Clinical Article

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Anterior Versus Posterior Approach for Multilevel Cervical Spondylotic Myelopathy

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Abstract

Background Data: Cervical spondylotic myelopathy (CSM) is a common spinal disorder that we face in daily clinical practice. Both anterior and posterior approaches alone or in combination with one another have been used to treat the condition. The ideal approach however is still not agreed on particularly when the levels involved are three or more.

Purpose: We report our experience in managing multilevel CSM using both anterior and posterior approaches and compare the clinical and radiological outcome and also complications.

Study Design: Retrospective analysis clinical case study.

Patients and Methods: Forty-two patients who had surgery for multilevel CSM under our care were included in this study. We recorded the Visual Analogue Score (VAS) for neck pain, Nurick myelopathy score and cervical alignment (C2-C7 angle) on lateral X ray film preoperatively and on each follow up visit (3 weeks, 3, 6 and 12 months). We compared the results using Paired Student's t-test was used for comparing paired data having entered all data into Paired Student's t-test was used for comparing paired data.

Results: There was a significant difference in myelopathy and neck pain improvement in both groups and significant improvement in cervical alignment in the anterior approach but not posterior approach group.

Conclusion: Both anterior and posterior approaches significantly improve neck pain and myelopathy in patients with multilevel cervical spondylotic myelopathy although the anterior approach has the advantage of kyphotic angle correction. (2015ESJ076)

Key words: Cervical spondylotic myelopathy, laminectomy, fusion, corpectomy, anterior cervical discectomy

Introduction

Cervical Spondylotic myelopathy is a common disorder that we meet in increasing frequency in day-to-day clinical practice.[3,6,8] Different surgical approaches were used to treat multiple level cervical myelopathy including cervical laminectomy with or without instrumented fusion, laminoplasty, skip laminectomy, multilevel anterior discectomy, and multilevel corpectomy with or without middle vertebra preservation or a combination of anterior and posterior approaches.[3,6,8,11,15-17]

The ideal anterior or posterior approach for the treatment of multilevel (3 or more) cervical myelopathy is subject to considerable scientific debate and is yet to be agreed on. There are multiple studies in the literature comparing different anterior and posterior approaches to try and find out the ideal approach.[2,8-10,14]

We compare our clinical and radiological outcome and complication rate for anterior and posterior cervical decompression and fusion for the management of multilevel Cervical Spondylotic Myelopathy (CSM).

Patients and Methods

We conducted a retrospective review of all patients with cervical spondylotic myelopathy (CSM) who had treatment under our care and screened patients for eligibility to be included in this study. We selected adult patients with CSM who have multilevel (three or more) compression and had surgery utilising an anterior or posterior approach. We excluded patients who had less than three-level compression, patients who had anterior and posterior surgery (360°), patients who had non-degenerative compression (eg. tumour or trauma) and patients who had previous cervical spine surgery. We also excluded patients who had less than 12-month follow up period or if their pre and postoperative imaging was not available. We compared patients' visual analogue score (VAS) for neck pain, Nurick myelopathy score and radiological cervical spine alignment using the C2-C7 angle preoperatively and on each subsequent visit.

Operative Technique:

Cervical laminectomy and instrumented fusion (lateral mass screws):

Under general anaesthesia, we positioned the patients prone on the operating table with arms by the side and extra care is taken to protect pressure points. The neck is kept neutral with a degree of head flexion at the occipito-cervical joint and the skull is fixed in a three-point fixator and skull clamp. We infiltrate the skin with a mixture of lidocaine and adrenaline then perform a longitudinal midline incision and sticking to the midline avascular plane, we separate the muscles bilaterally in a sub-periosteal fashion to expose the lamina and facet joints keeping the muscle attachments to C2 spinous process intact unless involved in the decompression and fusion. We also take extra care not to jeopardise the facet joint capsules of the levels we are not planning to fuse. Once the exposure is done, intraoperative level confirmation with image intensifier is performed. We use a high-speed drill with a match-head burr (Midas Rex® - Medtronic® USA), we angle the drill medially to be perpendicular to the dorsal aspect of the lamina and drill a gutter bilaterally just medial to the junction between lamina and facet joint. Once the laminae are fully separated, we keep them in place connected by the ligaments until the screws and rods are placed and tightened to avoid injury to the spinal cord. We utilise Magerl screw entry point and direction[5]. We then use the high-speed drill in and around the facet joint of the levels to be fused to prepare raw surface for fusion and use the patient's laminae and spinous processes as autograft. We then elevate the laminae en bloc and bleeding points in the drilled bone edge are readily controlled with bone wax. We inspect the dura to ascertain adequate decompression then we perform haemostasis. We then close the wound in layers with a suction drain for twenty-four hours (figure 1)

