linked to an increased incidence of antibiotic resistance as well as rates of hemolytic-uremic syndrome (HUS) [4,5,7]. Of the patients who tested positive for only a virus, none were given antibiotics for diarrhea, highlighting the utility of the GI PCR test in identifying patients with viral etiologies to avoid empiric antibiotic use. Potential disadvantages of GI PCR in the ED include increased costs, greater detection of asymptomatic colonization [8], and increased ED length of stay. Others disadvantage of GI PCR is that it lacks the ability to test for antibiotic resistance, perform genome sequencing or perform serotyping [9]. The most significant limitation of this study is that the difference in antibiotic prescribing rates may have been due to differences in clinical severity and not due to results of the GI PCR.

Author contributions

ACM, AL, ST contributed to study concept and design, acquisition of the data.
ACM, YM, HW, AL, ST contributed to analysis and interpretation of the data.
YM and HW contributed statistical expertise.
AL, ACM, HW, MI, ST, YM contributed to drafting and critical revision of the manuscript.
ACM takes responsibility for the paper as a whole.

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Fig. 2. Antibiotics given for diarrhea.

References


Early diagnosis of acute respiratory failure using an E-health application in patients requiring oxygen therapy

Dear editor-in-chief

Patients without life-threatening conditions, who require a treatment at the hospital, are admitted to a medical unit without continuous monitoring. Monitoring of patients by the nurse is performed manually with a maximum frequency of three or four times per day. In addition to this monitoring, these patients could be real-time monitored, using Sensium® E-health technology [1]. This wearable and wireless Patch measures heart rate (HR), respiration rate (RR) and axillary temperature, and provides updated data every 2 min. The Emergency physician is notified by E-mail and I-phone® (Apple) application of abnormal...
changes in patients’ vital signs suggestive of patient deterioration (Fig. 1). The present case describes how the application E-health technology allows early diagnosis of acute respiratory failure.

A thirty-six years old homeless patient presented a hyperthermia at 38.4 °C. HR was 110 bpm, RR was 22 min\(^{-1}\), and pulse oximetry indicated an oxygen saturation level between 93 and 95% SpO\(_2\). Following physical examination and thoracic radiography, we established the diagnosis of right lower lobe pneumonia. Laboratory tests showed white blood cell count of 14.7 · 10\(^9\) L\(^{-1}\) (N: 4–10.10\(^9\)) and procalcitonin was 0.39 μg·L\(^{-1}\) indicating a bacterial infection [4]. A treatment with systemic amoxicillin 1000 mg was started, three times per day for seven days. After initiation of oxygen therapy (2 L·min\(^{-1}\)), RR was 18 min\(^{-1}\) and SpO\(_2\) was 99%. We monitored in real time the patient in our medical unit, using Sensium® technology and the nurse had to check vital signs manually every 8 h. Three hours after he was admitted, emergency physician received an alert by E-mail on the 29 August 2018 at 13:26 pm indicating a sudden increase of RR from 22 min\(^{-1}\) to 51 min\(^{-1}\), HR from 75 to 157 bpm, and temperature from 38.0 to 39.5 °C at 13:32 (Fig. 2). Clinical examination found a severe acute respiratory failure with severe sepsis. He had an increase in bronchial congestion. He was immediately admitted in critical care unit. Because of early care due to the alarm signal, the patient quickly received reinforcement in oxygenation therapy without requiring mechanical ventilation and the treatment for the sepsis resulting from pneumonia. His medical condition improved within only three days before going back to medicine unit. The patient was discharged from the hospital after seven days.

Breathing is controlled by the respiratory centers, located with other vital centers in the medulla, which is part of the brain stem [2]. The respiratory system is designed to maintain homeostasis with respect to gas exchange and acid-base status. Derangements in oxygenation as well as acidosis can lead to dyspnea. The medulla oblongata contains the dorsal respiratory group responsible for the inhalation, the ventral respiratory group responsible for the exhalation and the pneumotaxic center which ensures the modification of inspiratory time and finally, the RR increase [3].

Ventilation is measured as ventilation minutes (Vm), i.e. total amount of mobilized air by the lung in a minute. Vm (L·min\(^{-1}\)) is calculated as RR (min\(^{-1}\)) × tidal volume (Vt in L) [4]. The normal RR is approximately 12 min\(^{-1}\) [5]. The Vt is 6–8 mL·kg\(^{-1}\) [5], or on average 500 mL [6]. The RR increases in order to maintain constant Vm, in case of ventilatory disorder generating a decrease of the Vt. During acute respiratory failure, RR is higher than 25 min\(^{-1}\) [7]. Then, consequently RR can get beyond 30 to 40 min\(^{-1}\) due to the reinforcement of the pneumotaxic center command. On the contrary, in case of a decreased pneumotaxic command (e.g. in case of a toxic coma), RR can be reduced to 5 min\(^{-1}\) [2]. One of the early clinical sign of a respiratory failure is the RR increase. By increasing the ventilation, the exhalation also becomes active so that the abdominal muscles become active. Will appear the others clinical signs of the work of breathing [8]. Cyanosis and desaturation are warning clinical signs of respiratory decompensation [7].

Usually, patients hospitalized for community-acquired pneumonia requiring oxygen therapy but without vital distress, are not monitored in an intensive or critical care unit after their visit to ED. This situation can be life-threatening, especially if patients are unable to call for help like this confused patient, until the nurse arrives for scheduled surveillance. The present case demonstrated how E-health technology using the Sensium® device might be helpful to early diagnose these clinical deteriorations by alerting doctors and nurses of early signs of acute respiratory failure and sepsis which are RR and HR. Continuous vital signs monitoring outside the critical care setting is feasible and may provide a benefit in terms of improved patient outcomes and cost efficiency [9]. Future large, well-controlled randomized studies in high-risk populations requiring oxygen would evaluate the clinical benefit of this E-health technology for continuous monitoring systems. It might be able not only to
detect clinical degradation but also could be incorporated in a predictive clinical strategy to prevent fatal outcome in some patients monitored outside an intensive unit.

**List of abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>HR</td>
<td>heart rate</td>
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<tr>
<td>RR</td>
<td>respiration rate</td>
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<tr>
<td>Vm</td>
<td>ventilation minutes</td>
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<tr>
<td>Vt</td>
<td>tidal volume</td>
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**Availability of data and material**

All data analyzed during this study are included in this case presentation. For more details, please contact the corresponding author.

**Consent for publication**

The corresponding author declare that the patient consent for publication of individual clinical details. The manuscript does not contain individual image or video.

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**Competing of interest**

The authors declare that they have no competing interests.

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**Faculty opinions concerning ultrasound utilization in the emergency department**

As point-of-care ultrasound (POCUS) is becoming increasingly pervasive in the emergency department (ED), ultrasound is being incorporated into medical education targeting every stage of training: medical school, residency, and fellowship [1-4]. Previously under-developed, ultrasound education targeting academic emergency medicine faculty (AEMF) is a growing area of interest as hospitals, administrators, and emergency medicine leadership are facing hospital specific ultrasound privileging and credentialing questions [5,6]. Despite the growing interest in the ultrasound competency of AEMF, advanced training and availability of ultrasound technology, the number of faculty who use POCUS and the frequency of its use does not match the growth in training and availability of the devices [4,7,8]. The purpose of this study was to determine the perceived barriers to POCUS utilization experienced by AEMF at an academic