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# Multiplane Transesophageal Echocardiography for Multiclinical Dilemmas

Lulzim S. Kamberi<sup>1</sup>, Daut R. Gorani<sup>1</sup>, Hajdin R. Çitaku<sup>1</sup>, Hamza H. Selmani<sup>1</sup>, Arton I. Beqiri<sup>2</sup>, Ardian I. Mustafai<sup>2</sup>

University Clinical Centre of Kosova, Prishtina, Kosova<sup>1</sup>

International Medicine Hospital for Cardiovascular Disease, Prishtina, Kosova<sup>2</sup>

## Original paper

### SUMMARY

**Introduction.** Transesophageal echocardiography was introduced 4 decades ago. Its use have had very limited clinical indication. Now it has become very useful clinical tool. Indications for its use are almost as indications for transthoracic echocardiography, especially to assess deeper cardiovascular structures. Transesophageal echocardiography is semi-invasive examination with small number of complications. **Aim of the study.** To determine usefulness of transesophageal echocardiography in various cardiac conditions based in our experience. Also to encourage use of transesophageal echocardiography as reliable examination. **Methods.** All of the patients signed a Term of Free Informed Consent, approved

from Ethics Committee. We enrolled 425 patients who have done TEE in last 5 years (2006-2010) by authors. Medical history and Clinical evaluation was carefully performed by expert cardiologists. Procedures were performed in two different centers using machines, PHILIPS iE33 and Siemens acuson CV 70, with equipment attached to a multi frequency 2.5 to 3.5 MHz for TTE and 7.0 MHz for TEE multiplane transducer. TEE were performed and images were obtained according to the standard recommendations. **Results.** The results were analyzed by a standard method of descriptive statistics using Pivot Table of Excel Office 2007. Results. We have analyzed 425 transesophageal echocardiography. The examination of the thoracic aorta in severe hypertension patients was conducted in 96 cases;

atrial fibrillation in 118; aortic dissection 49 cases, aortic stenosis was evaluated in 28 cases; finding of source of emboli 36 cases; suspicion for aneurysm of the thoracic aorta in 14 cases, 11 cases with suspected endocarditis; the type of intervention for mitral valve was evaluated in 28 cases. Interatrial septum abnormalities 37 cases; and miscellaneous 18 cases. No minor or mayor complications happened. **Conclusion.** Transesophageal echocardiography can elucidate many dubious serious conditions immediately after it is performed. So, we think that transesophageal echocardiography is very useful tool in everyday clinical use, almost without complications if it is done correctly. **Key words:** transesophageal echocardiography, transthoracic echocardiography, echocardiography.

## 1. INTRODUCTION

Transesophageal echocardiography (TEE) was first reported in 1971, in 1975 was described pulsed wave Doppler interrogation from within the esophagus, in 1976 was reported transesophageal M-mode echocardiography as a means of assessing ventricular function (1, 2, 3). The indications for TEE examination in Europe were first published on behalf of the Working Group of the European Society of Cardiology in 2001 (4). Any condition in which transthoracic approach does not yield images of good quality is a potential indication for TEE, but mainly TEE is indicated to assess cardiac structures (deep or posterior) not usually seen by Transthoracic echocardiography (TTE), such as the superior vena cava, pulmonary veins, left atrium, interatrial

septum, mitral valve, valvular vegetations and the thoracic aorta—all potentials sources of embolism. Finally, TEE has important applications in the operating room (5, 6, 7, 8, 9, 10, 11). TEE is a relatively safe procedure with a low complication rate. Procedural complications have been observed in 0.47% to 2.80% of patients with successful esophageal intubation. The vast majority of complications are minor. Major complications, defined in one study as death, laryngospasm, sustained ventricular tachycardia, or congestive heart failure, occur in approximately 0.3% of patients. In the Multicenter European Survey of 10,419 examinations, the TEE examination had to be interrupted prior to completion in 0.88% of studies (12, 13, 14, 15). In one study, there were 226 major and minor complications

