



## Clinical Utility of Transoesophageal Echocardiogram at Cardiac Center-Sana'a city, Yemen

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### Abstract

**Background:** Transesophageal echocardiography is not only an invaluable diagnostic tool for cardiac patients, but also is essential for cardiac monitoring in critically ill patients in cardiac and non-cardiac surgery settings and in the differential diagnosis of unexplained hemodynamic collapse. **Aim:** To assess the first detailed review of the indications and clinical utility of TEE in noninvasive diagnostic cardiac unit at cardiac center in TMGH-Sana'a city, Yemen. **Methods:** A hospital based study was done among patients who had TEE performed at the cardiac center, TMGH from 1-Jun to 31-December 2009 and from 1-Jun to 31-December 2011. Data for 856 patients were abstracted and reviewed. Information gathered included demographic data, indications for the procedure, findings and clinical recommendations. Data were collected from all reports of performed TEE for presented patients and the used machine was hp 5500 echo. **Results:** Most of the patients was RHD which represents around 88% and female represent nearly 65%. The most common condition in 2009, 51.5% of the cases were diagnosed RHD, 4.3% CHD and 1.3% PH while in 2011, 36.4% were diagnosed RHD, 2.9% CHD and 0.7% PH. Cardiac surgery in 26% in 2009 & 30% in 2011 or for balloon mitral valvuloplasty 53% in 2009 & 33.6% in 2011. The most common complications were thrombus in left atrium & left atrial appendage & vegetation formation, thrombus takes 4% 14% in 2009 & 2001 respectively, Vegetation was found to be on mitral (3.5% & 2.8%) 2009, 2011 aortic (0.8% & 2.3%) or on both valves (1%) in 2009 % 2011. Cardiac surgery 25.9% in 2009 and 30.2% in 2011 or balloon mitral valvuloplasty 53% in 2009 and 33.6% in 2011 were recommended to management of patients while 10.2% in 2009 and 16.4% in 2011 were recommended to receive oral anticoagulant therapy for 8 weeks. **Conclusion:** TEE has been commonly performed to evaluate heart disease in Yemen without any major complications resulting from the procedure.

**Keywords:** TEE; RHD; CHD; PH; Yemen

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### Introduction

Cardiovascular diseases are generally considered the leading cause of death in both developed and developing countries. Echocardiography is the most frequently used diagnostic tool for real-time imaging of cardiac structure and function. In the last decade, transoesophageal

echocardiography (TEE) has become essential in cardiac surgery, and has expanded its role in other areas of patient care.<sup>1-5</sup> TEE is performed by inserting a probe with a transducer into the esophagus, and offers superior visualization of posterior cardiac structures, because of the close proximity of the esophagus to the

posteromedial heart, without visual interference from the lung and skeleton. In 1976, Frazin et al<sup>6</sup>, first introduced the clinical use of TEE when a modified rigid endoscopic probe with a single M-mode crystal was used. In 1980, the phased-array ultrasound transducer was introduced, and it was later reduced in size. The process of implementing biplane probes<sup>7-9</sup> by using crystal miniaturization with color doppler is the standard principle used in echocardiography. In 1990, Multiplane TEE probes become available, utilizing mechanical or electronic rotation of the 180 degree scanning plane.<sup>10-13</sup> Remarkable progress in TEE probe technology has been made in the last 10 years.

More recently, real-time three-dimensional (3D) imaging has been available by using a matrix array ultrasound probe and an appropriate processing system.<sup>14</sup> This enables detailed anatomical assessment of cardiac pathology and particularly valvular defects.<sup>15</sup> Now, TEE is a well-established and standard diagnostic technique in the operating room, intensive care unit, and laboratory catheter room.

TEE can reveal new findings that necessitate crosschecking preoperatively, such as mitral valve (MV) disorders, blood clots or intracardiac masses, dissection of the aorta, and implanted prosthetic (artificial) heart valves.

In 1996, a joint task force of the American Society of Anesthesiologists (ASA) and the Society of Cardiovascular Anesthesiologists (SCA) published guidelines for the perioperative application of TEE.<sup>16,17</sup>

### **Aim of the study**

To assess the first detailed review of the indications and clinical utility of TEE in noninvasive diagnostic cardiac

unit at cardiac center in TMGH-Sana'a city, Yemen.

