Research Article

Cloward Procedure Outcome using Hashmi Cage for Anterior Cervical Discectomy and Fusion Experience in Pakistan

Aurangzeb Kalhoro*, Kashif Ahmed, Pervaiz Ali, Abdul Sattar M. Hashim

Department of Neurosurgery, Neurospinal & Cancer Care Institute, Karachi, Pakistan.

Abstract: Background: We aim to focus on ACDF patients treated with Hashimi cage filled with autologous bone. We will assess the safety of this approach based on the specific surgical level and its outcome.

Objective: Study aims to evaluate the results of the Hashmi cage used in the Cloward Procedure while using odom's based criteria for the outcome.

Materials and Methods: This was a descriptive study researched at the Neuro Spinal Cancer Care Institute in Karachi, time duration from 16 June 2016 to 31 June 2022. The study included patients with a single-level prolapsed intervertebral cervical disc. During the surgery. Bony Fusion was assessed using movement ≤ 1 mm in flexion and extension cervical X-rays, was required.

Result: We had 162 patients; among them males were 102 (62.96%) and female patient were 60 (37.03%). The median range for the age was from 23 to 63 years with mean 48 years ± 3.6 age. Clinically the patients presented with radiculopathy, commonly of the C6 level which was patients (63.73%). Odom's based criteria were used to evaluate the results of the procedure. Among the patients, 92.84% showed excellent outcomes, 4.9% had good results, 1.8% had fair outcomes, and 1.23% had a poor outcome.

Conclusion: ACDF with the Hashmi cage and plate application is a highly effective treatment option. This approach not only ensures better removal of the problematic discs but also significantly increases the likelihood of successful fusion and better radiological outcomes.

Keywords: Cloward procedure, Hashmi cage, Corpectomy, Anterior cervical discectomy fusion, Radiculopathy, Spine.

INTRODUCTION

The cervical spine radiculopathy is, a relatively common medical condition of spine with a reported prevalence of 3.5 cases as per 1,000 individuals, the cervical radiculopathy can be caused by many reasons such as prolapsed intervertebral disc, stenosis, and trauma or cervical lesions [1]. As with time the, not only there is a rise in the number and the overall cost but the specialized surgery like ACDF is common and now performed with expertise in neurosurgical field of surgical practices [2]. The MRI spine is a highly sensitive investigation, as it provides valuable information about disc protrusion, which can help in diagnosis and decision making [3]. Overall, the period for admission and the time from discharge for the entire duration of ACDF can vary between 20 and 96 hours [4]. Ambulatory care aims to significantly decrease the need for hospital stays after surgery and enhance patient contentment [5]. The prolapsed cervical discs initially are managed with conservative treatment, However, if conservative management fails it requires intervention surgery, which can be done either anterior, posterior or 360 approach depending on progression levels [6].

Remarkably, fusion following anterior cervical discectomy has shown remarkable results, with patients experiencing significant relief from radiculopathy pain. Nevertheless, it is essential to acknowledge that performing ACDF without plating may lead to potential issues such as nonunion and graft dislodgement as complications [7]. The utilization of cervical plating has shown high rates of fusion when compared to procedure performed without the use of cervical plate augmentation [8]. Although ACDF with plating has its advantages for single or multiple level but it has its own set of complications [9]. The outcome of the study was evaluated using Odom's criteria. The Cloward is technique which is helpful in huge disc, osteophytes and laterally gives good space to relive pain [10].

The suitability of ACDF as an outpatient procedure should be investigated since it is a frequently performed surgery for degenerative disc disease and herniated discs. Our research aims to build upon existing literature by focusing on ACDF patients treated with Hashimi cage filled with autologous bone. We will assess the safety of this approach based on the specific surgical level being addressed and study aims to evaluate the results of the Hashmi cage used in the Cloward Procedure while using odom's based criteria for the outcome.

MATERIALS AND METHODS

This study was a descriptive type study, which was observed at the Neurospinal and cancer care institute in Karachi, Sindh, from 16 June 2016 to 31 June 2022. All the patients who were enrolled

*Address correspondence to this author at the Department of Neurosurgery, Neurospinal & Cancer Care Institute, Karachi, Pakistan.
Email: draurangzebkalhoro@gmail.com

after providing with consent and obtaining approval from the hospital's committee for ethical review. The study included patients with a single-level prolapsed intervertebral cervical disc who had not responded to conservative management and showed sign and symptoms related to the cervical disc. Patients with cervical trauma, involvement of multiple levels, fractures, or previous cervical pathology surgeries were excluded.

