

Role of POC CRP during the pandemic

Being able to streamline local healthcare and reduce unnecessary A&E and hospital admissions for frail and vulnerable patients has never been more relevant in light of the COVID-19 pandemic. Point-of-care CRP haematology analysers, installed in locations across Cornwall, are helping to reduce trips to hospital or get people home sooner, as **Mandy Campbell** reports.

At the start of the COVID-19 lockdown, the Royal Cornwall Hospitals NHS Trust (RCHT), in partnership with the Cornwall Foundation NHS Trust, purchased and installed five new Microsemi CRP point-of-care (POC) haematology analysers (Horiba UK). The installation of these POC analysers across Cornwall is now enabling patients to have pathology tests performed locally by clinical staff in acute and community settings, rather than visiting the main Royal Cornwall Hospital in Truro.

The Microsemi CRP (Fig. 1) can simultaneously deliver full blood count (FBC) plus CRP results to support the rapid near-patient distinction between bacterial and viral illnesses, as well as other acute applications highlighted in the scientific literature. For example, for triage, in addition to the early recognition of sepsis, CRP can assist in: guiding subsequent investigation in children with unexplained limping or pseudoparalysis; the detection and differential diagnosis of acute abdominal syndromes, particularly appendicitis; and recently risk stratification and management of Coronavirus patients.

These recent POC installs are not only relieving pressure on the main hospital, but also enabling patients to be treated in the community, closer to home, where possible. This is of course advantageous during COVID-19, but it also paves the way for future pathology provision across the county by supporting the improvement of patient pathways.

Install expedited by COVID-19

Originally the installations were planned to improve patient experience and access to pathology testing across the winter, and to aid the diagnosis of a wide range of conditions including flu. In light of the



Figure 1: Horiba's Microsemi CRP in use in the community in Cornwall

current COVID-19 pandemic, the Microsemi CRP analysers install was expedited. Horiba Medical responded rapidly to the Trusts' order following a successful validation study of its POC analyser with main laboratory haematology samples. A Horiba team of two then ensured installation and staff training within just two days during 'lockdown'.

"Our focus on using new POCT such as the Microsemi CRP haematology analysers is supporting the population across Cornwall with a new way of triaging patients to help keep them out of hospital and A&E unless truly necessary," said Lisa Vipond, lead BMS clinical chemistry & POCT, RCHT. "It is also helping to get many patients home sooner from hospitals where they previously had to wait for main lab results. All these factors are supporting patient safety, especially those that are particularly vulnerable to any infection."

Patient pathways improved

Microsemi CRP analysers are now located in Bodmin and Camborne Redruth Community Hospitals, with another planned soon for St Austell. Unnecessary trips to hospital can be prevented as patients are tested close to home, providing GPs and community clinicians with immediate results so they can best manage treatment. This is enabling different patient pathways using community hospitals and minor injuries units for people who still need monitoring and support, but not urgent care. It is also keeping vulnerable patients, such as the elderly, away from risk in the main hospital while being reassured by test results that they are receiving appropriate care.

Due to the creation of green and red COVID-19 zones within the Trust, a further two new Microsemi CRP analysers are placed in the Surgical Assessment Lounge at Truro and St Michael's Hospital, Hayle, to support surgical teams with pre- and post-surgery patient assessments. POCT in these locations is enabling faster turnaround times to results, so streamlining service and enabling patients to be discharged sooner which is helping to maintain social distancing, particularly where space is limited.

Lisa Vipond explained why the Trusts selected the CRP analysers to support them in their new POCT set-up, which is transforming the pathology service in Cornwall to enhance patient pathways. "We were looking for a very specific POCT haematology solution which was easy-to-use by non-laboratory personnel, quick at producing results and with minimal maintenance. The availability of full blood count with CRP in a POC analyser was a real winner as our clinical teams value CRP as a quick indicator on the best patient pathway and what to look for next." ►

“By helping us to enable local triaging with true POC, the analysers will beneficially change patient flow across Cornwall. Having these POC analysers during the COVID-19 pandemic will help keep people safe and, by not exposing them to unnecessary risk, we can keep beds available for those who truly need them.”

