Original Article

Use of a free jejunal graft for oesophageal reconstruction following perforation after cervical spine surgery: case report and review of the literature

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Study design: Single-subject (male, 16 years of age) case.

Objectives: To demonstrate a suitable method for oesophageal repair after perforation as a complication of anterior spinal fusion in an individual with quadriplegia, and to review the literature on oesophageal perforation and repair.

Setting: University hospital, large trauma centre with departments for spinal injuries and reconstructive surgery in Germany.

Methods: A free jejunal graft used for oesophageal reconstruction in a post-traumatic situation after a complicated treatment course in a C6 quadriplegic patient.

Results: A protuberant loose screw of the titanium plate after anterior spinal fusion perforated the oesophagus. Imbricating sutures and a fascia lata patch were insufficient to repair the oesophageal leakage. An 8 cm long segment of the cervical oesophagus including a fistula had to be excised, and a free microsurgical jejunal flap was used for restitution of continuity. The jejunal vessels were connected to the superior thyroid artery and external jugular vein. At 1 week after the oesophageal repair, an enteral contrast study showed a small amount of contrast medium leaking at the oesophago-pharyngeal anastomosis. A percutaneous gastric tube was inserted, and oral feeding was limited to tea and still water for 4 weeks. The further course was uneventful.

Conclusions: Oesophageal perforation is a rare but recognized complication after cervical spine surgery, which can mostly be managed using secondary suture techniques. The free jejunal flap is a reliable and innovative tool in the particularly complex situation of a segmental oesophageal loss. It should be considered in similar cases to reconstruct oesophageal continuity or to treat stricture and fistula formations.

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Introduction

Perforation of the cervical oesophagus after anterior spinal fusion is a rare but recognized complication.^{1–6} Delayed perforation after spinal surgery may lead to bacterial or fungal mediastinitis, septic shock, and death.^{2,7–11} The clinical features are inconstant, and may include the obvious signs of an oesophageal leakage such as pain, swelling and tenderness of the neck,

dysphagia, cough, aspiration, phonetic changes as well as fever of unknown origin, leukocytosis, and unexplained persistent tachycardia.^{4,6,8}

The majority of oesophageal injuries can be repaired using double layer or imbricating sutures,^{4,11} or local flaps for defect coverage.^{2,7} Nonsurgical treatment leads to chronic fistula formation requiring tube feeding for weeks to months.^{3,5,7,10,12}

To the best of our knowledge, this is the first reported case of the use of a free jejunal flap for oesophageal reconstruction after anterior cervical spine surgery.

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Case report

A 16-year-old male patient was injured in a motorcycle accident, sustaining a flexion–compression fracture with posterior displacement of C5 into the spinal canal. The associated spinal cord injury was sensory incomplete at C4. A complete quadriplegia at C6 resulted. A CAT scan clearly delineated a 'burst' fracture of C5 (Figure 1), but did not primarily show any evidence of abnormality in the cervical oesophageal region. The patient underwent a partial corpectomy of the fifth cervical vertebra, and reconstruction from the fourth to sixth cervical vertebra with a cortico-cancellous strut from the iliac crest and a 'double H'-shaped titanium plate (Figure 2). On the 11th postoperative day the patient developed a cervical abscess around the plate. The patient underwent emergency revision drainage. During the revision, pus and food particles were evacuated, and an oesophageal perforation was seen. The wound was debrided, irrigated, and openly drained. The patient received broad-spectrum intravenous antibiotics. A nasogastric tube was inserted to bypass the perforated portion of the oesophagus. The patient underwent re-exploration and

debridement of the cervical wound the following day and also 5 days later. The wound was left open again. The patient's general condition improved, but a persistent oesophageal fistula developed. On the 31st post-traumatic day re-exploration and repair of the oesophageal perforation using a Vycril imbricating suture was performed in collaboration with the ENT service, but a recurrent fistula occurred within a week. The next revision 7 days later demonstrated a protruberant loose screw perforating the oesophagus. The loose screws and the potential risk of a spinal osteomyelitis required the removal of the titanium implant. The strut graft showed signs of infection and nonunion, and was also removed. The leakage in the posterior lateral wall of the oesophagus was then repaired using a fascia lata patch. Postoperatively, the patient was scheduled to remain in a halo device for 3 months. After a recurrent oesophageal leakage was detected, revision was performed in collaboration with the Department of Plastic and Reconstructive Surgery on the 46th post-traumatic day. An 8 cm long segment of the cervical oesophagus including the fistula was excised, and a free microsurgical jejunal flap was used for reconstruction of

