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Original research article

Regional wall motion abnormality using transoesophageal echocardiography: Transgastric view

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Abstract

TOE is based on the physics of ultrasound where the image is shown by complex transformation of reflected sound signals into a mosaic of pixels in different gray shades.The normal audio frequency range of humans is between 20 to 20,000Hz. Frequency above 20,000Hz is referred to as ultrasound waves. Study design: Prospective observational study, Study population: Adult patients who underwent elective OPCAB procedure, Sample size: 83. The septal wall on assessment before grafting had dyskinetic, akinetic, severe hypokinetic and mild hypokinetic wall movement in 4 (6%), 9 (13%), 4 (6%) and 14 (19%) patients respectively. 41 (56%) patients had normokinetic wall movement. Following grafting there was improvement seen as 57 (80%) of patients had normokinetic wall movement. Only 1 (1%) patient had severe hypokinetic wall movement and 14 (19%) patients had mild hypokinesia. In the posterior wall dyskinesia, akinesia, severe hypokinesia and mild hypokinesia was seen in 4 (6%), 7 (10%), 6 (9%) and 14 (19%) patients respectively before grafting. Post grafting the wall movement improved such that only 2 (3%) patients had akinesia and 14 (19%) patients had hypokinesia. 56 (78%) patients had normokinetic wall movements.

Keywords: Regional Wall Motion Abnormality, Transoesophageal Echocardiography, Transgastric View

Introduction

TOE is an imaging technique used for monitoring and in the diagnostic assessment of cardiac anatomy and physiology. Transoesophageal Doppler was first introduced in 1971, and transoesophageal M mode was described in 1976. Later in 1980 the use of M - mode TOE was established for the continuous monitoring of left ventricle (LV) function. However, TOE became a practical reality only after the transducer system was mounted at the end of a gastroscope [1].

Cahalan *et al* [2], father of perioperative TOE, introduced the use of TOE intraoperatively at the University of California. Hewlett-Packard invented colour flow Doppler with TOE in 1986. In 1987, pulsed wave Doppler was introduced with TOE, while the biplanar probes first became available in 1989.

It is based on the physics of ultrasound where the image is shown by complex transformation of reflected sound signals into a mosaic of pixels in different gray shades.

The normal audio frequency range of humans is between 20 to 20,000Hz. Frequency above 20,000Hz is referred to as ultrasound waves. TOE machine operates between a frequency range of 2 to 10MHz whereas cardiovascular structures reflect ultrasound waves between a range of 1 to 10MHz.

Velocity of ultrasound travelling through a medium with density is called propagation velocity. Different tissues have different propagation velocities. The soft tissues of heart have a propagation velocity of 1540 m/sec

Methodology

Study design: Prospective observational study

Study population: Adult patients who underwent elective OPCAB procedure

Sample size: 83

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Sample selection
Inclusion criteria
Adult patients who underwent OPCAB

Exclusion criteria\
- Contraindications for TOE-
- Oesophageal pathology
- Aortic aneurysm
- Suspected/ actual neck injury
- Post radiation therapy,
- Emergency surgical procedures
- Off pump CABG converted to on pump CABG
- Patients weighing less than 25kg.

Results
In the TG view, four walls of left ventricle were assessed namely – anterior, lateral, septal, and posterior.

Table 1: Pre-grafting findings of anterior wall in TG view

Wall	RWMA	No of patients
Anterior	Dyskinesia	4 (6%)
	Akinesia	7 (10%)
	Severe hypokinesia	17 (23%)
	Mild hypokinesia	24 (33%)
	Normokinesia	20 (28%)

Before grafting, in the anterior wall there were only 20 (28%) patients with normokinetic wall movement. Dyskinetic, akinetic and severely hypokinetic wall movements were seen in 4 (6%), 7 (10%), and 17 (23%) patients, respectively. However, after grafting there was significant improvement in anterior wall movement where normokinetic wall movement was seen in 50 (69%) of the patients and mild hypokinetic wall movement in 22 (31%) patients. None of the patients had Dyskinetic, akinetic or severe hypokinetic wall movements

Table 2: Pre-grafting findings of septal wall in TG view

Wall	Rwma	No of patients
Septal	Dyskinesia	4 (6%)
	Akinesia	9 (13%)
	Severe hypokinesia	4 (6%)
	Mild hypokinesia	14 (19%)
	Normokinesia	41 (56%)

The septal wall on assessment before grafting had dyskinetic, akinetic, severe hypokinetic and mild hypokinetic wall movement in 4 (6%), 9 (13%), 4 (6%) and 14 (19%) patients respectively. 41 (56%) patients had normokinetic wall movement. Following grafting there was improvement seen as 57 (80%) of patients had normokinetic wall movement. Only 1 (1%) patient had severe hypokinetic wall movement and 14 (19%) patients had mild hypokinesia.