### **Subject and Methods**

A hospital based study was carried out to assess the first detailed review of the indications and clinical utility of TEE in noninvasive diagnostic cardiac unit at cardiac center in TMGH-Sana'a city, Yemen. from 1-Jun 2009 to 31-December 2009 and from 1-Jun 2011 to 31-December 2011. All the patients admitted to cardiac center in TMGH and had TEE in this period were admitted to this study. 844 patients were included in the study, 490 patients in 2009 and 354 in 2011. This study was conducted at noninvasive diagnostic cardiac unit at cardiac center in TMGH, Sana'a city, Yemen. The center is public-owned which charges only a nominal fee for services provided to the public.

The center provides medical and surgical cardiac services. Noninvasive diagnostic cardiac unit is active vital department was established with different subunits of stress ECG, 4 Echocardiography labs, TEE lab and the 24 hours monitoring of heart rate and blood pressure.

The physicians in this unit are trained hardly to be fit in dealing with findings of their diagnostic tool. In non-invasive diagnostic cardiac unit where the first TEE lab started in Yemen provided with four probes (3 adult and one pediatric) works three days/week, ranged between 3-10 cases per day, with standard ways of TEE preparation as well as intraoperative TEE when recommended.

Data were collected through structure questionnaire. The questionnaire was included demographic data, indications for the procedure, findings and clinical recommendations. Data was collected from all reports of performed TEE for presented patients & the used machine was hp 5500 echo. Machine with

specific TEE probe is suitable for patient age and clinical situation. Patient preparation have to be: fasting, quit, re-assured, in left lateral position with head slightly flexed, under local anesthesia and all questions have answers. The Statistical Package for Social Sciences software (SPSS, version 18.0, Chicago. Inc) was used for data processing and statistical analysis. Variables were described using frequency and percent distribution for categorical variables and mean and standard deviation for continuous variables. The study was approved by the manager of TMGH in Sana'a city.

## Results

### Demographic characteristics

Total number of patients was 844, of them 490 in 2009 and 354 in 2011. The result of the study showed that 60.1% of the patients were females and 30.9% were males in 2009 while 60.5% of the patients were females and 30.5% were males in 2011. The mean age of the patients was 33.1 year in 2009 and 35.1 year in 2011. Most of the patients were referred from out patients department (OPD) 89.8% and other 10.2% were referred from ward in 2009 while 90.4% referred from OPD and 9.6% referred from ward in 2011.

### Diagnosis

Table 1 shows diagnosis of patients who performed TEE. The results of the study showed that, in 2009, 51.5% of

the cases were diagnosed rheumatic heart disease (RHD), 4.3% chronic heart diseases (CHD), 1.3% pulmonary hypertension (PH), 0.6% were normal and 0.4% had other diagnosis while in 2011, 36.4% were diagnosed RHD, 2.9% CHD, 0.7% PH, 0.7% were normal and 1.2% had other diagnosis.

### Patterns of cardiac diseases

- ***Effected valve among patients with RHD:***

The findings of the study showed that, RHD affects mainly (mitral) the three valves (mitral, aortic and tricuspid) in about 55.3% in 2009 and 68.6% in 2011 of rheumatic patients while mitral and aortic valve (MV,AV) were affected about 20.1% in 2009 and 10.7% in 2011. More details presenting in Table 2.

- ***Valve disorders among patients with RHD:***

Mitral stenosis (MS) was severe in about 70% in 2009 and 58% in 2011, this decrease mainly due to decrease the total number of patients & decrease of viability of BMV procedure. Patients with post cardiac surgery whom underwent into TEE were 7.1% in 2009 and 11.9% in 2011 for mitral while 3.7% in 2009 and 7.1% in 2011 for aortic. More details presenting in Table 3.

