

Clinical Study

Sagittal range of motion after extensive cervical fusion

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Abstract

BACKGROUND CONTEXT: Complicated cervical spine revision and deformity correction surgeries are becoming increasingly common. These challenging operations often necessitate fusion of the entire cervical spine. Patients frequently express concern over the likely loss of range of motion (ROM) of the neck postoperatively. However, we are aware of no study that specifically examines the sagittal cervical ROM after extensive cervical fusion.

PURPOSE: To characterize sagittal ROM after extensive cervical fusion.

STUDY DESIGN: Retrospective case series.

PATIENT SAMPLE: Thirty patients were included.

OUTCOME MEASURES: Radiographs at final follow-up were measured for cervical ROM by the occipitocervical and cervicosternal angles with the neck in full flexion and extension.

METHODS: The surgical and medical records at one tertiary referral academic institution were used to identify adults who had undergone extensive cervical fusion between 1996 and 2008. An “extensive cervical fusion” entailed an upper instrumented vertebra proximal to C3 and lower instrumented vertebra distal to C7. Radiographs at final follow-up were measured for cervical ROM by the occipitocervical and cervicosternal angles with the neck in full flexion and extension.

RESULTS: The average age at surgery was 58.3 ± 10.0 years. The surgical levels were occiput–T1 (one patient), occiput–T4 (one patient), occiput–T6 (one patient), C1–T1 (one patient), C1–T2 (one patient), C2–T1 (nine patients), C2–T2 (eight patients), C2–T3 (six patients), and C2–T4 (two patients). Twenty-seven of the procedures were revisions. The other surgical indications were chin-on-chest deformity (one patient), cervical scoliosis (one patient), and multilevel cervical myelopathy (one patient). The mean follow-up period was 34.5 ± 30.9 months (range, 6–154 months). The mean cervical ROM values by the occipitocervical and cervicosternal angles were $29.5 \pm 11.0^\circ$ and $7.5 \pm 5.0^\circ$, respectively. The mean total cervical ROM value was $34.1 \pm 14.7^\circ$.

CONCLUSIONS: A substantial degree of sagittal ROM can be maintained after extensive surgical fusion of the cervical spine. © 2014 Elsevier Inc. All rights reserved.

Keywords:

Cervical ROM; loss of cervical motion; cervicothoracic fusion; occipitocervical fusion; craniocervical fusion; occipitocervicothoracic fusion; cervicosternal angle

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The disclosure key can be found on the Table of Contents and at www.TheSpineJournalOnline.com.

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Introduction

The sagittal cervical range of motion (ROM) in healthy adults is between 117° and 140° by quantitative motion analysis [1–3]. With aging, cervical ROM declines in all primary planes [4–8]. For example, extension decreases by 5.9° per decade [4]. Additionally, cervical lordosis decreases and cervicothoracic junctional kyphosis increases as part of the normal aging process [9].

Complicated cervical spine revision and deformity correction surgeries are becoming increasingly common. These challenging operations often necessitate fusion of nearly the entire cervical spine [10]. Cervical fusions extended cranially to the occiput or C1 will lose a substantial amount of neck motion. Approximately half of all cervical flexion-extension motion comes from the occiput to C1 and half of all cervical rotation occurs at C1–C2 [11]. The sagittal ROMs of the cervical spine in the dynamic radiographs were 11.3° at C1–C2, 7.6° at C2–C3, 13.6° at C3–C4, 17.4° at C4–C5, 16.5° at C5–C6, and 15.0° at C6–C7 [12]. The ROM of the neck is important to the activities of daily living. During activities including walking, the sagittal ROM of the cervical spine in healthy control subjects was 13° (tenth to ninetieth percentile, 8–27) [13]. During driving, the angles of cervical axial rotation were an average of 35° left and 42° right [14]. Older drivers with decreased ability to turn their heads are hindered in their perception of oncoming vehicles [15]. However, we are aware of no report in the literature that specifically examines sagittal cervical ROM after extensive cervical fusion.

Materials and methods

This study was approved by our university's institutional review board. This is a retrospective, single-institution case series study of adults treated with extensive cervical fusion. The surgical records of the senior author were queried to identify adults who had undergone extensive cervical fusion between 1996 and 2008. An “extensive cervical fusion” entailed an upper instrumented vertebra proximal to C3 and lower instrumented vertebra distal to C7.

Abstracted patient data included gender, age at surgery, age at final follow-up radiographic studies, comorbidities including diabetes mellitus and smoking history, body mass index, weight, height, surgical indication, and the duration of radiographic follow-up. Surgical data collected included surgical levels and the number of fused segments. Lateral radiographs were obtained using standard techniques. The patients stand upright, their heads facing forward. The X-ray tube is positioned 72 inches from the patient. To determine the sagittal cervical ROM postoperatively, radiographs at final follow-up were measured by the occipitocervical angle made by the anterior border of the cervical

EVIDENCE & METHODS

Context

A common concern of patients undergoing cervical fusion is loss of range of motion. The authors analyze their results with extensive fusions.

Contribution

In the sagittal plane, it appears that a reasonable range of motion is maintained despite multilevel cervical fusion. This is likely occurring through adjacent levels cephalad and caudal to the arthrodesis.

Implications

Though limited to the flexion-extension movements, these data can help counsel patients about the range of motion they can expect following a multi-level cervical fusion. Further study of other motion planes, particularly rotational motion, are needed as this is a commonly asked question by patients prior to surgery.

fusion mass and the McGregor line and the cervicosternal angle made by the anterior border of the cervical fusion mass and the anterior border of the sternum with the neck

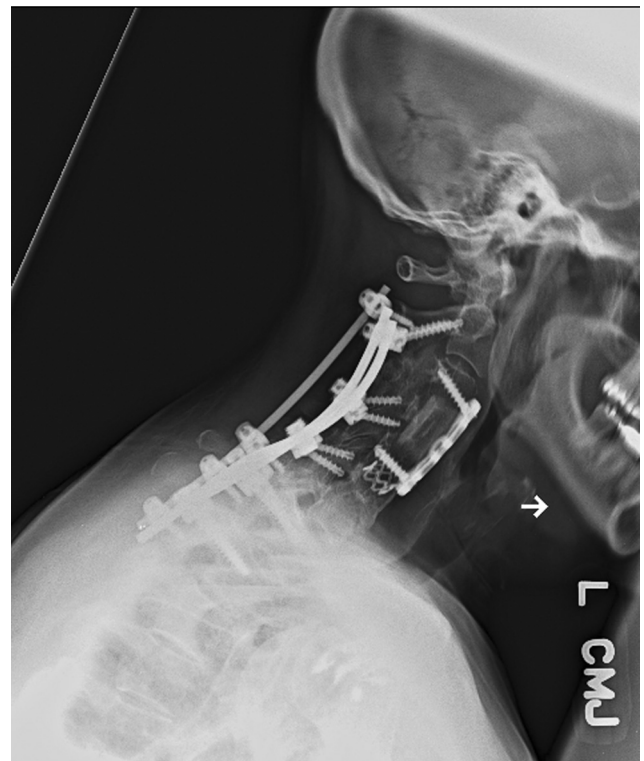


Fig. 1. Radiograph was assessed for the neck range of motion by describing the occipitocervical angle made by the anterior border of the cervical fusion mass and the McGregor line and the cervicosternal angle made by the anterior border of the cervical fusion mass and the anterior border of the sternum with the neck flexed.

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