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When Bedside Ultrasound Changes the Course: FAST and Cardiac POCUS in Two Pediatric Emergency Cases

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Case Report

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Abstract

medicine, particularly in trauma patients and acute cardiorespiratory symptoms. While the role of POCUS is well established in unequivocal cases, its added value may be particularly important when severe pathology is not immediately apparent clinically. The diagnostic performance of POCUS varies according to the indication; in particular, Focused Assessment with Sonography for Trauma (FAST/eFAST) has limited sensitivity for excluding intra-abdominal injury when used alone. We report the case of two pediatric emergency patients in which bedside POCUS revealed serious pathology that was not immediately apparent at presentation.

Case presentation: First case: a 13-year-old boy presented following blunt abdominal trauma. He was hemodynamically stable, with localized left-sided abdominal tenderness and no clear signs of acute abdomen. Bedside extended FAST identified a small amount of free fluid in the retro-vesical space and poor visualization of the left kidney. These findings led to an urgent contrast CT which demonstrated an American Association for the Surgery of Trauma (AAST) grade IV left renal injury with urinary extravasation associated with AAST grade II splenic injury. He was monitored in the pediatric intensive care unit and managed conservatively with no need for any surgical or radiological intervention.

Second case: a 14-year-old boy was referred for progressive weight loss for the last two weeks, asthenia, worsening dyspnea and orthopnea. At presentation, he was normotensive and showed preserved peripheral perfusion, but sustained tachycardia suggested possible early hemodynamic compromise. He showed right-sided hypoventilation but no jugular venous distension, no muffled heart sounds or any other clinical signs of tamponade. Lung ultrasound showed a large right-sided pleural effusion, while cardiac POCUS unexpectedly identified a significant circumferential pericardial effusion with concerns for hemodynamic compromise. Urgent echocardiography confirmed tamponade and emergency pericardiocentesis was performed with rapid clinical improvement. Cytological and histopathological analysis of the pericardial fluid showed 93% blasts expressing dim CD45, with an immunophenotype consistent with cortical T-cell acute lymphoblastic lymphoma/lymphoma according to European Group for the Immunological Classification of Leukemias (EGIL) classification. Similar findings were identified in the pleural fluid.

Conclusion: These cases highlight the value of POCUS as an adjunctive bedside tool in pediatric emergency care. While not intended toreplace CT, echocardiography, or specialist assessment, actionable information that enabled early assessment of disease severity, refined the diagnostic process, and guided timely and appropriate clinical management.

Introduction

Point-of-care ultrasound (POCUS) is increasingly used as a bedside imaging diagnostic tool in emergency and critical care settings, particularly in the evaluation of trauma and shock[1,2]. Although it requires prior training, it is associated with ease of use, immediate availability and the absence of

ionizing radiation making it especially valuable in pediatric populations[3,4]. Over the years, advances in ultrasound technology and growing clinician expertise have transformed POCUS into a bedside, real-time and non-invasive diagnostic tool[5]. Initially developed in adult medicine, POCUS has progressively become an essential component of pediatric care, improving diagnostic accuracy, guiding procedures and reducing radiation exposure[5]. The use of POCUS in pediatrics has expanded considerably and now includes the assessment of cardiac, abdominal, pulmonary and musculoskeletal conditions[6]. In pediatric emergency medicine, common applications include the Focused Assessment with Sonography for Trauma (FAST), cardiac POCUS, lung ultrasound and ultrasound-guided bedside procedures[7]. FAST is primarily used to identify intra-abdominal bleeding following trauma, whereas cardiac POCUS allows rapid evaluation of cardiac function, pericardial effusion, and hemodynamic status[5]. In trauma care, recent ATLS recommendations consider FAST/eFAST as an early bedside adjunct when shock, hemorrhage, or thoracoabdominal injury is suspected, particularly in unstable patients, while emphasizing that its use should not delay resuscitation, hemorrhage control, or definitive imaging when indicated[8]. Despite its growing use in pediatric emergency medicine, the diagnostic performance of POCUS remains variable across studies with reported sensitivities and specificities differing according to study design, patient population, operator experience, and clinical indication[9]. Recent guidelines from the American Academy of Pediatrics emphasize that some applications of POCUS, such as FAST, may lack sufficient sensitivity to reliably exclude certain pathologies when used alone and should therefore be interpreted in conjunction with clinical findings and other diagnostic investigations[10,11,1]. Nevertheless, POCUS remains a valuable adjunct in pediatric emergency medicine because it can rapidly redirect diagnostic reasoning and accelerate time-sensitive management decisions. In this case series, we present two pediatric cases in which FAST and cardiac POCUS played a pivotal role in the early identification of life-threatening conditions, allowing prompt diagnosis and urgent therapeutic management.

