USE OF THORACIC ULTRASOUND AMONG RESPIRATORY PHYSICIANS IN NIGERIA: RESULTS FROM A PRELIMINARY SURVEY

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ABSTRACT:

Introduction: Pleural diseases are common causes of respiratory morbidity and mortality. Globally, the use of thoracic ultrasound is gaining prominent role in the evaluation of pleural diseases either for diagnostic or therapeutic purposes. It is increasingly becoming part of many thoracic society guidelines to perform thoracic ultrasound before carrying out any pleural procedure. There is however paucity of data on training, accessibility and use of thoracic ultrasound in diagnosing and locating pleural diseases and its complications in developing countries.

Aim: To assess the knowledge, use and availability of thoracic ultrasound among Respiratory Physicians in Nigeria.

Methodology: We conducted a survey to assess the knowledge, availability and use of thoracic ultrasound among respiratory physicians in Nigeria using SurveyMonkey.

Result: Of the 57 respondents, only 12.3% had access to thoracic ultrasound on the ward while no respondents had a regular dedicated training session for thoracic ultrasound. Only 4, (7%) of the respondents had gotten level 1 competency, indicating ability to independently perform chest ultrasound of which half were senior registrar with more than 3 years of post-junior residency and other half were consultants.

Conclusion: There is dearth of ultrasound machines on the wards in most hospital among the respondents. The knowledge and use of thoracic ultrasound among Respiratory Physicians in Nigeria also appear to be low. Training, re-training and mentoring are needed to assist both trainees and trainers to attain the required competency in chest ultrasound in order to ensure safer pleural practices.

Keyword: Thoracic ultrasound, Pleural diseases, training

INTRODUCTION

Pleural diseases, including pleural fluid collection, pneumothorax and pleural masses are common causes of respiratory morbidity and mortality globally.1Many of these patients, especially those with pleural collections, present at the emergency units with dyspnoea which usually requires urgent intervention.1-3 Until recently chest X-ray (CXR) had been the first line imaging modality in the diagnosis of these conditions, and because the patients present at the emergency department, it is usually a hectic process getting the patient to the radiology department for CXR. Chest radiographs are sometimes acquired at the patient's bedside using portable X-ray machines and once the diagnosis is made, common practice is to intervene without imaging guidance.3-6 This has led to instances of dry taps from pleural collections, requiring repeated needle aspiration which is uncomfortable to the patients. Also, since the CXR are done in the anteroposterior (AP) view, it is very easy to underestimate the real amount of the free effusion. Other limitations of CXR are the inability to characterize the collection or localize pleural mass for possible biopsy.5-7

Globally, thoracic ultrasound (TUS) is becoming vital in the evaluation of pleural diseases either for diagnostic or therapeutic purposes.8,9 Some of the reasons being that TUS is a rapid bedside, inexpensive, non-invasive, radiation-free, diagnostic tool, which the clinician can use as an integral part of the initial clinical assessment of patients with pleural disease as well as for monitoring purposes.It allows for real-time assessment of the pleural space as well as having excellent diagnostic accuracy for many of the common pleural diseases.9-11 It is also an attractive alternative imaging modality for patients on whom thoracic computed tomography (CT) cannot be performed for various reasons.3It's introduction to the management of pleural diseases has increased the proportion of patients receiving correct diagnosis and treatment, thereby reducing the number of complications associated with unguided procedures following CXR

diagnosis.5,6,12

In patients with pleural effusion, it has proven to be of high value in distinguishing transudative from exudative pleural fluid, accurately estimating the volume of pleural fluid, and aiding the drainage of pleural effusions with a catheter or by simple thoracocentesis.12-15 Transthoracic aspiration biopsy can also be performed safely under real-time sonographic guidance to obtain specimens adequate for histologic diagnosis.

