Esophageal ingested body in a child with calcified ligamentum arteriosum: a case report

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Radiology Case. 2022 Aug; 16(8):8-12 :: DOI: 10.3941/jrcr.v16i8.4518

ABSTRACT

The calcification of ligamentum arteriosum occurs after the normal closure of the ductus arteriosus. Foreign body ingestion is a common event in the pediatric age, and it is frequently addressed in the Emergency Room. We report a case of foreign body in a patient with unknown calcification of the ligamentum arteriosum. His parents noted blood in the saliva, but he had no symptoms indicative of an acute clinical situation. The CT showed a hyperdense object in the aorto-pulmonary window with features compatible with a metallic object. The child underwent surgery, during which a calcified ligamentum arteriosum was found and no foreign body. This phenomenon has been described to be better identified using multi-section CT scans than X-Rays.

CASE REPORT

CASE REPORT

A 10-year-old boy presented to the Emergency Room complaining he had swallowed a seamstress pin while he was playing. His parents reported they did not see the ingestion but had immediately induced vomiting and noticed blood in the saliva.

The child's vital signs were stable, his physical examination was normal, and he was completely asymptomatic. The otolaryngologist performed an oral inspection, that found a small excoriation of the posterior wall of the pharynx, and a video-laryngoscopy (VLS) without retrieving any foreign body (FB).

ECG and laboratory exams were within the normal range. Based on the reported anamnesis, a non-enhanced computed tomography (CT) was performed. The CT (Figure 1) showed a linear hyperdense image (20 mm in length, 324 Hounsfield Units or HU) in the mediastinum, located at the aortopulmonary window, outside the esophageal lumen. Given the findings, a migrating sharp FB was suspected. The child was admitted and upon the cardiosurgical consultation, surgery was planned for the next day. Before surgery, a contrast-enhanced CT scan (Figure 2), was requested to investigate the anatomical relationship between the great vessels and the FB. It appeared to lean against the upper wall of the common pulmonary artery and the left pulmonary artery with the deepest end attached to the aorta. The 3D reconstruction, realized after the diagnosis of *ligamentum arteriosum*, confirmed the position of the FB (Figure 3).

A median sternotomy was performed and, after isolation of the aortopulmonary window and separation of the great vessels, a hard short segment was palpated, consistent with a calcified *ligamentum arteriosum*. No FB was found during the procedure. The post-operative follow-up was complicated by the occurrence of post-surgical pericarditis treated with anti-inflammatory drugs and colchicine.

DISCUSSION

Etiology & Demographics:

The calcification of *ligamentum arteriosum* (LAC) in children occurs after the normal closure of the ductus, developing from a few months to several years [1]. The phenomenon is recognized in literature amongst experienced pediatric radiologists, although its prevalence has not yet been well investigated. However, LAC appears to be more frequently observed than previously reported.

Foreign body (FB) ingestion is a common incident in the pediatric age, and it is a frequent problem addressed in the Emergency Room. Ingested FB are usually expelled within few days through the anus [2] apart from FB retained in the esophagus. A body stuck in the esophagus can lead to serious complications, such as FB embedded in the esophagus with subsequent perforation or, in case of sharp FB, transesophageal migration toward the mediastinum [3].

The prevalence of LAC is unknown and likely, underestimated. In the literature there are few and discordant studies about the frequency of LAC. Beluffi et al. report a frequency of 0.83% on chest radiographs in children [4]. On the other hand, when multi-section CT is used, the prevalence of LAC is much higher, being 37.8% in children and 11.2% in adults.

This difference can be explained with the superior image quality of CT compared to X-Ray [5]. Furthermore, analyzing the post-mortem multi-section CT of 220 children, LAC was retrieved in 30.5% of cases [6].

Imaging findings:

According to the literature, multi-section CT showed a higher sensibility to detect the presence of LAC, which can be not identified using X-Ray [5]. Hong et al. described LAC as: "a hyperdense structure in the typical location of LAC (i.e., around the aortopulmonary window) on both axial and coronal image planes or on one plane if the measured mean CT number in the presumed LAC was >100 HU" [5]. Indeed, in our case, LAC appears as a linear hyperdense body at the aortopulmonary window with a more than 300 HU value.

