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Management and Prevention of Postoperative Spine Infections

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Abstract

Background: The intrinsic benefits of various instrumentation systems involve rapid spine stabilization.

Aim of Study: To identify the cases and operations that correlated with a heightened probability of infections of deep wounds and to assess the effectiveness of the institution's current therapy protocol in eliminating these infections.

Patients and Methods: This retrospective research commenced with the assessment of hospital and office medical records, a computerized database, and charts from twenty consecutively managed cases who had surgical spinal instrumentation operations. The research has been conducted at Al-Azhar University from June 2022 to June 2024.

Results: The mean RF score of the studied group was 2.21±0.9. The mean number of days from operation to clinical presentation was 27.6±6.3, the mean temperature on admission was 37.5±4.2, the mean maximum temperature during hospital stay was 37.7±4.6, the mean of WBCs was 10.2±2.3, and the mean of ESR was 57.4±5.8. As regards wound culture, 16 (80%) of patients were positive. Mean of additional days spent in hospital was 16.6±3.1. The infection was superficial and deep in 16 (80%) of patients. The most common cause of infection was Staphylococcus aureus (55%), followed by mixed organisms (30%), and equal percentages (5%) were Streptococcus sp., Proteus mirabilis, and no organism identified.

Conclusion: Wound infections are a significant complication of spinal operations, with Staphylococcus aureus being the most common cause. Infections were superficial and deep in 80% of patients, while 20% had superficial infections.

Key Words: *Management – Prevention – Postoperative spine infections.*

Introduction

IN the past twenty years, significant advancements in surgical instruments for the vertebral column have developed for many spinal pathologies, involving fractures, degenerative conditions, and neoplastic illnesses **[1].**

The intrinsic benefits of various instrumentation systems involve prompt spinal stabilization, facilitating expedited case mobilization; correction of abnormalities; and preservation and restoration of the spine post-decompressive operation. Spinal surgeons must recognize the possible dangers associated with rigid internal fixation, including neurological damage and hardware failure. Infections can arise following any surgical intervention, and dealing with this complication in the context of spinal instrumentation is essential for delivering adequate care following surgery to these cases **[2,3].**

The occurrence of infection of a wound following spinal operations without instrumentation is rather low. In a period where antibiotic prophylaxis prior to spinal operation is commonplace, the infection rate following lumbar discectomy or laminectomy is about one percent **[4].**

The usage of spinal instrumentation evidently elevates the probability of following surgery soft-tissue infections, with recent retrospective assessments estimating the incidence between 2.1 and 8.5 percent. Several established risk factors for following surgery wound infections are closely associated with the placement of spinal equipment **[5].**

Identifying these potential factors will enable their reduction and, subsequently, might reduce the occurrence of infections of wounds. Considering the expanded utilization of spinal equipment in neurosurgery over the past decade, the management of associated infections following surgery has gained significance **[6,7].**

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The objective of this research is to identify the patient demographics and surgical techniques correlated with a heightened risk of infections of deep wounds, as well as to assess the effectiveness of the institution's existing treatment protocol in eliminating these infections.

Patients and Methods

The retrospective evaluation was initiated by assessing twenty consecutively managed cases who had a surgical spinal instrumentation process, as well as office and hospital medical records, a computerized database, and charts.

Inclusion criteria: Cases who underwent spinal instrumentation by either of two neurosurgeons (C.A.D. and V.K.H.S.). Cases that had multiple instrumentation operations, whether on the same day or on different days, have been categorized as distinct procedures, with operating times and losses of blood recorded individually.

Exclusion criteria: (1) Cases who had a spinal operation involving the insertion of a bone graft without instrumentation (such as cervical disc removal with iliac crest graft); (2) Those cases with documented spinal infection prior to their instrumentation process; and (3) Cases with instrumentation process and subsequently created an infection at the bone-graft donor site only.

Methods:

All patients were subjected to the following:

Cases have been recognized by the diagnostic codes for instrumentation and spinal infection in the records. Records from mortality and morbidity rounds, the infection control department, as well as personal surgeons' office files have been inspected to reduce the possibility of missing cases. Significant case-related risk factors that predict the onset of infections following surgery involve prior surgical procedures, diabetes mellitus, steroid usage, concurrent infections, malnutrition, skin integrity compromise, paralysis, tobacco use, and rheumatoid arthritis 4, 17, 24. To assess the relative significance of these risk factors as predictors of infection progression during spinal instrumentation, we assigned an arbitrary value of one to each above risk factor and calculated an RF score for every case.

