Abstract for ANAES ACP Academic Day 2022

Category: Clinical/Translational Research

Title: Integrated Microfluidic Chip as a Point-of-care Test for the Rapid Diagnosis of Sepsis in the Intensive Care Unit (ICU)– an exploratory study

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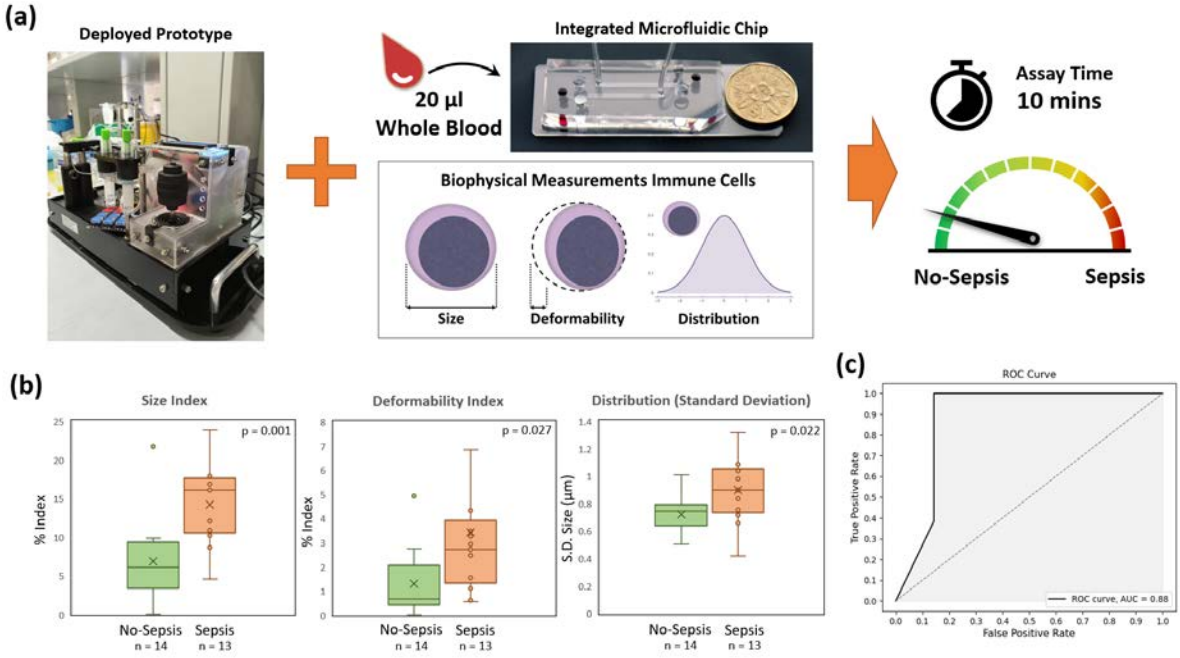
Aim: Sepsis is a global healthcare burden. In the Intensive Care Units (ICUs), it is difficult to diagnose sepsis early because its non-specific signs and symptoms may not be distinguishable from other non-septic conditions such as hypovolaemia and cardiogenic shock.

Methodology: Sepsis alters the biophysical properties of leucocytes. We aim to improve the speed and accuracy for diagnosis of sepsis by using an integrated microfluidic chip based on deterministic lateral displacement (DLD) assay. The assay uses 20 µL of whole blood and simultaneously sorts out the leucocytes and measures their biophysical properties (size, deformability, distribution). We recruited 27 adult patients sequentially from our ICU and analysed their blood samples within 24 hours of ICU admission using the assay. 13 patients were later diagnosed clinically to have sepsis (defined as clinical suspicion of infection with an increase of SOFA score of ≥ 2 points). The remaining 14 patients were diagnosed as not having sepsis.

Results: One operator could complete the analysis of each blood sample using the DLD assays within 10 to 15 minutes. The leucocytes of septic patients showed an increase in the percentage of enlarged cells ≥9.5 µm (14.2 ± 5.1% vs 6.9 ± 5.3%, p = 0.001); septic patients had an increased percentage of cell deformation (3.4 ± 3.1% vs 1.3 ± 1.3%, p = 0.027) and an increased cell size distribution (0.89 ± 0.2 3µm vs 0.72 ± 0.14µm, p = 0.022). The results of the assay were fed into a support vector machine

classification method resulting in a sepsis detection sensitivity of 96.2%, specificity of 84.1% and accuracy of 88%.

Conclusion: Our biophysical diagnostic modality for sepsis was achieved using small sample volumes, and an integrated microfluidic device as a point-of-care system. We intend to validate the accuracy of our DLD assay using a larger sample size in future studies.



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