Kulak Burun Bogaz Ihtis Derg 2008;18(2):106-109

CASE REPORT

Tracheo-innominate artery fistula in a laryngectomized patient

Larenjektomili bir hastada trakeo-innominat arter fistülü

Gani Atilla ŞENGÖR, M.D., Ömer AYDIN, M.D.[1]

Tracheo-innominate artery fistula is a rare but usually fatal complication of tracheostomy or intubation. To our knowledge, this complication has been reported following laryngectomy only in two patients. A 45-year-old woman with hypopharynx carcinoma developed tracheo-innominate artery fistula one month after total laryngopharyngoesophagectomy, as a complication of permanent tracheostomy, induced by the erroneous use of a 12-mm diameter silver tracheostomy cannula. With a median sternotomy, the innominate artery was reconstructed with Gore-Tex vascular graft interposition and separated from the trachea by a pedicled pericardial patch. Unfortunately, the patient sustained intermittent postoperative hemorrhages due to mediastinitis and died on the 15th day. After this tragic result, our attention was focused on both prevention of tracheo-innominate artery fistulas and methods of preventing and dealing with hemorrhages.

Key Words: Fistula/etiology; laryngectomy; tracheostomy/adverse effects; vascular fistula/etiology.

Trakeo-innominat arter fistülü, trakeostomi veya entübasyonun nadir fakat ölümcül bir komplikasyonudur. Bildiğimiz kadarıyla, bugüne kadar İngilizce literatürde bu komplikasyon larenjektomili hastalarda yalnızca iki olguda bildirilmiştir. Kırk beş yaşında bir kadın hastada hipofarenks kanseri nedeniyle uygulanan larengofarenjektomiden bir ay sonra, kalıcı trakeostomiye bağlı, 12 mm çaplı gümüş trakeostomi kanülünün neden olduğu trakeo-innominat arter fistülü gelişti. Median sternotomi yaklaşımıyla, innominat arter Gore-Tex damar grefti kullanılarak tamir edildi ve pediküllü perikard yaması ile trakeadan ayrıldı. Ameliyat sonrası dönemde mediastinite bağlı kanamalar gelişen hasta 15. günde kaybedildi. Bu trajediye neden olan durum, trakeo-innominat arter fistülü gelişimi ve akut kanamaların önlenmesi ve bu kanamalarla baş edilebilmesi için daha fazla dikkat edilmesi gerektiğini göstermektedir.

Anahtar Sözcükler: Fistül/etyoloji; larenjektomi; trakeostomi/yan etki; vasküler fistül/etyoloji.

Tracheo-innominate artery fistula (TIAF) is a highly lethal complication of long-term endotracheal intubation or tracheostomy. The incidence of TIAF has decreased with the introduction of high-volume, low-pressure cuffs. A low-lying tracheostomy (lower than the forth tracheal ring) may cause this complication peri- or postoperatively.[1-3] The frequency of TIAF following tracheostomy is 0.6-0.7%.[1,4-6] Cervical trauma or neoplasia may give rise to a hemorrhage of the innominate artery.[3] Mucosal damage may be caused by the tip or curved portion of an improperly positioned cannula and/or pressure necrosis of a high-pressure cuff, eroding the tracheal wall and causing damage to the vascular structures in the pretracheal space.[4,7] This damage usually occurs within three weeks postoperatively, but has been observed as early as 48 hours and as late as the second month.[4,6,7] Even if the patient can survive a

◆ *Nişantaşı ENT Group (Nişantaşı KBB Grubu), İstanbul; [1]Department of Otolaryngology, Medicine Faculty of Kocaeli University (Kocaeli Üniversitesi Tıp Fakültesi Kulak Burun Boğaz Hastalıkları Anabilim Dalı), Kocaeli, Turkey.*

◆ *Received - November 25, 2005 (Dergiye geliş tarihi - 25 Kasım 2005). Request for revision - February 6, 2006 (Düzeltme isteği - 6 Şubat 2006). Accepted for publication - February 21, 2006 (Yayın için kabul tarihi - 21 Şubat 2006).*

◆ *Correspondence (İletişim adresi): Dr. Gani Atilla Şengör. Valikonağı Cad., 107/E, D.1, 34363 Nişantaşı, İstanbul, Turkey. Tel: +90 212 - 296 91 54 Fax (Faks): +90 212 - 231 27 04 e-mail (e-posta): dr_atilla@yahoo.com*

sudden and massive hemorrhage attack, long-term survival rate is still very low (25%) despite improved grafting techniques.[5,7] Very few cases of TIAF in laryngectomized patients have been reported.[6,8]

