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Role of Lateral Mass Fixation in Cervical Spondylotic Myelopathy

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Abstract

Objective: Lateral mass plate and screw are very useful in patients with degenerative cervical canal stenosis who needed posterior decompressive laminectomy and fusion of the cervical spine. This study demonstrated the safety, surgical efficacy, and advantage of this system and compared the surgical results and outcome of combined decompressive laminectomy and lateral mass fixation with those patients who had only decompressive laminectomy.

Patients and methods: A prospective study on 60 patients with cervical myelopathy due to multi-level stenosis, who presented to neurosurgical departments at Cairo University, Egypt and Hospital and King Fahd Hospital, Al-Madinah, Saudi Arabia. The patients were divided into two groups group (A) at which 30 patients were managed by decompressive laminectomy alone, and group (B) 30 patients were managed by decompressive laminectomy supplemented the lateral mass fixation of the cervical spine. The patients were followed up clinically and radiologically immediately post-operative and every 3 months at out patients clinics for at least one year.

Results : There were 31 males and 29 females patients with a mean age of 52 years. All patients suffered from clinical manifestations of cervical Spondylotic radiculo-myelopathy in the form of spastic lower limbs and neck pain in 100% of cases, followed by brachialgia in 50% of cases in group A, and 70% in group B. motor deficits were detected in upper limbs in 75% in group A, and 85% in group B. sphincteric disturbances were noted in 8 cases in group A, and in 7 cases in group B. Nurick's myelopathy score was used to evaluate the functional status pre and post-operatively. The overall surgical results of the patients in group B showed better outcome than those in group A. There were no intraoperative remarkable complications, marked improvement was achieved in 57% of patients in group B, and in 33% in group A. No any patients deteriorated postoperatively.

Conclusion: The ultimate goal of surgical management of patients with cervical spondylotic myelopathy is to relieve the pain and to preserve or improve neurological deficits. The appropriate selection of the patients and sufficient surgical decompression with lateral mass fixation had been shown to be a safe and efficacious method to achieve satisfactory results in the treatment of degenerative cervical spondylosthenosis.

Key words: Cervical myelopathy - lateral mass - cervical spine - cervical fusion.

Introduction

CERVICAL spondylotic myelopathy is the most common spinal disorder in persons over 55 years of age in the entire world [6]. The pathogenesis of cervical spondylotic myelopathy is incompletely understood, yet the influence of certain factors is well established [8]. An important predisposing factor is the constitutive size of the spinal canal [26]. Other mechanical factors that cause compression of the cord may be grouped

under static elements as large posteriorly projecting osteophytes or sharp spurs from an ossified posterior longitudinal ligament, or dynamic elements as infolding of thickened, inelastic ligamentum flava during extension, and antero-or retroluxation of the vertebral bodies [18,9]. Vascular factors have been implicated in the pathogenesis of myelopathy, but the ischemic etiology seems to come only in the end stage of the disease [6]. There are two fundamental attributes of

an ideal surgical procedure to ameliorate the symptoms of cervical spondylotic myelopathy. First, the procedure should decompress the entire longitudinal extent of the involved portion of the cervical spine. Second, it should offer stabilization of the spine [3]. Decompressive laminectomy is indicated in patients with three or more level stenosis with no major focal anterior cord compression with maintained cervical lordosis. Laminectomy alone relieve the static factor of cord compression, but it does not relieve the dynamic factor i.e hypermobility at higher level, which may lead to instability on long term outcome and more deterioration of the condition which is reported in post-operative outcome in many series [2,4,5,21,22,25]. When internal fixation with lateral mass is added to decompressive laminectomy the outcome was improved [3,7,11] because posterior cervical segmental instrumentation is useful to immobilize the segment and allow for fusion to occur. The posterior cervical plate fixation introduced by Roy-Camille [24] consists of plates applied bilaterally along the posterior elements with screws inserted into the articular masses of the spinal segments to be stabilized. The principal advantage of posterior cervical plating over wiring techniques is immediate stability and superior strength of fixation. Posterior plates can also use when the lamina or spinous processes are deficient and may allow for a shorter fusion length than conventional wiring [12]. The screw fixation occurs in close proximity to the vertebral artery, nerve root, and spinal cord, which are at risk for injury at each level stabilized. There are few contra-indication for posterior cervical lateral mass fixation as in patients with osteoporosis, metabolic bone disease, ankylosing spondylitis where the bone is soft, and focal anterior compression of the spinal cord by bone, disc, or soft tissue table [1]. In our