Table 3: Pre-grafting findings of lateral wall in TG view

Wall	Rwma	No of patients
Lateral	Dyskinesia	4 (6%)
	Akinesia	2 (3%)
	Severe hypokinesia	10 (14%)
	Mild hypokinesia	22 (31%)
	Normokinesia	34 (46%)

With respect to assessment of the lateral wall there was dyskinesia, akinesia, severe hypokinesia and mild hypokinesia in 4 (6%), 2 (3%), 10 (14%) and 22 (31%) patients before grafting, respectively. 34 (46%) patients had normokinesia. After grafting the lateral wall was normokinetic in 56 (78%) patients, mildly hypokinetic in 15 (21%) patients and only in 1 (1%) patient, it was dyskinetic. There were no akinetic and severely dyskinetic wall movements in any patients.

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Table 4: Pre-grafting findings of posterior wall in TG view

Wall	Rwma	No of patients
Posterior	Dyskinesia	4 (6%)
	Akinesia	7 (10%)
	Severe hypokinesia	6 (9%)
	Mild hypokinesia	14 (19%)
	Normokinesia	41 (56%)

In the posterior wall dyskinesia, akinesia, severe hypokinesia and mild hypokinesia was seen in 4 (6%), 7 (10%), 6 (9%) and 14 (19%) patients respectively before grafting. Post grafting the wall movement improved such that only 2 (3%) patients had akinesia and 14 (19%) patients had hypokinesia. 56 (78%) patients had normokinetic wall movements.

Discussion

Quaddoura *et al*. [3] conducted a study about the role of IOTEE in 474 patients undergoing CABG between January 2001 to December 2003. It included both men and women between the age of 30 to 89 years, mean age 70 +/- 10 years. Among 474 patients, 52 (10%) patients had new pre-grafting findings out of which significant RWMA was found in 0.6% and the surgical plan was altered in 3.4% patients. Post grafting new RWMA findings was found in 3.2% of patients. IABP placement was done in 5 patients for haemodynamic maintenance. Seven (1.5%) patients were re-explored after the procedure, out of which graft revision was done in 5 patients while valve repair was done in 2 patients, which was identified because of IOTOE assessment after procedure. In 2% of patient's surgical plan was altered. Overall, new findings (pre and post grafting) were found in 13% of the patients' and surgical plan was altered in 5.5% of patients. Other relevant findings such as significant valve pathology, aortic atheroma, atrial and ventricular wall defects were also reported with the use of IOTOE. No complications were found using TOE in this study. This study therefore highlights the importance of IOTOE as a routine procedure during CABG surgeries in order to provide relevant information about functional status of the heart leading to any alterations in the surgical plan.

Gurbuz *et al*. [4] conducted a retrospective study on 927 patients who underwent OPCAB surgery over a period of 5 years between 2000 to 2005. Out of 927 patients IOTOE monitoring was done in 744 patients at two different institutions. The mean age of the patients was 69.1 +/- 8.0 years. Wall motion evaluation was done prior and after each distal anastomosis and at the end of the procedure. 247 patients undergoing OPCAB had new RWMA and 208 patients RWMA was reversed.

Around 37 (5.6%) patients had post-grafting IABP placement while 39 (5.2%) patients had post grafting RWMA, all of which underwent graft revision. In 31 (4.1%) patients RWM improved. Out of these 3 patients expired. They also used Doppler to evaluate grafts for their adequacy and they observed that due to the spasm of the graft, the flow was decreased. None of the patients were reported to have any complications with TOE. TOE was found to be effective in maintaining haemodynamics intraoperatively in around 51% patients. The authors concluded that IOTOE modifies strategy in off-pump coronary artery bypass grafting.

Eltzschig *et al*. [5] in their retrospective analysis between 1990 to 2005 on 12,566 cardiac surgical patients which included cardiac, aortic and thoracic procedures, found that among 3835 who underwent CABG procedure with IOTOE assessment, 207 (5.4%) patients had change in surgical procedure according to pre grafting IOTOE findings and in 130 (3.3%) patients mitral valve and aortic valve procedure was added. Therefore, 77 patients underwent isolated CABG in which, 58 (1.5%) patients had altered surgical plan based on pre grafting RWMA which was influenced by IOTOE. Post grafting IOTOE found RWMA in 31 (0.8%) patients, in which all patients underwent graft revision and additional grafting. This study gives valuable information about the use of IOTOE before and after procedure and its major influence on surgical decision making and avoiding unnecessary intervention associated with morbidity in all type of cardiothoracic procedures. This study also concludes that IOTOE examination is highly sensitive in detecting post CPB myocardial ischemia and RWMA associated with graft kinking.

