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ANTERIOR CERVICAL DISCECTOMY AND FUSION – A COMPARISON BETWEEN TITANIUM CAGE AND AUTOLOGOUS ILIAC BONE GRAFT

Dr Prammaraj A Subramanian G	Senior Resident, Department of Neurosurgery, Tirunelveli Medical College and Hospital, Tirunelveli.
Dr Geo Jerosh J R*	Assistant Professor, Department of Neurosurgery, Thanjavur Medical College and Hospital, Thanjavur *Corresponding Author
Dr Mathiyash Arthur	Professor and Head, Department of Neurosurgery, Thanjavur Medical College and Hospital, Thanjavur

ABSTRACT **Introduction:** The most common cervical spine procedure done worldwide is the anterior cervical discectomy and fusion. The indications are varied, and neurosurgeons are still on the search for an ideal graft material. **Aims and Objectives:** The aim of the study is to find the difference between the titanium cage and iliac autograft in both clinical and radiological aspects, the surgical ease of performing both, and the difference in complication rate. **Methodology:** It is a retrospective study from January 2023 to September 2023 of patients undergoing single to three-level ACDF. The time taken for the procedure, time to ambulation, other morbidities and fusion rate have been compared. **Results:** There were 44 patients in total (26 males and 18 females). 22 patients underwent autologous bone graft, and another 22 underwent titanium cage fixation. The median age and presentation features, such as Nurick grade, were comparable between the two groups. Between the two groups, the time taken for the procedure was statistically significantly different (p-value 0.000006) and also the time taken for ambulation (p-value < 0.0000001). Other parameters like fusion, motor improvement and patient satisfaction were the same at 6 month followup. **Conclusion:** The donor site postoperative pain was still significant enough to prevent early ambulation, though the small incision used for harvesting graft helped prevent other complications. The time taken for the procedure could not be reduced, as the graft has to be harvested, measuring the space after discectomy.

KEYWORDS : cage, autologous iliac bone graft, cervical, fusion

INTRODUCTION

Cervical disc prolapse causing myelopathy or radiculopathy is corrected by surgical discectomy alone or by added fusion. Fusion is essential for preserving the sagittal balance of the cervical spine(Ferraz et al., 2026). The anterior cervical plating, as an add-on procedure to the cage or the iliac bone graft in anterior cervical discectomy, aids in it when we curve the anterior cervical plate to maintain the physiological cervical lordosis. The maintenance of disc space height is also of importance for relieving the radicular symptoms. There is also a theoretical risk of increased kyphosis in the long run if there is no fusion.

The ideal material for disc replacement is still debated. The cervical disc replacement procedures are still on the lag of developing an ideal artificial disc (Laratta et al., 2018) (Leven et al., 2017). The age-old technique of autologous graft is an infallible one, though the morbidities associated are manifold, as reported in the literature. We compared the major parameters that are detrimental during the intraoperative and immediate postoperative period in this study.

Aims and Objectives

The aim of the study is to determine the efficacy of cage and iliac autograft in both clinical and radiological aspects, the surgical ease of performing both, cost comparisons, and the difference in complication rate.

METHODOLOGY

It is a retrospective study from January 2023 to September 2023 of patients undergoing single to three-level ACDF and compares the clinical outcome, time taken for the procedure and others in 22 patients who underwent titanium cage fixation and 22 patients who underwent iliac bone autografting. The cases with cage and autograft have been done by two different neurosurgeons trained by the same mentor. The study was approved by the Thanjavur Medical College Institutional Ethical Committee for Human Studies No. 1203/2024 on 15-11-2023.

The iliac bone was harvested by a 2 cm incision above the anterior superior iliac spine, at least 2 cm from the anterior-most point to prevent fracture of the same. The size of the graft harvested is measured by the space available after discectomy, and measuring the space with a 2-0 silk by holding it taut in the space by two Halsted mosquito hemostatic forceps from endplate to endplate. The chisel makes one cut, and the next cut is fashioned to make the graft a wedge-shaped one as shown in Figure 1 B, which helps maintain the physiologic lordosis of the cervical spine without the aid of the anterior cervical plate. However, if more than one level of discectomy was done, anterior cervical plating was done irrespective of a titanium cage or an autologous bone graft. The tricorticate graft could easily be identified in the C-arm images intraoperatively and the cortical bone gives the strength to maintain the disc space height.

Fusion was considered to have occurred if the CT scan showed ossification and the dynamic X-rays showed no instability.

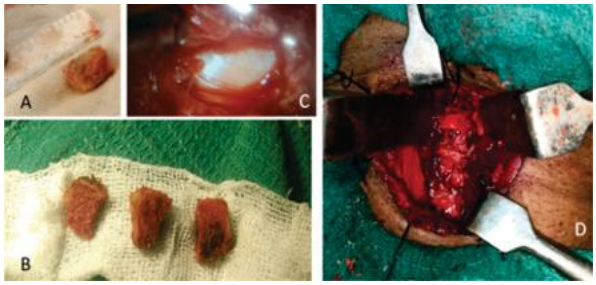

Figure 1. A 72 year old male, with difficulty in walking for the past three months, following a trivial trauma to the neck, weakness of all four limbs, with Hoffman's and Tromner's positive bilaterally, Nurick grade 3 at presentation underwent three level anterior cervical discectomy and fusion with autologous bone graft harvested (A, B) The autologous iliac bone harvested can be seen as tricorticate with the mild wedge shape for the cervical lordosis to be maintained. Intraoperatively pulsatile thecal sac noted at each level after discectomy (C). The intraoperative picture after the graft implant (D).

Figure 2. Intraoperative C-arm image showing the graft in situ and the anterior cervical plate curved to maintain the cervical lordosis (A). The 6-month follow-up, flexion (B) and extension (C) X-ray shows no dynamic instability. The CT cervical spine at 6-month follow-up shows fusion at all levels and the anterior cervical plate in situ.

