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BRIEF COMMUNICATION

Complications of Intraoperative Transesophageal Echocardiography in Adult Cardiac Surgical Patients—Experience of Two Institutions in Taiwan

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There is some safety concern about transesophageal echocardiography (TEE) when it is used routinely during cardiac operations. The purpose of this investigation was to study the incidence of intraoperative TEE-associated complications in adult cardiac surgical patients. The study population comprised 6255 consecutive adult cardiac surgical patients with intraoperative TEE examinations. TEE-associated complications occurred in 25 patients (0.4%). Most of these complications consisted of oropharyngeal mucosal bleeding (15/25, 60%). Esophageal perforation occurred in one patient. Two patients experienced upper gastrointestinal bleeding. Seven patients experienced dental injuries, and TEE probe insertion failed in 10 patients. We conclude that intraoperative TEE-associated complications in cardiac operations is very low; the complication rate we found was comparable to previously reported values. [*J Formos Med Assoc* 2007; 106(1):92–95]

Key Words: cardiac surgery, complications, transesophageal echocardiography

Transesophageal echocardiography (TEE) is used frequently in cardiac surgical procedures. It is considered to be of low risk, but there is some concern regarding its safety when it is used routinely during cardiac operations. In a study of 10,419 awake patients undergoing TEE, a complication rate of 0.18% was reported.[1] A number of TEE-associated complications have been reported since its introduction into clinical practice.[2,3] Two studies identified TEE as a risk factor for the development of postoperative swallowing disturbance.[4,5] Kallmeyer et al reported that TEE-associated morbidity occurred in 14 (0.2%) patients without any TEE-associated mortality.[6] To the best of our knowledge, the safety of TEE examination has not been examined before in Taiwan. The purpose of this investigation was to study the incidence of intraoperative TEE-associated complications in adult cardiac surgical patients.

Patients and Methods

The study population comprised a total of 6255 adult cardiac surgical patients (4368 patients and 1887 patients from each of two hospitals,

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respectively) who underwent intraoperative TEE between August 1997 and July 2005. In all patients, a multiplane TEE probe (GE Vingmed, Horten, Norway) lubricated with xylocaine jelly was inserted gently into the esophagus. If the insertion was not successful after two attempts, direct laryngoscopy was used to help the procedure, and if it failed again, then TEE insertion was abandoned.

Information on patients who experienced TEE-associated complications was collected by the investigators from the anesthesia and TEE records and from the consultation records and morbidity and mortality data in the cardiac surgical intensive care unit. Upper gastrointestinal (UGI) bleeding was defined as a large amount of fresh blood or coffee ground substance from the nasogastric tube during or after the operation, and dental injuries was defined as dislodged or loosened teeth after the insertion of the TEE probes.

Results

TEE-associated complications were found to have occurred in 25 patients, and the complications are shown in Table 1. The demographic and operative data of patients with TEE-associated complications are shown in Table 2.

Esophageal perforation occurred in a 61-year-old man who underwent aortic and mitral valve replacement and repair of tricuspid valve operations. However, 11 days after operation, fever, oxygen desaturation and hypotension developed abruptly. Diagnostic workup on postoperative day 12 confirmed the presence of esophageal perforation and empyema. The patient survived the emergent reoperation and was discharged 36 days after the first operation.

Two patients experienced UGI bleeding that required endoscopy for diagnosis and further treatment. The deep transgastric short-axis view of TEE was obtained several times in the first patient in whom a lot of coffee ground substance from the nasogastric tube was found postoperatively. Emergent gastroduodenoscopy revealed arterial bleeding, but surgery for the gastric bleeding was not done due to persistent cardiac failure and low cardiac output. The patient died 7 days after the operation. The other patient was diagnosed to have gastric mucosal abrasion and bleeding, which was stopped after gastroscopy with accompanying treatment. The patient recovered without any other event and was discharged 10 days after the operation.

There were 15 patients with a mean age of 62.2 ± 9.1 years (range, 43–78 years) who experienced oropharyngeal mucosal bleeding during their TEE examinations. The bleeding most commonly presented as blood-tinged secretions from the mouth during or after insertion of the TEE probe, and most of the bleeding stopped spontaneously without further treatment. Seven patients experienced dental injuries. These patients were of older age (mean, 71.8 ± 6.1 years; range, 63–78 years), and they all had dentures or unstable teeth before the operation. Dental injury was usually caused by pressure generated by the biteguard or the TEE probe on the solitary tooth remaining after removal of the denture. The TEE probe could not be inserted in 10 patients (0.016%).