How POC CRP haematology helps

The new POC CRP haematology analysers was originally planned in time for the ‘winter flu’ season in order to improve patient experience and access to pathology testing across the winter. This is because CRP is a common blood test used to support a wide range of clinical decision making, but it is particularly used as a proxy indicator for the presence or absence of bacterial infection. When combined with full blood cell count with white blood cell differentiation CRP can aid the distinction between bacterial and viral illnesses.

A range of factors are used to indicate the presence of bacterial infection, with sepsis, or systemic inflammatory response syndrome (SIRS), traditionally diagnosed based on the occurrence of physiological features such as abnormal body temperature, heart and respiration rate. Blood analysis can also be used as a secondary index to indicate SIRS, with an abnormal white blood cell (WBC) count being a clear indicator. However, CRP is also used as a biomarker to enhance this blood analysis.

Early marker of inflammation

As it is secreted by the liver in response to a variety of inflammatory cytokines, levels of

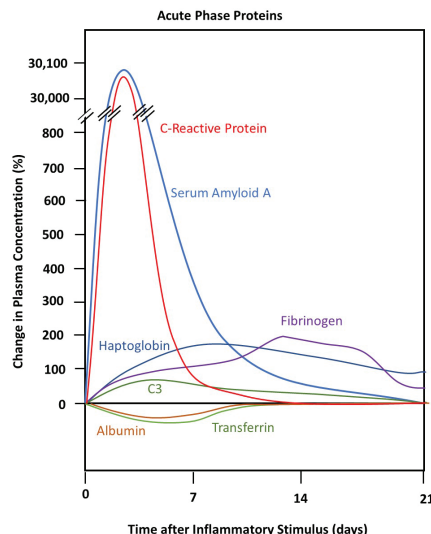


Figure 2: CRP is one of the earliest markers of inflammation or infection in blood, enabling early stage detection and treatment.

CRP in blood provide a significant indicator of inflammation, proving highly useful to guide clinical decisions, particularly as SIRS is indicated if it is present at >2.0 mg/dl. CRP is one of the earliest markers of inflammation or infection in blood, as shown in Figure 2; a sharp increase in levels is seen almost immediately after the onset of inflammation. Therefore, measuring CRP levels enables early stage determination of treatment, it also presents a definite and dynamic indicator throughout the first week of infection.

The efficacy of combined CRP and WBC

results have been shown to be medically comparable.¹ In cases where the CRP level is only marginally raised, differentiating a viral and bacterial infection can be difficult. Narrowing this grey area by combining CRP with a differential WBC provides more powerful information in order to better guide the decision as to whether or not a patient needs antibiotics (Fig. 3). With CRP’s short half-life, its measurement on an ongoing basis can also be used for progressively monitoring the effectiveness of each treatment regime.

CRP testing is normally performed in the hospital laboratory, and once received there, time to results can take up to 90 minutes. However, the time from needle to result can take considerably longer depending on patient and laboratory locations, as well as road systems which can prove challenging in places such as Cornwall. It is vital to be able to quickly exclude bacterial infections and sepsis in POC clinics, as well as emergency care, in order to obtain swift diagnosis and determination of disease severity for appropriate therapy and patient pathway decisions. In turn, this can also support antimicrobial stewardship, aiding cost savings by reducing antibiotic usage² as well as addressing antimicrobial resistance (AMR) challenges.

Fast clinical decisions

Being able to carry out CRP and blood cell analyses at the point when triage or treatment decisions are made is ideal. With the surprisingly fast progression of bacterial infections, the ability to make rapid clinical decisions based on laboratory quality diagnostics undertaken at the point-of-care is highly beneficial. Consequently, the Microsemi CRP has been specifically designed to deliver both CRP and haematology tests at the POC and validated for this purpose. The analyser requires just 18 µL of whole blood for the simultaneous measurement of full blood count, including three-part differential, and CRP within four minutes.

Validation studies have confirmed that the instrument demonstrates excellent correlation for FBC, differential and CRP when compared to routine laboratory methods. CRP correlation has been shown to be exceptional at 0.996 and it has also been observed that as the analyser’s three level whole blood control integrates CRP, this avoids the need for two separate controls.³ Furthermore, the study confirmed the Microsemi CRP’s suitability for use in Primary and Secondary Care, as well as paediatric settings due to its requirement for such a small volume blood sample.