Treatment & Prognosis:

No treatment is needed in case of diagnosis of LAC [1]. On the contrary, sharp ingested objects such as bones, needles, and pins can be associated with perforation of the esophagus that requires an emergent management. In the systematic review realized by Jayachandra et al. [2] spontaneous passage rates were found in just over a third of the studies and the most frequent method of extraction used was flexible and rigid endoscopy, followed by less common procedures as foley catheter extraction, esophageal bougienage, extraction with McGill forceps and magnet catheters. An immediate treatment, when necessary, leads to an excellent prognosis.

Differential Diagnoses:

1. Pathologic calcifications

The pathophysiologic mechanism of LAC is not atherosclerosis and there is no correlation between LAC and pathologic calcifications; LAC may be caused by myxoid degeneration of the ligamentum wall or thrombus regression [5]. Furthermore, multi-section spiral CT with coronal reformation can be used to differentiated LAC from other pathologic calcifications.

2. Ingested foreign body

Sharp ingested FB can perforate the esophagus, particularly when they stuck at the cervical esophagus [7]. The perforation of the esophagus enters in differential diagnosis with LAC especially if there is a positive history of FB ingestion, leading to a major surgery as in our report. The intraoperative transesophageal ultrasound in case of intracardiac sharp FB has been described [8] and could have been of some help in this case.

Conclusion:

The lack of knowledge of this uncommon condition can misguide the diagnostic pathway up to unnecessary major surgery with possible post-operative complications, as in the present case. Upon suspicion of transesophageal migration of a FB, the patient should be investigated taking advantage of all diagnostic techniques and bearing in mind the rare possibility of a LAC. Improving the knowledge of LAC among radiologists and surgeons should allow to better interpret the CT findings and to avoid invasive procedures in children and adults.

TEACHING POINT

Differentiating anatomical from pathological calcifications, such as the calcification of the ductus arteriosus from ingested foreign bodies, is important to avoid subjecting the patient to unnecessary procedures. Furthermore, multi-section CT shows better results in the identification of the calcification of the ligamentum arteriosum than X-Rays.

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FIGURES

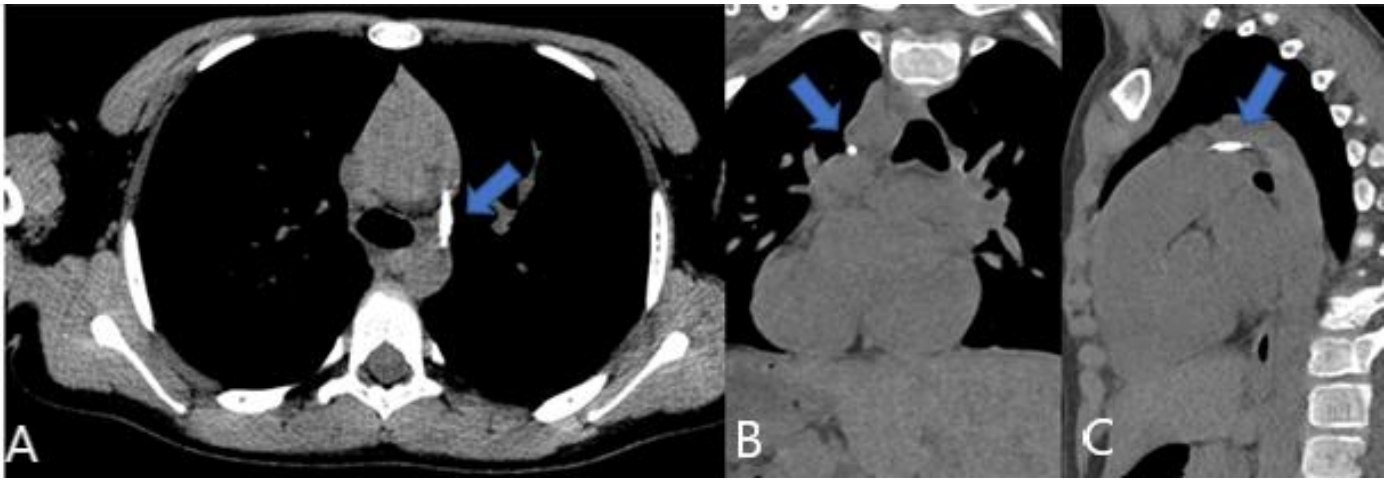

Figure 1: 10-year-old boy with the calcification of ligamentum arteriosum.