CASE REPORT

A 45-year-old woman was admitted to the ENT outpatient department of Kocaeli University Hospital with dyspnea. She had a history of total laryngopharyngoesophagectomy, gastric pull-up, and tube jejunostomy at another university hospital for well-differentiated epidermoid esophagus carcinoma and was submitted to radiotherapy. After 33 days postoperatively, she was admitted to a state hospital with stomal bleeding. The bleeding stopped spontaneously and she was treated empirically with tranexamic acid and vitamin K preparations. The following morning, she was referred to our clinic with respiratory distress. On presentation, she had a silver tracheostomy cannula, 12 mm in diameter, and there was no bleeding. The cannula was removed, the neck was extended, and the patient was examined using flexible and rigid endoscopes, which revealed a blood clot obstructing the right bronchus at the level of the carina. During aspiration of the clot, a sudden massive hemorrhage occurred. A No. 7 tube for cuffed intubation was inserted through the stoma to the level of the carina and hyperinflated immediately. Hemorrhage was controlled and, with ongoing suctioning, she was transferred to the intensive care unit (ICU) for stabilization. After the occurrence of another hemorrhage episode in ICU, she was brought to the operating room. A median sternotomy was performed by the surgical team headed by a cardiothoracic surgeon. The proximal and distal parts of the innominate artery were examined and a 3x7 mm defect was detected at the posteromedial aspect of the innominate artery, communicating with the anterior tracheal wall defect (Fig. 1). An 8-mm segment of friable artery was resected and replaced with a Gore-Tex vascular graft. The graft was surrounded by a pedicled pericardial patch and separated from the trachea. Stomaplasty was performed. Postoperatively, hemodynamic parameters and her general condition were good. On the tenth day, mediastinitis and sternum detachment occurred. Mediastinal swab cultures revealed *Pseudomonas aeruginosa*. Despite appropriate antibiotherapy and drainage, the patient died on the 15th day after repeated hemorrhages from vascular anastomosis.

Fig. 1. *A 3x7-mm defect at the posteromedial aspect of the innominate artery.*

DISCUSSION

Tracheo-innominate artery fistula is a rare and nearly always fatal complication of tracheostomy and endotracheal intubation.[5,9-11] With its characteristics of massive and sudden hemorrhage, TIAF requires emergency management.[3]

When massive hemorrhage begins, immediate arterial compression, control of the airway, and treatment of the damaged artery can be lifesaving.[12] To control hemorrhage, overinflation of cuff or digital arterial compression can be applied.[2,9] Under office conditions and in a case like ours with a narrow and low-lying tracheostoma, the sole alternative is the use of an intubation or tracheostomy tube with cuff because digital compression will obstruct inspiration. In other situations, suprasternal pressure can be applied.[2,5] Hemorrhage can also be controlled by passing a No. 5 or 6 Fogarty catheter through a branchial arteriotomy into the ascending aorta and then withdrawing the inflated balloon until it lodges in the innominate artery.[13] With the aforementioned methods, hemorrhage may be temporarily controlled in over 80% of cases.[5] The patient should be taken to the operating room with ongoing i.v. fluid and/or blood replacement.

For appropriate surgery, resection of the injured part of the innominate artery, interposition of the graft, and separation of the trachea from the artery are indicated.[9,12] In previous cases of innominate artery resection without graft interposition, neuro-

logical sequelae were rarely reported after stump pressure measurement techniques were applied.[2,3,5] Innominate artery stump pressure should be measured perioperatively, and if there is low or negligible back pressure, circulation should be reconstructed.[1,14] For this purpose, saphenous vein, innominate vein,[13] vascular grafts like Dacron prosthesis and Gore-Tex have been used.[3] Deguchi et al.[11] implanted a stent graft in the innominate artery through the brachial artery, after which the patient remained well for 14 months after the procedure. To separate the trachea from the innominate artery, there are several options for the use of viable tissues such as pedicled omental flap,[7] pedicled sternocleidomastoid muscle flap,[3,15] a pedicled thymus flap for children,[6,10] and as in our case, a pedicled pericardial patch.[12,16] In the postoperative period, intravenous antibiotherapy and hyperalimentation should be implemented.[5]

Mediastinitis, a complication of median sternotomy, causes postoperative hemorrhage and mortality due to graft necrosis, as in our case. Bloss and Ward[5] reported complete healing after daily antibiotic irrigation and drainage of the mediastinal space through irrigation catheters. Ramesh and Gazzaniga[17] emphasized that median sternotomy should be avoided to prevent mediastinal infection and sternal dehiscence. They performed a right anterior thoracotomy and a separate neck incision to isolate injured blood vessels.

