

EDITORIAL

Blood self-sampling: a missing link for remote patient care

Thomas Hügle 

In our modern times of digitalisation, apps and telemedicine, the ‘point of care’ is a hotly discussed topic. Where and with whom will rheumatic patient care, be orchestrated in the future? Only at the rheumatologist’s practice or clinic? The family doctor? The pharmacy? Or digitally and AI-supported by the patients themselves? And who will coordinate the interdisciplinary treatment, together with colleagues, for example, from dermatology or gastroenterology?

Electronic medical records make access to data easier for everyone. Both clinical data and blood results are available to the respective practitioner. Apps and wearables usually have the necessary interfaces, are interoperable and can be accessed from different systems to make the patient journey increasingly transparent.

All stakeholders agree that patients should be empowered and more involved in the treatment process, for example via digital disease management platforms.¹ Such platforms not only guarantee access to relevant health data but also enable the development of algorithms for predictive and cluster analyses as clinical decision support.²

Examples outside medicine have shown how the ‘point of care’ can shift. Who would have thought some time ago that we would no longer conduct banking transactions or travel bookings in the bank or at the travel agency, but via an app? An increasingly optimised user experience makes it easier and easier to understand and control complex processes online via appropriate user interfaces.

CENTRALIZED VERSUS DECENTRALIZED CARE IN RHEUMATOLOGY?

There are several arguments *for the practice or clinic* remaining the central ‘point of care’ in rheumatology:

1. Trust of patients in physicians and responsibility.

2. Empathy, as it is not possible to fully replicate genuine human interactions via digital means.
3. Established cooperation with colleagues from other specialities.
4. Professional expertise in terms of diagnosis and treatment.
5. Existing patient dossier and data infrastructure.
6. Clinical examination and ultrasound or X-ray on site.
7. Blood sampling with rapid laboratory analysis on site.
8. Reimbursement of health insurances.

Likewise, there are also several arguments *against the practice or clinic* as first-line point of care

1. Limited availability of the rheumatologist to see patients or evaluate incoming data.
2. Sometimes limited accuracy and subjectivity of clinical decisions.
3. Limited communication between patient and doctor between consultations.
4. Suboptimal coordination of interdisciplinary cooperation.
5. Wide use of patient-reported outcomes (PROs), telemonitoring and video consultations.
6. Remote self-collection of blood and rapid blood tests.
7. Emerging disease-specific digital biomarkers.
8. Artificial intelligence to aid diagnosis and treatment.
9. Other pandemics.

COVID-19 LOCKDOWN: THE ULTIMATE STRESS TEST FOR REMOTE PATIENT CARE

The COVID-19 lockdown was a sudden and unexpected stress test for remote patient care in practices and hospitals. Despite some digital patient management platforms have been in place already before 2020, they were

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telephone consultations, and emerging video consultations have kept patient care at a low level.³

At the beginning of the pandemic, PROs and wearables were only available for a small fraction of rheumatology patients. During lockdown, we had no clinical examination, ultrasound or blood sampling, no physiotherapy or occupational therapy and no available disease-specific digital biomarkers.

No inflammatory parameters were available as biomarkers, for example, for arthritis or polymyalgia patients, and likewise no complement and no serological biomarkers such as dsDNA titre or antineutrophil cytoplasmic antibodies to monitor lupus or vasculitis. C reactive protein (CRP) finger prick as point-of-care testing, similar to glucose measurement, has been applied in other settings.⁴ However, the process for performing, reimbursing and transmitting the result was not defined in the pandemic and, therefore, not feasible on a broad scale.

The result was insufficient monitoring and delayed diagnoses of immune-mediated diseases, with all their consequences, including increased disease activity and anxiety.⁵ In short, there was an abrupt black box in the patient journey of countless patients. The rheumatology practice or clinic as the 'point of care' failed in the pandemic! Maybe also for this reason, EULAR has published this year its points to consider for telemonitoring of rheumatologic patients.⁶

SELF-SAMPLED BLOOD COLLECTION

The article by Zarbl *et al* in this issue describes one 'missing link' in the remote diagnosis and telemonitoring of chronic inflammatory diseases: self-sampled blood.⁷ How much this would have helped in the pandemic! The authors describe the feasibility, user experience and, most importantly, validation of a method that can be performed independently by patients, to measure a broad panel of autoantibodies and some inflammatory parameters.

The process was as follows: two different self-adhesive devices based on a vacuum pump for capillary blood collection from the upper arm were tested. Eighty per cent of patients were able to obtain sufficient blood samples on the first attempt and 98% on the second attempt. The samples were centrifuged and then analysed for various antibodies and CRP, which had already been measured with a prior conventional phlebotomy blood sample. A portion of the samples were incubated for 72 hours and then centrifuged, to test for shipping delay.

The first finding was that this type of blood collection was less painful than the normal method in over two-thirds of the subjects and the user experience of the whole process was described as positive. Second, the subsequently measured levels of autoantibodies (including rheumatoid factor, dsDNA, PR3, MPO, RO52, Jo-1) were reliable, even after 72 hours of incubation at room temperature.

What is special about this study is the combination of both positive user experiences and validated measurements in an uncontrolled real-world scenario. As with all digital devices, the user experience is crucial to ensure sustained use.

Potentially, this process could have been extended by integrating the sending of the blood sample into the study to describe the full real-world scenario process. In a previous study from the same group, the upper arm method was compared with finger prick.⁸ The upper arm method achieved significantly better acceptance. The authors postulate that the automation of this method through the vacuum is the reason for this. The main advantage over the finger prick method, however, appears to be the larger quantity of blood obtained for measuring various values.

In summary, this patient-centred study shows a good feasibility and reliability of self-sampling on the upper arm via a self-adhesive device. Despite a relatively low sample size of 70 patients, especially for CRP and dsDNA measurements, self-sampling could improve the currently limited diagnostic accuracy of online symptom checkers with or without AI support.^{9 10} The efficacy of self-sampled blood for concrete disease monitoring and treat-to-target strategies in immune-mediated diseases remains to be clarified in future studies.

OUTLOOK

This study adds momentum to the self-management of rheumatic diseases. Patient care is about to become more flexible, more remote, as biological biomarkers from the blood likely will stay a necessity. Combinations of autoantibodies, cytokines with PROs and disease-specific digital biomarkers will undoubtedly make the patient journey in immune-mediated diseases more transparent and predictable.

The integration of the results into existing clinical workflows of rheumatologists remains to be clarified. Potentially, the interval of consultations, for example, for patients in complete remission, could be adjusted automatically or converted to video consultations. First, however, it would have to be clarified how valid the determined remission from PROs and biomarkers in the blood really is. Studies on the cost-effectiveness of this method also must follow in order for it to be used systematically and, above all, for it to be adopted by payers. If so, true point-of-care tests as 'lab-on-a-chip' at home to receive instant results could be the next step.

This article is certainly not the end of the story. 'Milking' blood through a vacuum pump and sending it by mail quite seems low-tech, but it is also cheap and scalable. More technically advanced work on biomarker monitoring is on the way, based on continuous non-invasive (eg, radio-frequency identification) or transdermal sensors through microtechnology and nanotechnology.

In any case, blood remains the number one source of biomarkers, and we have seen in diabetes how the

development of self-sampling can change patients' quality of life.¹¹ Until then, the motto is 'Panta rhei', everything is in flux—including self-sampled blood collection for immune-mediated diseases.

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