Evaluation of Physical Function in Individuals 11 to 14 Years After Anterior Cervical Decompression and Fusion Surgery—A Comparison Between Patients and Healthy Reference Samples and Between 2 Surgical Techniques

Anna M.K. Hermansen, PT,[a] Joshua A. Cleland, PhD, PT,[b] Ann-Sofi C. Kammerlind, PhD, PT,[c,d] and Anneli L.C. Peolsson, PhD, PT[e]

Abstract

Objective: The purpose of this study was to evaluate neck-related physical function in individuals 11 to 14 years after anterior cervical decompression and fusion (ACDF) surgery for degenerative cervical disk disease and to compare the long-term outcome of 2 surgical techniques, including the Cloward procedure and cervical intervertebral fusion cage.

Methods: In this cross-sectional study, 51 individuals, 11 years or more after ACDF, underwent testing of cervical active range of motion, hand-grip strength, static and dynamic balance, neck muscle endurance, and completed pain ratings. The participants' values were compared with values of age- and sex-matched healthy individuals to evaluate impairments. Correlations between different test scores and pain were performed. Group differences were analyzed between the 2 surgical techniques.

Results: Sixty-five percent and 82% exhibited impairment in ventral and dorsal neck muscle endurance, respectively. Impairment rates of 18% to 39% for cervical active range of motion, 27% to 43% for hand-grip strength, 37% for standing balance, and 35% for dynamic balance were recorded. Twenty-nine percent of the participants had impairment (>30 mm visual analog scale) in pain. There were no significant differences in physical function between the 2 surgical treatment groups (Cloward procedure or cervical intervertebral fusion cage) (P = .10-.92).

Conclusions: In those studied, a large percentage of patients who had anterior cervical decompression and fusion surgery have impairments in neck-related physical function when compared 11 to 14 years after surgery with age- and sex-matched healthy reference individuals. Neck-specific function, but not balance, was statistically correlated to pain. Neck muscle endurance was most affected, and balance impairments were also present in one-third of the individuals. There were no differences in long-term physical function between the 2 surgical techniques. (J Manipulative Physiol Ther 2014;37:87-96)

Key Indexing Terms: *Cervical Vertebrae; Neck Muscles; Physical Endurance; Range of Motion; Postural Balance; Surgical Procedure*

[a] PhD Student, Department of Medical and Health Sciences, Division of Physiotherapy, Faculty of Health Sciences, Linköping University, Linköping, Sweden.

[b] Professor, Physical Therapy Department, Franklin Pierce University, Concord, NH.

[c] Senior Lecturer, Futurum—the Academy for Healthcare, County Council, Jönköping, Sweden.

[d] Senior Lecturer, Department of Medical and Health Sciences, Division of Physiotherapy, Faculty of Health Sciences, Linköping University, Linköping, Sweden.

[e] Associate Professor, Department of Medical and Health Sciences, Division of Physiotherapy, Faculty of Health Sciences, Linköping University, Linköping, Sweden.

Submit requests for reprints to: Anna M.K. Hermansen, BSc, Department of Medical and Health Sciences, Division of Physiotherapy, Faculty of Health Sciences, Linköping University, SE-58183, Linköping, Sweden (e-mail: *Anna.hermansen@liu.se*).

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Anterior cervical decompression and fusion (ACDF) has been performed as a surgical intervention for cervical disk disease since the 1950s, when the Cloward procedure (CP) and the Smith-Robinson techniques were first introduced.[1,2] Previous research on outcomes after ACDF show reduced pain,[3-5] reduced neurologic symptoms,[5] and global improvement.[3-8] Despite these improvements, a number of studies have shown that patients report neck-specific disability[3-5,8,9] and continued pain[3-5,8-10] in short-term (6 months to 3 years) and long-term (6-10 years) follow-ups after surgery. We believe that there is a need to also evaluate physical function, which may have a great impact on everyday life in individuals after anterior cervical decompression surgery. Only a limited number of studies have previously evaluated cervical range of motion (ROM), neck muscle functioning, hand-grip strength, and balance after anterior surgery.[5,10-13] Of these, no study has previously evaluated functional outcome in patients after ACDF with more than a 3-year follow-up.

