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ORIGINAL PAPER

Simultaneous versus sequential one-stage combined anterior and posterior spinal surgery for spinal infections (outcomes and complications)

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Abstract To compare simultaneous with sequential one-stage (same anaesthesia) combined anterior and posterior spinal surgery in the treatment of spinal infections in terms of the operation time, blood loss and complication rate. Fifty-six patients who underwent one-stage (same anaesthesia) simultaneous or sequential anterior decompression and posterior stabilisation of the involved vertebrae for spinal infection from January 1994 to December 2002 were reviewed. In group I (n=29), sequential anterior and posterior surgery was performed. In group II (n=27), simultaneous anterior and posterior spinal surgery was performed. With regard to age and gender, there was no statistical difference between both groups (P=0.05). The analysed and compared data between the two groups included the age, gender, blood loss, operation time and postoperative complications. There was a statistically significant difference between the two groups in terms of the duration of surgery, amount of blood transfusion needed and occurrence of major postoperative complications (P<0.05). The mean correction of the kyphotic deformity was similar in both groups (P>0.05) without a subsequent loss of correction on follow-up radiographic films at a mean follow-up of 6.5 years (range, 3 to 11 years). Simultaneous anterior and posterior surgery is a good alternative procedure. It provides the ability to manipulate both anterior and posterior aspects of the spine at the same time and appears to result in less blood loss, a shorter operative time and fewer complications. However, gaining experience and the availability of two surgical teams are important factors in the success of the procedure.

Résumé Nous avons voulu comparer le traitement en un temps ou en un temps avec différentes séquences thérapeutiques (même anesthésie) combinant voie antérieure, voie postérieure dans le traitement des affections rachidiennes en comparant la durée opératoire, les pertes sanguines et le taux des complications. 56 patients ont bénéficié, en un temps (même anesthésie) d'une décompression antérieure et stabilisation postérieure pour affection rachidienne entre janvier 84 et décembre 2002 et ont été revus. Dans le groupe I (n=29) une chirurgie type séquentielle a été réalisée, dans le groupe II (n=27) une chirurgie avec abords simultanés antérieur postérieur. Les deux groupes ont été comparés en termes d'âge, de sexe, pertes sanguines, temps opératoire et complications. il y avait une différence significative entre les deux groupes en termes de temps opératoire, pertes sanguines, avec nécessité de transfusion et de complications post-opératoires (P<0.05). La correction de la cyphose a été identique dans les deux groupes (P>0.05) sans augmentation excessive des pertes de correction après un suivi de 6.5 ans (3 à 11 par an). la chirurgie réalisée de façon simultanée par devant et par derrière est un bon procédé chirurgical, elle permet de diminuer les pertes sanguines, de raccourcir le temps opératoire et diminuer le taux des complications. Cependant, l'expérience et la possibilité de travailler à deux équipes chirurgicales sont également des facteurs de succès importants dans cette technique.

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Table 1 Demographic characteristics of the groups

	Group I (n=29)	Group II (n=27)
Age (mean)	61.2	60.3
Sex (M/F)	13/16	12/15
Spinal level (T:TL:L)	17:7:5	16:6:5
Neurological status (present)	16	14
Diagnosis (osteomyelitis/tbc)	21/8	19/8

T: thoracic; TL: thoracolumbar; L: lumbar; M: male; F: female

Introduction

The classical treatment for spinal infections is non-operative, consisting of properly selected intravenous antibiotics administered for 3–6 weeks and external immobilisation [1, 11, 13, 15]. However, there are some indications for surgical intervention [1, 4, 5, 10, 11]. These include the presence of a neurological deficit, abscess formation, absence of clinical improvement with non-operative treatment and gross instability and kyphosis because of vertebral destruction.

In the surgical treatment, the anterior approach is almost always required [4–6, 8, 10, 11]. By this approach, one can directly access the affected vertebral bodies and intervertebral disc. It enables the surgeon to debride the involved tissues properly and also allows placement of a structural bone graft to reconstitute lost height and provide anterior load sharing [4–6, 11]. In some of the cases, an additional posterior approach is necessary for the correction and preservation of the sagittal alignment, augmentation of the stability of the affected segments and posterior reinforcement of lordosis.

