Information technology concerning SDAI and CDAI

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ABSTRACT

Disease activity assessment of rheumatoid arthritis has never been trivial. Composite indices like the Disease Activity Score using 28 joint counts 28 (DAS28) and the Clinical Disease Activity Index (CDAI) and the Simplified Disease Activity Index (SDAI) attempted to integrate several core set variables into one readout, which eventually laid the grounds for implementation strategies that targeted disease activity levels, like remission. While CDAI and SDAI were clearly simpler at times when a calculator was needed, this has likely become less relevant in the era of digital records, where core set variables are entered into a computed device after measurement. However, DAS28 has faced new challenges, which are derived from its lack of specificity when it comes to assessing remission.

Digital technology has advanced the management of patients with RA in clinical practice, since the disease activity levels can now be followed for each patient over adjustable time periods interesting for the clinician, such as since start of the last treatment. Also for research purposes, the digital records have allowed a more rapid course of projects from the scientific hypothesis to publication, simply by allowing to go to the digital database and select the items and observation needed. This has made clinical research much more efficient.

In the digital era, the CDAI and SDAI can still be used on a piece of paper without the necessity of any electronic device, and it is exactly this flexibility and versatility of these two scores that account for their continued success.

CDAI? SDAI?
What are we talking about?

Disease activity measurement in rheumatoid arthritis (RA) has come a long way (1). The complexity of disease and the absence of a gold atandard have made it necessary to combine several individual measures into composite scores (2). Examples are the Disease Activity Score (DAS), the DAS using 28 joint counts (DAS28), the Clinical and the Simplified Disease Activity Index (CDAI, SDAI), and a number of other instruments, which are partly or completely reviewed in the context of this supplement. The four mentioned scores (and their modifications), are the continuous disease activity instruments that attempted to integrate several of the American College of Rheumatology (ACR), the European League Against Rheumatism (EULAR), and the World Health Organisation / International League Again Rheumatism (WHO/ILAR) core set variables (3) into a single number (4). While the approach to develop these scores has been different, they all provide a single readout concerning the level of disease activity. In contrast to even more complex diseases, for which various separate instruments for assessment of the many different domains are necessary, such as in psoriatic arthritis, these integrative "single-number" scores have proven to be useful in clinical practice and as endpoints in RA clinical trials. A single readout score was developed specifically for arthritis activity of psoriatic arthritis, which excludes other domains not related to arthritis activity (5).

The composite indices for RA should also be contrasted from pure self-report questionnaires of disease activity, such as the Rheumatoid Arthritis Disease Activity Index (RADAI) (6) or the Rapid Assessment of Disease Activity in Rheumatology (RADAR) (7), which do not comprise "objective" assessment and require patient's memory of past activity. Likewise, function and quality of life, although mainly driven by the disease process, are confounded by irreversible joint damage which may significantly differ among patients and especially with increasing disease duration (8, 9); therefore respective questionnaires do not necessarily measure the degree of disease activity reliably,

