ORIGINAL ARTICLE

EXPERIENCE WITH TITANIUM CAGES IN ANTERIOR CERVICAL DISCECTOMY AND FUSION

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Background: Anterior cervical discectomy is a common procedure for treating patients for cervical disc prolapse. This study was conducted to study the surgical outcome and demographic characteristics of patients who were treated for anterior cervical disc prolapse. **Methods:** Study was conducted in the combined military hospital (CMH) Peshawar. Study interval was 3 years from 1st September, 2011 to 31st August, 2014. Total numbers of patients were 84. Males were 54 (64.28%) and females were 30 (35.71%). All the patients had undergone the procedure of anterior cervical discectomy and fusion with titanium cages (ACDF). All the patients had plain MRI cervical spine done for diagnosis of anterior cervical disc prolapse. **Results:** Total 84 patients were operated. In the patients who complained of brachialgia, 100% improvement was seen after the operation. Three (3.5%) of the patients, who presented with axial neck pain, continued to complain of pain and 2 (2.5%) of the patients complained of pain at the donor site after the operation. One of the patients had dural tear which resulted in subcutaneous cerebrospinal fluid (CSF) accumulation and was treated conservatively with repeated aspiration. Fusion rate was 100% with titanium cages used for fusion after anterior cervical discectomy. No complications were noted after the surgery at 1 year of interval. **Conclusion:** Results with titanium cages are expectedly good. Symptoms resolved and fusion rate was 100% at 1 year follow up.

Keywords: Axial neck pain, cervical disc prolapse, titanium cages, anterior cervical discectomy and fusion (ACDF)

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INTRODUCTION

Millions of people suffer from pain in the necks and the arms. A common cause of the cervical pain is the rupture or herniation of one or more discs. This happens when annulus fibrosis tears down and nucleus pulposis squeezes out. As a result pressure is applied on the nerve roots and spinal cord resulting in pain in the back of the skull, the neck, shoulder girdle, scapula, shoulder, arm, and hand. The nerves forming cervical plexus and brachial plexus can also be affected. Cervical disc herniation can occur because of aging process, wear and tear, or sudden stress from accident. Disc degeneration is a cause and can occur with both degenerative disc disease and aging.[1] Athletes, especially those playing contact sports, are prone to disc herniations.[2,3]

The cause of the pain is the compression of the nerve roots or spinal cord but it is increasingly recognized that back pain may not be completely due to compression, but may also be due to chemical inflammation.[4–7] There is evidence that points to a specific inflammatory mediator, tumour necrosis factor (TNF) of this pain.[8,9] Tumour necrosis factor (TNF) can also contribute to disc degeneration.[10]

There are two main methods of treating cervical disc prolapse, i.e., conservative and surgery. Conservative treatment consists of medicines, physical therapy and/or bracing. The patient who is going to be a candidate for surgery will have radiological evidence of disc prolapse, significant weakness in the arms, arm pain worse than neck pain and patient not responding to the conservative treatment.

Anterior cervical discectomy is a common procedure for treating patients for cervical disc prolapse. During surgery soft tissue of the neck are separated and the disc is removed. In order to maintain the normal height of the patient's disc space, surgeon may choose to fill the space with bone graft. Three types of grafts are used. Autograft, bone comes from patients own body commonly iliac crest. Allograft, bone comes from donor. Third type is bone graft substitute, comes from manmade plastics, ceramics or bio-resorbable compounds. It has shown that discectomy provide pain relief sooner than nonsurgical treatments.[11] Anterior cervical disecetomy[12] is successful in comforting arm pain in 92–100% of people. In patients with neck pain[12], it is successful in relieval of symptoms in 73–83% of people. One of the research[12] showed results that in the patients who underwent only cervical discectomy without bone graft, 67% achieved fusion. Patients who underwent both cervical discectomy and bone

grafts placement, 93% achieved fusion. While in the patients with discectomy, bone grafts placement and plates and screws, fusion was achieved in 100% of patients.