Combined anterior and posterior surgery can be performed in the same session (either simultaneous or sequential) or on separate days [3, 12, 14–16]. In this study, we aimed to compare the simultaneous with sequential one-stage (same anaesthesia) combined anterior and posterior spinal surgery in the treatment of spinal infections in terms of the operation time, blood loss, correction of kyphosis and complication rate.

Patients and methods

The medical charts along with imaging studies and operative reports were used to review 56 patients who underwent one-stage simultaneous or sequential anterior complete corpectomy at one level together with excision of the adjacent two discs, decompression and posterior stabilisation of the involved vertebrae for spinal infection from January 1994 to December 2002. In group I (n=29), sequential anterior and posterior surgery was performed. In group II (n=27), simultaneous anterior and posterior spinal surgery was performed. The demographical and disease characteristics of both groups were similar (Table 1).

Patient ages ranged from 38 to 74 years (mean, 60.8 years). Thirty-one patients were women, and 25 were men. All patients reported back pain and difficulty in walking. On admission, 30 patients had neurological deficits ranging from Frankel D to Frankel C. The infectious process involved the lumbar region in 33 patients, the thoracolumbar junction (T12-L1) in 13 patients and thoracic region (T1-T11) in 10 patients. The diagnosis was tuberculosis in 16 patients and bacterial vertebral osteomyelitis in the remaining 40 patients. Infectious microorganisms were identified by cultures in all cases.

The diagnosis was based on the clinical presentation, erythrocyte sedimentation rate, white blood cell count and imaging of a destructive lesion in plain radiographic films, computed tomograpy or magnetic resonance imaging. The diagnosis was confirmed by the results of pathological examination in all patients. All patients received appropriate antibiotic therapy (a 9-month course of antituberculous chemotherapy in case of spinal tuberculosis). Indications for surgery included a neurological deficit in 30 patients, abscess formation in 10 and/or local kyphosis in 37 patients.

In group I, surgery was performed in a sequential manner, i.e., posterior transpedicular screw instrumentation and fusion initially were performed, followed by anterior debridement and the placement of a structural bone graft (in 4 patients) or titanium mesh cages (in 25 patients) with the patient under the same anaesthesia. In group II, both procedures were performed simultaneously by two surgical teams with the patient placed in the lateral decubitus position. In the posterior surgery, transpedicular screw fixation with posterior spine arthrodesis was performed. In the anterior surgery, decompression and drainage of the abscess, if present, were performed. Iliac crest tricortical bone autograft (2 patients) or titanium mesh cages with autogenous chip bone graft (25 patients) were used to reconstruct the resected vertebral segment. The patients with osteomyelitis were treated with intravenous antibiotics for 6 weeks and 3 months of oral antibiotics after surgery and those with tuberculosis, with antituberculous therapy for 9 months. Mobilisation was started within the first week after operation without any external support.

The analysed and compared data between the two groups included age, gender, blood loss, operation time and postoperative complications. With regard to age and gender, there was no statistical difference between both groups (P>0.05). Superficial wound infection, urinary tract infection, wound necrosis and transient haematuria were considered minor postoperative complications; on the other hand, deep wound infection, neurological complications and pneumonia were regarded as major postoperative complications.

Table 2 Comparison of both groups in terms of outcomes and complications

	Sequential	Simultaneous	P
Operative time	7 h 30 min	5 h 12 min	<0.05
Blood transfusion	1,460 ml	960 ml	<0.05
Minor complications	30%	26%	>0.05
Major complications	14%	7%	<0.05
Postoperative hospitalisation	27 days	25 days	>0.05
Correction of kyphosis	16 degrees	17.1 degrees	>0.05
Number levels fused	4.2	3.8	>0.05

Local kyphosis angles were measured from preoperative, immediate postoperative and final follow-up X-rays. The amount of correction and loss of correction during the follow-up period was calculated and compared within two groups.

