

Outcome of Cloward Technique in Cervical Disc Prolapse

Lal Rehman, Hina Abdul Qayoom Khan and A. Sattar M. Hashim

ABSTRACT

Objective: To determine the association of pre-operative assessment of MRI findings, neurological status and symptoms with postoperative Cloward surgical outcome in cervical disc prolapse.

Study Design: Descriptive study.

Place and Duration of Study: The Neurosurgery Department of Jinnah Postgraduate Medical Centre (JPMC), Karachi, from May 2008 to May 2009.

Methodology: Patients presenting with neck pain, brachialgia, limb weakness and spasticity were clinically examined for pre-operative neurological status of power, reflexes and sensation. The exclusion criteria were, cervical disc prolapsed patients, planned for smith–Robinson and micro-discectomy, traumatic cervical disc prolapse and cervical spondylosis. Neuroradiological investigations included cervical spine X-rays and MRI. All patients were surgically treated for cervical prolapsed intervertebral disc with anterior cervical discectomy and interbody fusion with Cloward technique. Postoperative neck immobilization was done with cervical collar for 7-8 weeks. Drain was removed on first postoperative day while check plain cervical X-rays were taken on third day. Results were analysed using chi-square test with significance at $p < 0.05$.

Results: There were 30 patients including, 27 (90%) males and 03 (10%) females with mean age of 44.3 years. The commonest symptom was neck pain. The duration of symptoms ranges from 2 to 6 months. On MRI, prevalent levels of cervical disc prolapse were C 5-6 (43.3%) and C 6-7 (23.3%); 26 (86.6%) patients had disc herniation causing thecal effacement with cord compression and 04 (13.3%) patients showed ischemia of cord. Single-level Cloward surgery done in 26 (86.3%) patients while two-level Cloward surgery performed in 04 (13.3%) only. About 83.3% patients improved and 13.3% did not while 01 patient was re-operated. No complications and mortality was related to the surgical procedure. Statistically different variables identified, related to outcome were pre-operative neurological status ($p=0.001$) and spinal cord involvement on MRI ($p=0.001$).

Conclusion: Cloward technique for cervical disc prolapse was simple and safe surgical procedure with favourable results and few complications; 100% fusion occurred after Cloward surgery, even without instrumentation. Outcome was significantly affected by pre-operative neurological status and cord involvement.

Key words: Cloward procedure. Cervical spine fusion. Cervical disc herniation. Pre-operative neurological status. MRI.

INTRODUCTION

Cervical spine bears the weight of head, transmits load, allows motion and protects the spinal cord. A stable cervical spine will be able to undergo physiological displacement without cord or root injury, while an unstable spine gives rise to deformity, pain and also may damage spinal nerves and cord.¹

The intervertebral disc and adjacent vertebrae undergo changes with age. The annulus fibrosus becomes thin, radial slits appear in it and allows the nucleus to bulge and even rupture through, resulting in disc prolapse. Progressive disc space collapse allows further movement which exerts strain on apophyseal joints, associated with ligament hypertrophy. Bulging peripheral fibers of annulus may get calcified and form osteophytes, leading to further narrowing of canal. Before 1950,

surgery in the cervical spine was primarily performed with a posterior approach. Bailey and Bagley performed the first anterior cervical spine stabilization with an onlay fusion in 1952. The classical technique for spinal stabilization by graft fusion through anterior approach was advocated by Smith and Robinson in 1955,² and Cloward in 1958,³ to release the symptoms of cervical disc disease. Since the advent of the anterior approach by Smith-Robinson and Cloward, numbers of modifications have been undertaken by spinal surgeons to get better results.⁴ Anterior interbody fusion after the removal of intervertebral disc and osteophytes is an accepted mode of treatment for cervical disc prolapse and degenerated discs.⁵ Some use miniplates to prevent dislodgement of the graft after cervical disc removal.⁶ Some have shown good results after using titanium cage after cervical anterior decompression.⁷

The general symptoms are cervical pain, and a shift in posture in an attempt to counteract the first, limb weakness, spasticity and brachialgia. Pressure on the spinal nerves can result in radiculopathy and radiculomyelopathy, sensory dysfunctions and motor deficits. Plain radiographs and MRI are required for the diagnosis of disc prolapse and MRI is the cornerstone in diagnosis.

Department of Neurosurgery, Jinnah Postgraduate Medical Centre, Karachi.

Correspondence: Dr. Lal Rehman, Assistant Professor,
Department of Neurosurgery, Jinnah Postgraduate Medical Centre, Karachi.