Table 1. Incidence of complications of transesophageal echocardiography in 6255 cardiac surgical patients

Complication	*n* (%)
Esophageal perforation	1 (0.016)
Upper gastrointestinal bleeding	2 (0.03)
Oropharyngeal mucosal bleeding	15 (0.24)
Dental injury	7 (0.11)
Total	25 (0.4)

Discussion

Our study found that the complication rate due to TEE was 0.4%, which is similar to previously reported values.[6] However, the previous study did not examine the incidence of oropharyngeal mucosal bleeding, which comprised over half of our complications. The mucosal bleeding point was usually at the junction between the oral cavity

Table 2. Demographic and operative data of the 25 patients with transesophageal echocardiography-associated complications

Patient	Age (yr)	Gender	Procedure	OP time (min)	Complication
1	61	M	DVR	386	Esophageal rupture
2	75	M	DVR	361	UGIB
3	59	M	AVR	356	UGIB
4	53	M	CABG	352	OP mucosal bleeding
5	78	M	MVR	328	OP mucosal bleeding
6	65	F	CABG	320	OP mucosal bleeding
7	71	M	AVR	339	OP mucosal bleeding
8	72	F	CABG	285	OP mucosal bleeding
9	72	M	CABG	398	OP mucosal bleeding
10	70	M	CABG	358	OP mucosal bleeding
11	38	F	MVR	362	OP mucosal bleeding
12	78	F	AVR	284	OP mucosal bleeding
13	64	M	CABG	296	OP mucosal bleeding
14	74	M	CABG	410	OP mucosal bleeding
15	77	M	CABG	312	OP mucosal bleeding
16	72	F	AVR	336	OP mucosal bleeding
17	74	M	CABG + AVR	396	OP mucosal bleeding
18	75	M	Off-pump CABG	269	OP mucosal bleeding
19	57	M	CABG	347	Dental injury
20	68	M	AVR	298	Dental injury
21	70	M	CABG	310	Dental injury
22	76	F	Others	291	Dental injury
23	79	M	DVR	304	Dental injury
24	63	M	CABG + MVR	410	Dental injury
25	72	M	CABG	398	Dental injury

DVR = aortic and mitral valve replacement; AVR = aortic valve replacement; CABG = coronary artery bypass grafting; MVR = mitral valve replacement; UGIB = upper gastrointestinal bleeding; OP = oropharyngeal.

and the posterior pharyngeal wall. Compared with the previous study, in addition to the different incidence of oropharyngeal bleeding, endotracheal tube malpositioned by the TEE probe did not occur in our series.

Esophageal perforation occurred in one patient in our series. This complication may present with hemorrhage, dyspnea and hydropneumothorax or even the appearance of the TEE probe in the surgical field.[7] The mechanism of perforation was suggested to be the combination of local ischemia[6] resulting from compression by the distended left atrium anteriorly and the TEE probe posteriorly.

Continuous pressure at the TEE probe–mucosal interface and resultant tissue ischemia or thermal injuries caused by the piezoelectric crystal vibration at the TEE probe tip[8] was suggested as the mechanism for gastrointestinal mucosal injury. However, results from animal studies did not confirm these theories.[9,10] Since it is the transgastric and deep transgastric views[11] in which the TEE probe is anteflexed and in close contact with the gastric wall, deliberate handling of the TEE probe during these views might be helpful in avoiding this complication. Dental injury was caused by the force exerted by the shaft of the TEE probe or the hard biteguard. The solitary tooth is easily hurt by the continuous pressure generated by the inertia and weight of the TEE probe. In patients with a single or two teeth after removal of the denture, the insertion of the TEE probe should be carefully performed.

Swallowing abnormality, which was reported as a significant complication of TEE examination,[12]

was not found in our study. Since we only collected data on the intraoperative and immediate postoperative period when the patient was in the intensive care unit, it is possible that the incidence of this complication, which might be found after returning to the ward, was underestimated. Previous studies that focused on dysphagia after cardiac operations revealed that TEE was a significant risk factor for postoperative dysphagia,[4,5] however, it was not confirmed in other studies.[13]

We conclude that intraoperative TEE-associated complications in our cardiac operations are very low and the complication rate was comparable to previously reported values. Intraoperative TEE examination carries a relatively low risk; however, the probe should be inserted and positioned cautiously to avoid dental, oropharyngeal and esophageal injuries.

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