Applications of Point of Care Ultrasound in Neonatal Respirology. Can it be First the Line Investigation in NICU

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Abstract

Ultrasonography of lungs in neonates has been on explosive interest since last decade and has emerged as noninvasive tool for youngest population to help in diagnosing without exposure to radiation but also for therapeutic bridge in treatment of various respiratory conditions of neonatal lungs. Neonatal lung ultrasound has shown its efficacy for early surfactant administration within 1 - 2 hours of life with respiratory distress syndrome. Lung ultrasound score has been developed and one modified LUS score has been introduced with better role. LUS is very effective in predicting need for surfactant, monitoring oxygen saturation and bronchopulmonary dysplasia in preterm babies. Need for mechanical ventilation and failure to extubate from mechanical ventilation can also be determined with LUS score.

Keywords: *Lung Ultrasound (LUS); RDS (Respiratory Distress Syndrome); Transient Tachypnea of New Born, Pneumothorax; Neonatal Intensive Care Unit (NICU); Surfactant*

Abbreviations

LUS: Lung Ultrasound; RDS: Respiratory Distress Syndrome; NICU: Neonatal Intensive Care Unit
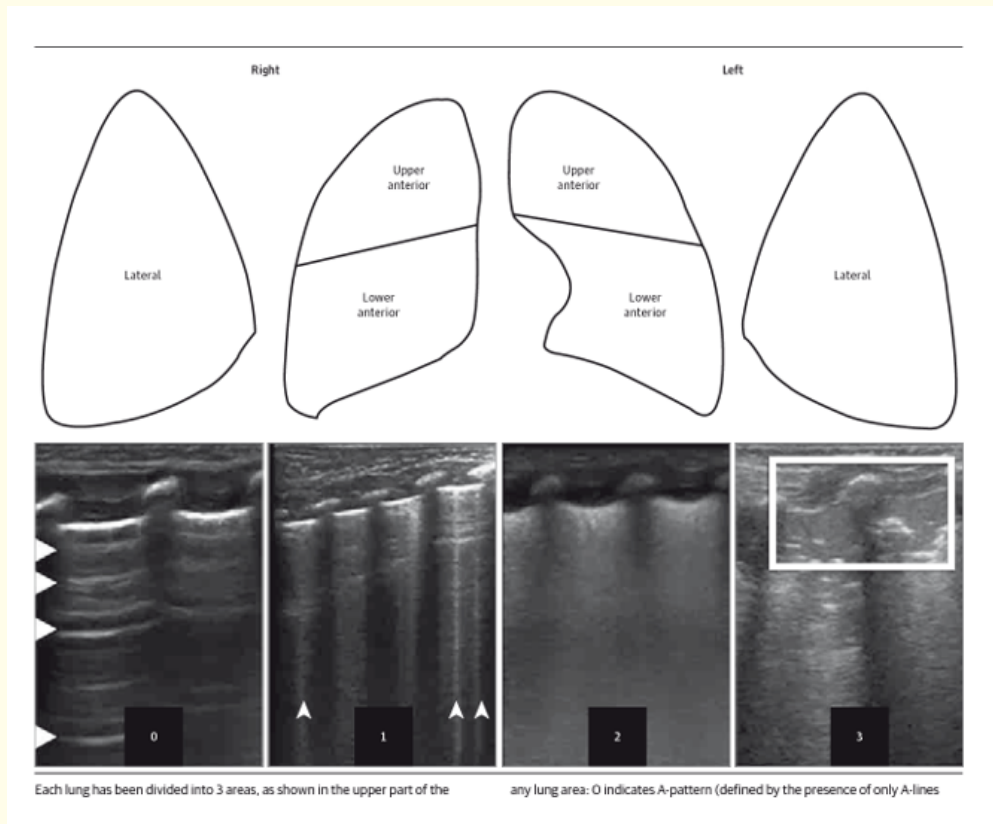
Introduction

