Bleeding from a tear in the gastric mucosa caused by transoesophageal echocardiography during cardiac surgery: effective haemostasis by endoscopic argon plasma coagulation

S. Kihara¹, T. Mizutani²*, T. Shimizu¹ and H. Toyooka¹

¹Department of Anaesthesiology and ²Department of Critical Care Medicine, University of Tsukuba, Tsukuba, Ibaraki, 305-8575, Japan

*Corresponding author

We present an unusual complication of transoesophageal echocardiography (TOE) during cardiac surgery. Although the patient had no oesophageal or gastrointestinal disease, a gastric mucosal tear of approximately 2 cm long occurred in the mucosa just distal to the gastro-oesophageal junction caused by the TOE probe. Bleeding from the tear was stopped using endoscopic argon plasma coagulation.

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Over the past decade, transoesophageal echocardiography (TOE) has become more widely used in the perioperative period, especially during cardiac surgery. Complications from TOE are infrequent in awake patients.¹⁻³ In anaesthetized, unconscious patients, however, blind positioning and manipulation of the probe may increase the risk of injury to the oesophagus or stomach. During cardiopulmonary bypass (CPB) in particular, low perfusion pressure, hypothermia and systemic heparinization may predispose to mucosal damage and bleeding. We present a case of gastric mucosal tear after TOE monitoring in a patient undergoing coronary artery bypass grafting. Bleeding from the tear was stopped using endoscopic argon plasma coagulation.

Case report

A 46-yr-old, 160-cm, 74-kg man presented for coronary artery bypass surgery. He had a history of episodes of chest pain on effort. However, there was no evidence of oesophagitis, hiatus hernia, gastric ulcer or gastritis. Blood cell counts and blood chemistry were within normal limits. Prothrombin time was mildly prolonged because of anticoagulant therapy that had been started 6 weeks before the day of surgery to alleviate ischaemic episodes. Electrocardiography showed normal sinus rhythm without evidence of ischaemia at rest. Coronary angiography revealed 90–99% stenoses of the three coronary vessels. Surface echocardiography and left ventriculography showed normal cardiac wall motion.

General anaesthesia was induced with fentanyl and midazolam i.v., and a tracheal tube and an 18-Fr nasogastric tube (Argyle Salem Sump Tube, Nippon Sherwood, Tokyo, Japan) were placed. A TOE probe (Model UST-5280S-5, Aloka, Tokyo, Japan; 5.0 MHz; dimensions, 14.8×10 mm tip and 8×8 mm shaft) was passed into the distal oesophagus without any resistance. As the nasogastric tube interfered with the TOE image, it was removed after suctioning of gastric contents. The heart was imaged in the four-chamber or short-axis view by manipulation of the probe without difficulty before bypass. This time was prolonged as a new harvesting technique of the radial artery graft under endoscopic guidance was performed.

After systemic heparinization, the coronary arteries were bypassed during the 84-min aortic cross-clamping period. The probe was left in a neutral, unlocked position during CPB. Separation from CPB was accomplished uneventfully with infusion of dopamine, nitroglycerine and milrinone, which was started on the basis of a routine protocol at that time. To obtain the four-chamber and short-axis views of the heart, the TOE probe was manipulated between the distal oesophagus and proximal stomach. It was possible to manipulate the TOE probe without any resistance and a high-quality image was obtained while coming off bypass. Heparin was reversed with protamine and no remarkable bleeding was seen in the surgical field. No blood was transfused. At the end of surgery, the TOE probe was removed without difficulty. The probe had been present in the oesophagus or stomach for 6 h during operation. A nasogastric tube was re-inserted without any resistance, and immediately, about 100 ml of uncoagulated, fresh blood returned through it. As the patient was haemodynamically
Bleeding in the gastric mucosa caused by TOE

Fig 1 Top: A 2-cm linear tear (double arrow) in the gastric mucosa revealed by an endoscope (single arrow). An active bleeding point was recognized at the bottom of the tear. Bottom: The point in the tear at which bleeding was coagulated (double arrow) using argon plasma coagulation (single arrow).

