

ASSESSMENT OF OUTCOMES OF PATIENTS UNDERGOING DISC PRESERVING FUNCTIONAL CERVICAL DISC SURGERY

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Abstract

The concept of accelerated degeneration of adjacent disc levels as a consequence of increased stress caused by inter body fusion of cervical spine is widely accepted. These phenomenon supports the hypothesis that reconstruction of an intervertebral disc after discectomy with functional disc prosthesis would offer benefit. Degeneration of an intervertebral disc involves progressive dehydration and fibrosis of the nucleus pulposus. These modifications induce loss of elasticity, loss of intervertebral height, formation of osseous spurs, cracking and bulging of the annulus fibrosus, and eventually, extrusion of nucleus tissue. Hence based on above findings the present study was planned for Assessment of Outcomes of Patients Undergoing Disc Preserving Functional Cervical Disc Surgery.

The present study was planned in Department of Neurosurgery, SKMCH, Muzaffarpur, Bihar, India. Total 10 cases operated for cervical radiculopathy were enrolled in the present study. Diagnostic evaluation was performed by anterior posterior and lateral standard radiographs of the cervical spine and magnetic resonance imaging (MRI) evaluation of the cervical spine. All patients had follow up X-ray of the cervical spine anterior and posterior view with flexion and extension study, at 4 weeks and at subsequent follow up.

The data generated from the present study concluded that the major symptoms experienced by the patients were neck and radicular pain. C6-7 cervical root level was affected in majority patients. Majority of the had an excellent surgical results. Post operative follow up X-ray after 6 months revealed adequate motion at the operated site.

Keywords: Cervical Disc Surgery, Cervical radiculopathy, Disc preserving, Disc Herniation, etc.

Introduction

Anterior cervical discectomy (ACD) was described in the mid-20th century as a treatment for lateral cervical disc syndrome. [1, 2] This procedure involved removing the symptomatic disc from an anterior approach without placement of a bone graft. Early studies demonstrated fusion rates that were similar to those of procedures using bone graft. [2, 3] Multiple larger studies have also shown the ACD procedure to be safe and effective. [4, 5]

With the advent of ACD, anterior cervical discectomy and fusion (ACDF) techniques were simultaneously and independently popularized by Cloward [6] and Smith and Robinson. [7] ACDF similarly involves removing the symptomatic cervical disc with an added step of placing bone graft to encourage bony fusion of the upper and lower vertebral body. This added step has been argued to further encourage cervical fusion to maximize stability and maintain disc space height to decrease the likelihood of foraminal stenosis. [8] However, placement of a bone graft also introduces potential complications of graft dislodgement and failure, as well as donor-site complications if auto graft is used. Nonetheless, the ACDF technique has been found to have excellent long-term clinical outcomes. [9, 10]

The anterior cervical discectomy and fusion with instrumentation (ACDFI) technique involves the additional stabilization of the cervical spine with instrumentation. Early instrumentation involved wiring techniques. This was largely modified to cervical plate technology after their introduction and application in the 1980s. [11] Design has subsequently improved to now include constrained, no constrained, rotational, rigid, and dynamic plate subtypes. [12] Argued benefits of plate instrumentation include reduced graft dislodgements, increased fusion rates, and decreased foraminal stenosis. However, as with the introduction of bone graft, the additional placement of hardware introduces hardware-related complications.

Since their introductions, heated debates have compared ACD, ACDF, and ACDFI. Prospective randomized controlled trials have been performed that demonstrate similar clinical outcomes between the 3 groups, with a decreased rate of cervical fusion and increased incidence of kyphosis in the ACD group. [3, 13, 14, 15] Guidelines were also published in 2009. [16] Proponents and detractors for these different procedures can be found throughout the scientific and surgical community.

The purpose of this article is not to compare and contrast these different surgical techniques or plate technologies

but to highlight the role of these 3 procedures for treatment of cervical spine disease.

As mentioned above, ACD, ACDF, and ACDFI are different but very similar techniques for the surgical treatment of cervical spine disease. This article discusses the differences between these techniques.

When referring to the ACDFI technique, various plate technologies exist. These can be roughly categorized as rigid versus dynamic versus rotational, non constrained versus constrained, and rotational plating systems. Recent biodegradable and single-screw-per-vertebral body systems have also been introduced. The nuances of these plating systems are not discussed in this article.

When referring to the bone graft techniques, namely ACDF and ACDFI, surgical choices of using auto graft and allograft exist. The differences between these types of bone graft are not discussed.

The indications for ACD, ACDF, and ACDFI include cervical spine trauma and resulting instability, radiculopathy, myelopathy, osteomyelitis, spondylosis, vertebral body tumors, opacified posterior longitudinal ligament, and post laminectomy kyphosis.

