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Orthosis Free One Level Anterior Cervical Discectomy and Fusion Using Stand Alone Cage

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Background Data: The anterior cervical discectomy and fusion (ACDF) operation has gained much popularity since its introduction in the 1950s by Smith and Robinson. Despite the biomechanical advantages of cage with or without plate application, the use of cervical collars or external cervical orthosis (ECO) after instrumented anterior cervical fusion is still widely practiced.

Purpose: Our study aims at documenting the clinical and radiological outcomes of patients that had one level ACDF using standalone cage without the use of ECO in the postoperative period taking in consideration the results of other similar studies in the literature.

Study Design: Retrospective cohort study on 50 patients that suffered one-level cervical disc pathology in the form of degenerative spondylosis, radiculopathy or myelopathy. Outcome measures include visual analogue scale to compare the degree of neck and arm pain, Neck Disability Index, mean local segmental cervical angle, fusion, and mean disc height preoperative and six months and two years postoperative.

Patients and Methods: Fifty patients had one level ACDF using standalone PEEK cage filled with autogenous iliac crest bone graft during the period between December 2009 and December 2013. Thirty one were females (62%) and nineteen were males (38 %). The indications for surgery were symptomatic single-level cervical spondylotic radiculopathy or myelopathy

that had failed medical treatment for at least 6 weeks. Important exclusion criteria were traumatic instability, severe osteoporosis, infection and tumors.

Results: Fifty patients had one level ACDF with standalone cage, the correlation between both preoperative mean VAS for neck and arm pain and that after 6 months and 2 years postoperative reveals highly significant improvement with P-value 0.0001. In the meantime, concerning neck disability index (NDI) the correlation between preoperative mean and that at 6 months and 2 years postoperative showed significant improvement with P-value 0.0001.

Conclusion: In comparison to the results in the literature demonstrating the outcomes of both ACDF with the usage of ECO and without in the postoperative period, our results show that the use of a cervical brace does not improve the fusion rate or the clinical outcomes of patients undergoing single-level ACDF using standalone PEEK cage filled with autogenous iliac crest bone graft. (2016ESJ106)

Keywords: Cervical, discectomy, cage, fusion, collar

Introduction

Anterior cervical discectomy and fusion (ACDF) is an established procedure for the treatment of cervical degenerative disc disease. The ACDF operation has gained much popularity since its introduction in the 1950s by Smith and Robinson[6]as well as Cloward.[16] Nowadays, the technique has become a mainstay in the treatment of degenerative cervical spondylosis, cervical spondylotic radiculopathy, cervical spondylotic myelopathy, and degenerative spinal instability.[5]

Although clinical outcomes following ACDF are generally good,[5] two of the major complications observed with follow-up are nonunion and graft migration, driving some to consider rigid internal fixation and cervical immobilization postoperatively to enhance fusion.[2] The advantages of using a plate are an augmentation in stability across the treated segment and a reduction in motion between the graft and the endplate. The plate is also deemed to act as a buttress, preventing graft extrusion.[9]

Different groups of surgeons have tried to explain that rigid plate fixation is associated with better outcomes, particularly in multilevel cervical disc disease, but the outcomes have been equivocal.[1]There is even less evidence available to support the use of rigid plate fixation for single-level ACDFs, and many of the studies that do exist are limited by low numbers of patients, variable follow-up durations, and/or differences in the types of hardware and allografts used.[7]

Despite the biomechanical advantages of plate application, the use of cervical collars or external cervical orthosis (ECO) after instrumented anterior cervical fusion is still widely practiced.[8] Surgeons may continue to use a collar because of the lack of quality studies demonstrating that the use of cervical collars after instrumented anterior cervical fusion is unnecessary. Because of the very different opinions concerning postoperative bracing among surgeons.[15] The specific objective of this study is to retrospectively analyze and document the clinical and radiographic outcomes of patients that had one level ACDF using standalone PEEK cage filled with autogenous iliac crest bone graft

without the use of ECO in the postoperative period taking in consideration the results of other similar studies in the literature.