Figure 1 CAT scan at day of trauma showing a 'burst' fracture of C5 and dorsal dislocation of the fragments into the spinal channel resulting in a spinal cord injury, and a complete quadriplegia at the C6 level

Figure 2 Postoperative X-rays after partial corpectomy of the fifth cervical vertebra and reconstruction from the fourth to sixth cervical vertebra with a cortico-cancellous strut from the iliac crest and internal fixation using a 'double H'-shaped titanium plate

continuity (Figure 3). This final operation was performed by the senior author of this manuscript. The jejunal vessels were connected to the superior thyroid artery and external jugular vein. The former bed of the infected cortico-cancellous strut was filled with an additional segment of mesentery on the same vascular pedicle. The remaining soft tissue defect was covered by a split thickness skin graft. At 1 week after the oesophageal repair, a Gastrografin study showed a small amount of contrast medium leaking at the oesophago-pharyngeal anastomosis. A percutaneous gastric (PEG) tube was inserted, and oral feeding was limited to tea and still water for 4 weeks. The patient could leave the ICU, and was transferred to the Spinal Injury Department for further rehabilitation. At 4 weeks after the oesophageal repair, an endoscopy showed no leakage or stricture. The patient was started on oral feedings; the PEG tube was removed 2 weeks later. The patient's wounds healed, and bony union of C4–C7 was achieved with a slight dorsal bend of 25°. The further course was uneventful.

Discussion

Occult oesophageal perforation after cervical spine injury, penetrating or blunt trauma may lead to severe

mediastinitis, sepsis, and death.^{2,7–11} A mortality rate between 4 and 50% has been reported.^{2,4,6} Early diagnosis and surgical revision are critical, because improved survival is clearly associated with early treatment.^{13–15} Traumatic perforations of the cervical oesophagus account for 20–40% of all oesophageal injuries.^{16–18} Most of the perforations of the cervical oesophagus (43%) are caused iatrogenically by endoscopic procedures.^{2,19,20} Surgical procedures such as cervical spine surgery, medianoscopy, and thyroidec-tomy account for approximately 8% of the oesophageal injuries.^{11,21} Although the manifestations of oesophageal perforation usually occur within 1 week following anterior cervical spine fixation procedures, late perforations, occurring several weeks to years after surgery, are also reported.^{5,8–11} Perforation of the cervical oesophagus should be suspected in patients with neck or throat pain, dysphagia, odynophagia, unexplained aspiration or choking, fever, localized neck tenderness, induration, haemoptysis, or the presence of subcutaneous emphysema.^{4,6,8} Plain X-ray films of the cervical spine may reveal subcutaneous emphysema in the cervical soft tissues, while the chest X-ray film may occasionally show mediastinal emphysema. These signs and symptoms may be masked in such patients because

Figure 3 Intraoperative situation after two previous attempts of oesophageal repair (suture and fascia lata patch). A free jejunal flap reconstructed a complex 8 cm long segmental defect of the cervical esophagus. The former bed of the infected cortico-cancellous strut was filled with mesentery. An additional jejunal segment on the same vascular pedicle served as a monitor of blood supply, and was removed after 1 week. The remaining soft tissue defect was covered by a split thickness skin graft

corticosteroids are now commonly used in the early period after spinal cord injury. Definitive diagnosis and localization of the cervical oesophageal perforation is usually established by a contrast oesophagogram using a water-soluble contrast medium,^{4,5,6,9} but was not indicated in our case since the leakage was obvious after surgical revision.

Most of the oesophageal perforations can be repaired by double layer imbricating sutures.^{4,11} However,

oesophageal strictures occur in up to 54% after suture.⁴ A high incidence of fistula formation requiring tube feeding for several weeks to months has been reported following nonsurgical treatment of an oesophageal leakage.^{3,5,7,10,12} For few cases the use of local muscle flaps such as the sternocleidomastoid flap^{2,7} has been reported.

