IODINE-IMPREGNATED INCISION DRAPES IN SPINE SURGERY: IMPACT ON SURGICAL SITE INFECTION

Campos impregnados com iodo em cirurgia da coluna: impacto na infecção de sítio cirúrgico

Paños quirúrgicos impregnados com yodo em cirugía de coluna: impacto en la infección del sitio quirúrgico

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ABSTRACT: Objective: To evaluate the impact of iodine-impregnated incision drapes (IIIDs) to prevent surgical site infection (SSI) in the spine. Method: Retrospective cohort study comparing SSI outcome in patients in which IIIDs were and were not used, from 2015 to 2019. **Results:** The overall frequency of SSI was 16.7%, with SSI rate among patients using and not using IIIDs of 40% and 60%, respectively; p = 0.728; 95% confidence interval (95%CI) 0.19–3.11. Normothermia was the only independent protective factor for SSI (p = 0.043). The treatment of infectious complications resulted in hospital costs increase of 83.6% each day of care. Patients who were treated with IIIDs stayed 10 days less (± 4.9) in hospital. **Conclusions:** The results suggest that the use of IIIDs was not associated with a lower risk of SSI. These data can be useful for surgical planning and patient safety.

Keywords: Surgical drapes. Spine. Surgical wound infection. Infection control. Products with antimicrobial action.

RESUMO: Objetivo: Avaliar o impacto de campos adesivos impregnados com iodo (CAII) na prevenção de infecção de sítio cirúrgico (ISC) de coluna vertebral. **Método:** Coorte retrospectiva que comparou desfecho de ISC em pacientes que utilizaram CAII com os que não usaram, de 2015 a 2019. **Resultados:** A frequência geral de ISC foi de 16,7%, com a taxa de ISC para os que utilizaram CAII de 40% e, entre os que não usaram, de 60%; p = 0,728; intervalo de confiança de 95% (IC95%) 0,19–3,11. A normotermia foi o único fator protetor independente para ISC (p = 0,043). O tratamento de complicações infecciosas acarretou o incremento de custo hospitalar de 83,6% a cada dia de atendimento. Os pacientes que utilizaram CAII tiveram 10 (± 4,9) dias a menos de permanência hospitalar. **Conclusões:** Os resultados sugerem que o uso de CAII não foi associado a menor risco de ISC. Esses dados podem ser úteis para o planejamento cirúrgico e a segurança do paciente.

Palavras-chave: Campos cirúrgicos. Coluna vertebral. Infecção da ferida cirúrgica. Controle de infecções. Produtos com ação antimicrobiana.

RESUMEN: Objetivo: Evaluar el impacto de las paños quirúrgicos adhesivos impregnados de yodo (IIIDS) en la prevención de la infección del sitio quirúrgico (ISQ) de la columna. **Método:** Cohorte retrospectiva que comparó el resultado de ISQ en pacientes que usaron IIIDS con los que no lo hicieron, de 2015 a 2019. **Resultados:** La frecuencia general de ISQ fue del 16.7%, con una tasa de ISQ para los que usaron IIIDS del 40% y, entre los que no lo usaron, 60%; p = 0,728; Intervalo de confianza del 95% (IC 95%) 0,19–3,11. La normotermia fue el único factor protector independiente para la ISQ (p = 0,043). El tratamiento de las complicaciones infecciosas supuso un aumento de los costes hospitalarios del 83,6% por día de atención. Los pacientes que utilizaron IIIDS tuvieron 10 (± 4,9) días menos de estancia hospitalaria. **Conclusiones:** Los resultados sugieren que el uso de IIIDS no se asoció con un menor riesgo de ISQ. Estos datos pueden ser útiles para la planificación quirúrgica y la seguridad del paciente.

Palabras clave: Paños quirúrgicos. Columna vertebral. Infección de la herida quirúrgica. Control de infecciones. Productos con acción antimicrobiana.

