

CORRELATION OF PSEUDARTHROSIS AND RECURRENT CERVICAL MONORADICULOPATHY AFTER ONE LEVEL OF ANTERIOR CERVICAL DISCECTOMY (ACD) AND FIXATION USING METHYLMETHACRYLATE (MMA)

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OBJECTIVE: This study was performed to determine the prevalence of pseudarthrosis, at the level of the MMA two years or longer after the one-level ACD, and to understand the correlation of the pseudarthrosis with recurrent monoradiculopathy. The literature has been vague about relevancy of pseudarthrosis and recurrent monoradiculopathy.

METHODS: 23 patients with cervical radiculopathy who had had one level ACD and fixation MMA were studied. Each patient had a postoperative neurological assessment, dynamic x-ray, magnetic resonance imaging (MRI) and

computed tomography (CT) scan of the cervical spine two years or longer.

RESULTS: 19 patients (82.6%) had arthrodesis at the level of the MMA and 4 patients had pseudarthrosis, and of them, 2 patients had motion and 2 patients did not. None had evidence of recurrent radiculopathy at the level of the ACD.

CONCLUSION: We found no evidence to correlate pseudarthrosis to recurrent monoradiculopathy after ACD and fixation with MMA.

Key Words: Pseudarthrosis, Methylmethacrylate, arthrodesis, cervical radiculopathy, anterior cervical discectomy.

INTRODUCTION

The use of MMA in ACD operations first appeared in the European literature in 1967 by W. Grote, et al [1]. Robert Cantu published the use of MMA in ACD operation in the English literature in 1973 [2]. S. Alemo published the locked-in technique in the Neurosurgery journal in 1985 [3]. Later, we modified the technique by using a Kyphon filler to inject liquid MMA into the vertebral interspaces and discontinue the 15-pound cervical traction after the setting stage of the MMA. Since 1985 several publications supporting the usefulness of the technique have been published in the English literature; however, the technique has remained relatively unknown to most spine surgeons. In fact, there is no mention of the technique in the major neurosurgical or orthopedic textbooks. The rationale for the use of MMA has been the simplicity of the technique for the surgeon and immediate fixation without the need for any

postoperative cervical bracing that has been the most valuable selling point to the patients. The extra cost and some complications of the other ACD techniques have been avoided.

MATERIALS and METHODS

188 patients had ACD and fixation with MMA locked-in technique at one, two, or three levels by the senior author from 1983 through 2007. This prospective study was designed to evaluate the relation of the pseudarthrosis with recurrent cervical radiculopathy in one-level surgery. A letter was sent to each patient who had one-level surgery two years or longer to participate in this academic study. Of those who responded, only 23 patients volunteered both to participate in this study, and their insurance agreed to pay the cost for neurologic exam, dynamic cervical spine x-ray, CT and MRI. 12 patients were male, 11 were female. At the time of the surgery, the range of ages was from 32 to 60 (median 46). The follow-up studies were two years to 18 years after the original surgery (median 8). Each patient had neurologic exam, dynamic cervical spine x-ray, CT, and MRI in 2007 along with the original preoperative imaging and dynamic cervical spine x-ray within 24 hours postoperatively that all had shown

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fixation at the level of the MMA. Axial neck pain was documented preoperatively and postoperatively, but was not considered radiculopathic symptoms. Recurrent pain, numbness, weakness, and/or abnormal deep tendon reflex in the correspondent upper extremity were evidence of radiculopathic symptoms and signs.

