

Elective non-instrumented anterior cervical discectomy and fusion in Ghana: A preliminary report

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Summary

Background: This study is a retrospective analysis of forty-one consecutive patients who underwent elective single or multilevel anterior cervical discectomy and fusion (ACDF) in Ghana. All the patients had been followed up for at least six months.

Methods: The medical records of forty-one consecutive cases were analysed retrospectively. The parameters reviewed included patient demographics and presentations, number of fusion levels, complications and clinical outcome.

Result: Non-instrumented ACDF constituted 22% of all the neurosurgical procedures performed during the study period. A total of 41 patients underwent the procedure. Seventy-eight percent of the patients were male; the mean age of all the patients was 52 years; follow-up was for an average of 21 months. Preoperative assessment revealed that 98% had myelopathy and 2% had radiculopathy only. No patient was operated on for only pain. There were no repeat operations performed.

All levels operated on were fused for a total of 67 levels; 37% at one level only and 63% at two levels; no patient was fused or operated on at three levels. Ninety percent of the fusions were at the C4—5 and C5—6 levels. The mean ages of males and females fused at one level only were 48 and 60 years respectively; the difference was statistically significant ($P<0.05$). For patients fused at two levels; 81% were males and 19% were females, the difference was statistically significant ($P<0.05$). However, there was no statistical difference between the ages of males and females operated on at two levels ($P>0.05$). In addition there was no statistical difference between the ages of males operated on at one level or two levels nor was there a difference between the ages of females operated on at one or two levels ($P>0.05$).

The mean preoperative Nurick grade was 2.3 (SD, 1.9); the mean Nurick grade postoperation was 1.3 (SD, 1.3). The difference is significant ($P<0.001$). There was also a significant relationship between the preoperative and postoperative Nurick grades for males operated on at either one or two levels ($P<0.01$); however none could be demonstrated for females ($P>0.01$).

The total operative complication rate was 12%; the most common complication was graft/donor site infection (7%). There was no operative or postoperative mortality. Eighty six percent of the patients had an excellent or good clinical outcome as defined by Odom's criteria. Of the 34% who did not have excellent or good clinical outcome, follow up radiologic studies showed excellent graft fusion in all of them.

Conclusion The majority of patients undergoing non-instrumented ACDF in Ghana have cervical myelopathy involving two cervical levels. However, a large majority of them have excellent or good clinical results after surgery. The most common complication is graft/donor site infection

Keywords: Anterior cervical discectomy, Cervical fusion, Ghana.

Résumé

Cet étude est une analyse rétrospective de quarante et un patients consécutifs qui avaient subi simple électif ou la disquetomie cervicale antérieure multiniveau et fusion (ACDF) au Ghana. Tous les patients avaient eu des soins post-hospitaliers d'une durée de six mois au moins.

Méthodes: Les dossiers médicaux de quarante-et-un cas consécutifs ont été analysés rétrospectivement. Les paramètres examinés comprennent: démographie des patients, présentations, nombre de niveau de la fusion, complications et résultats cliniques.

Résultats: ACDF non instrumenté s'élève à 22% de tous les procédures neurochirurgicales opérées au cours de la période de cet étude. Au total, 41 patients avaient subi cette procédure. Soixante dix huit pourcentage des patients étaient mâle, l'âge moyen de tous les patients était 52 ans. Soins post-hospitalier était en moyenne 21 mois. Estimation préopératoire a indiqué que 98% étaient atteints de la myelopathie et 2% avaient radiculopathie seulement. Aucun patient n'a été opéré pour une seule douleur. Il n'y avait pas de cas d'une opération répétée. Dans l'ensemble, tous le niveaux opérés étaient 67, 37% dans un seul niveau, et 63% dans deux niveaux. Aucun patient n'a été fusé ou opéré au trois niveaux. 90% des fusions étaient aux niveaux C4 - 5 et C5 - 6. L'âge moyen des mâles et femmes fusés dans un seuls niveau étaient 48 et 60 ans respectivement, la différence était statistiquement important ($P<0,05$).