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Received: 01/14/2021 – Approved: 09/01/2021
https://doi.org/10.5327/Z1414-4425202100030004

INTRODUCTION

Spine surgeries are procedures more and more performed due to the increase in average life expectancy[1]. When indicated, they aim to save an individual's or improve their quality of life, but the lack of safety regarding some uncontrolled factors can cause infections, disabilities and even death[2]. Despite using protocols for the prevention of surgical site infection (SSI), this remains a significant cause of postoperative morbidity, mortality and increased costs. Some procedures involving prostheses have a higher risk of complications, in addition to prolonged hospital stays and possible readmissions for new procedures and therapies[3].

Given this scenario, the need for efforts to create SSI prevention strategies is highlighted. It is important to identify risk conditions, which are clinical factors or conditions predisposing to SSI, in order to perform any adjustments and ensure surgical safety[2]. One relevant aspect is the surgical wound exposure to the environment during the procedure. Added to other predisposing conditions, this can be determinant for SSI[3]. SSI prevention is based on causes such as bacterial load, agent virulence, risk of infection and the patient's immune defense[2].

Among various elements identified for the prevention of SSI, one of the most important procedures is skin preparation, and there are few antiseptics available to meet this recommendation. The objectives of using these chemical agents are to remove microorganisms, provide chemical death and inhibit the growth of microorganisms through various techniques and combinations, thus reducing the skin (temporary and resident) microbiota for as long as the surgery can last[4].

Given this multifactorial context, multidisciplinary care and interdisciplinary actions are clearly needed, along with additional technologies to prevent this problem. The use of an iodine-impregnated incision drapes (IIIDs) is an option to reduce the resident skin microbiome that persists after the application of classic antiseptic preparations[4-6].

OBJECTIVES

Primary objective

- Assess the impact of IIID in preventing spinal SSI.

Secondary objectives

- To describe the clinical characteristics and risk factors of patients undergoing spinal surgery;
- To assess the cost-effectiveness of IIID in the incidence of spinal SSI;
- To check whether the use of IIID interfere with the length of hospital stay;
- To determine the frequency of cutaneous adverse reactions associated with IIIDs.

METHOD

This is a retrospective cohort study conducted with 60 patients undergoing spinal surgeries and assessing the use of IIIDs, from January 2015 to December 2019, in a teaching hospital in the countryside of Rio Grande do Sul (Brazil). The institution is philanthropic and has seven operating rooms, with an average of 622 anesthetic-surgical procedures per month and 2.6 spine surgeries per month during the study period.

The patients chosen for the research were identified in surgery reports extracted from the institutional care system, which made it possible to evaluate and classify the variables and the use or not of IIIDs. Inclusion criteria were all patients over 18 years old, undergoing spinal surgery in the study period, with a clean classification, by the only surgical team in the specialty. Patients undergoing spinal surgery classified as infected were excluded. All individuals were analyzed based on electronic and physical records, from which a form was filled in with the study variables and then sorted according to the use or not of IIID and the outcome of SSI (Figure 1).

Patients undergoing surgery for arthrodesis, spine fracture, spinal dislocation, spinal disc herniation and laminectomy were evaluated during hospitalization and in the long term (90 days after discharge) by the Infection Control Service. The criteria established by the National Health Surveillance Agency (ANVISA)7 and by the institutional SSI surveillance protocol after discharge were complied with. Superficial incisional SSI, deep incisional SSI, and organ-space SSI were considered. The records were made in a specific computerized infection control system and considered for SSI analysis.

Table 1 shows the variables predicting central nervous system SSI risk defined according to ANVISA[7,8], by the

American Society of Anesthesiologists (ASA)[9] classification and by the National Nosocomial Infections SSI risk index (IRIC), the National Nosocomial Infections Surveillance (NNIS) from the Centers for Disease Control and Prevention (CDC)[10]. The variables collected for analysis were: age, gender, care plan (private and non-private [Single Health System]), surgical emergency, pre-surgical admission and pre-surgical admission to an intensive care unit (ICU), ASA, body mass index (BMI), surgery site, surgery duration, skin preparation, use of IIID, antimicrobial prophylaxis (30 to 60 min before incision), extended prophylaxis (24 hours), surgical trauma, presence of infection before and after the procedure, normothermia (35.5 to 38.3 °C), use of drains up to 24 hours after the surgery, postoperative admission to the ICU, and death.

