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ORIGINAL PAPER

Anterior Cervical Discectomy, Drainage and Non-instrumented Cortico-Cancellous Allograft Fusion: A Treatment Option for Ventral Cervical Spinal Epidural Abscess

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Introduction: Ventral cervical spinal epidural abscess is a very rare clinical condition with a relatively high morbidity and mortality. Due to the paucity of reported cases there is heterogeneity and no clear "gold standard" in the treatment of these patients. **Objective:** The authors report four consecutive patients with ventral cervical spinal epidural abscess treated with anterior cervical discectomy, abscess drainage and original non-instrumented cortico-cancellous allograft spinal fusion. **Methods:** The authors retrospectively reviewed a series of four patients treated for ventral cervical epidural spinal abscess. All patients were treated with an urgent operation. Anterior cervical discectomy, abscess drainage, and non-instrumented cortico-cancellous allograft spinal fusion followed by cervical immobilization and systemic antibiotic treatment were utilized. **Results:** The bone fusion occurred within a mean of 3.5 months of follow-up. No significant radiologic or clinical evidence of graft subsidence was noted after a minimum of 2.5 years follow-up. All patients resolved infection and were neurologically intact. No complications of treatment were noted. **Conclusion:** Urgent operative treatment with anterior cervical discectomy, abscess drainage and non-instrumented cortico-cancellous allograft spinal fusion, followed by immobilization and the appropriate systemic antibiotic treatment is an effective original modification for the treatment and resolution of ventral cervical epidural spinal abscess.

Key words: cervical spine; cervical spinal epidural abscess; ventral cervical spinal epidural abscess, non-instrumented fusion.

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1. INTRODUCTION

These infections, therefore, whether acute or chronic, seemed to occur (1) only in spinal epidural space, (2) only in the dorsal half of the spinal canal, and (3) principally in the thoracic region (Dandy, 1926) (1). As was noted by Dandy (1) spinal epidural abscess (SEA) is a very rare condition and its ventral and cervical location is even more infrequent. Ventral cervical spinal epidural abscess (VCSEA) frequently has an atypical presentation, may be missed at initial examination in about half of the cases, and has a potential of devastating consequences (2, 3, 4, 5, 6, 7, 8, 9, 10, 11). VCSEA occurs in 19% of all SEAs (11). Interestingly, in many reported series, VCSEA operative treatment and technique for the most part has not been clearly reported, detailed or standardized. Herein we report our unique experience and successful results with four patients harboring VCSEA utilizing microsurgical anterior cervical discectomy, abscess drainage and original non-instrumented cortico-cancellous allograft bone fusion.

2. MATERIAL AND METHODS

We analyzed data from four consecutively treated patients harboring VCSEA. We reviewed each patient's medical chart, follow-up data, and neuro-imaging until complete resolution of infection and verified fusion had occurred, and patients were discharged from follow-up (Figures 1, 2 and 3).

Perioperative protocol

Laboratory workup included the following: white blood cell counts and differentials, sedimentation rate, C-reactive protein values, blood cultures and intra-operative cultures and sensitivities. Preoperative imaging included cervical spinal MRIs with and without contrast and plain cervical spine x-rays. Infectious disease consultation was obtained in all cases. The patients were followed during the postoperative course by infectious disease specialists along with the authors until complete clearance of infection and surgical healing has occurred. Postoperative anterior/posterior and lateral x-rays verified bone fusion and were done on a regular basis for at least 2.5 years. Also

Figure 1. (Patient #1). A. Sagital post-contrast T-1 weighted preoperative MRI showing rim contrast enhancing of hypointense VCSEA (asterix) and spinal cord compression largest at C4-C5 level. B. Sagital T-2 weighted preoperative MRI of the same patient showing hyperintense VCSEA (asterix). C. Lateral plain x-ray of the cervical spine showing complete postoperative fusion at the C4-C5 level. D. Sagital postoperative T-2 weighted MRI showing status post evacuation of the VCSEA.

postoperative cervical spine MRI scans were done to confirm VCSEA removal.