Trans-cranial magnetic stimulation is a newer method which measure the time taken for the nerve impulse to travel from cerebral cortex through pyramidal tract to anterior horn cells. It is known as central conduction time. It helps the physician to determine whether myelopathy is present or not and identify the levels of stenosis especially when two lesions may be responsible for symptoms such as stenosis at two cervical levels.[13]

MATERIAL AND METHODS

Our study was conducted in a combined military hospital, a tertiary care hospital of Peshawar. Study interval was 3 years from 1st September, 2011 to 31st August, 2014. It was a prospective study and included all the patients who presented, were investigated and operated in the respective hospital. All the patients had either clinical evidence of radiculopathy, myelo-radiculopathy, myelopathy or neck pain and failure of conservative treatment. All the patients, except with progressive neurological deficit which included the patients with myelopathy and poor motor functions of the hand, were treated conservatively for 8 weeks with gabapentin (100 mg B.D), naproxen (500 mg B.D), tizanidine (4 mg B.D),, omeprazole (40 mg O.D), and methyl cobalamin (1000 mg O.D),. The patients with poor motor function and myelopathy were subjected to surgery without giving conservative treatment. The Plain MRI of cervical spine was the main modality of investigation. Total numbers of patients were 84 who belonged to various cities of Khyber Pakhtunkhwa. No multilevel corpectomies were done in multilevel diseases but instead they were treated by multilevel disc resection followed by titanium cages fixation. Mainly four cervical X-rays were done, i.e., one at the time of operation to check the position of titanium cage, 2nd at 6 weeks from operation day, 3rd at 6 months and 4th at 1 year from operation day. All the patients were followed to assess fusion, cage migration, subsidence or breakage. All the patients were followed for 1 year with cervical x-rays to assess fusion, cage migration, subsidence or breakage.

Patients were arbitrary divided into four groups, i.e., group-A (30 and less than 30 years), group-B (31–40 years of age), group-C (41–50 years of age), group-D (Above 50 years of age). In our institution titanium cages were used. Immediate postoperatively, Philadelphia collar was used and was continued for 4–6 weeks. In patients with bi-level cage placement, it was continued for 6 weeks

All of the patients who had clinical and radiological evidence of radiculopathy, myelopathy or myelo-radiculopathy due to cervical disc prolapse were included while who had radiculopathy or myelopathy due to any other reason than cervical disc prolapse were excluded.

Neck disability index (NDI) is a functional status questionnaire, which is completed by patients, was used in our study to assess the status of improvement in the patients. The parameters included are pain, personal care, lifting, reading, headaches, concentration, work, driving, sleeping and recreation. Total score is 50 with each parameter numbered 0–5. Increase number shows increased severity. The following interpretation was presented by Vernon and Moir[14]:

- 0–4 points (0–8%) no disability
- 5–14 points (10–28%) mild disability
- 15–24 points (30–48%) moderate disability
- 25–34 points (50–64%) severe disability
- 35–50 points (70–100%) complete disability

RESULTS

Total numbers of patients were 84. Males were 54 (64.28%) and females were 30 (35.71%). Male to female ratio was 1.8. Majority of the patients belonged to age group C (41–50 years of age) and percentage was 36.9%, followed by group-D (Above 50 years of age), group B (31–40 years of age) and group A (30 and less than 30 years), respectively. The frequencies are given in the table-1. The patients presented with following signs and symptoms: Axial neck ache, brachilagia, quadriparesis, monoparesis and poor hand grip. Most commonly noted complaint was bachialgia (left hand 21.4% and right hand 27.4% of the total presented patients), followed by quadriparesis (27.4%). The relative frequencies of different signs and symptoms are given in the table-2. The various level of stenosis noted on plain MRI of cervical spine is given in the table-3. Most commonly involved cervical intervertebral spaces were C5/C6 (47.6%) and C6/C7 (19%). The patients belonged to different cities of Khyber Pakhtunkhwa. In patients with brachialgia, total improvement was seen but in the patients who were complaining of axial neck pain, 3 (3.5%) of them continued to complain of pain. Pain at the donor site was reported by 2 (2.3%) patients who responded to neuropathic pain medicine (Pregabalin) for 6 weeks. One of the patient had a dural tear, which resulted in subcutaneous cerebrospinal fluid (CSF) collection. It was managed conservatively by repeated aspirations which were done weekly and it stopped spontaneously in 4 weeks period. One of the patient had a dural tear which resulted in sq csf collection. It was managed by repeated aspiration, weekly and stopped in 4 weeks period. Mean visual analogue scale reading was

6 before operation. 100% improvement was seen on VAS for arm pain intensity while 93% improvement was seen on VAS for neck pain intensity. Overall 93% improvement was seen on NDI after surgery. 95% of the patients had no functional impairment and continued daily activities. Mean hospital stay was 4 days with a range of 3–7 days. No case of cage migration, subsidence or breakage was noted. Mostly patients were from Peshawar (23.8%), Mardan (17.9%) and Swabi (13.1%).