Several societies like the European Federation of Societies for Ultrasound in Medicine and Biology, British Thoracic Society and European Association of Cardiovascular Imaging, have clear guidelines and descriptions of logbook on the number of observed, supervised chest ultrasound, and basic knowledge curricula, which must be obtained by a trainee before performing unsupervised lung ultrasound examinations. 5,10,16-19

There is however paucity of data on training, accessibility and use of thoracic ultrasound in diagnosing and locating pleural diseases and its complications in developing countries. This study therefore aims at assessing the knowledge, use and availability of thoracic ultrasound among Respiratory Physicians in Nigeria.

Methodology: We adapted a 17-question survey using the online-based SurveyMonkey. The questionnaire has been previously used among Respiratory Residents in the United Kingdom.16 The direct link for the survey was e-mailed to different respiratory medicine training centers in Nigeria. We also forwarded the survey link to the WhatsApp group of the Nigerian Thoracic Society where all Respiratory Physicians and Senior Residents in Respiratory Medicine were registered. Data on the participant's training center, whether private, state or tertiary center were collected together with the specialty and status, whether resident doctor or a consultant. If a resident doctor, the number of years in training was obtained while the number of years post fellowship was asked from the consultant, together with information on the current competencies and whether they have dedicated pleural disease services in their centers. Accessibility of thoracic ultrasound on the wards, the provision of dedicated ultrasound training sessions in the hospital and whether the resident doctor had a training mentor in thoracic ultrasound were also asked from the respondents. Questions to ascertain the current level of competency (as defined by the criteria for completion of the Directly Observed Procedural Skills), whether a log book was maintained and the frequency of ultrasound scanning requests by other departments or specialties were also asked. Also questions on the knowledge of the uses of ultrasound in respiratory medicine were also obtained as well as presence of complication in pleural procedures despite using ultrasound. Descriptive statistics was used to describe the age, sex, grade of practice, current workplace and years of specialist training. Data were analyzed using the Pearson's Chi-squared (χtest) to test the relationship between access to regular ultrasound sessions, ultrasound training mentor and current work place. Statistical analyses were performed using the SPSS 21.0 Version (SPSS Inc, Chicago, Illinois).

RESULTS

Fifty–seven (57) respondents participated in the survey with more than half of the respondent less than 45years (63.2%) and Male (68.4%). The Consultants were more than the Residents (66.7%) while 21.1% of the Residents had more than 3 years post-junior residency. More than three-quarter of respondents were currently working in Federal Hospital as shown in Table 1.

Of the 10 respondents who had training mentors, 6, (60.0%) were mentored by Radiologists, while one person (10.0%) by Ultra-sonographer. The rest were mentored by Chest Physicians. Forty-seven (82.5%) had no training mentor (table 2). Only 12.3% of the respondents had access to thoracic ultrasound on ward while 28.1% had ever attended a thoracic ultrasound course (Table 2).

None of the respondents had regular dedicated training session for thoracic ultrasound (100.0%). Hospitals that had dedicated pleural disease service were 28.1% (Federal Hospitals had 81.2% and State Hospitals had 18.8%). Respondents with level 1 competent were 7.0% and about 12% have had complication in pleural procedures despite using thoracic ultrasound as depicted in Table 3.

As shown in Table 4, most of the respondents had no access to thoracic ultrasound on the ward (Federal Hospital (78.0%) and State Hospital 22.0%). There was no significant association between respondents with or without training mentor, attendance of thoracic ultrasound course, having dedicated pleural disease services and current place of work. Table 5 depicted that 50% of respondents with >3years post junior residency had level 1 competency.

Table 1: Sociodemographic characteristics of Respondents

Variables (n=57)	Frequency	%
Age at last birth		
<45 years	36	63.2
45-65years	20	35.1
>65years	1	1.8
Sex		
Male	39	68.4
Female	18	31.6
Grade of Practice		
Consultant	38	66.7
Senior Registrar	19	33.3
Years of Specialist training		
SR* with ≤2years	3	5.3
SR with 3years	4	7.0
SR with >3yrs	12	21.1
Consultant	38	66.7
Current Workplace		
Federal Hospital	45	78.9

Table 2: Proportion of respondents with or without a training mentor and the mentor.