Cases presentation

Case 1

A previously healthy 13-year-old Caucasian adolescent presented to the pediatric emergency department following a bicycle accident. The patient had fallen from a BMX bike during a jump of approximately 0.5 meters at an estimated speed of 25 km/h. On initial assessment, he was alert and hemodynamically stable. On presentation, blood pressure was 130/60 mmHg, and heart rate fluctuated between 75 and 130 beats/min, without sustained tachycardia. Peripheral pulses were palpable, extremities were warm, and capillary refill time was less than 3 seconds. Physical examination revealed localized tenderness of the left hemi-abdomen without any ecchymosis, guarding, abdominal distension, nor any sign suggestive of acute abdominal bleeding. Blunt Abdominal Trauma in Children (BATiC) score was 12, supporting further evaluation for intra-abdominal injury. Bedside eFAST was performed immediately despite the absence of overt shock, given the trauma mechanism, left-sided abdominal tenderness, and elevated

BATiC score. The suprapubic view showed a small amount of free retrovesical fluid. On the left upper quadrant view, the left kidney could not be clearly delineated because of a heterogeneous perirenal/retroperitoneal appearance, raising suspicion for significant renal injury rather than simple intraperitoneal bleeding. No pericardial effusion, pleural effusion, or pneumothorax was identified on the remaining eFAST views. These echographic findings prompted urgent contrast-enhanced computed tomography (CT) of the abdomen and pelvis, performed approximately one hour after presentation. CT confirmed a severe left renal injury, classified as grade IV according to the AAST, with collecting system disruption and urinary extravasation, but no active bleeding. Associated findings included a subcapsular renal hematoma, extensive retroperitoneal fluid extending beyond Gerota's fascia, segmental arterial branch occlusion, and an AAST grade II splenic laceration without vascular involvement. Given the severity of the renal injury despite preserved hemodynamic stability, the patient was admitted to the pediatric intensive care unit for close monitoring and conservative management. Serial clinical examinations, hemoglobin measurements, and renal ultrasounds remained stable, with no need for surgical or radiological intervention. During hospitalization, the patient developed transient arterial hypertension related to renal trauma, requiring temporary antihypertensive therapy. The overall clinical course was favorable, and outpatient nephrology follow-up was arranged after discharge.

Case 2

A previously healthy 14-year-old boy was referred to the pediatric emergency department for a 2-week history of progressive weight loss, asthenia, and worsening dyspnea, occurring with minimal exertion and orthopnea. He reported unintentional 5 kg weight loss. He denied chest pain, syncope, fever, or any previous cardiac history. On presentation, vital signs revealed blood pressure of 127/98 mmHg, heart rate of 150 beats per minute, respiratory rate of 28/min, and oxygen saturation of 97% on room air. Peripheral pulses were palpable, the extremities were warm, and capillary refill time was less than 3 seconds. Physical examination demonstrated markedly decreased breath sounds over the entire right lung field. Notably, there was no jugular venous distension, no muffled heart sounds, and no overt clinical signs suggestive of cardiac tamponade. Electrocardiography demonstrated sinus tachycardia with low-voltage QRS complexes. Given the combination of persistent tachycardia and unilateral hypoventilation, bedside POCUS was performed. Lung ultrasound rapidly identified a large right-sided pleural effusion. In addition, cardiac POCUS unexpectedly revealed significant circumferential pericardial effusion with concerns for hemodynamic compromise. Given the time-critical nature of these findings, chest radiography was not performed, and urgent comprehensive transthoracic echocardiography was obtained directly. This confirmed cardiac tamponade with partial collapse of the right atrium and right ventricle. Emergency pericardiocentesis was performed, draining approximately 200 ml of pericardial fluid, resulting in rapid clinical improvement. Concurrently, 200 ml of right pleural fluid was evacuated. Cytological and histopathological analysis of the pericardial fluid demonstrated 93% blasts expressing dim CD45. The immunophenotype was consistent with cortical T-cell acute lymphoblastic lymphoma/lymphoma (T-ALL/LBL) according to European Group for the Immunological Classification of Leukemias (EGIL) classification. Similar findings were identified in the pleural fluid. Subsequent positron