Point of care ultrasound in neonates was described in 1960's which got immense interest over a decade in medicine especially neonatology, and its usefulness is increasing over time [1]. In the recent field of research the potential role of lung ultrasound in diagnosing pulmonary diseases has been established. Traditionally lungs have been considered unsuitable for ultrasonography due to presence of air and small anatomy of rib cage. However, recent studies have favored the use of lung ultrasound to be a valid alternative tool to chest X-ray to diagnose pulmonary diseases in neonates [2]. Respiratory distress syndrome is the most common morbidity in preterm babies and occurs either due to lack of adequate surfactant in lungs or lack of time to get enough maturation of lungs [3]. Lung ultrasound (LUS) has made possible to recognize patterns of normal aerated lungs and in contrast to the lungs having pathological pattern of interstitial or alveolar involvement [4]. Lung patterns can be described by bedside use of ultrasound by neonatologist as it is easier in neonates owing to small size and absence of excessive fat and musculature [5]. There are typical findings for neonatal respiratory distress syndrome [6], meconium aspiration syndrome [7], transient tachypnea of newborn [8] and pneumothorax [9] which can be compared to normal lung patterns defined.

Lung ultrasound score

Lung ultrasound score has been developed to assess severity of lungs involved. Lungs are divided into three zones, upper anterior, lower anterior and lateral. LUS score ranges from 0 - 18. Four patterns have been assigned depending upon the lung involvement. Spectrum of lung involvement is described as normal aerated lungs, an interstitial pattern, alveolar pattern and consolidation [6,8]. LUS score

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was assigned as 0 indicates A pattern, indicating A lines only, 1- Pattern B indicates 3 or more well space B lines, 2- Severe B pattern indicates coalescent B lines, with or without consolidation limited to sub pleural area, 3- Pattern indicates consolidation [4,10]. A modified lung ultrasound score has been introduced in neonates that used posterior pulmonary lung fields as compared to lateral lung fields and 5 grade rating scale instead of 4 [11].

Each lung has been divided into 3 areas, as shown in the upper part of the   any lung area: O indicates A-pattern (defined by the presence of only A-lines

Discussion

Various studies have shown the effectiveness of LUS score. Riamondi., *et al.* showed that several lung scores done on lungs are equivalent to simple one in neonates [5]. One study showed good correlation between oxygenation status in both preterm and term babies and need for surfactant administration in babies less than 34 weeks of gestation [12]. One study in 2018 showed LUS score ability to predict need of surfactant in extremely preterm babies [13]. Lung ultrasound during resuscitation has shown benefits to predict early surfactant administration in preterm babies [14]. Rodriguez-Fanjul, Javier., *et al.* a randomized control trial showed early surfactant replacement with use of ultrasound in preterm babies resulting in alternative tool for treating preterm babies with surfactant rather than using FiO_2 requirement criteria [15]. Along with prediction of early surfactant administration in preterm babies lung ultrasound has been shown to monitor and predict bronchopulmonary dysplasia in preterm babies a meta analysis has well demonstrated the usefulness of lung ultrasound to early predict bronchopulmonary dysplasia in preterm babies less than 32 weeks [16]. A recent study done in neonates introduced a modified lung ultrasound score which takes posterior lung fields rather than lateral lung areas and 5 grade rating scale. it

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emphasized better score weight with posterior lung fields in correlating oxygen saturation over fraction of inspired oxygen and predicting mode of respiratory support in pre term neonates with respiratory distress syndrome [11]. Lung ultrasound score has been found useful to determine failure of extubation from mechanical ventilation in preterm babies with respiratory distress [17].

Conclusion

Lung ultrasound has been found very effective tool in neonatal intensive care unit in diagnosing treating monitoring and predicting outcomes in neonates. This bedside investigation can be done by trained neonatologists and residents. However more studies needed to compare efficacy of lung ultrasound scores. Lung ultrasound in neonates can be the first line investigation in respiratory pathologies of new born babies both preterm and term.

Conflicts of Interest

There is no financial or non-financial interest with any organization in this manuscript.

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Authors Contribution

Concept, idea, processing and critical analysis and literature review.

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