HealthManagement
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Abionic's Unique Sepsis Detection Solution

Based in Switzerland, Abionic is an in vitro diagnostic company, uniquely positioned at the intersection of medical technology, biotechnology and nanotechnology. The company has developed an unparalleled nanofluidic technology-based platform, the abioSCOPE® to offer patients fast blood test results right at the Point-of-Care (PoC).

The abioSCOPE® is a compact and ultra-fast diagnostic solution, providing quantitative results at the PoC from only a single drop of patient sample (blood, saliva, urine) and only within few minutes.

The fast turnaround time of Abionic's tests relies on the ability of the nanofluidic to force molecules to go into a nanochannel, limiting their travel distance to a few hundred nanometers and thus significantly reducing incubation time. A washing step is not needed as the surface-to-volume ratio is extremely high, and non-specific background is negligible.

Protein levels can thus be efficiently quantified within an ultra-short assay time, with high precision and accuracy on a closed, small, easy-to-operate platform, providing lab quality results at the PoC (**Figure 1**).

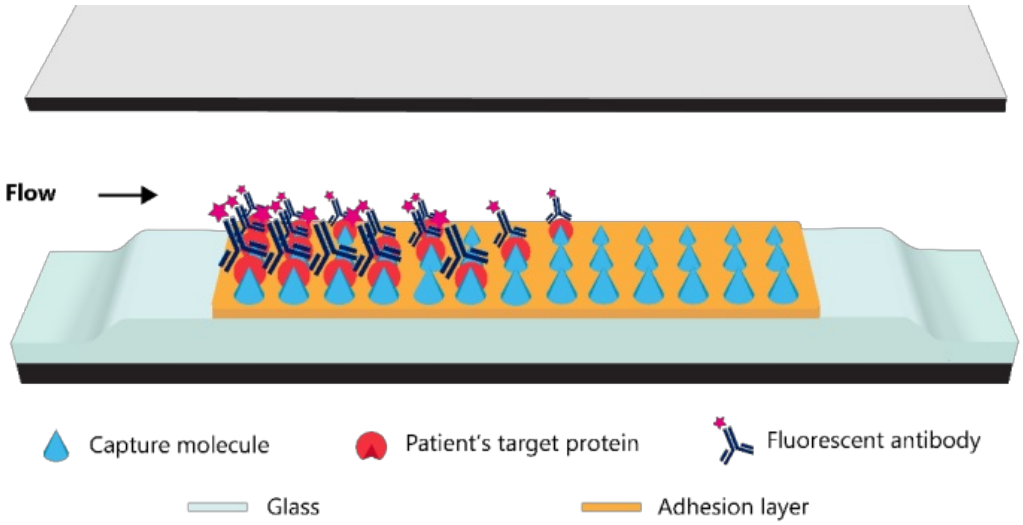

Figure 1. Cross-section through a nanofluidic biosensor

By bringing together the ultra-rapid platform, abioSCOPE® and the Pancreatic Stone Protein (PSP) biomarker, Abionic's offer a unique sepsis solution enabling healthcare professionals to detect sepsis in just 5 minutes, up to 72h before the standard of care.

Sepsis: The Need for Speed

Sepsis requires prompt and tailored treatment; any delay in its diagnosis increases the risks of mortality and progression toward septic shock. Each hour of delay in the initiation of suitable antibiotic therapy was shown to decrease the survival of patients with septic shock by 7.6% (Kumar et al. 2006).

Often a silent disease, sepsis seldom presents with clear signs and symptoms that would enable physicians to diagnose it early, until sudden clinical degradation occurs, with adverse and often fatal outcomes. Since the clinical complications of infection are reflected first by changes at the molecular and cellular levels, and later by the appearance of clinically overt signs, the timely measurement of sensitive and specific biomarkers can provide a unique window of opportunity for the timely initiation of adequate treatment.

Therefore, the availability of an early and accurate sepsis biomarker at the patient's bedside is key to transforming sepsis care by enabling faster access to treatment, tailoring treatments, decreasing mortality and by lowering sepsis-related healthcare costs.

Pancreatic Stone Protein (PSP)

PSP is a biomarker produced mainly by the pancreas, small intestine, and stomach (Reding et al. 2017), and could be the missing tool for early detection of sepsis, i.e., infection and dysregulated organ response. Indeed, the hypothesis is that the pancreas is the first organ to react to sepsis and that increased PSP blood concentrations are associated with the development of sepsis (Pugin et al. 2021; Klein et al. 2015).

With the abioSCOPE® placed at the bedside of the patients, PSP levels can be measured rapidly (in as little as 5 minutes) at the PoC from a single drop of whole blood. This enables the close monitoring of blood PSP concentrations associated with the early development of sepsis, providing immediate, actionable results (**Figure 2**).