Anterior Approach:

The choice of the actual procedure is tailored for each case, if the patient has multilevel focal compression mainly confined to the disc level and not extending much behind the vertebral body, then multilevel Anterior Cervical Discectomy and Fusion (ACDF) is utilised. On the other hand, if the compression is extending behind the vertebral body to the extent that good decompression is difficult to achieve through the disc space, then cervical corpectomy is done which on occasions is combined with ACDF in another level. We operated on all patients under general anaesthesia using a standard

technique: We positioned patients supine with a small sand bag between their shoulder blades to achieve a mild degree of neck extension. Patients' heads were maintained in a neutral position resting on a head-ring. We used a standard right-sided incision and Cloward® retractor in all cases and the blades were placed under the longus colli muscle to avoid undue retraction or injury to the pharynx, oesophagus, larynx and carotid sheath. We drilled away the lower anterior lip of the upper vertebral body to improve the line of sight. We used Caspar® retractor in all cases but due care was taken to avoid over-distraction. We operated using the surgical microscope and a high-speed drill and excised the posterior longitudinal ligament (PLL) in all cases. We used Polyetheretherketone (PEEK) cages filled with synthetic bone graft (biocompatible calcium phosphate) for ACDF. We placed the cage flush with the anterior vertebral line. Cage position was confirmed with image intensifier (II) in all cases prior to retractor removal. Meticulous haemostasis is then done and the wound is closed in layers over a suction drain. Similar approach to ACDF is used with removal of the disc above and below the corpectomy level. We then use a high-speed drill to perform the corpectomy. Our preference is to use vertebral body replacement cage supported in place with anterior plate and screws. In cases where we perform a combination of corpectomy and ACDF we extend the plate to cover both procedures. Proper placement is confirmed with II and then we close the wound in layers over a suction drain (figure 2).

Post-operative care:

Following return to the wards, once patients are eating and drinking, we encouraged them to mobilise early. We removed the drain after 24 hours and patients stayed in hospital for a few days after the procedure. Following discharge, patients were offered a quick postoperative check visit (typically at 7-21 days) and follow-up appointments at 3, 6 and 12 months. We clinically evaluated the patients' myelopathy based on Nurick's classification. We asked the patients about their function and conducted a full neurological examination. We used self-reported VAS to evaluate the patients' neck pain and recorded them preoperatively and on each follow up visit.

Serial Radiological Evaluation:

Our general practice is to obtain an antero-posterior (AP) and lateral cervical spine X-ray for all patients preoperatively, on postoperative day one (before discharge), during the first follow up visit (7-21 days) then on every subsequent follow up visit (typically 3, 6 and 12 months). We recorded the cervical alignment of C2–C7 curvature for all patients preoperatively and on each X ray. All data were entered and analysed on the SPSS® statistical package (Statistical Programs for the Social Sciences, UK). Paired Student's t-test was used for comparing paired data.

Results

Between January 2010 and July 2014, forty-two patients who had surgery under our care met the inclusion criteria. Both groups were demographically matched (Table 1). Twenty-two patients (52.4%) had posterior cervical decompression and instrumented fusion (PCF) and twenty (47.6%) had anterior cervical decompression and fusion (ACF). Fourteen of the PCF group were males (63.64%) and eight were females (36.36%) with a mean age ±SD of 66±6.37 years (Range=56-79). For the ACF group, twelve (60%) were males and eight (40%) were females with a mean age ± SD of 64±7.4 years (Range=48-75) (Table 1).

There was no significant difference in the duration of preoperative symptoms between the two groups (9.7±5.7 months, range 2-24) for PCF and (10.25±7.16 months, range 4-30) for ACF. Likewise, the myelopathy severity on Nurick scale was matched between the two groups (2.9 ± 0.86 for the PCF group and 3±0.79 for the ACF group).

