Successful surgical management of a delayed pharyngo-esophageal perforation after anterior cervical spine plating

Dino Solerio · Enrico Ruffini · Giosué Gargiulo ·
Michele Camandona · Eleonora Raggio ·
Antonio Solini · Marcello Dei Poli

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Abstract A case report of a 41-year-old man who had a delayed pharyngo-esophageal perforation without instrumentation failure 7 years after anterior cervical spine plating is presented and the literature on this issue is reviewed. This injury resulted from repetitive friction/traction between the retropharyngo-esophageal wall and the cervical plate construct leading to a pseudodiverticulum and perforation. Successful treatment of the perforation was obtained after surgical repair using a sternocleidomastoid muscle flap. This case stresses the necessity of careful long-term follow-up in patients with anterior cervical spine plating for early detection of possible perforation and the use of muscle flap as the treatment of choice during surgical repair.

Keywords Pharyngeal esophageal perforation · Anterior cervical surgery · Plate instrumentation · Pseudodiverticulum · Myofascial flap

Introduction

Anterior surgical approaches to the cervical spine has gained popularity during the last two decades since it was introduced by Robinson, Smith, Badgley, Southwick and Cloward. Common indications are cervical degenerative disc disease, neoplasms and trauma. The original techniques have been refined with the use of plates and screw fixation with or without bone implants. This has resulted in an 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 reduced the indication for posterior procedures [2, 4, 5, 9].

Esophageal perforation after anterior cervical spine surgery is an uncommon, but well recognised, complication mostly from plate displacement. Various etiologies have been identified: penetrating and non-penetrating trauma, iatrogenic surgical lesions and chronic erosion from synthesis devices, usually following migration [4, 7, 9–11]. Occasional reports of esophageal perforation without plate displacement have been described and controversy exists about optimal management [6–8, 11].

We present a case of delayed pharyngo-esophageal perforation in the presence of a normally positioned cervical plate, successfully managed with sternocleidomastoid muscle flap.

Case report

A 41-year-old man underwent anterior cervical surgery for decompression, arthrodesis and fixation with plate screwed (Atlantis® Anterior Cervical Plate System, Medtronic Sofamor Danek, Minneapolis, MN, US) at the C4–C6

D. Solerio (✉) · M. Camandona · E. Raggio · M. Dei Poli
General Surgery 3, San Giovanni Battista Hospital,
University of Turin, via Genova 3, 10126 Turin, Italy
e-mail: soleriod@libero.it

E. Ruffini
Thoracic Surgery, San Giovanni Battista Hospital,
University of Turin, Turin, Italy

G. Gargiulo · A. Solini
Orthopaedic Surgery, San Giovanni Battista Hospital,
University of Turin, Turin, Italy

level, for a C5 burst fracture with incomplete permanent spastic tetraplegia that occurred in 1998. The operation was conducted without using a self-retaining distractor, but with simple hooks in order to avoid excessive or prolonged wound retraction. In the early postoperative period, a percutaneous tracheotomy for positive-pressure ventilation support and bronchial secretion clearing was performed. After 7 years, he came to our observation presenting with hyperthermia, right latero-cervical swelling and a fistulous orifice at the site of the cervical surgical scar. Lateral radiograph and computed tomography evidenced a good fusion, a normally positioned cervical plate and an abscess extending from the retropharyngeal and prevertebral space to the sternocleidomastoid muscle medially, and to the larynx and the esophagus laterally (Fig. 1). A hydro-soluble contrast swallow imaged a posterior pharyngo-esophageal diverticulum located anterior to the cervical spine plating, with a diverticulo-cutaneous fistulous tract (Fig. 2). Esophagoscopy confirmed the site of perforation with exposition of a screw normally fixed to the plate at the bottom of the diverticulum. The patient was then scheduled for surgery. A bilateral cervicotomy was performed. After drainage of the abscess, we observed the distal part of the plate and its screws protruding into the diverticulum. The cervical esophagus and hypopharynx were isolated. A diverticulotomy was necessary to remove the plate and the screws, which were surrounded by bone (Fig. 3). The diverticulum was excised using a linear stapler. At the end of the neck surgery, a nasogastric tube for suture detention and a jejunostomy for enteral nutrition were added. Postoperatively, the patient had a salivary fistula. Esophagoscopy showed a small dehiscence of the proximal stapler

