MANAGEMENT OF WOUND INFECTION AFTER LUMBAR ARTHRODESIS MAINTAINING THE INSTRUMENTATION

MANEJO DA INFECÇÃO DE FERIDA OPERATÓRIA APÓS ARTRODESE LOMBAR MANTENDO A INSTRUMENTAÇÃO

MANEJO DE LA INFECCIÓN OPERATORIA DESPUÉS DE ARTRODESIS LUMBAR SIN REMOVER LA INSTRUMENTACIÓN

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ABSTRACT

Objective: To determinate whether a surgical protocol with immediate extensive debridement, closed irrigation system and antibiotic therapy would be effective to achieve healing of deep wound infection without removing the instrumentation. Methods: Prospective cohort study with 19 patients presenting degenerative spinal stenosis or degenerative spondylolisthesis, who developed infection after posterior lumbar arthrodesis. The diagnosis was confirmed by a microbial culture from subfascial lumbar fluid and/or blood. Patients were treated with a protocol of wound exploration, extensive flushing and debridement, placement of a closed irrigation system that was maintained for five days and intravenous antibiotics. The instrumentation system was not removed. Results: Mean age was 59.31 (±13.17) years old and most patients were female (94.7%; 18/19). The mean period for the identification of the infection was 2 weeks and 57.9% underwent a single wound exploration. White blood count, erythrocyte sedimentation rate and C-reactive protein showed a significant decrease post-treatment when compared to pre-treatment values. A significant reduction of erythrocyte sedimentation rate and C-reactive protein was also observed at the final evaluation. No laboratory test was useful to predict the need for more than one debridement. Conclusion: Patients with wound infection after instrumentation can be treated without removal of the instrumentation through wound exploration, extensive flushing, debridement of necrotic tissue, closed irrigation system during 5 days and proper antibiotic therapy. The blood tests were not useful to predict surgical re-interventions.

Keywords: Surgical wound infection; Chronic disease; C-Reactive protein; Leukocyte count; Erythrocyte count.

RESUMO

Objetivo: Determinar se um protocolo cirúrgico de desbridamento extenso imediato, sistema de irrigação fechado e antibioticoterapia seria eficaz para alcançar a resolução da infecção profunda da ferida sem remover a instrumentação. Métodos: Estudo prospectivo de coorte com 19 pacientes com estenose espinhal degenerativa ou espondilolistese degenerativa, que desenvolveram infecção após artrodese lombar posterior. O diagnóstico foi confirmado por uma cultura microbiana de fluido subfascial lombar e/ou sangue. Os pacientes foram tratados com um protocolo de exploração de ferida, irrigação extensa e desbridamento, colocação de um sistema de irrigação fechado que foi mantido durante cinco dias e antibióticos por via intravenosa. O sistema de instrumentação não foi removido. Resultados: A média de idade foi de 59,31 anos (± 13,17) e a maioria dos pacientes era do sexo feminino (94,7%; 18/19). O tempo médio para a identificação da infecção foi de duas semanas e 57,9% foram submetidos a apenas uma exploração da ferida. A contagem de eritrócitos, a sedimentação de eritrócitos e a proteína C-reativa mostraram diminuição significativa após o tratamento. Na avaliação final, também foi observada redução significativa da sedimentação de eritrócitos e de proteína C-reativa. Nenhum exame laboratorial foi útil para prever a necessidade de mais do que um desbridamento. Conclusão: Os pacientes com infecção da ferida após a instrumentação podem ser tratados sem a remoção da instrumentação por meio da exploração da ferida, irrigação intensa, desbridamento de tecidos necróticos, sistema de irrigação fechado mantido por 5 dias e antibioticoterapia adequada. Os exames de sangue não foram úteis para prever a revisão cirúrgica.

Descritores: Infecção da ferida operatória; Doença crônica; Proteína C-reativa; Contagem de leucócitos; Contagem de eritrócitos.

