analysis was not described

among patients with infection. The clinical characteristics of the 30 patients with SSI following hydrocelectomy are summarized on Table 2.

Factors predisposing to SSI related to the patients' clinical characteristics and operative care

The clinical demographic variables and comorbidities were similar across patient groups with and without SSI. Neither an ASA preoperative score greater than or equal to 2 (p=0.12) or the presence of an associated infectious process, such as erysipelas, at the time of admission (p=0.23) was associated with the occurrence of infection. Among the 53 patients presenting chronic smoking habits, 26.4% (14⁄53) developed SSI, which was associated with a higher risk for SSI (odds ratio [OR] = 2.84, 95% confidence interval [CI] = 1.27 to 6.35, $p < 0.01$) in the univariate analysis. In fact, in the adjusted multivariable analysis, only smoking habits were statistically associated with SSI after hydrocelectomy (odds ratio [OR] = 2.84, 95% confidence interval [CI] = 1.30 to 6.24, $p = 0.01$). Chronic smokers were found to have a 2.84-fold increase in their chance of presenting SSI (Table 3). Prophylaxis with cefazolin at the time of anesthetic induction occurred in 63.7% (125/196) of procedures. Nevertheless, no significant statistical difference was identified between groups that had been given or had not been given antibiotic prophylaxis. Moreover, none of other pre-, intra-, and post-operative variables analyzed showed an independent association with SSI following hydrocelectomy (Tables 3 and 4).

Discussion

Hydrocelectomies are common in urological practice and considered technically simple. At teaching hospitals, it is commonly performed by physicians at an early stage of their training. However, there is little data available regarding complication rates or risk factors for adverse outcomes [7]. Uehara *et al*. [14], found a 1.6% of infection rate, much lower than the rates reported in a review by Swartz *et al*., in which SSI after hydrocelectomy varied from 3.6 to 9.3% [7]. Conversely, in a single-center prospective study with a limited number of hydrocelectomies analyzed, the SSI rate reached 20% [5]. In the present study, we found a 15.3% SSI rate, well above the average rates described in most of the literature for this type of surgery. Smoking was the only independent predisposing factor to SSI in this present study. We hypothesized that the fact that the hydrocelectomy was being performed by

Table 1. Demographic variables and clinical characteristics of the 196 patients included in the study.

Demographic variables/clinical characteristics	N = 196	%
Age		
Mean	52.5	
Median	54	
(Min-Max)	(16-89)	
Level of schooling		
Illiterate	36	18.6
Primary school	65	33.2
Secondary school	37	18.9
Higher education	12	6.1
NA	46	23,4
Profession		
Student	9	4.6
Employed	132	67.3
Retired	22	11.2
NA	33	16,8
Consumption of alcohol	32	16.3
Time* (mean)	29.8	
Smoking	53	27
Time* (mean)	29.7	
Bacterial infection at admission	6	3.1
Diabetes mellitus	13	6.6
Arterial hypertension	59	30.1
ASA**		
Level I	110	56.1
Level ≥ II	86	43.8
Use of medications at admission	62	31.6

NA-Data not available; *In years; ASA** Clinical classification by the American Society of Anesthesiology.

resident physicians at an early stage of their urological surgery training may be also regarded as a possible reason for the higher SSI rate identified in our study. In addition, the use of strictly clinical criteria for diagnosing SSI needs to be highlighted. Calvo *et al*., identified a SSI rate of 11.8% by applying an isolated clinical method for the diagnosis of infection, which was also higher than in most previous results [15]. Thus, it is difficult to compare our infection rate with that published by other authors due to differences regarding the SSI definition, diagnostic methods and follow-up criteria used, as well as the differences among population groups.