emission tomography–computed tomography (PET-CT) imaging revealed a large circumferential anterior superior mediastinal mass with mass effect on adjacent vascular structures, associated with additional pleuropulmonary nodular lesions and renal lesions. Staging investigations, including bone marrow aspiration and lumbar puncture, showed no evidence of bone marrow or central nervous system involvement. Treatment was rapidly initiated according to the LBL 2018 protocol, beginning with prednisone at a dose of 90 mg/day, followed by systemic chemotherapy.

Discussion

The reportedcases, although involving distinct clinical scenarios, illustrate how bedside POCUS identified severe underlying pathology that was not immediately apparent on initial clinical evaluation, thereby accelerating diagnostic orientation and therapeutic management.

The first case, involving a 13-year-old boy presenting after blunt abdominal trauma with initial reassuring clinical findings except for abdominal tenderness, highlights the potential added value of focused abdominal sonography for trauma in the early assessment of pediatric trauma patients. Although the initial clinical examination did not strongly suggest severe injury, the BATiC score of 12 supported further abdominal imaging. In this context, bedside eFAST provided immediate additional information by identifying abnormal abdominal findings and raising suspicion for significant renal trauma, thereby reinforcing the need for urgent cross-sectional imaging. CT subsequently confirmed severe grade IV renal injury. This discrepancy between the relatively benign abdominal examination and the severity of the lesion may be explained by the predominantly retroperitoneal location of the renal injury. Unlike intraperitoneal bleeding, retroperitoneal injuries may initially cause limited peritoneal irritation, resulting in a soft abdomen without guarding, distension, or overt signs of acute abdominal bleeding. This case emphasizes how FAST may contribute to the early identification of occult abdominal or retroperitoneal injury and guide further investigations without delay, even in apparently stable trauma patients, when clinical risk scores or the mechanism of injury itself already support imaging.

FAST has progressively become a cornerstone of the initial imaging evaluation of trauma patients. Several adult studies have demonstrated that FAST use may improve clinical management by reducing abdominal CT utilization, complications, healthcare costs, and emergency department length of stay[12,13]. In pediatric trauma, ATLS, describes FAST/eFAST as an early bedside adjunct during the primary survey when shock, hemorrhage, or thoracoabdominal injury is suspected. It may rapidly identify free intraperitoneal fluid, pericardial effusion, pneumothorax, or hemothorax[8]. However, data regarding its utility in hemodynamically stable pediatric trauma patients remain limited and controversial[11,14–16].

A large multicenter observational study demonstrated that FAST use increased with clinician suspicion of IAI and was associated with reduced CT utilization, particularly among patients with low to moderate suspicion of injury[17]. In contrast, other studies have questioned the clinical benefit of FAST in this setting. A randomized controlled trial found no significant reduction in CT utilization, emergency department length of stay, hospital costs, or missed injuries between patients evaluated with FAST and

those managed with standard care[17]. Furthermore, a 2021 meta-analysis reported limited diagnostic sensitivity for FAST in pediatric blunt abdominal trauma, with a pooled sensitivity of 35% and specificity of 96%, suggesting that FAST alone may not reliably rule out intra-abdominal injury[11]. Taken together, these findings illustrate the ongoing controversy regarding the role of FAST in hemodynamically stable pediatric trauma patients. In the present case, despite preserved hemodynamic stability and relatively reassuring abdominal examination findings, promptly performed FAST examination raised early suspicion of an occult abdominal or retroperitoneal injury and helped prioritize prompt CT imaging and appropriate monitoring. This observation supports the potential role of FAST as a rapid bedside, non-invasive adjunct in the initial evaluation of selected pediatric trauma patients.

