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.

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. The frequency of TIAF following tracheostomy is 0.6-0.7%. Cervical trauma or neoplasia may give rise to a hemorrhage of the innominate artery. 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. This damage usually occurs within three weeks postoperatively, but has been observed as early as 48 hours and as late as the second month. Even if the patient can survive a
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 antibiotic therapy and drainage, the patient died on the 15th day after repeated hemorrhages from vascular anastomosis.

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.[9] 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.[8,12] In previous cases of innominate artery resection without graft interposition, neuro-
logical sequelae were rarely reported after stump pressure measurement techniques were applied.\textsuperscript{[2,3,5]} Innominate artery stump pressure should be measured perioperatively, and if there is low or negligible back pressure, circulation should be reconstructed.\textsuperscript{[1,14]} For this purpose, saphenous vein, innominate vein,\textsuperscript{[13]} vascular grafts like Dacron prosthesis and Gore-Tex have been used.\textsuperscript{[9]} Deguchi et al.\textsuperscript{[8]} 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,\textsuperscript{[7]} pedicled sternocleidomastoid muscle flap,\textsuperscript{[7,19]} a pedicled thymus flap for children,\textsuperscript{[8,10]} and as in our case, a pedicled pericardial patch.\textsuperscript{[12,16]} In the postoperative period, intravenous antibiotherapy and hyperpulsation of the tube and observation of blood 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.\textsuperscript{[9,10]}

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

REFERENCES