The mean operative time ranged from 60 to 120 minutes average of 85 minutes. No complication occured during the surgery and no need for blood transfusion was required. The mean hospital stay was 6 days ranging from 5 to10 days. Patients were regularly followed with cervical x-rays.

Fusion rate was assessed on X-rays and in our study was 100%. At 1 year follow up, there was 100% of patients reported improvement in whom brachialgia was main complaint while 3 (3.5%) of the patients who complained of axial neck-ache before operation, continued to complain of pain. In these patients on follow up X rays fusion was noted but the cause of pain could not be explained by clinical and radiological assessment.

Two (2.3%) of the patients, complained of the pain at the donor site at 3 months from the operation day. It responded to the drug pregabalin. All the patients with radiculopathy and numbness/poor grip improved and returned their previous jobs by 6 weeks.

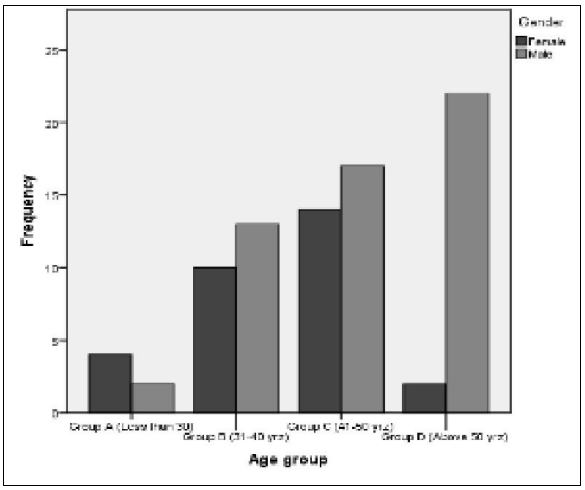

Figure-1: Gender distribution of patients in different age groups

Table-1: Frequency of patients in various age groups

Age group	Male	Female	Total	%
Group-A (30 and less than 30 years)	4	2	6	7.1
Group-B (31–40 years of age)	10	13	23	27.4
Group-C (41–50 years of age)	14	17	31	36.9
Group-D (Above 50 years of age),	2	22	24	28.6
Total	54	30	84	100

Table-2: Clinical signs and symptoms in patients

Signs and Symptoms	Frequency	%
Axial neckache	6	7.1
Bilateral brachialgia	6	7.1
Cervical spondylotic myelopathy (pain+numbness+weakness)	4	4.8
Left brachialgia	18	21.4
Quadriparesis	23	27.4
Right brachialgia	23	27.4
Right monoparesis	2	2.4
Right hand poor grip+pain+numbness	2	2.4
Total	84	100.0

Table-3: Level of stenosis on MRI

Level of stenosis	Frequency	%
C3/C4	2	2.4
C3/C4, C4/C5	4	4.8
C4/C5	8	9.5
C4/C5, C5/C6, C6/C7	4	4.8
C5/C6	40	47.6
C5/C6, C6/C7	8	9.5
C6/C7	16	19.0
C7/T1	2	2.4
Total	84	100.0%

DISCUSSION

Various surgical procedures are available for cervical disc herniation with anterior cervical discectomy and fusion, endoscopic foraminotomies, cervical disc arthroplasty and total cervical disc replacement to name a few. Anterior cervical discectomy is performed through incision in the front of the neck which can be followed by bone graft or cervical cage. In the absence of bone graft cervical fusion do occur as one of the studies by Xie JC and Hurlbert RJ[12] showed results of 67% fusion in the absence of bone graft. Bone graft can be obtained either from patient himself (autograft) or from other human (allograft). Mostly from the patient, graft is obtained from the iliac crest cancellous bone. The study by Xie JC and Hurlbert RJ[12] showed that the fusion rate with bone graft was 93% and with both bone graft and cervical cages were 100%

In study by R.J. Mobbs, P. Rao, & N.K Chandran[15] 98% fusion was noted in the plating group as compared to 93.5% in the non-plating group. Similarly in other study R.D Dickerman, A.S Reynolds & B.Morgan[16], fusion rate with PEEK cages was 100%. When compared to these studies the fusion rate with titanium cages in our study, which was 100% at 1 year follow up, seems to be superior to autogenous bone grafts and similar to PEEK cages.

