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Buckling of Transesophageal Echocardiography Probe: A pitfall at insertion in an anesthetized patient

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ABSTRACT

Buckling of the transesophageal echocardiography probe was encountered in 6 of 23 patients (26.1%), although no complication occurred. When buckling occurred, acquisition of images and manipulation of the probe became difficult, resistance was felt when withdrawal of the probe was attempted, and the probe was fixed in the extreme ante- or dorsiflexion. In this situation, the probe was carefully advanced into the stomach, in which the buckled probe was unfolded, and then withdrawn to the esophagus. Buckling of the probe tip is not uncommon at insertion of the probe, especially when using a flaccid probe in an anesthetized patient. A TEE operator should be aware of the possibility of buckling. Unusual resistance associated with buldging of the submandibular region is a sign of a folded-up probe tip. Use of laryngoscopy is recommended in order to avoid inserting the buckled probe into the esophagus.

Key words: *Transesophageal echocardiography, Complication, Esophageal rupture, Probe*

At insertion of a probe, which is the first step of transesophageal echocardiography (TEE) examination, buckling of the probe can occur[2)], which is a potentially dangerous malfunction leading possibly to an esophageal rupture. We report our experience and discuss the mechanism, prevention, and treatment of a buckled probe.

SUBJECTS AND METHODS

Twenty three consecutive patients undergoing cardiovascular surgery were studied, for whom TEE was used as one of intraoperative monitors. The patients consisted of 18 men and 5 women with ages ranging from 43 to 85 years old. No disease contraindicating the intraoperative use of TEE was encountered. No morphological abnormalities causing difficult insertion of the probe was found except in one patient, who had mediastinal tumor. Written informed consent was obtained from every patient.

After induction of anesthesia, a 5MHz single-plane transesophageal probe (UST-5225V-5, Aloka, Tokyo) was inserted by experienced operators according to the routine procedures[1)]. Before insertion, the probe tip was unlocked, straightened, and adequately lubricated with jelly. The probe was held with the transducer directed anteriorly and, perpendicular to the patient's face, gently introduced into the mouth along the centerline of the hard and soft palate. At first, the jaw was lifted because the tongue tended to drop. When several attempts failed using this technique, the patient's head was held at the sniffing position, the trachea was lifted anteriorly, or a laryngoscope was used.

Buckling of the probe was diagnosed when: 1) images could not be easily obtained, 2) manipulation of the probe became difficult, 3) resistance was felt when withdrawal of the probe was attempted, and 4) the probe was fixed in the extreme flexion[2)].

RESULTS

A laryngoscope was used from the beginning in one patient who had mediastinal tumor deviating the trachea laterally, because insertion of the probe accompanied by careful inspection of the esophageal orifice was considered to be necessary. The jaw lifting technique was used in the remaining 22 patients. Among them, entry of the probe into the esophagus was smooth in 11 cases (50.0%). It was possible but with significant resistance in 5 cases and buckling occurred in four. Insertion accompanied by jaw lifting was unsuccessful in 6 cases. Placing the head in the sniffing position was helpful for smooth entry in two patients. The trachea was lifted in two patients and insertion was successful in one case but buckling occurred in the other. A laryngoscope was used for two patients, but buckling occurred in one of them. In this particular patient, the mouth could not be opened enough due to unusual rigidity, and the pharynx was not seen clearly. In total, buckling occurred in 6 of 23 patients

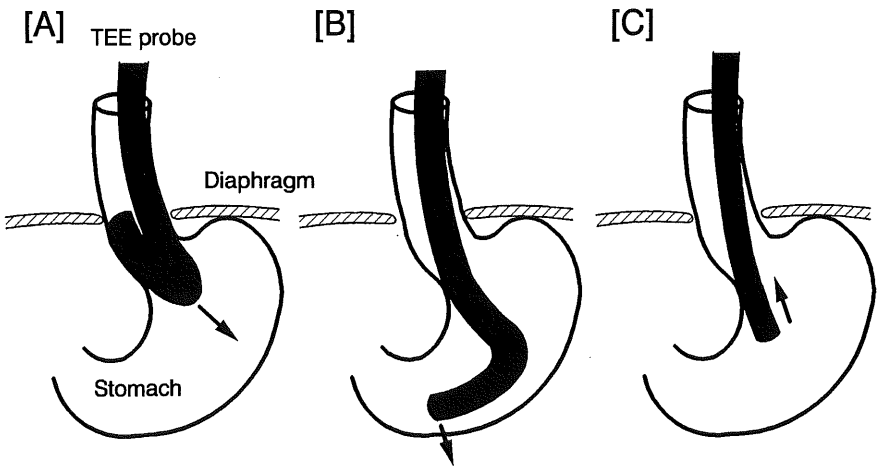

Fig. 1. Procedures for unfolding buckled probe tip. (A) The buckled probe is advanced into the stomach. (B) The buckling is unfolded in the stomach. (C) The unfolded probe is withdrawn into the esophagus.

