

## Pericardial diverticula misdiagnosed as pericardial cysts

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Pericardial cysts, which result from complete closure of an embryonic pericardial defect, are believed to occur at a frequency of 1 in 100,000, based on a 1958 chest radiograph screening.<sup>1</sup> Surgery is routinely not recommended, unless obvious compression of adjacent organs is demonstrated. However, 10% of all cysts may be instead a pericardial diverticulum with a persistent connection to the pericardial space, not apparent from radiologic studies, and identified only at surgery.<sup>2</sup> These lesions may cause atypical symptoms that are relieved only after surgery, as demonstrated by this case report.

### CASE REPORT

A 66-year-old retired biologist was diagnosed in 1984 with an “enlarged fat pad,” by chest radiograph. Chest computed tomography (CT) scans revealed a right, cardio-phrenic, 2.5-cm, soft-tissue cystic mass that had increased to 7.3 cm by 2008 (Figure 1). Additional studies included: standard cardiac exercise stress tests in 1989, 1993, and 1998 (all normal); exercise stress tests with images in 2001 and 2008 (all normal); cardiac catheterization in 2003 (negative for significant disease); echocardiograms in 2001, 2005, and 2008 (mild mitral insufficiency); 24-hour Holter monitors in 1993 and 2001 (normal); cardiac magnetic resonance imaging in 2008; negative testing for pheochromocytoma in 2010; and a magnetic resonance imaging echocardiogram in 2012 (a 4.7 × 3.6 × 4.1 cm “pericardial cyst” without evidence of compression).

Intermittent, daytime, anterior chest symptoms, not affecting the patient’s usual activities, were characterized as follows: nonradiating; unrelated to activity, inspiration, or position; duration from minutes to hours; and intensity of 2 to 5 on a scale of 0 to 10. Different nocturnal symptoms occurred lasting 2-12 hours: over 90% of the episodes woke her from sleep: forceful heart pounding, intense anxiety, tachycardia,

inability to lie back down, mild chest discomfort sometimes, but without dyspnea, nausea, indigestion, flushing or diaphoresis. The episodes were not related to exercise, stress at work, the sudden death of her husband, eating, drinking, sexual activity, or urinating or bowel habits.

Frequency was not predictable, either for the vague daytime chest discomfort, or the nocturnal attacks, which both ranged from being weekly episodes, to years apart. Empiric treatment with beta-blockers for presumed supraventricular tachycardia decreased her heart rate, but did not lessen the other symptoms that accompanied the nocturnal attacks. Antianxiety medications did not abort them.

Symptoms began to increase in the spring of 2012. A portable electrocardiogram monitor recorded a normal sinus rhythm with a narrow complex during a night attack. Severe episodic fatigue attacks lasting <2 hours occurred, with a “heart-pounding sensation,” unrelated to activity. While the patient was resting in a recliner, a family member noted a substantial neck-vein distention. However, by the time the patient saw her internist, symptoms had resolved, and the examination was normal.

Because of the positional symptoms, a connection between the “cyst” and the pericardial space was hypothesized, which would allow a shift of fluid from the lesion into the pericardium, possibly resulting in a localized transient pericardial effusion affecting the venous return to the right atrium. The patient was again referred to another thoracic surgeon, who did not attribute the symptoms to the “cyst” but agreed to perform surgery. On May 25, 2012, the patient underwent video-assisted thoracoscopic



**FIGURE 1.** Chest computed tomography scan showing a right, cardio-phrenic, 7.3-cm, soft-tissue, cystic mass.

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surgery to remove the “cyst.” A diverticulum with a 4-to-5-mm communication to the pericardium was found and removed. The patient has been asymptomatic since surgery.

### DISCUSSION

As demonstrated by the preceding description, current radiologic studies, which fail to include this diagnosis, cannot differentiate a pericardial diverticulum from a cyst. A search of PubMed entries in the range of dates from 1946 to the present identified 36 cases of pericardial diverticula in English ([Appendix E1](#) provides references describing the cases reviewed). Of these 36 cases, although symptoms were mentioned in only 24 (66%), 16 of the 24 (66%) had clinical complaints, including 11 with chest discomfort. Eight (33%) were asymptomatic. In addition, patients reported other complaints, identified in [Appendix E1](#). After surgery, resolution of symptoms was reported in 13 of 17 cases including the case report (76%). Pericardial diverticula may therefore cause atypical symptoms without compression, compared with pericardial cysts, which resolve after surgery.

Recent literature reports do not discuss the shift of fluid from the pericardial space to the diverticulum, or the reverse, which could contribute to the symptoms, but this shift has been clearly documented in numerous earlier cases. This shift was first reported in 1946, by Dr Mazer<sup>3</sup> describing Dr Sweet’s surgical report on a pericardial diverticulum:

... it was noticed that the fluid within the mass began to disappear, and, in squeezing it, all the fluid was expressed into the pericardial cavity. When the pressure was released, the action of the heart slowly pushed the fluid back into the sac, distending it once more about as much as when it was first seen. ... The communicating opening was a little more than 0.5 cm in diameter.

This case report, therefore, encourages a thoracic surgeon to include the possibility of diagnosis of a pericardial diverticulum when evaluating a patient with a symptomatic pericardial cyst, and supports the recommendation made previously by Akiba and colleagues<sup>4</sup> “. . . that a symptomatic anterior mediastinal cyst be completely resected even if it does not appear large enough to compress the neighboring organs.”

