

## Case Report

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# The mechanism of mitral regurgitant jets identified by 3-dimensional transesophageal echocardiography

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**Abstract:** This study is a case report, which presents a case of severe mitral regurgitation in a 77-year-old man. Two-dimensional transesophageal echocardiography (TEE), regurgitant jets directed anteriorly in early systole and centrally to laterally in late systole were seen, while three-dimensional TEE showed a flail posterior middle scallop not only angulated centrally, but also laterally, which provided insight into the mechanism of mitral regurgitant jet direction. This case demonstrates the clinical usefulness of 3-dimensional TEE for identifying the mechanism of mitral regurgitant jets.

The institution where the figures and the videos were recorded: Division of Cardiology, Mazankowski Alberta Heart Institute, University of Alberta Hospital, Edmonton, Alberta, Canada.

**Keywords:** Genetics; Insurance; Risk assessment

## 1 Introduction

Degenerative mitral valve disease with leaflet prolapse and severe regurgitation is progressive and requires surgical repair. Both accurate localization of the valve lesion and identification of the mechanism of regurgitation are crucial to guide the surgical approach [1]. Either 2-dimensional echocardiography or 3-dimensional echocardiogra-

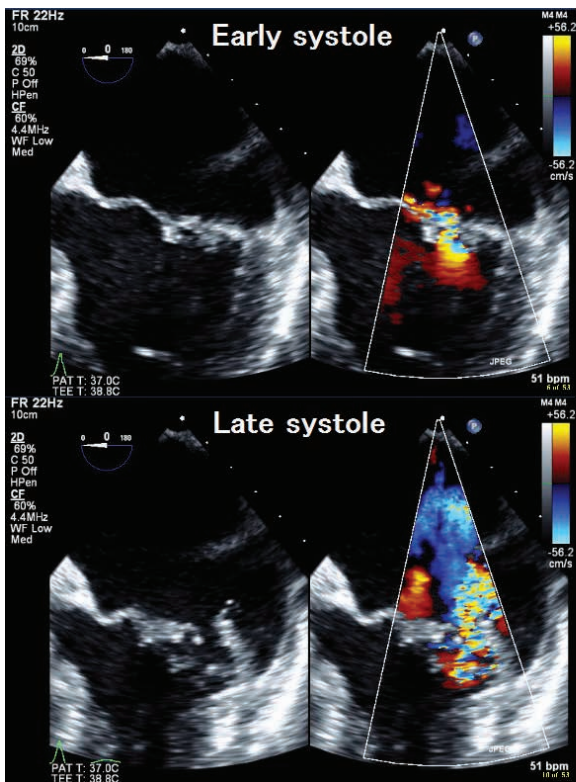
phy should be used to define the mitral valve geometry and the mechanism of regurgitation [2].

## 2 Case report

A 77-year-old man was hospitalized following severe mitral regurgitation. He was scheduled to undergo mitral valve surgery and was referred for transesophageal echocardiography (TEE) to determine if the valve could be repaired. The 4-chamber view of two-dimensional (2-D) TEE showed a flail posterior leaflet and severe mitral regurgitation. Effective regurgitant orifice area was 0.81 cm<sup>2</sup> using the 2-D proximal isovelocity surface area (PISA) technique and 0.65 cm<sup>2</sup> using three-dimensional (3-D) planimetry. Late systolic flow reversal was seen in 3 of 4 pulmonary veins, which indicated that the mitral regurgitation was severe.

The regurgitant jet was directed anteriorly in early systole and centrally to laterally in late systole (Figure 1, 'Supporting Information' Video 1). The posterior leaflet prolapse caused the anterior jet in early systole, while the posterior leaflet flail opened the orifice completely in late systole and caused the central jet. In this case, the question to determine was why the posterior leaflet flail was causing a laterally directed jet in late systole. One normally expects an anteriorly directed jet with posterior mitral valve prolapse and a centrally directed jet with complete mitral leaflet flail. On 3-D TEE, the flail leaflet was found to be located at the posterior middle scallop (Figure 2, 'Supporting Information' Video 2). The flail scallop was angulated not only centrally, but also laterally. This angle of the flail scallop explained not only the centrally directed jet, but also the laterally directed jet. It was found that all of the mitral regurgitant jets were attributable to the prolapse and flail of the posterior middle scallop. On 3-D TEE with color flow Doppler, the anterior jet in early systole and the central to posterolateral jet in late systole were also confirmed, although the image resolution was

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**Figure 1:** The anteriorly directed mitral regurgitant jet in early systole in the 4-chamber view on 2-dimensional transesophageal echocardiography (top). The centrally to laterally directed mitral regurgitant jet in late systole in the 4-chamber view on 2-dimensional transesophageal echocardiography (bottom).

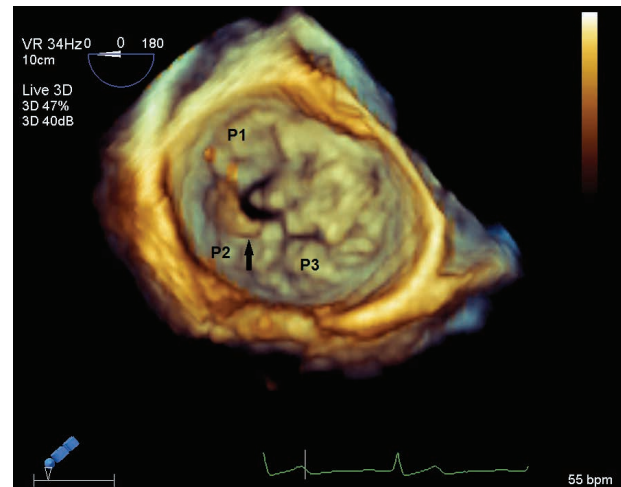
low. It was concluded that the mitral valve could likely be repaired.

**Ethical approval:** The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board or equivalent committee.

**Informed consent:** Informed consent has been obtained from all individuals included in this study.

### 3 Discussion

Eccentric mitral regurgitation jets are produced by complex pathology of the mitral leaflet. The usefulness of 3-D TEE to determine the site of mitral prolapse has been reported [3]. Three-dimensional image quality has evolved, and operator familiarity is increasing, such that



**Figure 2:** The flail of the mitral posterior middle scallop on 3-dimensional transesophageal echocardiography. The flail scallop is not only angulated centrally, but also laterally (arrow). P1, posterior lateral scallop; P2, posterior middle scallop; P3, posterior medial scallop.

3-D TEE will have an increasing role in preoperative evaluation for surgical repair.

In this case, 3-D TEE showed that the mitral flail scallop was angulated not only centrally, but also laterally. This finding explained the mechanism of the eccentric mitral regurgitant jets directed anteriorly in early systole and centrally to laterally in late systole seen on 2-D TEE. The relationship between the pathology of the flail mitral valve and the direction of the complex mitral regurgitant jets was clearly identified on 2-D TEE Doppler color and 3-D TEE images. Thus, the present case demonstrated the usefulness of 3-D TEE for providing a defining and convincing image of the pathological anatomy to evaluate the flail mitral valve.

**Conflict of interest statement:** The authors declare no conflicts of interest associated with this manuscript.

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### Video Legends

**Video 1:** The regurgitant jet is directed anteriorly in early systole and centrally to laterally in late systole.

**Video 2:** The flail of the mitral posterior middle scallop on 3-dimensional transesophageal echocardiography.