

# Dynamic Slow-Motion Display in the Diagnosis of Functional Pulmonary Atresia in Fetal Ebstein Anomaly



Noboru Inamura, MD, PhD, *Osakasayama, Japan*

## INTRODUCTION

Fetal tricuspid valve disease with severe tricuspid valve insufficiency, including both Ebstein anomaly and tricuspid valve dysplasia, is frequently associated with cardiovascular compromise in utero. Therefore, the overall prognosis of affected fetuses is extremely poor.<sup>1</sup> Above all, the presence or absence of anterograde flow to the pulmonary artery is an important factor determining a prognosis of Ebstein anomaly.<sup>2</sup> However, it is difficult to diagnose the presence or absence of anterograde flow to the pulmonary artery as functional pulmonary atresia.

## CASE PRESENTATION

A 23-year-old woman was referred to our hospital at 19 weeks' gestation because of cardiomegaly. Fetal echocardiography demonstrated cardiomegaly (cardiothoracic area ratio 45%) and severe tricuspid valve insufficiency in the four-chamber view. We diagnosed Ebstein anomaly. The pulmonary artery flow was observed in an anterograde direction.

At 32 weeks' gestation, fetal echocardiography showed severe cardiomegaly (cardiothoracic area ratio 55%), and pulmonary artery flow was observed in a retrograde direction. The blood flow direction of the ductus arteriosus spread toward the pulmonary artery. These findings suggested that the pulmonary valve was closed. Furthermore, investigation using dynamic slow-motion display visualized the movement of the pulmonary valve and a small amount of regurgitation flow at the pulmonary valve in end-systole more clearly (Figure 1, Video 1).<sup>3</sup> Finally, we diagnosed functional pulmonary atresia. Diagnosis after birth was similar.

## DISCUSSION

It is necessary to find a small amount of pulmonary regurgitation to diagnose functional pulmonary valve atresia. However, to find a small amount of pulmonary regurgitation is difficult because the fetal heart rate is rapid. Therefore, fetal echocardiography must use a high frame

## VIDEO HIGHLIGHTS

**Video 1:** This Video shows a dynamic slow-motion display. Panel (A) is a monochrome image of a dynamic slow-motion display showing the right ventricular outflow tract. The frame rate was 75 Hz. The movement of the pulmonary valve can be clearly visualized. Panel (B) shows a color image of a dynamic slow-motion display. A small amount of pulmonary valve regurgitation is clearly seen at the end systolic phase. The frame rate was 26 Hz.

**Video 2:** This video was taken with standard fetal echocardiography. Panel (A) is a monochrome image showing the right ventricular outflow tract. The frame rate was 50 Hz. Opening of the pulmonary valve is unclear. Panel (B) shows a color image. The blood flow direction of the pulmonary valve can not be identified. The frame rate was 14 Hz.

[View the video content online at www.cvcasejournal.com.](http://www.cvcasejournal.com)

rate. The color Doppler method is necessary to find small amount of pulmonary valve regurgitation. However, the dilemma is that the frame rate decreases if color Doppler is used.

With dynamic slow-motion display, slow reproduction is possible without decreasing frame rate. Therefore, dynamic slow-motion display is suitable for observation of the valve function of fetuses (Videos 1 and 2). In the present case we were able to visualize a small amount of pulmonary regurgitation clearly using dynamic slow-motion display.

## CONCLUSION

Dynamic slow-motion display is useful for the diagnosis of fetal valve form and function.

From the Department of Pediatrics, Kindai University Faculty of Medicine, Osakasayama, Japan.

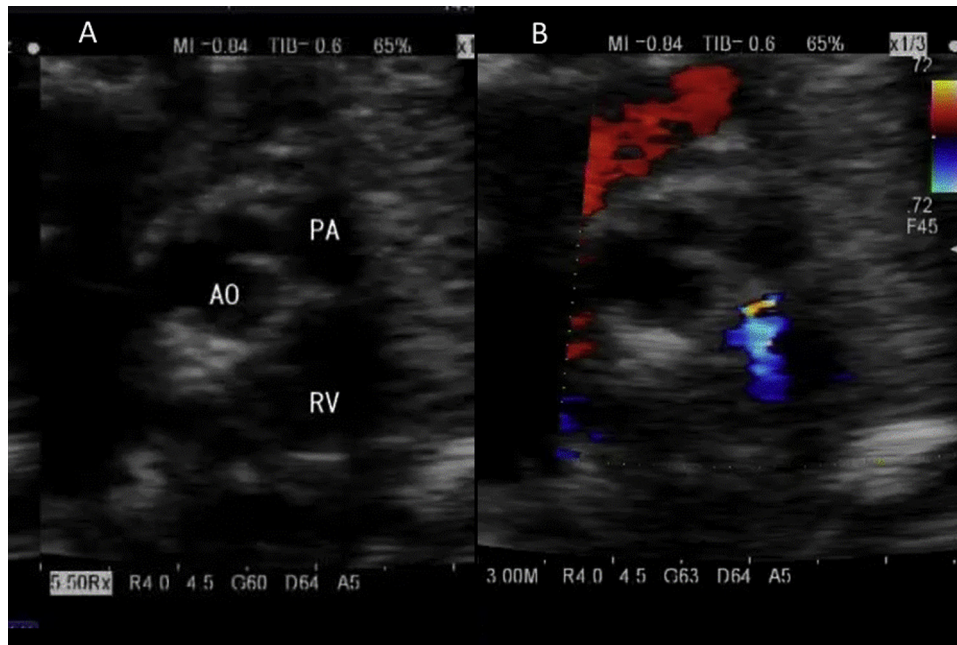
Keywords: Ebstein anomaly, Pulmonary valve, Functional atresia, Dynamic slow-motion display

Conflicts of interest: The authors reported no actual or potential conflicts of interest relative to this document.

Copyright 2019 by the American Society of Echocardiography. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

2468-6441

<https://doi.org/10.1016/j.case.2019.07.009>



**Figure 1** Dynamic slow-motion display. **(A)** A monochrome image of dynamic slow-motion display showing the right ventricular outflow tract. The motion of the pulmonary valve can be clearly visualized. **(B)** A color image of dynamic slow-motion display. A slight amount of pulmonary valve regurgitation is clearly seen at the end-systolic phase.

#### SUPPLEMENTARY DATA

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.case.2019.07.009>.

#### REFERENCES

1. Hornberger LK, Sahn DJ, Kleinman CS, Copel JA, Reed KL. Tricuspid valve disease with significant tricuspid insufficiency in

the fetus: diagnosis and outcome. *J Am Coll Cardiol* 1991;17:167-73.

2. Inamura N, Taketazu M, Smallhorn JF, Hornberger LK. Left ventricular myocardial performance in the fetus with severe tricuspid valve disease and tricuspid insufficiency. *Am J Perinatol* 2005;22:91-7.

3. Watanabe T, Kikuchi A, Kasahara E. Introduction of functions to support fetal heart examinations with the purpose of prenatal diagnoses of congenital heart diseases. *Medix* 2015;57:18-24.