There was a noticed improvement in myelopathy in both groups (mean Nurick scale from 2.9±0.86 to 1.68±0.71 for PCF and from 3±0.79 to 1.65±0.67 for ACF). There wasn't however any significant difference between the two groups. Mean VAS for neck pain at final follow up was not significantly different between the two groups (1.68±0.89 for PCF and 1.7±0.73 for ACF) although it was more higher in the PCF group compared to ACF in the early postoperative period (Table 2). The mean C2-C7 angle increased at final follow up in the ACF group from 8.9°±5.31 to 11.2°±7.52, whereas in the PCF group there was no kyphotic angle correction (figure 3).

Regarding complications, two patients in the

PCF group had temporary C5 palsy that completely recovered, one patient had inadvertent durotomy with a lax pseudomeningocele that was managed conservatively and one patient had postoperative wound haematoma that needed surgical evacuation.

In the ACF group, two patients had temporary dysphagia, one patient had permanent and two had temporary hoarseness of voice due to vocal cord palsy and one patient had inadvertent durotomy that did not cause CSF leak or collection postoperatively.

Table 1. Demographics

Group	Number	Males	Females	Mean Age	Mean duration (Months)	Nurick's Scale
PCF	22 (52.4%)	14	8	66	9.7	2.9±0.86
ACF	20 (47.6%)	12	8	64	10.25	3±0.79

PCF= posterior cervical fusion, ACF= anterior cervical fusion

Table 2. Clinical Outcome

Group	Preop Nurick scale	Postop Nurick scale	Preop neck pain VAS	Postop neck pain VAS
PCF	2.9	1.68	4	1.68
ACF	3	1.65	3.95	1.7

VAS= visual analogue score, PCF= posterior cervical fusion, ACF= anterior cervical fusion

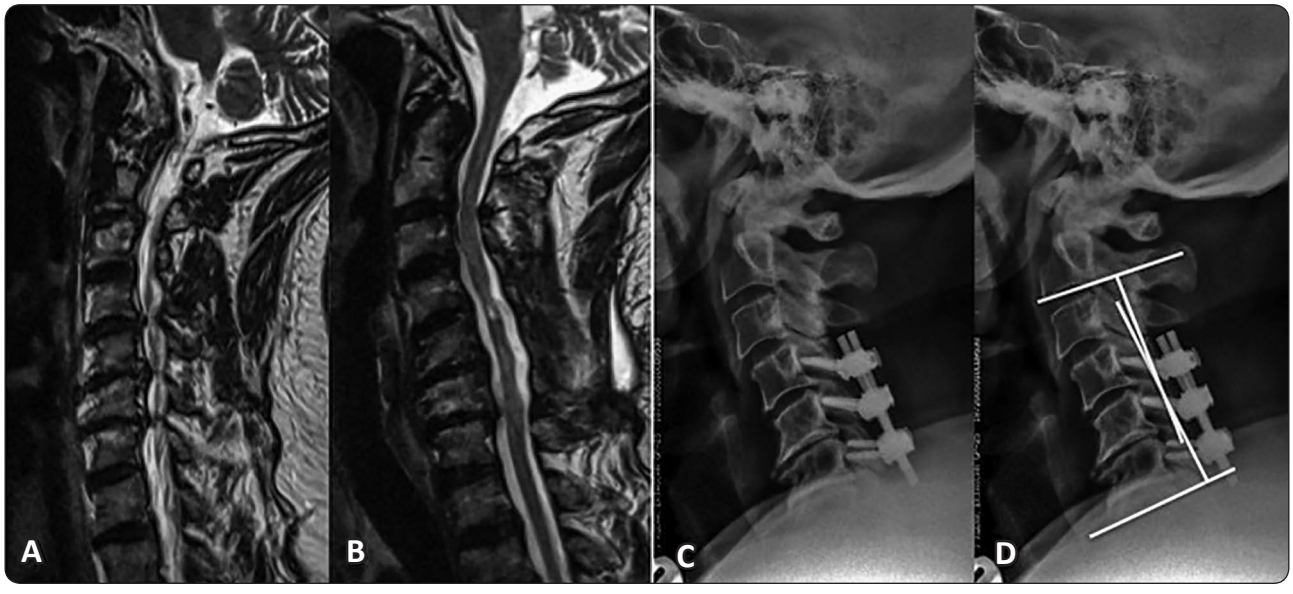

Figure 1. a case of cervical spondylotic myelopathy managed by posterior cervical decompression and instrumented fusion with lateral mass screws. A: preoperative MRI scan (sagittal T2WI) showing cord compression, B: Postoperative MRI scan (sagittal T2WI) demonstrating adequate cord compression with posterior cord displacement, C: Postoperative X-ray lateral view showing hardware in position and D: Cervical alignment demonstrated by C2-C7 angle.