RESUMEN

Objetivo: Determinar si un protocolo quirúrgico de desbridamiento extenso inmediato, sistema de irrigación cerrado y antibioticoterapia seria eficaz para alcanzar la resolución de la infección profunda de la herida sin remover la instrumentación. Métodos. Estudio prospectivo de corte con 19 pacientes con estenosis espinal degenerativa o espondilolistesis degenerativa, que desarrollaron infección después de artrodesis lumbar posterior. El diagnóstico se confirmó por un cultivo microbiano de fluido subfascial lumbar y/o sangre. Los pacientes fueron tratados con un protocolo de exploración de la herida, lavado profuso y desbridamiento, la colocación de un sistema de irrigación cerrado que se mantuvo durante cinco días y antibióticos por vía intravenosa. El sistema de instrumentación no ha sido retirado. Resultados. La media de edad promedio fue de 59,31 (± 13,17) años y la mayoría de los pacientes eran mujeres (94,7%; 18/19). El tiempo medio para la identificación de la infección fue de 2 semanas y el 57,9% se sometió a una única exploración de la herida. Recuento de glóbulos blancos, velocidad de sedimentación globular y la proteína C-reactiva mostraron una disminución significativa después del tratamiento en comparación con los valores pre-tratamiento. En la evaluación final también se observó una reducción significativa de la tasa de sedimentación de eritrocitos y de proteína C-reactiva. Ningún análisis de laboratorio fue útil para predecir la necesidad de más que un desbridamiento. Conclusión. Pacientes con infección de la herida después de la instrumentación se pueden tratar sin la remoción de la instrumentación a través de la exploración de la herida, lavado extensivo, desbridamiento de tejido necrótico, sistema de irrigación cerrado durante 5 días y antibioticoterapia adecuada. Los análisis de sangre no fueron útiles para predecir reintervenciones quirúrgicas.

Descriptores: Infección de herida operatoria; Enfermedad crónica; Proteína C-reactiva; Recuento de leucocitos; Recuento de eritrocitos.

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INTRODUCTION

Deep wound infection (DWI) occurs after instrumented posterior lumbar spinal surgery, despite antibiotic prophylaxis and aseptic techniques.[1,2] In these cases the incidence of DWI increased from 1.5%, in patients in whom instrumentation was not used, to 6% in cases in which a fixation system was used, such as pedicular screws and interbody device.[2-6] Once the patients have a lumbar DWI there is a reduction of a favorable surgical outcome[2,7,8] and treatment cost increases.[7,9-11]

The proper treatment of DWI after instrumented spinal fusion surgery is crucial to achieve spinal fusion and a successful outcome.[12] The principles of treatment are appropriate antibiotic therapy, nutritional support and aggressive debridement.[10,13] No consensus exists in the literature regarding primary or delayed wound closure, the need or not for a suction-irrigation system and the need to remove the instrumentation.[4,5,14-18]

The purpose of this surgical prospective cohort study was to investigate the efficacy in patients with DWI after instrumented posterior lumbar spinal surgery for degenerative diseases through a protocol with wound exploration, washing, extensive debridement, use of closed irrigation system for five days, appropriate antibiotic therapy and maintaining the instrumentation, as well as to what extent blood tests can predict the need for reintervention.

METHODS

Patients with a diagnosis of postoperative DWI were selected in a surgical prospective cohort study of patients with lumbar degenerative spinal stenosis and degenerative spondylolisthesis disorders who underwent lumbar spine decompression and instrumented fusion between January 2000 and December 2011. The study was approve by the Istitutional Reviw Board (protocol # 33708). The instrumentation material used was titanium for pedicle screws and titanium or polyetheretherketone for the interbody device. This surgical cohort is followed systematically as described briefly elsewhere.[19]

All patients were treated and followed by the same surgeons (AF, OR). The patients received antibiotic prophylaxis with cefazoline during the first surgical procedure and aseptic techniques were meticulously implemented during the surgical procedure.

The patients reported lumbar pain combined with fluid leakage from the skin. Usually fever, shaking and hemodynamic stability were associated. The patient was promptly submitted to clinical evaluation and blood samples were collected for analysis of white blood cells (WBC), erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), blood and urine culture. The patient was promptly submitted to surgical intervention and subfascial fluid and tissue was collected for a laboratory culture. The diagnosis of DWI was established after positive bacterial cultures from subfascial fluid and inflammatory tissue.

