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Adjacent Segment Degeneration after Anterior Cervical Discectomy and Fusion

Systematic Review / Meta-analysis

Submitted for Partial Fulfillment of Master Degree in Orthopedic Surgery

By

Sayed Saied El-Sayed El Ghazawy

M.B.B.Ch, Faculty of Medicine Ain Shams University

Under supervision of

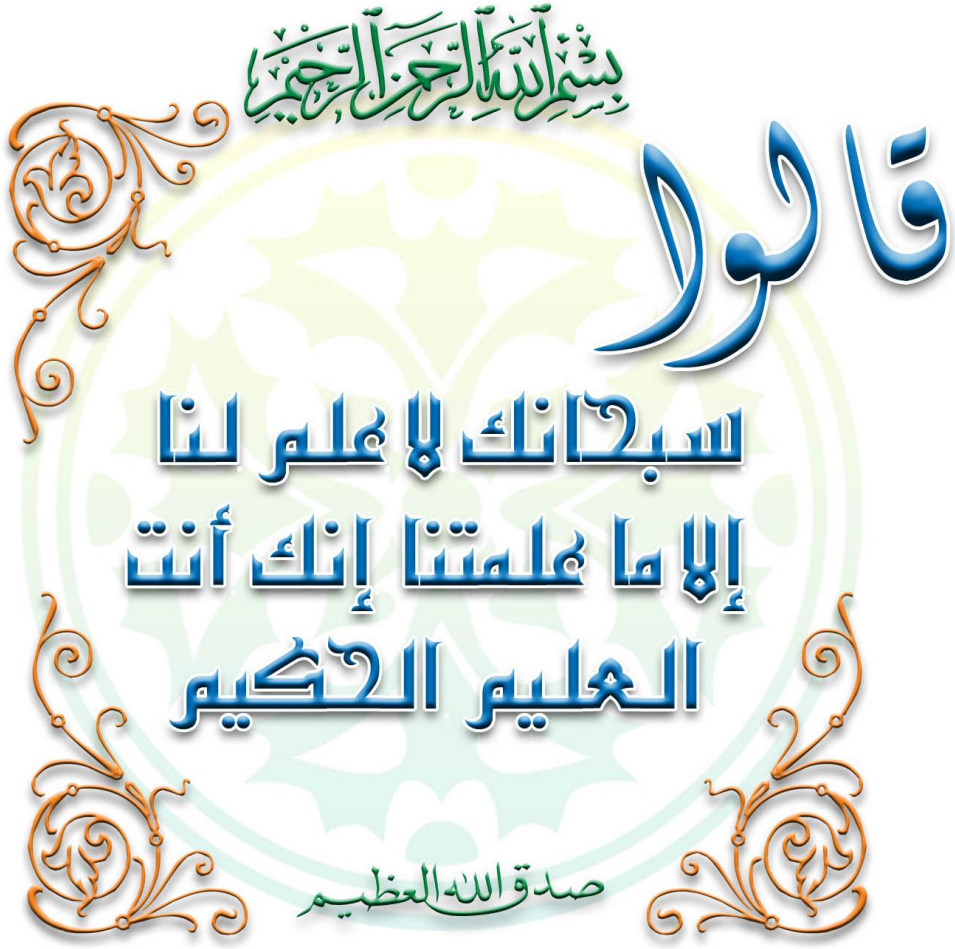
Prof. Dr. Fady Micheal Fahmy

Assistant Professor of Orthopaedic Surgery
Faculty of Medicine - Ain Shams University

Prof. Dr. Abdel Rady Mahmoud

Assistant Professor of Orthopaedic Surgery
Faculty of medicine - Ain Shams University

Faculty of medicine
Ain Shams University
2021



سورة البقرة الآية: ٣٢

Acknowledgment

First and foremost, I feel always indebted to **ALLAH,**
the Most Kind and Most Merciful.

I'd like to express my respectful thanks and profound gratitude to **Prof. Dr. Fady Micheal Fahmy,** *Assistant Professor of Orthopaedic Surgery, Faculty of Medicine - Ain Shams University for his keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

I am also delighted to express my deepest gratitude and thanks to **Prof. Dr. Abdel Rady Mahmoud,** *Assistant Professor of Orthopaedic Surgery, Faculty of medicine - Ain Shams University, for his kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

Sayed El Ghazawy

Adjacent Segment Degeneration after Anterior Cervical Discectomy and Fusion

***Fady Micheal Fahmy, *Abdel Rady Mahmoud, **Sayed Saied El-Sayed El Ghazawy**

*Department of Orthopaedic Surgery, Faculty of Medicine - Ain Shams University

**Orthopaedic Resident at El Salam Specialized Hospital

Corresponding author: Sayed Saied El-Sayed El Ghazawy,

Mobile: 01060375450; **Email:** sayedelghzawy123@gmail.com

ABSTRACT

Background: Anterior cervical discectomy and fusion (ACDF), is commonly used for treatment of degenerative cervical spondylotic radiculopathy and myelopathy, and satisfactory out-comes have been reported in many studies. However, subsequent disc degeneration at levels adjacent to the fusion remains an important problem.