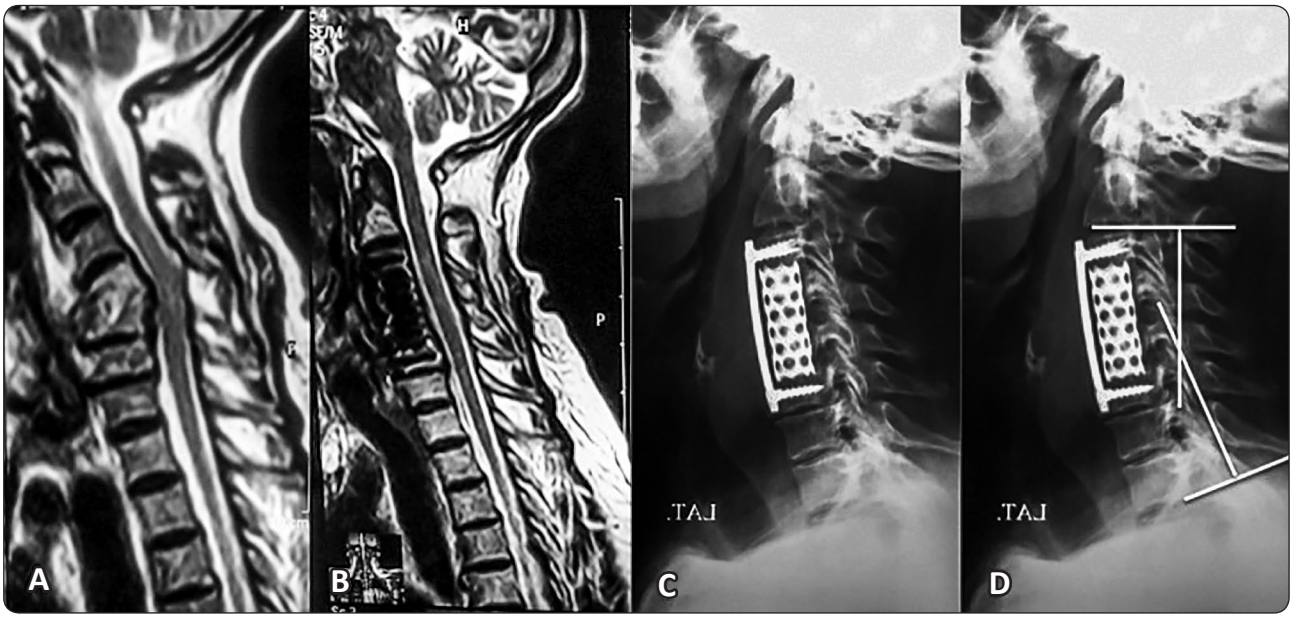

Figure 2. a case of cervical spondylotic myelopathy managed by anterior corpectomy and fusion. A: preoperative MRI scan (sagittal T2WI) showing cord compression and cervical kyphosis, B: Postoperative MRI scan (sagittal T2WI) demonstrating adequate cord compression, C: Postoperative X-ray lateral view showing hardware in position and D: Cervical alignment demonstrated by C2-C7 angle.