When there was a clinical suspicion of postoperative infection, patients were submitted to wound exploration for the purpose of extensive washing, collecting material for bacteriological examination, removal of the devitalized bone fragments and necrotic tissue, placement of a continuous irrigation system, and primary wound closure. The instrumentation system was not removed. A closed irrigation system was placed during the surgery and continuously used for 5 days. The same surgical team performed all procedures.

The inflow system catheter of the irrigation system was placed under the fascia in the cephalad portion of the wound. The inflow catheter was continuous irrigated with sterile normal saline, set at a flow of 40cc/hour. The outflow system consisted of a thoracic drain placed deep in the fascia, and connected to a negative pressure suction device.

Properly targeted intravenous antimicrobial agents were administered during 4 to 6 weeks and then followed by at least 2 weeks of oral antimicrobial therapy. In addition to monitoring the patients' clinical status and temperature, responsiveness to the treatment was regularly accessed through the blood test results of WBC, ESR and CRP, and the culture results of the fluid from the outflow irrigation system before having them removed.

The irrigation system was replaced for another 5 days if the CRP and ESR did not diminish, the clinical symptoms of infection did not improve, or when the irrigation system outflow fluid continued to present positive cultures.

The radiological evaluation of the lumbar spine was performed with plain radiography, flexion-extension radiology and computer tomography (CT)[19] where the following were analyzed: lumbar lordosis, presence of fusion, displacement of intervertebral device, instability and breakage or displacement of devices before the wound exploration, 30 days, 6 months and at the last evaluation.

The lumbar lordosis was analyzed with the patient in orthostatic position in sagittal neutral lumbar view from the superior border of the first lumbar vertebra to the superior plateau of the sacrum.

Segment instability was defined as a translational displacement of more than 3mm in flexion-extension radiology.

The presence of a bone bridge in the lumbar instrumented vertebrae was addressed using CT in coronal and sagittal views at the facet area, transverse process and the interbody space.

Statistical analyses

Statistical analyses were conducted with SPSS 20. Categorical variables were presented as number and percentage. Continuous variables were presented as mean and standard deviation or median and interquartile interval, depending on distribution. Paired analyses were performed with a paired Student t test. Bivariate comparisons were performed with an independent Student t test. Confidence intervals of 95% (CI 95%) were calculated. ROC (receiver operating characteristics) curve analyses were conducted in order to verify the discrimination capacity of laboratory elements in predicting the need for more than one debridement. The area under the ROC curve higher than 0.80 or 0.90 indicates appropriate levels of discrimination in a clinical context; the closer the area is to 0.50, the higher the probability of random results in discrimination.

RESULTS

During the last decade, among the 390 patients with lumbar spinal stenosis and degenerative spondylolisthesis who underwent decompression and instrumented fusion (4.87%), 19 patients presented postoperative DWI.

The baseline characteristics of the infected patients are shown in Table 1. The mean age of the sample was 59.31 (±13.17) years old and most of them were women (94.7%; 18/19). Degenerative spinal stenosis (57.9%, 11/19) and degenerative spondylolisthesis (42.1%, 8/19) were the primary pathology. Comorbidity for infection was observed in 68.4% (13/19) of the sample, such as obesity in 5 cases, systemic arterial hypertension in two cases, diabetes *mellitus* in nine cases, and chronic corticosteroid use in one case. The number of fused levels varied from 1 to 14 (median = 2; P25: 2 - P75: 4). The symptoms of wound infection were observed in the first 2 weeks after the primary surgery in 8 (57.1%) patients (median 2; P25: 1 - P75:3). The number of interventions was one debridement in 11 patients (57.8%), two in three patients (15.7%) and more than two in 5 patients (26.3%). The follow-up varied from 6 to 72 months (mean 45.63 ± 20.27).

The most common bacteria identified in cultures was *Staphilococcus aureus* (68.4%, 13/19) and polymicrobial infection was identified in 15.8% (3/19) patients. (Table 2)

Paired analyses demonstrated a trend to normality of the laboratory exams after 6 weeks and the final evaluation of DWI treatment. (Table 3) During the first 6 weeks, a mean value reduction was observed of 2828.94 in WBC (sd: 4128.19; CI95%: 839.21 - 4818.67; $P = 0.008$), 38.05 in ESR (sd: 21.11; CI95%: 27.87 - 48.23; $P < 0.0001$) and 66.66 in CRP (sd: 41.21; CI95%: 46.80 - 86.53; $P < 0.0001$). In the time elapsed between 6 weeks post-treatment and the final evaluation, a mean difference reduction was observed of 2230.0 in WBC (sd: 49.27.55; CI95%: -145.00 - 46.05; $P = 0.064$), 36.73 in ESR (sd: 26.70; CI95%: 23.86 - 49.60; $P < 0.0001$) and 25.50 in CRP (sd: 23.28; CI95%: 14.28 - 36.72; $P < 0.0001$). (Figures 1 to 3)

There were no laboratory tests for WBC, ESR or CRP that could

Table 1. Baseline characteristics of the patients with DWI.