In our study total improvement was seen in the patients who were complaining of arm pain but 3 (3.5%) of them continued to complain of axial neck pain. Pain at the donor site was reported by 2 (2.3%) patients. One of the patients had a dural tear, which resulted in subcutaneous cerebrospinal fluid (CSF) collection and was managed conservatively by repeated aspirations and resolved spontaneously in 4

weeks period. Overall 93% improvement was seen on VAS and NDI after surgery. 95% of the patients had no functional impairment. Study by Bohlman *et al*[18], who used Robinson anterior cervical discectomy and arthrodesis method, showed that (66.3%) patients had no pain in the neck, (21.3%) patients had mild pain in the neck, (7.3%) patients had moderate pain in the neck, (3.2%) patients had mild radicular pain, and (1.6%) patients had a combination of mild radicular pain and moderate pain in the neck. (88.5%) patients had no functional impairment, and (11.4%) patients had a slight limitation of function during the activities of daily living.

Fountas *et al*[17] studied the complications occurring in the Anterior cervical discectomy and fusion procedure. The mortality rate was 0.1% and overall morbidity rate was 19.3%. The most common complication was the development of isolated postoperative dysphagia, 9.5% of patients. Postoperative hematoma was found in 5.6% with surgical intervention in only 2.4% cases. Recurrent laryngeal nerve palsy was found in 3.1% of cases, dural penetration in 0.5%, oesophageal perforation in 0.3%, worsening of pre-existing myelopathy in 0.2%, Horner's syndrome in 0.1%, instrumentation backout in 0.1%, and superficial wound infection in 0.1% of cases

Anterior cervical foraminotomy by Johnson *et al*[19] revealed good results with (91%) had improved or resolved radicular symptoms and (9%) had persistent radicular symptoms necessitating further surgery (one two-level anterior cervical neural discectomy and fusion and one posterior foraminal decompression). *Krupp et al*[20] practiced the foraminotomy procedure which showed that good results were obtained in 98% of the patients with soft disc lesions, in 91% of the patients with combined findings, and in 84% of those with hard disc lesions. In 93% of the cases, there was improvement of paresis and in 82% improvement of the sensory deficits. A total of 92% of the patients were able to carry out their previous occupation to the full extent.

Pain at the donor site was reported by 2 (2.3%) patients who responded to pregabalin treatment for 6 weeks; while the study by Silber *et al*[21] reported pain at the donor site by 26.1% of patients and 11.2% chronically use pain medication

Cervical total disc replacement (TDR) is new procedure to address radicular pain and preserve functional motion between two vertebral bodies. One randomized controlled trial[22] compared the safety and efficacy of cervical TDR to anterior cervical discectomy and fusion (ACDF).VAS neck and arm pain intensity and frequency were statistically lower at all follow-up time points compared with preoperative levels, but not difference was found between two treatments. Neurologic success (improvement or maintenance) was achieved in 90.9% of (TDR) and 88.0% of Fusion patients (p=.638). 84.4% of patients with (TDR) showed more than or equal to 4° of motion or maintained motion relative to preoperative baseline level. Significant statistical difference in the number of secondary surgeries was found with p-value of 0.033 in 8.5% of Fusion patients within the 24 month follow up period compared with 1.8% of (TDR) patients. A statistically significant difference in medication usage was found with 89.9% of (TDR) patients who were not on strong narcotics or muscle relaxants as compared with 81.5% of Fusion patients.

CONCLUSION

In our experience the results of anterior cervical discectomy and fusion with titanium cages were excellent. The fusion rate was regularly assessed at follow up on cervical x-rays and at 1 year follow up was 100%. The improvement of symptoms of brachialgia was excellent, while some of the patients with axial neck pain continued to have the symptoms. The results of our study are comparable to other studies.[12,15,16,18,19,22]

AUTHOR'S CONTRIBUTION

MJ: Contribution to Conception, Design and Acquisition of data, Final approval of the article. MUR: Contribution to analysis and interpretation of data, Drafting of the article, Revision of article for intellectual content. AA: Contribution to drafting of the article. SSB: Contribution to final approval of the article. AK: Contribution to final approval of the article

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