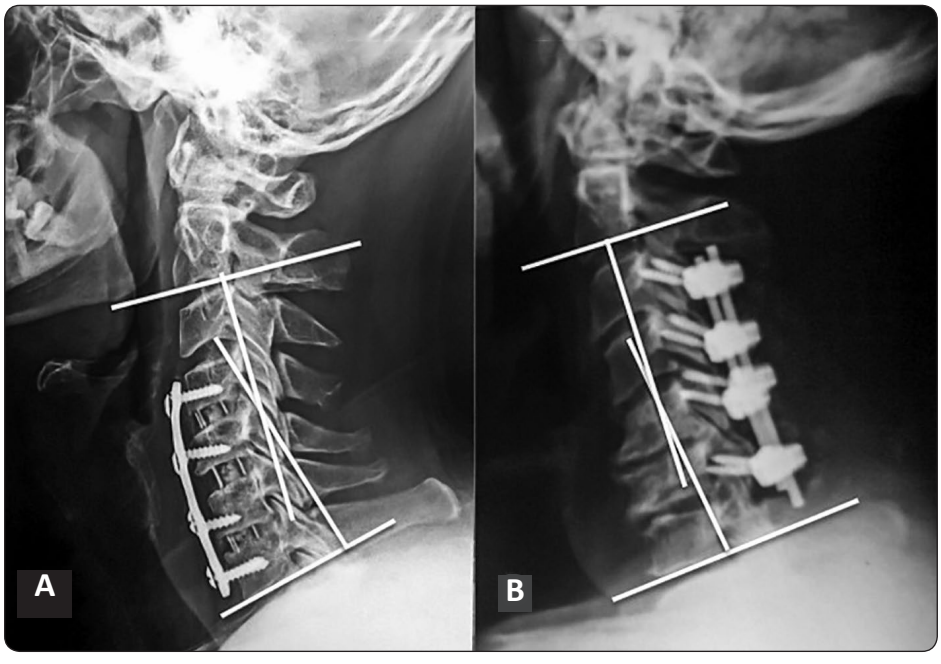

Figure 3. Cervical alignment using C2-C7 angle on a postoperative X ray following (A) multilevel anterior cervical discectomy and fusion with cage and plate and (B) multilevel posterior cervical decompression and instrumented fusion with lateral mass screws

Discussion

Cervical Spondylotic myelopathy is a common disorder that we face in clinical practice, various surgical options have been utilized over the years including cervical laminectomy, laminoplasty, posterior cervical fusion, multilevel anterior cervical discectomy, cervical corpectomy and a combination of approaches.[16,14,1] The debate between anterior and posterior approach for the treatment of multilevel cervical compression due to Spondylotic myelopathy is not new and is yet to be resolved.[4] Supporters of the anterior approach argue that it allows direct compression of the offending pathology, which is usually disco-osteophytic bars and also allows restoration of cervical lordosis and immediate stabilisation,[12,14] while those of the posterior approach suggest that multilevel posterior decompression will achieve good cord decompression through a 'total decompressing effect' where the spinal cord will shift posteriorly away from the offending anterior compressive pathology if the patient's neck is not in kyphosis, they suggest that it will be better decompression than that achieved through multilevel ACDF particularly if the compression extends behind the vertebral body and more biomechanically sound than multilevel corpectomy.[4,7,16]

A few studies compared anterior to posterior approaches to try and resolve the debate. In their study, Liu et al,[10] compared 27 patients had laminoplasty and 25 had ACDF including 3 or more levels using the plate cage benezech (PCB) implant system. They reported significant functional improvement in both groups, significantly shorter operative time with the anterior approach but with significantly more complications and more restriction in the range of movement (ROM) postoperatively. In a similar study, Edwards et al,[2] retrospectively compared 13 patients who underwent multilevel corpectomy and fusion to 25 patients who underwent laminoplasty for the management of CSM, they found both procedures to significantly improve functional outcomes but with higher complication rates in the corpectomy group. So both studies send a similar message, laminoplasty takes longer time but is less restrictive to neck movements and has fewer complications compared to multilevel ACDF or multilevel corpectomy and anterior plating.[2,10]

Two more recent studies comparing cervical laminectomy and instrumented fusion with lateral mass screws to a combination of multilevel ACDF and corpectomy have a different conclusion. Lin et al,[9] compared 27 patients who had multilevel ACDF combined with segmental corpectomy at the most significant level of compression with 24 patients who had cervical laminectomy and instrumented fusion with lateral mass screws for multi-level CSM. Both procedures significantly improved functional outcome (although better results were achieved with the anterior approach) with the advantage of kyphosis correction with the anterior approach. Shunzhi et al,[14] retrospectively compared 29 patients who had multilevel anterior corpectomy and fusion with middle vertebra preservation to 24 patients who had cervical laminectomy and fusion with lateral mass screws. There was significant functional improvement in both groups with the advantage of lordosis restoration with the anterior approach. So the message from these two studies is better outcome with both approaches with a possible functional advantage in addition to the significantly improved lordotic angle restoration in the anterior group. Our results are more in line with the results of these two studies where both groups had significant improvement but no kyphotic angle correction was achieved in the posterior approach group as opposed to significant improvement in the anterior group alignment as measured by the C2-C7 angle.