En ce qui concerne des patients fusés en deux niveaux, 81% étaient mâles et 19% étaient femmes, la différence était statistiquement important ($P<0,05$). Toutefois, Il n'y a pas une différence statistique entre les âges des mâles et des femmes opérés en un ou deux niveaux et d'ailleurs il n'y avait pas une différence entre les âges des femmes opérées en un ou deux niveaux ($P>0,001$). Le moyen grade Nurick préopératoire était 2,3 (SD, 1,9), le moyen grade Nurick postopératoire était 1,3 (SD, 1,3). La différence est importance ($P\geq 0,001$). Il y avait également un rapport important entre les grades Nurick préopératoires et postopératoire pour des mâles opérés dans soit un ou deux niveaux ($P<0,01$); cependant, aucun ne peut être démontré pour des femmes ($P<0,01$). Au total, le taux de complications opératoire était 12%, la complication la plus fréquente

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était la greffe siège infection (7%), Il n'y avait pas la mortalité opératoire ou postopératoire.

D'après la définition du critère d'Odoms, quatre vingt six pourcentage des patients avaient un très bon résultat ou un bon résultat clinique. Entre le 34% qui n'avaient pas eu un très bon résultat, études radiologiques des soins post-hospitaliers ont démontré une très bonne greffe fusion chez tous.

Conclusion: La plus grande partie de patients qui suivent le traitement ACD non-instrumenté au Ghana sont atteints de la myelopathie cervicale impliquant deux niveaux cervicaux. Cependant, le plus grand nombre d'entre eux avaient un excellent ou un bon résultat clinique après la chirurgie. La complication la plus fréquente est la greffe/donneur siège infection.

Introduction

Anterior cervical discectomy and fusion (ACDF) was introduced in to Ghana in 1979. It has since become a standard treatment for cervical radiculopathy and spondylotic myelopathy refractory to conservative management. Cloward and Smith and Robinson simultaneously described different techniques for ACDF in 1958^{1,2}. To date both methods have been utilised in Ghana. However, there has never been a published report documenting the patient demographics, preoperative symptom complex, complication rates and clinical results.

Since 1996, instrumented ACDF has been introduced in Ghana at tremendously increased cost relative to non-instrumented ACDF. Without prior data and analysis of elective non-instrumented ACDF in Ghana, it is difficult to justify this and to compare the clinical results of non-instrumented and instrumented ACDF. It has also hitherto been impossible to compare the results of ACDF in Ghana with series published from other sites.

Clearly, preliminary analysis of ACDF in Ghana will provide important base line data that will assist in health care planning and serve as a basis for comparison and evaluation as other techniques are introduced and applied. This study analyses the patient demographics, presenting symptoms, fusion levels, post-operative results and complications of patients undergoing elective non-instrumented ACDF in Ghana.

Materials and methods

Between January 1999 and December 2001, 41 consecutive patients underwent single or multilevel elective ACDF for cervical radiculopathy or myelopathy. Non-operative therapy failed in all 41 patients. This included in each case the use of anti-inflammatory medications, analgesics, cervical collars and strengthening exercises. All operations were performed by the senior author (NBA).

A retrospective review of their medical records was carried out. The parameters analysed included, patient demographics, symptom complex at initial visit, preoperative evaluation, surgical procedure, complications and postoperative status. Clinical outcomes were recorded at 6 months using the Nurick grading system and Odom's criteria⁷, (Table 1). Only the Nurick system was used to assess preoperative status.

Statistical analysis

1. After a normal distribution test was applied, two sample t test was used to analyse which two groups are significantly different when compared to each other, $P < 0.05$ was considered significant.
2. In order to compare two or more groups with outcome variables in more than two categories, a chi-squared was

used; where indicated, the Yates correction for continuity was applied; $P < 0.05$ was considered significant.