Data collection was performed preoperatively, including proper history, neurological examination, and imaging based on MRI cervical spine and dynamic X-ray of the cervical spine for all patients. During the surgery, a Hashmi cage filled with autologous bone pieces collected during Cloward procedure were used to minimize trauma to the iliac spine and improve body fusion. The surgeries were conducted by a senior consultant with expertise to reduce biases. The spinal level was confirmed with C arm image intensifiers.

Postoperatively, cervical collars were used. Preoperative and postoperative questionnaires were documented and Odom's criteria was taken under consideration. The Fusion of the bone was documented after flexion and extension cervical spine dynamic X-rays and motion ≤ 1 mm was considered successful for the process of fusion; such dynamic x-rays were done on the 3rd month of follow-up.

STATISTICAL ANALYSIS

Data analysis was performed using SPSS version 23.

OPERATIVE PROCEDURE

The patients were positioned supine on the operative table, under general anesthesia. The neck was kept in extended procedure by placing the sandbag under their shoulders, plus Gardner's traction was applied, while in some cases, adhesive white tapes were useful for maintaining the shoulder pull, ensuring a clear cervical spine on the C arm. A skin incision (horizontal) was made, and the platysma muscle with the plane was cut. Further, sternocleidomastoid was moved laterally, plan was established medially to the carotid sheath, while trachea and esophagus on the medial side, the vertebral body was reached though medial plane, working between the Longus coli muscle. The surgical level was identified and verified with needle placement and an intervertebral distractor was applied to all cases to retract the muscles. The relevant disc involved was removed, and the Cloward drill guide was placed over the disc site, using a dowel guard to reach up to the posterior ligament of the cervical vertebra, remaining disc was excised or removed, dura was cleared, retrieved bone pieces were then inserted inside the Hashmi cage. After a complete decompression, the Hashmi cage was placed and fixed with plating, post to above procedure, the wound was cleaned by irrigating surgical plane with saline and closed in layers. Patients were advised to wear a Philadelphia collar during the postoperative period. Post operatively cervical collar was used for 30 days. The Fig. (**1A**) shows X-Ray cervical spine lateral view with Hashmi cage and fixation with platting and Fig. (**1B**) shows the Hashmi cage picture used for fusion.

RESULT

In our study, we had a total of 162 patients, who fulfilled our institutional criteria were included in the study. Out of these, male patients were 102(62.96%) and 60(37.03%) were females. The age was between the range of 23 to 63 years and the mean age was 48 years ± 3.5. Clinically the patients presented with radiculopathy, commonly of the C6 level which was patients (63.73%) as shown in, while in our series we 58 patients (35.80%) had pragmatic spurling sign while Hoffmann sign was helpful in 42 patients (25.93%). The C5/C6 level was the common level of spine involved and common fusion site, which was the followed by C4/C5, C6/C7and lastly C3/C4 respectively, Table **1** while clinical presentation of the patient Table **2**.

Table 1. Involved Vertebral Levels.

Disc level	n	%
C3/C4	23	14.19%
C4/C5	36	22.22%
C5/C6	69	42.59%
C6/C7	32	19.75%
C7/T1	2	1.23%

Table 2. Clinical Presentation of the Patient.

	Presentation	n = 162
1	Limb weakness	56(45.67%)
2	Paresthesia	121 (74%)
3	Neck pain	107(66.0%)
4	Gait abnormality	67(41.3%)
5	Radiation	64(39.50%)
6	Bladder involvement	49(30.2%)

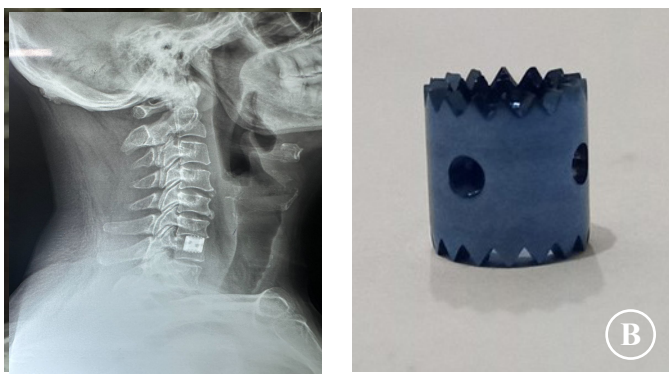

Fig. (1). (**A**). Hashmi Cage Seen in Place with Platting (With patient permission). (**B**). Hashmi Cage used in the ACDF Surgery.