study comparison between decompressive laminectomy alone and decompressive laminectomy combined with lateral mass fixation was done on the study of 30 patients of each group to determine the role of lateral mass fixation in preventing and/or reducing the progression of the disease and improvement of the final outcome.

Patients and methods

This is a study of 60 patients with cervical myelopathy due to multi-level stenosis, 30 patients of them were managed by decompressive laminectomy alone (group A), 30 patients were managed by decompressive laminectomy supplemented with the lateral mass fixation of the cervical spine (group B). These patients all suffered cervical myelopathy or cervical radiculopathy in combination with sever degenerative changes due to sever cervical spondylosis, multiple degenerative disc disease and degenerative facet arthrosis. Posterior cervical decompression and stabilization are indicated in patients with sever spondylotic changes in which dynamic radiographs suggest segmental instability. Comparison study of the outcome of both groups was done. The patients were admitted From January 1999 to December 2001 in two neurosurgical centers, at al Kasr Al-Eini, Cairo University, and King Fahd Hospital, Al-Madinah Al-Munawarah, Saudi Arabia. All patients were subjected to full neurological examinations. Plain X-ray and cervical MRI were done for all patients. Pre-operative grade of myelopathy and functional status was determined using Nurick's scale table [2]. Post-operatively, the patients was followed up as regard to radiological and clinical status immediately post-operatively and every 3 months to one year. Myelopathy grade & functional status were determined, follow up plain X-rays were done to check screws positions and any changes in spinal alignment.

Operative details

The critical technical aspect of posterior cervical plating is the safe placement of screws into the lateral mass with a screw length sufficient for maximal fixation [14]. In all our patients cervical CT scan of the levels to be instrumented were reviewed to determine the specific location and orientation of the neural foramen and the vertebral artery. All the patients in group A&B were operated upon for slandered posterior cervical exposure, laminectomy by drilling two gutters on both sides of the lamina till thin shell of bone was reached which removed en-bloc after cutting the ligamentum flavum to minimize cord injury. Foraminotomy was done when required. Group B: adding lateral mass fixation using screws and plates system (Axis from Medtronic Sofamor-Danek, Memphis, TN, USA). The screw entry point was identified 1 mm below and medial to the center of the facet using the technique described by Margel with 20 degree lateral and 20 degree cranial angulation's parallel to the joint line to avoid injury to the vertebral artery and spinal nerve root [10,14]. The screw length ranged from 12 to 16 mm with 3.5mm in diameter. A bony fusion was done using bony fragments from lamina and was placed inside facet joint after curetting the cartilaginous articulation surface. Post-operative hard collar was used for 2 months.

Results

This study includes 60 patients in 2 groups, group A: - includes 30 patients were operated upon by decompressive laminectomy alone. Group B:- includes 30 patients

