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EDITORIAL

Why Ultrasound May Ameliorate the Approach to Pneumonia in Children

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ABSTRACT

Community-acquired pneumonia (CAP) is the leading cause of worldwide mortality in children. In hospitalised patients, the suspicion of pneumonia has been traditionally confirmed through chest radiography. Nowadays, the use of lung ultrasound permits a new diagnostic approach based on sonographic visualization of lung consolidations: recent studies have shown an elevated accuracy of this technique in the diagnosis of children pneumonia. Since the presence of two valuable imaging techniques, we feel the need for a comparison in strengths and limitations between radiography and lung ultrasound in the diagnosis and follow-up of children with CAP.

Key words: Community-acquired Pneumonia (CAP); Lung Ultrasound; Sonography; Pediatric Infectious Disease

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EDITORIAL

Community-acquired pneumonia (CAP) represents the leading cause of worldwide mortality in children, and one of the most common serious pediatric infectious diseases in developed countries[1,2]. CAP can be defined clinically as the presence of signs and symptoms of pneumonia, such as fever and a raised respiratory rate, in a previously healthy child due to an infection which has been acquired outside hospital[3]. According to current guidelines, chest radiography (CXR) should not be routinely performed in an ambulatory setting, as it has not demonstrated to improve the outcome, and diagnosis is therefore frequently committed to clinical evaluation alone[3].

The use of chest radiography to confirm the suspicion of pneumonia is suggested only in hospitalized patients, and in a single frontal view, in order to3 spare the young patient unnecessary radiation exposure[3]. Despite the avoidance of the lateral projectionmay mask retrocardiac consolidations and pleural effusions, CXR is a fundamental test, of quick execution andwhich provides a panoramic view of the thoracic structures including lung and pleura, heart and vessels.

In the past decade, a new diagnostic approach, based on the sonographic visualization on lung consolidations, has been described. In 2008 Copetti and Cattarossi published the first study reporting the high accuracy of lung ultrasound in detecting CAP in children[4]. Afterwards, several research teams with different expertise in ultrasounds confirmed the reproducibility of these results on different cohorts ofinpatients[5-8] Recently, current evidences have been included in a meta-analysis which further confirmed the high accuracy of ultrasound in the diagnosis of children pneumonia[9] As it appears, pediatricians may now choose between two imaging techniques. The question is: which is the best?

Both arecharacterized by strengths and limitations. Ultrasound is a radiation free technique, an undoubted advantage in the pediatric

population in which serious concerns about radiation exposure have been raised[10]. In children, ultrasound is particularly suitable because of the thinner chest wall and small lung volumes. Moreover, the technique does not require a radiology service and may be performed by the caring physician, and, more extensively, employed in underserved regions or developing countries[11,12]. Regarding the weaknesses of ultrasound, it is reknown to be an operator-dependent exam, in opposition to traditional radiology. On the other hand, recent evidence has shown that CXR as well, is affected by low interpretation agreement between radiologistseven if the methods for interpretation are standardized[13-15]. Probably, the most important limitation of ultrasound is the fact that it assesses only the portion of the lung in direct contact with the pleura. Thus, despite the fact that pulmonary infiltrates that spare the pleura are relatively uncommon, there is the possibility of false negative tests[16].

Because of the characteristics depicted above, the choice between CXR and ultrasound should be made upon individual cases, and depending on availability and expertise.

Another important issue regarding CAP is the detection and management of the related complications, such as parapneumonic pleural effusion, empyema, lung abscess, pneumatoceles and necrotizing pneumonia. Current guidelines suggest the use of CXR in those cases in which a complication is suspected, reserving, for severe cases or non-resolving pneumonia,computed tomography (CT)[3]. Although it is the gold standard in chest imaging, CT has biological and economic costswhich restrict its use to selected cases[17]. It is well known that ultrasound is accurate in detecting pleural effusions, even if small or loculated, and empyema. The employment of ultrasound in the follow up of CAP could help avoid or detect complications at an early stage, thus modifying prognosis, therapies and related costs.

There are specific forms of CAP, such as necrotizing pneumonia, which should be suspected, confirmed and treated quickly. Necrotizing pneumonia is asevere infectionrelated to pathogens such as Staphylococcus aureus or Streptococcus pneumonia, in which necrotizing changes may occur causing a devitalization of lung tissue[18]. A recent study, assessinglung perfusion through color-Doppler, showed that ultrasound is accurate in diagnosing necrotizing pneumonia compared to computed tomography as gold standard[19]. Recognizing this dangerous conditionat an early stage is fundamental for therapeutic success, and a tight follow up could permit an in-depth understanding of its evolution.It mayalso provide an example of how the use of ultrasound may improve our understanding of the most severe cases, which remain affected by high mortality.

In the management of children pneumonia there are other unsolved research questions, such as the duration of antibiotic treatment and of hospitalization. These are complex issues related toseveral aspects, however it could be possible that information from real-time visualization of the evolution of the disease through ultrasound may provide insightsto better define timing of treatment.

In conclusion,current evidences suggest that lung ultrasound isa new reliable technique to diagnose pneumonia. Ultrasound and chest-x ray should be used according to clinical judgment and availability considering the intrinsic limitations of each technique. Ultrasound operators should be adequately trained, certified, and experienced.Further studies should assess if in children routine use of lung ultrasound may reduce diagnostic radiation exposure. Moreover, being ultrasound cheap and repeatable at the bedside, it could be employed for close follow-up of CAP in hospitalized patients. This approach may theoretically detect pneumonia-related complications at earlier stages of the disease and requires prospective studies.

CONFLICT OF INTERESTS

The authors declare that they do not have conflict of interests.

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