Operative technique

The operative approach was based on that described by Smith and Robinson and is described below:

All patients were operated on under general anaesthesia. No cervical traction was utilised. Patients were placed with a roll underneath the shoulders and the neck placed in extension with the neck on a soft roll for support. The chin is strapped down securely with tape. The shoulders are pulled toward the foot of the table and secured in this position with tape applied to the tops of both shoulders and secured to the foot of the table. Horizontal cutaneous incisions on the right side were used for both single level and multilevel discectomies. Anatomic landmarks were crucial to determining the site of the transverse incision as radiographic control was not available. The hyoid bone corresponds to C3, the thyroid cartilage C4–5 interspace and the cricoid cartilage to C5–6 interspace. In addition the carotid tubercle corresponds to the C6 transverse process and can easily be palpated; the most superior point of the cervical lordotic curve with the neck in extension corresponds to C5-6 interspace.

Loupe magnification and coaxial head illumination were utilised. At the operative site further distraction was obtained by utilising a vertebral spreader to a maximum of 19mm. No drills were utilised as none were available. The endplates were cleared of cartilage. Posterior osteophytes were removed using various sizes and angles of curettes and rongeurs. In the same way, anterior foraminotomy was performed if radicular signs were evident preoperatively. The posterior longitudinal ligament was not opened. The disc space was measured and an appropriately sized tricortical autologous anterior iliac crest graft was harvested and placed cortex anterior. No drains were utilised.

Postoperatively, a neck brace was used for 6 weeks. Patients were ambulant on the first postoperative day and were discharged by the tenth day when all sutures had been removed. A physiotherapy regimen was started on the third postoperative day and continued for six weeks. Patients were examined for follow up at 4 weeks, 3 months, 6 months, 12 months and annually.

Results

Forty one patients (9F, 32M) constituted the series. They each underwent the operation of non-instrumented ACDF once. This constituted 21.9% of the total of 188 neurosurgical procedures performed during the period under review. The mean age was 53.0 years (R 36–68, SD, 10.0). The males had a mean age of 51.7 years (SD, 9.8) and the females 57.8 years (SD, 9.4). All patients were followed up for at least six months. The mean follow-up was 21.5 months (R 6-36, SD, 10.6).

Forty patients (97.6%) had clinical evidence of myel-

Table 1 Disability in cervical myelopathy (Nurick grading scale).

0	Root signs and symptom, no cord involvement
1	Sign of cord involvement; normal gait
2	Mild gait impairment; able to be employed
3	Gait abnormality; prevents employment
4	Able to ambulate only with assistance
5	Chair-bound or bed ridden

Table 2 Odom's criteria

Excellent	No complaint referable to cervical disease Do daily occupation without impairment.
Good	Intermittent discomfort referable to cervical disease.
Satisfactory	Does not significantly interfere with work. Subjective improvement.
Poor	Physical activity significantly impaired. Worsening or no improvement.

Table 3 Patient demographics and presentation

No of patients	41
Mean age in year (SD)	53.0 (10.0)
Male : Female	32.9
Presentation	
Radiculopathy	1
Myelopathy	40
Pain only	0

opathy preoperatively with marked knee hyper-reflexia. All the patients had a complete or partial motor deficit. No patient was operated on for pain only. Only one patient (2.4%) had purely radicular symptoms and radiculopathy only on examination. The mean Nurick grade preoperatively was 2.3 (SD, 1.9) for the study group. Thirty nine patients (95.1%) had cervical myelograms and post myelo-CT scans; 2 patients (4.9%) had cervical myelograms only without postmyelo-CT scans.

All the levels operated on were fused; a total of 67 levels were fused (Table 4). Fifteen (36.6%) patients were fused at only one level; the rest (63.4%) were fused at two levels; the difference is not significant (chi-sq, $P>0.05$). No patient was fused at three levels. Sixty (89.6%) of the fusions were performed at the C4-5 and C5-6 levels. There were 35 C4-5 fusions, constituting 52.2% and 25 C5-6 fusions constituting 37.3% of the total. Five fusions were at C3-4 and 2 fusions at C6-7 made up 7.5% and 3.0% of the total.