In our study, most SSI cases were superficial (63%), in concordance with most previous studies [11,15], with wound exudate and dehiscence of the suture line being the main clinical signs of infection. Indeed, previous studies showed a significant relationship between dehiscence and SSI, although the systematic diagnosis of patients with some degree of suture line inflammation, used alone as a sign of infection may have overestimated the number of cases of SSI [11,15]. Alonso-Isa *et al*., reported that 34% of wound exudate sample cultures resulted in either no, or inconclusive growth, but still opted to consider local secretion as indicative of SSI, which may have resulted in an overestimation of the number of cases [12].

Smoking was the only independent factor associated with infection in the present study, increasing by nearly three times the chance for SSI. In their review, Grabe *et al*., pointed out that the use of nicotine promotes delays in tissue healing and increases SSI risks among urological procedures [16]. The pathophysiological consequences of smoking on surgical outcomes are related to the toxic effects of the inhalation leading to tissue hypoxia by the mechanism of vasoconstriction, associated with inadequate stimulation of fibroblasts under oxidative stress conditions [17]. The delay in wound healing and increased risk of local infection has been associated with decreasing cell migration and inadequate accumulation of connective tissue in the wound [17]. In

Table 2. Clinical characteristics of the infection and antibiotic therapy among 30 patients with SSI after hydrocelectomy.

Case	Age	Smokers	*ASA score**	Discharge	Dehiscence	Fever	Infection	Hospital readmission	Antibiotic therapy
1	51	No	I	Yes	Yes	No	Superficial	No	Amox/clavul**
2	45	Yes	II	Yes	Yes	No	Deep	Yes	Combination***
3	78	No	II	Yes	Yes	No	Superficial	No	Ciprofloxacin
4	64	No	II	Yes	Yes	Yes	Deep	Yes	Combination***
5	60	Yes	II	Yes	No	No	Superficial	Yes	Ciprofloxacin
6	35	No	I	Yes	No	No	Superficial	Yes	Ciprofloxacin
7	37	No	I	No	No	No	Superficial	No	Cephalexin
8	35	No	III	Yes	Yes	No	Superficial	Yes	Combination***
9	60	Yes	II	No	No	No	Superficial	No	Cephalexin
10	56	Yes	I	No	No	Yes	Deep	Yes	Ciprofloxacin
11	50	No	I	Yes	No	No	Superficial	No	Cephalexin
12	81	Yes	II	No	No	Yes	Deep	Yes	Ceftriaxon
13	28	No	I	No	Yes	No	Deep	Yes	Amox/clavul**
14	62	Yes	II	Yes	No	Yes	Superficial	No	Cephalexin
15	28	No	I	No	No	Yes	Superficial	No	Cephalexin
16	81	No	II	Yes	Yes	No	Deep	No	Amox/clavul**
17	64	Yes	II	Yes	No	No	Superficial	No	Cephalexin
18	49	No	II	Yes	No	No	Superficial	No	Cephalexin
19	59	Yes	I	Yes	Yes	No	Deep	No	Cephalexin
20	61	Yes	II	Yes	No	No	Superficial	No	Cephalexin
21	48	Yes	I	Yes	No	No	Superficial	No	Cephalexin
22	59	No	I	Yes	No	No	Deep	No	Cephalexin
23	74	No	II	Yes	No	No	Deep	No	Combination***
24	33	No	I	No	No	No	Superficial	No	Ciprofloxacin
25	57	Yes	II	Yes	Yes	Yes	Deep	Yes	Ceftriaxon
26	48	No	I	No	No	No	Superficial	No	Cephalexin
27	68	Yes	II	Yes	No	No	Superficial	No	Cephalexin
28	71	No	II	No	No	No	Superficial	No	Cephalexin
29	62	Yes	II	Yes	Yes	No	Superficial	No	Amox/clavul**
30	61	Yes	I	Yes	Yes	No	Deep	No	Combination***

**American society of Anesthesiology* classification; **Amox/clavul: Amoxicillin+ clavulanic acid; ***Combination therapy: cephalosporins plus quinolones, cephalosporins plus aminoglycosides.

a study by Nolan *et al*., a large number of smoking patients were retrospectively analyzed for SSI risk factors, and the conclusion was that smoking on the day of surgery was independently associated with an increased rate of infection after elective surgeries [18]. In a recent systematic review, Sørensen *et al*. demonstrated an increased risk of infection in 51 studies evaluating procedures distributed across several specialties; the meta-analysis showed a significant increase in infection among the smokers' group [19]. In another similar analysis, Hawn *et al*., were also able to show increased SSI rates among smokers undergoing urological surgeries [17].