The free jejunal flap has been used successfully for pharyngeal and oesophageal reconstruction in tumour

cases.^{22–26} The predominant tumours in this area are squamous cell carcinomas. The tubed free radial forearm flap has also been frequently used for the same indications.^{27–29} The discussion about the ideal method for reconstruction of the cervical oesophagus is still ongoing.^{27,29,30} However, a high success and low complication rate has been reported for both methods.^{22–29} The lateral island trapezius myocutaneous flap,³¹ the extended submental island flap,³² and the pectoralis major myocutaneous flap^{33,34} are reported to be alternative methods for cervical oesophageal reconstruction, and might be suitable also in trauma situations. However, the data available on these procedures for the particular indication of post-traumatic oesophageal repair are limited.

In recent years, the free jejunal flap has been our standard procedure for pharyngeal and oesophageal reconstruction in tumour cases. The relatively high rate of fistula formation, reported by some authors,²⁵ could not be confirmed in our series. The free jejunal flap for segmental oesophageal reconstruction was selected to use the anti-infectious properties of the well-vascularized mesentery, and to fill the dead space after removal of the plate and the bone graft. To the best of our knowledge, this is the first reported case for this particular indication. The radial forearm flap appeared not to be appropriate in this case. Although a post-operative contrast oesophagogram showed a small leakage at the oesophago-pharyngeal anastomosis, a recurrent fistula formation did not occur after PEG feeding and only inert oral fluid intake. This minor complication seems to be acceptable considering the long treatment course and the underlying septic situation.

In summary, oesophageal perforation is a rare but recognized complication after cervical spine surgery, which can mostly be managed using secondary suture techniques. These operations are successful in closing the oesophagus, but lead to a high incidence of secondary strictures. For larger defects local muscle flaps can be used for closure. The free jejunal flap has been shown to be a reliable tool in this particular complex situation of a segmental oesophageal loss. It can only be speculated if early application of this flap would have prevented the infection of the bone graft and the plate loosening, but the use of a free jejunal segment should be considered in similar cases to reconstruct oesophageal continuity or to treat pertinent stricture and fistula formations.