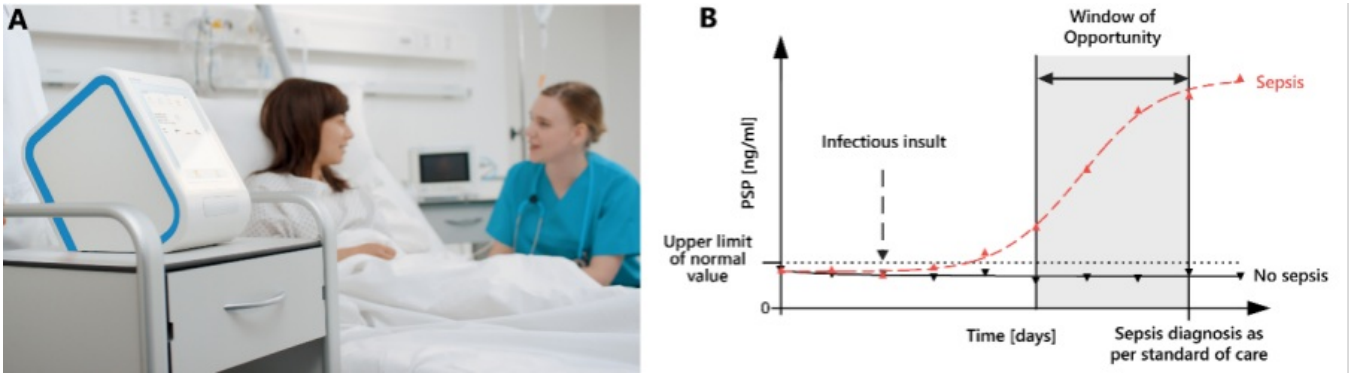

Figure 2. (A) abioSCOPE® device and (B) schematised trajectories of PSP in patients who develop nosocomial sepsis (dashed red line) or not (solid black line). An increasing PSP in the days preceding the clinical diagnosis of sepsis offers a unique window of opportunity for Clinicians to perform additional diagnostic investigations and to start therapeutic interventions aimed at mitigating the impacts of sepsis. **See earlier - act better.**

Use of the PSP for the Diagnosis of Sepsis inICUs

Biomarkers have always played essential roles in the diagnosis of sepsis, but canonical markers such as C-reactive protein (CRP) and procalcitonin (PCT) have intrinsic limitations.

PSP can differentiate, more accurately than CRP and PCT, infection from sepsis and an inflammatory state from sepsis in intensive care patients including severely burns (Klein et at al. 2020), in postoperative patients including cardiac surgery (Klein et al. 2015), in trauma patients (Keel et al. 2009) and on admission to the ICU (Llewelyn et al. 2013).

A primary advantage of PSP over canonical sepsis biomarkers is that its concentration increases early, up to 72 hours in advance, in the course of sepsis development (Pugin et al. 2021; Klein et al. 2015). This early increase is exemplified well in the typical case of a 71-year-old hospitalised for a traumatic brain injury, which required immediate ICU admission with invasive mechanical ventilation, in whom an increase in the PSP concentration early in sepsis development was observed, opening a window of opportunity for timely, targeted clinical management (**Figure 3**).