Operative technique:

All cases were administered a single dose of the 2nd-generation cephalosporin Zinacef throughout the initiation of anesthesia and subsequently every eight hours for the following twenty-four hours post-initial instrumentation procedure. The surgical area has been cleansed with chlorhexidine gluconate for 4.5 minutes. Wound cultures have been obtained from cases who developed infections upon their readmission to the hospital or during operating debridement. The operational debridement of the wound involved reopening the whole duration of the prior incision, draining pus from all possible spaces within the wound, and thoroughly excising the remaining sutures, loose bone graft particles, as well as purulent and necrotic tissues. We attempted to retain most of the grafted bone within the incision to facilitate bone fusion. A closed irrigation-suction apparatus, referred to as the "feed-me/drain-me" system in our institution, has been included in the treatment regimen for most cases with wound infections. Catheters and drains were typically positioned both superficially and deeply relative to the lumbodorsal fascia in the presence of a deep-seated infection. In some cases, an extra drainage and catheter system was inserted at the iliac crest graft harvest site. Red rubber catheters featuring longitudinal side openings were employed for continuous irrigation by linking them to an intravenous normal saline solution. Antibiotic drugs have been administered to the IV bags promptly following the acquisition of a wound culture at the bedside. Antibiotic medications comprise nafcillin (one gram per liter in normal saline) or vancomycin (five hundred milligrams per liter in normal saline). The antibiotic drug has been chosen based on the gram stain as well as culture results, providing a high concentration of targeted antibiotics directly to the wound site for the infecting organism(s). The irrigation rate was often sustained at between twenty-five and fifty milliliters per hour. The drainage tubes have been attached to medium-pressurehemovacs that emerged via distinct stab incisions. The fascia has been sutured closed using several non-absorbable interrupted stitches. The dermis has been secured using multiple No. 0 retention sutures in conjunction with a watertight continuous 3-0 nylon suture. Irrigation systems have been put in for a duration of between five and seven days before being removed. The drainage tubes have been retained for an extra day to ensure that a sufficient volume of irrigation fluid persisted within the wound.

Results

Regarding this table, the mean age of studied group was 54.7±8.9, the mean BMI of studied group was 27.5±4.3, 55% of patients were male and 45% were female.

The mean surgical duration of studied group was5.93±.3, the mean EBL of studied group was 958±5.6, 35% of patients the drain has beenimplanted into the wound prior to closure. (Table 2).

The mean RF score of studied group was 2.21±0.9. (Table 3).

Regarding this table, the mean number of r from operation to clinical presentation was 27.6±6.3, the mean of temperature on admission was 37.5±4.2, and the mean of maximum temperature during hospital stay was 37.7±4.6. The mean of WBCs was 10.2±2.3, and the mean of ESR was 57.4±5.8. As regards wound culture, 16 (80%) of patients were positive. Mean of additional days spent in hospital was 16.6±3.1. Infection was superficial and deep in 16 (80%) of patients (Table 4).

Regarding this table, the most common cause of infection was Staphylococcus aureus (55%) followed by Mixed organisms (30%) and equal percentages (5%) were Streptococcus sp., Proteus mirabilis and No organism identified. (Table 5).

Table (1): Distribution of demographic data among the studied group.

	Studied group N=20
Age:	
Mean ± SD	54.7±8.9
BMI:	
Mean ± SD	27.5±4.3
Sex:	
Male	11 (55%)
Female	9 (45%)

SD: Standard Deviation.

Table (2): Distribution of surgical data among the studied group.

	Studied group N=20
Surgical duration (hours):	
Mean ± SD	5.93±.3
EBL (ml):	
Mean ± SD	958±5.6
Drain	7 (35%)

EBL: Estimated blood loss.

Table (3): Distribution of infection risk factor (RF) score among the studied group.

	Studied group N=20
RF score:	
Mean ± SD	2.21±0.9

SD: Standard Deviation.

Table (4): Distribution of cases' presentations on initial diagnosis among the studied group.

