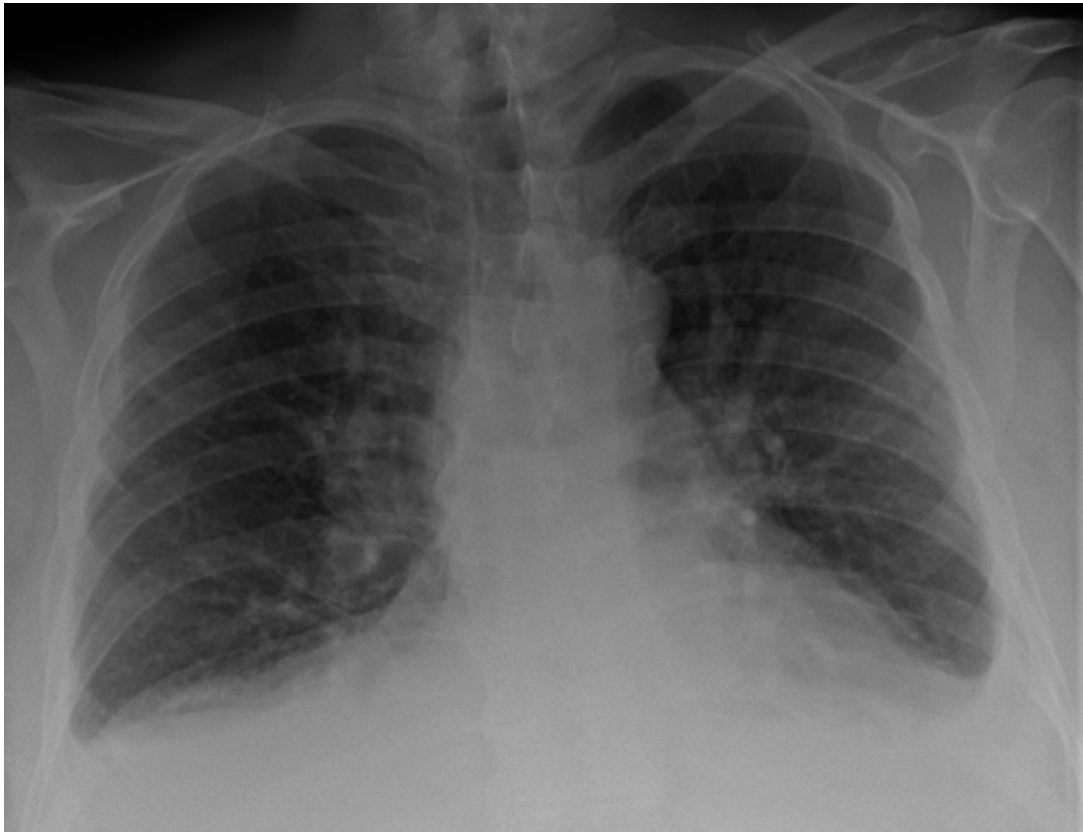


Cardiac Silhouette Enlargement on a Chest X-ray

[See online here](#)

The chest X-ray is a cheap, feasible, screening tool for cardiac and respiratory diseases in neonates, children, and adults. The heart shadow on the chest X-ray 'cardiac silhouette' occupies half of the anteroposterior chest X-ray film in normal individuals. Therefore, the examination and evaluation of the cardiac silhouette on the conventional X-ray have received interest from radiologists and pediatricians. The main aim of examining the cardiac silhouette is to determine the heart's size, the identification of the different contours of the heart, and the categorization of the pulmonary vascularity.



Systemic approach to a chest X-ray

Chest X-rays can be used to **screen for abnormal** heart size, the presence or absence of one or more heart chambers, and pulmonary vascularity. **Intracardiac lesions cannot be visualized on a chest X-ray.**

Examining the heart using a chest X-ray requires at least two views, anteroposterior and lateral, for adequate 3D visualization. When reviewing the chest X-ray, pay particular

attention to:

1. The image quality: Check for adequate exposure, lack of rotation, adequate penetration, and adequate lung expansion
2. The size and shape of the heart
3. The status of pulmonary vascular markings
4. Parenchymal lung abnormalities
5. Pleural pathologies

Often, a chest X-ray will indicate more than one pathology. Therefore, one should try to interpret the chest X-ray systemically, rather than jumping to conclusions based on the most obvious pathology.

The size of the heart on a chest X-ray is determined by:

- Cardiac chamber sizes
- Cardiac wall thickness
- Pericardial space
- Pericardium

Cardiomegaly is defined as the enlargement of any of the above components. This is visible on a chest X-ray by a **cardiothoracic ratio of >0.5**.

To determine the cause of **cardiomegaly** using a chest X-ray, pay close attention to the **enlarged heart's shape**. For instance, cardiomegaly in an adult with a prominent aortic arch is most likely due to left ventricular hypertrophy, which can be caused by systemic hypertension or aortic stenosis.