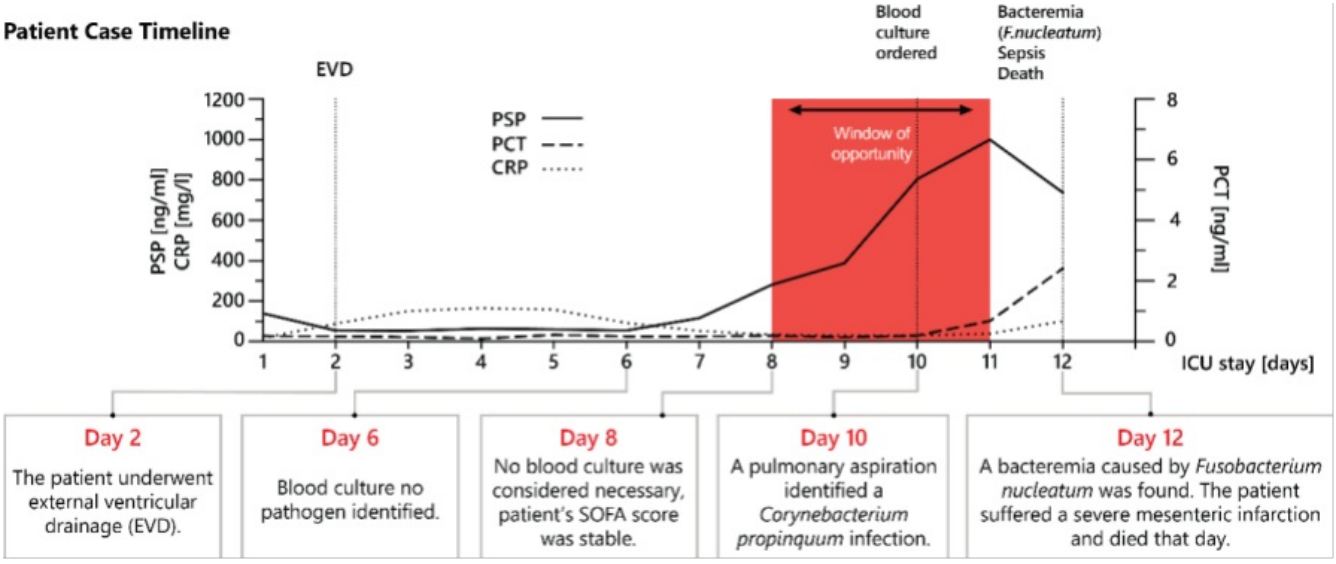

Figure 3. Patient case timeline for a 71-year-old male patient hospitalised for a traumatic brain injury, and which required immediate ICU admission with invasive mechanical ventilation.

It is important for intensive care physicians to be able to differentiate between patients suffering from a systemic inflammatory response without infection,

compared to those suffering from sepsis. This differential diagnosis is imperative to administer the appropriate treatment. A multicentric study on critically ill patients published in Critical Care, showed that PSP was the only biomarker able to identify sepsis 72 hours before clinical diagnosis. Providing a large window of opportunity to adapt the patient's clinical management (**Figure 4**) (Pugin et al. 2021).

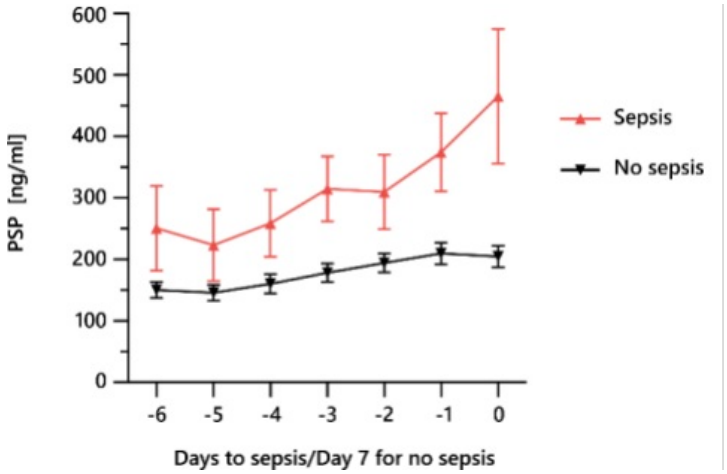

Figure 4. The average daily PSP concentration with SEM preceding the diagnosis of nosocomial sepsis (day 0; red line) or ICU discharge for patients who did not develop sepsis (black line). PSP, pancreatic stone protein; SEM, standard error of the mean. Adapted from Pugin et al. 2021.

This multicentric study also showed that the combination of PSP and CRP had the best diagnostic accuracy (AUC 0.79 95%CI 0.72-0.86) the day of sepsis compared to procalcitonin (AUC 0.75 95%CI 0.68-0.82), either biomarker alone or other combinations of biomarkers.

As PSP has shown excellent performance not only in the identification of sepsis, but also as a prognostic biomarker, serial PSP measurements every 24 hours should be implemented at the bedside with the abioSCOPE® and can aid the clinical management and early identification of sepsis in patients at risk or suspected of sepsis. This approach provides opportunities for the timely initiation of sepsis care bundles, appropriate preventive therapies and ICU monitoring of such patients.

In addition, a constantly low PSP value is a strong indicator of a patient's stability to rule out sepsis (with high negative predictive value) in patients presenting a sepsis-like clinical picture; in such cases, no additional microbiological investigation or other sepsis-focused procedure is recommended. A low, stable PSP level also supports the decision to not administer or initiate unnecessary empiric antimicrobial treatment (**Figure 5**).