In the analysis of variables, location was categorized as "upper surgery" for procedures at the level of the cervical spine, regardless of levels or approach, and as "lower surgery" for all others.

IIID (Ioban® 2; 3M, St. Paul, MN) is a drape covered with a hypoallergenic acrylic adhesive and impregnated with iodine, very sensitive to pressure, which promotes a sterile surface and helps to prevent the migration of microorganisms to the surgical site4. Only one surgical team participated in the research and they did not have a criterion defined for IIID.

The costs of medicines, materials (including orthoses and prostheses), exams, hospital equipment and structure were measured. All hospitalization costs were considered, except the remuneration of the medical care team. These data were provided by the institution and reflect the aforementioned value for the period of care.

Data were analyzed in the Statistical Package for Social Sciences (SPSS IBM, Armonk, USA), version 23.0. Effect measures such as difference in means or difference in proportions, were used with their respective 95% confidence intervals (95%CI). A multiple linear regression model was applied to variables with $p < 0.20$ in the simple linear regression, to consider risk factors for the outcome. Values of $p < 0.05$ were considered significant.

The project was submitted, via Brasil platform, for consideration by the Research Ethics Committee and approved under opinion number 3,629,429, on October 8, 2019, in compliance with the Guidelines and Regulations for Research Involving Human Beings (Resolution 466/2012 by the National Health Council).

RESULTS

In total, 60 patients were paired according to use of IIIDs and diagnosis of SSI. Table 1 shows the study participants

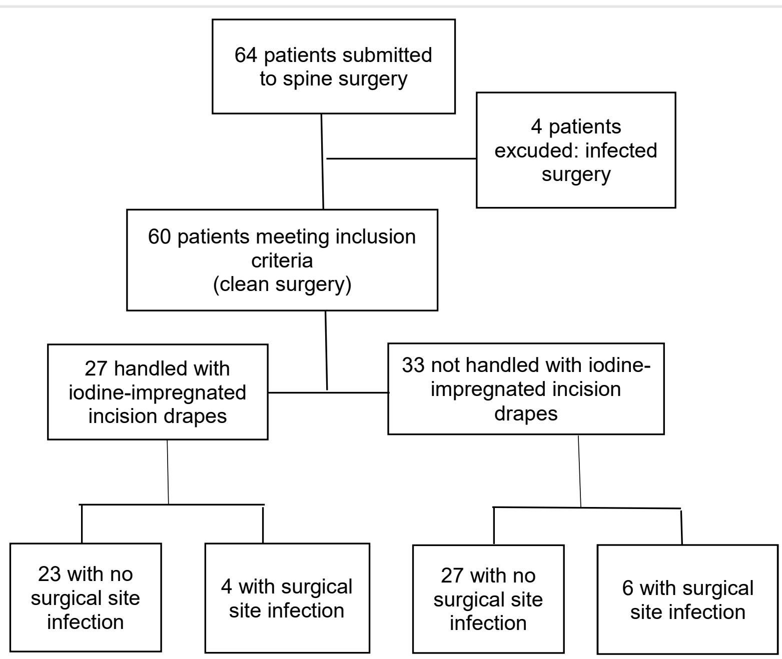

Figure 1. Flowchart of patients undergoing spine surgery in a teaching hospital in the countryside of Rio Grande do Sul (2015 to 2019).

and baseline variables. When comparing patients who had IIIDs applied to those who did not, a statistically significant difference was found with regard to ASA III score, length of stay with a drain > 24 hours, upper and lower surgery, surgical time (hours), surgical trauma and post-surgical ICU stay (days) in the immediate postoperative period, all with $p \leq 0.05$. The use of antimicrobial prophylaxis showed no difference between the group that used IIDs, and patients

Table 1. Characterization of patients undergoing spine surgery in relation to the use of iodine-impregnated incision drapes.