	Studied group N=20
Postoperative day of diagnosis: Mean ± SD	27.6±6.3
Temperature on admission: Mean ± SD	37.5±4.2
Maximum temperature during hospital stay: Mean ± SD	37.7±4.6
WBC: Mean ± SD	10.2±2.3
ESR: Mean ± SD	57.4±5.8
Wound culture	16 (80%)
Add hospital days: Mean ± SD	16.6±3.1
Location of infection:	
Superficial and deep	16 (80%)
Superficial	4 (20%)

SD: Standard Deviation.

Table (5): Distribution of infections following operation after spinal instrumentation among the studied group.

	Studied group N=20
Staphylococcus aureus	11 (55%)
Streptococcus sp.	1 (5%)
Proteus mirabilis	1 (5%)
Mixed organisms	6 (30%)
No organism identified	1 (5%)

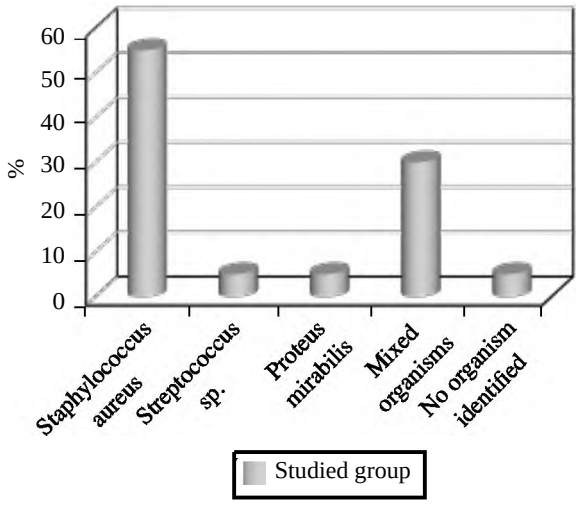

Fig. (1): Distribution of postoperative infection among the studied group.

Discussion

Our current study showed that the mean age of the studied group was 54.7±8.9 years, the mean BMI of the studied group was 27.5±4.3, 55% of patients were male, and 45% were female.

This aligns with the findings of Levi AD et al. *[10]*, who aimed to assess the management of infections following surgery following spinal instrumentation. They stated a mean age of the subjects at 57.3 years (range 34–83 years). Among the 17 cases of infection, there were ten males and seven females.

Kalfas F et al. *[11]* aimed to investigate infections associated with spinal instrumentation, reporting a study population of twenty-seven males and twenty-four females. The average age at the time of index surgery was 61.2 years, with a range of forty-eight to eighty-three years.

In the current research, we found that the mean surgical duration of the studied group was 5.93±.3, the mean EBL of the examined group was 958±5.6, and 35% of patients had the drain that had been implemented into the wound prior to closure.

In conjunction with our findings, Levi AD et al. *[10]* stated that the mean time of instrumentation procedures that resulted in infection was 5.29 hours, with a mean estimated blood loss of 956 milliliters. In seven of the seventeen cases, a drain has been placed into the wound prior to closure.

As well, Perry JW et al. *[12]*, who stated that the mean length of surgery was 6 hours in the infected group.

We found that the mean RF score of examined groups was 2.21±0.9.

Our results are supported by Levi AD et al. *[10]*, who reported that the mean RF score was 2.18 in cases that progressed an infection.

Our results showed that the mean number of days from operation to clinical presentation was 27.6±6.3, the mean temperature on admission was 37.5±4.2, while the mean maximum temperature during hospital stay was 37.7±4.6. As regards laboratory investigation, the mean of WBCs was 10.2±2.3 × 106/ml, and the mean of ESR was 57.4±5.8 mm/hour. As regards wound culture, 16 (80%) of patients were positive. Mean of additional days spent in hospital was 16.6±3.1. As for the location of infection, infection was superficial and deep in 16 (80%) of patients, while 4 (20%) of them had infection present superficially.

Similarly, Levi AD et al. *[10]* observed that the average duration from operation to clinical presentation was 27.6 days (range 4–120 days), with a mean readmission temperature of just 37.5 degrees Celsius. Throughout the 2^{nd} admission, higher temperatures were more prevalent than the 1^{st} admission temperatures. The mean WBC count upon admission was 10.2 (×10^6/ml), with a range of 5 to 22.9 (×10^6 cells/ml). The erythrocyte sedimentation rate has been increased in all five of the seventeen cases tested, with a mean of 57.4 millimeters per hour (normal range 0–20 millimeters per hour) and a range of forty-five to eighty-four millimeters per hour. Conversely, the cultures yielded positive results in all cases.