The mean age of the males fused at only one level was 48.1 years (SD, 8.8); that of the females was 59.5 years (SD,

Table 4 Fusion level

Level	Patients
C3 – 4	5
C4 – 5	35
C5 – 6	25
C6 – 7	2
67 levels fused in 41 patients	

Table 5 Clinical outcome (Odom's criteria)

Outcome	Number of patients (%)
Excellent	27 (66%)
Good	8 (20%)
Satisfactory	5 (12%)
Poor	1 (2%)

11.2); the difference is significant (t test, $P<0.05$). Considering the patients fused at two levels, the mean ages of the males and females were 53.5 years (SD, 9.7) and 56.5 years (SD, 7.5) respectively; the difference was not significant (t test, $P>0.05$).

No significant differences were also noted for the following ($P>0.05$)

1. age of males operated on at one level and those operated on at two levels.
2. age of females operated on at one level and those operated on at two levels.

Fifteen patients were operated on at one level; they comprised 11 (73.3%) males and 4 (26.7%) females; the difference was not significant (chi-sq; $P>0.05$). A total of 26 patients (63.4% of total sample) were operated on at two levels, they comprised 21 (80.8%) males and 5 (19.2%) females; the difference was significant (chi-sq; $P<0.05$).

The mean preoperative Nurick grade for all the patients was 2.3 (SD, 1.9). The mean postoperative Nurick grade at six months was 1.3 (SD, 1.3); this was statistically significant (chi-sq, $P<0.001$). There was also a statistically significant relationship between the preoperative and postoperative Nurick grades for males operated on at either one or two levels (chi-sq; $P<0.01$). This was not the case for females operated on at two levels (chi-sq; $P>0.01$). For females operated on at one level, the sample size was far too small for any conclusion to be drawn.

There were 3 (7.3%) wound infections at the graft/donor site; 1 (2.4%) superficial neck wound infection and 1 (2.4%) postoperative respiratory arrest. The total operative complication rate was 12.1% (Table 6).

The clinical outcome at 6 months was assessed by utilising Odom's criteria (Table 2). This showed that overall, 27 patients (66%) had an excellent clinical outcome (Table 5) Eight patients (20%) had good results, 5 patients (12%) had a satisfactory outcome and one patient (2.4%) had a poor outcome. Fourteen patients (34%) who did not have excellent results had

Table 6 Intraoperative and postoperative complications

Complication	Number of patients (%)
Superficial neck wound infection	1 (2.3%)
Graft/donor site wound infection	3 (7.3%)
Post operative respiratory arrest	1 (2.4%)
Total	5 (12.0%)

lateral cervical spine radiographs taken at 6 weeks, 3 months and 6 months post surgery. These were evaluated for disc height, angular deformity and status of fusion. In all of these patients osseous fusion was noted by the presence of cross trabeculations, absence of osteophytes and absence of motion on flexion-extension films.

Discussion

Smith and Robinson², Cloward¹ were the first to describe a small series of patients to undergo ACDF. Odom et al⁴ prepared a four category system to classify patients outcomes after surgery. ACDF has been widely adopted on the premise that the immobility of the joint decreases the probability and rate of osteophytosis and promotes reabsorption of pre-existing osteophytes^{5,6}. Bone grafts distract the disc space, increase

the size of the intervertebral foramina at the same level and prevent postoperative settling^{3,6,7}. Thorell et al concluded that those patients who underwent ACDF did better than those who underwent discectomy without fusion⁸.

Our series showed a large male preponderance. Lunsford et al had no gender predominance with hard lateral herniations, but had twice as many men as women affected by soft lateral herniations⁹. Sampath et al in a group of patients with cervical spondylotic myelopathy had 48% males¹⁰. Brain in 1963 quoted a study by Kellgren and Lawrence that revealed the incidence of spondylotic disease to be about the same in men and women, but women tended to be less severely affected than men¹¹.