Aim of the Work: To perform a systematic review and meta-analysis to evaluate incidence, risk factors, and impact of radiographic and clinical postoperative adjacent segment degeneration (ASD) following anterior decompression and instrumented fusion.

Method: Medline databases (PubMed, Medscape, ScienceDirect. EMF-Portal) and all materials available in the Internet till 2020.

Data Extraction: If the studies did not fulfill the inclusion criteria, they were excluded. Study quality assessment included whether ethical approval was gained, eligibility criteria specified, appropriate controls, and adequate information and defined assessment measures.

Conclusion: If the former is true, index ACDF procedures may be adjusted to include additional levels now identified as higher risk**.** If the latter is true, motion preserving treatments such as CDR may gain more traction. This review illuminates the heterogeneous methodology of the literature on ASDeg and ASDz after ACDF and the paucity of high-quality data published on these phenomena. Standardized methodology for radiographic evaluation of ASDeg and clinical outcome measures for ASDz are critical before the fundamental question on their etiology can be resolved.

Keywords: Adjacent segment degeneration, anterior cervical discectomy and fusion

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List of Abbreviations

Abb.	Full term
ACDF	Anterior cervical discectomy and fusion
ASD	Adjacent segment degeneration
ASDz	Adjacent segment disease
CDR	Cup-to-disc ratio
CT	Computed tomography
JOA	Japanese Orthopedic Association
MRI	Magnetic resonance imaging
NDI	Neck Disability Index
PEEK	Polyetheretherketone
RML	Restricted maximum likelihood
ROM	Range of motion
TDR	Total disc replacement
VAS	Visual analogue scale

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INTRODUCTION

Anterior cervical discectomy and fusion (ACDF), is commonly used for treatment of degenerative cervical spondylotic radiculopathy and myelopathy, and satisfactory out-comes have been reported in many studies. However, subsequent disc degeneration at levels adjacent to the fusion remains an important problem.

The reported risk factors related to the development of adjacent segment degeneration are the number of fusion segments, the fusion level, age of the patient, combined underlying conditions, and previous degeneration.

Cervical radiculopathy and myelopathy can be severely debilitating to patients, causing numbness, pain, and weakness. First described by Robinson and Smith [1] and Cloward [2], anterior cervical discectomy and interbody fusion (ACDF) is currently the gold standard surgical treatment for affected patients who fail nonoperative measures [3,4].

Follow-up studies of ACDF have demonstrated that breakdown may occur at the level cranial or caudal to the fused motion segment(s) [5]. The adjacent segment degeneration (ASDeg) is defined as radiographic degenerative findings viewed on X-ray, computed tomography, or magnetic resonance imaging (MRI) at the adjacent motion segment, and adjacent segment disease (ASDz) is defined as clinical symptoms

presumed to be related to the degenerative changes, have remained the subject of some debate [5–8]. The radiographic and clinical methods for detecting or classifying ASDeg and ASDz have been broad and inconsistent.

To date, no standard radiographic modality has been established to assess ASDeg and clinical end points for ASDz vary from validated outcome measures to reoperation rate.

Publications on ACDF out comes have reflected this heterogeneity of technique and analysis, likely contributing to the discrepancy in values reported for both ASDeg and ASDz. A broad range of published values for the incidence of ASDeg has been reported from 18.33% to 96% [6] with an equal variation in reported incidence of ASDz where values range from 0.8% [7] to 42.9% [9]

AIM OF THE STUDY

The objective of this study is to perform a systematic review and meta-analysis to evaluate incidence, risk factors, and impact of radiographic and clinical postoperative adjacent segment degeneration (ASD) following anterior decompression and instrumented fusion.

REVIEW OF LITERATURE

Cervical disc disease is a common, well-defined disease entity responsible for axial neck pain, radiculopathy and myelopathy.

Often, the standard of care for those patient's refractory to medical management is anterior cervical discectomy and fusion.

The success of this operation is well documented.[10,11] One of the purported long-term complications of this procedure is adjacent segment disease (ASD), also known as transitional syndrome. The mechanism of and the causal relationship between spine fusion and ASD is actively debated. Despite this debate, surgical procedures have been developed to avoid this complication. The motion preserving procedures are postulated to decrease ASD to as this problem is related to a change in biomechanics of the fused cervical spine.

There is a fair body of evidence indicating that fusing a cervical spine segment results in altered biomechanics at adjacent levels, leaving some to conclude that the development of adjacent problems is secondary to altered forces across the adjacent spinal segments.[12-16] Others believe that adjacent degeneration and disease are a natural history process [17,18] and would occur regardless as to whether or not the affected level was next to one that was previously fused.