

Egg and banana sign of severe pulmonary arterial hypertension

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ABSTRACT

The egg and banana sign can be seen on chest computed tomography (CT) in patients with severe pulmonary arterial hypertension (PAH). It is identified by the presence of the pulmonary artery (PA) lateral to the aortic arch with the aortic arch being described as the banana and the PA as the egg.

KEY WORDS: Carina crossover, egg and banana sign, severe pulmonary hypertension

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APPEARANCE

The egg and banana sign can be seen on chest computed tomography (CT) in patients with severe pulmonary arterial hypertension (PAH). It is identified by the presence of the pulmonary artery (PA) lateral to the aortic arch with the aortic arch being described as the banana and the PA as the egg [Table 1].

EXPLANATION

The egg and banana sign is more specific for severe PAH. This is due to increased PA pressure, which leads to several pathophysiological changes within the artery.^[1] This includes vascular remodeling through dilatation, thickening, and stiffening of the arterial wall. Mechanisms include phenotypic changes of smooth muscle cells and increase in elastin and collagen by resident fibroblasts.^[2] Overall, these changes contribute to a significant increase in PA diameter, which in turn can be used in the radiologic diagnosis of PAH.

DISCUSSION

PAH is the progressive increase in pressure throughout the pulmonary arterial system that leads to chronic arterial wall changes and eventually right heart failure.^[1,2] Early treatment is imperative for slowing disease progression, and diagnostic criteria need to be developed to aid in early diagnosis. A number of studies over the past couple decades, including the Framingham heart study have linked moderate to severe PAH with an increase in the PA diameter. The Framingham study, which adjusted for age, found that a PA diameter >29 mm in men and 26 mm in women correlated with self-reported dyspnea, a clinical marker for PAH. Unfortunately, due to the size of the study diagnostic heart catheterization could not be performed.^[3] More recent studies have also come to this conclusion, and the most recent data suggest that a PA diameter of >29 mm had a sensitivity of 87%, specificity of 89%, and a positive predictive value of 97% for PAH.^[3] Due to the close correlation of increased PA diameter and PAH CT-guided measurements of the PA has become

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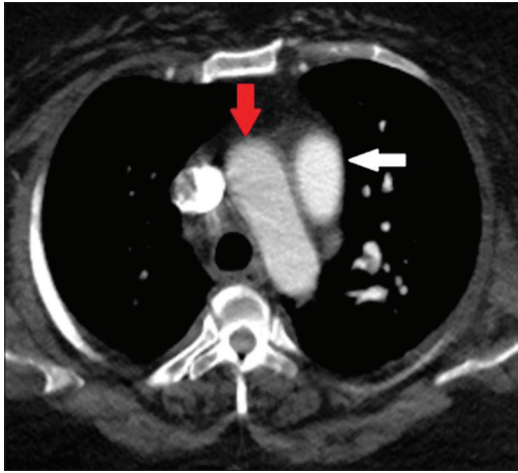


Figure 1: Axial computed tomography with contrast of chest shows the egg (white arrow) and banana (red arrow) sign indicative of severe pulmonary arterial hypertension

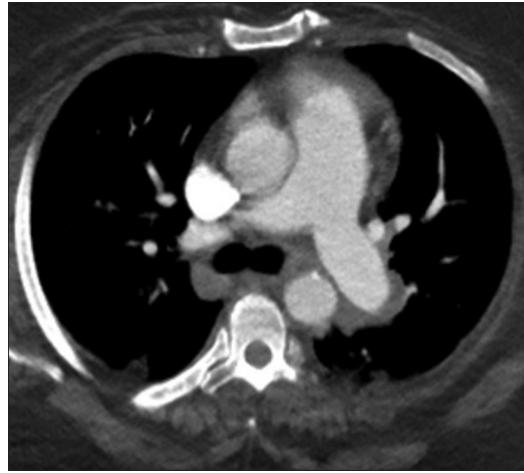


Figure 2: Axial computed tomography of chest with contrast showing increased central pulmonary artery diameter as compared with ascending aorta. This finding is due to severe pulmonary arterial hypertension

Table 1: Egg and banana sign in pulmonary arterial hypertension

Egg and banana sign

Describes the increase in the diameter of the central pulmonary artery and the simultaneous appearance of the pulmonary artery at the level of the aortic arch on axial chest CT. This is usually suggestive of a diagnosis of severe pulmonary arterial hypertension

Differential diagnosis for a vessel lateral to the aortic arch

- Persistent left superior vena cava
- Partial anomalous pulmonary venous return (vertical vein)
- Accessory hemiazygos vein
- Left superior intercostal vein

CT: Computed tomography

Table 2: Vascular findings in pulmonary arterial hypertension

Vascular changes in PAH	Description
PA enlargement	>33 mm has better specificity
PA/AO ratio	>1 more specific for PAH
PA/bronchus ratio	>1 increases specificity for PAH
Carina crossover sign	Recently added sign for PAH
Egg and banana sign	Seen often in severe PAH
Calcification of PA	Sine qua non for PAH

PAH: Pulmonary arterial hypertension, PA: Pulmonary artery, AO: Ascending aorta

Table 3: Cardiac findings in pulmonary arterial hypertension

Cardiac changes in PAH

- Right atrial enlargement
- RV hypertrophy >4 mm
- Bowing of interventricular septum to the left
- Increased RV/LV ratio >0.9
- Contrast reflux into the hepatic vein
- Coronary sinus diameter >11 mm

RV: Right ventricular, LV: Left ventricular, PAH: Pulmonary arterial hypertension

a diagnostic screening tool. Direct measurement of the PA is performed at the level of bifurcation, at a right

angle to its long axis, and at the level of the ascending aorta. In addition to measuring the PA diameter, an increase in specificity to 100% can be obtained when a PA diameter of ≥ 29 mm is accompanied by a segmental artery-to-bronchus ratio $> 1:1$. Another useful measurement is the ratio between the PA and adjacent aorta with a value > 1 suggesting PAH [Table 2].^[4] Along with direct measurements two distinct signs can be used to describe PA diameter enlargement, the “egg and banana sign” and the “carina crossover sign [Figures 1 and 2].”^[5] The egg and banana sign as previously described is a good indicator of severe PAH [Table 1]. More recently, the carina crossover sign in which the right PA crosses the carina midline anteriorly rather than the expected caudal course has also been described [Figure 2 and Table 3].

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Conflicts of interest

There are no conflicts of interest.

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