**Table1: Diagnosis of patients who performed TEE at cardiac center, TMGH, Sana'a in 2009&2011**

Diagnosis	2009		2011		Total	
	F	%	F	%	F	%
• Normal	5	0.6	6	0.7	11	1.3
• RHD	435	51.5	307	36.4	742	87.9
• CHD	36	4.3	25	2.9	61	7.2
• PH	11	1.3	6	0.7	17	2
• Other	3	0.4	10	1.2	13	1.5
<b>Total</b>	<b>490</b>	<b>58.1</b>	<b>354</b>	<b>41.9</b>	<b>844</b>	<b>100</b>

**Table 2: Effected valve among patients with RHD who performed TEE at cardiac center, TMGH, Sana'a in 2009&2011**

Effected valves	2009		2011	
	F	%	F	%
• TV*	272	55.3	243	68.6
• MV and AV	99	20.1	38	10.7
• MV and TV	45	9.1	29	8.2
• MV	29	5.9	14	4.0
• AV	1	0.2	2	0.6
• None	44	8.9	28	7.9
<b>Total</b>	<b>499</b>	<b>100</b>	<b>354</b>	<b>100</b>

\*Triple valve

**Table 3: Valve disorders among patients with RHD who performed TEE at cardiac center, TMGH, Sana'a in 2009&2011**

Three Valve	2009		2011	
	F	%	F	%
<b>MV</b>				
• Normal	51	10.4	33	9.3
• MS	15	3.1	36	10.2
• MR	32	6.5	39	11.0
• MVD	357	72.9	204	57.6
• Post-surgery	35	7.1	42	11.9
<b>AV</b>				
• Normal	120	24.5	70	19.8
• AS	2	0.4	-	-
• AR	308	62.9	227	64.1
• AVD	42	8.6	32	9.0
• Post-surgery	18	3.7	25	7.1
<b>TV</b>				
• No	149	30.4	80	22.6
• TR	313	63.9	241	68.1
• TVD	28	5.7	33	9.3

- **Pulmonary Hypertension :**  
One of the most important parameter is pulmonary hypertension which identified as primary 2.2% in 2009 and 2% in 2011 and secondary that subdivided into secondary to RHD 86% in 2009 and 84.9% in 2011. On other hand the secondary to CHD associated PH was 7.9% in 2009 and 7.1% in 2011. Only 3.5% of the patients without

complications in 2009 and 5.1% in 2011. Table 4.

- **Complications secondary RHD associated PH:**  
The most common complications were thrombus in left atrium and left atrial appendage and vegetation formation. The thrombus formation was subdivided into smoky flow which was found in 51.1% in 2009 and 36.2% in 2011, the pre clot stage of thrombus formation 3.9%

and 13.9% in 2009 and 2011 respectively, 39% of cases in 2009 and 39.8% in 2011 cases were no thrombus formation.

The vegetation was 5.3% in 2009 and 6.2% in 2011, vegetation is found to be on mitral valve (MV)

(3.5% & 2.8%) in 2009 and 2011 respectively, on aortic valve (AV) (0.8% & 2.3%) or on both valves (1%) in 2009 and 2011 respectively, but most of cases 94.7% were no vegetation formation. Table 5

**Table 4: Pulmonary Hypertension among patients who performed TEE at cardiac center, TMGH, Sana'a in 2009&2011**

Pulmonary Hypertension	2009*		2011	
	F	%	F	%
Primary	11	2.2		2.0
Secondary to RHD associated PH				
• Mild RHD associated PH	96	9.5	59	16.7
• Moderate RHD associated PH	175	35.6	153	43.2
• Severe RHD associated PH	152	30.9	92	26.0
Secondary to CHD associated PH	39	7.9	25	7.1
None	17	3.5	18	5.1
<b>Total</b>	<b>490</b>	<b>100</b>	<b>354</b>	<b>100</b>

\*Missing value

**Table 5: Complications secondary RHD associated PH who performed TEE at cardiac center, TMGH, Sana'a in 2009&2011**

Complications	2009		2011	
	F	%	F	%
Vegetation				
• Mitral valve	17	3.5	10	2.8
• Aortic valve	4	0.8	8	2.3
• Both valve	5	1.0	4	1.1
• No vegetation	464	94.7	332	93.8
Thrombus				
• Smoky flow	251	51.2	128	36.2
• Pre clot	19	3.9	48	13.6
• Thrombus	29	5.9	37	10.5
• No thrombus	191	39.0	141	39.8

### Recommendation of management

Recommendation of management is either to send patient for cardiac surgery 25.9% in 2009 and 30.2% in 2011 in which mitral valve surgery represent 8% in 2009 and 10% in 2011 or balloon mitral valvuloplasty 53% in 2009 and 33.6% in 2011 while 10.2% in 2009 and 16.4% in 2011

were recommended to receive oral anticoagulant therapy for 8 weeks to be re-evaluated after that for possibility of intervention. 10.4% of total 2009 cases and 19.8% in 2011 were found to be in condition that may tolerate to be followed up in next few months with regular medical treatment. Table 6.