E-mail: drlalrehman@yahoo.com

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Postoperatively, there is a risk of hematoma, infection, damage to local structures (esophagus, trachea) and recurrent laryngeal nerve. Postoperative pain in iliac crest may often incapacitate the patient for several days. Drain is kept to prevent hematoma formation. Cervical collar is applied for few weeks for the restriction of movements. Relaxation exercises should be included and applied in the management of neck pain which improve the outcome and decrease the hospital stay.⁸

Keeping in view these different modalities of treatment in mind, the objective of this study was to find out the role of Cloward technique in the prolapsed cervical disc and determine the association of pre-operative factors with surgical outcome.

METHODOLOGY

This descriptive study comprised patients of either gender with cervical prolapsed disc who underwent Cloward surgery, from May 2008 to May 2009, in the Neurosurgery Department of Jinnah Postgraduate Medical Centre, Karachi. Patients with recurrent disc and with traumatic cervical disc were excluded. Details of age, gender, presenting complains, neurological status for power, reflexes and sensation, MRI findings and surgical outcomes were entered on the proforma for analysis. Plain radiographs of the cervical spine and MRI were done in all cases. MRI was used to assess the level of prolapsed inter vertebral disc and compression of the cord and roots and any changes in the spinal cord. Those patients underwent single or two-level Cloward fusion with a trimmed iliac graft harvest. The outcome of surgery was evaluated in all patients in

terms of neurological improvements. Postoperatively, drain was removed on first day; check X-rays were done on third day to see the graft placement and its height. Post-operative symptoms complaints were defined as no, mild or moderate complaints.

The data were analyzed with the help of SPSS, version 12. The association of pre-operative assessment of neck pain, brachialgia and limb weakness with postoperative outcome was determined with the help of chi-square test of proportions. The effect of age group, MRI findings, pre-operative neurological status with the postoperative surgical outcomes was tested by Pearson's chi-square test. The results were significant with $p < 0.05$.

RESULTS

There were 30 patients, scheduled for the Cloward surgery during the study period. Among them, 27 (90%) were males and 03 (10%) were females. Male to female ratio was 9:1. The mean age at presentation was 44.3 years ranging from 20 to above 60 years. There were 13.3% (n=4) patients aged 20-30 years, 30% (n=9) patients aged 31-40 years, 33.3% (n=10) patients aged 41-50 years, 20% (n=6) patients aged 51-60 years, and 3.3% (n=1) patient above 60 years.

The average duration of symptoms was 2-6 months. The most common complaints were neck pain (n=30; 100%) patients, brachialgia (n=24; 80%) and limbs weakness (n=15; 50%). Pre-operative neurological status is shown in Table I.

Plain X-rays of the cervical spine (lateral and antero-posterior views) and MRI were done in all cases. On

Table I: Effect of different variables on surgical outcome in 30 patients.

Variables	Improved postoperatively	Not improved	Surgical failure	Total	Chi-square	p-value
Age						
20-30	04	0	0	04 (13.3%)	4.9	0.758 Not Significant
31-40	08	01	0	09 (30%)		
41-50	08	01	01	10 (33.3%)		
51-60	04	02	0	06 (20%)		
> 60	01	0	0	01 (3.3%)		
MRI findings						
Thecal effacement and cord Compression:	25	0	0	25 (83.3%)	30.0	0.001 Significant
Cord ischemia	0	04	01	05 (16.6%)		
Preoperative: Neurological status						
Power						
0/5	0	02	01	03 (10%)	30.650	0.001 Significant
1/5	0	01	0	01 (3.3%)		
2/5	01	01	0	02 (6.6%)		
3/5	05	0	0	05 (16.6%)		
4/5	19	0	0	19 (63.3%)		
Reflexes						
Normal	20	01	0	21 (70%)	19.464	0.001 Significant
Brisk	05	01	0	06 (20%)		
Mute	0	02	0	03 (10%)		
Sensation						
Intact	23	0	0	23 (76%)	0.923	0.001 Significant
Decrease	02	04	01	07 (23.3%)		

Table II: Surgical outcome in patients operated with Cloward technique.