The Odom's criteria were employed for a deeper understanding of the procedural outcomes to observe the results of the Hashmi

procedure's outcomes, enhancing the comprehensive evaluation of the technique's effectiveness. Among the patients, 92.84% showed excellent outcomes, 4.9% had good results, 1.8% had fair outcomes, and 1.23% had a poor outcome as shown in Table **3**. Additionally, the fusion success was assessed using radiology, specifically X-ray lateral view of the cervical spine to check the Hashim cage's position and the absence of radiolucent gaps. The cervical spine dynamic x-rays were also to observe any motion, the fusion rate after 6 months was 96.9%, and ≤ 1 mm gap of a between spinous space on motion of flexion /extension x-ray spine, which indicate a good and acceptable fusion. Dysphagia occurred in 3 (1.85%) patients, while one case (0.61%) of cerebrospinal fluid (CSF) leak was managed conservatively. Fortunately, there were no instances of screw breakage or surgical site infection in any patient.

Table 3. Outcome Based on Odom's Criteria.

Outcome	No of patient	%
Excellent	149	92%
Good	8	4.9%
Fair	3	1.84%
Poor	2	1.23%

DISCUSSION

Cloward procedure is considered as the one of the most effective treatments for degenerative cervical conditions, cervical trauma, and infective spondylodiscitis. This procedure involves using a titanium plate and a Hashimi cage filled with either allograft or autograft. By employing this technique, fusion between adjacent vertebrae is significantly improved, maintaining their height and providing stability. Additionally, it facilitates easier removal of the discs. As a result, outstanding outcomes are achieved, with a fusion rate of 96.9% after 6 months. The occurrence of surgical site mild infection was observed in three patients (2.61%), and one case (0.88%) of cerebrospinal fluid (CSF) leak was managed conservatively. Importantly, there were no instances of screw breakage in any of the patients.

In our research, we harvested the Hashmi cage, after Cloward procedure which can be observed in the accompanying image. The autologous bone was kept in the cage, and plating was also utilized (as depicted in the picture) to enhance fusion and reduce morbidity associated with grafting from the iliac site. Some studies [11], have indicated that using only the fibular and iliac crest autologous graft of the bone for fusion without using the fixation plate is possible, but it has been observed that fusion rates improve when anterior cervical plates are used, for single or multiple levels. However, the use of these traditional grafting methods has also led to notable issues like significant donor site morbidity issues and may lead to collapse of graft, titanium and PEEK cages have been introduced as alternatives for fusion procedures, this also depends on institutional choices.

Multiple cage systems in multilevel ACDF demonstrated comparable safety and effectiveness to each other and, in some cases, even to the standard "routine" ACDF. The PEEK cage–plate system, despite longer fusion time, yielded particularly favorable results in multilevel cases. Monitoring changes in lower adjacent height is crucial to avoid adjacent segment disease (ASD) casing symptoms at multilevel ACDF [12,13].

Recent research has consistently demonstrated the benefits of using Anterior Cervical Discectomy and Fusion (ACDF) with anterior cervical plating to enhance the alignment and stability of the cervical spine. This surgical approach not only leads to significant alignment improvement but also effectively prevents interbody lock subsidence, reducing the risk of post-surgery complications. Additionally, employing ACDF with anterior cervical plating has been shown to decrease the likelihood of requiring further surgical interventions, highlighting its long-term success in managing cervical spine conditions. By employing ACDF with anterior cervical plating, patients can experience improved postoperative outcomes and a reduced need for additional procedures. The combination of these positive effects makes this surgical technique a valuable option for patients suffering from cervical spine issues. Consulting a relevant professional is essential for determining the most suitable treatment plan, considering individual circumstances and medical history [14,15].