Operative technique

The patient was placed under general endotracheal anesthesia and positioned supine. The left anterior surface of neck was sterilely prepped and draped. Incision was marked horizontally from midline slightly crossing the anterior border of the sternocleidomastoid muscle. After incising the skin, subcutaneous tissue and platysma muscle, the superficial cervical fascia was opened. The dissection was carried between neck organs medially and neurovascular bundle laterally. Deep cervical fascia was opened and anterior longus colli muscle was partially separated from the anterior surface of the cervical spine. The cervical retractor was then placed in position, retracting in superior-inferior and lateral-lateral direction. Appropriate level was confirmed with the lateral C-arm fluoroscopy. The microscope was then placed in position and microsurgical technique was used. The anterior longitudinal ligament was opened with No 15 knife and disk material emptied with an aid of pituitary rongeurs. Multiple swabs for cultures were taken from the disk space and the abscess. The VCSEA was drained (Figures 3A and B). Once the disk material and purulent contents were completely emptied, antibiotic saline was used to copiously irrigate the area. The high-speed drill was used to shave off cartilaginous end-plates of adjoining vertebral bodies. The drilling was done until "healthy" bone tissue was noted (Figure 3C). Following this, a cortico-cancellous bone allograft (Processed at the RTI Biologics, Alachua, FL; distributed by the Spinal Graft Technologies, Memphis, TN) of appropriate height was chosen and placed into position to achieve inter-vertebral body fusion. Care was taken to obtain a tight fit of the graft. Final anterior-posterior and lateral C-arm X-rays were used to confirm the position of the allograft and spinal reconstruction. A drain was placed along the anterior surface of the cervical spine and closure followed by wound dressing and hard C-collar immobilization was done.

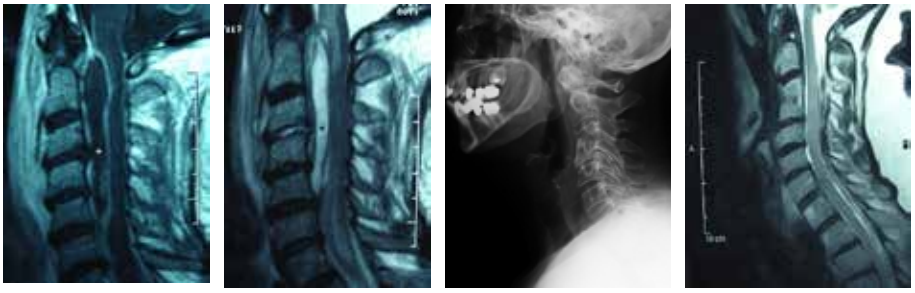

Figure 2. (Patient #2). A. Sagital post-contrast T-1 weighted preoperative MRI showing rim contrast enhancing of hypointense VCSEA (asterix) and spinal cord compression extending from C1 to C5 level. B. Sagital T-2 weighted preoperative MRI of the same patient showing hyperintense VCSEA.(asterix) and diskitis at the C3-C4 level. C. Lateral plain x-ray of the cervical spine showing complete postoperative fusion at the C3-C4 level. D. Sagital postoperative T-2 weighted MRI showing status post evacuation of the VCSEA.

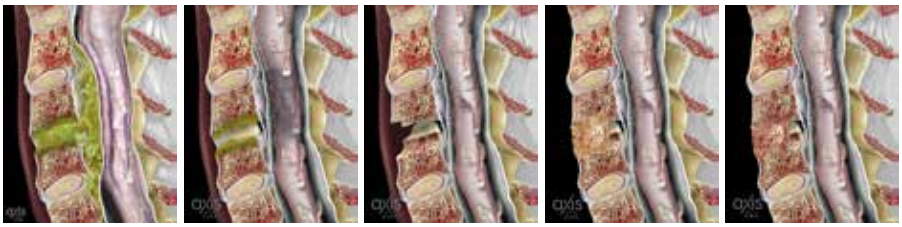

Figure 3. Artist's rendition of the stages of the VCSEA. A. Diskitis, the VCSEA and the cord impingement . B. Status post discectomy and VCSEA evacuation. C. Adjacent vertebral endplate drilling until "healthy" bone is reached. D. Status post placement of the graft in the inter-vertebral space. E. Status post graft fusion.

