the absence of published data specifically relating to serotype distribution of pneumococcal pneumonia for children, this is the only up-to-date national reference source available spanning our study time frame.[2 3] It provides data on pneumococcal serotype distribution for cases of invasive pneumococcal disease for 2000/1 to 2005/6 and shows the most common serotypes present prior to the introduction of PCV7, which was relevant to our study.

We agree that it is not possible to determine fully the exact aetiology of pneumonia from an HES diagnosis, although we have made every attempt to do so. However, we do think the trends in diagnosed pneumonia following the introduction of PCV7 remain of interest.

Elizabeth Koshy,[1] Joanna Murray,[1] Alex Bottle,[1] Mike Sharland,[2] Sonia Saxena[1]

[1]Department of Primary Care and Public Health, Imperial College London, London, UK; [2]Paediatric Infectious Diseases Unit, St George's Hospital NHS Trust, London, UK

Correspondence to Dr Elizabeth Koshy, Department of Primary Care and Public Health, Imperial College London, Charing Cross Campus, 3rd Floor, Reynolds Building, St Dunstan's Road, London W6 8RP, UK; e.koshy@ic.ac.uk

Competing interests None.

Provenance and peer review Not commissioned; not externally peer reviewed.

Accepted 8 November 2010
Published Online First 2 December 2010

Thorax 2011;**66**:827–828.
doi:10.1136/thx.2010.154914

REFERENCES

1. **British Thoracic Society Standards of Care Committee**. Guidelines for the management of community acquired pneumonia in childhood. British Thoracic Society Standards of Care Committee. *Thorax* 2002;**57**(Suppl 1):i1–24.
2. **Health Protection Agency**. *Invasive Pneumococcal Disease (IPD) in England and Wales after 7-Valent Conjugate Vaccine (PCV7); Potential Impact of 10 and 13-Valent Vaccines*. http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1245581527892 (accessed Nov 2010).
3. **Health Protection Agency**. *Pneumococcal Serotype Distribution For Samples Referred For Serotyping Epidemiological Years (July–June): 2000/1–2005/6*. http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/Pneumococcal/EpidemiologicalDataPneumococcal/BackgroundEpidemiologyPneumococcal/IPDTables/pneumoPneumococcalSerotypeDistribution/ (accessed Nov 2010).

Ultrasound performs better than radiographs

We applaud the British Thoracic Society (BTS) for its efforts to improve patient care through scientific evidence. We thus recognise the recent guidelines on pleural procedures and thoracic ultrasound (TUS) as an important attempt to develop a rational approach to chest sonography.[1] However, we are concerned that the BTS has reached conclusions based on a less complete review of TUS.

The guidelines state that 'the utility of thoracic ultrasound for diagnosing a pneumothorax is limited in hospital practice due to the ready availability of chest x-rays (CXR) and conflicting data from published reports'.[1] This conclusion appears to be based on a small (but landmark) study of 11 patients from 1986 to 1989, two small studies with only four pneumothoraces in one and another small series whose ultrasounds were retrospectively reviewed. Against these small and somewhat dated studies, a large number of recent investigations support a quite different conclusion.

Many well-performed retrospective reviews and a number of prospective studies have compared TUS to chest radiographs (CXR) in the detection of pneumothoraces using CXR as the criterion standard. Noting the limitations of CXR in detecting pneumothoraces, we feel that only prospective studies utilising CT as the reference criterion are valid to assess the relative merits of ultrasound versus radiography. Although methodology and populations have varied, at least nine comparative trials, conducted in the last decade, have noted a higher sensitivity for TUS than CXR in the detection of pneumothorax. While the widely reported sensitivities (49%–100%) for TUS detection of pneumothoraces has not been explained, a more important point is that, in each of these studies, the sensitivity of TUS was significantly higher than CXR. Sonographic specificities were not significantly different from those of CXR, ranging from 94% to 100%. Furthermore, in the studies where it is reported, the likelihood ratios have ranged from 36 to 153.[2–4] Since a typical benchmark of a useful test is one that can generate positive likelihood ratios of greater than 10, these test characteristics have persuaded many, including the authors of two systematic reviews, that TUS is a more accurate test than supine anteroposterior CXR for the detection of pneumothorax. Finally, we would also like to take issue with the assumptions underlying the phrase 'ready availability of chest x-rays'. For many critical care and emergency department patients with sudden unexplained dyspnoea, the delay involved in obtaining a 'stat' portable CXR can be lethal. For such patients, bedside TUS may allow for rapid initiation of life-saving interventions.