Pre-operative assessment	Postoperative outcome			Chi-square	p-value
	No complain	Mild complain	Moderate complain		
Neck pain (n=30)	25 (83.3%)	05 (16.6%)	0 (0%)	52.50	0.001
Brachialgia (n=24)	19 (79.1%)	04 (16.6%)	01 (4.1%)	34.88	0.001
Limbs weakness (n=15)	10 (66.6%)	03 (20%)	02 (13.3%)	11.40	0.003

MRI basis, levels of cervical (C) disc prolapse were 3.3% (n=1) each at C2-C3, at C3-C4, between C3-C4 and C5-C6, and at C4-C5 and C5-C6, 13.3% (n=4) had at C4-C5, 43.3% (n=13) at C5-C6, 6.6% (n=2) between C5-C6 and C6-C7 while 23.3% (n=7) at C6-C7. According to the MRI, 86.6% (n=26) patients had disc herniation causing thecal effacement with cord compression only, while 13.3% (n=4) patients had ischemia and edema of cord.

All patients underwent single or double-level Cloward fusion. In 93% (n=28) patients, left sided incision was given. Transverse incision was made in 26 (86.3%) patients and oblique type in 04 (13.3%).

Single level Cloward done in 86.3% (n=26), while there were 13.3% (n=04) cases of two-level Cloward. Following the procedure, vertebral arthrodesis was achieved by using an iliac auto graft in all the patients. There was no post-operative mortality. A stable fusion was achieved in 83.3% (n=25) patients. No instrumentation was performed in those patients.

As for as the outcomes of Cloward surgery is concerned, 83.3% (n=25) patients had significant improvement, i.e. no neck pain, 79.1% (n=19) no brachialgia and 66.6% (n=10) with no limbs weakness, and in one of them, re – do surgery was done, 13.3% (n=4) patients had cord changes in the form of ischemia and showed poor recovery.

There was no postoperative cerebrospinal fluid leak, hematoma, infection or recurrent laryngeal nerve damage. An early mobilization was achieved in 25 patients, with the neck movements restricted by cervical collar for 6-8 weeks. On third postoperative day, lateral cervical X-rays were taken in all patients, which revealed that the bone graft was properly placed and there was no listhesis. Overall hospital stay was one week.

The age (p=0.758) and gender had no bearing on outcome being statistically not significant, neither did the duration of symptoms. The pre-operative neurological assessment (p=0.001) and MRI findings (p=0.001) had a statistically significant effect on outcome, as shown in Table II.

DISCUSSION

In 1958, Cloward described the anterior cervical decompression and interbody grafting as it is generally performed.³ The approach was easy to perform and provided a wide exposure. The anterior spine could be decompressed and stabilized in one operation. Several

authors. have reported the results of anterior cervical decompression and fusion in patients with cervical disc disease.^{3,9} The Cloward anterior interbody fusion is often employed for treatment of cervical degenerative disease.

In the present study, there are 90% (9:1) male patients outnumbered the female counterpart. Therefore, it is seen that males are prone to the cervical disc herniation as shown by Jensen *et al.*¹⁰

The susceptibility of disc prolapse increases with age being common in the middle age. According to one study the average age was 57.01 years.¹¹ In the present patients the average age was 44.3 years. The duration of symptoms was 2-6 months while Jeffreys reported 12 months in 53.4% and less than 12 months in 46.6%.¹¹

According to Jeffrey *et al.*,¹² myelopathy was present in 42%, radiculopathy in 41%, a combination of myelopathy and radiculopathy in 14%, and neck pain alone in 3%. According to another study, the most common presenting symptoms were pain, weakness, and radiculopathy; 88% of patients had neurological complaints and almost all patients presented with two or more than two symptoms. In the present study, neck pain was present in all patients, brachialgia in 56.6% and limb weakness in 50%.

Plain X-rays and MRI must be done in all of the cases to find out the level of disc prolapse and associated features. MRI is the cornerstone for diagnosis, as it also gives information that how much the cord is affected, which is essential while predicting the prognosis. When mild to moderate cord compression is present on MRI, better post-surgical results can be achieved by the Cloward technique, with cord ischemia satisfactory outcome is to possible and even failure of surgery is likely. In this study, 83.3% (n=25) patients without cord ischemia improved while 13.3% (n=04) did not, and 3.3% (n=01) patient needed re-operation. Hence, MRI findings were statistically significant.

Cervical disc prolapsed is prevalent at the level of C5-C6 and C6-C7, due to the wide range of movements. Dubuisson *et al.* described 36 % of the lesions occurred at the C 5/6 level and 54% at the C 6/7 level.¹⁴ In the present study, 43.3% patients had disc herniation at C 5/6 level and 20% at C 6/7 level.

In the cervical spine, corpectomy partially compromises anterior spinal support segment, in this series of patients, after the Cloward procedure, this instability was managed by bone graft harvested from the iliac bone.