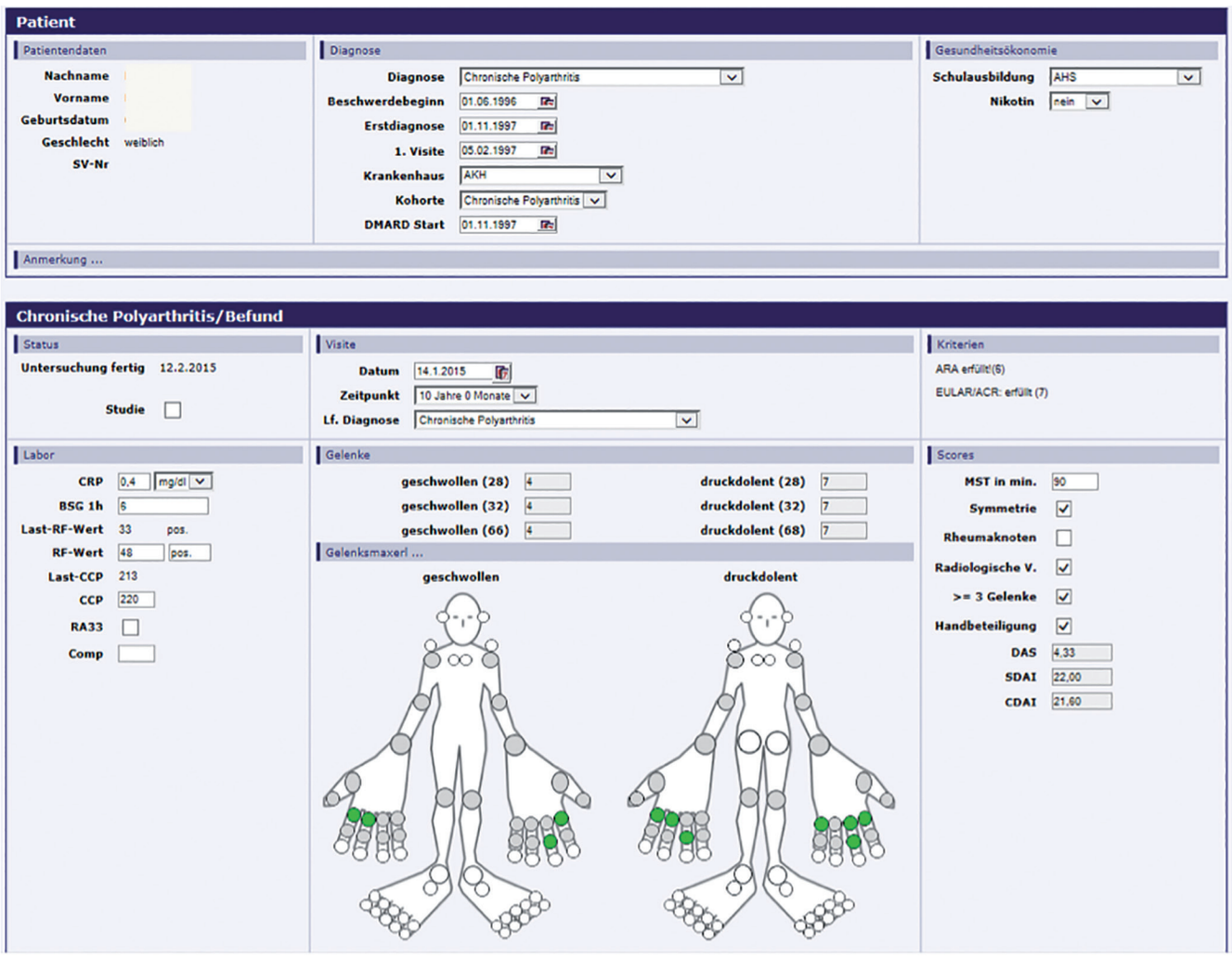

Fig. 1. Screenshot of the CaraBase web based data entry template.

although they are valuable to obtain a global view on functional capacity. Examples of such questionnaires are the HAQ (10) and its modifications (11), the Arthritis Impact Measurement Scales (AIMS/AIMS2) (12), and the Short-form 36 (SF-36) (13).

The digital era: the value of CDAI and SDAI in comparison to other scores

The CDAI and SDAI initially were developed in times when electronic records were not thought of. The benefit at those times was certainly their ease of use and the absence of a requirement for a calculator or PC to obtain the respective result (14). If systematic digital medical record documentation is implemented, the complexity of the DAS-based scores would not diminish their practicability as it did in those times. The digital record would present the collected core set variables as well as the single readout of the composite measure.

However, the secular trends have not only worked in favour of the DAS based scores. In contrast, as the number of patients who improve their disease activity to remission steadily increased over the last two decades, also some problems became apparent with these scores. The DAS and DAS28 based scores had been developed in times when remission was not common and much higher levels of disease activity were acceptable in clinical practice. Thus, both the weighting of the different components and the cutpoints for disease activity states were based on (a) patient populations that do not reflect current practice, and (b) physician's decisions to change treatment that are not timely anymore given today's progress towards absence of active disease and the high number of agents available for treatment of RA. Even attempts to dramatically lower the remission cut-point of the DAS28 (15) do not resolve the problem of this score based on its weighting. Also, these scores do not reflect disease activity consistently when different therapeutics are used, such as agents that directly interfere with the acute phase response (APR) *versus* agents that do not (16).

