

# Atrium Septal Pouch: An Anatomic Variant of the Interatrial Septum



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## INTRODUCTION

The atrial septal pouch (SP) is a structure originated by the partial fusion of the septum primum and the septum secundum, in the absence of a patent foramen ovale, forming a cavity that, according to the location of the initial portion of the closure, opens toward the left, right, or both atria.

The presence of SP might be a possible site of thrombus formation predisposing to thromboembolic events. Transesophageal echocardiography (TEE) with the use of agitated saline and the Valsalva maneuver is considered the gold standard for diagnosis.

In this report we report the case of a patient diagnosed with this new anatomic variant.

## CASE PRESENTATION

A 62-year-old male patient with dilated cardiomyopathy of alcoholic etiology presented with a transient ischemic attack. The patient was in sinus rhythm on all available electrocardiograms. He underwent transthoracic echocardiography to investigate the etiology of the transient ischemic attack, showing a suggestive image of a thrombus in the left atrium, requiring further investigation.

TEE revealed severe biventricular dysfunction and the presence of a slightly mobile thrombus located in the interatrial septum measuring  $1.4 \times 1.0$  cm and another thrombus inside the SP (Video 1). Three-dimensional echocardiography showed the SP in communication with the left atrium and thrombus inside it (Video 2, Figure 1). The left atrial appendage had reduced emptying speed, with no thrombus inside it. A patent foramen ovale was not demonstrated by saline injection or color Doppler.

On the third day of hospitalization, the patient presented with fever and leukocytosis. Findings on chest computed tomography were consistent with pneumonia; blood and urine cultures were negative. His clinical condition deteriorated, with severe hypoxia requiring mechanical ventilation, and despite antibiotics and other measures, after 15 days, he died of hypoxemia.

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Keywords: Septal pouch, Thrombus, Thromboembolic events, Septum primum, Septum secundum

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328

## VIDEO HIGHLIGHTS

**Video 1:** Bicaval view showing thrombus (*white arrow*) at the interatrial septum and the SP with thrombus within (*yellow arrow*).

**Video 2:** Three-dimensional image showing the SP (*yellow arrow*) at the left atrium (LA) and thrombus within (*white arrow*).

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

## DISCUSSION

The SP is considered a new anatomic variant that resembles a kangaroo's pouch and has generated interest because of its cardioembolic potential. It results from incomplete fusion of the septum primum and the septum secundum, and unlike the appendage, it does not have contractility, as it is exclusively formed by fibrous tissue.<sup>1,2</sup>

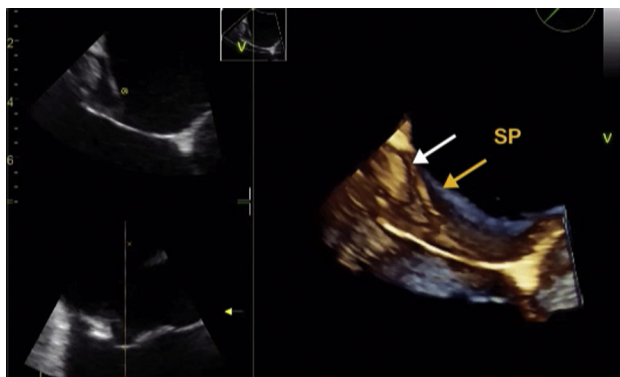
During embryonic development, pressure in the right atrium is greater than in the left atrium, allowing a gap between the septum primum and the septum secundum, with the passage of blood from the right to the left atrium. After birth, pulmonary artery resistance decreases, causing a decrease of right atrial pressure compared with left atrial pressure, favoring fusion. In 25.9% of the population, communication is maintained, known as patent foramen ovale.<sup>3</sup>

Variations of fusion over the septal overlap zone will define the location of an SP. When fusion occurs in the caudal portion, it results in a SP opening to the left atrium, whereas if fusion is limited to the cranial portion, the pouch will open to the right atrium. If fusion occurs in the middle of the overlap zone, two SPs will be observed<sup>4,5</sup> (Figure 2).

Three autopsy studies carried out in 2010 and 2016 showed that the prevalence of left SP varies from 39% to 41%, while in studies that used TEE for diagnosis, the prevalence was lower, varying from 18% to 29%. The prevalence of right SP is 5.1%, and that of double pouch is 3.7%.<sup>1,3,4</sup>

Regarding dimensions, left SP is considered a small structure, with an average depth of  $8.4 \pm 5.1$  mm and a volume of  $0.31 \pm 0.11$  mL.<sup>1</sup> Right SP is comparatively smaller than left SP, with an average depth of  $6.2 \pm 3.4$  mm and volume of  $0.25 \pm 0.08$  mL. As far as we know, right SP has no clinical significance.<sup>1</sup>

Approximately 87% of strokes have ischemic origin (20% cardioembolic events). Ten percent to 30% are considered cryptogenic. It is important to explore other potentially emboligenic structures of the left atrium.<sup>5,6</sup>