were operated upon by decompressive laminectomy plus lateral mass fixation. The clinical characters described in table [3], there was no any remarkable variation as regard to sex, age, in both groups, and the duration of symptoms ranged from 1 to 3 years in both groups. Heaviness in both lower limbs was the commonest symptoms. Spasticity occurred in all patients in both groups. Lordotic curve in plain X-rays in all patients with group A and in 19 patients in group B. extensive spondylotic changes was present in all patients in both groups. MRI cervical spine revealed three levels stenosis or more in all patients in both groups, the commonest level was C3-C6 in 50 patients. Cord signals in MRI was present in 6 patients in group A and in 9 patients in group B. post-operative results showed relieved of neck pain in 15 patients in group A and in 28 in group B, improvement of brachialgia occurred in 70% and 90% in group A and B respectively. Immediate improvement of motor power occurred in 20 patients in group A and in 26 patients in group B. spasticity improved in 22 in group A and in 27 patients in group B. evaluation of the post-operative myelopathy was carried out immediately and every 3 months, using Nurick's myelopathy grading. The final evaluation was determined after 1 year. The overall improvement was seen better in group B more than group A table [4,5]. Follow up plain X-rays revealed progressive kyphosis in 6 patients in group A. no any patients in group B showed this change in cervical curve.

Table [1]

Contraindication for cervical lateral mass fixation
• Active local or systemic infection
• Significant risk of infection (immunocompromise)
• Shortened life expectancy
• Debility
• Mental incompetence
• Poor bone quality (osteoporosis, osteomalycia, osteodystrophy, etc)
• Anatomic constraints (congenital anomalies, sever kyphosis, childhood)

Table 2

Nurick's Grades of disability in Spondylotic myelopathy	
Grade	description
Grade 0	Root manifestations without cord affection
Grade 1	Signs of cord affections Normal gait
Grade 2	Mild gait impairment
Grade 3	Moderate gait impairment without assistant
Grade 4	Ambulatory with assistant
Grade 5	Bed ridden or chair dependant

Table 3

Clinical presentation of the patients		
Symptoms & signs	Group A No.30 patients	Group B No.30 patients
Neck pain	30 (100%)	30 (100%)
Brachialgia	15 (50%)	21 (70%)
Heaviness in both L.L.	26 (87%)	27 (90%)
Motor deficits	23 (75%)	26 (85%)
Spasticity	30 (100%)	30 (100%)
Sphincteric dysfunction	8 (27%)	7 (24%)

Table 4

Surgical outcome evaluation by Nurick's Myelopathy grade in group B		
Grade	Pre-operative	Post-operative
Grade 0	----	----
Grade 1	----	17 (57%)
Grade 2	16 (53%)	9 (30%)
Grade 3	8 (26%)	4 (13%)
Grade 4	6 (20%)	1 (3%)
Grade 5	----	----

Table 5

Surgical outcome evaluation by Nurick's Myelopathy grade in group A		
Grade	Pre-operative	Post-operative
Grade 0	----	----
Grade 1	----	10 (33%)
Grade 2	18 (60%)	7 (23%)
Grade 3	7 (23%)	8 (26%)
Grade 4	5 (16%)	6 (20%)
Grade 5	----	----



Fig. (1): Preoperative plain X-ray showing sever spondylotic changes.

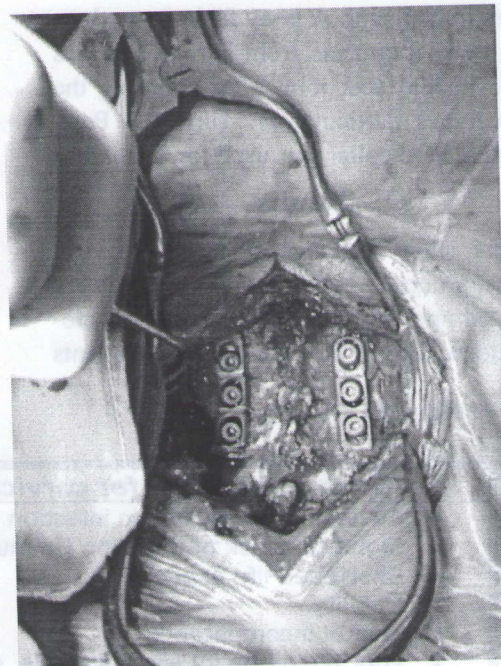


Fig. (2): Intra-operative picture showing screws and platas in place.

