Intraoperative Transesophageal Echocardiography during Surgery for Congenital Heart Defects in Pediatrics

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Abstract

OBJECTIVES: The importance of intraoperative transesophageal echocardiography in congenital heart surgery, its diagnostic accuracy and its predictive value on long-term follow-up. STUDY DESIGN: This is a retrospective study done on 1156 patients in which the preoperative and postoperative transthoracic echo reports were analyzed together with the intraoperative transesophageal echo reports performed for patients undergoing ventricular and atrial septal defect closure, mitral valve repairs and right ventricular outflow tract repairs. RESULTS: Intraoperative transesophageal echocardiography detected the highest incidence of residual pathololgy in mitral valve repairs and the least in atrial septal defect repairs. It was also helpful in defining patients in need for surgical revision intraoperatively. Intraoperative transesophageal echocardiography was most accurate in diagnosing residual mitral regurgitation and least accurate in atrial sepal defects. On follow up, residual septal defects had a tendency to close spontaneousely, residual right ventricular outflow tract gradients tended to decline, while the residual mitral valve regurgitations were liable to progress. CONCLUSION: Intraoperative transesophageal echocardiography has an influential role in congenital heart surgery; it may miss a significant percentage of residual defects but is able to predict the fate of residual lesions detected intraoperatively.

KEY WORDS: intraoperative transesophageal echocardiography, residual lesion, residual lesions, septal defects, mitral valve, right ventricular outflow tract.

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"As we express our gratitude, we must never forget that the highest appreciation is not to utter words, but to live by them"

John F. Kennedy

And I, hereby, second that saying

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AMVL	Anterior mitral valve leaflet
AO	Aorta
APV	Absent pulmonary valve
ASD	Atrial septal defects
AVC	Atrio-ventricular canal
CHD	Congenital heart disease
FN	False negative
FP	False positive
IVC	Inferior vena cava
LA	Left atrium
lcc	Left coronary cusp
LPA	Left pulmonary artery
LV	Left ventricle
LVOT	Left ventricular outflow tract
ME	Mid esophageal
ncc	Non-coronary cusp
NPV	Negative predictive value
PA	Pulmonary artery
PMVL	Posterior mitral valve leaflet
PPV	Positive predictive value
RA	Right atrium
rcc	Right coronary cusp
RPA	Right pulmonary artery
RV	Right ventricle
RVOT	Right ventricular outflow tract
RVOTO	Right ventricular outflow tract obstruction
SVC	Superior vena cava
TEE	Transesophageal echocardiography
TN	True negative
TOF	Tetralogy of Fallot
TP	True positive
TTE	Transthoracic echocardiography
TV	Tricuspid valve
UE	Upper esophageal
VSD	Ventricular septal defects

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Introduction and Aim of Work

1.1. Introduction

The transesophageal approach is recognized as an effective window for imaging intracardiac and vascular structures due to the proximity of the esophagus to the heart and major blood vessels. Initial consideration of using the esophagus as a site of echocardiographic imaging was made in the mid- 1970s by Frazin *et al*. who described the use of an esophageal M-mode ultrasonic crystal *(Frazin et al., 1976)*. The early 1980s marked the introduction of a gastroscope with a two-dimensional transducer. Since the introduction of transesophageal echocardiography (TEE) to the intraoperative setting in the late 1980s *(Schluter et al., 1982)*, multiple publications have documented the utility of this imaging modality in adult cardiac patients in the evaluation of valvular repair *(Goldman et al., 1987; Taams et al., 1989; Foster et al., 1998)* and prosthetic valve function *(Nellessen et al., 1988; van den Brink et al., 1989)*, and for monitoring of myocardial ischemia *(Leung et al., 1989; Smith et al., 1985)* and left ventricular preload *(Abel et al., 1987; De Bruijn 1987; Harpole et al., 1989)*.

As surgical advances in the care of patients with heart disease rapidly evolve, the contributions of TEE continue to be demonstrated *(Applebaum et al., 1998; Shanewise et al., 2002; Pu et al., 2003)*. Immediate detection of suboptimal surgical interventions by TEE has been shown to improve surgical outcomes, thereby avoiding subsequent reoperations and reducing morbidity, mortality, and cost *(Benson and Cahalan, 1995)*. Until the early 1990s, intraoperative evaluation of infants and children undergoing surgery for congenital heart was not feasible via the transesophageal approach due to the fact that probe sizes were not suitable for examination in young children. The subsequent development of miniaturized technology initially generated a number of studies which demonstrated that TEE can be performed safely in the pediatric age group and provides substantial benefit as well *(Ritter, 1990; Ritter and Thys, 1989; Stumper et al., 1990; Ritter et al., 1989; Lam et al., 1991)*. This experience has been substantiated over the last decade.' *(Miller-Hance and Russell, 2005)*