Case	Gender	Age	Pathology	Associated factors	Fusion levels	Time for onset (weeks)	Number of debridements	Organism	Antibiotics (weeks)	Follow-up period (months)
1	F	55	DS + DH	Obesity, SAH, DM	L2-S1	2	2	*Staphylococus Aureus*	3 IV	59
2	F	28	SS	DM	L4-S1	5	1	*Staphylococus Aureus*	3IV	64
3	F	77	SS	DM	T11-S1	2	3	*Escherichia Coli*	6 IV	32
4	F	39	DS + DH	Obesity	L4-S1	2	1	*Staphylococus Aureus + Escherichia Coli + Corynebacterium*	2 IV	24
5	F	70	S	SAH, Depression	L1-S1	3	3	*Staphylococus Aureus + Klebsiella Pneumoniae*	3 IV	6
6	F	68	DS + DH	DM	L3-L5	3	5	*Enterobacter*	3 IV	72
7	F	63	S	-	T3-L5	3	3	*Escherichia Coli*	3 IV	45
8	F	41	DS + DH	-	L3-L5	3	1	*Staphylococus Aureus*	2 IV	41
9	F	60	SS	-	L4-S1	2	1	*Staphylococus Aureus*	3 IV	70
10	F	66	SS	DM	L2-L5	1	1	*Staphylococus Aureus*	3 IV/6 PO	64
11	F	54	DS + DH	-	L3-S1	2	1	*Escherichia Coli + Enterococcus Faecalis*	3 IV/4 PO	63
12	F	67	DS + DH	Obesity	L3-L5	1	4	*Enterobacter*	5 IV/2 PO	67
13	M	70	SS	DM	L3-L5	1	1	*Staphylococus Aureus*	3 IV/4 PO	60
14	F	58	SS	Obesity, DM	L4-S1	5	2	*Staphylococus Aureus*	4 IV/ 8 PO	49
15	F	51	DS + DH	-	L4-S1	1	2	*Escherichia Coli*	4 IV/2 PO	55
16	F	60	DS	Obesity, DM	L3-L5	1	1	*Staphylococus Aureus*	3 IV/4PO	30
17	F	77	S	-	L2-S1	8	1	*Staphylococus Aureus*	4 IV/ 8 PO	24
18	F	72	SS	Corticoid	L2-L5	3	1	*Staphylococus Aureus*	4 IV/ 8 PO	24
19	F	51	SS	DM	L4-L5	1	1	*Staphylococus Aureus*	3 IV/4 PO	18

SS= Spinal Stenosis; S= Scoliosis; DS= Degenerative Spondylolisthesis; DH= Discal Herniation; DM = Diabetes *mellitus*; SAH = Systemic Arterial Hypertension; IV= Intravenously; PO= Orally.

Table 2. Frequency of identified germs in subfascial fluid of patients with DWI.

	Number of cases	C
Staphylococus Aureus	13/19	68.4%
Escherichia Coli	5/19	26.3%
Corynebacterium	1/19	5.3%
Klebsiella Pneumoniae	1/19	5.3%
Enterobacter	2/19	10.5%
Enterococcus Faecalis	1/19	5.3%

Table 3. Laboratorial parameters of patients treated for DWI at preoperative, 6 weeks postoperative and at the final evaluation.