References

- Gaudinez RF *et al.* Esophageal perforations after anterior cervical surgery. *J Spinal Disord* 2000; **13**: 77–84.
- Lamesch P *et al.* Perforation of the cervical esophagus after ventral fusion of the cervical spine. Defect coverage by muscle-plasty with the sternocleidomastoid muscle: case report and review of the literature. *Chirurg* 1997; **68**: 543–547.
- Brouwers MA, Veldhuis EF, Zimmerman KW. Fracture of the thoracic spine with paralysis and esophageal perforation. *Eur Spine J* 1997; **6**: 211–213.
- English GM, Hsu SF, Edgar R, Gibson-Eccles M. Esophageal trauma in patients with spinal cord injury. *Paraplegia* 1992; **30**: 903–912.
- Newhouse KE *et al.* Esophageal perforation following anterior cervical spine surgery. *Spine* 1989; **14**: 1051–1053.
- Pollock RA, Purvis JM, Apple Jr DF, Murray HH. Esophageal and hypopharyngeal injuries in patients with cervical spine trauma. *Ann Otol Rhinol Laryngol* 1981; **90** (4 Pt 1): 323–327.
- Finiels PJ, Hernandez G, Sabatier P, Frerebeau P. Delayed esophageal perforation after cervical osteosynthesis. Case illustration. *J Neurosurg* 2000; **92** (1 Suppl): 123.
- Lew TW, Darby J, Marion DW. *Candida mediastinitis* and septic shock following occult esophageal perforation in a patient with posttraumatic quadriplegia. *J Trauma* 1995; **39**: 805–808.
- Colachis III S, Murray KD. Esophageal perforation: a delayed complication following traumatic spinal cord injury. Case report. *Paraplegia* 1992; **30**: 449–453.
- Kelly MF, Spiegel J, Rizzo KA, Zwillenberg D. Delayed pharyngoesophageal perforation: a complication of anterior spine surgery. *Ann Otol Rhinol Laryngol* 1991; **100**: 201–205.
- Whitehill R, Sirna EC, Young DC, Cantrell RW. Late esophageal perforation from an autogenous bone graft. Report of a case. *J Bone Joint Surg Am* 1985; **67**: 644–645.
- Balmaseda Jr MT, Pellioni DJ. Esophagocutaneous fistula in spinal cord injury: a complication of anterior cervical fusion. *Arch Phys Med Rehabil* 1985; **66**: 783–784.
- Attar S *et al.* Esophageal perforation: a therapeutic challenge. *Ann Thorac Surg* 1990; **50**: 45–49; discussion 50–51.
- Burnett CM, Rosemurgy AS, Pfeiffer EA. Life-threatening acute posterior mediastinitis due to esophageal perforation. *Ann Thorac Surg* 1990; **49**: 979–983.
- Tilanus HW *et al.* Treatment of oesophageal perforation: a multivariate analysis. *Br J Surg* 1991; **78**: 582–585.
- Ballesta-Lopez C *et al.* Iatrogenic perforations of the esophagus. *Int Surg* 1993; **78**: 28–31.
- Thomaszek D, Rosner MJ. Occult esophageal perforation associated with cervical spine fracture. *Neurosurgery* 1984; **14**: 492–494.
- White RK, Morris DM. Diagnosis and management of esophageal perforations. *Am Surg* 1992; **58**: 112–119.
- Wright RA. Upper-esophageal perforation with a flexible endoscope secondary to cervical osteophytes. *Dig Dis Sci* 1980; **25**: 66–68.
- Davidson JH. Esophageal perforation by cervical spur during gastroscopy. *Gastrointest Endosc* 1968; **15**: 79–80.
- Merkle NM, Foitzik Th, Riedl St, Fritz Th. Infections of the mediastinum. *Chirurg* 1990; **61**: 629–638.
- Jurkiewicz MJ. Vascularized intestinal graft for reconstruction of the cervical esophagus and pharynx. *Plast Reconstr Surg* 1965; **36**: 509–517.
- Coleman JJ *et al.* Jejunal free autograft: analysis of complications and their resolution. *Plast Reconstr Surg* 1989; **84**: 589.
- Berger A *et al.* Free jejunal graft for reconstruction of oral, oropharyngeal, and pharyngoesophageal defects. *J Reconstr Microsurg* 1984; **1**: 83–94.
- Kato H *et al.* Primary esophageal reconstruction after resection of the cancer in the hypopharynx or cervical

- esophagus: comparison of free forearm skin tube flap, free jejunal transplantation and pull-through esophagectomy. *Jpn J Clin Oncol* 1987; **17**: 255–261.
- 26 Theile DR, Robinson DW, Theile DE, Coman WB. Free jejunal interposition reconstruction after pharyngolaryngectomy: 201 consecutive cases. *Head Neck* 1995; **17**: 83–88.
- 27 O'Brien CJ *et al*. Evaluation of 250 free-flap reconstructions after resection of tumours of the head and neck. *Aust NZ J Surg* 1998; **68**: 698–701.
- 28 Azizzadeh B *et al*. Radial forearm free flap pharyngoesophageal reconstruction. *Laryngoscope* 2001; **111**: 807–810.
- 29 Cho BC *et al*. Pharyngoesophageal reconstruction with a tubed free radial forearm flap. *J Reconstr Microsurg* 1998; **14**: 535–540.
- 30 Nakatsuka T *et al*. Comparative evaluation in pharyngo-oesophageal reconstruction: radial forearm flap compared with jejunal flap. A 10-year experience. *Scand J Plast Reconstr Surg Hand Surg* 1998; **32**: 307–310.
- 31 Castillo MH, Peoples JB, Machicao CN, Singhal PK. The lateral island trapezius myocutaneous flap for circumferential reconstruction of hypopharynx and cervical esophagus. *Dig Surg* 2001; **18**: 93–97.
- 32 Janssen DA, Thimsen DA. The extended submental island lip flap: an alternative for esophageal repair. *Plast Reconstr Surg* 1998; **102**: 835–838.
- 33 Fabian RL. Pectoralis major myocutaneous flap reconstruction of the laryngopharynx and cervical esophagus. *Laryngoscope* 1988; **98**: 1227–1231.
- 34 Neifeld JP, Merritt WA, Theogaraj SD, Parker GA. Tubed pectoralis major musculocutaneous flaps for cervical esophageal replacement. *Ann Plast Surg* 1983; **11**: 24–30.