Patient selection is important in complication prevention. Increased patient age, decreased bone density, and a positive smoking history can play a role in increasing complication rates. Additionally, an increase in the number of planned cervical levels to be decompressed can increase the complication risk.

Antibiotic infusions prior to skin incision should be used to decrease wound infection rates. Intraoperative fluoroscopic radiography should also be used to assess the cervical spine and facilitate proper hardware placement. An operative microscope that magnifies the operative field but also provides a strong light source is helpful. Intraoperative spinal cord monitoring has also been used as an effective measure for avoiding spinal cord and nerve root injury during surgical procedures.

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Since their introductions, heated debates have compared ACD, ACDF, and ACDFI. Prospective randomized controlled trials have been performed that demonstrate similar clinical outcomes between the 3 groups, with a decreased rate of cervical fusion and increased incidence of kyphosis in the ACD group. [3, 13, 14, 15]

Complications specific to ACD, ACDF, and ACDFI include hardware and graft failures, neurologic injury, and neck-related complications. [18]

Hardware complications involve failures related to instrumentation. Reported incidence rates are from 1%-20%. Hardware complications can include screw back out (2%-10%), plate fracture (2%), [20] screw breakage (1%-7%), [19, 20] , and plate migration (1%-3%). Graft fusion failures have also been described with an incidence that ranges from 3%-9%. Interestingly, plate length, increasing age, use of allograft, and a re operative procedure have been linked to a higher incidence of plate failure. [19]

Neurologic complications can also occur with cervical procedures. These include dural tears leading to cerebrospinal fluid leaks, spinal cord injuries, and nerve root injuries resulting in weakness (1%-5%) [19]. Complications related to neck surgery are also possible. Dysphagia due to oesophageal retraction and intubation has been reported to range from 4%-16%. [19] Postoperative neck hematoma causing airway obstruction has been reported. [19] Esophageal perforations can also occur, especially during the opening approach to the vertebral body.

The concept of accelerated degeneration of adjacent disc levels as a consequence of increased stress caused by inter body fusion of cervical spine is widely accepted. These phenomenon supports the hypothesis that reconstruction of an intervertebral disc after discectomy with functional disc prosthesis would offer benefit. Degeneration of an intervertebral disc involves progressive dehydration and fibrosis of the nucleus pulposus. These modifications induce loss of elasticity, loss of intervertebral height, formation of osseous spurs, cracking and bulging of the annulus fibrosus, and eventually, extrusion of nucleus tissue. Hence based on above findings the present study was planned for Assessment of Outcomes of Patients Undergoing Disc Preserving Functional Cervical Disc Surgery.

Methodology:

The present study was planned in Department of Neurosurgery, SKMCH, Muzaffarpur, Bihar, India. Total 10 cases operated for cervical radiculopathy were enrolled in the present study. Diagnostic evaluation was performed by anterior posterior and lateral standard radiographs of the cervical spine and magnetic resonance imaging (MRI) evaluation of the cervical spine. All patients had follow-up X-ray of the cervical spine anterior and posterior view with flexion and extension study, at 4 weeks and at subsequent follow up.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them.

Approval of the institutional ethical committee was taken prior to conduct of this study.

Following was the inclusion and exclusion criteria for the present study.

Inclusion Criteria: Cases of surgery were Unilateral cervical radiculopathy not responding to conservative treatment of more than 6 weeks (or earlier if patients exhibited profound weakness) and Imaging studies corresponding to the clinical features.

Exclusion criteria: Cases having presence of cervical spondylotic myelopathy symptom, Previous cervical spine surgeries and Multilevel disc prolapse.

Results & Discussion:

Cervical radiculopathy is the condition caused by the compression of cervical vertebrae. Cervical radiculopathy occurs due to the damage or disturbance of the nerve function in the nerve roots. Cervical radiculopathy is caused due to damage of nerve roots. Degenerative changes in bones, ruptured disc, arthritis and several other injuries that cause pressure on nerve roots leads to cervical radiculopathy.

Cervical radiculopathy is caused due to degenerative changes in the disc, in middle-aged people. The cause of cervical radiculopathy in young people is majorly due to ruptured disc. This disc further gets compressed or inflamed resulting in pain.

Cervical radiculopathy can be diagnosed with the help of radiography findings. The other tests that are used to determine cervical radiculopathy are electromyography, magnetic resonance imaging (MRI) and computed tomography myelography (CTM), as it helps in evaluation of disc ruptures and compressions.

Cervical radiculopathy can be treated with the combination of medications and physical therapies. Anti-inflammatory drugs such as corticosteroids and non-steroidal drugs are mostly used for the treatment of cervical radiculopathy. The doctor may prescribe these medications to consume orally or by injection. Physical therapies such as mobilization, exercise, and cervical traction are suggested by the doctor as it helps to reduce pain. In severe cases, surgery may also be suggested to relieve pressure from the nerves.

