Non-Invasive Pneumothorax Detection
Michael D. Twardowski, Biomedical Engineering, University of Rhode Island
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Abstract— Pneumothoraxxes are a common injury pattern in emergency medicine. Clinical testing using Micropower Impulse Radar (MIR) to assist in the diagnosis of pneumothoraxxes has shown promise to be a more rapid, and reliable diagnostic test than currently available imaging modalities [3].

I. INTRODUCTION

TRAUMATIC pneumothoraxxes and hemopneumothoraxxes are common after blunt and penetrating thoracic trauma. Conventionally Chest X-rays (CXR) and Chest CatScan (CT) scans are used to diagnose a pneumothoraxx. These methods are not practical for use by first responders and combat medics due to their lack of portability. Detection of pneumothoraxxes on site is key if the patient must be transported by air, where air pressure changes during flight could worsen patients’ symptoms. MIR devices are portable and lightweight (less than one pound). The have an advantage over other alternative methods in that they are insensitive to background noise, making them ideal for use in combat zones and air transport [1].

II. METHODS

The Pneumoscan™, a device developed by PneumoSonics, uses Micropower Impulse Radar (MIR) to detect variations densities in the thoracic cavity. To scan a patient the Pneumoscan graphically displays eight scan locations for the user to easily identify proper placement of the scanning device. Audible sounds are used to confirm a successful scan, and the user will be prompted to rescans any results that were in error. The simple user interface allowed scans to be obtained and results to be reported in less than a minute [2].

A study was conducted at the Level 1 trauma center in Switzerland. Patients with traumatic injuries to the thoracic cavity and suspected to have a pneumothoraxx, were assessed by a clinical exam followed by taking a CXR and a scan using the PneumoScan™. The scan was blinded to assessing medical practitioner to prevent searching for positive results. The results of both diagnostic tests were compared to the true disease state established by a subsequent Chest CT [3].

III. RESULTS

MIR devices were able to detect pneumothoraxxes as small as 30 ml, a level below the threshold of clinical significance [1]. The Swiss study surveyed 50 patients. Seven patients were diagnosed with a pneumothorax by CT. Six of those were also detected by the Pneumoscan, resulting in a sensitivity of 85.7%. Out of the remaining 43 patients, the Pneumoscan found one false positive. This resulted in a specificity of 97.7%. In comparison, the sensitivity for the clinical examinations and the CXR were both 28.6% [3].

IV. DISCUSSION

When compared to the sensitivity and specificity of CT the overall performance of the Pneumoscan was good. Medical practitioners were able to effectively use the device only after a brief 15-minute introduction. Compared to clinical examination and conventional CXR the Pneumoscan proved to be a more sensitive method. Conventional CXR misses 16-76% of all pneumothoraxxes. The overall performance of the Pneumoscan combined with its ease of use and portability makes it an ideal medical tool for use by first responders, combat medics, and by medical practitioners in any environment.

References