In one of the studies, it was demonstrated that the procedure resulted in negligible blood loss, and the duration of the procedure was within 120 minutes. Moreover, patients' hospital stays ranged from 3 to 5 days in their comparative analysis. Additionally, the study highlighted that using bone grafts alongside bone offered more advantages compared to other methods [16]. In the course of our extensive research, we observed that the procedure was consistently carried out with remarkable efficiency, taking an average of approximately 70 minutes for completion. Moreover, our findings indicated that the occurrence of blood loss during the procedure was kept to an absolute minimum, further enhancing the safety and well-being of the individuals involved. Additionally, we meticulously analyzed the post-procedure phase and discovered that patients undergoing this particular medical intervention typically experienced a relatively short hospital stay, with an average duration of approximately 3 days. This relatively brief period of hospitalization is indicative of the successful management of patients' recovery and highlights the efficacy of the overall treatment process.

In another comparative study, the short and long-term impacts of two-level ACDF surgery were examined in patients with two-level cervical spondylotic myelopathy and radiculopathy, the occurrence of dysphagia, pain, numbness, and stiffness was lower in comparison to anterior cervical corpectomy and fusion (ACCF) procedures [17]. According to a study, a Fusion success rate of 94.4% was reported in patients [18]. In our own study, we observed a comparable result, with 96% achieving Fusion. However, it is important to note that this percentage might vary from hospital to hospital due to differences in the technical approach utilized.

The most frequent complications observed following ACDF include the worsening of existing Myelopathy, challenges with swallowing, infections at the surgical wound site, and paralysis of the Recurrent Laryngeal Nerve (RLN). The primary risk factor for experiencing difficulty swallowing after surgery is undergoing ACDF with multiple levels involved [19-21]. In contrast to our study, we encountered minimal complications during the procedure, thanks to the expertise of a highly specialized spinal surgeon. The most notable issues we faced were limited to wound infections and, in a single case, a cerebrospinal fluid leak. However, these complications were effectively and conservatively managed.

LIMITATIONS

This can only be used at single level degenerative disease which is though very common, the study was performed at single Centre plus there is no denying that the possibility of adjacent level disease is a genuine concern when considering surgical interventions for spine-related issues. While artificial disc replacement has shown promise as a treatment option, its high cost presents a significant obstacle for many of our patients seeking relief from their spinal conditions.

CONCLUSION

With 97% result, the Hashmi cage and plate application for ACDF procedure is a highly effective treatment option for single-level disc issues. Modified Cloward procedure, with Hashim cage, this approach not only ensures better removal of the problematic discs but also significantly increases the likelihood of successful fusion and better radiological outcomes. Moreover, it minimizes the necessity for a postoperative collar, making it a comprehensive and favorable treatment choice.

AUTHORS' CONTRIBUTION

- **Aurangzeb Kalhoro**: Design and conception, Interpretation, Manuscript writing.
- **Kashif Ahmed**: Data collection, Literature review, Data analysis.
- **Abdul Sattar M. Hashim**: Critical revisions of manuscript.
- **Pervaiz Chandio**: Manuscript writing, Literature review, Data analysis.

CONFLICT OF INTEREST

Declared none.

ACKNOWLEDGEMENTS

We express our profound gratitude to Prof. Dr. Abdul Sattar M. Hashim. for his invaluable contributions to the field of neurosurgery, which have significantly benefited patients. Additionally, we extend our appreciation to the Neurospinal and Cancer Care Institute, Karachi for providing us with their valuable data, as well as to the other authors and our anesthesia team and staff for their collaborative efforts.

REFERENCES

[1] Naoum S, Vasiliadis AV, Koutserimpas C, Mylonakis N, Kotsapas M, Katakalos K. Finite element method for the evaluation of the human spine: A literature overview. J Funct Biomater 2021; 12(3): 43.

[2] Canizares M, MacKay C, Davis AM, Mahomed N, Badley EM. A population-based study of ambulatory and surgical services provided by orthopaedic surgeons for musculoskeletal conditions. BMC Health Services Res 2009; 9(1): 1-9.

[3] Kalhoro A, Panezai AS, Hassan S, Javeed F, Rehman L. The outcome of subaxial cervical injury in adult patients managed surgically through an anterior approach. Pakistan J Neurol Surg 2020; 24(4): 337-42.

[4] Villavicencio AT, Pushchak E, Burneikiene S, Thramann JJ. The safety of instrumented outpatient anterior cervical discectomy and fusion. Spine J 2007; 7(2): 148-53.