Patients and Methods

Fifty patients underwent single level ACDF with standalone PEEK cage using percutaneously harvested iliac crest autograft during the period between December 2009 and December 2013. Thirty one (62%) females and nineteen (38 %) males were included in this study. The indications for surgery were symptomatic single-level radiculopathy and or myelopathy that had failed medical treatment for at least 6 weeks. Important exclusion criteria were traumatic instability, severe osteoporosis, infection and tumors. Outcome measures included neck and arm pain visual analogue scales (VAS) [0–10], and the Neck Disability Index (NDI). Comparison was carried between preoperative and six months and two years postoperative. Cervical fusion, mean local segmental cervical angle and mean cervical disc height in mm were carried between preoperative and six months and two years postoperative. These are the outcome measures used to monitor efficacy of single level ACDF with standalone PEEK cage filled with iliac crest bone graft, in the mean time we totally dispensed the usage of ECO during the whole postoperative period exclusively for the all 50 patients and during the follow up period. Cervical fusion was assessed on cervical spine static and dynamic X-ray. Fusion was considered according to the following accepted criteria: (1) absence of motion between the spinous processes at dynamic lateral radiographs, (2) absence of a radiolucent gap between the graft and endplates, and (3) presence of continuous bridging bony trabeculae at the graft endplate interface. When the radiographic fusion is controversial, two-dimensional computed tomography (CT) scan reconstructions were performed and considered as a more accurate means to assess for radiographic fusion.[9] Disc height was measured on preoperative and postoperative radiographs and determined by measuring the distance from the posterior inferior aspect of the superior vertebral body to the posterior superior corner of the inferior vertebral body.[10]

Local segmental cervical angle was measured by Cobb method on plain X-ray lateral view between upper margin of cranial vertebral body and lower margin of caudal vertebral body.[14]

Results

Fifty patients had one level ACDF were included in this study; four out of 50 patients had level C3-C4 level ACDF with 8 %, 11 patients had C4-C5 level ACDF with 22 %, 19 patients with percentage of 38% had C5-C6 level ACDF, and 16 patients had C6-C7 level ACDF with 32%. Mean age was 54±5.4 years with minimum 44 years and maximum 60 years. Mean VAS for preoperative neck pain was 4.3±1 (Range from 2 to 7) and was 2.7 at 6 months postoperative. The correlation between both reveals highly significant improvement with P=0.0001 after 6 months follow up. Meanwhile, the correlation between the preoperative neck pain VAS 4.3 and that of the 2 year follow up score 1.3±0.97 (Range from 0 to 3) shows also significant improvement with P=0.001. VAS for mean preoperative arm pain was 7±1.6 (Range from 4 to 10) and that for six months postoperative was 2.7 and the correlation between both means reveals highly significant improvement with P=0.0001, in the meantime, the correlation

between VAS for mean preoperative arm pain that was 7 and that for the 2 years postoperative was 1±0.75 (Range from 0 to 3) reveals highly significant improvement with P-value 0.0001. Correlation between mean preoperative local segmental cervical angle (CA) that was 8.6±2 degrees (Range from 6 to 10) and for the 6 months postoperative 6±2 degrees reveals significant improvement with P=0.0001. In the meantime, preoperative CA and that of the 2 years follow up 7.3±1 degrees (Range from 5 to 9) reveals highly significant improvement with P=0.0001**.** Concerning neck disability index (NDI), the preoperative mean NDI 32.5±13.9 (Range from 15 to 60) and the 6 months postoperative 13.4±9.7 showing significant correlation with P=0.0001, in the meantime the improvement continues at the 2 year follow up period with mean 8±2.4 (Range from 5 to 14) P=0.0001 at 2 year follow up. The correlation between the mean preoperative disc height 6.2mm±1.25 (Range from 5 to 10) and the mean disc height at 6 months postoperative that was 7.8±2.5mm and the correlation between both revealed significant improvements with P=0.0001, however, the correlation between mean preoperative disc height with the 2 years postoperative follow up 6.1±1.24mm (Range from 4 to 10) reveals non-significant results with P-value 0.7. In this study all patients had fusion; no patient had cage extrusion and no graft site complication. (Table 1)

Three cases out of the 50 cases in our study had got complications with a percentage of 6 %, one case had postoperative superficial wound infection that was managed by systemic IV antibiotic according to culture and sensitivity and the condition was self-limiting and resolved after 2 weeks. A second case experienced postoperative dysphagia most probably due to intraoperative traction maneuvers and the problem was managed conservatively and relieved few weeks postoperatively. The third case suffered recurrent laryngeal nerve palsy due to traction manipulations during the operative procedure presented clinically as hoarseness of voice, swallowing difficulty and was managed conservatively and the condition ameliorated during the next few weeks.