To prevent TIAF, the use of high-volume, low-pressure cuffs and a shortened period of intubation is recommended. As far as possible, tracheostomy should not be performed lower than the fourth tracheal ring and the risk for an innominate artery anomaly should be kept in mind.[3,7] However, in a cadaver study of Oshinsky et al.,[18] tracheostomy was performed in the second and third tracheal rings, and in every dissection, some part of the cuff or tip of the tracheostomy tube was found to be adjacent to the innominate artery. Therefore, we recommend that silver tracheostomy cannulas be chosen in a size appropriate for individual tracheas and/or silicon cannulas be used. Stomal care is necessary to prevent local contamination and infection.

Despite all precautions, prevention of TIAF formation may not be possible in some cases. Therefore, we must be aware of the warning signs of TIAF. In particular, in a low position tracheostomy, the pulsation of the tube and observation of blood in tracheal aspiration must always be evaluated.[3] Biller and Ebert[19] stated that half of their cases exhibited minor bleeding episodes lasting from several hours to several days. In our case, a bleeding episode appeared 24 hours before massive hemorrhage. In cases where the source of bleeding is not located in the area near the tracheostomy or primary carina, the patient must be taken to the operating room for a more definitive examination and possible vascular repair. A careful fiberoptic bronchoscopy can be helpful for diagnosis.[5,9]

We emphasize that, because tracheostomized patients are often in contact with us, we the oto-laryngologists should have cuffed intubation or tracheostomy cannulas at hand in our policlinics or offices, so as, at the very least, to be prepared for primary intervention for TIAF.

REFERENCES

1. Arola MK, Inberg MV, Sotarauta M, Vanttinen E. Tracheo-arterial erosion complicating tracheostomy. Ann Chir Gynaecol 1979;68:9-17.
2. Jones JW, Reynolds M, Hewitt RL, Drapanas T. Tracheo-innominate artery erosion: Successful surgical management of a devastating complication. Ann Surg 1976;184:194-204.
3. Silen W, Spieker D. Fatal hemorrhage from the innominate artery after tracheostomy. Ann Surg 1965;162: 1005-12.
4. Schaefer OP, Irwin RS. Tracheoarterial fistula: an unusual complication of tracheostomy. J Intensive Care Med 1995;10:64-75.
5. Bloss RS, Ward RE. Survival after tracheoinnominate artery fistula. Am J Surg 1980;139:251-3.
6. Hazarika P, Kamath SG, Balakrishnan R, Girish R, Harish K. Tracheo-innominate artery fistula: a rare complication in a laryngectomized patient. J Laryngol Otol 2002;116:562-4.
7. Yoshida K, Ohshima H, Iwata K, Murakami F, Tomida Y, Matsuura A, et al. Rupture of the innominate artery following tracheostomy: report of a case. Surg Today. 1998;28:433-4.
8. Petrek JA, Bains MS, Spiro RS. Innominate artery fistula caused by laryngectomy tube. South Med J 1983; 76:672-4.
9. Reed MF, Mathisen DJ. Tracheoesophageal fistula. Chest Surg Clin N Am 2003;13:271-89.
10. Nakanishi R, Shimazu A, Mitsudomi T, Masuda T, Osaki T, Onimura S, et al. Successful management of tracheo-innominate artery fistula using interposition of a thymus pedicle flap. J Laryngol Otol 1995; 109:161-2.
11. Deguchi J, Furuya T, Tanaka N, Nobori M, Seki Y, Nomura Y, et al. Successful management of tracheo-innominate artery fistula with endovascular stent graft repair. J Vasc Surg 2001;33:1280-2.
12. Keceligil HT, Erk MK, Kolbakir F, Yildirim A, Yilman

M, Unal R. Tracheoinnominate artery fistula following tracheostomy. Cardiovasc Surg 1995;3:509-10.
13. Nunn DB, Sanchez-Salazar AA, McCullagh JM, Renard A. Trachea-innominate artery fistula following tracheostomy. Successful repair using an innominate vein graft. Ann Thorac Surg 1975;20:698-702.
14. Nelems JM. Tracheo-innominate artery fistula. Am J Surg 1981;141:526-7.
15. Kierner AC, Zelenka I, Gstoettner W. The sternocleidomastoid flap-its indications and limitations. Laryngoscope 2001;111:2201-4.
16. Hsiao CW, Lee SC, Lee KC, Cheng YL, Tzao C. Tracheoinnominate artery fistula: successful surgical management of one case. Thorac Cardiovasc Surg 2002;50:249-50.
17. Ramesh M, Gazzaniga AB. Management of trachea-innominate artery fistula. J Thorac Cardiovasc Surg 1978;75:138-40.
18. Oshinsky AE, Rubin JS, Gwozdz CS. The anatomical basis for post-tracheotomy innominate artery rupture. Laryngoscope 1988;98:1061-4.
19. Biller HF, Ebert PA. Innominate artery hemorrhage complicating tracheotomy. Ann Otol Rhinol Laryngol 1970;79:301-6.