	IIIDs (n = 27)	No IIIDs (n = 33)	p
Mean age (years/SD)	59 (± 17.67)	55 (± 17.96)	0.346*
Age ≤ 60 years	14 (51.9)	18 (54.5)	0.835**
Male	14 (51.9)	23 (69.7)	0.157**
Surgical urgency	12 (44.4)	12 (36.4)	0.971**
Private care	22 (81.5)	14 (42.4)	0.002**
Non-private care	05 (20.8)	19 (79.2)	0.002**
Pre-surgical hospitalization ≥ 24 hours	14 (36.8)	24 (63.2)	0.216**
Pre-surgical hospitalization in ICU	08 (29.6)	09 (27.3)	0.840**
ASA I	05 (18.5)	01 (3.0)	0.257**
ASA II	16 (59.3)	26 (78.8)	0.212**
ASA III	06 (22.2)	06 (18.2)	0.050**
BMI < 25 kg/m^2	07 (25.9)	12 (36.4)	0.387**
BMI 25 – 29,9 kg/m^2	10 (37.0)	15 (45.5)	0.511**
BMI > 30 kg/m^2	10 (37.0)	06 (18.2)	0.100**
Duration of surgery (hours/SD)	4.8 (± 1.35)	4.0 (± 1.38)	0.000*
Duration of surgery > 4 hours	19 (54.3)	16 (45.7)	0.087**
Skin degermination	27 (100.0)	33 (100.0)	0.529**
Skin antisepsis	27 (100.0)	33 (100.0)	0.051**
Use of extended prophylaxis	27 (100.0)	29 (87.9)	0.061**
1st generation antimicrobial prophylaxis	24 (88.9)	24 (72.7)	0.119**
Extended antimicrobial prophylaxis — glycopeptides	03 (11.1)	05 (15.2)	0.647**
Normothermia (T > 35.5 ºC)	13 (48.1)	16 (48.5)	0.979**
Use of drain	27 (100)	30 (90.9)	0.108**
Drain > 24 hours	06 (22.2)	17 (51.5)	0.008**
Upper surgery	05 (18.5)	14 (42.4)	0.048**
Lower surgery	22 (81.5)	19 (57.6)	0.048**
Surgical trauma	03 (11.1)	00 (0.0)	0.049**
Incidence of SSI	04 (14.8)	06 (18.2)	0.728**
Superficial SSI	00 (0.0)	02 (6.06)	0.163**
Deep SSI	02 (7.40)	04 (12.12)	0.545**
Organ-space SSI	02 (7.40)	00 (0.0)	0.112**
Postoperative ICU admission (days/SD)	3.3 (± 1.90)	2.7 (± 1.90)	0.001*
Postoperative ICU admission	10 (37)	11(33.3)	0.765**
Obit	01 (3.7)	00 (0.0)	0.529**

*Student's t-test; **χ^2 test; IIIDs: iodine-impregnated incision drapes; SD: standard deviation; ICU: intensive care unit; ASA: American Society of Anesthesiologists; BMI: body mass index (kg/m^2); T: temperature (°C); SSI: surgical site infection.

who had it applied did not present any associated adverse skin reactions.

In Table 2, the predictive variables for SSI were: normothermia (relative risk — RR = 0.37; 95%CI 0.10–1.31; p = 0.050), duration of surgery (hours) (RR = 0.22; 95%CI % 0.09–6.11; p = 0.000), mean length of stay (days) after surgery in the ICU (RR = 0.32; 95%CI 0.12–5.85; p = 0.003). There were no differences between the incidence of infection in the groups that used or did not use IIIDs. The overall frequency of SSI was 16.7% (10/60), with rate 40% and 60% for patients who had IIIDs applied, respectively (p = 0.728; 95%CI 0.19–3.11).

Infections occurred in nine (90%) lower surgeries. Six (60%) patients required ICU admission after surgery, with an average of four (± 2) days. The mean hospital stay was 31 (± 2) days.