With established myeloradiculopathy, the management option for cervical disc prolapse is surgical decompression. Anterior cervical discectomy and ACDF is the standard surgical approach for cervical spondylotic myeloradiculopathy due to anterior thecal/nerve root compression. [20] Initial description of anterior approach for cervical discectomy always included bony fusion [21], which was popularized, by Smith and Robinson. [22-23] This was advocated to prevent the possibility of late

kyphosis from disc space collapse or radiculopathy from for amlinal narrowing. Arguments in favour of fusion include the potential for the development of for amlinal stenosis. Fusion stabilizes the spine and may prevent progressive deterioration due to instabilities. [24] The basic principle is that the bone graft between the involved interspaces gives inherent stability and allows fusion to occur even in degenerative situations. The anterior cervical decompression and fusion is now widely accepted as a safe and effective treatment modality for cervical disc herniation. Studies for this procedure have found this to be reproducible, with a high level of patient satisfaction. [25-26] There are several factors affecting the fusion rate of anterior graft including the type of graft [22] and the surgical technique. [27]

Table 1: Demographic Detail

Parameters	No. of Cases
Sex:	
Males	8
Females	2
Total	10
Age:	32 – 63 years

Table 2: VAS & Disc Height

Parameters	Pre Operative No. of Cases	Post Operative No. of Cases
VAS:		
No Pain	0	0
Mild Pain	0	10
Moderate Pain	0	0
Severe Pain	10	0
Disc Height:		
Less than 5 mm	0	1
5.0 – 5.5 mm	3	4
5.5 – 6.0 mm	6	4
6.0 – 6.5 mm	1	1
Total	10	10

Several biomechanical studies demonstrate significant increase in the shear strain, intradiscal pressure and segmental motion at the adjacent level [28-29] after spinal fusion. Hilibrand, et al. reported that symptomatic degeneration with radiculopathy or myelopathy occurs at 26% rate at 10 years follow up. [30] Often these patients require additional procedures to address degeneration of adjacent level. Baba H, et al reported long term follow up of 146 patients and concluded that 25% of patients had disc degeneration at adjacent level following spinal fusion. [31] Gore and Sepic reported 14% rate of adjacent level radiculopathy at seven years follow up of 133 patients. [32]

Anderson, et al. [33] have published a pivotal study on the wear characteristic of the Bryan disc in vitro in a cervical spine simulator and in vivo biologic response in goat and chimpanzee models. The authors concluded that the wear rate is low in vitro and they did not find any inflammatory

response in vivo models. This is an extremely important observation predicts satisfactory long-term performance.

The failure of total joint replacement has been largely attributed to wear debris from polymer-bearing surfaces. Wear debris induces an intense cellular inflammatory reaction, which results in then production of cytokines that cause resorption of bone. This process known as aseptic loosening, leads to destabilization and mechanical failure of the joint. The possibility of the similar process occurring with polymer nucleus of both the variety of disc prostheses has been studied.

Cervical radiculopathy is a dysfunction of nerve root of the cervical spine where C6& C7 nerve roots are the most commonly affected. In the younger population, it is a result of a disc herniation or an acute injury causing for a minimal impingement of an existing nerve whereas in older patients, cervical radiculopathy is often a result of for a minimal narrowing from osteophyte formation, decreased disc height, degenerative changes of the uncovertebral joints anteriorly & of the facet joints posteriorly. [34]

It encompasses important symptoms other than pain, such as paresthesia, numbness and muscle weakness in dermatomal or myotomal distribution of an affected nerve root. Although patients with cervical radiculopathy may have complaints of neck pain, the most frequent reason for seeking medical assistance is arm pain. [34]

Most patients with cervical radiculopathy will improve regardless of treatment modality. In fact, roughly 88% will improve within four weeks of non operative management. [35] In a retrospective case series, 80% of those with objective weakness or reflex deficit improved within three weeks of conservative management. [36] Repeat examination at follow-up is crucial. Progression of an objective neurologic finding at any point may signify advancing nerve root compression and should trigger an MRI and referral to a spinal surgeon. The optimal timing for referral in cases of recalcitrant but non progressive radiculopathy is not clear. There is evidence to support referral within four to eight weeks. [37] Radiography and MRI can be considered if there is no improvement at four to six weeks. If imaging reveals evidence of nerve root impingement that correlates with physical examination findings, referral to a spinal surgeon is recommended.

Conclusion:

The data generated from the present study concluded that the major symptoms experienced by the patients were neck and radicular pain. C6-7 cervical root level was affected in majority patients. Majority of the had an excellent surgical results. Post operative follow up X-ray after 6 months revealed adequate motion at the operated site.

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