Practical use of CDAI and SDAI in digital medical records: the example from Vienna

After their development, the SDAI and CDAI have been used at the Division of Rheumatology in Vienna over many years. A clinical database was established in the late 1990s and continues to this day, in which joint counts, patient

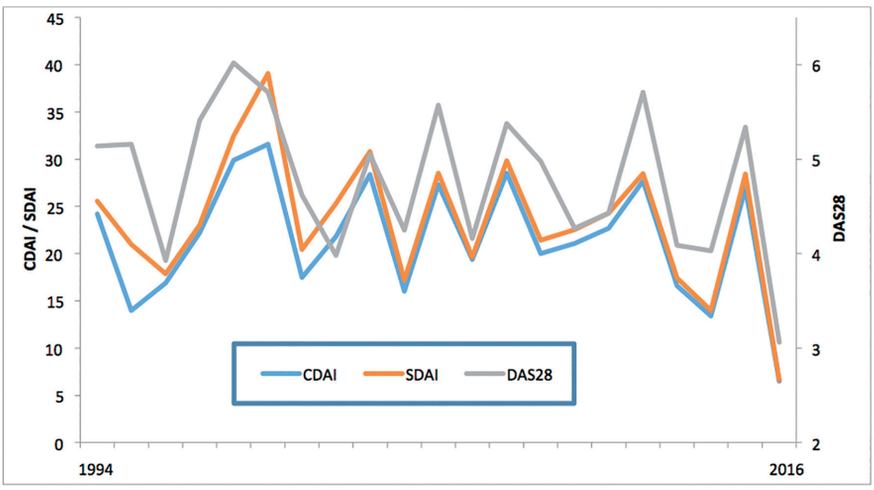

Fig. 2. Example of the visual interface connecting measurements of disease activity with treatment information. The detailed types of treatments have been removed, but each interval mark on the x-axis represents one of the 21 treatment segments that this particular patient has gone through over 22 years. Segments had different durations, so the axis is not spaced equally between the interval lines.

and evaluator global scores, pain scores, and levels of acute phase measures have been documented. Initially the purpose of the database was clinical and outcomes research, its sole use in its early years, and many publications resulted from analyses of this database over time (17-24). As the interface advanced over the years and means and measures for confidentially have been implemented to allow access for authorised individuals, the database began to support the clinicians' daily work. Through a secure web based system, authorised access was possible from all workstations in the outpatient clinic. Physicians were able to access the clinical assessment data that had been obtained by our biometricians just before the patients entered the doctors' office.

In the subsequent years, based on the input and suggestions from the clinicians, the usefulness of the features in the database were further improved for application in routine clinical care. The variables obtained were separated into core characteristics of patients (which would essentially remain stable over time), as well as disease activity items (which would represent all relevant actual data at the respective patient visit) (Fig. 1). This particularly included a graphical interface, which allowed the illustration of CDAI and SDAI courses over time (Fig. 2). In conjunction with the respective treatment data, this graphical interface allowed the determination of treatment effects of all documented courses of disease modifying antirheumatic drugs, a process, which before that time had required considerable time. For use in clinical decision making, we primarily use the CDAI, because it does not require the availability of an acute phase reactant measure which we frequently receive only after the patient's visit. Thus every patient can have an index result on the spot, and immediate decisions can be made. In that way, a digital application had saved the physician's time, a fact that in the forefront of the project was assumed by many to be the opposite.

Information technology and the use of CDAI and SDAI in clinical research

Digital records are the basis of many types of research. In former times, data were extracted from patients' charts, and issues of incompleteness of the medical records or their legibility clearly hampered systematic use of out-of-routine data for retrospective epidemiological or outcomes research. Also, this system of data acquisition was notoriously ineffective, as in many cases "the wheel was reinvented" each time a new project was initiated. Today the clinical database (named "CaraBase" for "Care of RA database") is fully integrated in clinics, but data can be obtained by researchers of the Department at any time for research purposes.

The appealing benefits of the CDAI have, for example, led to its use by the Corrona investigator (25). According to their own website, Corrona "operates the largest real world observational database in rheumatoid arthritis: offering deep clinical insights from over 40,000 patients and 130,000 + patient-years of detailed clinical observational data from physicians and patients." The main limitation of Corrona is the absence of laboratory measurements for many of their patients' visits; in fact, a recent report comparing the CDAI and measures of APR out of Corrona showed that only a minority of Corrona visits had APR measurements linked to a respective clinical assessment (26). This limitation has led to the presentation of CDAI in many of the Corrona reports, since the setting essentially rules out the systematic use of any of the other composite disease activity measures.

Conclusion

Rheumatoid arthritis has always been the prototype of disease for rheumatologists with respect to the development of novel therapeutics and of novel measures. The availability of CDAI and SDAI for clinicians and researchers has significantly improved the efficiency in clinical practice and the productivity of outcomes research and other types of research. The era of information technology has fully adopted CDAI and SDAI in digital records, databases and other digital means, such as application for cell phones or tablets. Despite all these advances, these scores can still be used on a piece of paper without requirement of any electronic device. This flexibility and versatility of these two scores account for their success and their frequent and steadily increasing use in routine clinical care and in research.

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