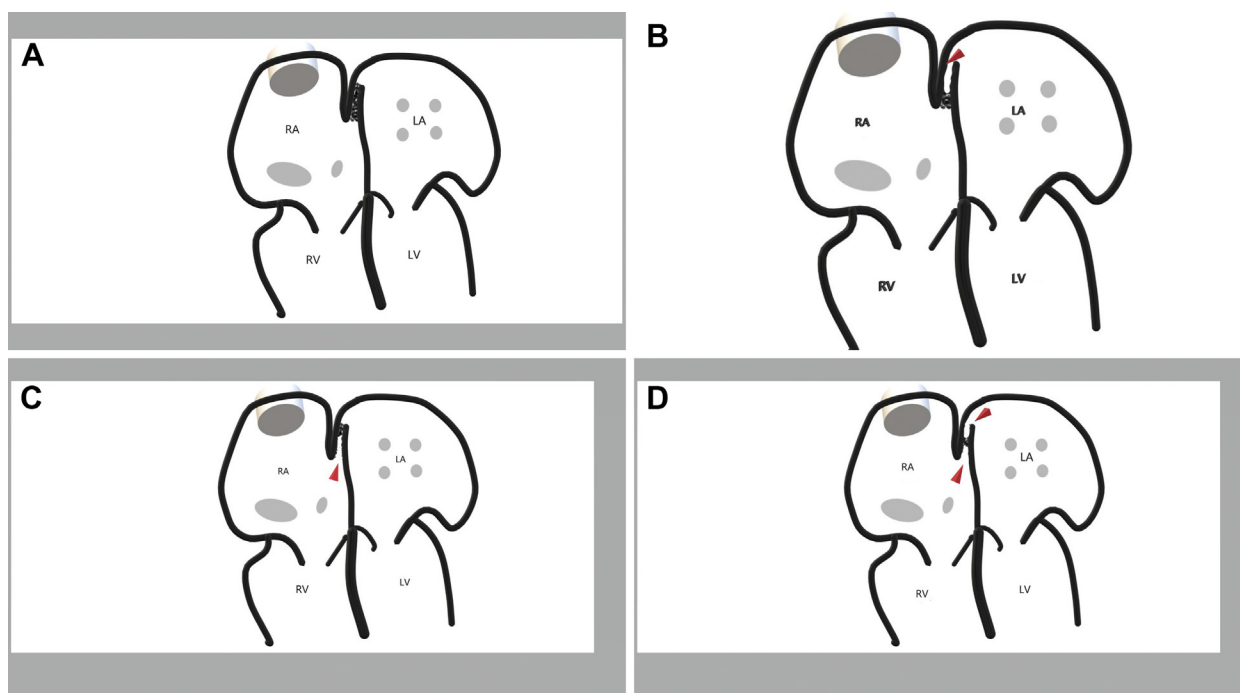


**Figure 1** Three-dimensional image showing the SP (yellow arrow) at the left atrium (LA) and thrombus within (white arrow).

tients with SP, it was not visualized by two-dimensional TEE in six patients; information such as the depth and measurement of the opening of the pouch could be obtained only using three-dimensional TEE. Prospective studies will show the clinical importance of these data.

The differential diagnosis is double atrial septum, an extremely rare congenital anomaly, which presents a double wall in the septum, which distinguishes an atrial chamber between the two chambers. This space can communicate with the left atrium via the patent foramen ovale and with the right atrium through an accessory fenestration. A subcostal view is essential for this diagnosis.<sup>10</sup>

The morphology of SP is well known, but more studies are essential to confirm the relationship between this structure and thromboembolic complications.



**Figure 2** Fusion variations in the overlap zone between the septum primum and septum secundum. **(A)** Fusion between the septum primum and septum secundum over the entire overlap zone. **(B)** Fusion limited to the caudal zone, forming a left atrial pouch. **(C)** Fusion limited to the cranial zone, forming a right atrial pouch. **(D)** Fusion in the middle of the overlap zone, forming two double pouch (left and right). Red arrows indicate septal pouch opening to the left atrium **(B)** and right atrium **(C)**.

The anatomy of an SP may lead to stasis and thrombus formation with possible embolization. However, studies show different results when it comes to the association of SP and stroke. In addition, it can be considered an arrhythmogenic substrate.<sup>7</sup>

TEE using agitated saline solution and the Valsalva maneuver is considered the gold standard for diagnosis. The solution will fill the right atrium and will not pass through the septum to the left atrium, unless the patient has a patent foramen ovale. The most used views are the bicaval and the midesophageal short-axis view.<sup>8</sup>

Studies have shown the incremental value of three-dimensional TEE compared with two-dimensional TEE in the identification and characterization of SP. Elsayed *et al.*<sup>9</sup> showed that among 44 pa-

## CONCLUSION

SP is an anatomic variant resulting from the incomplete fusion of the septum primum and septum secundum. Its diagnosis is made using TEE with agitated saline contrast. This new structure must be evaluated because it can be potentially emboligenic, but more studies are needed to show a causal relationship.

## SUPPLEMENTARY DATA

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.case.2020.05.022>.

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