Similarly, the second case highlights the important role of cardiac POCUS in the rapid identification of life-threatening cardiovascular pathology in pediatric emergency settings. The patient presented with progressive dyspnea, weight loss, and unilateral hypoventilation, without overt clinical signs suggestive of cardiac tamponade. Bedside POCUS rapidly identified both a large pleural effusion and a significant pericardial effusion, immediately orienting the diagnostic and prompting urgent echocardiographic confirmation and therapeutic pericardiocentesis. Previous pediatric case reports and small case series have similarly highlighted the utility of cardiac POCUS in the early recognition of pericardial effusion and tamponade physiology in emergency settings, particularly when classical clinical signs are absent or incomplete[18,19]. The role of cardiac POCUS in pediatric emergency medicine has expanded in recent years, particularly for the assessment of chest pain, dyspnea, tachycardia, shock, and pericardial effusion[5]. In children with acute respiratory or thoracic symptoms, chest radiography remains a used first-line imaging modality. However, it provides limited information on cardiac function or hemodynamic compromise and could delay diagnosis in time-critical conditions. In this context, cardiopulmonary POCUS can complement chest radiography, and in selected unstable or high-risk patients, may even precede it, by providing immediate bedside assessment of pleural fluid, pneumothorax, pericardial effusion, and ventricular function. Our case illustrates how POCUS redirected the initial diagnostic approach from a presumed isolated thoracic process to a life-threatening pericardial effusion requiring urgent drainage.

In a retrospective study including 1241 cardiac POCUS examinations performed in a pediatric emergency department, chest pain (52%), dyspnea (20%), and tachycardia (18%) were the most common indications for cardiac POCUS[20]. Compared with expert review, real-time cardiac POCUS interpretation achieved a sensitivity and specificity of 100% and 99.5%, respectively, for the detection of pericardial effusion and left ventricular systolic dysfunction[20]. Some studies have additionally demonstrated that trained non-cardiologist pediatric emergency physicians are able to evaluate left ventricular systolic function with reasonable diagnostic accuracy[21].

Beyond improving diagnostic facility, cardiac POCUS may permit earlier therapeutic interventions and reduce delays in care[21]. However, as with FAST, its diagnostic performance remains operator-dependent and should be interpreted alongside clinical examination and comprehensive imaging when necessary.

In contrast to FAST, the use of cardiac POCUS for the detection of significant pericardial effusion and major cardiac dysfunction appears to demonstrate higher diagnostic performance in pediatric emergency settings, although robust prospective pediatric data remain limited[21,20].

Together, these two cases illustrate how bedside POCUS may reveal severe underlying pathology despite non-specific clinical findings. In blunt abdominal trauma, FAST/eFAST may help identify occult abdominal or retroperitoneal injury and prioritize cross-sectional imaging, while in undifferentiated respiratory distress, cardiopulmonary POCUS may rapidly redirect the diagnostic approach toward life-threatening cardiovascular pathology Although POCUS should not replace comprehensive imaging or specialist evaluation, these observations support its growing role as an important adjunctive bedside tool in pediatric emergency medicine.

This report has several limitations, including the descriptive nature of a two-case series and the inability to generalize these findings to broader pediatric populations. Nevertheless, these cases illustrate the potential clinical impact of POCUS in selected pediatric emergency scenarios and highlight the need for further large-scale prospective studies to better define its optimal indications and impact on clinical outcomes in children.

Conclusion

The reportedcases highlight the clinical impact of POCUS in pediatric emergency care, to rapidly identify occult, potentially life-threatening pathology in children with initially non-specific or misleading clinical presentations, thereby expediting diagnostic orientation and appropriate management. In case of trauma, although the elevated BATiC score may support abdominal imaging, eFAST provides immediate bedside information in hemodynamically stable children or adolescent with non-alarming abdominal examination, potentially raising early suspicion of significant renal or retroperitoneal injury before CTfindings.. Lung and cardiac POCUS have shown their potential in redirecting the initial diagnostic by promptly revealing not only large pleural effusions, but also unexpected pericardial effusions requiring urgent drainage. In both cases, POCUS does not replace definitive imaging or specialist assessment. Rather, it provides essential bedside information that helps assess disease severity, accelerate diagnostic orientation, and facilitate timely appropriate care.

Abbreviations

AAST
American Association for the Surgery of Trauma
BATiC
Blunt Abdominal Trauma in Children
CT
computed tomography
EGIL

European Group for the Immunological Classification of Leukemias
eFAST
extended Focused Assessment with Sonography for Trauma
FAST
Focused Assessment with Sonography for Trauma
PET-CT
positron emission tomography–computed tomography
POCUS
point-of-care ultrasound
T-ALL/LBL
T-cell acute lymphoblastic leukemia/lymphoblastic lymphoma

Declarations

Ethics approval and consent to participate

This case report was conducted in accordance with the ethical principles of the Declaration of Helsinki and the ethical requirements of the University Hospitals of Geneva. Written informed consent to participate was obtained from the parents or legal guardians of both patients.

