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WILL ULTRASOUND REVOLUTIONIZE THE DIAGNOSIS OF PNEUMONIA IN CHILDREN POPULATION?

Karol Wielgus¹  , **Maria Pawłowska**¹ ,
Piotr Bator² , **Adrian Bobrzyk**² ,
Angelika Wawryszuk³ , **Weronika Kamińska**² ,
Grzegorz Łyko² , **Maria Antos**³ ,
Krzysztof Rachwał² , **Jan Ramian**² 

¹Faculty of Medical Sciences in Zabrze, Medical University of Silesia, Katowice, Poland

²Faculty of Medical Sciences in Katowice, Medical University of Silesia, Katowice, Poland

³Collegium Medicum, Jan Kochanowski University, IX Wieków Kielc 19A, 25-317 Kielce, Poland



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 karol.wielgus23@gmail.com

ABSTRACT

Worldwide, pneumonia continues to be a major cause of morbidity and mortality in children. The effectiveness of ultrasonography and chest radiography (X-ray) in the diagnosis of pneumonia in pediatric patients is examined in this paper. Although chest radiography has been the norm for years, worries about radiation exposure have made ultrasonography seem like a viable substitute. This article assesses both modalities' diagnostic value and accuracy through a review of recent literature. As a potentially useful diagnostic tool, ultrasonography has advantages over chest X-rays, including accessibility, low radiation dose, and similar diagnostic efficacy. Ultrasound has a high negative predictive value, which indicates that it may be used to efficiently triage patients in emergencies. The decision between an X-ray and an ultrasound ultimately comes down to several variables, such as patient condition, physician skill, and equipment accessibility. However, considering ultrasound's safety record and diagnostic capabilities, it offers a strong substitute for diagnosing pneumonia in kids, in line with WHO guidelines to reduce radiation exposure in this susceptible group.

Keywords: ultrasound, pneumonia, pediatrics

INTRODUCTION

For almost two centuries, pneumonia has been known to be a frequent and potentially fatal inflammatory illness of the lung parenchyma. [1,2] The World Health Organization (WHO) indicates pneumonia is one of the leading causes of death among children under 5 years of age.

Pneumonia usually presents with characteristic symptoms and is not a diagnostic difficulty. Fever in combination with respiratory symptoms such as chills, cough, fever, sputum production, pleuritic chest discomfort, and dyspnea are suggestive of pneumonia. [1] Depending on the etiological factor, age etc., the clinical picture may be different.

Pneumonia can be widely categorized into nosocomial pneumonia (NP), nursing home-acquired pneumonia

(NHAP), or community-acquired pneumonia (CAP), which occurs during less than five days of hospitalization. [2]

The most frequently detected pathogen is *Streptococcus pneumoniae*, which exists in 30–40% of hospitalized individuals with community-acquired pneumonia. [2] Ten to twenty percent of all cases of pneumonia are caused by the "atypical agents," which include *Legionella*, *Mycoplasma*, and *Chlamydia pneumoniae*. [2] Ten percent of cases are caused by viruses; the most prevalent viruses are influenza and parainfluenza and adenovirus are less common. [2]

Chest radiography is typically required for the diagnosis of community-acquired pneumonia, along with specific laboratory studies to assess the severity of the illness and any coexisting illnesses, as well as microbiologic testing. [1]

Most CAP patients who receive appropriate antibiotic therapy have a straightforward course of treatment. However, a small minority of patients (<5%) may experience systemic complications such as bacteremia, pulmonary complications (e.g., vascular invasion with infarction, bronchopulmonary fistula, pleural adhesions), acute illness-related complications, and failure to respond to therapy. [2]

The purpose of our work is to assess these two methods in the diagnosis of lungs in children, taking into account the latest scientific research.

MATERIALS AND METHODS

To create this work, we used available resources from medical databases such as Pubmed and Google Scholar. In the first stage, we searched for articles on the issues we were interested in. Then we verified them in terms of content, conflict of interest and research methodology. As a result, we received a set of 14 articles with the highest impact factors. We selected the latest, multi-environmental articles including meta-analysis.

OVERVIEW OF THE STATE OF KNOWLEDGE

Characteristic clinical pictures and typical changes in physical examination enable the diagnosis of the disease without additional tests. However, sometimes nonspecific symptoms contribute to misdiagnosis or delayed diagnosis. This has a direct impact on the frequency of complications in patients. Therefore, we need a test that can be used on a large scale in the youngest children to facilitate correct and quick diagnosis.