On arrival in the intensive care unit, an oesophagogastro-duodenoscopy (GIF Type 2T200, Olympus, Tokyo, Japan) was performed. It revealed a bright red clot at the gastro-oesophageal junction. This was flushed with saline and a linear tear of approximately 2 cm long was seen in the gastric mucosa just distal to the gastro-oesophageal junction (Fig. 1, top). Active bleeding was observed at the bottom of the tear. Haemostasis was undertaken using argon plasma coagulation through the endoscope (APC 300 Argon Plasma Coagulator; Erbe USA, Inc., Marietta, GA, USA). A 2.3-mm flexible probe was inserted via a side port of the endoscope. Haemostasis was easily achieved with 60 W of output and 2 litre min⁻¹ of argon flow (Fig. 1, bottom). Endoscopic examinations showed no evidence of oesophagitis, gastritis or other mucosal damage.

Proton pump inhibitor therapy was started and no further bleeding was observed. The patient was weaned from mechanical ventilation on the first day after operation and made a satisfactory recovery.

Discussion

Over the past decade, TOE has become increasingly used in the perioperative period. During cardiac surgery in particular, TOE allows good assessment of cardiac function.⁴⁻⁶ In conscious subjects, a low incidence of complications related to this procedure has been reported in several multicentre studies.¹⁻³ One of these surveys showed that only two cases of bleeding occurred in 10 419 examinations.³ In one, bleeding was from oesophageal infiltration by a malignant lung tumour, and the other case had only minor pharyngeal bleeding. In anaesthetized patients, however, intraoperative use of TOE may have additional risks. First, response to excessive force is prevented. Second, monitoring is often prolonged. Third, the gastrointestinal mucosa may be ischaemic during anaesthesia. During cardiac surgery in particular, the risk of mucosal damage may be greater because of low perfusion pressure to the peripheral tissues and hypothermia during CPB. A small haemorrhagic injury may be made worse by systemic anticoagulation.

In spite of these concerns, to our knowledge only two cases of oesophageal damage caused by the TOE probe during cardiac surgery have been reported.⁷ ⁸ In both, damage to the oesophageal mucosa near the gastro-oesophageal junction was seen, as in the our case. In our patient, bleeding was observed from the bottom of the gastric tear but no history of oesophagitis or gastritis was obtained and there was no evidence of other gastrointestinal disease. As the blood from the gastric tube did not form clots, bleeding was likely to have begun during CPB. Furthermore, the shape and size of the tear appeared to be caused by the TOE probe and not by the nasogastric tube.

Urbanowicz and colleagues⁹ investigated the pressure produced by a TOE probe in the oesophagus in both dogs and humans. In the animal study, the maximum surface pressure generated by the TOE probe was only 10 mm Hg. However, in the human study, up to 60 mm Hg of pressure occurred in one of six patients during descending thoracic aneurysm surgery. The authors suggested that high pressure between the oesophageal mucosa and the TOE probe could occur during thoracic surgery.

In our patient, the relatively long time that the TOE was in place (i.e. 6 h) may have been responsible, in part. It appears that the shape of the TOE probe (Fig. 2), which has several angular portions, may also be related to the occurrence of the tear. Therefore, we recommend that the manufacturers should improve the shape of the TOE probe to reduce angular portions to avoid the risk of tear formation.
Fig 2 Tip of the transoesophageal echocardiography (TOE) probe which was used in our case. It has several angular portions.

In previous reports, patients were treated successfully by adequate red cell replacement or conservative H2-antihistamine therapy. Our patient may have recovered after conservative therapy without argon plasma coagulation. However, we thought it necessary to remove the clot to evaluate the extent of gastric mucosal damage. Also, argon plasma coagulation is easy to perform during endoscopy because the argon probe can be inserted via the side port of the endoscope. Therefore, we chose argon plasma coagulation therapy to ensure haemostasis and to avoid homologous blood transfusion. The technique does not require the probe to touch the tissue at any time. As the depth of coagulation by argon plasma coagulation is limited to the surface of the tissue, it is safer than conventional electric coagulation.10

This was an unusual complication of TOE during cardiac surgery. Although this complication may be rare, special caution is needed in using TOE, especially during cardiac surgery requiring systemic hypothermia and anticoagulation. If gastrointestinal bleeding is recognized, prompt diagnosis and adequate treatment may be needed to avoid further complications from homologous blood transfusion. Argon plasma coagulation is a highly effective means of obtaining haemostasis for this complication.

References
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