

Original Article

Risk factors of surgical site infections in instrumented spine surgery

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Abstract

Background: The incidence of wound infections associated with instrumented spine surgery ranges from 2 to 20%. These complications may lead to poor outcomes. Knowing the risk factors associated with surgical site infections (SSI) after utilizing spinal implants is essential to avoid these complications, including hardware removal.

Methods: We reviewed retrospectively 550 patients who underwent spinal fusion surgery from 2011 to 2015; 16 developed SSI after spinal instrumentation. The diagnosis of SSI was established based on positive wound swab or blood cultures, and various clinical, laboratory, and radiological findings. Additional preoperative and intraoperative risk factors were analyzed.

Results: The incidence of SSI after spinal instrumentation surgery was 2.9%. Obesity was a statistically significant parameter ($P = 0.013$) that contributed to SSI along with the alcoholism and/or drug abuse ($P = 0.034$); use of a Foley catheter nearly reached significance levels.

Conclusions: There is an increased risk of SSI in patients who are obese or use drugs and/or alcohol. Clear preoperative identification of these risk factors prior to implanting spinal instrumentation should help prevent SSI in the future.

Key Words: Spinal hardware, spinal implants, spinal infections, spine surgery, surgical site infections, risk factors

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INTRODUCTION

The incidence of wound infections associated with instrumented spine surgery ranges from 2 to 20%, and typically leads to poor outcomes.^[5] Knowing the risk factors contributing to surgical site infections (SSI) after spinal instrumentation^[3,4] is essential to avoid such complications in the future. The literature cites several risks factors that contribute to SSI including obesity, longer operation time, diabetes mellitus, a smoking habit, renal failure, osteoporosis, etc.^[2,7,9] The aim of this study was to identify unique SSI risk factors seen in our series of 550 patients (2011–2015).

MATERIALS AND METHODS

We reviewed retrospectively 550 patients who underwent spinal fusion from 2011 to 2015; there were

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16 patients (9 males and 7 females) who developed SSI. They averaged 60.2 years (range 37–82 years) of age.

Wound prophylaxis

All procedures were performed using a standard surgical scrub and 2 g cefazolin sodium was administered 30 minutes before skin incision and then once a day for 48 hours after surgery. Surgical drains are placed and then removed 48 hours postoperatively. The choice of hardware for instrumented fusion was based on spinal pathology and typically included titanium screws/rods or cervical plates.

Assessment/diagnosis of SSI

All patients had postoperative laboratory tests and a computed tomography (CT) scan 48–72 hours after surgery. Magnetic resonance imaging (MRI) and inflammatory laboratory tests were made only in patients with suspicion of infection. Diagnostic criteria of SSI included local wound redness, dehiscence, secretions, tenderness to palpation [Figure 1], increasing back pain, a positive culture on surgical wound swab or blood culture, fever, positive laboratory tests [increase of C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR), count of white blood cell, neutrophils and lymphocytes] and abnormal radiological findings (MR/CT documented an abscess, abnormal uptake of contrast medium) [Figure 2].

Analysis of risk factors for SSI

Multiple risk factors for SSI were analyzed in this study including sex, age, smoking status, diabetes mellitus, obesity (BMI >30), chronic renal failure, chronic obstructive pulmonary disease (COPD), rheumatoid arthritis, chronic heart disease, osteoporosis, polytrauma, presence of co-infections at the time of surgery, preoperative corticosteroids intake. Intraoperative factors included type of disease (degenerative spine disease, tumors, pathologic fracture for concomitant osteoporosis, and traumatic fracture), surgical vertebral level (cervical, thoracolumbar, and lumbar or lumbosacral), surgical



Figure 1: Example of wound dehiscence in patient who underwent instrumented spinal surgery, with redness, secretions and tenderness to palpation

approach (anterior or posterior), number of fused levels (≤ 3 or > 4), type of implanted prosthesis, perioperative antibiotic prophylaxis, operation time, number of operators present in the operating room, blood loss, need for transfusion, Foley catheter, and length of stay in the postoperative period.

