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Bi-plane color transesophageal Doppler echocardiography (color TEE): Its advantages and limitations

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Introduction

Color Transesophageal Doppler echocardiography (color TEE) has made study in real-time, on-line, beat by beat, of intracardiac events possible without the inconvenience of a probe in the operative field and without exposing the patients to the risk of infections. However, in the present state of art, color TEE has two major limitations: 1) The size of the probe is not suitable for use in pediatric or infant patients. 2) Only a transverse view can be obtained at one level at a time. In order to further enhance the use of the probe, we have recently developed and tested two new probes, a bi-plane probe and a pediatric probe, and have already reported our initial clinical experiences of the use with these new probes at Saitama with good results [1]. In this communication, the author will discuss briefly the advantages and limitations of bi-plane color TEE from a surgeons viewpoint.

Probe and patient population

The bi-plane probe, 13.5 mm in diameter and one hundred cms. long, has transverse and longitudinal transducers mounted side by side but 1.5 mm apart from each other on the same transesophageal shaft. There are two types of probes available, one (which we mainly used) has longitudinal transducer at the tip, whereas another probe where transverse transducer is at the tip. The tip is 29.5 mm in length as compared to 13 mm length of the conventional probe. The bi-plane images can be reproduced simultaneously by synchronisation of ECG to cinememory loop. This probe can be used with commercially available Aloka-870 system. We have studied totally ninety patients with the bi-plane probe. To date we have had no complication from this probe.

Advantages

We have found the use of bi-plane probe of advantage in the following situations:

(1) Mitral regurgitation: The regurgitant jets were evaluated by transverse and longitudinal transducers, thus reconstruction of three-dimensional concept of blood flow dynamics were obtained. There were cases where additional regurgitant jets were visualised by use of the longitudinal transducer.

(2) Aortic aneurysms: In dissecting aneurysms the site of entry and false lumen were visualised in all DeBakey type III cases. In examination of descending aorta the image obtained by transverse transducer is computer tomography equivalent whereas the longitudinal image is angiographic equivalent. In examination of arch of aorta with transverse transducer a horizontal scan of aorta was obtained whereas with the longitudinal transducer a short-axis cross-section of the arch was obtained. With bi-plane probe we were able to visualise few more centimeters of ascending aorta in the 'blind zone' where right main bronchus crosses the aorta.

(3) Atrial Septal Defect: Evaluation of atrial

septal defect in two planes gave us additional information about the size of the defect.

(4) Left Ventricular Function: Evaluation of left ventricular function was obtained by measuring ejection fractions in bi-plane. This was useful in patients having apical wall motion abnormality, as the longitudinal scanning gave us additional information.

Limitations

(1) As the two transducers are separated from each other by one centimeter from center point to center point we had to minimally reposition each transducer to visualise the exact same cardiac segment.

(2) The images were stored in cine-loop memory and were visualised half a minute later, off-line. Thus in sense it was not true real-time but reproduced with cine-memory mode. To address this problem we have recently studied seven cases in true real-time with the newly developed technology, where no cine-memory loop was used.

Conclusion

The bi-plane probe provides superior information at least in cases of aortic aneurysms and mitral regurgitation. With further refinement of true real-time technology, in near future it will be possible to use bi-plane probe in real-time, on-line intraoperatively and immediate postoperative period.

Reference

1. Omoto R. Recent technological progress in transesophageal color Doppler flow imaging with special reference to newly developed bi-plane and pediatric probes. Proceedings of International Symposium on transesophageal echocardiography. (Dec. 1, 1988, in Mainz), P. 3 (abstract).