The analyser also incorporates a number of additional features, important for POC when integrating into primary care units for

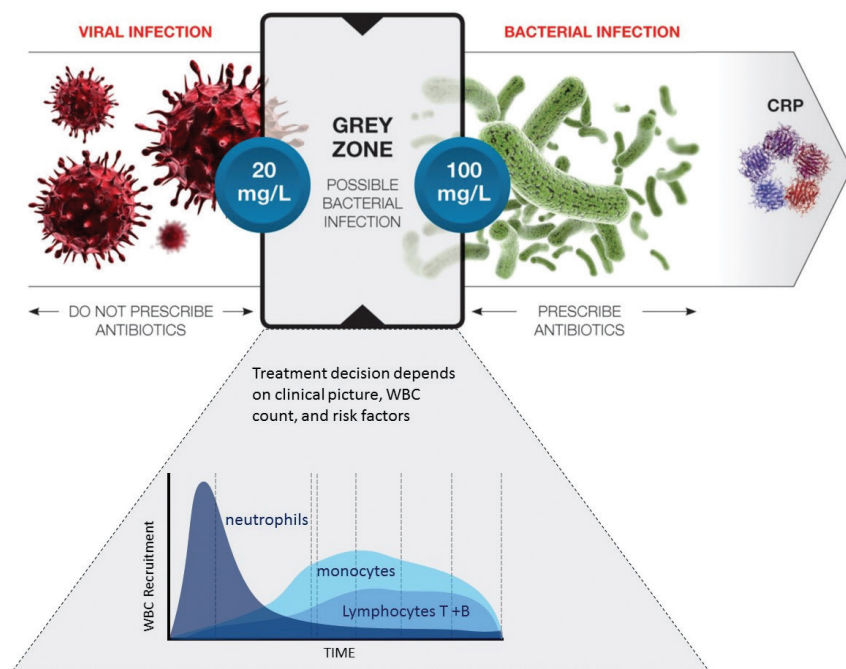


Figure 3: Treatment decision made depends on the clinical picture, WBC count and risk factors

first-line medical treatments. For example, it can be easily operated by caregivers and not just biomedical scientists. Additionally, it is compact and lightweight, taking up minimum space in busy departments. Its strength also lies in its capability in providing rapid screening of microbial infection and predictive diagnosis of infectious diseases, as well as access to other applications in a POCT setting.

COVID-19 biomarkers

Interestingly, studies have confirmed the effectiveness of CRP combined with FBC in flu diagnostics⁴ and now these are being seen as potentially useful biomarkers in the screening, triage and prognosis of COVID-19.^{5,6} White blood cells, platelets and CRP have all been observed to be abnormal in COVID-19 infected patients and can be used to help in the assessment of the severity of infection; therefore, supporting clinical decision making for risk stratification and management (Fig. 4).

The gold standard for confirmation of COVID-19 diagnosis is through the detection by molecular analysis of the viral genome using qPCR. However, detection of the virus is not a predictor of the severity of the disease, so the use of the aforementioned biological markers with clinical observations can support prompt patient management decisions. Therefore, the Microsemi CRP could aid in triage to help potentially identify COVID-19, particularly those patients most likely to require intervention and/or intensive care. It can also facilitate the continuation of other critical clinical services by aiding the separation of COVID-19 patients. Where possible, it can even be used for testing in the community to avoid the unnecessary travel of vulnerable or possibly infected individuals.

