

The Stethoscope, Respiratory Examination and Lung Ultrasound in the COVID-19 Era

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Abstract:

The current Covid-19 pandemic has hugely disrupted the delivery of routine and established medical care. Patients can develop a wide range of clinical signs and symptoms from a cough and fever to severe respiratory failure. There is an ongoing argument on a concise investigative pathway to ensure the safety of all healthcare workers. The stethoscope can help with any clinical respiratory assessment but the risk of cross infection is high. Computer tomography should not be routinely performed. There is a potential place for lung ultrasound but outcomes are not yet determined.

Keywords: respiratory failure; stethoscope; ultrasound; Covid-19

Introduction

The covid-19 era poses significant and unprecedented challenges for re-organisation of care, redistribution of resources and rationing of services [1,2]. A review of patients' clinical characteristics showed a high prevalence of respiratory symptoms and respiratory failure which require full assessment [3]. There is a view that the stethoscope has limited usefulness in that assessment [4]. The respiratory examination is taught in medical schools all over the world and forms an integral part of some postgraduate examinations. Further investigations usually are a chest radiograph (CXR) and if there is still diagnostic doubt, or need to narrow down the differential diagnoses, a computer tomogram (CT) can be performed [5,6].

The stethoscope in respiratory failure

In 1816, a French physician, René Laennec, invented the stethoscope and was also the first to describe the terms rales, rhonchi, crepitation, and egophony which are associated with specific respiratory conditions [7]. Over time, acquiring and wearing a stethoscope has become a rite of passage for many doctors and has formed an integral part of the diagnostic pathway [8]. The respiratory examination comprises of four basic tenets: inspection, palpation, percussion and auscultation. Auscultation requires the stethoscope to be applied to the front and back of chest, as well as under the axillae. However, the signs are neither specific nor sensitive. The main sign in respiratory failure syndromes is crackles [9]. Crackles on auscultation have a sensitivity of 19-67% and a specificity of 36-96%, with a positive likelihood ratio of 2.3 and a negative likelihood ratio of 0.8 [9]. Thus, their use in ruling pneumonia in or out is limited as their presence or absence only slightly changes the initial diagnosis (poor inter observer reliability, 72% agreement, kappa value 0.41) [10]. Lovrenski et al replicated similar findings in children with suspected pneumonia [11]. Hence, given the high incidence of interstitial changes and respiratory failure in Covid-19 and the risk of cross infection with taking a stethoscope from a patient to the next, the stethoscope should be disregarded [3,4].

CXRs and CTs in the Covid-19 era

The current worldwide pandemic of Covid-19 (SARS-CoV-2) started in China and has now spread around the world. At the time of writing, latest figures show just over 550,000 confirmed cases and 26,000 deaths related to it [12]. Measures to curb the spread of the disease have included social distancing, closure of schools and non-essential work, closure of borders, cessation of international travel and lockdown of entire cities. This has been well documented in the literature and mainstream media [13]. However, it is primordial that the healthcare workers assessing suspected or confirmed cases takes clear steps to avoid the spread of Covid-19 to other patients with the possible creation

of new outbreaks. Patients have a high incidence of respiratory symptoms that require assessment [3]. In the early days of the outbreak, some Chinese centres ran out of polymerase chain reaction (PCR) testing kits, which only have an approximate sensitivity of 60-70% and chest computed tomography (CT) scans were used as a diagnostic tool. In a review of 113 deceased patients from China, 100% of the deceased patients and 94% of the recovered patients had bilateral changes on chest radiography [3]. Typical findings on CT images are bilateral ground glass opacities and subsegmental areas of consolidation. The British Thoracic Society of Imaging has produced some guidance to minimise risk to staff and reduce transferring patient to and from the radiology department and reduce CT scanning as well as deep cleaning in between scans. The decision tool suggests that there is no role for CT imaging in the diagnosis of COVID-19 unless the patient is seriously ill or if PCR is unavailable [14].

Does lung ultrasound have a role?

Lung ultrasonography in acute respiratory failure has been described for over a decade. A 2008 single centre study of bedside lung ultrasound examination protocol showed an accuracy of 90.5% in diagnosing the cause of acute respiratory failure in critically ill patients. The methods were standardised and reproducible [15]. This has been since incorporated in consensus guidelines [16]. As such, it has been debated as to whether lung ultrasound can have a role to play in the diagnostic pathway for Covid-19. The vast majority of point of care ultrasound machines are small, portable and can be easily cleaned in between patients. Huang et al performed lung ultrasound on 19 non-critical Covid-19 patients and found them to have specific characteristics (large number of B lines, subpleural pulmonary consolidation and poor blood flow) which were mainly visible in the posterior and inferior areas [17]. Ultrasound missed lesions that were completely intrapulmonary and apical and some of the analysis is only in abstract form. Care must be applied to the analysis of this as this is a pre-print, and not peer-reviewed. Peng et al found similar findings using a similar 12 zone method but the article lacks details about the clinical characteristics of the patients [18]. Poggiali et al found strong correlation between similar ultrasound findings and strong correlation between ultrasound and CT scan findings [19].

Soldati et al propose a standard process for the use of lung ultrasound for COVID-19 patients but so far there have been no studies looking at patient outcomes [20]. Newly designed guidance from the Association of Chartered Physiotherapists in Respiratory Care are laudable and eventual data gathered from the application of lung ultrasound will be crucial [21].

A quick survey of 40 patients with confirmed Covid-19 was performed locally. All of them were on the respiratory wards and 12 were receiving continuous positive airway pressure (CPAP) ventilation. No

patients had a respiratory examination when they first presented, all had abnormal CXRs and none had had a CT scan. None had had a lung ultrasound either. The question is whether these patients had a lung ultrasound initially, would it have changed their management? That is unlikely, as they were all getting admitted into a side room and being swabbed. Swabs results are available locally within a few hours. A quick survey of 12 patients whose first swabs were negative for Covid-19 was also done. All were treated as being high suspicion for Covid-19 and were also in side rooms. All had abnormal CXRs and none had CTs. 6 were receiving CPAP. The only difference in management between the two groups was that the confirmed Covid-19 patients were all enrolled in the Recovery trial [22]. However, the inclusion criteria into that particular trial has now changed, and patients not confirmed to have, but with high suspicion of Covid-19 are eligible too.

Conclusions

From the current evidence and practice, stethoscopes and CT scans have minimal roles in Covid-19 and only if there is significant diagnostic uncertainty. Whilst lung ultrasound has been shown to demonstrate specific characteristics in Covid-19, there is no current evidence for lung ultrasound changing management and affecting patient outcomes. The vast majority of physicians are not trained at lung ultrasound and that will prove a significant barrier for widespread use. Other foreseeable barriers are the availability of ultrasound machines, and the manpower and time required to clean machines after use on a patient. Perhaps lung ultrasound may have a role to play in triage of suspected Covid-19 patients in resource limited settings but again this has not been studied or reported.

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