Esophageal Perforation Following Anterior Cervical spine surgery: A Systematic Review of the Literature

Sameer H. Halani, M.S.
Jonathan Riley, M.D., M.S.
Griffin R. Baum, M.D.
Daniel Refai, MD
Faiz U. Ahmad, M.D., M.Ch.

Department of Neurosurgery
Emory University School of Medicine
Learning Objectives

By the end of this presentation, learners should be able to:

1.) Develop an understanding of etiology of esophageal perforations in anterior cervical spine surgery
2.) Identify the prognosis, outcomes, and methods of repair of esophageal perforations
3.) Appreciate the clinical manifestations of esophageal perforation in the post-operative period
Anterior Approach to the Cervical Spine

Methods

• PubMed database was searched using the following terms and parameters:
  – Full texts available
  – Published between January 1980 to Present
    • Last search performed on March 30\textsuperscript{th}, 2015
  – “anterior cervical spine surgery” and
    • ‘esophageal’
    • ‘esophagus’
    • ‘complications’
    • ‘esophageal injury’
    • ‘dysphagia’
    • ‘esophageal perforation’
  – Articles were limited to the English language and humans were defined as the subjects for all studies.
PRISMA Guidelines for Systematic Review

**Identification**
- Records identified through database searching (n = 2559)
- Additional records identified through other sources (n = 8)

**Screening**
- Records after duplicates removed (n = 2567)

**Eligibility**
- Records screened (n = 2567)
- Records excluded (n = 2457)
- Full-text articles assessed for eligibility (n = 110)
- Full-text articles excluded, for the following reasons: described pharyngeal injuries, showed no evidence of perforation, did not differentiate whether damage was due to trauma or surgery in large cohort reports, abstracts only, letters to the editor, included patients that were also included in later studies (n = 50)

**Included**
- Studies included in qualitative synthesis (n = 60)
- Studies included in quantitative synthesis (n = 50)
Meta-analysis: Indications for Anterior Spine Surgery

- Trauma, including fracture and dislocation: 53%
- Cervical spondylomyelopathy: 16%
- Herniated disc: 13%
- Degenerative Disc Disease: 10%
- Tumors: 8%
- Herniated disc: 13%
Meta-analysis:
Spinal Level Operated On

- C2-3: 4
- C3-4: 12
- C4-5: 26
- C5-6: 46
- C6-7: 39
- C7-T1: 6
Causes of Esophageal Perforation

- Hardware failure 44%
- Chronic erosion by Plate or Screw 20%
- Intraoperative injury (tools or retraction) 29%
- Graft penetration or extrusion 7%
- Screw migration, 11
- Plate migration, 5
- Loosened screw/plate, 17
Stratification by Time to Diagnosis

<table>
<thead>
<tr>
<th>Intraoperative Tools and Dissection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware failure</td>
</tr>
<tr>
<td>Instrumentation Penetration w/o hardware failure</td>
</tr>
</tbody>
</table>

Early (<30 d)  
Delayed (>30 d)
Presenting Symptoms and Clinical Findings

- Dysphagia/odynophagia
- Cough
- Wound leakage
- Neck swelling
- Fever
Imaging Studies Used

- Contrast swallow exam
- CT scan
- Endoscopy
- Plain radiograph
- MRI
Successful repair of esophageal perforation after anterior cervical fusion for cervical spine fracture

Song-Ho Ahn, Sun-Ho Lee *, Eun Sang Kim, Whan Eoh

Department of Neurosurgery Samsung Medical Center, Sungkyunkwan University, School of Medicine, 50 Ilwon-dong, Gangnam-gu, Seoul 135-710, Republic of Korea

Esophageal perforation related to anterior cervical spinal surgery

Zhao-Ming Zhong\textsuperscript{a}, Jian-Ming Jiang\textsuperscript{a}, Dong-Bin Qu\textsuperscript{a}, Jian Wang\textsuperscript{b}, Xiang-Ping Li\textsuperscript{c}, Kai-Wu Lu\textsuperscript{a}, Bo Xu\textsuperscript{a}, Jian-Ting Chen\textsuperscript{a,}\textsuperscript{*}

\textsuperscript{a}Department of Spinal Surgery, Nanfang Hospital, Southern Medical University, 1838 North Guangzhou Avenue, Guangzhou 510515, China
\textsuperscript{b}Department of Joint Surgery, Nanfang Hospital, Southern Medical University, Guangzhou, China
\textsuperscript{c}Department of Otolaryngology-Head and Neck Surgery, Nanfang Hospital, Southern Medical University, Guangzhou, China

Method of Esophageal Repair

- Primary closure only: 34%
- Muscle flap with primary closure: 54%
- Conservative treatment: 12%
Types of Muscle Flaps

- SCM flap: 68%
- Radial forearm flap: 8%
- Pectoralis flap: 8%
- Other muscle flaps (Infrahyoid, jejunal, omental, longus coli, latissimus dorsi): 16%
Complications following Esophageal Perforation

• Secondary Complications (Incidence = 15.6%)
  – Pneumonia (n = 6)
  – Mediastinitis (n = 4)
  – Osteomyelitis (n = 3)
  – Sepsis (n = 3)
  – ARDS (n = 2)
  – Recurrent Laryngeal nerve damage (n = 1)
Outcomes

• Average time to oral intake = 30.43 days (range 4-188)
  – Primary repair alone: mean = 28.3 days (range 7-188)
  – SCM Flap: mean = 27.3 days (range = 6-113)
  – Conservative treatment: mean = 68 days (range = 7-135)
• Average repairs attempted = 1.57 (n = 94); range 1-9 repairs
  – 29 patients required >1 repair
    • 21 achieved complete resolution only AFTER instrumentation was removed
• Mortality incidence = 4.08% (n = 6)
Case Example

- 40-year-old Male, MVA
- C6-C7 bilateral facet perched with incomplete spinal cord injury
- CT- C6-C7 bilateral facet fracture /perch with about a 20% to 25% listhesis.
- MRI- cord compression at C6-7 due to the anterolisthesis.
Pre-operative Imaging
Surgery

- C6-7 ACDF with fibular strut
- No complications
- Discharged in few days
Few days later

- Subcutaneous emphysema
- Right vocal cord paralysis
- ?wound infection
- CT with oral/IV contrast
Surgery for repair with ENT

• Posterior C6-7 instrumentation fusion first
• Then Rigid Esophagoscopy in OR- saw the defect
• Removal of hardware
• Esophageal defect clearly seen- Dubhoff visualized
• Esophageal repair with inf based SCM flap
Post-Operative Imaging
• The muscle functions as a bolster for repair
• Provides a layer of separation between the esophagus and the graft/instrumentation
• Increases the antibiotic delivery due to its vascularized nature.
Conclusion

• Most common presenting sx = Dysphagia
• Intra-operative damage and hardware failure are the two most common causes of esophageal perforation
• Perforations are most commonly identified using contrast swallow studies
• Perforation repair is most commonly achieved using SCM flap with primary closure
• There is a high morbidity and mortality associated with esophageal perforations
References


• 29Sahjpaul, R. L. Esophageal perforation from anterior cervical screw migration. Surgical neurology 68, 205-209, doi:http://dx.doi.org/10.1097/WNL.0b013e31815e01f3 (2007).