(2.3%) noted during the first 10,000 TEE done. There is a learning curve for performing TEE, after which the likelihood of complications drops, which usually occurs after the first 200 cases (16). Mortality rate reported to be 0.01% (17). Despite TEE is associated with a low complication rate, the echocardiographer must be knowledgeable about the types of complications and their predisposing factors, and should be meticulous in preventing their occurrence (18). TEE is the most accurate in finding of cardiogenic and “aortogenic” embolism (19). In one study; of 588 patients having TEE, aortic plaque was present in 43.7% (20). It is important to realize that the prevalence of severe aortic plaque in stroke patients (14% to 21%) is on the same order of magnitude as that of the other 2 important causes of

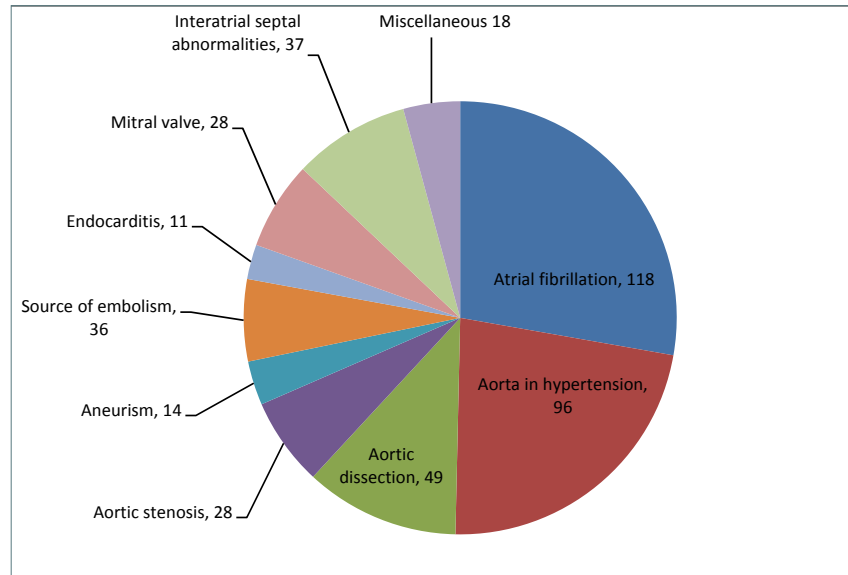
embolic stroke, carotid artery disease (10% to 13%) and atrial fibrillation (18% to 30%), which were documented in 2 large series of consecutive stroke patients (21, 22). The aorta is an important source of atheroemboli, as recent studies have confirmed the strong correlation between severe aortic atheromatous plaques and stroke/death in the elderly (23).

Protruding atheroma is an important finding, and its correct diagnosis and treatment may influence patient's longevity and quality of life (24). TEE is used primarily to determine the source of emboli (25).

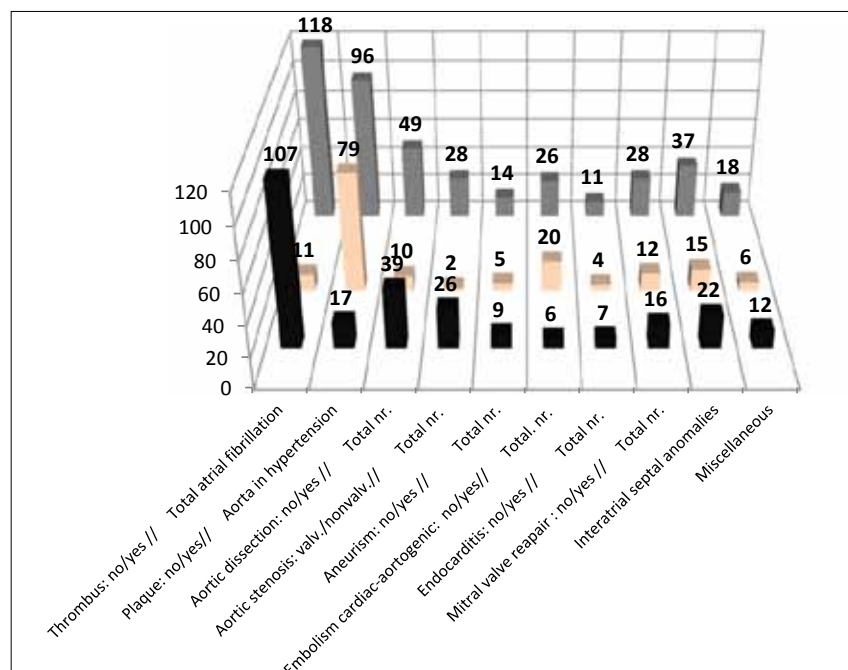
TEE can image almost the entire thoracic aorta well and has become widely used for the detection of aneurism, aortic dissection and to characterize aortic atherosclerosis (26). TEE is very useful for follow-up of congenital heart disease in adult life which is likely to grow linearly, with increasing complexity and increasing need for reinvestigation and reintervention with time (27). TEE is gold standard for intraatrial masses (28). While TTE can occasionally reveal a PFO, TEE demonstrates the interatrial septum in great detail. Atrial septal abnormalities can be clearly visualized (29). TEE studies are the current best imaging modality, particularly if prosthetic material is present. Specificity for detecting vegetations, abscesses, or other evidence of infective endocarditis can approach 100% (30).