FINDINGS: Non-enhanced multi-section computed tomography (CT) in axial (A), coronal (B) and sagittal (C) planes showing the hyperdense linear image at the aortopulmonary window (arrows). The mean value of Hounsfield Unit (HU) was 324.

TECHNIQUE: Non-enhanced multi-section CT in axial, coronal and sagittal planes. Siemens SOMATOM Definition Flash. Slice width: 0.75 mm. 80kVp x 1771mAs. Total DLP: 244 mGycm.

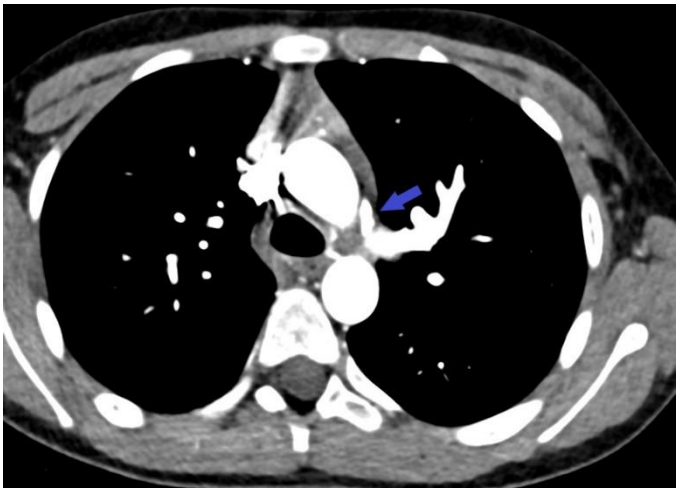

Figure 2: 10-year-old boy with the calcification of ligamentum arteriosum.

FINDINGS: Contrast-enhanced CT in axial plane. The hyperdense linear image of about 20 mm (arrow) is closed to the great vessels.

TECHNIQUE: Multi-section contrast-enhanced CT in axial plane. Intravenous contrast: Iomeron 400. Total amount contrast administered = 50 ml. Siemens SOMATOM Definition Flash. Slice width: 0.75 mm. 80kVp x 2110mAs. Total DLP: 114 mGycm.

Figure 3: 10-year-old boy with the calcification of ligamentum arteriosum.

FINDINGS: The arrowhead shows the hyperdense linear body found in the CT (arrow). The 3D image identified the calcified body at the aortopulmonary window with great precision.

TECHNIQUE: 3D reconstruction of contrast-enhanced CT. Syngo.via software.

Etiology	Myxoid degeneration of the ligamentum wall or thrombus regression
Incidence	-0.83-37.8% in children -11.2% in adults
Gender ratio	No gender prevalence has been described
Age predilection	The calcification can occur from a few months to several years after the normal closure of the ductus arteriosus
Risk factors	No risk factors have been identified
Treatment	No treatment is needed
Prognosis	100 % (No complications associated with the presence of LAC have been described)
Findings on imaging	Hyperdense structure in the typical location of LAC (i.e., around the aortopulmonary window) on both axial and coronal image planes, with >100 HU

Table 1: Summary table of calcification of ligamentum arteriosum.
LAC = ligamentum arteriosum calcification, HU = Hounsfield Units

Diagnosis	Age	Common location	Complications	Imaging findings
LAC	Few months-several years	Aortopulmonary window	No symptoms associated	NCECT: hyperdense linearity of various lengths at the aortopulmonary window with a HU value typical of bone
Ingested FB	Through pediatric age	Along the gastrointestinal path	Decubitus, perforation, transesophageal migration, respiratory symptoms	X-Ray: hyperdense body of different forms and lengths located from esophagus to the anus NCECT: give a more detailed picture of the FB MRI: better to avoid in suspicion of metallic objects
Atherosclerosis	Mainly adulthood	Large and medium arteries, especially coronary vessels	Heart associated symptoms	NCECT with coronal reformation: Linear hyperdensity along coronary vessels.

Table 2: Differential diagnosis table for calcification of ligamentum arteriosum.
LAC = ligamentum arteriosum calcification, NCECT = non-contrast-enhanced computed tomography, HU = Hounsfield Units

ABBREVIATIONS

CT = Computed Tomography
FB = Foreign Body
HU = Hounsfield Units
LAC = Calcification of ligamentum arteriosum
VLS = Video-laryngoscopy

KEYWORDS

Foreign body; ligamentum arteriosum; ductus arteriosus; calcified ligamentum arteriosum; aortopulmonary window

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