Variables	Frequency	%
Do you have a training mentor in thoracic ultrasound (n=57)		
Yes	10	17.5
No	47	82.5
Proportion of respondents with training mentors(n=10)		
Yes – radiologist	6	60.0
Yes – Chest physician	3	30.0
Yes Ultra-sonographer	1	10.0
Proportion of respondents with no training mentors		
No	47	82.5

Table 3: Access and usage of thoracic ultrasound by respondents

Variables	Frequency	%
Do you have access to thoracic ultrasound on ward (n=57)		
Yes	7	12.3
No	50	87.7
Have you attended a thoracic ultrasound course (n=57)		
Yes	16	28.1
No	41	71.9
Do you have a regular dedicated training session for thoracic ultrasound (n=57)		
Yes	0	0.0
No	57	100.0
Do you have dedicated pleural disease service in your hospital (n=57)		
Yes	16	28.1
No	41	71.9
Current competence of respondents (n=57)		
Unable to perform the procedure	33	57.9
Able to perform procedure under direct supervision	13	22.8
Able to perform procedure with limited supervision	7	12.3
Level 1 competent	4	7.0
Are you maintaining a log book(n=57)		
Yes	11	19.3
No	46	80.7

Table 4: Relationship between access to regular ultrasound sessions, Ultrasound training mentor and current work place

Variables	Current work place				Chi-Square	P-Value
	Federal Hospital n=45 (78.9%)		State Hospital n= 12 (12.1%)			
	Yes	No	Yes	No		
Access to thoracic Ultrasound on ward	6(13.3)	39(86.7)	1(8.3)	11(91.6)	0.220	0.639
Ultrasound training mentor	9(20.0)	36(80.0)	1(8.3)	11(91.6)	0.891	0.345
Have you attended a thoracic ultrasound course	14(31.1)	31(68.9)	2(16.7)	10(83.3)	0.979	0.322
Do you have dedicated pleural disease services	13(28.9)	32(71.1)	3(25.0)	9(75.0)	0.071	0.790

Table 5: The prevalence of current level of competence and years of training among respondents

Year of training	Unable to perform the procedure n=33(57.9%)	Able to perform under direct supervision n=13(22.8%)	Able to perform procedure with limited supervision n=7(12.3%)	Level 1 competent n=4(7.0%)
SR with 2years of residency training	3(100.0)	0(0.0)	0(0.0)	0(0.0)
SR with 3years of training	2(50.0)	2(50.0)	0(0.0)	0(0.0)
SR with >3years of residency training	6(50.0)	4(33.3)	0(0.0)	2(16.7)
Consultant	22(57.9)	7(18.4)	7(18.4)	2(5.3)

Discussion:

This study has highlighted important areas of use of thoracic ultrasound among Respiratory Physicians in Nigeria. Globally, the use of thoracic ultrasound by Respiratory Physicians is gaining prominence. In Nigeria, the availability of the ultrasound machine on the ward is still rather low. More than 80 % of the respondents do not have access to mobile ultrasound on the ward. In a similar UK study, over 70% of the respondents have access to mobile ultrasound machines on the wards.16

This already raises question on how pleural procedures are conducted. This finding may suggest that most Physicians in Nigeria still perform blind pleural procedures. The West African College of Physicians and the National Post Graduate Medical College of Nigeria curricula need to reflect current global best practices regarding pleural procedures. The first area will be for stake holders in hospital management to make mobile ultrasound available.

Another area of concern highlighted by the study is the fact that training mentors are quite few as only 17.5% of the respondents reported having a training mentor in thoracic ultrasound.
Up until recently in many hospitals in Nigeria, thoracic ultrasound has been solely conducted by Radiologists. With emerging changes in practice, there is urgent need for more training for Respiratory Physicians to be able to develop this skill. Avenues such as regular update courses organized by Radiologists in collaboration with Respiratory Physicians will need to be explored in other to provide regular training opportunities. This is particularly important as only 12.3% of the respondents have ever attended a thoracic ultrasound course. Apart from update courses, intra-hospital training should be inculcated into the weekly program of the teaching Hospitals. There should be dedicated days of training residents particularly Respiratory Residents rotating through the Radiology department.