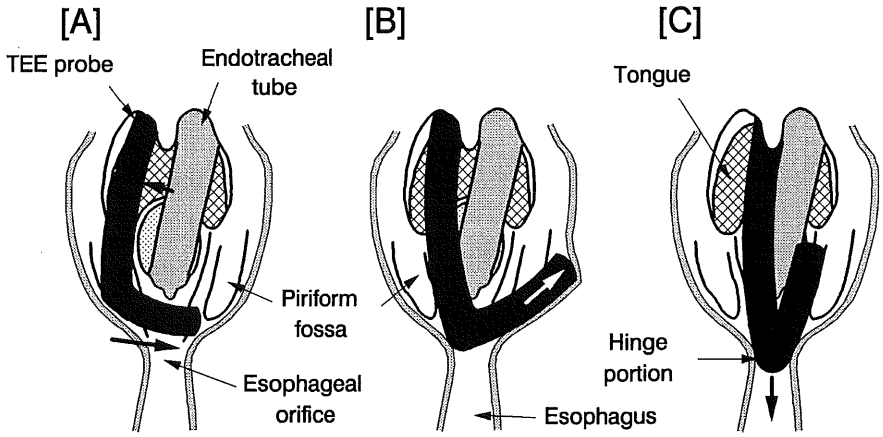

Fig. 2. Possible mechanism of buckling. (A) The probe tip is swerved laterally by the tongue and the probe tip lies transversely above the esophageal orifice. (B) The hinge portion approaches the orifice, with the probe tip pushing the pharyngeal wall. (C) The buckled up probe is pushed into the esophagus in a V shape.

(26.1%). In these cases, significant resistance on advancing the probe through the mouth was associated with bulging of the lateral submandibular region.

When buckling was encountered, the probe was advanced gradually through the cardia into the stomach, where the buckling was unfolded allowing the straightened probe to be withdrawn to the esophagus (Fig. 1)[2]. Control of the probe tip was recovered after this technique in every patient. No complication such as esophageal rupture was encountered. The probe was inspected after TEE examination, but no malfunction of the probe for routine use was ascertained.

DISCUSSION

Buckling of the probe tip has been reported in only one paper, published by Kronzon et al[2]. We consider that several factors were related to the high incidence of buckling in our series: 1) the flaccidity of the probe, 2) the insertion technique, and 3) the anesthetized state of the patients.

Kronzon et al mentioned flaccidity of the probe[2]. Aging of the probe can be responsible, as they experienced a case after usage of approximately 300 times of a particular probe. In an aged probe, the steering wire for controlling the flexion of the probe tip can be elongated, leading to insufficient stiffness for insertion.

The insertion technique can also be responsible. Fig. 2 schematically illustrates a probable mechanism of buckling. The tongue often drops in spite of jaw lifting and swerves the probe laterally, and the probe tip lies transversely above the esopha-

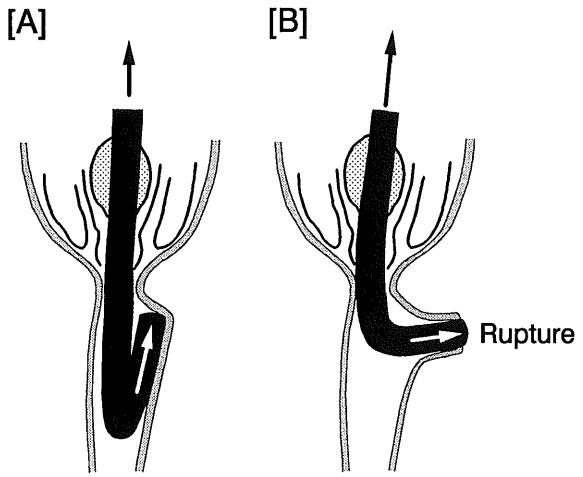

Fig. 3. Rupture of the esophagus, caused by withdrawing the buckled probe forcefully.

geal orifice (Fig. 2A). The hinge portion approaches the esophageal orifice, with the probe tip pushing the lateral wall of pharynx, which is recognized as a protrusion of the submandibular region (Fig. 2B). Thus, the buckled up probe is pushed into the esophagus in a V shape with the hinge portion ahead (Fig. 2C). Flaccidity of the probe would further increase the occurrence of buckling.

Buckling is more probable in an anesthetized patient in the supine position than in an awake patient in the left decubitus position, who can intentionally swallow the probe. In the latter condition, the tongue is unlike to drop and the patient could report an unusual feeling in the pharynx.

Kronzon et al reported that the buckled probe tip was fixed in the extreme anteflexion in all patients[2]. In this situation, the transducer faces the probe itself and an image cannot be obtained. However, in some cases in our series, images could be obtained with the control knob fixed, indicating extreme dorsiflexion of the probe, with the transducer facing the esophageal wall.

Once buckling occurs, the probe should not be withdrawn forcefully because of a possible rupture of the esophagus (Fig. 3). Instead, the probe should be advanced into the stomach, where the buckling is released as shown in Fig. 1. Significant resistance is often felt when the probe tip passes through the cardia or diaphragm. The probe is gently rotated, sounding the direction of the probe for advancing with minimal resistance. As soon as the probe tip is in the stomach, control of the knob is restored.

TEE is not necessarily contraindicated in patients with a history of total or subtotal gastrectomy as long as the probe is manipulated only in the esophagus[1]. However, unfolding of buckled probe in the residual stomach or jejunum is inadvisable. If TEE is to be used in these cases, extremely careful insertion is mandatory.

In order to prevent buckling, a routine check-up of the probe is primarily important. The length of the probe tip distal to the hinge portion varies among commercially available models. A more flexible probe with a shorter tip is more likely to cause buckling. Unlocking the probe tip before insertion, which is a commonly accepted procedure, may ease the occurrence of buckling. It may also be better to lock the lateral bending of the probe in order to avoid its lateral swerving in the pharynx. Use of a laryngoscope is recommended when unusual resistance is felt in the pharynx, although it is not perfect in case the pharynx cannot be seen clearly.

In conclusion, buckling of the probe at insertion is not uncommon, especially when using a flaccid probe in an anesthetized patient. A TEE operator should be aware of the possibility of buckling. Unusual resistance associated with bulging of the submandibular region offers a clue to the buckling of the probe tip. Use of a laryngoscope is recommended in order to avoid inserting the buckled-up probe into the esophagus. Once buckling occurs, it should be unfolded in the stomach.

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