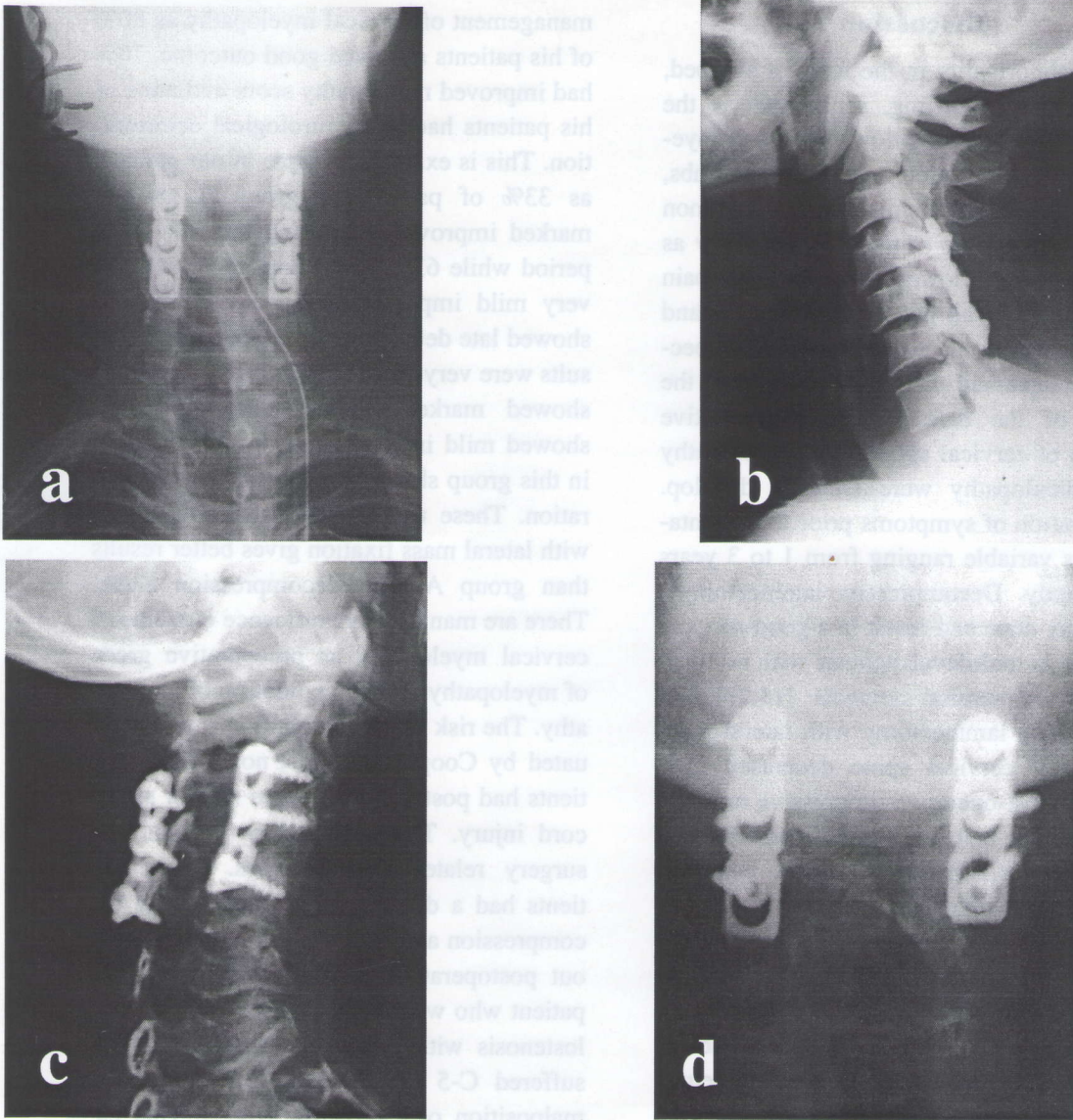


Fig. (3 a, b c, d): Postoperative plain x-ray showing plates and screws in position.