## 2. METHODS

All of the patients signed a Term of Free Informed Consent. We enrolled 425 patients who have done TEE in last 5 years (2006-2010) by authors. Medical history was taken, specially dysphagia, hematemesis, operations on gastrointestinal tract and cervical spine disease. Clinical evaluation was performed by expert cardiologists using clinical criteria, TTE and TEE. Procedures were performed in two different centers using machines, PHILIPS iE33 and Siemens accuson CV 70, with equipment attached to a multi frequency 2.5 to 3.5 MHz for TTE



**Diagram 1.** Indications and number of examinations for transesophageal echocardiography



**Diagram 2.** Number and main transesophageal echocardiography findings or ruling out pathologies suspected from transthoracic echocardiography

and 7.0 MHz for TEE multiplane transducer.

TEE were performed with the patients in left decubitus and the upper left limb slightly flexed beneath the head. Patients were advised previously to maintain a 4-hour fast, dentures and oral prostheses have been removed and were submitted to oropharyngeal anesthesia with lidocaine spray and to sedation (midazolam). The transducer, after coated with lubricating jelly, was introduced through the mouth (bite guard) and into the esophagus and gastric

cavity for visualization of the cardiac and aorta structures. The images were obtained according to the recommendations of the American Society of Echocardiography (4, 10, 16). The results were analyzed by a standard method of descriptive statistics using Pivot Table of Excel Office 2007.

## 3. RESULTS

Number of analyzed TEE was 425. TEE examination of the thoracic aorta, in cases of longstanding severe hypertension (part of another ongoing study)



**Figure 1.** a) Dilated left atrium with presence of thrombus in left atrial appendage. b). Aortic dissection. c) Aortic plaque grade 3 in patients suffered atheroemboli. d). Interatrial septal defect.

was conducted in 96 cases; Atrial fibrillation in 118; aortic dissection was suspected in 49 cases, aortic stenosis was evaluated in 28 cases; finding of the source of emboli, 36 cases; suspicion for aneurysm of the thoracic aorta in 14 cases, 11 cases with suspected endocarditis; the type of intervention for mitral valve was evaluated in 28 cases. Interatrial septum abnormalities 37 cases; and miscellaneous, 18 cases (Diagram 1).

Atrial fibrillation was present in 118 cases, 11 were with intracavitary cardiac thrombus or 9.3% (Figure 1a). Of 96 cases with severe longstanding hypertension atherosclerotic plaques grade 2 and/or grade 3 are found in 79 cases (82.3%). From 49 cases with suspected aortic dissection diagnosis was confirmed in 10 cases (Figure 1b). TEE for evaluation of the aortic stenosis was performed in 28 cases in 2 (7.14) of them nonvalvular stenosis (subvalvular) were established, in one of them was found also intramural aortic hematoma. Of 14 cases of suspected aneurysm of the thoracic aorta at any level diagnosis was confirmed in 5 (35.7%) cases. In 26 cases TEE was performed to find source of embolism (cardiac/"aortogenic") which was confirmed in 20 (76.92%) cases (Figure 1c). Of 11 cases of suspected endocarditis diagnosis was confirmed in 4 (36.36%) cases. Mitral valve was evaluated to determine type of operation in 38 cases; valve repair was estimated to be appropriate in 20 (52.63%). Of 37 cases with suspected interatrial septal abnormalities positive pathological findings have been confirmed in 15 (40.54%). Miscellaneous cases were 30 (pulmonary hypertension, interventricular septal defect, tho-