Jeffreys performed Cloward in 71.3% patients having one space operation, 27.8% two spaces and 9% three spaces; the C 4/5 and C 5/6 levels were the most frequent.¹¹ It showed that single level Cloward is practiced more as compared to multilevel. In multilevel Cloward technique, the risk of complications and failure of surgery is possible, but in the present study 100% results were achieved and no complications seen with double level. According to the literature, fusion rates decrease significantly in multilevel surgery and some authors recommend the addition of a plate system to improve the results.¹⁵ Heiko described multilevel fusion in 38.5% (n=10) with few complications.¹⁶ In one patient with a pre-operative cardiac disease, postoperative brady-tachyarrhythmia absolute necessitated pacemaker implantation. In 2 patients hematoma at the site of iliac crest graft harvesting, postoperative dysphagia was observed in 4 patients and hoarseness in 3 patients. The mean fusion rate for 348 patients in the study Cauthen *et al.*, ranged from 75% (multilevel) to 88% (one level), the complication rate was 0.1%.¹⁷

In all patients, the bone graft was snugly fitted by distracting the spine using manual traction. Autogenous bone graft, mostly harvested from iliac crest, is a gold standard in cervical arthrodesis. Smith and Robinson and Simmons *et al.* did not generally recommend osteophytes resection or discuss this point in detail;^{2,18} in contradistinction, Cloward believed it to be important.³ It is very important that all the disc material is removed, and the bone is removed from the endplate until punctate hemorrhage from cancellous bone is seen to achieve good incorporation of the graft.¹⁹ Cervical interbody fusion allows preservation of the physiological lordosis and stability of the cervical spine.

According to the Dubuisson *et al.*,¹⁴ patients presenting with radiculopathy had better outcome than those presenting with combined radicular and spinal cord involvement. In this series, 83.3% (n=25) patients had no postoperative neck pain, 79.1% (n=19) no brachialgia and 66.6% (n=10) with no limbs weakness after surgery, and in only one patient was re – do surgery done. This was a very satisfactory outcome.

In Cloward technique, complicated infection is rare with prophylactic antimicrobial use. It is suggested that the incidence of unintentional laceration of the dura mater during spinal surgery might be as high as 14%.²⁰ Majority of them are repaired intraoperatively. Therefore, leakage of cerebrospinal fluid and secondary intracranial infection induced by incidental durotomy are rare. Postoperative pain in iliac region often incapacitated the patient for several days. Jeffreys¹¹ noted complications in 15 patients (14%) which painful hands in 05, 02 being worse immediately after operation, donor site infection in 3 and tear in vertebral artery, pneumonia, epilepsy, psychosis, and a bleeding duodenal ulcer in 01 each. Martin *et al.*, reported 9.4%

post-surgical kyphosis.²¹ In the present cohort of patients, there was not a single complication and no mortality related to the surgical procedure.

In a companion paper,¹¹ 108 patients operated for Cloward, among them, 10 patients required re - do operations i.e., 5 had a second Cloward's and 5 after an initial Cloward's operation, had a laminectomy. In this study only a single patient required re – do surgery.

Phillips found in a series of 102 patients with cervical spondylotic myelopathy, treated by either a Minerva collar, laminectomy or Cloward's operation, the best results were obtained by Cloward's operation with 73% showing sustained improvement and 58% returning to work.²² Erickson *et al.* found no compromise in safety and efficacy of anterior cervical discectomy and fusion when performed as an outpatient.²³ However, anterior cervical plating was not used in those series. There are many other techniques for cervical disc herniation, which are being used by the spinal surgeons like, Smith–Robinson's procedure, anterior cervical microforaminotomy, combination of different instrumentations to get satisfactory results. In Peolsson *et al.* prospective randomized study, he compared the outcome of anterior cervical decompression and fusion (ACDF) with a cervical intervertebral fusion cage (CIFC) and the Cloward procedure (CP). The fusion rate in CIFC group was only 55%, compared to 85% in CP group. There were no significant differences in any outcome variable between the two treatments. For both CP and CIFC the pain intensity improved. However, except for reduced donor site pain, preservation of lordosis, and a higher pseudarthrosis rate, he found the same clinical outcome with CIFC and the Cloward procedure.²⁴ In this series as well no instrumentation was performed and still 83.3% satisfactory results were acquired.

CONCLUSION

Cloward anterior cervical fusion for cervical spine disc disease is a relatively simple, inexpensive and safe surgical procedure with favourable results. In Cloward, the anterior cervical decompression and fusion is widely accepted safe and effective modality. The striking benefits of Cloward technique are an easy approach to spine, lack of implant requirement, few complications if at all, good postsurgical results, early patient mobilization and short hospital stay.

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