Tabela 2. Caracterização dos pacientes submetidos à cirurgia de coluna em relação à presença de infecção.

	no SSI (n = 50)	SSI (n = 10)	p
Mean age (years/SD)	54.94 (± 17.49)	56.80 (± 20.28)	0.766*
Age ≤ 60 years	27 (54.0)	05 (50.0)	0.817**
Male	32 (64.0)	05 (50.0)	0.406**
Surgical urgency	07 (14.0)	02 (20.0)	0.628**
Private care	28 (56.0)	08 (80.0)	0.157**
Non-private care	22 (44.0)	02 (20.0)	0.157**
Pre-surgical hospitalization ≥ 24 hours	33 (66.0)	05 (50.0)	0.338**
Pre-surgical hospitalization in ICU	15 (30.0)	02 (20.0)	0.522**
ASA I	06 (12.0)	00 (0.0)	0.248**
ASA II	35 (70.0)	07 (70.0)	1.000**
ASA III	09 (18.0)	03 (30.0)	0.386**
BMI < 25 kg/m^2	16 (32.0)	03 (30.0)	0.901**
BMI 25 – 29,9 kg/m^2	21 (42.0)	04 (40.0)	0.907**
BMI > 30 kg/m^2	13 (26.0)	03 (30.0)	0.794**
Duration of surgery (hours/SD)	4.2 (± 1.36)	5.0 (± 1.48)	0.000*
Duration of surgery > 4 hours	29 (58.0)	6 (60.0)	0.907**
Skin degermination	50 (100.0)	10 (100.0)	0.019**
Skin antisepsis	50 (100.0)	10 (100.0)	0.047**
Use of extended prophylaxis	50 (100.0)	10 (100.0)	0.355**
1st generation antimicrobial prophylaxis	42 (84.0)	6 (60.0)	0.083**
Extended antimicrobial prophylaxis — glycopeptides	05 (10.0)	03 (30.0)	0.089**
Use of IIIDs	23 (46.0)	04 (40.0)	0.728**
Normothermia (T > 35.5 ºC)	27 (54.0)	02 (20.0)	0.050**
Use of drain	47 (94.0)	10 (100.0)	0.427**
Drain > 24 hours	26 (52.0)	08 (80.0)	0.149**
Upper surgery	18 (36.0)	01 (10.0)	0.107**
Lower surgery	32 (64.0)	09 (90.0)	0.107**
Postoperative ICU admission (days/SD)	2.6 (± 2.03)	04 (± 1.79)	0.003*
Postoperative ICU admission	15 (30.0)	06 (60.0)	0.069**
Obit	00 (0.0)	01 (10.0)	0.066**

*Student's t-test; **χ^2 test; IIIDs: iodine-impregnated incision drapes; SD: standard deviation; ICU: intensive care unit; ASA: American Society of Anesthesiologists; BMI: body mass index (kg/m^2); T: temperature (°C); SSI: surgical site infection.

Two (6.1%) cases of superficial SSI were found, with incidence in patients who did not have IIIDs applied ($p = 0.193$; 95%CI 0.09–0.28) — one case of *Serratia* spp. confirmed and another case with negative culture. These infections happened in patients undergoing lower surgery. Infections occurred on average five (± 2) days after surgery, with mean of 15 (± 9) days of hospital stay.

Deep SSI occurred in two (7.4%) patients who had IIIDs applied during surgery and in four (12.2) who did not have it ($p = 0.545$; 95%CI 0.00–0.29). Of these, two had *Enterobacter* spp. and one had *Klebsiella* spp.; no microorganisms were found in the cultures of the other patients. Infections occurred on average within 33 (± 44) days, with five cases (83.3%) up to the sixteenth day. Of the six patients who had deep SSI, four (66.7%) were admitted to the ICU after surgery, with a mean stay of three (± 2) days and mean hospital stay of 36 (± 18) days. These infections (5/6) occurred in patients undergoing lower surgery.