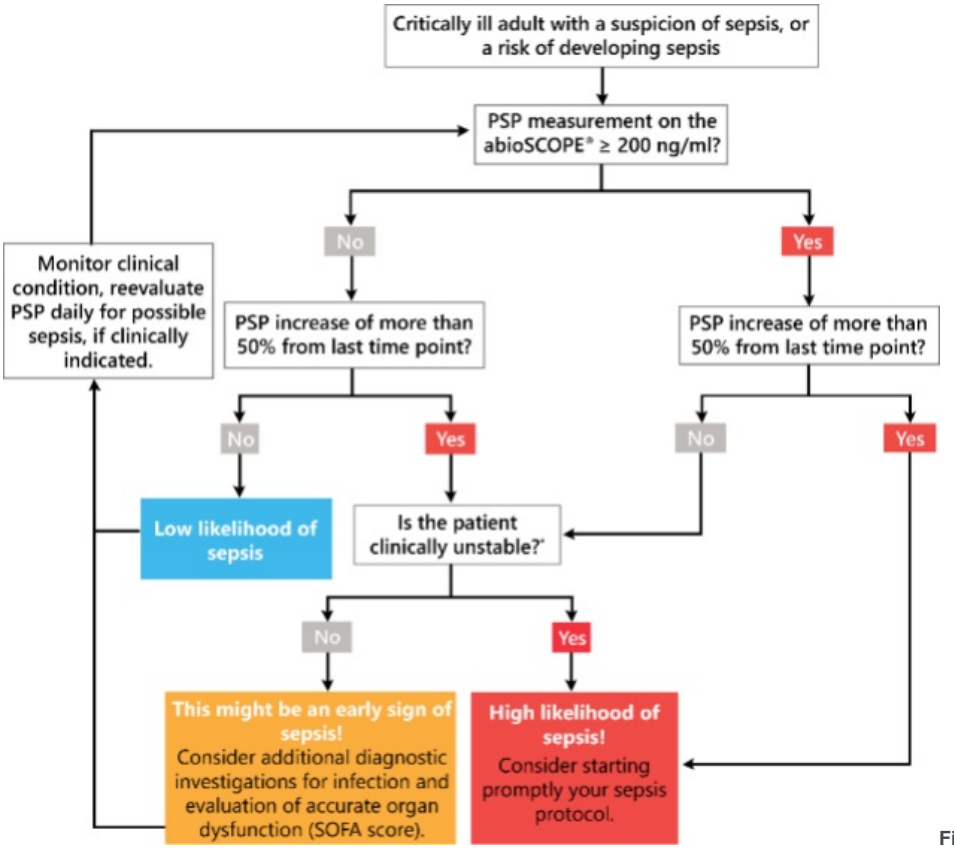

Figure 5. Decision tree for the interpretation of serial PSP measurement in critically ill adults with sepsis risk or suspicion.

The PSP test performed on the abioSCOPE® device is designed for on-demand use in the ICU. Compact, robust, and intuitive to use, it is fully compatible with hospital information systems and fits seamlessly into the workflow and can be positioned next to blood gas analysers. When sepsis is suspected, or needs to be ruled out, an immediate access to reliable test results is essential, without the need to wait for laboratory turnaround times. The information gained from serial PSP measurements may be crucial in determining whether a patient is developing nosocomial sepsis, preceding the appearance of overt clinical signs and symptoms, and guiding further diagnostic workup and therapeutic management, which may ultimately attenuate sepsis severity.

Key Points

- The PSP level is associated with the development of sepsis and aids the identification of sepsis before the appearance of clinical signs and symptoms.
- PSP measurement provides a unique opportunity for the timely initiation of tailored diagnostic workup and therapeutic intervention to mitigate the impact of sepsis.
- PSP is suited for use in:
- Identification of patients at risk of developing sepsis in the next 72 hours

o Guidance in the implementation of strategies aiming to minimise the severe consequences associated with sepsis

o Indication to avoid unnecessary microbiological investigation and other sepsis diagnosis workup procedures

o Reduction of mortality

o Reduction of the length of stay and costs

References

Keel M et al. (2009) Pancreatic stone protein is highly increased during posttraumatic sepsis and activates neutrophil granulocytes. Critical Care Medicine. 37:1642–1648.

Klein HJ et al. (2015) Pancreatic stone protein predicts postoperative infection in cardiac surgery patients irrespective of cardiopulmonary bypass or surgical technique. PloS One. 10.

Klein HJ et al. (2020) Pancreatic Stone Protein Predicts Sepsis in Severely Burned Patients Irrespective of Trauma Severity: A Monocentric Observational Study. Ann Surg.

Kumar A et al. (2006) Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock: Critical Care Medicine. 34.

Llewelyn MJ et al. (2013) Sepsis biomarkers in unselected patients on admission to intensive or high-dependency care. Critical care. 17:R60.

Pugin J et al. (2021) Serial Measurement of Pancreatic Stone Protein for the Early Detection of Sepsis in Intensive Care Unit Patients: A Prospective Multicentric Study. Critical Care.

Reding T et al. (2017) The pancreas responds to remote damage and systemic stress by secretion of the pancreatic secretory proteins PSP/regI and PAP/regIII. Oncotarget. 8.

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