We also analyzed other classical risk factors associated with SSI, such as the type of antiseptic skin preparation applied prior to surgery. In our study, as in other previous studies [1], no difference in the rate of SSI were identified among patients undergoing hydrocelectomies being prepared with iodopovidone and those prepared using chlorhexidine solution. Regarding surgical prophylaxis with antibiotics, scrotal procedures are usually considered to be a clean-contaminated or Class II surgery, which makes it reasonable to indicate a preoperative single-dose of antibiotic [2]. Nevertheless, more controlled, prospective, randomized studies are needed to validate the positive impact of antimicrobial prophylaxis among patients undergoing scrotal surgery [14,20]. Interestingly, the lack of antibiotic prophylaxis did not increase the SSI rates in our study. In fact, appropriate use of prophylactic antibiotic 30 to 60 minutes prior to initiate hydrocelectomy should have had an impact on the reduction of SSI rates. We noticed, however, that the medical indication for adequate timing of preoperative antibiotic prophylaxis was not followed by many investigated cases. Moreover, detailed information regarding antibiotic prophylaxis, including the exact time of intravenous administration, type and dose of antibiotic, were missing in 71 patients (36%) in the medical records.

Table 3. Demographics, clinical characteristics and surgical variables among patients with and without infection after hydrocelectomy: univariable and multivariable analysis for risk factors to develop SSI.

	SSI				**Univariate analysis**				**Multivariable analysis**			
	YES		**NO**		**OR**	**CI (95%)**		***P***	**OR**	**CI (95%)**		***P***
Number subjects=196	**N = 30**	**%**	**N = 166**	**%**		**Lower**	**Upper**			**Lower**	**Upper**	
Demographic data												
Age Mean (SD)	55.5 (±2.7)		52 (±1.3)		1.01	0.98	1.03	*0.3**				
Clinical characteristics												
Alcohol consumption N = 32	6	20	26	15,6	1,34	0,5	3,61	*0,55**				
Time consumption***	35 (±15.0)		29 (±4.2)		1.03	0.92	1.15	*0.58**				
Smoking N = 53	14	46,6	39	23,4	2.84	1.27	6.35	***0.01****	2.84	1.3	6.24	***0.01***[#]
Smoking status***	25 (+/-4.9)	31.2 (+/-3)	0.97	0.92	1.06	*0.32**						
Diabetes Mellitus N = 13	2	6,6	11	6,6	1	0.21	4.78	*0.99**				
Arterial hypertension N = 59	11	36,6	48	28,9	1.42	0.63	3.21	*0.39**				
ASA score[$] (N = 110) I	13	43,3	97	58,4	1							
(N = 83) ≥ II	16	53,3	67	40,3	1.83	0.83	4.03	0.12*	3.95	0.7	30.7	0.104[#]
Pre-, trans- and post-operative care												
Hair removal N = 37	5	16,6	32	19,2	0.83	0.29	2.35	*0.73**				
Antibiotic prophylaxis N = 125	22	73,3	103	62	1.68	0.7	4	*0.24**				
Type of antiseptic: Iodopovidone N = 182	27	90	155	93,3	0.63	0.16	2.44	*0.51**				
Chlorhexidine N = 14	3	10	11	6,6	1							
Type of surgery Minor N = 44	9	30	35	21	1							
Medium/Major N = 16	1	3,3	15	9	0.67	0.36	1.91	*0.67**				
Drain N = 20	5	16,6	15	9	2.03	0.67	6.03	*0.21**				
Urinary retention N = 11	2	6,6	9	5,4	1.24	0.25	6.07	*0.78***				
Urinary catheter N = 11	2	6,6	9	5,4	1.28	0.25	6.03	*0.8***				
Catheter: Intermittent N = 7	1	3,3	6	3,6	0.53	0.05	5.32	*0.59***				
Foley catheter N = 4	1	3,3	3	1,8	0.5	0.02	11.08	*0.61***				