3. RESULTS

Four consecutive patients were treated for VCEA using anterior cervical discectomy, abscess drainage and non-instrumented cortico-cancellous allograft fusion. Two patients were males and two patients were females. Age ranged from 33-68 years with a mean of 47. Hospital stay ranged from 10 to 24 days with a mean of 16. One patient had a methycillin resistant staphilococcus aureus (MRSA) and one patient had a methycillin sensitive staphylococcus aureus (MSSA) isolated. One patient had a combination of Staphylococcus epidermidis and MRSA isolated. One patient had no bacterial growth. Three patients had a positive risk factors in their history. Follow up ranged from 30-77 months, with a minimum of 2.5 years. All patients wore a hard C-collar postoperatively until fusion was completed and verified via X-ray evaluation (Figures 1C and 2C). Completion of bone fusion time ranged from 3-4 months with a mean of 3.5 months (6 weeks). No evidence of clinically significant graft subsidence was noted in any of four patients after at least two years of follow- up. The patients' details are summarized in Table 1.

PT	AGE/SEX	LEVEL OF	HOSPITAL	INITIAL LABS	ISOLATED	ANTIBIOTIC	RISK FACTORS
		SURGERY	STAY (DAYS)		MICROORGANISMS	(DURATION)	
1	33 / F	C4-C5	10	WBC 19.0	Staph epidermis +	Vancomycin /	
				ESR: 93	MRSA	7 weeks	
				CRP: 26			
2	68 / F	C3-C4	21	WBC: 11.9	MSSA	Oxacillin /	UTI
				ESR: 110		12 weeks	Staph septicemia
							(L) LE cellulitis
3	44 / M	C5-C6	24	WBC: 15.7	MRSA	Vancomycin /	IV drug use
				UA: WBC 33.2		8 weeks	Staph. Bacteremia
				Bact. 8938.4			
4	44 / M	C5-6	7	WBC: 4.7	No growth	Vancomycin /	Alcoholism
				ESR: 90		8 weeks	Dental problems/
				CRP: 0.2			carious tooth

Table 1. Demographic, Laboratory, and Risk Factor data of VCSEA patients

4. DISCUSSION

SEA has been reported to occur in 0.2-1.2 cases per 10.000 hospitalizations. Some reports claim that this incidence has increased in the past two decades due to the aging population, intravenous drug use, and an increasing use of spinal instrumentation. Bacteria gain access to the epidural space via contiguous spread or hematogenous infection from a remote source. Its treatment (conservative versus operative), timing of surgery (early versus late), and outcomes vary in reports. Pain, fever and neurological deficits are the most frequent presentations. Non-specific laboratory parameters may include elevated sedimentation rate (ESR), elevated C-reactive protein (CRP), elevated white blood cell count (WBC), and at times positive blood cultures. Risk factors include: diabetes mellitus, IV drug use, endocarditis, obesity, end stage renal disease, alcoholic liver cirrhosis, pneumonia, history of trauma, history of smoking, dental abscesses, urinary tract infection (UTI), cancer, chronic use of steroids, etc. The most commonly isolated microorganism is Staphylococcus aureus, followed by S. epidermidis, Streptococcus, and gram negative bacteria (Escherichia). In up to 40% of cases, the microorganism is not isolated. Mortality rates are up to 16%. Antibiotic treatment duration is also quite variable and ranges from 4-12 weeks (3, 4, 5, 8, 10-44). The gold standard radiologic diagnostic option for SEA remains magnetic resonance imaging (MRI) in all 3 planes including fat suppression techniques and contrast enhancement. On T-1 weighted sequences, they appear iso- to hyperintense and on T-2 weighted images- hyperintense (2, 11, 16, 33, 41, 45, 46). VCSEAs are rare with only 19% incidence among SEA (47). Interestingly, in a number of reports, operative treatment and technique for the most part have not been clearly reported, detailed or standardized. From these reports, we could gather that the utilized treatment options included "surgical drainage," "surgical decompression," "surgical debridement," "anterior" or "posterior" approaches, "anterior decompression," "fusion", "instrumentation," "stabilization", "fixation", "laminectomy", "corpectomy," and "hemilaminectomy (2, 3, 4, 5, 6, 7, 8, 10, 16, 20, 23, 26, 30, 32, 33, 34, 35, 36, 38-44, 48-52).