Figure 1: Discectomy using Acrylic only in one-level in 23 patients

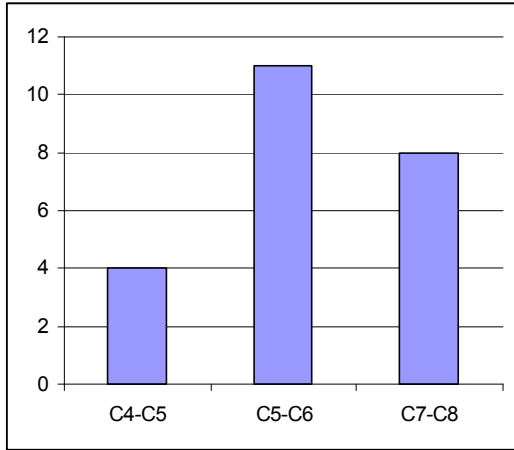
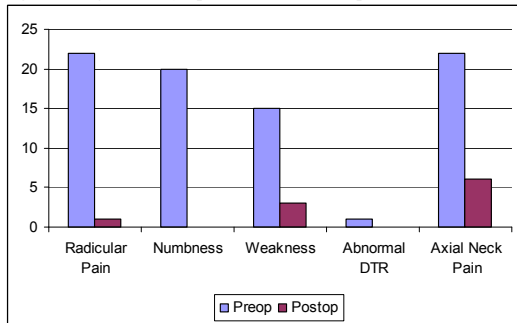


Figure 2: Signs and Symptoms Pre & Post Operative



RESULTS

19 patients (82.6%) had arthrodesis (Figure 3) at the level of the MMA confirmed by sagittal CT reconstruction (Figure 4).

Figure 3: Prevalence of Arthrosis & Pseudarthrosis, at the level of the MMA in 23 patients.

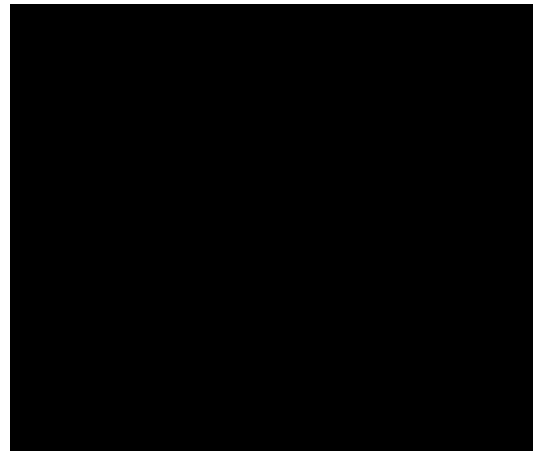


Figure 4: Mid-sagittal CT of cervical spine depicting solid fusion of body of C6-C7 and MMA spacer processes of C5-C6 indicative of both pseudarthrosis and motion.



2 patients had pseudarthrosis without motion (8.7%) and 2 patients had pseudarthrosis with motion (8.7%) on dynamic lateral cervical spine x-ray by measuring the distance between the tip of the two adjacent spinous processes in flexion vs. extension position (Figures 5A/B & 6A/B).

Figure 5: (A) Lateral cervical spine x-ray depicting a patient with pseudarthrosis with MMA spacer, but not change in distance between the tips of the spinous processes of C5-C6 during flexion. (B) Lateral cervical spine x-ray of the same patient as (A) during extension with no change of distance between the tips of the spinous process of C5-C6.

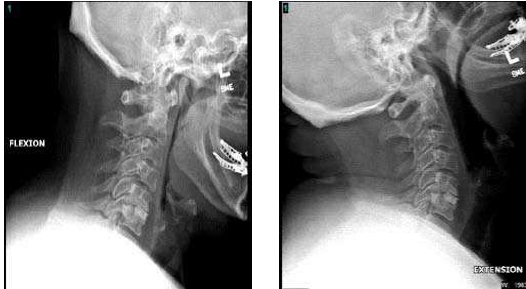
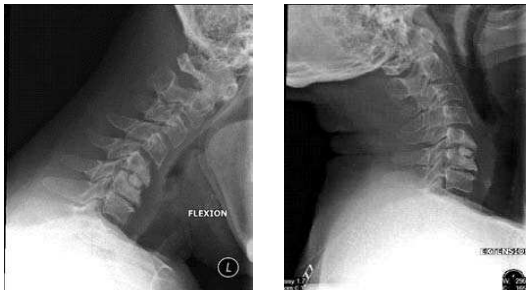
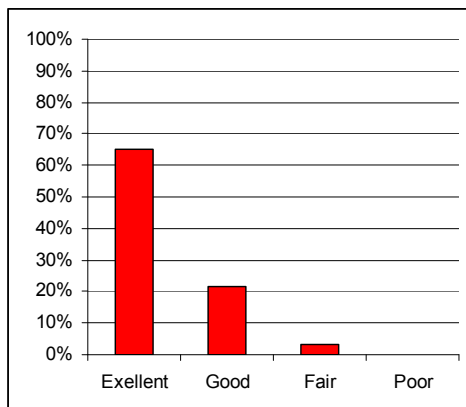