Statistical evaluation

Data were compared with a control group of 16 patients and analyzed by univariate statistical analysis with Chi-square test for the discrete variables. $P < 0.05$ was considered statistically significant. The software used for data analyses was SPSS (IBM, SPSS Statistics 24, Armonk, NY, Version 20).

RESULTS

The risk factors found to contribute to SSI in our series included obesity (statistically significant parameter with a P value of 0.013), as well as history of alcohol or drug abuse with a P value of 0.034 [Tables 1-3]. None of the others reached clinical significance [Table 4].

DISCUSSION

SSI after instrumented spinal surgery have an incidence between 0.7% and 12%.^[8] Knowledge of risk factors may help prevent onset of major complications and poor outcomes. In this series, only a few risk factors reached statistical significance. The association between obesity (BMI >30) and infections is well documented in literature; it seems that the existence of excessive adipose tissue invalidates blood supply resulting in hypoxia and reduction of chemotactic activity of the immune system cells.^[2] This relationship has also been documented in this study with statistical significance ($P = 0.013$).

The abuse of alcohol and drugs causes reduction of liver response to infection diseases, nutritional depletion and increased vulnerability of the immune system to infections.^[1,7] This study showed statistical significance between the consumption of alcohol and drugs and the occurrence of wound infections after spinal implants with a P value of 0.034.

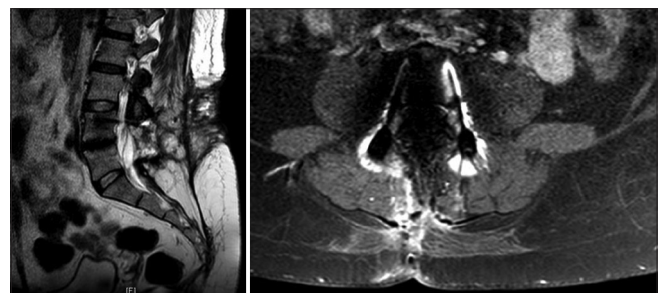


Figure 2: Example of MRI in patient with SSI after spinal implantation, with collected abscess and post-contrast enhancement

Table 1: Pre-operative risk factors

Pts	Sex	Age	Diabetes	Alcohol and drugs abuse	Smoke	Renal failure	RA	COPD	Cardiac disorders	Obesity	Polytrauma	Osteoporosis	Peri-operative corticosteroid therapy
1	M	79	-	-	-	+	-	-	+	-	-	-	+
2	F	73	-	-	-	-	+	-	+	-	-	+	+
3	F	77	-	-	-	-	-	-	+	-	-	-	+
4	F	54	-	-	+	-	-	-	-	-	-	-	-
5	M	66	-	-	+	-	-	-	+	-	-	-	+
6	M	68	-	-	-	-	-	-	-	-	-	-	-
7	M	37	-	+	-	-	-	-	-	-	-	-	+
8	M	37	-	+	+	-	-	-	-	-	-	-	+
9	F	63	-	-	-	-	-	-	+	-	-	-	-
10	M	52	-	-	-	-	-	-	+	+	+	-	+
11	M	66	-	-	+	-	-	-	+	+	-	-	-
12	F	72	-	-	-	-	-	-	+	+	-	-	+
13	M	82	+	-	-	-	-	-	-	-	+	-	-
14	F	44	-	-	-	-	-	-	-	+	-	-	-
15	F	45	-	-	-	+	-	-	+	-	-	-	+
16	M	50	-	+	+	-	-	-	-	-	+	-	+