In conclusion

The Microsemi CRP point-of-care haematology analyser can streamline and enhance diagnostic pathways in the community, change patient flow and help to reduce hospital admissions for vulnerable patients. It is an ideal 'near-patient' analyser for this purpose, as it is compact, user-friendly and uniquely delivers a laboratory-accurate, three-part differential full blood count combined with a C-reactive protein

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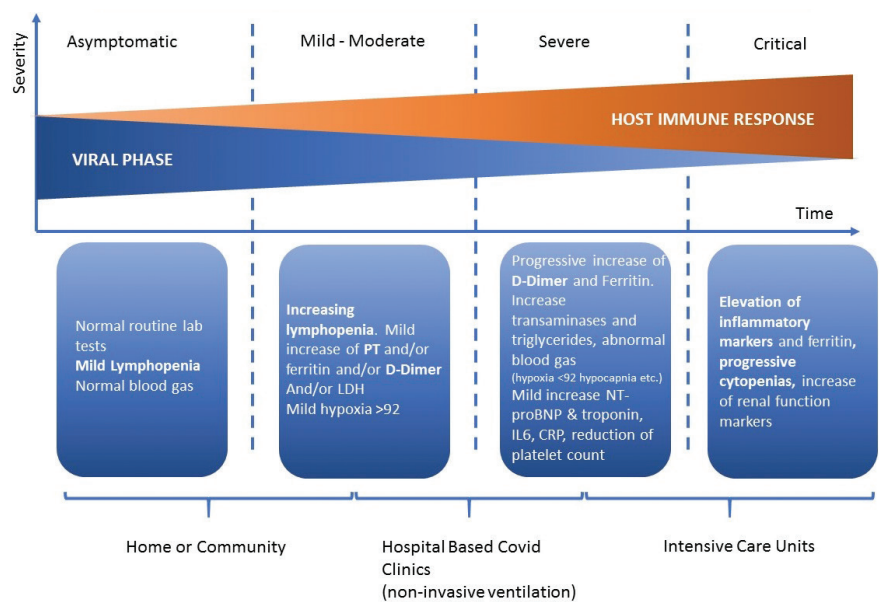


Figure 4: Biological markers for screening, triage and prognosis of COVID-19.⁶

measurement. This means it can support the rapid diagnosis of a wide range of conditions, particularly helping in the early diagnosis of infections.

Information gathered from this POC CRP haematology analyser is of great value in determining the presence of bacterial infection and inflammation, and differentiating viral infection, thus supporting antibiotic stewardship. Furthermore, given the rapidity of results delivered, patients can receive the treatment they need immediately, or be referred appropriately and without delay. This not only relieves pressure on the main hospital, but also enables patients to be safely and effectively treated in the community, closer to home, where possible.

References

- 1 Caldas JP, *et al.* (2008). Accuracy of white blood cell count, C-reactive protein, interleukin-6 and tumor necrosis factor alpha for diagnosing late neonatal sepsis. *J Pediatr (Rio J)*;84 6:536-42
- 2 Takemura Y, (2004). Immediate Availability of C-Reactive Protein and Leukocyte Count Data Influenced Physicians' Decisions to Prescribe Antimicrobial Drugs for New Outpatients with Acute Infections. *Clinical Chemistry*; 50 1 :241-244
- 3 Woolley, T. (2014). A Comparison Between the Horiba Microsemi Point-of-Care C-Reactive Protein and Full Blood Cell Analyzer and the Horiba Pentra 120 and Roche Cobas 6000. *Point of Care*;13: 66-69

- 4 Inaba, T., Pastore, M., Seguy, F., Fujita, N. (2010). Microsemi LC-667CRP evaluation in perspective of influenza diagnosis. International Society for Laboratory Hematology 2010 conference.
- 5 Siatka, C., Eveillard, M., Nishimura, J., Duroux, C., Ferrandi, G. (2020). COVID-19 screening, prognosis and severity assessment with biomarkers for management of patients. HORIBA Medical White Paper. Published April 10 2020.
- 6 HORIBA Medical (2020). How biological markers could contribute to the monitoring of COVID-19? Focus Note #2: Inflammatory Marker. https://www.horiba.com/en_en/products/by-segment/medical/hematology-analyzer/coronavirus-covid19/how-crp-inflammatory-marker-could-contribute-to-the-monitoring-of-covid-19-focus-note-2-inflammatory-marker/ (Accessed June 2020)



About the author

Mandy Campbell joined Horiba UK in 2002 after 15 years as a biomedical scientist. She has held a variety of roles in the company, including product specialist and technical/training manager, and is now in charge of UK sales and marketing for the medical segment.