Although most cases of acute gastrointestinal hemorrhage either spontaneously resolve or respond to medical management and/or endoscopic treatment, there remain a significant number of patients who require emergency evaluation and treatment [1]. The incidence of nonvariceal UGI bleeding is 80% to 90% of all UGI bleeding and the mortality between 5% and 10% [2]. For the treatment of UGI hemorrhage, endoscopy is the initial procedure of choice because of its diagnostic utility and its low mortality [2]. Generally, endovascular and surgical approaches are utilized when endoscopy fails, but operative mortality rates with massive UGI bleeding can reach 20% [3]. Although few studies have examined transcatheter arterial embolization (TAE) treatment of acute esophageal cancer bleeding, the optimal TAE protocol has not yet been established [4-7]. Generally, permanent embolizing devices, such as polyvinyl alcohol (PVA) and N-butyl cyanoacrylate (NBCA), are currently preferred to use for the vessel occlusion due to cancer bleeding. Here, we report a case of massive esophageal cancer bleeding refractory to endoscopic therapy that was successfully managed with blind TAE using gelfoam slurry. No complication associated with this method was observed. We also review previous literatures.

CASE REPORT

A 46-year-old man presented to our emergency department with progressive dysphagia over the previous 3 months. An estimated body weight loss of 6 kg was noted over 1 month. The patient had a 10-year history of diabetes mellitus, which was being treated by standard methods. His temperature was 36.5°C, blood pressure was 100/70 mm Hg, and pulse rate was 72 beats/min. Abdominal palpation and blood values, including blood glucose, were within normal ranges. An electrocardiogram, thoracic radiograph, and plain abdominal radiograph were unremarkable.
Panendoscopy (PES) identified a very large necrotic mass with active oozing in the lower third of the thoracic esophagus. A tissue biopsy confirmed sarcomatoid carcinoma. For tumor staging, thoracic computed tomography (Fig. 1) and esophagography were performed, revealing a mass in the distal third of the thoracic esophagus with celiac nodal metastasis.

During hospitalization, after Port-A catheter implantation and jejunostomy, tarry stool was observed with severe anemia (hemoglobin 9.2 g/dL), followed by emesis. Despite transfusion of 8 U packed red blood cells and medication, the patient’s hemodynamic status remained unstable. Emergency PES identified a prominent bleeding tumor in esophagus, but the exact source of the hemorrhage could not be found. Angiography was thus performed. A 5-F angiosheath was inserted into the right femoral artery. An aortogram obtained with a 4-F catheter (J-curve; Terumo Corporation, Tokyo, Japan) demonstrated a hypervascular tumor in the mediastinum receiving blood supply from a...
branch of the aorta. Angiography of the esophageal branch from aorta showed an esophageal tumor in the lower third portion measuring approximately 8 cm in length (Fig. 2), but did not reveal definite extravasation of contrast medium to identify the source of bleeding. Angiograms of the intercostal arteries (at the level of the esophageal tumor) and left gastric artery also failed to identify the source of bleeding too. Due to the patient’s unstable hemodynamic status, TAE of the tumor-supplying aortic branch was planned.

Initially, we intended to selectively embolize the tumor-supplying branch with NBCA or PVA, but we gave up due to technical inaccessibility. Instead, we used gelfoam slurry (1–0.5-mm gelfoam pieces mixed with contrast medium) through a 2.7-F microcatheter (Progreat, Terumo Corporation, Tokyo, Japan). Post embolization of angiogram showed no opacification of tumor vessels, indicating complete occlusion (Fig. 3). Then, the patient was transferred to the ward with no sign of bleeding 1 day post-operatively; 1 week later, he was stable hemodynamically and began chemotherapy. He discharged from the hospital 2 weeks later.