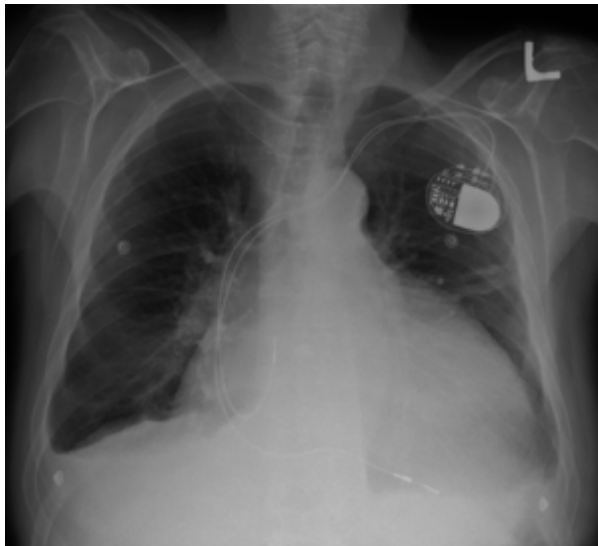


Image: "Cardiomegaly" by James Heilman, MD. License: [CC BY-SA 3.0](https://creativecommons.org/licenses/by-sa/3.0/)

Patients with heart failure can present with an enlarged cardiac shadow on a chest X-ray due to left ventricular dilatation, pulmonary edema, and pleural effusions.

Artifactual causes of cardiac enlargement

Cause	Reason
Rotation	Distorts the heart's appearance
Suboptimal inspiration	Diaphragm moves upwards and compresses the heart

Portable supine film	Magnification due to AP film
Pectus excavatum	Heart is compressed between the sternum and spine

Specific cardiac pathologies' effects on the cardiac silhouette

Atrial septal defects on the chest X-ray

Atrial septal defects are characterized by an **opening between the two atria**, causing blood to flow from the left to the right atrium and increasing pulmonary blood flow. The chest X-ray will **show increased pulmonary vascular markings, in addition to an enlarged cardiac silhouette**.



[Image](#): "ASD Chest X-Ray" by WikiSysop. License: [CC BY-SA 3.0](#)

Ventricular septal defects on a chest X-ray

Like atrial septal defects, pulmonary blood flow is expected to increase in ventricular septal defects. **Increased pulmonary vascular markings** will appear on a chest X-ray. **Left atrial and left ventricular dilation are common** findings. The lateral view might reveal posterior deviation of the esophagus due to left atrial enlargement.

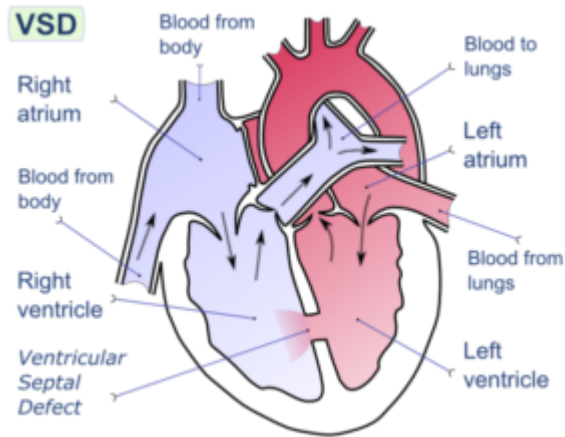


Image: "Ventricular septal defect-en" by Manco Capac. License: [CC BY-SA 3.0](https://creativecommons.org/licenses/by-sa/3.0/)

Coarctation of the aorta on a chest X-ray

Coarctation of the aorta is normally observed in a neonate, and it is visible on a chest X-ray. If left untreated, **severe coarctation of the aorta might result in left ventricular hypertrophy and an enlarged cardiac silhouette**. Rib notching, due to deformation of the inferior surface of the ribs, is a sign of severe coarctation of the aorta.

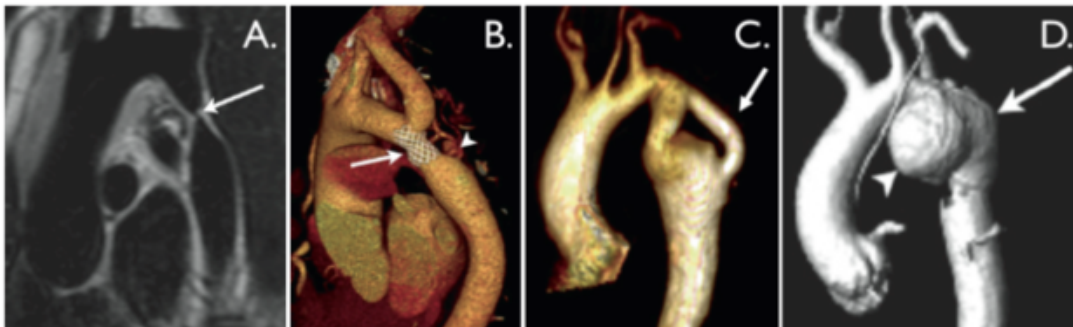


Image: "Coarctation of the aorta" by Hopewell N Ntsinjana , Marina L Hughes and Andrew M Taylor. License: [CC BY 2.0](https://creativecommons.org/licenses/by/2.0/)

Patent Ductus Arteriosus on a chest X-ray

Pulmonary blood flow is expected to increase and can manifest as increased pulmonary vasculature on a chest X-ray. **Left atrial and left ventricular enlargement** are common. The **posterior deviation of the esophagus**, which was caused by an enlarged left atrium, is visible on a lateral view chest X-ray.