Table 2: Intraoperative and post-operative risk factors

Pts	Pathology	Site	Number of level fused	Approach	Type of device (rods and screw=1; mesh=2; cage=3; bone=4)	Allergies	Trasfusion	Bladder catheter	Coexisting infection	N° of person in operating room	Duration (hour)	Blood loss (ml)	Time of stay (days)
1	fracture	cervical	≤3	posterior	1	-	-	+	-	>12	≥3	<500	20-40
2	fracture	thoracolumbar	>4	posterior	1	-	+	-	-	>12	≥3	<500	>40
3	degenerative	lumbosacral	≤3	posterior	1	-	-	-	+	7-12	≥3	<500	20-40
4	degenerative	lumbosacral	≤3	posterior	1	-	-	-	-	7-12	≥3	<500	<20
5	tumor	lumbosacral	≤3	posterior	4	-	-	-	+	<7	<3	<500	>40
6	degenerative	cervical	≤3	anterior	2	-	-	-	-	7-12	<3	<500	20-40
7	fracture	lumbosacral	≤3	posterior	1	-	-	+	-	7-12	<3	<500	20-40
8	fracture	cervical	≤3	anterior	3	-	-	-	-	<7	≥3	<500	<20
9	degenerative	lumbosacral	≤3	posterior	1	-	-	+	+	<7	<3	<500	>40
10	fracture	thoracolumbar	>4	posterior	1	-	-	-	-	7-12	<3	<500	20-40
11	fracture	thoracolumbar	>4	posterior	1	-	+	+	-	7-12	<3	>1000	>40
12	degenerative	lumbosacral	≤3	posterior	1	-	-	-	-	<7	≥3	<500	<20
13	fracture	thoracolumbar	>4	posterior	1	-	-	+	-	7-12	≥3	<500	20-40
14	tumor	thoracolumbar	≤3	posterior	1	-	-	+	-	<7	≥3	<500	<20
15	tumor	thoracolumbar	>4	posterior	1	-	+	+	-	7-12	≥3	<500	<20
16	fracture	cervical	≤3	posterior	1	-	+	+	-	7-12	≥3	500-1000	<20

We found no statistical correlation of SSI with associated diseases (e.g., chronic renal failure, rheumatoid arthritis, COPD, cardiovascular disease, osteoporosis, and polytrauma). The use of short-term corticosteroid therapy did not significantly increase the risk of SSI, but studies show long treatments, in the course of chronic diseases, as metastases or rheumatoid arthritis, are potential risk factors.^[6] The type of vertebral disease, which needs a

stabilization surgery, is not statistically significant for SSI, nor was the type of vertebral pathology or the type of instrumentation used.^[10]

Finally, we showed that intraoperative risk factors do not contribute to SSI. This included no correlation with the estimated blood loss, transfusion requirements, operative time, or even the use of an intraoperative Foley.

Table 3: Results of the statistical analysis

	Value	dF	Asymp. Sig. (2 sided)
Significance value: Alcohol and drug's abuse			
Pearson's Chi-square	4,479	1	,034
Likelihood Ratio	2,271	1	,019
Linear-by-Linear Association	4,361	1	,037
N° of Valid Cases	38		
Significance value: Obesity			
Pearson's Chi-square	6,147	1	,013
Likelihood Ratio	7,579	1	,052
Linear-by-Linear Association	5,985	1	,014
N° of Valid Cases	38		

Table 4: P value (statistical significance, P value < 0.05)

Risk factors	P value
Sex	0,350
Age	0,782
Chronic renal failure	0,114
Rheumatoid arthritis	1,412
COPD	0,747
Multiple trauma	1,397
Heart disease	0,432
Osteoporosis	0,537
Obesity	0,013
Alcohol or drug abuse	0,034
Type of disease	2,506
Site of disease	0,347
Number of fused levels	0,983
Type of approach	0,114
Type of prosthesis	1,565
Prophylaxis	9,812
Allergies	1,154
Duration of surgery	0,240
Blood loss	1,172
Need of transfusions	0,126
Intraoperative bladder catheter	0,080
The number of operators in the operating room	0,135

CONCLUSIONS

In this study, significant risk factors contributing to SSI (16/550) included obesity and drug and alcohol abuse. Other risk factors such as the use of Foley catheter and number of people in operating room are less important with *P* values near statistical significance.

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Conflicts of interest

There are no conflicts of interest.

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