Fig. 1 Sagittal computed tomography reconstruction evidenced a good fusion and a normally positioned cervical plate

Fig. 2 Contrast study shows the posterior pharyngo-esophageal diverticulum located anterior to the distal part of cervical spine plating with fistulous tract at the bottom

line. After an unsuccessful treatment with fibrin glue, a right cervicotomy was performed. The fistulous internal orifice on the hypopharynx was difficult to locate because of severe fibrosis. After debridement of the posterior pharyngeal wall and the proximal esophagus, the medial and lateral surface of the right sternocleidomastoid muscle was exposed and a superior-based pedicled flap was prepared. The muscle flap was then interposed between the pharyngo-esophageal junction and the cervical spine and secured to these structures. A contrast study performed on the 10th postoperative day showed no evidence of fistula (Fig. 4); the oral feeding was gradually resumed within 2 weeks, jejunostomy nutrition was stopped and the patient was eventually moved to a rehabilitation centre. Further postoperative radiological controls for evidence of bone fusion were not performed due to the long time span from anterior cervical surgery to pharyngo-esophageal perforation.

Discussion

Anterior cervical spine fusion and plate fixation is a well-established procedure for the treatment of numerous conditions including spondylitic myelopathy with or without disc herniation, trauma and tumors. Plating has been

Fig. 3 Intraoperative photograph shows the plate before removing without screws. It is well visible (*at the center*) through the diverticulotomy the distal part of the plate protruding into the bottom of the diverticulum

reported to achieve a fusion rate up to 98%, resulting in early mobilization and reduced graft-related complications, especially in a multilevel fusion [2–12]. The overall complication rate is generally low, although the incidence is probably underestimated (range 5–20%). Among them pharyngo-esophageal perforation is uncommon, but of utmost importance for the possibility of graft infection leading to osteomyelitis, medistinitis, sepsis and death. Its incidence is low and estimated between 0.02 and 1.49%, but its mortality is high ranging between 12 and 20% [3, 4, 7, 9–12].

Pharyngo-esophageal perforation may result from non-surgical and surgical causes. Non-surgical causes include penetrating or non-penetrating trauma and intubation in emergency. Non-penetrating trauma leads to pharyngeal or esophageal perforation with two mechanisms: hyperextension and laceration by anterior cervical osteophytes or entrapment of esophageal wall between vertebral bodies at the time of fracture reduction. The clinical presentation is usually acute and the most vulnerable site is at the level of the crico-pharyngeus muscle or the pyriform sinus [3, 4, 6–8]. Surgical causes may be further subdivided into acute or delayed. Acute injuries include cervical dissection, excessive or prolonged retraction of

Fig. 4 Contrast study shows no evidence of fistula

the pharyngeal and esophageal structures or the use of sharp instruments and drills [2–4, 7, 8, 10–12]. The retraction is particularly dangerous when the naso-gastric tube is positioned because the wall of the hypopharynx or the esophagus may get “trapped” in a high-pressure claw between the retractor and the tube, resulting in an ischemic injury and in a secondary perforation [7]. Delayed injuries are due to chronic compression/contact with successive necrosis, formation of abscess and perforation by graft dislodgement or screw migration with or without plate failure [3, 5–7, 9, 10]. Dislodgement of the screw often follows a benign course and is completely asymptomatic. This results from the small diameter of the screws and their slow migration process from the external to the internal mucosa, permitting the tissue repair of the defect. The migrated screw is then successively eliminated through the gastrointestinal tract [5, 9, 12]. Another cause of delayed injuries includes repetitive friction between the retropharyngo-esophageal wall and the plating system normally positioned with adhesion and traction-type pseudodiverticulum and perforation [11, 12]. This in the complete spinal cord injuries results from the obligatory supine position and pharyngo-esophageal hypomotility. Indeed, the major risk factors for deglutition disorders are the presence of tracheostomy, prolonged

orotracheal intubation, anterior cervical surgery and complete spinal lesion [1].