Table 1. Reported Outcome Parameters in our Patients (N=50)

Parameters	PerOp. Mean±SD	6 months PostOp. Mean±SD	2 years PostOp. Mean±SD	P Value
Neck pain(VAS)	4.3±1.07	2.68±1.019	1.34±0.96	0.0001
Arm pain(VAS)	7±1.6	2.36±1	1±0.75	0.0001
Neck Disability Index	32.5±13.9	13.4±3.7	8±2.4	0.0001
Local segmental Cervical Angle/degree	8.6±1.2	6±0.9	7.3±1	0.01
Disc height/mm	6.2±1.25	7.8±1.3	6.1±1.2	0.7

Discussion

The use of a cervical brace after ACDF was the standard of care before the development and widespread use of anterior cervical plates. The brace was necessary to limit motion across the fusion site to allow healing to occur and to protect the graft from expulsion and fragmentation. In theory, the use of a cervical plate, acting as an internal brace replaces the function of the external brace. However, most surgeons have not abandoned the use of a cervical brace even in the presence of a cervical plate. This study demonstrates that the use of a cervical brace after single-level ACDF and plating is probably unnecessary and whatever the level of the fusion is. This change in practice will improve patient comfort, obviate the morbidities associated with brace use, and eliminate the cost of the brace.[11]

Cervical collars have been used in patients, pre and postoperatively, for ACDF surgeries aiming at cervical immobilization. Since studies have shown that cervical collars decrease cervical spine mobility, collar use has been often assumed to prevent further spinal cord injury. Other potential benefits of cervical collars are the restriction of neck extension, flexion, lateral tilt (bending), and rotation. Other studies[7] have documented that cervical immobilization decreases pain and provides spinal stability. The benefits of ECO are not just physical but also psychological since they also provide patients with an increased sense of security.

Campbell et al, [4] performed a retrospective analysis of 257 patients divided into braced (149 patients) and non-braced (108 patients) groups without randomization after decompression and arthrodesis using allograft and anterior cervical plate. Although the data for this study were collected during a randomized control trial, the actual design of this study is retrospective. The fusion rate at six months was not statistically different between braced (89.8%) and non-braced (94.5%) groups (p = 0.379).Once again, at 24 months follow up, the rate of fusion was not statistically different between the two groups, with 96.1% fusion in the braced group and 100% fusion in the non-braced group (p = 0.552). The results of this study indicate that external bracing after ACDF is not related to improved fusion rates.[4]

Abbott et al,[1] conducted a randomized controlled trial with 33 patients ACDF without ECO (16 patients) to ACDF with ECO (17 patients). Although the rate of fusion in both groups was 100%, the effect of bracing on fusion rates cannot be determined due to low patient numbers.

Pickett et al,[14] performed a web-based survey of Canadian spine surgeons to define current practices in the management of patients undergoing ACDF. Invitations to contribute in the questionnaire were sent to 159 Canadian neurosurgeons or spinal orthopedic surgeons. Sixty surgeons were included in this survey. According to this analysis, surgeons recommended ECO for 92% of patients without anterior cervical plates and 61% of patients with anterior cervical plates. Surgeons indicated “multilevel pathology, concern regarding bone strength or screw placement, the ‘routine’” and patient discomfort as reasons for the use of external bracing.

Common characteristics are shared by the most of cervical orthoses that exist. To decrease cervical mobility, cervical orthoses are universally designed to provide a maximum fit against the jaw, occiput, and

upper thorax. While Halos are designed to be more restrictive than soft collars, they do not strictly eliminate mobility, despite the general agreement that rigid cervical orthoses have more limitations to cervical motion. Additionally, despite being less restrictive, soft collars may have an additional benefit of increasing patient awareness due to enhanced proprioception.[12]

The use of cervical orthoses after ACDF is not without complications. Even though some of these may appear extreme, reported complications of ECO include skin breakdown and damage, swallowing difficulties, coughing, breathing difficulties, and vomiting. Other complications include marginal mandibular nerve palsy with long-term sensory compromise, potential increase in intracranial pressure, possible delayed extubation or weaning difficulties from the ventilator.[17]

In our study, single level ACDF with standalone PEEK cage filled with iliac crest bone graft harvested via percutaneous technique was done for 50 patients at variable levels varying between 8% at C3-C4 level to 38% at C5-C6 level, all 50 patients spent the whole postoperative period for two years without the usage of any external Orthosis. We had 100% fusion rate, no cage extrusion and 6% approach related complication.