Case	WBC	WBC	WBC	ESR	ESR	ESR	CRP	CRP	CRP
	Debridement surgery preoperative	Postoperative 6 weeks	Final follow-up	Debridement surgery preoperative	Postoperative 6 weeks	Final follow-up	Debridement surgery preoperative	Postoperative 6 weeks	Final follow-up
1	6600	5400	6000	97	91	38	25	18.8	8.3
2	10000	9400	9400	115	100	18	6.8	6.5	3.7
3	36500	24900	5900	91	79	8	172	146	50
4	11900	12100	7200	135	75	10	91.3	11.5	10.6
5	9120	6070	6400	133	82	23	207	33.4	9
6	10700	8500	5800	98	40	16	108	32	4
7	8700	7800	6200	90	34	18	43.8	9	4
8	9800	9000	4900	111	48	10	78	18	4
9	10600	12100	10400	113	100	11	119	13	9
10	14600	8000	7600	68	30	7	69	40	10
11	10500	7400	6300	108	50	23	120	23	3
12	11200	15000	9800	72	42	22	130	43	7
13	10700	7700	5200	38	14	7	72	15	5
14	8700	8200	7400	98	53	12	120	24	8
15	14400	1100	9000	66	50	9	68	17	3
16	11900	8000	4800	82	30	4	78	46	12
17	13200	8000	5200	45	20	20	142	70	7
18	13000	10100	9500	45	20	4	142	42	6
19	10000	9600	9000	86	10	10	138	55	15

WBC = White Blood Count; ESR = Erythrocyte Sedimentation Rate; CRP = C - Reactive Protein.

predict the need for more than one debridement. (Table 4) According to these analyses the laboratory tests did not have the discrimination capacity to predict the need for more than one debridement. Also, there was no statistically significant difference in the mean of blood exams from pre-treatment and 6 weeks post-treatment between patients who underwent one debridement versus patients who underwent two or more reinterventions. (Table 5)

There was no displacement of the intervertebral device or breakage of the screw or rod at the final radiological examination. All patients have their spinal instrumented segments fused and without instability. The lumbar lordosis was higher during the short postoperative period, compared with the preoperative level. At the last evaluation there is a loss of 5 ± 2.6 grades of lumbar lordosis when compared with the early postoperative period.

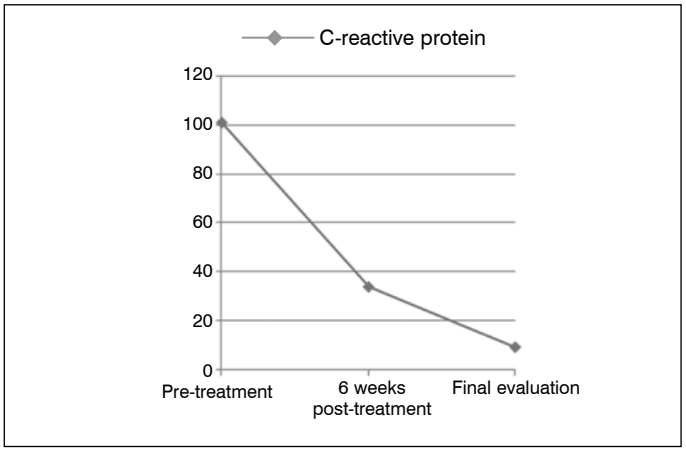

Figure 1. Evolution of C-reactive protein preoperatively, 6 weeks and final evolution.

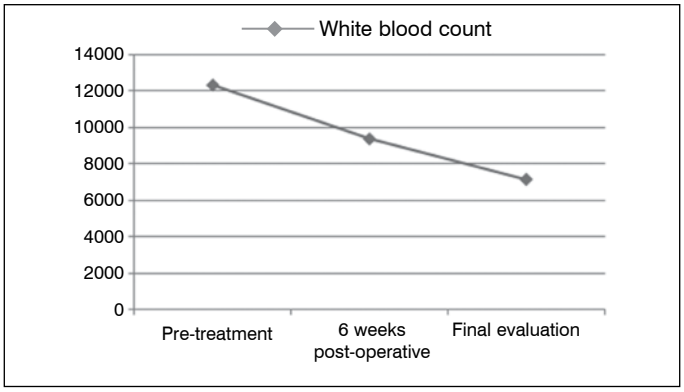

Figure 2. White blood count preoperatively, 6 weeks and final evolution.