We observed that nearly a third of the respondents are unable to perform thoracic ultrasound at all. This is rather abysmal given that all the respondents were Senior Registrars and Consultants in Respiratory Medicine. This also will imply that they either do not perform pleural procedures or they are performed blindly with the possibilities of complications such as organ puncture and pneumothorax. Although this was not the focus of this study, it will be interesting to note the number of complications arising from performing blind pleural procedures among the respondents. More than 70% of the respondents reported no complications with performing pleural procedures under ultrasound guidance. It has been shown that performing pleural procedures under ultrasound guidance significantly reduces the rate of complications.[5] A study by Grogan et al,[20] showed that the rate of pneumothorax during pleural procedures was reduced from 30% when performed blindly to 0 % when performed under ultrasound.

Only 4 of the respondents representing about 7% are able to perform chest ultrasound independently. The benchmark set by the Royal College of Physicians for Respiratory Residents is the attainment of level 1 competence which implies ability to perform thoracic ultrasound independently and able to identify the basic anatomy of the plueral.16In a UK study among Respiratory Residents, nearly a third of them have attained leve1 competence and a larger percentage (43.5%) were able to perform thoracic ultrasound with limited supervision.[16]
The use of log book to document the number of ultrasounds performed is well known among Residents in other developed climes. Although 11 of the respondents in our survey representing about 20% indicated that they keep a log book, there is need to inculcate documentation of performed or observed chest ultrasound into the post-graduate training curricula for Pulmonology Residents in Nigeria.

Having a dedicated pleural service team has been shown to improve quality of practice and outcome for pleural procedures.[21] Most of the respondents from our study reported absence of a dedicated pleural service in their hospital. This is a potential area to explore for the improvement of practice in line with global standards and improved outcome for patients.

Although those in Federal institutions are more likely to have access to thoracic ultrasound on the ward and more likely to have access to a training mentor or to have had a previous attendance at a thoracic ultrasound course when compared with those in state hospitals, the differences were not significant. This highlighted the fact that most Federal institutions in Nigeria may be more equipped than State-owned ones. The other explanation is that most of the respondents from Federal institutions are likely to be from teaching hospitals with relatively better facilities.

This study has highlighted important deficiencies in the area of thoracic ultrasound in Nigeria. To the best of our knowledge, this is one of the earliest studies focussing on this emerging aspect of respiratory medicine practice.

There are important limitations to highlight. Like with any other questionnaire-based study, this is likely to be dependent on who is responding and the information they volunteer.
A better way might have been to carry out on-the-spot assessment of what is being done, hence there is every likelihood that we might be under-reporting the areas of deficiencies.

Having highlighted this, it is important to point out the potential areas that need to be addressed. We concluded that the use of thoracic ultrasound in Nigeria is still largely in the early stages.
There is need to develop and inculcate the use of thoracic ultrasound in the performance of pleural procedures among Respiratory Physicians in Nigeria.

Emphasis should be towards provision of mobile ultrasounds for the ward and emergency rooms use. In addition, training, re-training and mentoring are urgently required to assist both trainees and trainers attain the required competency in chest ultrasound in order to ensure safer pleural practices.

