



## Radiation diagnosis of hydrothorax: radiography and computed tomography

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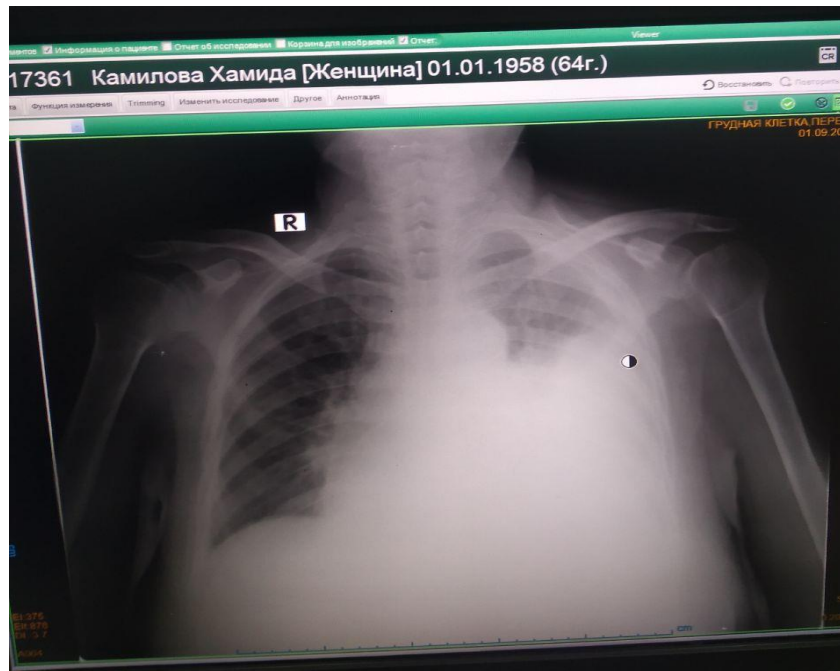
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**Abstract:** The term "hydrothorax" (at least in radiodiagnosis) refers to a condition in which there is liquid of any kind in the chest cavity. It can be exudate, transudate, blood, lymph, bile, pus, etc. It is difficult to establish the nature of the fluid in the chest cavity using an X-ray examination (one can only assume), therefore, when describing radiographs (and CT), only the volume (approximately - with radiographs, more precisely - plus or minus 100 ml - with CT), as well as the localization of the liquid content.

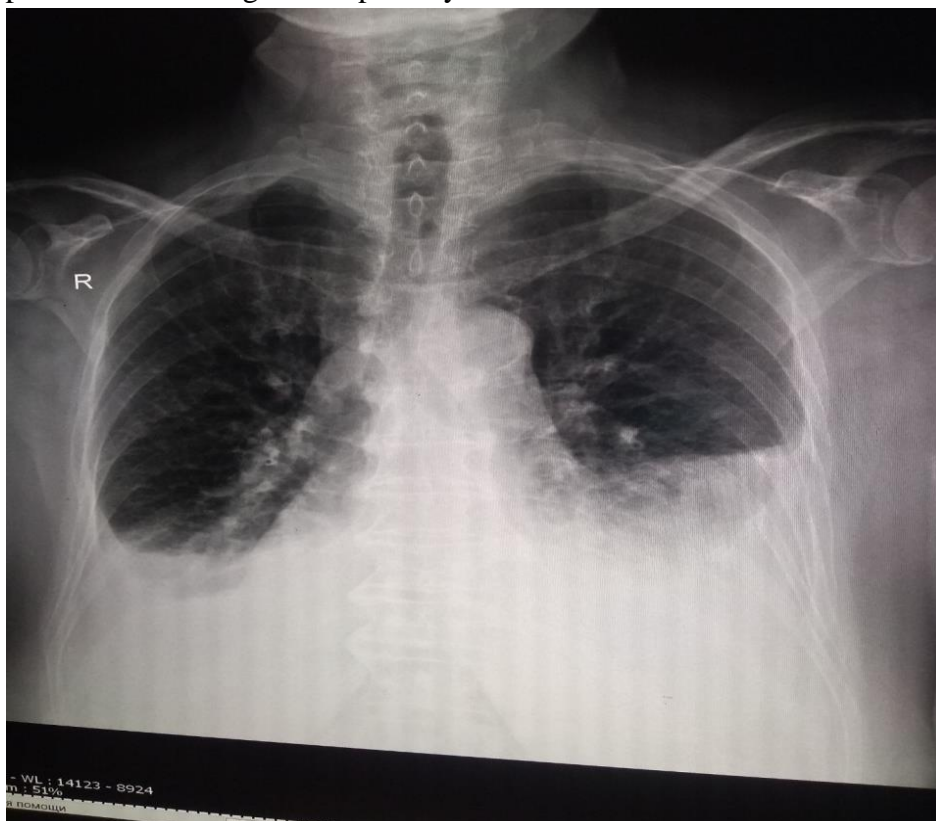
**Key words:** Hydrothorax: definition, causes, classification.