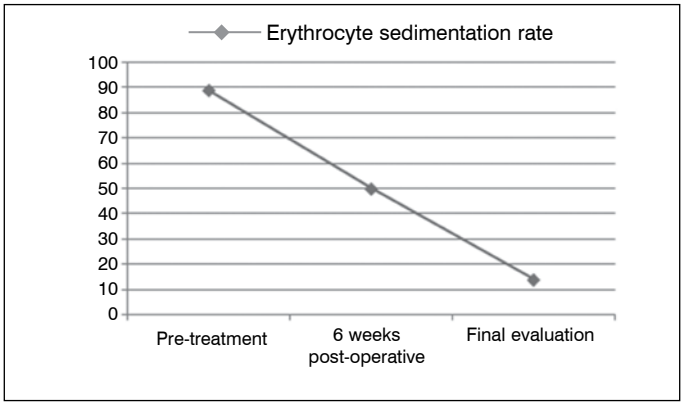

Figure 3. Evolution of erythrocyte sedimentation rate preoperatively, 6 weeks and final evolution.

DISCUSSION

DWI after lumbar spinal instrumented fusion results in a lower level of satisfaction,[7] higher costs,[10] further surgical interventions,[2,4] higher morbidity,[6] and may compromise the surgical outcome if not treated properly.[2,7]

Technological advances allow indicating surgery in patients with complex spinal disorders with a higher clinical morbidity while maintaining a good surgical outcome.[5, 20] However, there is an increased risk of complications such as DWI,[1,4,5,20] despite the prevention technics by using aseptic techniques and prophylactic antibiotics.[1,21,22] In our series, the incidence of DWI was 4.87% in patients with lumbar degenerative disease who underwent posterior lumbar decompression and instrumented fusion.

Table 4. Demonstrates the results of calculated area under the ROC curve of variables.

	Area	95% CI	p
Difference WBC (pre *versus* 6w)	0.466	0.186 - 0.745	0.804
Difference WBC (pre *versus* final)	0.568	0.294 - 0.842	0.620
Difference WBC (6w *versus* final)	0.568	0.273 - 0.863	0.620
Difference ESR (pre *versus* 6w)	0.619	0.358 - 0.881	0.881
Difference ESR (pre *versus* final)	0.523	0.254 - 0.791	0.791
Difference ESR (6w *versus* final)	0.392	0.130 - 0.654	0.654
Difference CRP (pre *versus* 6w)	0.534	0.258 - 0.810	0.804
Difference CRP (pre *versus* final)	0.494	0.215 - 0.773	0.967
Difference CRP (6w *versus* final)	0.455	0.187 - 0.722	0.741
WBC preoperative	0.631	0.337 - 0.924	0.342
ESR preoperative	0.466	0.193 - 0.739	0.804
CRP preoperative	0.472	0.181 - 0.762	0.836

Table 5. Mean difference between pre-treatment and six weeks post-treatment in laboratory exams comparing one *versus* more than one debridement.

	One debridement	More than one debridement	p
White blood cell count	2254.54 (2456.97)	3618.75 (5828.12)	0.549
Erythrocyte sedimentation rate	40.81 (21.79)	34.25 (20.96)	0.519
C-reactive protein	65.10 (33.43)	68.82 (52.54)	0.852

The efficacy of the treatment of postoperative spinal infection is correlated with early diagnosis and aggressive management with surgical debridement, appropriate antibiotics and nutritional supplementation.[1,23] There is a discussion about the efficacy of the closed irrigation system, the need for removing instrumentation and primary or secondary wound closure.[3-5,12,14-18,24-30] In our experience, these patients can be successfully managed with aggressive surgical debridement combined with a closed irrigation system and primary wound closure without removing the instrumentation.

Rohmiller *et al*.[12] in a retrospective study from 1990 to 2002 reported their management of 28 cases of DWI including the onset of acute and late wound infections. These patients were treated by debridement, antibiotics and a closed suction irrigation system during a varying period of time ranging from 1 to 15 days (mean 4 days). The irrigation system was used only once in 75% of cases and twice in the remaining cases. The closed drainage was used for only one day in seven patients (50%), two days in two patients (14.28%) and more than two days in five patients (35.72%). The authors concluded that debridement, antibiotics and a closed suction irrigation system are an effective method to treat postoperative DWI. In our study, the patients have an acute DWI and the treatment was prompt extensive debridement, antibiotics and a closed irrigation system during 5 days that could be repeated by replacement of the drainage system. Using this protocol it was possible to treat the infections without removing the instrumentation or compromising the surgical goals.