Statistical Analysis

The data was entered in an Excel spreadsheet, and R Studio 2026.01.1 software was used for the statistical analysis. Fisher's exact test was used to compare categorical variables as the sample size was small. The Shapiro-Wilk test showed a significant departure from normality of the data values. Hence, the Mann-Whitney U test or Wilcoxon rank-sum test was used to compare the data.

RESULTS

22 patients underwent autologous bone graft (12 males and 10 females) and another 22 (14 males and 8 females) underwent titanium cage fixation. The median age of the autologous bone graft group was 54 years (IQR 47.25 – 60.75) and of the titanium group was 56 years (IQR 49 – 61.5). The age distribution between the two groups was not significantly different, with a p-value of 0.826. The time taken for the procedure was statistically significantly different, with a Z value of -4.5302 and p-value 0.000006 by the two-tailed Mann-Whitney U test. The time taken for ambulation among the two groups was also significantly different, with a Z value of -5.6804 and p-value < 0.0000001.

There was fusion noted in 19 patients in the autologous bone graft group and in 18 patients in the titanium cage group at the end of 6 months, as determined by the CT cervical spine and dynamic cervical spine X-rays. On Fischer's exact test, there was no significant difference between the autologous bone graft and the titanium group with a p-value of 1.000, Odds Ratio = 1.355; 95% CI: [0.292, 6.289].

All patients improved in motor status or were relieved of the radicular pain at 6 months of follow-up. Intraoperative blood loss was slightly increased by a new incision site. There was no immediate postoperative morbidity due to the graft harvesting, except for the increased time to ambulation. No other complications were noted in our study. The donor site pain was unnoticeable by all 22 patients at 6 months of follow-up in our study. The subsidence rate and the Cobb angle difference have not been studied as the follow-up period was short.

Table 1. Comparison of the titanium Cage and the Iliac Bone Autograft Groups.

	Titanium cage	Iliac bone autograft
Age	56 years (IQR 49 – 61.5)	54 years (IQR 47.25 – 60.75)
Time taken for the procedure	95 minutes (90 – 103.75)	120 minutes (106.25 – 130)
Time to ambulation	2 days (2 -3)	8 days (7 - 8.75)
Postoperative donor site pain	Not applicable	Insignificant after 7 days
Fusion at 6 months follow-up	18 patients	19 patients

DISCUSSION

In 1958, Cloward (Cloward, 1958)and Robinson and Smith (Smith & Robinson, 1958)described anterior cervical decompression individually. The graft was dowel – shaped as described by Cloward and horseshoe-shaped as described by Robinson and Smith, though both were taken from the iliac crest. Since then, the graft to be placed after discectomy has been disputed among different surgeons. The characteristics of an ideal graft are osteogenesis, osteoinduction and osteoconduction. Only the autograft has all these. However, the graft site morbidity includes donor site pain, infection, incisional hernia and even jejunal perforation(Heneghan & McCabe, 2009).

This led to the search for other graft like allograft, xenograft, demineralised allograft, Polymethylmethacrylate (PMMA) (Chau & Mobbs, 2009), titanium, polyetheretherketone (PEEK)(Liu et al., 2017), carbon fibre (Salame et al., 2002). Though the allograft had drawbacks like the theoretical risk of infection in the allograft, an inert synthetic graft that can affect fusion, interfere with postoperative imaging, the morbidity of the graft site is excluded in all.

The time taken for the procedure is increased significantly by the harvesting of iliac bone graft (p-value = p-value 0.000006). In cases where the iliac graft is used to fill the cages, the harvesting can be done by another surgeon simultaneously during discectomy. In our procedure, since we use the iliac graft fashioned to maintain the lordosis of the cervical spine, that cannot be done. Hence, the prolongation of duration of surgery is unavoidable.

The donor site morbidity has been tried to avoid by using other sites like sternum, fibula, patella, and rib and clavicle (Sangala et al., 2010) (Iwasaki et al., 2014) However, most have tried to harvest only cancellous bone for filling the cages, unlike us where we use it as a structural tricorticate graft. In our study, we did not find any morbidity except for the increased time to ambulation that was statistically significant (p-value < 0.0000001). We feel the smaller incision, along with the dissection done only for the small size of the graft, was the reason for it. There was no donor site pain at the 6-month follow-up time. However, long-term follow-up to rule out incisional site hernia and multicentre studies with a large number to see if the same results are achievable.

Local autograft (Sehan Park et al., 2019) to Recombinant human bone morphogenetic protein 2 (rhBMP-2) (Goldman et al., 2024) have been used along with the synthetic cages for promoting fusion across the endplates. The preparation of endplates is of prime importance for this. The current cage of preference among surgeons is PEEK, according to a survey among AO spine members(Yoon et al., 2017).

Disc space heights (DSH) and segmental interbody angles (SIA) (Liu et al., 2017) and the local kyphotic angle (Mittal et al., 2020) have been used to determine the sagittal balance and their influence on outcome clinically. In our study, the follow-up was not long enough to analyse these sagittal balance factors. However, the shape of our graft is made in an effort to maintain the sagittal balance by maintaining the cervical lordosis at the level surgery was done.

CONCLUSION

The method of small incision with harvesting of the small wedge-shaped tricorticate iliac bone graft, a little away from the anterior superior iliac spine, helped in avoiding the intraoperative complications. However, the donor site postoperative pain was still significant enough to prevent early ambulation. The time taken for the procedure was also prolonged and cannot be reduced significantly, as the graft has to be harvested after preparation of the endplates and measuring the space, and hence cannot be done simultaneously when the discectomy is being done.

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