Anterior cervical spine surgery (ACSS) is an established treatment for cervical spine disorders and trauma. Pharyngeal diverticulum is a rare complication after ACSS and not well documented. Here we describe a patient who developed pharyngeal diverticulum after 5 years of ACSS for trauma. Pharyngeal diverticulum and dysphagia were persisted even after removal of plate and screws (elsewhere). He presented to us with dysphagia, weight loss and fistula of left neck with salivary and food discharge. Investigations revealed posterior pharyngeal diverticulum with fistula which opens in left posterior triangle of neck. Since the pharyngeal diverticulum was densely adherent with Prevertebral fascia, he underwent partial excision of diverticulum and fistulous tract with surrounding pharyngeal muscles reinforcement.

On follow up (20 months post surgery), the patient remained in good condition with no further complications or neck discharge. This case was presented for its rarity and the need of long term X ray follow up after anterior cervical spine surgery.

Keyword: Anterior cervical spine surgery (ACSS), Pharyngeal diverticulum, complication

Pharyngeal diverticulum: a delayed complication of anterior cervical spine surgery

INTRODUCTION:
Cervical spine surgery by anterior neck approach has been the standard procedure for the last few decades, for various cervical spine disorders. Injury of pharynx and esophagus during cervical spine surgery is one of the most serious complications which can lead to death [1–3]. Pharyngoesophageal perforation after Anterior Cervical Spine Surgery (ACSS), as an early complication, is already well-documented. However, another type of esophageal
complication, pharyngoesophageal diverticulum is not so well-recognized. It is an acquired pouch which is located proximal to the upper esophageal sphincter, usually on the posterior hypopharyngeal wall [4]. Only 8 cases have been reported in the literature. We describe the clinical, radiographic, and operative characteristics of a patient with pharyngoesophageal diverticulum which developed after ACSS.

**CASE REPORT:**

A 38 years old male, a farmer by occupation, had met with a road traffic accident in April 2002 while he was riding a two wheeler. He had complained of neck pain with right upper limb numbness following the accident. Investigations had revealed fracture of the 6th cervical vertebra. He had undergone cervical fusion of C 5 and C 6 vertebra with plates and screws elsewhere. Patient was asymptomatic for the next 5 years. He developed a painful swelling in the left side of the neck in February 2007 which ruptured after a week, discharging pus, saliva and later food contents. Patient reported to the same hospital and was diagnosed to have developed a pharyngoesophageal diverticulum due to the previous anterior cervical spine surgery [Fig.1]. He underwent re-exploration of neck, when the plate and screws were removed. But the left cervical fistula persisted and he visited many hospitals during the next 3 years with no relief.

**Fig 1. Pharyngeal diverticulum and fistula with plate and screws.**

He was referred to us in August 2010 with the left cervical fistula discharging saliva and occasionally food contents. He also had dysphagia for solids and weight loss for the past 6 months. He was moderately built and poorly nourished. There was a transverse scar in anterior neck and an external opening in the posterior triangle of neck discharging saliva. On taking oral fluids, a bulge was seen in posterior triangle of the neck with discharge of fluid through the external opening. A plain x-ray of the neck showed a soft tissue swelling in the left side of the prevertebral space. Barium Esophagram revealed a posterior pharyngeal diverticulum with a fistula [Fig.2] and Upper Gastrointestinal Endoscopy also demonstrated the pharyngeal diverticulum.

**Fig 2. Persistent pharyngeal diverticulum and fistula after removal of plate and screws.**
He underwent surgery which revealed a 5x3 cm diverticulum in the left postero-lateral aspect of hypopharynx with a normal cervical oesophagus. The diverticulum was densely adherent to the prevertebral fascia. A fistulous tract was also noted, arising from the apex of the diverticulum which opened onto the left posterior triangle of neck. Since the posterior wall of the diverticulum was densely adherent to the pre-vertebral fascia, the anterior wall of the diverticulum was excised after dividing the striated muscles of pharynx and esophagus. The remaining posterior wall was approximated and the fistulous tract was excised into the diverticulum [Fig.3]. Post operative period was uneventful. Oral sips and soft diet were started on the 7th and 9th post-op day respectively. He was able to take solids without odynophagia, regurgitation or neck discharge. On follow up (20 months post surgery), the patient remained in good condition with no further complications or neck discharge.