Figure 6: (A) Lateral cervical spine x-ray depicting C5-C6 pseudarthrosis, MMA spacer and increased distance between the tips of the spinous process of C5-C6 during flexion. (B) Lateral cervical spine x-ray of the same patient as (A) during extension with reduction of the distance between the tip of the spinous processes of C5-C6 indicative of both pseudarthrosis and motion.



Of the 23 patients (100%), none had evidence of recurrent radiculopathy at the level of the previous ACD at the time of the follow-up. The long-term outcome of 23 patients after one level ACD with MMA using Odom's Criteria is depicted in Figure 7.

Figure 7: Long-term outcome (%) of 23 patients after one level anterior cervical discectomy with Methylmethacrylate based on Odom's Criteria.



Odom's Criteria:

Excellent: all preoperative symptoms relieved, abnormal finding improved
Good: minimal persistence of preoperative symptoms, abnormal finding unchanged or improved
Fair: definite relief of some preoperative symptoms, others unchanged or slightly improved
Poor: symptoms and signs unchanged or exacerbated

DISCUSSION

It has been the sentiment of the majority of spine surgeons that arthrodesis of the cervical spine yields better results than decompressive surgery alone in the treatment of cervical mono-radicular pathology, and therefore, ACD with bone graft and plate has been the most popular technique in the surgical treatment of cervical mono-radicular pathology. Despite this popularity, the superiority of the technique has not been proven as of yet. Those advocating posterior foraminotomy have reported favorable results, comparable to results of anterior cervical discectomy with fusion [4, 5, 6, 7, 8]; a long-term study by Lunsford and others suggested that the results of ACD with or without bone graft are comparable [9, 10, 11, 12, 13, 14]; adding a plate to ACD and bone graft has not proven to improve the clinical results [15, 16]; we and others have reported good clinical results with ACD using MMA comparable to ACD with bone graft and plate [17, 18, 19, 20].

European spine surgeons have reported the rate of arthrodesis with the MMA technique from 28% to 90% [21, 22], observing that they had used radiolucent MMA for fixation and follow-up imaging was limited to plain x-ray.

We believe our rate of 82.6% is more accurate because of utilization of the radio-opaque MMA and long-term follow-up studies using a combination of dynamic lateral cervical spine x-ray, sagittal CT, and sagittal MRI that gave more sensitivity to our assessment.

CONCLUSION

In our small series, we found no evidence to correlate pseudarthrosis to the incidence of recurrent radiculopathy in long-term follow-up after the ACD and fixation with the MMA. The review of the literature revealed that more scientific work has to be done in order to establish the relevancy of recurrent monoradiculopathy to pseudarthrosis. Until adequate work is done, the preference of any technique in the treatment of cervical

monoradiculopathy based upon the rate of arthrodesis alone cannot be justified.