For statistical analysis, the *t* test was used and a *P* value of less than 0.05 was considered as statistically significant.

Results

In the sequential group (group I), the mean duration of surgery was 7 h 30 min (range, 4 h 45 min–10 h). The average blood transfusion during the surgery was 1,460 ml. The mean time in hospital was 27 days (range, 21 to 30 days). Eight patients (30%) suffered from minor and four patients (14%) suffered from major postoperative complications (three deep wound infections and one pneumonia). The mean correction of the kyphotic deformity was 16° (range, 8 to 28°). The fusion involved at a mean of 4.2 vertebral segments.

In the simultaneous group (group II), the mean duration of surgery was 5 h 12 min (range, 3 h 30 min–7 h). The average blood transfusion during the surgery was 960 ml. The mean time in hospital was 25 days (range, 21 to 28 days). Seven patients (26%) suffered from minor and two patients (7%) suffered from major postoperative complications (one deep wound infection and one pneumonia). The mean correction of the kyphotic deformity was 17.1° (range, 10 to 25°). The fusion involved at a mean of 3.8 vertebral segments.

There was a statistically significant difference between the two groups in terms of the duration of surgery, amount of blood transfusion needed and occurrence of major postoperative complications ($P<0.05$). The mean duration of surgery was less in group II than group I. The patients in group II required less blood transfusion and they faced fewer major postoperative complications such as deep wound infection, neurological complications and pneumonia. There was no difference in the postoperative hospital stay in both groups owing to the need for long-term intravenous antibiotic administration. There was also no difference in the rates of minor postoperative complications in the two groups ($P>0.05$).

The amount of correction in the local kyphosis angle was 16 degrees in group I and 17.1 degrees in group II. It was similar in both groups ($P>0.05$) without subsequent loss of correction on follow-up radiographic films. At a mean follow-up of 6.5 years (range, 3 to 11 years), all patients had regained their previous motor function and former ambulatory status with eradication of the infection and attainment of solid bony fusion. The complete results are summarised in Table 2.

Discussion

The goals of surgical treatment in spinal infections are eradication of the infectious process, reversal of the neurological deficit, relief of pain and prevention or correction of the associated kyphosis while maintaining spinal stability.

The anterior surgical approach is almost always necessary for vertebral infections as it provides the surgeon direct access to the diseased vertebral segments to perform radical debridement of the infected tissues [4–6, 8, 10, 11]. However, by the anterior approach, spinal stability is only partially restored. Therefore, it is necessary to add posterior stabilisation to restore spinal stability and to correct any kyphotic deformity present. Posterior stabilisation also allows early mobilisation without external support [7].

Combined anterior and posterior surgery can be performed in the same session (either simultaneous or sequential) or on separate days [3, 12, 14–16]. In the literature, there are a few studies comparing the same day versus staged combined spinal approach in spinal infection management [2, 7]. On the other hand, there is only one report comparing sequential versus simultaneous (same day) combined approach in vertebral osteomyelitis [15]. The authors in that study suggested that combined sequential or simultaneous same-day anterior and posterior surgery in the management of vertebral osteomyelitis is a safe and efficient method to control the infection, stabilise the affected segment and rapidly mobilise the patients. They concluded that patients with thoracolumbar osteomyelitis necessitating surgical treatment should undergo combined same-day anterior decompression and posterior stabilisation. However, they stated that there was no difference in the outcome whether combined surgery was done sequentially or simultaneously.