In two (7.4%) patients in whom IIIDs were used, organ-space SSI was identified, although the difference was not significant ($p = 0.112$; 95%CI 0.13–0.34). In both surgeries, there was a rupture of the dura mater and no growth of microorganisms in the culture. Infections occurred within nine (± 1) days in postoperative patients admitted to the ICU, with a mean stay of five (± 1) days and a mean hospital stay of 28 (± 14) days.

Regarding the IRIC of the analyzed procedures, 47 (78.3%) surgeries had an IRIC equal to 1, including in this category seven (70.0%) cases of infection ($p = 0.483$; 95%CI 0.00–0.28). In the general analysis, pre- and postoperative glycemic control was achieved in 50% of these patients, and a later surgical approach occurred in 33 (55.0%) of them, with nine (27.3%) cases of SSI.

There was one (1.7) case of death on the 25th postoperative day after a deep SSI in a female patient, older than 60 years, with IRIC = 2, ASA III, obese and with comorbidities (diabetes and heart disease).

Variables with $p < 0.20$ were associated with variables with $p < 0.05$ for the multivariate analysis of risk factors for SSI: inpatient healthcare system ($p = 0.157$), extended antimicrobial prophylaxis with cephalosporin ($p = 0.083$), extended antimicrobial prophylaxis with glycopeptides ($p = 0.089$), surgical drain time > 24 hours ($p = 0.149$), upper and lower surgery ($p = 0.107$), postoperative stay in ICU ($p = 0.069$) and death ($p = 0.069$).

Table 3 shows the logistic regression, where normothermia had a $p < 0.05$ (RR = 0.27; 95%CI, 0.01–0.40) and maintained an association with SSI. Other tested variables maintained a $p > 0.05$, with no level of significance.

The cost of the procedures was R$ 3,031,388.7 (US$ 571,960.13), with R$ 1,135,125.7 (US$ 214,174.66) related to the ten patients who had SSI. The cost of the 50 patients who did not develop infection was R$ 1,896,263.0 (US$ 357,785.47).

On average, the costs were R$ 1,936.99/day (US$ 365.47/day) in patients who did not present infection and R$ 3,615.05/day (US$ 682.08/day) in patients who developed infection. The main difference was related to the costs of treatment for infectious complications, with an increase of 83.63%/day in hospitalization, as patients who had infections had a higher mean hospital stay, of 31.4 (± 17.4) days, compared to those who did not have it (19.6, ± 14.2 days), that is, 11.8 (± 3.2) days more.

The cost for healing of patients who were not handled with IIIDs was higher than those who were, although the difference was not significant ($p = 0.728$; 95%CI 0.00–0.33). Regardless of the outcome infection or absence of infection, this study shows that the mean hospital stay of patients not handled with IIIDs was 26 (± 17) days, and that of those who were handled with IIIDs was 16 (± 10) days.

DISCUSSION

The use of IIIDs to prevent infection in spine surgeries was not statistically significant in this study. When analyzing

Table 3. Multiple linear regression model with variables predicting surgical site infection in patients undergoing spine surgery.

	no SSI (n = 50)	SSI (n = 10)	p	RR 95%CI
Normothermia (T > 35.5 ºC)	27 (54.0)	02 (20.0)	0.043	0.269 (0.006–0.402)
Lower surgery	32 (64.0)	09 (90.0)	0.277	0.153 (0.104–0.353)
Postoperative ICU admission	15 (30.0)	06 (60.0)	0.242	0.166 (0.092–0.356)
Antimicrobial prophylaxis, 1st generation cephalosporin	42 (84.0)	06 (60.0)	0.229	0.196 (0.501–0.123)

SSI: surgical site infection; RR: relative risk; 95%CI: 95% confidence interval.

the clinical variables comparing patients who were handled with IIIDS with those who were not, this may have occurred due to the non-uniformity of groups and the fact that it was not controlled. Patients treated with IIIDs were considered more severe, that is, they had a higher ASA III score, longer surgical time, dura mater trauma (pre- and intraoperative) and were admitted to the ICU after surgery.

