3D fusion echocardiography improves transoesophageal left ventricular assessment

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Methods

- Accurate left ventricular (LV) assessment by transoesophageal echocardiography can be clinically important particularly in intensive care or intraoperative settings. However, assessment from oesophageal views is limited by foreshortened imaging planes and mitral valve pathology.
- Transgastric views allow better alignment but they may be limited by patient tolerability or not possible due to patient-related factors (e.g. post gastric surgery).
- Fusion of multiple 3D volume datasets is now technically possible and improves LV visualisation from transthoracic windows.

Objectives

- We hypothesized that fusion of full echocardiographic transoesophageal cardiac volumes using a real time three dimensional (RT3D) probe would improve LV image quality and allow short axis image reconstruction from the oesophagus with improved image quality vs. transgastric short axis views.

Results

- Image quality of 4 or 2 chamber and short axis views improved with fusion (mean 1.8 vs. 2.2 (p<0.05).
- There were fewer 0 ratings post fusion (78 vs. 32) and greater 2 and 3 ratings (165 vs.212).
- The image quality of optimal (unfused) mid short axis oesophageal view was similar to the transgastric view (mean 2.0 vs. 2.0 p = 0.8) and improved with fusion (mean 2.5, p <0.05).
- FOV increased post fusion (25.86% vs. 57.88%, p <0.05). CNR improved post fusion by 64% (p <0.05).
- Interobserver agreement was good (difference 0.1 -0.2 image points,CI 0-0.2 and good correlation r =0.78, p<0.05).

Methods

- Contrast-to-noise ratio (CNR) was used as a quantitative measurement the image quality, defined as the ratio of the signal intensity differences between image regions (myocardium and blood pool) to the image noise (variance of image regions).
- The field of view (FOV) is the number of voxels in the 3D plane above the LV.
- 2 readers analysed all images. Changes in image quality were assessed using overall group means and student t tests. Bland Altman agreement and Pearson’s Correlation were used to assess interobserver relationship.

Conclusions

- 3D fusion transoesophageal echocardiography significantly improves LV segmental image quality and allows acquisition of short axis views from the oesophagus in all patients.
- Fused datasets were noted to have significantly increased fields of view in the near field. This approach may reduce requirement for transgastric images; improve patient procedure tolerability and safety as well as shorten procedure time.

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Background

- Accurate left ventricular (LV) assessment by transoesophageal echocardiography can be clinically important particularly in intensive care or intraoperative settings. However, assessment from oesophageal views is limited by foreshortened imaging planes and mitral valve pathology.

Methods

- 2 chamber or 4 chamber 3D volumes were obtained in 40 patients. A 3D dataset of the optimal 2 or 4 chamber view was obtained. 2-5 further volumes were acquired following small probe manoeuvres (1cm withdrawal or advancement and angle adjustment <5°).

- 3D images were fused together. Segments were rated 0-3 depending on the amount of visualised endocardial border: 0. <50%
1. 50-75%
2. 75-99%
3. 100%

Figure 1: 3D 4 chamber view with short axis reconstruction
Figure 2: Fused 3D 4 chamber view with short axis reconstruction
Figure 3: 2D short axis transgastric view