Tetralogy of Fallot on a chest X-ray

Tetralogy of Fallot appears as a **small, rather than a large, cardiac silhouette**. Sometimes, pulmonary stenosis can cause an enlarged right ventricle, which manifests as an uplifted the cardiac apex. The small pulmonary arteries, narrowed mediastinum, and uplifted cardiac apex **give the heart the shape of a boot**. This radiographic feature, known as Coeur en sabot, is quite specific for the tetralogy of Fallot. Diminished pulmonary vascular markings, due to decreased pulmonary blood flow, are visible on the

chest X-ray.



[Image](#): "HeartTOP" by James Heilman, MD. License: [CC BY-SA 3.0](#)

Atrioventricular canal defect on a chest X-ray

Atrioventricular canal defects are characterized by **atrial septal defects, ventricular septal defects, and an abnormal atrioventricular valve**. This condition generally causes the four chambers of the heart to become enlarged. Increased pulmonary vascular markings are visible on the chest X-ray.

Pulmonary valve stenosis on a chest X-ray

Blood-flow through a stenosed valve **causes pulmonary artery dilation**, which manifests as a prominence of the pulmonary artery segment that is found in the mid-left border of the cardiac silhouette. If left untreated, the patient might **develop right ventricular hypertrophy and/or enlargement**. Enlargement of the right ventricle presents with a fullness of the lower retrosternal portion of the cardiac silhouette on a chest X-ray's lateral view.

Aortic valve stenosis on a chest X-ray

Like pulmonary stenosis, **blood flow through the stenosed aortic valve will be jet-like, causing the ascending aorta to dilate**. Therefore, aorta fullness and prominence in the mid-region of the right heart border should be visible on a chest X-ray. Left ventricular enlargement, with lateral displacement of the cardiac apex, can be seen in untreated aortic stenosis cases. **Congestive heart failure, with pulmonary edema and pleural effusions**, is found on the chest X-rays of patients **with prolonged histories of untreated severe aortic stenosis**.

Tricuspid atresia on a chest X-ray

Patients with tricuspid atresia **must have a patent ductus arteriosus or systemic-to-pulmonary arterial collaterals to survive**. Therefore, increased pulmonary blood flow

is a common finding in this condition. The cardiac silhouette in tricuspid atresia is small or normal.

Truncus arteriosus on a Chest X-ray

Patients with truncus arteriosus have **a single great vessel instead of two major vessels** arising from the heart, i.e., they do not have a pulmonary artery and an aorta. This main truncus manifests as a narrow mediastinum on a chest X-ray. Patients with this congenital anomaly usually have **DiGeorge syndrome**, which is characterized by the **absence of the thymus gland**, and further contributes to the narrowed mediastinum on a chest X-ray.

Total anomalous pulmonary venous return on a chest X-ray

In patients with total anomalous pulmonary venous return, the **pulmonary veins drain into a vertical vein that is connected to the innominate vein**. This abnormal venous configuration results in dilated vertical and innominate veins, as well as an enlarged superior vena cava.

The dilation of these three major veins results in a round image above the cardiac silhouette. This image is **known as a snowman appearance** and is characteristic of total anomalous pulmonary venous return. Pulmonary venous congestion is visible.

Acquired cardiac pathologies on a chest X-ray

Systemic hypertension can result in left ventricular hypertrophy, which can manifest as an enlarged cardiac silhouette with downward and lateral displacement of the cardiac apex.

Acquired aortic stenosis usually results in an image that is similar to systemic hypertension, but may also indicate congestive heart failure.

Patients with a **large myocardial infarction** can present with acute pulmonary edema and a normal or an enlarged cardiac silhouette, depending on the presence or absence of left ventricular hypertrophy.

Pericardial effusions and pericardial or cardiac tumors can also present with an enlarged cardiac silhouette on a chest X-ray.

References

Abdulla R., Luxenberg D.M. (2011) "[Cardiac Interpretation of Pediatric Chest X-Ray.](#)" In: Abdulla R. (eds) Heart Diseases in Children. Springer, Boston, MA, pp: 17-34. DOI 10.1007/978-1-4419-7994-0_2; Available at: https://link.springer.com/chapter/10.1007%2F978-1-4419-7994-0_2

Legal Note: Unless otherwise stated, all rights reserved by Lecturio GmbH. For further legal regulations see our [legal information page](#).