The protective factors against SSI were: normothermia, shorter surgical time and shorter postoperative stay in ICU. However, in the linear regression model, only normothermia remained as an independent variable, being even recommended by several national and international guidelines[11-14]. A meta-analysis suggests no association with SSI, but the authors propose further research[15]. A study showed that the incidence of hypothermia in surgical patients is high, increases during the procedure and is present in the post-anesthetic recovery room. The authors highlight the need for continuing education of the team regarding the application of preventive measures to avoid this problem[16].

In the analysis of the other variables, although not statistically significant, superficial SSI was not identified in patients who were handled with IIID. This probably stems from its property of reducing the transient microbiota, even in the deepest layers of the skin (1,000 micrometers), due to a technology of greater concentration and permanence of the antiseptic agent[5]. A study concluded that the use of IIIDs in orthopedic surgery significantly reduces the bacteria that colonize the skin where the incision is made, decreasing the theoretical probability of SSI[17]. Another research reported a decrease in superficial SSI in cardiac surgeries[4].

Deep SSI did not differ when using or not IIIDs. The cases of meningitis had trauma to the dura mater as a risk factor. As expected, IIIDs have no action in the face of deep traumatic complications[4], as its antiseptic technology does not encompass that. The frequencies of SSI categorized by IRIC in our study were higher than in other research[18].

Surgical procedures closer to the lumbosacral spine are known to encompass a larger tissue microbiome, especially with greater tissue recolonization in the peri- and postoperative periods. One of the goals of skin antisepsis is to mainly reduce bacteria of the *Staphylococcus* spp. Genus group, the main agent of spinal SSI[19].

Spinal SSI varies between 1 and 13%, and the posterior approach surgery has a higher incidence of infection than the anterior approach[19,20]. The surgical schedule is another related factor, with intervention at various intervertebral levels[2]. These findings raise questions about the confounding variables between superficial and deep SSI, which can generate conflicting results about the direct and indirect benefits of the IIIDs[6].

This analysis did not suggest that overweight added any level of risk of SSI, although it was present in 70% of the cases (superficial and deep SSI). On the other hand, this relation was also reported by another study[2]. There is evidence that for every 1 mm of subcutaneous fat thickness adds 6% to the risk of SSI, with an increase of up to four times in patients with fat thickness above 50 mm in the lumbar region[21].

Postoperative glycemic control was adequate in half of the patients and, as it is an easy-to-measure and low-cost variable, it should be a priority and encouraged by the surgical team.

Overall mortality was low, being comparable to that of another study. Age, female gender and comorbidities influence both the risk of postoperative complications and the mortality rate[22].

Patients who did not have SSI had a shorter hospital stay and, consequently, were associated with lower care costs. Determining the cost-effectiveness of IIIDs, although it is not significant in reducing SSI, brought up another great advantage, which was the reduction in the total costs of hospital care[4]. We emphasize that patients who were handled with IIIDs stayed in hospital ten (± 4.9) days less. Prescription of antimicrobials, surgical reinterventions, need for anesthesia and additional tests were very common. Reducing hospitalization costs is an important parameter to assess the effectiveness of a surgical procedure and adjuvant treatments.

STUDY LIMITATIONS

The fact that this was a retrospective investigation, with few subjects, without control of those who used or not IIIDs or its application to patients at higher risk, is a limitation. This may have resulted in no differences in SSI rates. The rate of positive microorganism cultures was low, which also makes it difficult to analyze the most common infectious agents. Variables that are known risk factors were not collected because they were not registered in the physical and computerized medical records.

CONCLUSIONS

Our results suggest that the use of IIIDs was not associated with a statistically significant reduction in SSI. Only normothermia was a protective factor for SSI in linear regression. The costs of complications related to the surgical site or other areas increased the cost of hospitalization, while in the group of patients using IIIDs we saw a reduction in the total cost of care. These data can be useful for surgical planning, patient counseling, and for tracing efforts to improve the safety and cost-effectiveness of spine surgeries. Further prospective, controlled and multicenter studies should be carried out to check for positive results.

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