We are keenly aware that TUS has pitfalls, and that its use requires due caution by properly trained sonologists. However, recognising that guidelines are living documents reflecting best evidence,[5] we respectfully submit that the BTS guidelines in question are thus somewhat incomplete. In our view, after further review and consensus development according to the GRADE criteria, data reported from the 21st century, far from being conflicted, provide strong and consistent evidence regarding the superiority of sonography over CXR in the diagnosis of pneumothorax (see online supplement).

The World Interactive Network Focused on Critical Ultrasound (WINFOCUS) International Liaison Committee on Pleural and Lung Ultrasound (ILCPLUS) is constituted by experts in pleural and lung ultrasound and clinical epidemiology experts in the process of evidence assessment, including GRADE and RAND Appropriateness Methodologies for the development of evidence-based clinical recommendations and consensus statements.

Eustachio Agricola,[1] Charlotte Arbelot,[2] Michael Blaivas,[3] Belaid Bouhemad,[2] Roberto Copetti,[4] Anthony Dean,[5] Scott Dulchavsky,[6] Mahmoud Elbarbary,[7] Luna Gargani,[8] Richard Hoppmann,[9] Andrew W Kirkpatrick,[10] Daniel Lichtenstein,[11] Andrew Liteplo,[12] Gebhard Mathis,[13] Lawrence Melniker,[14] Luca Neri,[15] Vicki E Noble,[12] Tomislav Petrovic,[16] Angelika Reissig,[17] Jean Jacques Rouby,[2] Armin Seibel,[18] Gino Soldati,[19] Enrico Storti,[15] James W Tsung,[20] Gabriele Via,[21] Giovanni Volpicelli[22]

[1]San Raffaele Hospital, Milan, Italy; [2]Pitie Salpetriere Hospital, Pierre et Marie Curie University-Paris 6, France; [3]Northside Hospital Forsyth, Cumming, Georgia, USA; [4]Fondazione IRCCS Policlinico San Matteo, Pavia, Italy; [5]University of Pennsylvania, Philedelphia, Pennsylvania, USA; [6]Henry Ford Hospital, Detroit, Michigan, USA; [7]King Saud University for Health Sciences, Riyadh, Saudi Arabia; [8]National Council of Research, Pisa, Italy; [9]University of South Carolina, Columbia, South Carolina, USA; [10]Regional Trauma Services, University of Calgary, Calgary, Alberta, Canada; [11]Paris-Ouest University, Paris, France; [12]Massachusetts General Hospital, Boston, Massachusetts, USA; [13]University of Innsbruck, Rankweil, Austria; [14]New York Methodist Hospital, Brooklyn, New York, USA; [15]Ospedale Niguarda Ca' Granda, Milan, Italy; [16]University PARIS XIII, Paris, France; [17]Friedrich Schiller University, Jena, Germany; [18]Diakonie Klinikum Jung-Stilling, Germany; [19]Valle del Serchio General Hospital, Lucca, Italy; [20]Mount Sinai Medical Center, New York, New York, USA; [21]Fondazione IRCCS Policlinico San Matteo, Pavia, Policlinico San Matteo, Pavia, Italy; [22]San Luigi Gonzaga University Hospital, Torino, Italy

Correspondence to Andrew W Kirkpatrick, Regional Trauma Services, Foothills Medical Centre, 1403 29 St NW, Calgary, Alberta, T2N 2T9, Canada; andrew.kirkpatrick@albertahealthservices.ca

► Additional materials are published online only. To view these files please visit the journal online (http://thorax.bmj.com).

Competing interests This letter is being written on behalf of the WINFOCUS International Liaison Committee on Pleural and Lung Ultrasound (ILCPLUS). The goal of this group is to promote the use of point of care ultrasound although none of the members has any specific financial conflicts.

Provenance and peer review Not commissioned; not externally peer reviewed.

Accepted 13 November 2010
Published Online First 30 December 2010

Thorax 2011;**66**:828–829.
doi:10.1136/thx.2010.153239

REFERENCES

1. **Havelock T,** Teoh R, Laws D, *et al*. Pleural procedures and thoracic ultrasound: British Thoracic Society pleural disease guideline 2010. *Thorax* 2010;**65** (Suppl 2):ii61–76.
2. **Kirkpatrick AW,** Sirois M, Laupland KB, *et al*. Hand-held thoracic sonography for detecting post-traumatic pneumothoraces: the Extended Focused Assessment with Sonography for Trauma (EFAST). *J Trauma* 2004;**57**:288–95.
3. **Soldati G,** Testa A, Sher S, *et al*. Occult traumatic pneumothorax: diagnostic accuracy of lung ultrasonography in the emergency department. *Chest* 2008;**133**:204–11.
4. **Soldati G,** Testa A, Pignataro G, *et al*. The ultrasonographic deep sulcus sign in traumatic pneumothorax. *Ultrasound Med Biol* 2006;**32**:1157–63.
5. **Elbarbary M,** Melniker L, Volpicelli G. Development of evidence based clinical recommendations and consensus statements in the critical ultrasound field: why and how? *Crit Ultrasound J* 2010;**2**(3):93–5.

