

POSTERIOR FUSION AND INTERSPINOUS STABILIZATION WITH WIRE IN LOW CERVICAL INJURIES

R. Tuncer *, M. Saveren *, E. Nuzumlalı **, M.Yıldız *

Fifteen patients with cervical dislocation and fracture - dislocation were treated with posterior stabilization. Following reduction, posterior fusion was done with a bone graft which was removed from the iliac crest and the dislocated vertebrae were stabilized with wiring through the spinous processes. Anterior and posterior stabilization was done in 2 patients who have had significant vertebral compression. No significant complication of the technique was observed in the patients. To lessen the problems as late instability and deformity which would be seen with conservative treatment frequently, seems possible with posterior surgical stabilization.

Key Words : low cervical - posterior fusion - interspinous wiring.

Anterior dislocation or fracture - dislocation of cervical spine generally occurs as a result of hyperflexion injury (16, 18). The goals of the treatment are to improve the spinal cord functions, to restore and stabilize the spinal alignment for early rehabilitation and ambulation and to prevent late instability and deformity (2, 17).

There isn't any agreement for the treatment in these injuries yet. Many authors suggest that there isn't any significant difference between the conservative or surgical methods (1, 9, 19). However the rate of the development of early redislocation and late instability with Halo immobilization was reported high (5, 7, 17).

In the surgical treatment, anterior and/or posterior approach is performed. The major advantage of the anterior approach is the anterior decompression of the spinal canal (6,13). Insufficient stabilization and recurrent deformity were reported as disadvantages of this approach (2,20). If there isn't any anterior compression on the spinal canal, posterior approach is ideal, particularly in locked facets.

Various material and devices are used with different techniques with the goal of fusion and internal fixation for the posterior stabilization. All these methods have advantages and disadvantages (8,10, 12, 14,21).

In this study, the patients with low cervical dislocation or fracture - dislocation in which bone fusion and interspinous stabilization technique were used, were presented and the results were discussed.

MATERIAL AND METHOD

Fifteen patients who have admitted to the department of Neurosurgery, Faculty of Medicine, University of Akdeniz, from February 1988 to July 1989, with cervical trauma and who have had low cervical (C3 - C7) dislocation or fracture - dislocation were included to this study. Following admission, physical and neurological examination has been done and the type of the trauma pain, neurologic grade (according to Frankel) were recorded. The level of the injury and the type of the fracture were determined with evaluation of cervical radiographs. Subsequently Crutchfield traction was applied to all patients with local anesthesia. The traction with a weight of 5 kg for head and 2 kg for each vertebra and total weight not more than 18 kg was performed. The weight was increased carefully. The parameters mentioned above, were recorded at the traction period. Open reduction was performed in the patients whose dislocations have not been reduced with traction using maximal weight in 10 days.

After reduction, posterior approach was performed in 13 patients for stabilization and anterior and posterior approach was done in 2 patients who have had prominent compression fracture. In the posterior approach dissection was done in prone and at traction with visualising articular facets bilaterally. In 3 patients, reduction was unsuccessfully with traction and open reduction was done. The base of the upper spinous process at the level of the lesion was holed and a wire was passed through of it. The bone graft which was removed from iliac crest and shaped as H, was placed between the upper and lower spinous processes with maximal surface contact between the spinous processes, laminae and facets. The wire circling around

* Department of Neurosurgery, Faculty of Medicine, University of Akdeniz.

** Department of Orthopaedi and Traumatologie, Faculty of Medicine, University of Akdeniz.

the lower spinous process was twisted upon the graft (Fig.1).

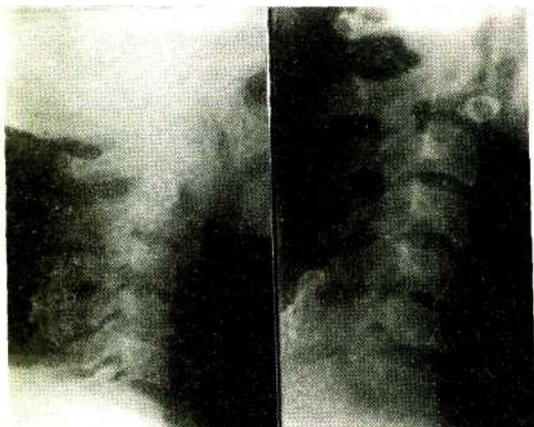


Fig. 1: Postoperative lateral radiograms of 2 patients with C3-C4 and C5-C6 fracture-dislocation respectively.

Minerva mold was applied to the first patient, collar was used at the other 14 patients. The patients whose neural deficits would permit, started walking in 1 week. Others had rehabilitation program. The patients were followed monthly intervals for 3 months and then were seen once in every 3 months. At each observation pain, neurological signs and cervical radiograms were obtained.

RESULTS

Of all patients 12 were male and 3 were female. The mean age was 31.6, ranging from 19 to 48. Trauma was found to be the result of traffic accident in 73.3 % of the patients. The injury was found at the level of C5-6 in 53.3% of the patients. The type of the trauma, injury level and the type of the fracture arc shown in Table I.