Consent for publication

Written informed consent for publication of the clinical details and clinical images was obtained from the parents or legal guardians of both patients.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

D.D. and A.S. conceived and drafted the manuscript. L.L. supervised the work, revised the manuscript, and approved the final version. I.M.D. and C.T. critically reviewed the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

Data sharing is not applicable to this article, as no datasets were generated or analysed during the current study. The clinical information presented in this case report is available from the corresponding author on reasonable request, subject to applicable privacy and confidentiality requirements.

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Figures

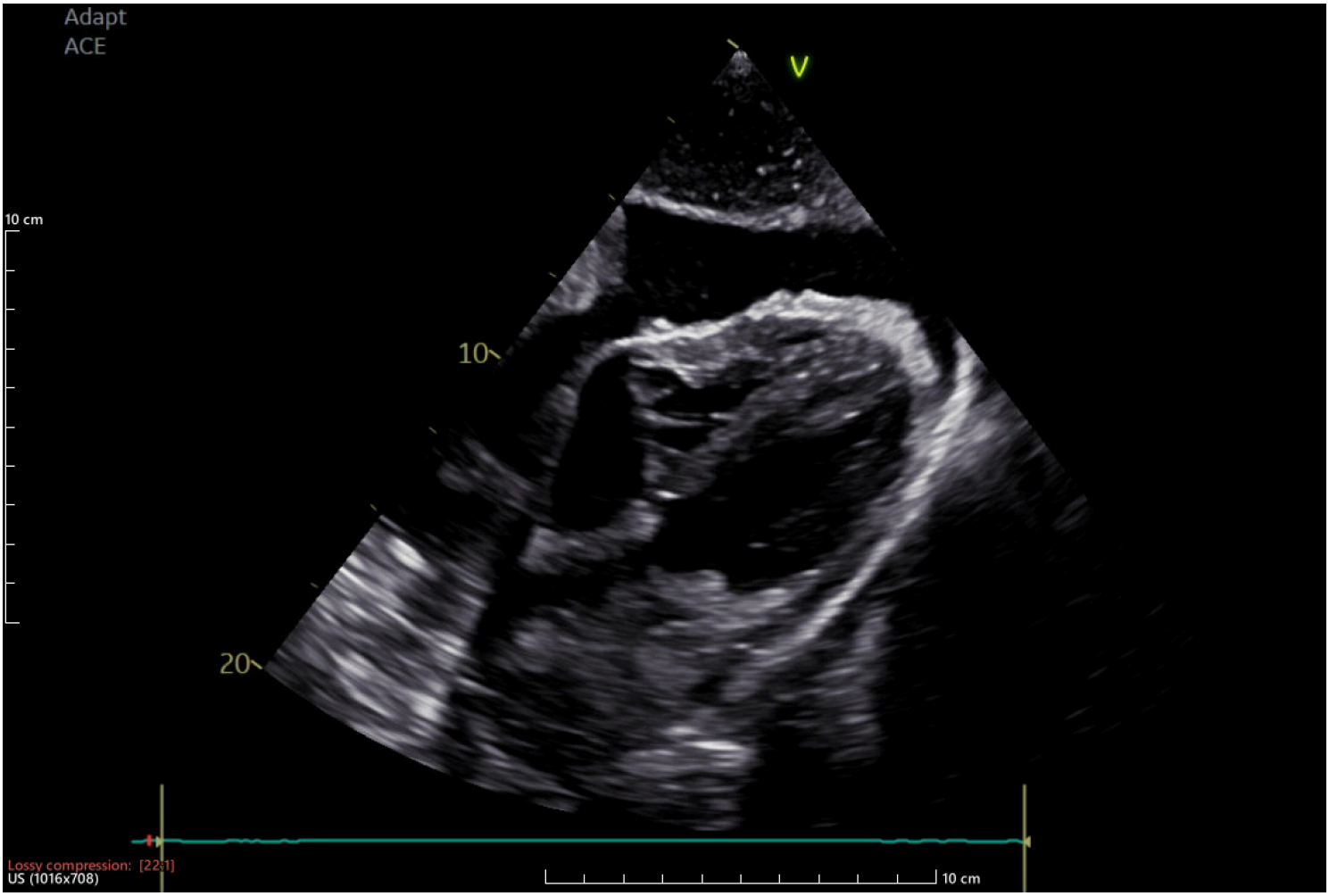


Figure 1

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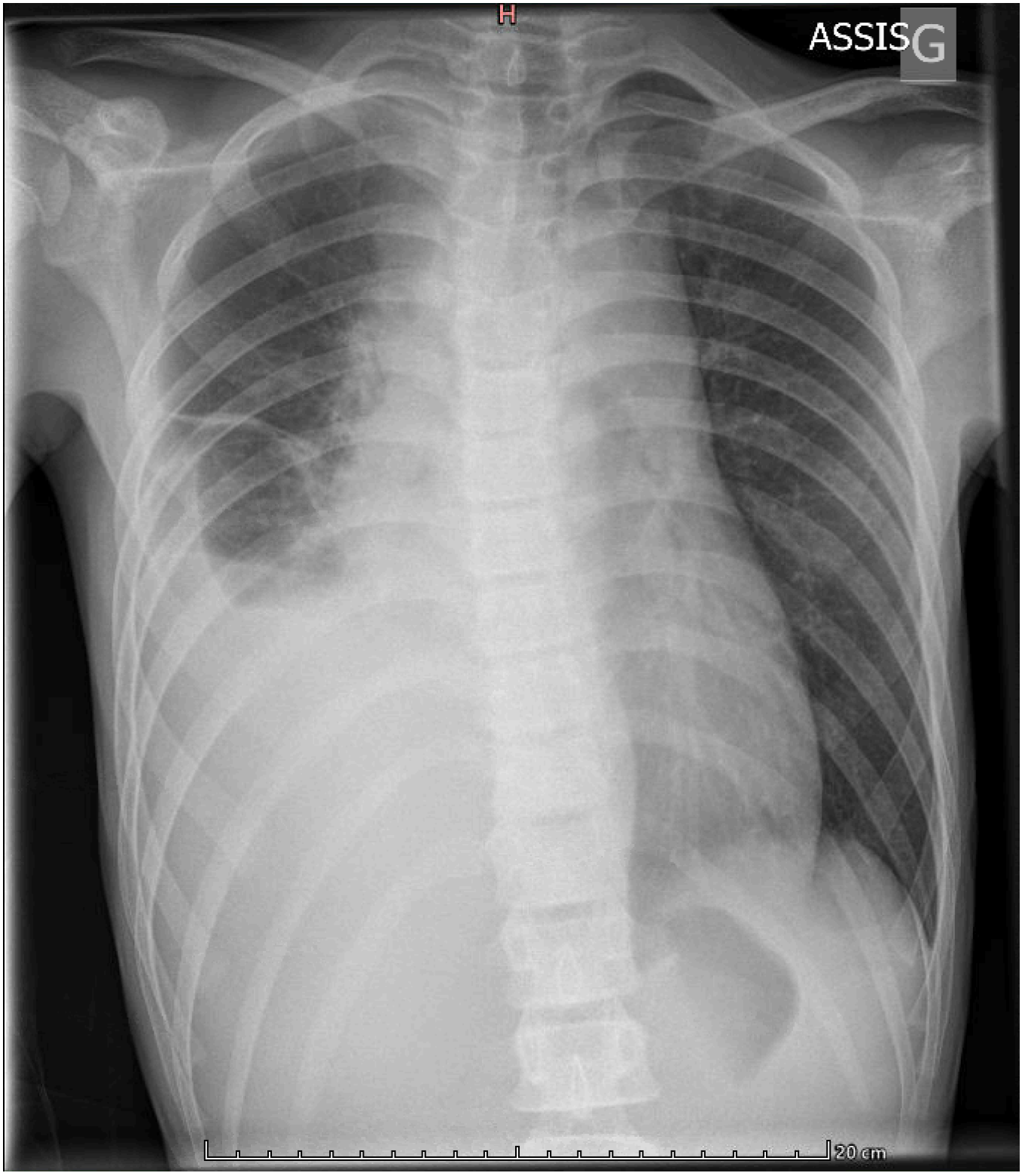


Figure 2

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