rax deformities, cardiac tumors), 6 cases (20%) resulted with positive abnormal findings as, one with interventricular septal defect, two with interatrial septal defect (Figure 1d), two with myxoma, and in one case presence of left atrial appendage thrombus.

Nr. of all TEE*	Failure to intubate	Complications minor or mayor
425	1 (0.23%)	0

**Table 1.** Complications of transesophageal echocardiography. \*TEE-transesophageal echocardiography

Of total, 425 examined cases (Table 1) no major or minor complications have been registered except, one (0.23%) case of unsuccessful probe introduction (patient non-compliance).

#### 4. DISCUSSION

Percentage of thrombus in atrial fibrillation was 9.3 % (11/118), which is higher than in recently reported study of 6.3% (48/757) (32). We deduced that this is due to inadequate treatment (very small number of patients were anticoagulated). Inadequate prophylaxis with anticoagulant in AF was also reported (31). Thrombus finding, is possible with high sensitivity and specificity only with TEE as the gold standard (26), and this has great impact on treatment and in the way of rhythm conversion (32).

Of 96 cases studied for aortic atherosclerotic plaques in group with severe longstanding hypertension, plaques grade 2 and/or grade 3, according to Amarenzo classification (21), are found in 79 cases (82.3%). We consider this of high value since, atherosclerotic plaques in aorta are on the same order of magnitude as that of the other 2 important causes

of embolic stroke, carotid artery disease (10% to 13%) and atrial fibrillation (18% to 30%), which were documented in 2 large series of consecutive stroke patients as well as death in the elderly. Meissner I. et al. reported, that of 588 patients having TEE as part of the study, aortic plaque in any location was present in 43.7%, comparing with our finding of 82.3%, we can clearly conclude the impact of severe longstanding hypertension on plaques forming into aorta (21, 22, 33).

The aorta is an important source of athero-emboli, as recent studies have confirmed the strong correlation between severe aortic atherosclerotic plaques and stroke/death in the elderly. Of 64 cases of suspected for aortic dissection, diagnosis was confirmed in 10 cases. Aortic dissection represent very serious emergent life-threatening condition, success rate of treatment depend on time of diagnosis (32). Of 17 cases of suspected aneurysm diagnosis was confirmed in 7 cases, also the exact size and location of aneurysms was realized. From 36 cases examined to find source of embolism, explanation for embolism was accomplished with TEE in 24 cases. However we consider that the number of TEE for this pathology (finding the source of emboli) is very small comparing with developed country where this is predominant indication (to explain "cryptogene" source of embolisms) (35). We consider that we should encourage physicians (especially cardiologists, neurologists and surgeons) to look after source of embolisms, in what TEE is very useful, for better treatment and prevention.

Of eleven cases suspected for endocarditis diagnosis was definite in 4 cases, so in seven cases diagnosis

was ruled out by TEE which is the best imaging modality with specificity approaching 100% (30). Mitral valve repair was found to be possible, as a best choice, in 20 from 38 cases suspected. Diagnosis for interatrial septal abnormalities were found in 15 from 37 cases. TEE is the method of choice for these abnormalities (27). In two cases of pulmonary hypertension interatrial septal defect was found to be the cause, they were older than 60 years with few medical controls (including that of cardiologist) done before but defect was missed.

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Corresponding author: Lulzim S. Kamberi, MD. Mother Theresa Street. No number, 10 000 Pristina, Kosova.  
Phone: +377 44 14 56 80; e-mail: lulzimkamberi@gmail.com