Obviously, there is no a "gold standard" for the treatment of patients with VCSEA and a variety of options have been reported. As a general rule and due to the paucity of these cases, the experience in their treatment is continuously gained via limited numbers of VCSEA patients per report or single case reports that are included in each paper. Hence, future prospective randomized studies on VCSEA are not likely. Ten years ago, a meta-analysis summarized SEA experience up to that time (11). Autograft usage has been frequently reported (12, 17, 18, 22, 25, 29, 52, 53, 54). Hadjipavlou et al utilized two staged procedure- corpectomy and auto-grafting anteriorly, followed by posterior instrumentation (25). A two staged procedure, initial debridement followed by treatment of infection and then later auto-grafting and stabilization was used by Schimmer (53). Stone et al used anterior decompression and auto-grafting with external immobilization (halo and c-collar for 3 months respectively) (52). Acosta et al utilized different approaches- anterior decompression, autografting with or without instrumentation or 360 degrees approach (12). Dietze et al. (56) utilized anterior decompression, fibular strut grafting +/- Caspar plating in their 5 cases of VCSEAs. Case reports with "minimally invasive technique" with hemilaminectomies and catheter drainage (37, 56) or endoscopy assisted drainage (57) in the treatment of VCSEA have also been published. Report of Muzzi et al. (9) utilizes anterior cervical discectomy and drainage of VCSEA, but interestingly, without any grafting or fusion.

Despite technical differences noted above (2-18, 20, 22, 23, 25-30, 32-44, 47-54, 56, 57, 58) the mainstay of treatment of VCSEA remain an early, preferably urgent (i.e. within 24 hours after diagnosis) surgical drainage, ventral approach to ventral location, spinal reconstruction of anterior/middle surgical columns, prolonged antibiotic treatment, and immobilization. Our experience clearly supports that protocol. Spinal bone removal for decompression for the VCSEA drainage should obviously be limited. Only discectomy, in our experience, and in the experience of some other authors (9, 17, 52, 53, 54, 55) should suffice. Furthermore, in our experience, the discectomy should be centered at the disk involved in diskitis or alternatively at the disk level of maximal thickness of the abscess.

The use of ilium tricortical autografts have been frequently reported in spinal reconstruction after VCSEA decompression (12, 17, 18, 22, 25, 29, 52, 53, 54). However, the donor site morbidity remains the concern, including pain, potential infectious contamination of the clean hip wound, increased operative time, as well as appropriate sizing of the graft. Fibular strut allografting has also been utilized (56). To our knowledge, the use of cortico-can-

cellous allograft has not been reported previously in VCSEA patients. This allograft has multiple width/height sizing options and has proved to be an outstanding option in our patients and has successfully replaced the need for tricortical ilium autograft. Finally, it provided timely and appropriate fusion without evidence of significant radiologic or clinical graft subsidence.

We believe that less is more regarding the usage of metallic implants in the infected area and that strategy has been supported by findings of Shad et al. (54). They removed the metallic plate that they used for their original surgery one year after decompression and fusion in their patients with VCSEA. At that time, one year later, they confirmed continued colonization of the implant with the original microorganism in all of their cases despite the lack of active infection. Lack of use of the plates for fixation did not appear to have an effect on the speed of bone fusion or the fusion itself in our cases. Finally, not using the plate did decrease the cost of the procedure in our cases what may be an additional bonus.

5. CONCLUSION

Urgent operative treatment with anterior cervical discectomy, abscess drainage and non-instrumented cortico-cancellous allograft spinal fusion, followed by the immobilization and appropriate systemic antibiotic treatment is an effective original modification for the treatment and resolution of the VCSEA. Further reports of experiences in VCSEA treatment are needed.

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