**DISCUSSION:**

Anterior cervical spine fusion and plate xation is a well-established procedure for the treatment of numerous conditions including spondylitic myelopathy with or without disc herniation, trauma and tumors. This has resulted in early spine stability, early patient mobilization, improved union rate and reduced hospital stay. Further, the technique has decreased the need for rigid external immobilization and had reduced the indication for posterior cervical procedures [5, 6]. The overall complication rate is generally low, although the incidence is probably underestimated (range 5–20%) [5]. Pharyngo-esophageal complications are very rare after anterior cervical spine surgery. Among them pharyngo-esophageal perforation is uncommon, but of utmost importance, for the possibility of graft infection which may lead to osteomyelitis, mediastinitis, sepsis and death. Its incidence is low and estimated between 0.02 and 1.49%, but associated with a high mortality, ranging between 12 and 20% [5, 6]. Early esophageal injuries occurring after anterior cervical spine surgery may be secondary to fractured
vertebrae, retractor placement, electrocautery, traumatic endotracheal intubation, pressure necrosis or direct perforation with instruments.[6,7,8]. Some small esophageal perforations may not be recognized intraoperatively, but may close spontaneously. Delayed injuries are due to chronic compression or contact with plates and screws leading to successive necrosis, as in our case [9]. Among all kinds of esophageal injuries related to anterior cervical spine surgery, pharyngoesophageal diverticulum is the most unusual, with only eight cases reported by seven previous authors (Table 1). The pathogenic mechanism of the development of this type of diverticulum, after cervical spine surgery is not well known. The most popular theory is that of a traction-related diverticulum resulting from pulling of the pharyngeal wall due to scar tissue in the surrounding area [11,12]. Chronic micro traumatic effect from plates and screws to esophageal wall can also cause traction-related diverticulum [12]. Inferior constrictor injury during the primary surgery is the other cause for this diverticulum formation. As the inferior pharyngeal constrictor muscle plays an important role in the swallowing mechanism, this may have caused an outow obstruction, creating a high pressure zone in the hypo pharynx, eventually resulting in pulsion type of diverticulum [13]. The common symptoms of pharyngoesophageal diverticulum are dysphagia, odynophagia, regurgitation and chest infections due to aspiration. Early recognition of pharyngoesophageal diverticulum seems to be difficult due to its delayed presentation of dysphagia. Work up involves Plain X-ray, esophagography with contrast medium, endoscopy and CECT scan of neck. Among this, a contrast esophagogram can clearly demonstrate the contour of the pouch, its position relative to the pharynx and esophagus and the fistulous tract. There are various treatment options for pharyngoesophageal diverticulum including conventional open surgery and endoscopic therapy. However, for patients with diverticulum as a complication of ACS injury, endoscopic therapy is difficult due to deranged anatomy, posterolateral position of diverticulum and surrounding scar tissue [15]. Therefore open surgery is recommended which involves diverticulectomy with excision of fistulous tract, if present. The repair site can be reinforced with soft tissue like sternocleidomastoid muscle ap [16], pectoralis major ap [13], infrahyoid muscle ap [17], omental ap [18] or free jejunal loop [19]. In our patient, the presentation was a pharyngeal diverticulum with a fistulous tract, eight years after the ACS surgery. An operative excision of both the diverticulum and the fistulous tract was done with reinforcement using surrounding pharyngeal muscles. Good functional result was achieved post-operatively which was confirmed by real time fluoroscopic gastrograffin study.

CONCLUSION:
Pharyngeal diverticulum with fistula is a very rare presentation after Anterior Cervical Spine surgery. Surgery is not straightforward as in a Zenker’s diverticulum, due to scar tissue and deranged anatomy. In our case, though anatomical correction could not be perfect, functional result was achieved. Surgeons should always be alert of the possibility of esophageal injury related to cervical spine surgery especially when the patients have esophageal symptoms. Routine X-ray follow up and careful history taking is helpful for early detection.
<table>
<thead>
<tr>
<th>Reference</th>
<th>Age (Yrs)</th>
<th>Sex</th>
<th>Indication</th>
<th>Operation Level</th>
<th>Location</th>
<th>Graft or Implant Dislodgment</th>
<th>Postoperative Development</th>
<th>Symptoms</th>
<th>Speculated Cause</th>
<th>Treatment</th>
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<th>Followup (yr)</th>
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<tr>
<td>Goftart et al.[20]</td>
<td>44</td>
<td>M</td>
<td>Trauma</td>
<td>C5-7</td>
<td>AF without IF</td>
<td>Posterior</td>
<td>Yes</td>
<td>8 months</td>
<td>Dysphagia, Regurgitation, Weight Loss</td>
<td>Scar adherence, Submucosal Fat Reinforcement</td>
<td>OES, DE, ER</td>
<td>18 months</td>
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<td>Salam and Cable[21]</td>
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<td>CS-6</td>
<td>AF without IF</td>
<td>Posterior</td>
<td>Yes</td>
<td>3 years</td>
<td>Dysphagia, Regurgitation</td>
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<td>Symptom reduced, Occasional regurgitation</td>
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<td>AF+IF</td>
<td>Posterior</td>
<td>No</td>
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<td>26</td>
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<td>No</td>
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<td>Summers et al.[23]</td>
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<td>Degenerative disease</td>
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<td>51</td>
<td>M</td>
<td>Trauma</td>
<td>CS-7</td>
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<td>Posterior</td>
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<td>C5</td>
<td>AF ?IF</td>
<td>Posterior</td>
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<td>Scar tissue Adherence and inferior Pharyngeal Constrictor Muscle Absence</td>
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<td>Our case</td>
<td>38</td>
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<td>Trauma</td>
<td>C-6</td>
<td>AF with IF</td>
<td>Left, Posterosilateral</td>
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<td>Scar adherence</td>
<td>OS, DE, ER</td>
<td>Symptom free</td>
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</tbody>
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by an anterior approach to the cervical spine. Ann Chir 43:343–347