Conclusion

As a consensus to most of studies designed to assess the role of ECO after ACDF as a routine step, in comparison to the results in the literature demonstrating the outcomes of both ACDF with the usage of ECO and without, our results show that the use of a cervical brace does not improve the fusion rate or the clinical outcomes of patients undergoing single-level ACDF with standalone PEEK cage filled with autogenous iliac crest bone graft. Our study suggests no definite role for ECO after surgery in the management of postoperative period following one level ACDF.

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الملخص العربي

استئصال لغضروف عنقي وحيد المستوى مع التثبيت بواسطة أقفاص معدنية دون الاعتماد على الدعامات الخارجية

البيانات الخلفية: ان عملية استئصال الغضروف العنقي المنزلق و تثبيت الفقرات من الأمام بواسطة شريحة لهي أسلوب جراحي متبع منذ خمسينيات القرن الماضي.ان من الدواعي لاجراء تلك الجراحة هي الانزلاق الغضروفي العنقي و خشونة الفقرات العنقية المؤثرةعلى الأعصاب الطرفية نتيجة الضغط على الاعصاب الناشيء من اختناق مخارج الأعصاب بين الفقرات والمسبب لاعتلال النخاع الشوكي.ان استخدام الدعامات الخارجية في شكل دعامة رقبة صلبة او اسفنجية بعد اجراء الجراحة لهو دأب الكثير من الجراحين وذلك لقلة الدراسات على مدى جدوى استخدام تلك الدعامات بعد الجراحة بالاضافة لبعض الأعراض الجانبية الناتجة عن الجراحة مثل فشل الشريحة المثبتة وتحركها بعد الجراحة أو تزحزح الرقعة العظمية المساعدة في التثبيت ما دفع الكثير من الجراحين لزيادة الاحتياط باستخدام الرقبة الخارجية كوسيلة تثيت اضافية.

الغرض:تهدف الدراسة لتوثيق نتائج استئصال الغضروف العنقي وحيد المستوى مع التثبيت بواسطة أقفاص معدنية دون استخدام دعامات خارجية للعنق مع الوضع في الاعتبار نتائج الدراسات السابقة التي دارت في ذات السياق

تصميم الدراسة: هي دراسة أترابية بأثر رجعي على عدد ٥٠ مريض يعاني من انزلاق غضروفي عنقي وحيد المستوى مع استخدام معايير الاحساس بالألم لتقييم درجة الشعور بالألم في العنق والذراعين قبل وبعد اجراء الجراحة

المرضى والطرق: ان هذه الدراسة قد أجريت على عدد خمسين مريض تم استئصال الغضروف العنقي لهم مع التثبيت بواسطة اقفاص تحتوي على رقع عظمية من الحوض, وقد تمت الدراسة على هؤلاء المرضى مع الاستغناء التام عن استخدام اي وسيلة تثبيت خارجية خلال فترة المتابعة التي امتدت لمدة عامين.

النتائج: لقد أوضحت نتائج تلك الدراسة أن مقياس الشعور بالألم في الرقبة والذراعين قد تحسن بشكل ملحوظ بعد اجراء الجراحة عن قبل اجرائها, كذلك تحسنت درجة الزاوية الانحدابية للفقرات العنقية بعد العملية عن قبلها بشكل ملحوظ. في المقابل قل ارتفاع القرص الغضروفي بعد اجراء العملية عن قبلها.

الاستنتاج: لقد أثبتت تلك الدراسة مع الدراسات التي أجريت في ذات السياق أن استخدام تلك الوسائل المساعدة في التثبيت الخارجي كالدعامات الصلبة غير مؤثر على نتائج الجراحة وأننا نوصي بعدم استخدام أي وسيلة مساعدة لتحقيق نتائج ايجابية لما بعد اجراء الجراحة.