The perforation site is usually at the C5/C6 or C6/C7 level, frequently involving the pharyngo-esophageal junction, which corresponds to the C5 level. If perforation occurs in the distal esophageal cervical portion, infection may spread to the superior mediastinum with high risk of sepsis and death [3, 7, 8, 10–12].

The clinical presentation of pharyngo-esophageal perforation after anterior cervical plating depends on the etiology, location and time course. It ranges from asymptomatic to life-threatening presentation (latero-cervical abscess or fistula). Generally, symptoms include neck pain, subcutaneous emphysema, dysphagia, dysphonia, fever, leukocytosis, neurological deficit and cough [2–12]. Therefore, a strict clinical surveillance is important for all patients submitted to anterior cervical spine plating [2, 4, 5, 7–9, 11, 12]. Early diagnosis is essential to improve the prognosis: if the treatment is instituted within 24 h the mortality rate is 20%, on the contrary it may be as high as 50% if instituted later [8–10].

Numerous imaging techniques are useful in the diagnosis of pharyngo-esophageal perforation. Plain neck X-ray may show such indirect signs as subcutaneous emphysema, presence of prevertebral air, widening of the retropharyngo-esophageal space due to edema or fluid collection and migration of fixation material. Contrast pharyngo-esophageal study and mainly flexible endoscopy may locate the perforation and its proximal-caudal extension. Neck CT scan may detect the presence of an abscess and graft displacement [2, 4, 7, 8, 10, 11]. The use of all above-mentioned techniques achieved the sensitivity of 80% [7].

Non-surgical conservative management includes stopping oral intake, positioning naso-pharyngo-esophageal tube for decompression, and introducing enteral nutrition with gastrostomy or jejunostomy and antibiotic therapy [2–4, 6–8, 10–12]. Unfortunately, about 20–25% of the patients treated conservatively developed an abscess and the mortality rate was 18% [7, 8]. Therefore, non-surgical treatment is indicated only for small (less than 1 cm) asymptomatic contained defects [5, 7–9]. For all other cases, the surgical treatment is the gold standard with the following objectives: closure of the perforation, control or prevention of infection and stabilization of the cervical spine if indicated [7]. Closure of perforation may be obtained with suture with or without pedicled muscle flap interposition [3, 4, 6–8, 11, 12]. Indication to flaps include severe bacterial infection, large perforations, delayed rather than acute lesions when there is a need to maintain the instrumentation, and in all cases of suture failure. The sternocleidomastoid muscle is a very effective flap due to its pliability, multifocal blood supply, anticipated good

cosmetic result and lack of significant donor site morbidity. The flap may be pedunculated using its superior or inferior insertion. Others flaps include the pleura, omentum, sternohyoid, sternothyroid or pectoralis muscle. The use of flaps allows resuming early oral feeding and is associated with a significantly lower failure rate than other procedures, but carries the risk of necrosis [7]. In all cases, an associated medical treatment is necessary. Finally, stabilization of the spine is obtained with structural autografts, replacement of the internal instrumentation or with external orthosis (cervical collar or halo, if needed) [2–4, 6–8, 10, 12]

Conclusion

A case of delayed pharyngo-esophageal perforation and pseudodiverticulum formation without instrumental failure occurring 7 years after anterior cervical spine stabilization is presented. This case stresses the necessity of careful long-term follow-up, especially in those patients who are submitted to anterior cervical spine stabilization, particularly in the presence of prolonged orotracheal intubation, tracheostomy and a complete spinal cord lesion. A sternocleidomastoid flap was effective in achieving a successful perforation repair of the pharyngo-esophageal perforation with an early return to oral feeding.

Conflict of interest statement None of the authors has any potential conflict of interest.

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