Combined anterior and posterior approaches currently are used in the surgical management of severe scoliosis [9, 16]. Performing the anterior and posterior approaches in

a sequential fashion instead of staged procedures has been shown in scoliotic patients to result in less blood loss, a shorter hospital stay, a lower rate of complications, earlier mobilisation and less anxiety for the patient and family, as the patient undergoes only one operation and one administration of anaesthesia [16]. However, those studies have not compared the type of same day combined surgical approaches. In our study, we found a statistically significant difference between simultaneously applied combined surgery groups and sequentially performed treatment in terms of the operation time, amount of blood transfusion needed and occurrence of major postoperative complications. The mean duration of surgery, blood transfusion requirement and postoperative major complications were less in patients who underwent simultaneous same day combined surgery. There was no disadvantage in relation to the correction of the kyphotic deformity. On the other hand, although the simultaneous procedures were somewhat shorter than the sequential procedures, the decision of whether to use a simultaneous or sequential combined approach was made only on the basis of the availability of two qualified surgical teams.

Although this report is a retrospective, uncontrolled review of the clinical outcome of combined anterior and posterior surgery in 56 patients with vertebral infection, we may conclude that simultaneous anterior and posterior surgery is a good alternative procedure. It provides the ability to manipulate both anterior and posterior aspects of the spine at the same time and appears to result in less blood loss, a shorter operative time and fewer complications. However, gaining the experience and the availability of two surgical teams are important factors in the success of the procedure.

References

1. Abramovitz JN, Batson RA, Yablon JS (1986) Vertebral osteomyelitis: the surgical management of neurological complications. Spine 11:418–420
2. Carragee EJ (1997) Pyogenic vertebral osteomyelitis. J Bone Joint Surg Am 79:874–880
3. Deutsch L, Testiauti M, Borman T (2001) Simultaneous anterior-posterior thoracolumbar spine surgery. J Spinal Disord 14(5):378–384
4. Eismont FJ, Bohlman HH, Prasanna LS et al (1983) Pyogenic and fungal vertebral osteomyelitis with paralysis. J Bone Joint Surg Am 65:19–29
5. Emery SE, Chan DPK, Woodward HR (1989) Treatment of hematogenous pyogenic vertebral osteomyelitis with anterior debridement and primary bone grafting. Spine 14:284–291
6. Fang D, Cheung KMC, Dos Remedios IDM et al (1994) Pyogenic vertebral osteomyelitis: Treatment by anterior spinal debridement and fusion. J Spinal Disord 7:173–180
7. Fountain SS, Jose S (1979) A single-stage combined surgical approach for vertebral resections. J Bone Joint Surg Am 61:1011–1017
8. Joughin E, McDougall C, Parfitt C et al (1991) Causes and clinical management of vertebral osteomyelitis in Saskatchewan. Spine 16:261–264
9. Leonard AS, Winter RB (1983) The techniques of anterior and combined anterior-posterior procedures. In: Winter RB (ed) Congenital deformities of the spine. Thieme-Stratton, New York, pp 131–147
10. Liebergall M, Chaimsky G, Lowe J et al (1991) Pyogenic vertebral osteomyelitis with paralysis: Prognosis and treatment. Clin Orthop 269:142–150
11. McGuire RA, Eismont FJ (1994) The fate of autogenous bone graft in surgically treated pyogenic vertebral osteomyelitis. J Spinal Disord 7:206–215
12. Pascal-Moussellard H, Klein JR, Schwab FJ et al (1999) Simultaneous anterior and posterior approaches to the spine for revision surgery: current indications and techniques. J Spinal Disord 12(3):206–213
13. Patzakis MJ, Rao S, Wilkins J et al (1991) Analysis of 61 cases of vertebral osteomyelitis. Clin Orthop 264:178–183
14. Powell ET, Krengel WF, King HA et al (1994) Comparison of same-day sequential anterior and posterior spinal fusion with delayed two-stage anterior and posterior spinal fusion. Spine 19 (11):1256–1259
15. Safran O, Rand N, Kaplan L et al (1998) Sequential or simultaneous, same-day anterior decompression and posterior stabilization in the management of vertebral osteomyelitis of the lumbar spine. Spine 23(17):1885–1890
16. Shufflebarger HL, Grimm JO, Bui V et al (1991) Anterior and posterior spinal fusion: staged versus same-day surgery. Spine 16:930–933