Kihara *et al*. [6] in their retrospective study on 1011 patients over a span of 7 years from 1998 to 2007 in a single institution used 5MHz TOE probe with ultrasound scanner. They evaluated the incidence of appearance of new RWMA, graft leakage after repair, intimal tears or flaps, valve dysfunction. Out of 1011, 360 patients who underwent isolated CABG with IOTOE monitoring, New RWMA was found in 17 patients (4.7%) out of which in 15 patients RWMA was reversed and 2 patients (0.6%) required graft revision following which recovery of graft was seen. Combined procedures with CABG included valve surgery and aorta replacement surgery. Others where only valve surgeries, aorta replacement surgery and other cardiothoracic surgeries. IOTOE assessment found 115 new abnormal findings in 1011 patients which were significant and helped in surgical decision making. There were nil complications and no failure in insertion of TOE.

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This study therefore concludes that IOTOE provides valuable information to aid in surgical decision making and thereby reduce surgical complications.

Mishra *et al.* [7] did a prospective, observational cohort study on 5016 cardiac surgeries over a period of four years between 1993 to 1997. 3660 patients underwent CABG procedures, and 1356 patients underwent valve surgeries, 2940 patients underwent isolated CABG procedure. 993 (27.13%) patients had altered surgical decision as suggested by IOTOE which included CABG combined with valve surgery and other cardiothoracic surgeries. They found major significant findings like ischemic detection which means RWMA in 458 (12.52%) patients, valve pathology in 9 patients and atheromatous aorta in 36 patients which were significant. Post grafting, around 29 (0.8%) patients required graft revision, 29 (0.8%) patients required IABP placement and in total 944 (25.79%) patients required haemodynamic support as suggested by IOTOE assessment. In valve surgery also IOTOE assessment helped in identifying the haemodynamic status and valve repair adequacy. The study concludes that IOTOE is helpful in change of surgical plan and aids in haemodynamic interventions and immediate assessment of surgical results which was reliable [8].

Conclusion

IOTOE can be used routinely as a definitive mandatory monitoring tool in cardiac surgeries. The quality of grafting can be immediately assessed by quantifying the regional wall movements post grafting when compared to pre grafting regional wall movements. This study was conducted to assess the RWMA using TOE at pre and post grafting OPCAB procedure.

References

1. Salgado FM, Verçosa N, Cavalcanti IL, Miana LA, de Souza CM, Borato E, *et al*. Impact of intraoperative transesophageal echocardiography in mortality in coronary artery bypass grafting. Revista do Colegio Brasileiro de Cirurgioes. 2013;40(5):357.
2. Cahalan MK, Stewart W, Pearlman A, Goldman M, Sears-Rogan P, Abel M, *et al*. American society of Echocardiography and Society of Cardiovascular. Anesthesiologists task force guidelines for training in perioperative echocardiography. J Am Soc Echoarcardiogr. 2002;15:647-52.
3. Qaddoura FE, Abel MD, Mecklenburg KL, Chandrasekaran K, Schaff HV, Zehr KJ, *et al*. Role of intraoperative transesophageal echocardiography in patients having coronary artery bypass graft surgery Ann Thorac Surg. 2004;78(5):1586-90.
4. Gurbuz AT, Hecht ML, Arslan AH. Intraoperative transesophageal echocardiography modifies strategy in off-pump coronary artery bypass grafting. Ann Thorac Surg. 2007;83(3):1035-40 DOI:10.1016/j.athoracsur.2006.10.019.
5. Eltzschig HK, Rosenberger P, Löffler M, Fox JA, Aranki SF, Shernan SK, *et al*. Impact of intraoperative transesophageal echocardiography on surgical decisions in 12,566 patients undergoing cardiac surgery. Ann Thorac Surg. 2008;85(3):845-52. DOI: 10.1016/j.athoracsur.2007.11.015.
6. Kihara C, Murata K, Wada Y, Hadano Y, Ohyama R, Okuda S, *et al*. Impact of intraoperative transesophageal echocardiography in cardiac and thoracic aortic surgery: experience in 1011 cases. J Cardiol. 2009;54(2):282-8.
7. Mishra M, Chauhan R, Sharma KK, Dhar A, Bhise M, Dhole S, *et al*. Real- time intraoperative transesophageal echocardiography--how useful? Experience of 5,016 cases. J Cardiothorac Vasc Anesth. 1998 Dec;12(6):625-32. DOI: 10.1016/s1053-0770(98)90232-4.1998;12(6):625-32.
8. Savage RM, Lytle BW, Aronson S, Navia JL, Licina M, Stewart WJ, *et al*. Intraoperative echocardiography is indicated in high-risk coronary artery bypass grafting. Ann Thorac Surg. 1997;64(2):368-74.