In our cases the number of interventions was one debridement in 11 patients (57.8%), two in three patients (15.7%) and more than two in five patients (26.3%). The cases where more than two debridements were needed to resolve the spinal infection, three interventions were necessary in three cases, four interventions in one case and five debridements in one case. In those cases, the reoperation was indicated because the values of PCR and VSG were being progressively reduced but not as normal values or positive cultures was observed in the irrigation system outflow fluid. The patient and his family were informed about the necessity to have the instrumentation removed in cases where the infection persisted. They decided that this therapy should be the last to be adopted since they have to pay again for the instrumentation to be replaced.

On the contrary of publications showing favorable results using the closed irrigation system for DWI[5,12,31] there are reports of increased risk of pseudarthrosis and pseudomonas superinfection.[28]

There are contradictory suggestions in the literature about the need to remove instrumentation after the diagnosis of DWI. Some publications advocated the removal of instrumentation for successful treatment of infection,[4,14,24,27,32] while others maintain the instrumen-

tation in order to minimize the risk of pseudarthrosis and instability.[3,5,14,15,25,26,30,33] Weinstein *et al.*[30] support the idea that the instrumentation should not be removed in order to maintain the surgical goal. Theiss *et al.*[33] pointed out that there was no evidence to suggest that spinal instrumentation inhibited the ability to treat spinal infection. Kim *et al.*[4] reported good results for the resolution of the DWI after wide debridement, antibiotic therapy and implant removal, but the authors describe an increase in complications, such as pseudarthrosis, loss of intervertebral height and lordosis. We demonstrated that it is possible to have the infection treated with the instrumentation in place to achieve the goals of primary surgery. In our cases no displacement or breakage of the instrumented devices was observed, the surgical spinal segments were fused and the lumbar lordosis maintained. Besides, the instrumentation allows stabilizing the motion segment and, theoretically, decreases the inflammation and promotes bone healing.[1,34]

Early detection and prompt management of DWI are crucial to achieve a successful outcome.[32,35] Many methods have been studied to perform the early detection of DWI, including plain radiographs, spinal biopsy, MR imaging, and laboratory tests.[32,36] Mok *et al*.[37] reported that the elevation or failure to decrease the levels of CRP had a sensitivity of 82%, specificity of 48%, positive predictive value of 41% and negative predictive value of 86% to detect or exclude DWI. Blood tests such as WBC, ESR and CRP are simple methods to identify and follow the course of WDI.[32] In our experience, the time of onset of this complication occurs in two weeks postoperatively in the majority of patients. Whenever the patient has a history of lumbar pain, associated with abnormal laboratory tests of WBC, ESR, CRP, and presence of a fluid leakage from the skin, surgical debridement is mandatory to collect material to confirm or not the infection and at the same time to treat with extensive and aggressive debridement and washing.

Dipaola *et al*.[38] studied a series of 128 patients with DWI and reported that predictive factors of multiple irrigation and debridement were: positive methicillin-resistant *Staphylococcus aureus* culture, distant site infection, presence of instrumentation, location of surgery in the posterior lumbar spine, the use of non autograft bone graft material and the presence of diabetes *mellitus*. Mehta *et al*.[39] suggested that in obese patients, the distribution of the body fat such as skin to lamina distance and thickness of the subcutaneous fat, is more predictive of DWI than absolute obesity. The laboratory parameters were used to follow the resolution of infection, but not as a parameter to predict the need for reinterventions. In our article, we could not find a laboratory test to predict the necessity for new interventions, only a relationship between the reduction of these parameters and infection resolution.

There is an ongoing multicenter study to increase the sample and achieve a greater level of evidence and statistical impact.

CONCLUSION

A protocol combining prompt surgical exploration, extensive washing, debridement of necrotic tissue, placement of a closed irrigation system for a period of five days and proper intravenous antibiotics therapy, was successfully used to treat a DWI in patients after instrumented posterior lumbar surgery without removal of the instrumentation. Six weeks after the treatment there was a decrease of WBC, ESR and CRP, however none of these laboratory tests are useful to predict the need for surgical reinterventions.

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