*Chi-square test** Fisher exact test [#]Univariate and multivariate regression analyses (adjusted) Bold indicates significant finding at $p < 0,05$; ***Mean in years/Standard deviation; [&]Bacterial infection described in the clinical history at admission in other body site; [$] ASA score: *American society of Anesthesiology;* SSI = Surgical Site Infection; NA = Data not available; OR = Odds Ratio (Chances Ratio); CI = Confidence Interval; SD = Standard Deviation; Min-Max = Minimum-Maximum.

Table 4. Univariate and multivariable analyses for quantitative variables associated with SSI following hydrocelectomy.

				Univariate analysis				Multivariable analysis			
		SSI		OR	CI (95%)		P*	OR	CI (95%)		P*
		YES	NO		Lower	Upper			Lower	Upper	
Length of hospital stay	Mean (days) SD	3 (± 0.5)	2.7 (± 0.1)	1.04	0.9	1.2	*0.564*				
Operative time	Mean (minutes) SD	62.5 (± 6.9)	64.6 (± 4)	0.99	0.99	1	*0.827*				
1st Return	Mean (days) SD	14.6 (± 1.3)	20.6 (± 1.1)	0.95	0.9	0.99	*0.02*	0.93	0.83	1.05	*0.3*
2nd Return	Mean (days) SD	34.6 (± 5.6)	53.7 (± 5.5)	0.97	0.95	0.99	*0.04*	0.98	0.95	1.01	*0.2*

*Logistic regression analysis; OR = Odds Ratio (Chances Ratio); CI = Confidence Interval; SD = Standard Deviation.

We acknowledge that our study has several important limitations, which are mainly due to its retrospective design and the small number of patients diagnosed with SSI (type II error). This fact limits the multivariate analysis adjusted for factors that could have been important for the emergence of SSI, such as the presence of indwelling Foley catheter and drains. The study was conducted in a single public university teaching hospital, situated in a medium-sized city that offers specialized urology care to a wide referral area. Therefore, studies analyzing risk factors using different populations may find difficulties in reproduce these results. Another limitation was the strictly clinical diagnosis of SSI, which probably influenced the total number of cases included.

Conclusions

We found higher rates of SSI after hydrocelectomies compared to previous studies. Smoking was an independent and modifiable risk factor for SSI in the multivariate analysis. Prospective studies are needed to better understand the effectiveness of prophylactic antibiotics.

Acknowledgements

This study received no funds or grants. We thank the Urology Department of Onofre Lopes University Hospital for use of the patient archives, and the local statisticians for their support in statistical analysis.