[5] Malik AT, Xie J, Retchin SM, *et al*. Primary single-level lumbar microdisectomy/decompression at a free-standing ambulatory surgical center vs a hospital-owned outpatient department—an analysis of 90-day outcomes and costs. Spine J 2020; 20(6): 882-7.

[6] Ban D, Liu Y, Cao T, Feng S. Safety of outpatient anterior cervical discectomy and fusion: A systematic review and meta-analysis. Eur J Med Res 2016; 21: 1-7.

[7] Akhavan-Sigari R, Rohde V, Alaid A. Cervical spinal canal stenosis and central disc herniation c3/4 in a man with primary complaint of thigh pain. J Neurol Surg Rep 2013; 74(02): 101-4.

[8] Khan S, Ullah A, Khan M, Hussain R, Ali M. Outcome of anterior cervical discectomy with peek cage fixation for single level cervical disc disease. Pak J Neurol Surg 2020; 24(2): 138-42.

[9] Baig AA, Aguirre AO, Soliman MA, *et al*. Standalone vs. anterior cervical plating for one-to-two level anterior cervical discectomy and fusion (ACDF): A propensity score-matched comparative study. World Neurosurg 2023; S1878-8750(23)00904-X [Online ahead of print].

[10] Kalhoro A, Hashim AS, Saleem A. Cervical spine discectomy, osteo-facetectomy by noble art of cloward procedure and its modification-a single centre study. Pak J Neurol Surg 2020; 24(1): 77-81.

[11] Niu CC, Liao JC, Chen WJ, Chen LH. Outcomes of interbody fusion cages used in 1 and 2-levels anterior cervical discectomy and fusion: titanium cages versus polyetheretherketone (PEEK) cages. Clin Spine Surg 2010; 23(5): 310-6.

[12] Epstein NE, Agulnick MA. Review of anterior cervical diske-

ctomy/fusion (ACDF) using different polyetheretherketone (PEEK) cages. Surgical Neurol Int 2022; 13: 556.

[13] Lee HC, Chen CH, Wu CY, Guo JH, Chen YS. Comparison of radiological outcomes and complications between single-level and multilevel anterior cervical discectomy and fusion (ACDF) by using a polyetheretherketone (PEEK) cage–plate fusion system. Medicine 2019; 98(5): e14277.

[14] Scholz M, Schnake KJ, Pingel A, Hoffmann R, Kandziora F. A new zero-profile implant for stand-alone anterior cervical interbody fusion. Clin Orthop Rel Res 2011; 469: 666-73.

[15] Pitzen TR, Chrobok J, Štulik J, *et al*. Implant complications, fusion, loss of lordosis, and outcome after anterior cervical plating with dynamic or rigid plates: Two-year results of a multi-centric, randomized, controlled study. Spine (Phila PA 1976) 2009; 34(7): 641-6.

[16] Carrier CS, Bono CM, Lebl DR. Evidence-based analysis of adjacent segment degeneration and disease after ACDF: A systematic review. Spine J 2013; 13(10): 1370-8.

[17] Broida SE, Murakami K, Abedi A, *et al*. Clinical risk factors associated with the development of adjacent segment disease in patients undergoing ACDF: A systematic review. Spine J 2023; 23(1): 146-56.

[18] Khokhar TI, Kiran S, Majeed MN, Anwar K, Bashir A. Anterior cervical discectomy and fusion surgery: Results with zero-profile spacer/cage. Pak J Neurol Surg 2022; 26(1): 173-8.

[19] Ullah MA, Usman M, Khan FU, Jalal A. Anterior cervical corpectomy with cage fixation for cervical spondylotic myelopathy. Pak J Neurol Surg 2021; 25(1): 90-5.

[20] Akmal M, Afzal O, ul Hassan A, Raza MH, Ishfaq M, Mahmood K. Anterior cervical discectomy and fusion: operative technique and post-operative complications–an experience in a tertiary care hospital. Pak J Neurol Surg 2020; 24(1): 73-6.

[21] Cheung ZB, Gidumal S, White S, *et al*. Comparison of anterior cervical discectomy and fusion with a stand-alone interbody cage versus a conventional cage-plate technique: A systematic review and meta-analysis. Global Spine J 2019; 9(4): 446-55.

Received: August 17, 2023 Revised: October 07, 2023 Accepted: October 12, 2023