**DISCUSSION**

TAE can be an excellent alternative option for the treatment of esophageal cancer bleeding if endoscopic therapy fails or the patient is a poor surgical candidate. TAE not only provides definitive control of bleeding but also avoids emergent surgery. In patients for whom definitive TAE treatment is not feasible, it still provides temporary control and resuscitation before surgery [8]. Opponents of TAE have argued that it may delay definitive surgery and carries a high risk of ischemic complications [8]. Improved equipment and developed techniques have made TAE safer and more feasible for the treatment of UGI bleeding. Presumably due to the rarity of the condition, few publications [4, 5] have investigated the efficacy of TAE treatment for the esophageal cancer bleeding, but the successful result of our case with no complication implies the promising feasibility of TAE. Because collateral capillary networks richly supply the esophagus, the risk of esophageal ischemia after selective embolization is expected to be low [4].

Actually, no matter what embolizers we use, no complication can be definitely avoided. Among the possible complications of TAE, spinal infarct is one of the severe complications. To our knowledge, there are no large series to study the spinal cord infarct after TAE treatment of esophageal cancer bleeding. In bronchial artery embolization, spinal cord injury related to invisible anastomotic connections between the bronchial circulation and anterior spinal artery had been reported [9]. Thus, careful analysis of the angiographic images to identify the spinal artery, particularly when injecting into a right intercostobronchial artery, is ultimately important [10]. Two kinds of spinal arteries, which may be seen at bronchial and intercostal angiography, are dorsal and ventral radicular arteries, two small vessels arising from dorsal and ventral roots [11]. Besides, the artery of Adamkiewicz, or greater anterior medullary artery, which reinforces the circulation of lumbar enlargement of the spinal cord, is usually observed to arise between T9 and T12 at angiography [11, 12]. Anterior medullary artery, which is the major independent source of spinal cord perfusion, is rarely observed and has a characteristic hairpin configuration at angiography. Many authors feel that opacification of anterior spinal artery or spinal radicular arteries arising from embolized artery is an absolute contraindication to proceed with embolization [13, 14]. Practically, unintentional embolization of radicular arteries does not cause clinical problem like spinal cord ischemia, indicating that opacification of radicular artery is not an absolute contraindication for embolization [11, 14]. However, for avoiding this disastrous complication, when the anterior medullary artery (artery of Adamkiewicz) is visualized at angiography, embolization should be prohibited [11]. In bronchial artery embolization, embolic materials greater than 200 nm and more distal superselective embolization of culprit vessel can decrease the possibility of neurologic complications because such embolizer is too large to enter the small spinal feeders, even though radicular arteries originated from the bronchial arteries [15]. Uflacker et al even reported two cases of successful bronchial artery embolization with no neurological complications by using large gelatin sponge particles in which the anterior spinal artery branched from the bronchial artery [14]. However, Tanaka et al [13] reported a case of spinal infarct after bronchial artery embolization using gelatin sponge particles.
greater than 2 mm in size to prevent entry into the spinal branch, it was likely attributed to the total occlusion of intercostal artery and could be avoided by means of more distal embolization. In esophageal artery embolization, it can be similarly considered that using greater particle and more superselective embolization of culprit vessel can also reduce the possibility of unexpected arterial embolization and ischemia.

Among the variety of embolic agents, coils are frequently used for the occlusion of bleeding vessel such as ruptured pseudoaneurysms [16]. Von Rahden et al [5] successfully used a coil to occlude the tumor-eroded inferior thyroid artery of a patient with massive esophageal cancer bleeding. Vogten [4] managed a case of massive bleeding of a benign esophageal ulcer with superselective coil embolization of the afferent esophageal branch of the thoracic aorta. Generally, the coil carries a low risk of infarction, is relatively easy to insert precisely, and effectively controls non-target embolization, but the main disadvantage is that the coil is permanent and may preclude re-access of the vessel in the future [3, 17]. In those patients with massive cancer bleeding, prominent vascularity and collateral circulation of the tumor, as noted at our case, can cause coil embolization less effective.