However, Kalfas F et al. *[11]* reported that infection was superficial in 82.3% and deep in 17.7% of the studied cases.

Concerning the distribution of infections following surgery following spinal instrumentation within the examined group Our findings indicated that the predominant source of infection was Staphylococcus aureus.

Kalfas F et al. *[11]* stated that Staphylococcus spp. (36 isolates; 70.6%) were the predominant culprits.

Sierra-Hoffman M et al. *[13]* aimed to evaluate the efficacy of managing spinal instrument infections following surgery using antibiotics as well as irrigation and debridement alone, without removal of hardware. They stated that methicillin-sensitive Staphylococcus aureus (MSSA) was the most frequently isolated organism.

Moreover, Fang XT and Wood KB *[14]* aimed to assess the clinical efficacy of treatment for following surgery spinal infections following instrumented spine fusion with extensive debridement or implant removal. They stated that the predominant bacteria, Staphylococcus aureus, has been identified in 17 patients (40.9%).

Conclusion:

We determined that wound infections constitute a significant complication of spinal operations, including equipment. The most common cause of infection was Staphylococcus aureus. Infection was superficial and deep in 16 (80%) of the patients, while 4 (20%) of them had superficial infections.

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العلاج والوقاية من التهابات العمود الفقرى بعد العمليات الجراحية

الخلفية: الفوائد الجوهرية لأنظمة الأدوات المختلفة تتضمن التثبيت السريع للعمود الفقرى.

الهدف: تحديد الحالات والعمليات التى ارتبطت بزيادة احتمال حدوث التهابات فى الجروح العميقة وتقييم فعالية بروتوكول العلاج الحالى فى المؤسسة فى القضاء على هذه العدوى.

المرضى والطرق: بدأت هذه الدراسة الاستعادية بتقييم سجلات المرضى فى المستشفى والمكاتب الطبية وقاعدة البيانات المحوسبة، بالإضافة إلى الرسوم البيانية لعشرين حالة تم التعامل معها بالتتابع والذين خضعوا لعمليات تثبيت العمود الفقرى الجراحية. تم إجراء البحث فى جامعة الأزهر من يونيو ٢٠٢٢ حتى يونيو ٢٠٢٤.

النتائج: كان متوسط درجة RF للمجموعة المدروسة ٢,٢١ ± ٠,٩. وكان متوسط عدد الأيام من العملية حتى ظهور الأعراض السريرية ٢٧,٦±٦,٣ يومًا، وكان متوسط درجة الحرارة عند القبول ٣٧,٥±٤,٢ درجة مئوية، وكان متوسط درجة الحرارة القصوى أثناء الإقامة فى المستشفى ٣٧,٧±٤,٦ درجة مئوية، وكان متوسط عدد خلايا الدم البيضاء ١٠,٢±٢,٣، وكان متوسط معدل ترسب كريات الدم الحمراء ٥٧,٤±٥,٨. فيما يتعلق بزراعة الجروح، كانت ١٦ (٨٠٪) من المرضى إيجابية. كان متوسط عدد الأيام الإضافية التى أمضاها المرضى فى المستشفى ١٦,٦±٣,١ يومًا. كانت العدوى سطحية وعميقة فى ١٦ (٨٠٪) من المرضى. كان السبب الأكثر شيوعًا للعدوى هو Staphylococcus aureus (٥٥٪)، تليه الكائنات المختلطة (٣٠٪)، وكانت هناك نسب متساوية (٥٪) من العدوى بسبب Streptococcus، Proteus mirabilis، ولم يتم تحديد أى كائنات فى بعض الحالات.

الخلاصة: تعد التهابات الجروح من المضاعفات الكبيرة فى العمليات الجراحية للعمود الفقرى، حيث يعد Staphylococcus aureus السبب الأكثر شيوعًا. كانت العدوى سطحية وعميقة فى ٨٠٪ من المرضى، بينما كانت ٢٠٪ فقط من الحالات سطحية.