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References

1. DiaconAH ,Brutsche MH , Solèr M . Accuracy of pleural puncture sites: a prospective comparison of clinical examination with ultrasound. Chest 2003; 123 (2): 436 - 441.
2. Lichtenstein D, Goldstein I, Mourgeon E, Cluzel P, Grenier P, Rouby JJ. Comparative diagnostic performances of auscultation, chest radiography, and lung ultrasonography in acute respiratory distress syndrome. Anesthesiology 2004; 100:9–15
3. Xirouchaki N, Magkanas E, Vaporidi K, Kondili E, Plataki M, Patrianakos A, et al. Lung ultrasound in critically ill patients: comparison with bedside chest radiography. Intensive Care Med 2011; 37:1488–1493.
4. Alrajab S,Youssef AM,Akkus NI et al. Pleural ultrasonography Versus chest radiography for the diagnosis of pneumothorax: review of The literature and meta-analysis. Crit Care 2013; 17: R208.
5. Havelock T, Teoh R, Laws D, Gleeson F. Pleural procedures and thoracic ultrasound: British Thoracic Society pleural disease guideline 2010. Thorax. 2010 Aug 1;65(Suppl 2):i61-76.
6. Rahman NM ,Singanayagam A , Davies HE , et al . Diagnostic accuracy, safety and utilisation of respiratory physician-delivered thoracic ultrasound. Thorax. 6fd`2010; 65 (5): 449 - 453.
7. Koenig SJ, Narasimhan M, Mayo PH. Thoracic ultrasonography for the pulmonary specialist. Chest 2011;140:133–41.
8. Kastelik JA, Alhajji M, Faruqi S et al.Thoracic ultrasound: an important skill for respiratory physicians. Thorax 2009;64:825–6.
9. Laursen CB, Sloth E, Lassen AT et al (2014) Point-of care ultrasonography in patients admitted with respiratory symptoms: a single-blind,randomized controlled trial. Lancet Respir Med 2:638–646.Diagnostic and Therapeutic Use oy
10. Pietersen P, Madsen K. Graumann O, Konge L, Nielsen BU, and Laursen CB. Lung ultrasound training: a systematic review of published literature in clinical lung ultrasound training. Crit Ultrasound J 2018; 10:23.
11. Yu C, Yang P, Chang C, Luh K. Diagnostic and Therapeutic Use of Chest Sonography: value in critically ill patients. AJR 1992; 159: 695-701. in
12. Duncan DR, Morgenthaler TI, Ryu JH, et al. Reducing iatrogenic risk in thoracentesis: establishing best practice via experiential training in a zero-risk environment. Chest 2009;135: 1315–20.
13. Evison M, Blyth KG, Bhatnagar R, Corcoran J, Saba T, Duncan T et al. Providing safe and effective pleural medicine services in the UK: an aspirational statement from UK pleural physicians. BMJ Open Resp Res 2018;5:e000307.
14. Salamonsen M , McGrath D , Steiler G, Ware R , Colt H ,Fielding D ,A New Instrument to Assess Physician Skill at Thoracic Ultrasound, Including Pleural Effusion Markup. Chest 2013; 144(3):930–934.
15. Grimberg A, Shigueoka DC, Atallah AN et al. Diagnostic accuracy of sonography for pleural effusion: systematic review. Sao Paulo Med J 2010; 128:90–95
16. Sutherland TJ, Dwarakanath A, White H, Kastelik JA. UK national survey of thoracic ultrasound in respiratory registrars. Clinical Medicine. 2013;13(4):370-3.
17. Education, Practical Standards Committee EFoSfUiM, Biology- Minimum training recommendations for the practice of medical ultrasound. Ultraschall Med 2006; 27:79–105.
18. Neskovic AN, Hagendori A, Lancellotti P et al. Emergency echocardiography: the European association of cardiovascular imaging recommendations. Eur Heart J Cardiovasc Imaging 2013; 14:1–11
19. Du Rand I, Maskell N. Introduction and methods: British thoracic society pleural disease guideline 2010. Thorax 2010;65(Suppl 2):ii1–ii3..
20. Grogan DR, Irwin RS, Channick R, Raptopoulos V, Curley FJ, Bartter T, Corwin RW. Complications associated with thoracentesis: a prospective, randomized study comparing three different methods. Archives of Internal Medicine. 1990 1;150(4):873-7
21. Hooper C, Maskell N. British Thoracic Society national pleural procedures audit 2010. Thorax. 2011 Jul 1;66(7):636-7.