Authors' response

We thank Agricola and colleagues[1] for their compliments on our guideline[2] and their contribution to the discussion on the role of ultrasound in the detection of pneumothorax, but we maintain that the medical community should proceed with caution when using ultrasound in the detection and management of pneumothoraces. If the reviews[3–7] referenced are not considered (5 papers), 13 of the remaining 24 papers referenced are in two well-defined patient groups—trauma[8–16] and post-intervention.[17–20] None of the papers published prospectively demonstrated improved outcomes and management change using ultrasound in comparison with chest x-ray (CXR), and perhaps more significantly only one prospective blinded study in medical patients with varying degrees of respiratory compromise has been reported and this demonstrated an unacceptably high false positive rate.[21]

We maintain that ultrasound is limited in its usefulness in the assessment of cases of spontaneous pneumothorax and following pleural procedures particularly in settings outside critical care. Many of these patients have underlying lung disease, particularly chronic obstructive pulmonary disease, which reduces the accuracy of pneumothorax detection by ultrasound.[21] If a pneumothorax is detected by ultrasound, a CXR is usually required to assess its size (unless a CT scan is then performed). If the pneumothorax is so small as to be undetectable on CXR, then it is unlikely to require intervention and the use of ultrasound will not have changed the management.

We acknowledge that in the assessment of a supine patient thoracic ultrasound performed by a skilled operator may detect even small pneumothoraces (and effusions) and that if these patients require positive pressure ventilation detecting even a small amount of pleural air may be relevant. Even so, in this group, caution is needed because, as shown in the prospective study by Goodman *et al*[18] using CT as the gold standard, small pneumothoraces may fail to be detected. The CXR is undoubtedly unreliable in the detection of small pneumothoraces in the supine patient[22] and in specific clinical circumstances, as suggested by Agricola *et al*, ultrasound may be of value. This being the case, we agree that if a suitably skilled operator and ultrasound equipment are available at the patient's bedside then ultrasound may provide useful diagnostic information, but we maintain that it is unlikely to obviate the need for a formal CXR.

We are surprised that the authors experienced significant delays in obtaining 'stat' portable CXRs in their critical care and emergency departments and that patients may have died as a consequence. Clinicians managing critically ill trauma patients require rapid access to portable CXRs and all institutions managing such patients should be able to deliver this.

In conclusion, we agree that in supine and trauma patients ultrasound may be a valuable tool in the detection of pneumothorax. In these patients, ultrasound may have increased sensitivity compared with a CXR, although difficulty with pneumothorax quantification suggests that ultrasound is unlikely to completely replace the need for a radiograph. In the majority of cases of spontaneous or postprocedure pneumothorax, ultrasound is unlikely to provide additional benefit over the combination of CXR and clinical judgement when deciding management.

Tom Havelock,[1] Richard Teoh,[2] Diane Laws,[3] Nick Maskell,[4] Fergus Gleeson[5]

[1]Wellcome Trust Clinical Research Facility, Southampton General Hospital, Southampton, UK; [2]Department of Respiratory Medicine, Castle Hill Hospital, Cottingham, East Yorkshire, UK; [3]Department of Thoracic Medicine, Royal Bournemouth Hospital, Bournemouth, UK; [4]Department of Clinical Sciences, Southmead Hospital, University of Bristol, Bristol, UK; [5]Department of Radiology, Churchill Hospital, Oxford, UK

Correspondence to Dr Tom Havelock, Wellcome Trust Clinical Research Facility, Southampton General Hospital, Tremona Road, Southampton. SO16 6YD, UK; t.havelock@soton.ac.uk

Competing interests None.

Provenance and peer review Not commissioned; not externally peer reviewed.