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**APPENDIX E1. Pericardial diverticula reviewed**

Reference	No. of cases	Age (y)	Symptoms	Study method:	Postsurgical diagnosis	Resolution of symptoms
				Presurgical diagnosis		postsurgery Yes/No
Mazer <sup>E1</sup> (1946)	1	55	Cough, epigastric distress, mild nausea	Chest radiograph: fat pad, omental hernia, mediastinal tumor	Pericardial diverticulum	Yes, at time of discharge, 14 d later
Brown <sup>E2</sup> (1946)	1	24	Asymptomatic	Chest radiograph: mediastinal mass	Pericardial diverticulum	Not applicable
Bishop <sup>E3</sup> (1950)	1	26	Fatigue, vague left anterior chest pain	Chest radiograph: pericardial cyst	Pericardial diverticulum	Unknown
Brown <sup>E4</sup> (1951)	1	27	Asymptomatic	Chest radiograph: pericardial cyst	Pericardial diverticulum	Not applicable
Halonen <sup>E5</sup> (1953)	1	20	Chest pressure when bending over	Fluoroscopy: possible pericardial diverticulum	Pericardial diverticulum	Unknown
Perasalo <sup>E6</sup> (1953)	2	28	Chest pain intermittent for 4 y Dyspnea Dizziness	Fluoroscopy: possible pericardial diverticulum	Pericardial diverticulum	Yes
		20	Asymptomatic	Fluoroscopy: possible pericardial diverticulum	Pericardial diverticulum	Not applicable
Ware <sup>E7</sup> (1954)	1	47	Asymptomatic	Chest radiograph: mediastinal mass	Pericardial diverticulum	Not applicable
Maier <sup>E8</sup> (1957)	1	29	Occasional chest discomfort	Chest radiographs: mass at cardiac border	Pericardial cyst and diverticulum	Yes
Fell <sup>E9</sup> (1959)	4	44	Asymptomatic	Chest radiograph: mediastinal mass	Pericardial diverticulum	Not applicable
		55	Nonexertional, intermittent, anterior chest pain for 2 wk	Chest radiograph: rounded density right paracardiac region	Pericardial diverticulum	Yes
		56	Asymptomatic	Chest radiograph: mediastinal mass	Pericardial diverticulum	Not applicable
Davis <sup>E10</sup> (1961)	1	56	Asymptomatic	Chest radiograph: mediastinal mass	Pericardial diverticulum	Not applicable
		10	Recurrent pulmonary infections, precordial chest pain, dyspnea	Chest radiograph: pericardial or bronchogenic cyst	Pericardial diverticulum	Yes
Kittredge <sup>E11</sup> (1967)	1	60	Dyspnea	Chest radiograph: pericardial diverticulum	Pericardial diverticulum	Unknown
Pader <sup>E12</sup> (1969)	1	35	Asymptomatic	Chest radiograph: left hilar mass	Pericardial diverticulum	Not applicable
Waterbolk <sup>E13</sup> (1991)	1	37	Recurrent attacks of pleuritic chest pain for 3 mo, duration <24 h	CT scan and MRI: pericardial cyst	Pericardial diverticulum	Yes
Hirooka <sup>E14</sup> (1991)	1	39	Unknown	Pericardial diverticulum	Pericardial diverticulum	Unknown
Matushita <sup>E15</sup> (1992)	2	60	Unknown	Pericardial diverticulum	Pericardial diverticula (both)	Unknown
		20	Unknown	Mediastinal cyst		Unknown
Santoro <sup>E16</sup> (1993)	1	31	Odynophagia	CT scan: mediastinal mass	Pericardial diverticulum	Yes
Wang <sup>E17</sup> (1994)	3	NA	Unknown	Mediastinal masses	Pericardial diverticula	Unknown
Yamamoto <sup>E18</sup> (1995)	2	54	Unknown	CT scan and MRI: upper mediastinal cysts: possible bronchogenic, lymphatic, esophageal, or pericardial cyst	Pericardial diverticulum	Unknown
		43	Unknown		Pericardial diverticulum	Unknown
Ohno <sup>E19</sup> (1998)	1	38	Unknown	CT scan: pretracheal lymph node	Pericardial diverticulum	Unknown

(Continued)

## APPENDIX E1. Continued

Reference	No. of cases	Age (y)	Symptoms	Study method:	Postsurgical diagnosis	Resolution of symptoms
				Presurgical diagnosis		postsurgery Yes/No
Takeda <sup>E20</sup> (2003)	3	NA	Unknown (all 3)	Chest radiograph and CT scans	Pericardial diverticulum (3)	Unknown (All 3)
Carretta <sup>E21</sup> (2003)	1	35	Recurrent chest pain	Mediastinal cysts (3) Chest radiograph: varied size MRI: cystic lesion partially attached to pericardium	Pericardial diverticulum	Yes
Hanada <sup>E22</sup> (2005)	1	64	Cough Dyspnea	CT scan: pericardial cyst	Pericardial diverticulum	Unknown
Wei X <sup>E23</sup> (2009)	1	51	8-y history of recurrent right-side chest pain	CT scan and MRI: upper mediastinal cyst: intrathoracic thyroid or pericardial cyst	Pericardial diverticulum	Yes
Akiba <sup>E24</sup> (2009)	2	75	Left parasternal chest pain for 5 mo	Chest radiograph and CT scan: anterior mediastinal cyst	Pericardial diverticulum	Yes
		55	Chest discomfort and pain for 3 mo	Chest radiograph negative CT and MRI: pericardial cyst	Pericardial diverticulum	Yes
Guler <sup>E25</sup> (2011)	1	76	Dyspnea, palpitations	CT: pericardial cyst; mitral stenosis; atrial fibrillation	Pericardial diverticulum	Yes

CT, Computed tomography; MRI, magnetic resonance imaging; NA, not available.