Li et al,[8] retrospectively compared 39 patients who had multilevel anterior cervical corpectomy and fusion with middle vertebra preservation to 28 patients who had posterior cervical laminectomy and fusion. They included patients suffering from multilevel CSM involving 4 or more vertebrae. They concluded that both procedures significantly improved functional outcome but with more operative time, blood loss and neck pain with the posterior approach and more complications particularly dysphagia with the anterior approach. A recent meta-analysis also reported a similar conclusion where the complication rate was found to be higher with corpectomy.[17]

Obviously the published literature so far is retrospective and the numbers are relatively small. So far the debate between anterior and posterior approaches for the management of

multilevel cervical Spondylotic myelopathy remains unresolved. Studies including ours, demonstrate that both approaches are successful with some advantage of one approach over the other.

Conclusion

Both anterior and posterior approaches significantly improve neck pain and myelopathy in patients with multilevel cervical spondylotic myelopathy although the anterior approach has the advantage of kyphotic angle correction. Prospective studies with bigger numbers and longer follow up would be helpful particularly in demonstrating delayed complications as adjacent segment pathology.

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الملخص العربي

المدخل الأمامي مقابل الخلفي لحالات اعتلال النخاع الشوكي العنقي الناشي عن القسط الفقري متعدد المستويات

البيانات الخلفية: يعد الاعتلال النخاعي الفقاري العنقي من الأمراض الشائعة والتي يواجهها جراح الأعصاب بشكل شائع أثناء الممارسة الطبية اليومية. تحتاج الكثير من هذه الحالات للتدخل الجراحي باستخدام الطريق الجراحي الأمامي أو الخلفي أو كليهما معا. يمكن عن استخدام الطريق الخلفي لتوسيع القناة العصبية عن طريق رفع الصفائح العظمية و يمكن إضافة مسامير الكتلة الجانبية لتثبيت الفقرات و منع الاعوجاج العنقي الأمامي. أما الطريق الجراحي الأمامي فيمكن عن طريقه استئصال الغضاريف و دمج الفقرات و قد يصاحبه تثبيت الفقرات باستخدام الشرائح والمساميركما يمكن من خلاله استئصال الجسم العظمي الفقاري. حتى الآن لا يوجد اتفاق عام بين جراحي العمود الفقري على الطريق الجراحي الأمثل في مثل هذه الحالات.

الهدف: نقدم في هذه الورقة البحثية نتائجنا في علاج خالات الاعتلال النخاعي الفقاري العنقي و نقارن فيها بين الطريق الأمامي و الخلفي من حيث آلام الرقبة و تحسن الاعتلال النخاعي و زاوية انحناء الرقبة وأيضا حدوث المضاعفات

المرضي و الطرق: أجرينا تحليلا لحالات الاعتلال النخاعي الفقاري والتي تم علاجها جراحيا تحت إشرافنا في الفترة من يناير ٢٠١٠ و حتى يوليو ٢٠١٤ باستخدام الطريق الجراحي الأمامي أو الخلفي مع تثبيت الفقرات

النتائج: تحسن المرضى في المجموعتين بدرجة ذات دلالة إحصائية من حيث آلام الرقبة و الاعتلال النخاعي و لم نجد فروقا ذات دلالة إحصائية عند المقارنة بين المجموعتين فيما عدا تصحيح زاوية ميل الرقبة والتي قد تحسنت بشكل دال إحصائيا في المجموعة التي تم علاجها باستخدام الطريق الجراحي الأمامي فيما لم تتحسن في مجموعة الطريق الجراحي الخلفي

الاستنتاج: نستنتج من البحث إمكان استخدام كلي الطريقين الجراحيين الأمامي والخلفي لعلاج الاعتلال النخاعي الفقاري العنقي وأن للطريق الجراحي الأمامي ميزة إضافية وهي تصحيح زاوية ميل الرقبة. نظرا لقلة عدد عينة البحث وتحليل النتائج بأثر رجعي فإننا نرى أن الموضوع يحتاج لأبحاث أخرى.