Accepted 30 November 2010
Published Online First 30 December 2010

Thorax 2011;**66**:829. doi:10.1136/thx.2010.156398

REFERENCES

1. **Agricola E,** Arbelot C, Blaivas M, *et al*. Ultrasound performs better than radiographs. *Thorax* 2011;**66**:828–9.
2. **Havelock T,** Teoh R, Laws D, *et al*. Pleural procedures and thoracic ultrasound: British Thoracic Society Pleural Disease Guideline 2010. *Thorax* 2010;**65**(Suppl 2):ii61–76.
3. **Ball CG,** Hameed SM, Evans D, *et al*. Occult pneumothorax in the mechanically ventilated trauma patient. *Can J Surg* 2003;**46**:373–9.
4. **Ball CG,** Kirkpatrick AW, Feliciano DV. The occult pneumothorax: what have we learned? *Can J Surg* 2009;**52**:E173–9.
5. **Wilkerson RG,** Stone MB. Sensitivity of bedside ultrasound and supine anteroposterior chest radiographs for the identification of pneumothorax after blunt trauma. *Acad Emerg Med* 2010;**17**:11–17.
6. **Alsalim W,** Lewis D. Towards evidence based emergency medicine: best BETs from the Manchester Royal Infirmary. BET 1: Is ultrasound or chest x ray best for the diagnosis of pneumothorax in the emergency department? *Emerg Med J* 2009;**26**:434–5.
7. **Elbarbary M,** Melneiker L, Volpicelli G. Development of evidence based clinical recommendations and consensus statements in the critical ultrasound field: why and how? *Crit Ultrasound J* 2010;**2**(3):93–5.
8. **Zhang M,** Liu ZH, Yang JX, *et al*. Rapid detection of pneumothorax by ultrasonography in patients with multiple trauma. *Crit Care* 2006;**10**:R112.
9. **Blaivas M,** Lyon M, Duggal S. A prospective comparison of supine chest radiography and bedside ultrasound for the diagnosis of traumatic pneumothorax. *Acad Emerg Med* 2005;**12**:844–9.
10. **Kirkpatrick AW,** Sirois M, Laupland KB, *et al*. Hand-held thoracic sonography for detecting post-traumatic pneumothoraces: the Extended Focused Assessment with Sonography for Trauma (EFAST). *J Trauma* 2004;**57**:288–95.
11. **Knudtson JL,** Dort JM, Helmer SD, *et al*. Surgeon-performed ultrasound for pneumothorax in the trauma suite. *J Trauma* 2004;**56**:527–30.
12. **Dulchavsky SA,** Schwarz KL, Kirkpatrick AW, *et al*. Prospective evaluation of thoracic ultrasound in the detection of pneumothorax. *J Trauma* 2001;**50**:201–5.
13. **Ball CG,** Kirkpatrick AW, Laupland KB, *et al*. Incidence, risk factors, and outcomes for occult pneumothoraces in victims of major trauma. *J Trauma* 2005;**59**:917–24; discussion 24–5.
14. **Rowan KR,** Kirkpatrick AW, Liu D, *et al*. Traumatic pneumothorax detection with thoracic US: correlation with chest radiography and CT—initial experience. *Radiology* 2002;**225**:210–14.
15. **Soldati G,** Testa A, Pignataro G, *et al*. The ultrasonographic deep sulcus sign in traumatic pneumothorax. *Ultrasound Med Biol* 2006;**32**:1157–63.
16. **Soldati G,** Testa A, Sher S, *et al*. Occult traumatic pneumothorax: diagnostic accuracy of lung ultrasonography in the emergency department. *Chest* 2008;**133**:204–11.
17. **Reissig A,** Kroegel C. Accuracy of transthoracic sonography in excluding post-interventional pneumothorax and hydropneumothorax. Comparison to chest radiography. *Eur J Radiol* 2005;**53**:463–70.
18. **Goodman TR,** Traill ZC, Phillips AJ, *et al*. Ultrasound detection of pneumothorax. *Clin Radiol* 1999;**54**:736–9.
19. **Chung MJ,** Goo JM, Im JG, *et al*. Value of high-resolution ultrasound in detecting a pneumothorax. *Eur Radiol* 2005;**15**:930–5.
20. **Sartori S,** Tombesi P, Trevisani L, *et al*. Accuracy of transthoracic sonography in detection of pneumothorax after sonographically guided lung biopsy: prospective comparison with chest radiography. *AJR Am J Roentgenol* 2007;**188**:37–41.
21. **Slater A,** Goodwin M, Anderson KE, *et al*. COPD can mimic the appearance of pneumothorax on thoracic ultrasound. *Chest* 2006;**129**:545–50.
22. **Tocino IM,** Miller MH, Fairfax WR. Distribution of pneumothorax in the supine and semirecumbent critically ill adult. *AJR Am J Roentgenol* 1985;**144**:901–5.