When evaluating self-reported measures of pain intensity and neck-specific disability, 10 years postoperatively using 2 different techniques of ACDF (the CP without a cage and the cervical intervertebral fusion cage [CIFC] with a carbon fiber cage), no differences between the 2 techniques were present.[4] The use of a cage in the ACDF procedure is proposed to prevent graft collapse and to restore cervical lordosis.[3] No studies have previously evaluated differences in long-term physical function between the 2 techniques.

A study of physical function may add to an understanding of the long-term outcome in patients after ACDF. Therefore, the aim of the present study was to evaluate neck-related physical function in individuals 11 to 14 years after ACDF and to compare the outcome of neck-related physical function between 2 surgical techniques (CP and CIFC).

Methods

The original randomized control trial was performed at a university hospital in Sweden between 1995 and 1998.[3] Inclusion criteria were radiculopathy of degenerative origin with or without neck pain of at least 6-month duration.[3] Patients were randomly assigned to either surgery with the CP[1] or the CIFC[3] techniques by an attending nurse. A total of 103 patients were included, but 8 individuals decided against having surgery leaving 95 patients in the original study (see flow chart in Fig 1).[3] Postoperatively, all individuals were instructed to wear a Philadelphia collar for 6 weeks and follow standard procedures after removal of the collar. This included standard postsurgery rehabilitation (which was not specifically designed for the study) containing mobility exercises, ergonomic advice, and posture control. The patients were referred to physical therapy in primary health care if needed. A minimum of 10 years after surgery, a new questionnaire was sent out to the remaining 90 individuals (Fig 1).[4] As a part of the questionnaire, all of the individuals were asked if they would be willing to participate in the present study, which included a clinical examination of physical function.

Seventy-three individuals returned the completed questionnaires.[4] The dropouts were caused by severe other diseases such as cancer or stroke (7 individuals), 1 incomplete questionnaire, and 9 individuals who did not return the questionnaire despite reminders.

Participants

Fifty-seven individuals (32 women and 25 men) agreed to participate in the present study evaluating function. After providing informed consent to participate, these individuals were contacted for scheduling of the clinical examination. Six individuals dropped out of the study before the clinical examination. Two individuals dropped out due to medical reasons unrelated to their neck problems, and 4 were unable to attend any of the scheduled testing opportunities for different nonmedical reasons.

The remaining 51 individuals (30 women and 21 men) participated in this study (see flow chart in Fig 1) including physical measures of neck-specific function, hand function, balance performance, and self-reported pain ratings. Twenty-five individuals had been operated on using the CP technique, and 26, with the CIFC procedure. There were no significant differences in the following variables between the 2 surgical technique groups: age, time to follow-up, preoperative pain (visual analog scale [VAS]), and disability (Neck Disability Index) ratings or number of levels operated on (Table 1). Six individuals (CP, 2; CIFC, 4) had at least 1 additional surgery, and 14 had a nonhealed fusion on radiographs at the 2-year follow-up (Table 1). Of the 51 participants, 7 were left handed.

This study was performed in accordance with the Declaration of Helsinki and was approved by the regional ethics review board in Linköping, Sweden.

Procedure

The clinical examination was performed starting with a rating of pain "at rest" followed by cervical active ROM (AROM) (cAROM) in 6 directions (flexion, extension, side-bending right and left, rotation right and left), hand-grip strength (right and left hand), clinical balance tests, and neck muscle endurance (NME) tests (ventral and dorsal). The order of performing the tests was standardized. The participants were given verbal instructions immediately before each measure. No warm-up exercises were performed before the measures. However, immediately before performing the different measures, 1 test trial was allowed to ensure that the instructions were correctly understood. The only rest allowed was the time taken to

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