CASE REPORT

Lung ultrasound-guided emergency pneumothorax needle aspiration in a very preterm infant

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SUMMARY

Pneumothorax is a frequent critical situation in the neonatal intensive care unit. Diagnosis relies on clinical judgement, transillumination and chest radiogram. We report the case of a very preterm infant suddenly developing significant and persistent desaturation and bradycardia. Re-intubation and cardiopulmonary resuscitation were performed. Clinical and cold light examination were not suggestive of pneumothorax according to two experienced neonatologists. A lung ultrasound scan showed evidence of right pneumothorax that was promptly aspirated. Approximately 20 min later, a chest radiogram confirmed the ultrasound diagnosis. Point-of-care lung ultrasound is a useful tool for detecting symptomatic pneumothorax and accelerating its treatment.

BACKGROUND

Pneumothorax is a common emergency in the neonatal intensive care unit (NICU) carrying an increased risk of intraventricular haemorrhage and death.¹ Diagnosis relies on clinical examination with transillumination and conventional chest X-ray (CXR). Recently, lung ultrasonography (LUS) has been used with success in an adult to diagnose pneumothorax.² Echographic diagnostic signs include absence of the rhythmic movement of the pleural leaflets (aka sliding sign) with underlying horizontal reverberations (aka A lines) and the detection of a transition point at the pneumothorax border where the sliding sign is present overlying

vertical laser-like reverberation artefacts also known as B lines. This transition area has been named 'lung point sign'.³ The combination of these signs yields a high diagnostic accuracy in adults.⁴ As the semeiology is believed to be the same across the age span, we report the case of an extremely low-birthweight (ELBW) neonate where the ultrasound diagnosis of pneumothorax preluded to lifesaving aspiration.

CASE PRESENTATION

An infant was delivered at 26 weeks with a birth weight of 680 g by an emergency C-section for maternal hypertension. Apgar scores were 7 at 1' and 8 at 5'. The baby was intubated in the operating room, stabilised and transferred to the NICU. There, she was connected to a ventilator, an umbilical line was placed and the baby was assisted in an isolette according to the NICU protocols. She received two doses of surfactant and enteral nutrition was started on the second day. On day six of life, while she was assisted with synchronised intermittent mandatory ventilation (with peak inspiratory pressure=20 cm/H₂O and positive end-expiratory pressure=4 cm/H₂O), she suddenly showed a significant desaturation with bradycardia. Her oxygen requirement rapidly rose from 0.3 to 0.8 and then to 1.

INVESTIGATIONS

Two experienced neonatologists promptly evaluated the baby and despite the air flow being perceived bilaterally, a new 2.5 mm endotracheal tube was

Figure 1 Ultrasound scan of the right lung showing the lung point (vertical arrows), that is, the transition from the vertical hyperechoic area to a hypoechoic area with horizontal reverberations of the pleura, also known as A lines (horizontal arrows), in mid-lung fields.

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Video 1 Ultrasound scan of the right lung clearly showing a normally sliding pleura overlying a diffusely hyperechogenic parenchyma in the upper lung fields. Bordering mid-lung fields, an abrupt passage to a still pleura on a hypoechoic area with horizontal reverberations of the pleura, also known as A lines, demonstrates the presence of pneumothorax.

inserted. The infant appeared severely hypotonic and in distress. The room lights were dimmed but the chest examination with cold light failed to detect an air leak syndrome. Manual ventilation was started with chest compressions. Epinephrine 1:10 000 0.3 mL was administered intravenously. Ultrasound scan of the right lung clearly demonstrated a still pleura overlying A lines in mid-lung fields (figure 1 and video 1). Upper pulmonary fields showed a normal pleural sliding with a clearly visible lung point sign.

TREATMENT

Emergency chest needling was quickly performed at the right mid-clavicular level.

OUTCOME AND FOLLOW-UP

Oxygen saturation rapidly rose to 100% together with the heart rate and FiO₂ was progressively lowered to 0.4. A supine antero-posterior chest X-ray confirmed, 20 min later, the presence of a residual, non-hypertensive right pneumothorax that was left untreated.

DISCUSSION

Bhatia *et al*¹ recently reported a 9.2% pneumothorax incidence in the first 3 days of life with 43% mortality among infants below 28 weeks of gestation. Pneumothoraces were diagnosed clinically (with transillumination) or on CXR. Indeed, transilluminating the neonatal chest became popular in the 1960s when the survival of ELBW babies was anecdotal; however, the diagnostic accuracy of transillumination has never been properly assessed to date. In our case, two experienced neonatologists gave a falsely negative evaluation at cold light examination. Although LUS has been shown to outperform CXR in the diagnosis of adult pneumothorax,² not much is known of its performance in the paediatric and neonatal age group. In the latter, LUS has shown reliability in different settings.^{5–8} A recent retrospective series reported as conference proceedings also confirmed a high LUS sensitivity for neonatal pneumothorax.⁹ Liu *et al*¹⁰ reported an ultrasound diagnosis of pneumothorax in a premature infant of unspecified gestational age and clinical characteristics. However, they describe a rather accidental finding as an extension of an abdominal scan in a presumably

stable patient. Our case affirms the previously undisclosed potential of LUS to detect a life-threatening condition in its decompensated form and to accelerate its treatment in the preterm neonate. Rapidity and lack of radiation exposure are clear advantages of LUS over CXR. Prospective comparative studies are warranted to establish priorities in this area of emergency diagnosis of a fragile patient population.

Learning points

- In the adult, lung ultrasound performs better in diagnosing pneumothorax (sensitivity=98.1%; specificity=99.2%)² than the conventional radiogram (sensitivity=75.5%; specificity=100%)².
- Point of care lung ultrasound is faster and radiation free compared to conventional radiology.
- Lung ultrasound may become a necessary tool in the diagnosis of neonatal hypertensive pneumothorax.

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Competing interests None.

Patient consent Obtained.

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