References

1. Kavoussi PK, Costabile RA (2012) Surgery of the scrotum and seminal vesicles. In: Wein AJ, Kavoussi LR, Partin AW, Peters CA, editors. Campbell-Walsh Urology. Philadelphia: Saunders Elsevier 1001-1022.
2. Kiddoo DA, Wollin TA, Mador DR (2004) A population based assessment of complications following outpatient hydrocelectomy and spermatocelectomy. J Urol 171: 746-748.
3. Leung ML, Gooding GA, Williams RD (1984) High-resolution sonography of scrotal contents in asymptomatic subjects. AJR Am J Roentgenol 143: 161-164.
4. Rioja J, Sánchez-Margallo FM, Usón J, Rioja LA (2011) Adult hydrocele and spermatocele. BJU Int 107: 1852-1864.
5. Beiko DT, Kim D, Morales A (2003) Aspiration and sclerotherapy versus hydrocelectomy for treatment of hydroceles. Urology 61: 708-712.
6. Francis JJ, Levine LA (2013) Aspiration and sclerotherapy: a nonsurgical treatment option for hydroceles. J Urol 189: 1725-1729.
7. Swartz MA, Morgan TM, Krieger JN (2007) Complications of scrotal surgery for benign conditions. Urology 69: 616-619.
8. Sarwar U, Akhtar N (2012) Fournier's gangrene developing secondary to infected hydrocele: A unique clinical scenario. Urology Annals 4: 131-134.
9. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR (1999) Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. Am J Infect Control 27: 97-132.
10. Grabe M (2011) Antibiotic prophylaxis in urological surgery, a European viewpoint. Int J Antimicrob Agents 38: 58-63.
11. Pessaux P, Atallah D, Lermite E, Msika S, Hay JM, Flamant Y, Arnaud JP (2005) Risk factors for prediction of surgical site infections in "clean surgery". Am J Infect Control 33: 292-298.
12. Alonso-Isa M, Medina-Polo J, Lara-Isla A, Pérez-Cadavid S, Arrébola-Pajares A, Sopeña-Sutil R, Benítez-Sala R, Justo-Quintas J, Gil-Moradillo J, Passas-Martínez JB, Tejido-Sánchez A (2017) Surgical wound infection in urology. Analysis of risk factors and associated microorganisms. Actas Urol Esp 41: 109-16.
13. Center for disease control and Prevention (2017) Guideline for prevention of surgical site infection. Available: https://www.cdc.gov/nhsn/pdfs/pscmanual/9pscssicurrent.pdf. Accessed 25 February 2017.
14. Uehara T, Takahashi S, Ichihara K, Hiyama Y, Hashimoto J, Kurimura Y, Masumori N (2014) Surgical site infection of scrotal and inguinal lesions after urologic surgery. J Infect Chemother 20: 186-189.
15. Calvo JG, Martín Tervero MP, Aguayo Osuna MP, Astillero Buitrago JM, Sánchez Gilbert MI, Rozas Sánchez MP (2010) Factors associated to surgical wound infection in urology. ENFURO: Rev Asoc Esp ATS Urol 116: 20-25. [Article in Spanish].
16. Grabe M, Botto H, Cek M, Tenke P, Wagenlehner FM, Naber KG, Bjerklund Johansen TE (2012) Preoperative assessment of the patient and risk factors for infectious complications and tentative classification of surgical field contamination of urological procedures. World J Urol 30: 39-50.

17. Hawn MT, Houston TK, Campagna EJ, Graham LA, Singh J, Bishop M, Henderson WG (2011) The attributable risk of smoking on surgical complications. Ann Surg 254: 914-920.
18. Nolan MB, Martin DP, Thompson R, Schroeder DR, Hanson AC (2017) Association between smoking status, preoperative exhaled carbon monoxide levels, and postoperative surgical site infection in patients undergiong elective surgery. JAMA Surg 152: 476-483.
19. Sørensen LT (2012) Wound healing and infection in surgery: the pathophysiological impact of smoking, smoking cessation, and nicotine replacement therapy: A systematic review. Ann Surg 255: 1069-1079.
20. Pérez Arbej JA, Cameo Rico MI, Pérez Cameo C, Mareca Doñate R (2010) Surgical wound infection in urological patients. a four-year review. Actas Urol Esp 34: 258-265.

Corresponding author
Mauro José Costa Salles
Hospital da Irmandade da Santa Casa de Misericórdia de São Paulo
Rua Dr Cesáreo Mota Jr 112, CEP: 01303-060, São Paulo, SP, Brazil.
Phone: +551121146262
Fax: +551121146363
Email: salles.infecto@gmail.com

Conflict of interests: No conflict of interests is declared.