**Table 6: Recommendation of management among patients who performed TEE at cardiac center, TMGH, Sana'a in 2009&2011**

Management	2009		2011	
	F	%	F	%
• Follow up	51	10.4	70	19.8
• BMV	259	52.9	119	33.6
• Open mitral commi	3	0.6	-	-
• Cardiac surgery	127	25.9	107	30.2
• Heparin/anticoagulant	50	10.2	55	16.4
<b>Total</b>	<b>490</b>	<b>100</b>	<b>354</b>	<b>100</b>

### Discussion

The application of TEE has been continuously increasing over past several decades. It is usually considered a very safe diagnostic and monitoring device. Though the complications are rare, but these complications must be known to the operators performing TEE. The complications are primarily related to gastrointestinal, cardiovascular and respiratory systems along with some miscellaneous problems related to probe insertion, drugs and inexperience of the operator. Strategies for the prevention of these complications are also analyzed in order to avoid the risk. Most of the patients were RHD which represents around 88% and female gender represent nearly 65%. The most common complications were thrombus in left atrium and left atrial appendage and vegetation formation, thrombus takes 4% 14% in 2009 and 2011 respectively, Vegetation was found to be on mitral (3.5% and 2.8%) 2009, 2011 aortic (0.8% and 2.3%) or on both valves (1%) in 2009 and 2011 respectively.

Recommendations were to send patient for cardiac surgery or for balloon mitral valvuloplasty. Patients were recommended to receive oral anticoagulant therapy for 8 weeks, 10% of total 2009 cases & 20% found to be in condition that may tolerate to be followed up in next few months with

regular medical treatment. TEE can be performed expeditiously and safely, with good acceptability by our local population.

TEE provides useful or additional information that supplements standard transthoracic echocardiography in a wide-ranging spectrum of cardiac conditions.

Simpsonm, 1994<sup>18</sup> reported that Transoesophageal echocardiography is a major diagnostic imaging technique with a wide range of clinical indications. Its use in cardiovascular diagnosis overcomes all the limitations of conventional transthoracic cardiac ultrasound imaging and it is now the investigation of choice in some areas. A study was conducted by Madu et al, 2011<sup>19</sup> to provide the first detailed review of the indications and clinical utility of TEE in the Caribbean showed that the TEE has been most commonly performed to evaluate valvular heart disease in Jamaica without any major complications resulting from the procedure. It provides additional information that supplements transthoracic echocardiography in a wide range of clinical conditions. Measures should be put in place to make TEE more widely available and accessible in Jamaica. Similar study was conducted by Mathur and Singh , 2009<sup>20</sup>. The application of TEE has been continuously increasing over past several decades. It is usually

considered a very safe diagnostic and monitoring device. Though the complications are rare, but these complications must be known to the operators performing TEE.

The complications are primarily related to gastrointestinal, cardiovascular and respiratory systems along with some miscellaneous problems related to probe insertion, drugs and inexperience of the operator. Strategies for the prevention of these complications are also analyzed in order to avoid the risk. Côté and Denault, 2008<sup>21</sup> was conclude that the use of transoesophageal echocardiography has increased over the past several years. It is generally considered a safe diagnostic and monitoring tool. Whereas complications associated with echocardiographic examination rarely occur, such complications must be known to echocardiographers performing these examinations. Chee et al, 1995<sup>22</sup> reported that the TEE has earned an important role in the evaluation of patients with cardiovascular diseases. They concluded that, TEE can be performed expeditiously and safely, with good acceptability by local population. TEE provides useful or additional information that supplements standard transthoracic echocardiography in a wide-ranging spectrum of cardiac conditions.

### **Conclusion**

TEE is one of the most potent diagnostic tool in cardiovascular disease investigations. Most patients were suffered from RHD and the most common complication was thrombus in left atrium, left atrial appendage and vegetation formation.

TEE provides additional information that supplements transthoracic echocardiography in a wide range of clinical conditions.

### **Recommendations**

Training for the medical staff is mandatory to improve the cardiac services. A semi-invasive procedures as TEE should be more used all-over the country to improve the quality of diagnosis and decision making for the treatment modality.

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