### Introduction.

The causes of hydrothorax can be both therapeutic pathology (congestion in the vessels of the small - pulmonary - circle of blood circulation), and tumor pathology (for example, metastases to the pleura provoke the development of hydrothorax of various sizes), acute surgical pathology (acute pancreatitis is often the cause of the accumulation of inflammatory fluid in the left half of the chest). Trauma to the chest with damage to the ribs, pleura is another reason for the accumulation of fluid (here, its hemorrhagic nature is more likely) in the chest cavity.



Hydrothorax can be classified according to the nature of the fluid (determined after puncture). Hemothorax - accumulation of blood in the chest cavity, chylothorax - accumulation of lymph, pyothorax - pus. Hydrothorax is also subdivided according to the volume of fluid - there is a minimal hydrothorax (50-100 ml), which can be detected only with computed tomography, a small volume hydrothorax (up to 500 ml), which can already be detected on a chest x-ray, an average hydrothorax (500-1500 ml), which gives a detailed x-ray picture, and large volume hydrothorax (over 1500 ml), leading to compression of the lung and respiratory failure.



This is what hydrothorax looks like on an x-ray (in direct projection) - on the left image. The arrow indicates a shadow with a horizontal upper border on the right in the lower sections - this is a sign that there is also gas in the chest cavity. In the image on the right, there are signs of hydrothorax on CT scan (mediastinal view) – the arrows mark the liquid with a density of +8...+10 Hounsfield scale units.

**Hydrothorax: signs on radiographs.** Depending on the volume, localization of the fluid, as well as the presence of air in the chest cavity, hydrothorax may look different on x-rays. The most characteristic, “classic” sign of hydrothorax in the direct projection image (necessarily performed in the patient’s standing position) is a darkening of medium intensity with an inclined upper border, the outer edge of which is higher than the inner one - such a border is due to a lower (compared to atmospheric) pressure in the pleural cavity and indicates the absence of gas in it. In the presence of gas in the chest cavity, the border of blackout becomes straight (horizontal).

These radiographs also show a left-sided hydrothorax in another patient, showing an obscuration with a sloping border on the left lower side. If the fluid is localized in the region of the anterior (or lateral) costophrenic sinus (or in both sinuses), the border of the darkening will be clear. In cases where the fluid is behind, on radiographs, the border of the darkening “blurs”, becomes fuzzy - in this case, a picture in the lateral projection is needed to differentiate hydrothorax from pneumonic infiltration of the lung, and also to reliably indicate to surgeons its localization. Unfortunately, it is possible to determine the volume of liquid on radiographs only approximately - the accuracy does not exceed plus or minus 500 ml (in ideal cases). For a more accurate determination of the volume, a CT scan is recommended.

**Signs of hydrothorax on CT.** On computed tomography, hydrothorax manifests itself as the presence of liquid contents in the chest cavity with a density of +5 to +20 Hounsfield units. This is what hydrothorax looks like on a CT scan. The number 1 marks the fluid with a density of +8...+10 units (according to Hounsfield), which occupies most of the volume of the left half of the chest cavity and causes compression of the lung (in the left image and in the image in the middle). The far right image shows minimal hydrothorax (fluid marked with arrows). Hydropneumothorax on CT: yellow arrows indicate the level of fluid in the chest cavity (in both images), in the right image, the number 1 indicates free gas in the chest, blue arrows indicate the edge of a slightly compressed lung. This condition is due to an attempt at surgical treatment of hydrothorax - fluid evacuation by puncture. The fluid was not completely evacuated, and as a result of a violation of the integrity of the chest wall and pleural cavity, gas entered it, causing some compression of the lung on the right. On the presented scans, hemothorax can be suspected. The number 1 in the left image indicates the fluid component in the chest cavity, the green arrows in the middle image indicate subcutaneous emphysema, the yellow arrow in the right image indicates a rib fracture (one of many in this patient) - all these are the consequences of a chest injury. On the presented scans, hemothorax can be suspected. The number 1 in the left image indicates the fluid component in the chest cavity, the green arrows in the middle image indicate subcutaneous emphysema, the yellow arrow in the right image indicates a rib fracture (one of many in this patient) - all these are the consequences of a chest injury. On the presented scans, hemothorax can be suspected. The number 1 in the left image indicates the fluid component in the chest cavity, the green arrows in the middle image indicate subcutaneous emphysema, the yellow arrow in the right image indicates a rib fracture (one of many in this patient) - all these are the consequences of a chest injury.

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