Pneumothorax in Newborns: Needle, Less Damage Done?

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The association between pneumothorax – a collection of air in the pleural space – and respiratory distress was described almost 200 years ago. Pneumothorax may itself be the primary cause or may occur as a consequence of other causes of respiratory distress. Distressingly, it may also be a consequence of treatment given for respiratory distress. It may present in acutely, sometimes critically, ill patients, and merit such urgent treatment that students are told that the chest X-ray (CXR) showing a tension pneumothorax is “the film that should never be seen”. Treatment options include watchful waiting for spontaneous resolution, aspiration of air through a needle temporarily inserted between the ribs (needle aspiration), and insertion of a catheter between the ribs that is left in situ for continued drainage (chest drain). Needle aspiration is recommended by the British Thoracic Society as the first line treatment of symptomatic spontaneous pneumothorax in adults.1

Like respiratory distress, pneumothoraces occur more frequently in the newborn period than at any other time of life. Risk factors include respiratory distress syndrome, meconium aspiration, pulmonary hypoplasia and elective caesarean section delivery. There is little consensus as to how pneumothorax in newborns should be treated, reflecting a lack of evidence from clinical trials. Much of the literature on pneumothoraces in newborns comes from observational and retrospective studies.2 3 Though disappointing, it’s perhaps unsurprising; it’s difficult to prospectively obtain consent to study emergency treatments, particularly when the population of interest are vulnerable and can’t consent for themselves. A Cochrane review of needle aspiration versus chest drain insertion for pneumothorax in newborn infants concluded that there was a need for randomised controlled trials comparing these two techniques to guide the management of pneumothorax in newborns.4

Newborns with mild clinical signs of respiratory distress that have a pneumothorax diagnosed on CXR are most often managed expectantly. When clinicians wish to drain a pneumothorax, the major concern with needle aspiration is that it may not provide definitive treatment, and that chest drain insertion will be needed and therefore delayed. Chest drains used in newborns are of either a trochar-type or a “pigtail” catheter inserted using the Seldinger technique. Complications have been reported with both. Injuries to thoracic organs have been reported with insertion of pigtail and trochar drains5 and breast deformities in adolescence have been reported as a result of trochar drains sited in infancy.6 While
many practitioners favour immediate insertion of a chest drain, for infants receiving respiratory support in particular, it is possible to manage a select group of neonates with pneumothorax expectantly.  

We wished to compare the effect of needle aspiration and chest drain insertion, both well accepted and widely-used treatments for pneumothorax in newborns. With the help of colleagues at five European centres (Dublin, Copenhagen, Stockholm, Milan, Padova), and without any specific funding, we enrolled 70 newborn infants to the NORD (Needle or Drain) trial. As the urgent need for treatment makes it extremely difficult to prospectively obtain consent to participate in a trial, the ethics committees at all participating sites approved enrolling babies using a ‘deferred consent’ process, whereby babies were enrolled and consent was then sought from parent(s)/guardian(s) as soon as possible after entry for their permission to use their infant’s information. The babies were receiving respiratory support (endotracheal ventilation, continuous positive airway pressure, or supplemental oxygen > 40%) and had a pneumothorax diagnosed on CXR that the treating clinicians wished to drain. They were randomly assigned to needle aspiration or chest drain insertion. We could not mask the intervention. Needle aspiration dramatically reduced the rate of chest drain insertion within 6 hours of diagnosis and during hospitalisation. Of the infants randomly assigned to needle aspiration, 55% had a drain inserted within 6 hours of diagnosis, and 70% during hospitalisation.

Our approach to looking after newborns has evolved over time – we aim to adopt a ‘hands-off’ approach while caring for even the most immature infants. While this has led to improved outcomes for newborns worldwide, trainees are not gaining the exposure to procedures – e.g. endotracheal intubation, chest drain insertion – that they had in the past. Treatment for pneumothoraces often occurs as an emergency. Simple measures such as performing a ‘time-out’ approach prior to drainage, similar to that of a surgical procedure, can help to reduce unwanted errors. This may help to ensure that the correct side of the chest is being drained on the correct patient at the correct time. The results of our study show that needle aspiration can be used as the initial management of draining a radiologically confirmed pneumothorax in a symptomatic newborn. Needle aspiration can be performed easily and quickly. It is less technically challenging than chest drain insertion and associated with fewer reported complications. Though many would agree that a finding that results in fewer infants having chest drains inserted is a good thing, we must be cognisant of the effect that this, and other studies supporting a less invasive management approach, may have on procedural experience.

We hope that our study brings some clarity to the treatment of symptomatic pneumothoraces in newborns. Many questions remain. Our study was not designed to address which type of needle (butterfly or venous catheter) or chest drain (both pigtail catheters and trochars were used) to use when draining a pneumothorax. Also, we found a strong association between ventilation and chest drain insertion. Babies who were ventilated at study entry were very likely to end up with a chest drain; and babies who were not ventilated at study entry and were randomly assigned to chest drain insertion
were very likely to be ventilated. It is difficult to decipher how these factors influenced each other in this unmasked study. We recommend that future studies of pneumothorax treatment in newborns stratify infants according to whether or not they are ventilated at the time of diagnosis.

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**References**