CHEST RADIOGRAPHY (X-RAY)

Radiologists believe that imaging is necessary in cases of community-acquired pneumonia to confirm or rule out the illness, distinguish between bacterial and viral origins, exclude other potential causes for the symptoms, and identify any associated complications. These beliefs are commonly held despite research that shows radiographic results do not help distinguish between bacterial and viral causes. As a result, they have no impact on the decision to treat with antibiotics. Chest radiographs, however, can be useful in certain conditions to aid the diagnosis; for example, in cases of pyrexia with moderate respiratory symptoms. [3] It is necessary to reevaluate the significance of imaging with the growing accessibility and safety of modalities including computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound (USG). [4]

Children with signs and symptoms of pneumonia who are not admitted to a hospital should not get a chest radiograph, according to British Thoracic Society recommendations for community-acquired pneumonia in children. [5] Despite these recommendations, chest radiographs are frequently taken for suspected pneumonia in children. [6,7] It's crucial to keep in mind that practice guidelines for pediatric community-acquired pneumonia are intended to support healthcare professionals in making judgments regarding the best course of action in certain clinical situations. [8]

One argument against the systematic use of chest radiographs is the perceived radiation risk, which is based on outdated information. The very low dosage of ionising radiation provided by standard chest radiographs is between 0.01 and 0.02 mSv. [9] Such modest amounts are thought to pose a "nearly non-existent" risk. [10]

ULTRASONOGRAPHY (ULTRASOUND)

Ultrasonography is a non-invasive imaging technique that does not expose the patient to radiation. This is especially important in children who are more sensitive to radiation. Ultrasound is also more accessible and less expensive than X-ray, making it an attractive alternative to X-ray [12]. In the Emergency Department, ultrasonography is a quick and non-invasive technique that is regularly used. Bedside ultrasonography has been demonstrated in multiple studies to be useful in the diagnosis of pneumonia, pulmonary embolism,

cardiogenic pulmonary oedema, and pneumothorax. Currently, the primary factor in the bedside ultrasonography diagnosis of CAP is the detection of consolidation. However, CAP patients do not always have consolidation but may have interstitial pneumonia or diffuse pulmonary infiltrations. Ultrasonography may reveal additional abnormalities, such as isolated interstitial patterns, pleural-line abnormalities, and subpleural lesions, even in the absence of consolidation. For the diagnosis of CAP, lung ultrasonography is more sensitive and accurate than chest X-rays. [11]

COMPARISON OF ULTRASOUND AND X-RAY

Many acute respiratory infections seen in routine pediatric radiology practice are viral in origin and do not require antibiotic treatment. However, a chest X-ray is frequently taken to rule out bacterial pneumonia. It is important to look for alternative (non-ionizing) imaging modalities for diagnosis and performance to prevent the youngster from needless radiation exposure. The emergency room frequently has ultrasound equipment available, suggesting it is a potential substitute for X-rays. [13] In comparison to adults, children have a higher sensitivity to ionizing radiation exposure.[14]

One of the recent studies showed that on chest X-rays, 59 regions of consolidations were found, and on ultrasound imaging, 71. When ultrasound imaging was used instead of chest X-rays, far more lesions were seen. It found that ultrasound showed good diagnostic performance (98% sensitivity, 92% specificity) when compared to chest X-rays. The extremely high negative predictive value (99%) of ultrasound imaging is particularly significant since it suggests that ultrasound is a reliable method of ruling out pneumonia and may be helpful for triage in the emergency department.[13]

Compared to chest X-rays, ultrasound identified substantially more regions of consolidation, and the consolidations found only by ultrasound were noticeably smaller than those found by both methods.[13]

CONCLUSION

According to WHO recommendations, radiological examination is recommended only in special cases. Although traditionally, chest radiography (X-ray) is the standard in the diagnosis of the lungs, ultrasonography is becoming more important as an alternative.

It can reduce radiation exposure in this population by taking the place of X-rays in the process of excluding lung consolidation in youngsters, according to its high negative predictive value. [13]

Based on the available scientific studies, it can be concluded that both ultrasound and X-ray are effective in diagnosing pneumonia in children. The choice of method depends on many factors, such as the availability of equipment, the experience of the doctor, the condition of the patient, and many others. However, given the limitations of X-rays, such as exposure to radiation, ultrasound is an attractive alternative, especially in children.

AUTHOR CONTRIBUTIONS

KW, MP, PB: conceptualization, literature review, writing - original draft preparation; AB, AW, WK, GŁ, MA, KR, JR: literature review, writing - review and editing.

All authors have read and agreed to the published version of the manuscript.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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