Gelfoam, a water-insoluble hemostatic agent, is used to occlude a vessel temporarily. The gelfoam particles further enhance the process of occlusion as thrombi adhere to them [18]. A combination of gelfoam and NBCA is considered to be the appropriate embolic treatment when the source of bleeding is a distal branch inaccessible by the microcatheter, or in the case of multiple bleeding points from distal branches [19]. Using TAE with gelfoam particles, Michal [20] successfully managed a bleeding benign esophageal ulcer with esophageal arteries arising directly from the aorta, and no esophageal ischemia or spinal cord injury was found. However, possible risks of gelfoam particles embolization include ischemia or infarction due to tissue-level occlusion [3, 19]. To decrease the risk of ischemia from tissue devascularization, larger particles (greater than 500 µm) are recommended [17]. To date, no published reports have determined the relationship between the amount of material used and recanalization. Presumably, a larger amount of occlusive agent will result in longer-lasting recanalization [21]. Although the gelfoam is typically degraded within 2 to 4 weeks, gelfoam slurry embolization successfully treated the cancer bleeding of our case and provided immediate resuscitation.

Using 150–250-µm PVA particle, a patient with esophageal cancer and severe esophageal hemorrhage after metallic stent implantation was successfully managed by TAE of the fifth posterior right intercostal artery [6]. In general, the use of PVA particles is reserved for tumors requiring permanent embolization at the level of the arteriolar bed. This method has been used successfully to treat gastrointestinal hemorrhage, usually through a microcatheter at a site distal to major vessels [3]. Due to the permanence of PVA, detailed angiography is necessary to select the correctly sized embolizer. PVA embolization is mainly dependent on thrombosis, rather than on the embolic material, thus, the coagulation state of the patient is important for the success of the procedure [16]. In our case, we achieved hemostasis with gelfoam slurry embolization, indicating that TAE using gelfoam slurry can be an alternative option for the management of esophageal cancer bleeding, if PVA is not available.

NBCA is another well-known liquid adhesive material for endovascular treatment, but its use beyond neurological applications is relatively limited. Park et al [7] reported radiological success in five patients with benign distal esophageal bleeding who underwent TAE with NBCA. Due to its low viscosity, NBCA can be easily inserted into the feeding arteries and collateral channels, resulting in effective hemostasis. Unlike temporary embolic agents, vascular occlusion using NBCA is permanent and cannot be removed by reversal of vessel flow [16]. Other disadvantages of NBCA are its lack of radio-opacity and its rapid polymerization time, which make it difficult to use. Inadequate control of NBCA may result in extensive penetration into the microcirculation and regurgitation into unintended vessels [17]. As the esophagus has a large amount of collateral circulation as well as possible communication with spinal vessels, TAE with NBCA risks embolization of non-target vessels. Therefore, careful attention to vascular anatomy and angiographic findings, as well as adequate training and experience, are absolutely necessary before NBCA embolization is performed.

Blind embolization, defined as embolization with no angiographic evidence such as extravasation of contrast medium to suggest acute bleeding, is controversial. No previous report has studied the efficacy of blind embolization for the treatment of esophageal cancer bleeding. However, Morris et al [22] found that blind embolization of the left gastric artery was effective when an active hemorrhagic site had been demonstrated on endoscopy. Because massive bleeding is often intermittent, embolization on the basis of endoscopic findings when no extravasation of contrast medium is seen angiographically may be feasible, especially to those patients in poor hemodynamic status. Based on our results, we can recommend blind embolization for esophageal cancer hemorrhage according to the endoscopic findings when clinically indicated. Considering the overall safety of this procedure, an absorbable material such as gelfoam slurry is preferred.

To our knowledge, no study has investigated the bleeding recurrence of esophageal cancer status post-TAE. Generally, recurrent bleeding after transarterial embolization can be attributed to incomplete initial embolization, progression of disease, and recanalization of previously embolized vessels [23]. In a large UGI bleeding study, a multivariate regression analysis found that occurrence
of early rebleeding did not negatively affect the survival of patients [24]. A possible explanation is that patients are relatively stabilized after the first failed embolization procedure, thereby allowing time to reorient the treatment strategy and ultimately resulting in success [24].

Nowadays, endoscopic therapy remains the preferred treatment method for esophageal hemorrhage but the optimal treatment strategy of massive esophageal cancer bleeding is still uncertain. Based on previous reports and our experience, TAE is safe and effective. Under critical conditions, endoscopy-directed blind TAE may be a viable alternative option when no definite source of bleeding is seen on angiography. Continued reports of endoscopy-directed blind TAE with long-term follow-up results will provide further support for its use.

REFERENCE