There was moderate or severe neck pain in all patients. At the initial neurological examination, 2 patients were graded as Frankel A.

Traction was applied to all of the patients for 3-10 days. Reduction was provided in 12 cases with traction. Open reduction was done in 3 patients. In 2 patients, two different surgical intervention, first anterior and then posterior stabilization was performed. The treatment methods and pre-postoperative neurological findings are shown in Table II.

Hospitalization period was varied from 14 to 35 days. The longer period was belonging to the patient who have had two surgical interventions.

All of the patients except one in Frankel A, showed some improvement postoperatively. 9 cases were found in Frankel E at their 3rd month.

In none of the patients, no complication with wire or graft was occurred postoperatively. Only in 2 patients, infection developed at the iliac crest.

9 patients (60%) were painless, 1 (6.6%) had a moderate neck pain at the follow up period. 5(33.3%) complained of mild neck pain relieved with simple analgesics.

Collar was removed between 4th and 6th months. Flexion-extension radiograms were obtained six months later. 2 mm dislocation was seen in 1 patient who have had anterior and posterior stabilization (Fig. 2). Flexible kyphosis was found in 1 patient. They both have had no complaint and there wasn't any other complications postoperatively.



Fig.2: Slight redislocation of the patient who have had anterior and posterior fusion and interspinous wiring, at 6th month postoperatively.

DISCUSSION

To attain to the purpose of the treatment in cervical dislocations depends on the continuity of the stabilization maintained with reduction at the beginning in cervical alignment.

Reduction can be done closed in the majority of the patients. This method has the advantages of the patient being awake and following the ability of the neurolog-

Case No.	Age	Type of trauma	Level of injury	Type of fracture
1	43	traffic accident	C5-C6	Fracture-dislocation
2	38	"	C6-C7	"
3	21	diving	C4-C5	Dislocation
4	23	"	C5-C6	Fracture-dislocation and C5 slight comp
5	35	traffic accident	C5-C6	Dislocation
6	35	"	C4-C5	Fracture-dislocation
7	36	"	C5-C6	Dislocation
8	33	"	C5-C6	Fracture-dislocation
9	37	Fall	C6-C7	"
10	19	diving	C5-C6	Fracture-dislocation and C5 severe comp.
11	36	traffic accident	C6-C7	Fracture-dislocation
12	48	"	C5-C6	Dislocation
13	40	"	C5-C6	Fracture-dislocation and C5 severe comp.
14	24	"	C6-C7	Fracture-dislocation
15	36	"	C3-C4	Fracture-dislocation

Table I: Type of trauma, level of injury and type of fracture in the patients with cervical injury.

Case No.	Initial Neurologic Grade	Type of Treatment	Neurologic grade in Postop. 3rd months
1	Frankel B	OR+PF+ISW	Frankel E
2	Frankel C	OR+PF+ISW	Frankel E
3	Frankel C	CR+PF+ISW	Frankel D
4	Frankel B	CR+PF+ISW	Frankel D
5	Frankel C	CR+PF+ISW	Frankel E
6	Frankel D	CR+PF+ISW	Frankel E
7	Frankel C	CR+PF+ISW	Frankel D
8	Frankel E	CR+PF+ISW	Frankel E
9	Frankel D	OR+PF+ISW	Frankel E
10	Frankel A	CR+AF+PF+ISW	Frankel A
11	Frankel A	CR+PF+ISW	Frankel A
12	Frankel D	CR+PF+ISW	Frankel E
13	Frankel B	CR+AF+PF+ISW	Frankel C
14	Frankel E	CR+PF+ISW	Frankel E
15	Frankel D	CR+PF+ISW	Frankel E

Table II: Preoperative and postoperative neurologic grades and the type of treatment in the patients with cervical dislocation or fracture-dislocation.

OR: Open reduction, CR: Closed reduction, PF: Posterior fusion, AF: Anterior fusion, ISW: Interspinous wiring.

ic findings easily and carefully. Reduction may be done open or closed with a kind manipulation, if closed reduction is failed with traction (3,17,18). We prefer open reduction in these patients.

Various techniques are used in posterior cervical stabilization a method which is used in the purpose of preventing redislocation and carrying on the reduction (4,10,12,14,17,21). Acrylic is a material used in posterior fusion other than bone graft (4,10, 21). It might be separated from the bone and by resulting with motion in that region it might cause the breakage of wire and spinous processes and instabilization might be seen (10,21). Because of these causes we prefer autogen bone graft in fusion.

Internal stabilization was done with a wire passing through spinous processes in our cases. This method is simple and has no risk in spite of neural structures. Breakage and difficulties in the control of twisting the wire may be counted as disadvantages of this method. The wire through facets and passing sublaminar are also recommended (12,21). It must not be forgotten that sublaminar technique has got the risks of neural injury (2,10). More rigid devices are used for internal fixation, also, and they have increased risk of neural injury (6,8,12,14).

We do not prefer anterior fusion alone for stabilization in cervical dislocations. But, we perform both anterior and posterior stabilization in the patients with anterior compression on the cord or with prominent vertebral compression fracture of corpus is accepted as a cause of excessive instability in these cases.