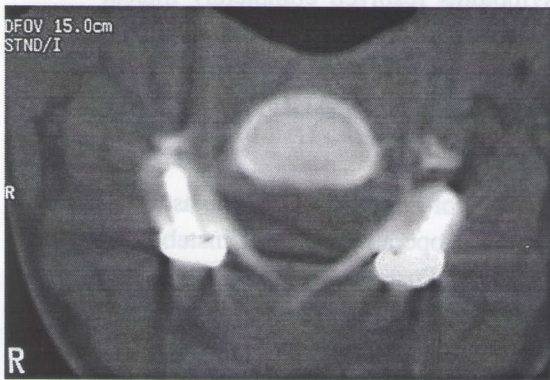


Fig. (4): Postoperative axial C.T scan showing perfect position of screws.



Fig. (5): Postoperative axial C.T scan showing malposition of RT screw irritated the corresponding nerve root.

Discussion

Gait abnormality in the form of stooped, short-stepped, shuffling, senile gait is the most common presentation of cervical myelopathy due to spasticity of the lower limbs, neck pain and brachialgia are less common [11,23]. This is the same with our study as spasticity in both lower limbs, but neck pain were elicited in all patients, while 50% and 70% of patients in group A and B respectively complained of brachialgia during the course of the disease. The degenerative changes of cervical spondylotic myelopathy and radiculopathy were slow to develop. The duration of symptoms prior to presentation was variable ranging from 1 to 3 years in our study. Decompressive laminectomy may be done and result in a good surgical outcome in multilevel stenosis with no focal anterior compression elements [15,23]. Decompression laminectomy with lateral mass fixation of cervical spine decreased incidence of post-operative progressive myelopathy and give better results in long term follow up [7,18,14]. Some authors conclude that patients with cervical myelopathy due to multi-level affections managed by decompressive laminectomy alone may lead to more cervical instability with kyphus formation on long term follow up which leads to unsatisfactory results & progressive neurological deterioration [11,12,15,24]. The role of laminectomy alone as an etiology of post-operative cervical instability is well known [15,16]. The study of the relation between postoperative instability and poor outcome or deterioration of improved patients is reported at many series [13,17,20,22,25]. Vonenbue et al [27] reported that 32% of his laminectomy patients deteriorated and in 57% of these patients instability was the cause of poor outcome. Decompressive laminectomy and lateral mass fixation give improvement of 95% as in Gonzales-ferral study during follow up period of 1 to 7 years [13]. Kumar et al in 1999 [17] confirmed the improvement role of internal fixation in the

management of cervical myelopathy as 80% of his patients achieved good outcome, 70% had improved myelopathy score and none of his patients had late neurological deterioration. This is exactly the same in our patients as 33% of patients in group A showed marked improvement during the follow up period while 63% of patients experienced a very mild improvement, and two patients showed late deterioration. In group B the results were very promising as 57% of patients showed marked improvement, and 46% showed mild improvement, no any patients in this group showed post-operative deterioration. These results confirm that group B with lateral mass fixation gives better results than group A with decompression alone. There are many factors influence outcome of cervical myelopathy as preoperative grade of myelopathy, and long duration of myelopathy. The risk of neurologic injury was evaluated by Cooper et al, [5] none of his patients had postoperative nerve root or spinal cord injury. There were four patients had surgery related complications. Three patients had a dural tear occurred during decompression and was repaired primary without postoperative remarkable squeals. One patient who was treated for marked spondylosthenosis with relative cervical instability, suffered C-5 dysesthesias secondary to a malposition of C-5 screw (fig.5). This patient was reoperated for screw revision, and his symptoms resolved completely thereafter. In many series there was no complications or morbidity related to placement of instrumentation [1,5,7,10,11,19,24].

Conclusion

The role of laminectomy alone as an etiology of postoperative cervical instability is documented. Posterior cervical fixation in which lateral mass screws and plates or rods are placed had been shown to be an ideal, safe and efficient method to overcome long term complications of cervical decompressive procedure.

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