Preoperative motor deficits in patients with cervical disc herniation have been documented to range from 25-74%^{9,12,13,14}, alterations in deep tendon reflexes have been documented from 26-70% of patients^{9,12,14}. The presence of these alterations in 100% of our patients is probably due to disease progression on account of late reportage before the institution of definitive treatment. The latency between the first symptoms and surgery is 2 to 3 times longer for hard disc than for soft disc herniations¹⁵.

Imaging techniques are essential to confirm the presence and location of cervical disc disease BUT they cannot be substituted for a meticulous history and physical examination. Several options are available for diagnostic imaging of cervical disc disease and several studies have compared myelograph, CT, CT-myelography and MRI^{16,17,18}. When results of imaging studies are compared to operative findings, the data has to be interpreted with caution since the operative findings are necessarily limited by the disc level operated upon and the surgical approach utilised. CT-myelography is comparable to or slightly superior to MRI in overall accuracy relative to surgical findings^{16,17,18,19}. This finding is reassuring to us in Ghana since at this time we do not have MRI facilities available and the large capital outlay required does not make its acquisition imminent.

Several authors have reported that the most frequent levels of disc herniation are C5-6 and C6-7^{7,14,20,21,22}. In our series 52% of the disc degenerations were at C4-5 and 37% at C5-6; only 3% were at the C6-7 level. In addition, varying frequencies of multiple disc herniations have been reported by various authors. Aronson et al²⁰ reported 38.6%, Wilson and Campbell¹⁵ had 2.8%. In our patients 63.4% underwent multiple level surgery. This could possibly be explained by the large number of our patients with myelopathy and by individual clinical and radiographic criteria for surgical intervention.

In our series, when the ages of the patients with single level surgery were compared with respect to gender, the mean age of the males was significantly less than those of the females. This supports the findings in the study by Kellgren and Lawrence quoted by Brain in 1963¹¹. Furthermore, we found that a significantly larger percentage of males than females were operated on at multiple levels.

Eighty-six percent of our patients had excellent or good clinical results after six months follow-up. There was also a significant improvement in Nurick grade post operation. Authors have reported that between 63 and 91% of patients who have undergone ACDF have had excellent or good results^{5,20,23,24,26,27}. Fessler et al reported that Nurick scores reflected improvement for 86% of patients that underwent anterior cervical corpectomy for cervical spondylotic myelopathy³². Our results also confirm the findings of Sampath et al that surgically treated patients with cervical myelopathy had a significant improvement in functional status and overall pain with improvement also observed in neurologic symptoms; those

treated nonsurgically had a significant worsening of their ability to perform activities of daily living, with worsening of neurologic symptoms¹⁰. None of our patients underwent three-level ACDF. Three-level ACDF has been associated with a pseudoarthrosis rate of 56%¹⁰. Generally, as the number of motion segments involved in fusion increases, there is an associated decrease in the rate of fusion^{29,30}. However, we were able to demonstrate 100% radiologic fusion in all our patients who did not achieve excellent results.

Our overall intraoperative and postoperative complication rate was 12.1% with wound infections constituting the majority (9.7%). The majority of the infections were at the graft or donor site; the medical complication rate was 2.4%; there was no unplanned reoperation and no inpatient mortality. Romano et al reported a 6.7% overall postoperative complication rate, with 1.8% having infectious complications, 1.8% non infectious surgical complications, 4.0% other medical complication, 0.35% unplanned reoperations and 0.13% inpatient mortality³¹. The case can therefore be made for changing to anterior cervical discectomy without fusion. This will eliminate the potential for graft/donor site infection and thereby reduce the infection rate considerably in our environment. Thorell et al noted that a high percentage of patients will have excellent or good outcomes after undergoing anterior cervical discectomies regardless of whether a bone graft is placed between the vertebral bodies or not. Specific evaluation of pain and level of function, for first time single-level interventions, revealed that there was no difference between fused and non-fused patients⁸.

Conclusions

Patients who underwent elective non-instrumented ACDF did well and benefited from their operations. Most of the patients were male, had cervical myelopathy and involvement at multiple levels. The most common complication was graft/donor site infection.

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