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REFERENCES

1. Grote W, Rottgen P. Die ventrale fusion bei der zervikalen osteochondrose und ihre behandlungsergebniss. *Acta Neurochir* 1967; 16:218-40.
2. Cantu RC. Anterior spinal fusion using methylmethacrylate (acrylic). *International Surgery* 1974; 59: 110-111.
3. Alemo-Hammad S. Use of acrylic in anterior cervical discectomy: a technical note. *Neurosurg* 1985; 17:94-6.
4. Grieve JP, Kitchen ND, Moore AJ, et al. Result of posterior cervical foraminotomy for treatment of cervical spondylitic radiculopathy. *Br J Neurosurg* 200; 14:40-3.
5. Woertgen C, Rothoerl RD, Henkel J, et al. Long-term outcome after cervical foraminotomy. *J Clinic Neurosci* 2000; 7:312-5.
6. Witzmann A, Hejazi N, Krasznai L. Posterior cervical foraminotomy. A follow-up study of 67 surgically treated patients with compressive radiculopathy. *Neurosurg Rev* 2000; 23: 213-7.
7. Kumar GRV, Williams RS Maurice, Bradford R. Cervical foraminotomy: an effective treatment for cervical spondylotic radiculopathy. *Br J Neurosurgery* 1998; 12:563-568.
8. Anand N, Regan JJ, Bray RS. Posterior cervical foraminotomy: long-term results and functional outcome of a consecutive series of patients with minimum two year follow up. *The Spine Journal* 2002; 2:5-6.
9. Lunsford LD, Bissonette DJ, Jannetta PJ, et al. Anterior surgery for cervical disc disease. Part 1: Treatment of lateral cervical disc herniation in 253 cases. *J Neurosurg* 1980; 53: 1-11.
10. Johnson JP, Filler AG, McBride DQ, et al. Anterior cervical foraminotomy for unilateral radicular disease. *Spine* 2000; 25: 905-9.
11. Noel G. Dan. Anterior cervical graftless fusion for soft disc protrusion. A review of 509 disc excisions in 476 patients. *Journal of Clinical Neuroscience* 1998; 5:172-177.
12. Husag L, Costabile G, Vanloffeld W, et al. Anterior cervical discectomy without fusion: a comparison with Cloward's procedure. *Journal of Clinical Neuroscience* 1977; 4: 331-340.
13. Donaldson JW, Nelson PB. Anterior cervical discectomy without interbody fusion. *Surg Neuro* 2002; 57: 219-25.
14. Savitz MH. Anterior cervical discectomy without fusion for instrumentation. *The Mount Sinai Journal of Medicine* 2000; 67: 314-317.
15. Wang JC, McDonough PW, Endow K, et al. The effect of cervical plating on single-level anterior cervical discectomy and fusion. *J Spinal Discord* 1999; 12:467-71.
16. Epstein NE. Anterior cervical discectomy and fusing without plate instrumentation in 178 patients. *J Spinal Disord* 2000; 13: 1-8.
17. Hamburgur C, Festernberg FV, Uhi E. Ventral discectomy with PMMA interbody fusion for cervical disc disease. Long-term results in 249 patients. *Spine* 2001; 26:249-255.
18. Genest AS, Taheri ZE, Kuntz D, et al. Anterior cervical discectomy with methylmethacrylate fixation. Report of over 1225 cases. *J Neurol Orthop Med Surgery* 1992; 13: 211-220.
19. Korinith MC, Kruger A, Oertel MF, et al. Posterior foraminotomy or anterior discectomy with polymethyl methacrylate interbody stabilization for cervical soft disc disease: results in 292 patients with mono-radiculopathy. *Spine* 2006; 15:1207-14.
20. Alemo S, Shenkin HA. Anterior cervical fusion using methyl methacrylate locked-in technique. *J Neurol Orthop Med Surg* 1993; 14: 224-226.
21. Boker DK, Schulthei BR, Probst Eva Maria. Radiologic long-term results after cervical vertebral interbody fusion with polymethyl methacrylate (PMMA). *Neurosurg Rev* 1989; 12:217-221.
22. van den Bent Martin J, Oosting Johannes, Wouda Ernest J, et al. Anterior cervical discectomy with or without fusion with acrylate: a randomized trial [cervical spine]. *Spine* 1996; 21:834-839.