Prognosis in patients with cervical dislocation depends on the width of the initial injury. Following cervical trauma, various neurological findings can be observed. The most important factor affecting the neural status is the diameter of the cervical spinal canal (11). Our patients with incomplete lesions showed progressive improvement, but no significant difference was found in patients with complete lesions postoperatively. In complete myelopathies generally results are similar except improvement in the functions of one or two roots.

In the conservative treatment, chronic pain and

long hospitalization period may be additive problems (2). We did not have such problems mentioned above in majority of our patients with posterior fusion.

In general, no significant complication was seen after posterior fusion and interspinous wiring. Breakage of the wire or spinous processes can be repaired with the same or multiple level stabilizations. Hyperextension which the result of excessive twisting of wire or development of flexible kyphosis are not important problems in general (2,9). Hyperextension is decreased when the wire is twisted upon the bone graft which is placed between spinous processes.

In summary, posterior stabilization of the cervical spine appears to be a good surgical technique which would prevent spinal cord injury resulting from instability of cervical vertebra and decrease the chronic pain and shorten the hospitalization period.

REFERENCES

- 1 . Allen RL- Perot PL, Gudeman SMK: Evaluation of acute nonpenetrating cervical spinal cord injuries with CT metrizamide myelography. *J. Neurosurg* 63:510-520,1985.
- 2 . Benzel EC, Kesterson L: Posterior cervical interspinous compression wiring and fusion for middle low cervical spinal injuries. *J Neurosurg* 70: 893-899,1989.
- 3 . Borne G, Bedou G, Pinaudeau M et al: Treatment of severe lesions of the lower cervical spine (C3-C7). *Neurochirurgia* 31:1-13,1988.
- 4 . Branch CL, Kelly DL, Davis CH, et al: Fixation of fractures of the lower cervical spine using methylmethacrylate and wire: Technique and result in 99 patients. *Neurosurg* 25 (4): 503-513, 1989.
- 5 . Bucci MN- Dausch RC, Maynard FA- Hoff JT: Management of posttraumatic cervical spine instability: Operative fusion versus Halo vest immobilization. Analysis of 49 cases. *J Trauma* 28(7): 1001-1006,1988
- 6 . Caspar W, Barbier DD, Klara PM: Anterior cervical fusion and Caspar Plate Stabilization for cervical trauma. *Neurosurg* 25 (4): 491-502,1989.
- 7 . Cooper PR, Maravilla RR, Sklar FH, et al: Halo immobilization of cervical spine fractures, *kj. Neurosurg* 50:603-610,1979.
- 8 . Cybulski GR: Methods of surgical stabilization for metastatic disease of the spine. *Neurosurg* 25(2): 240-251,1989.
- 9 . Donovan !H, Kopaniky D, Stolzmann E, Carter RE: The neurological and skeletal outcome in patients with closed cervical spinal cord injury. *J. Neurosurg* 66:690-694, 1987.
- 10 . Duff JA: Surgical stabilization of traumatic cervical spine dislocation using methyl methacrylate. *J. Neurosurg* 64: 39-44,1986.
- 11 . Ersmark H, Lowenhielm P: Factors influencing the outcome of cervical spine injuries. *J. Trauma* 28(3):407-410,1988.
- 12 . Garfin SR, Moore Mr, Marshall LF: A modified technique for cervical facet fusions. *Clin Orthop and Relat Researh* 230: 149-153,1988.
- 13 . Hamel E, Karimi-Nejad A, Frowein RA, et al: Results of conservative and surgical early treatment of cervical spine injuries. *Advances in Neurosurgery*, Vol 4 Springer Verlag 1977, pp 185-190.
- 14 . Holness RO, Huestis WS, Howes Wj, Langille RA: Posterior stabilization with an interlaminar clamp in cervical injuries: Technical note and review of the long term experience with the method. *Neurosug* 14(3): 318-322,1984.
- 15 . Maynard FM, Reynolds GG, Fountain S, et al: Neurological prognosis after traumatic quadriplegia. *J. Neurosurg* 50: 611-616,1979.
- 16 . Miller MD, Gehweiler JA, Martinez S, et al: Significant new observations on cervical spine trauma. *Am J Roentgenol* 130: 659-663,1978.
- 17 . Sabiston CP, Wing PC, Schweigel JF, et al: Closed reduction of dislocations of the lower cervical spine. *J Trauma* 28(6): 832-835,1988.
- 18 . Sonntag VKH: Management of bilateral locked facets of the cervical spine. *Neurosurg* 8(2): 150-152,1981.
- 19 . Wagner FC, Chehrazi B: Early decompression and neurological outcome in acute cervical spinal cord injuries. *J. Neurosurg* 56:699-705,1982.
- 20 . Van Petegham PK, Schweigel JF: Fractures of the cervical spine rendered unstable by anterior cervical fusions. *J Trauma* 19:110-1979. 21 . Whitehill R, Cicoria AD, Hooper WE, et al: Posterior cervical reconstruction with methyl methacrylate cement and wire: A clinical review. *J Neurosurg* 68: 576-584,1988.