How SCHILLER is redefining heart rate variability (HRV) analysis

The prognostic value of heart rate variability (HRV) was already established at the beginning of our era in China. Physiological research and technological developments then provided the means for using HRV in experimental and clinical settings.

SCHILLER is now offering a unique tool for the diagnosis of autonomic dysfunctions, based on an uncompressed graphical representation of the heart rate. Autonomic nervous system disruptions go hand in hand with reduced HRV, the heart being a central target organ of the autonomic nervous system. The heart rate is also an important control parameter for many regulatory processes in the human body and provides a large amount of information on the functioning and status of these regulatory systems.

In order to identify the relevant information, a statistical analysis of the heart rate is performed. This includes a spectral analysis. The difficulty lies in processing the data, in part highly compressed, resulting in loss of valuable information. An attempt is thus made at describing the status of an extremely complex system (i.e. the autonomic nervous system) with only a few parameters. One should however bear in mind that the whole information is actually just contained in the 120'000 RR intervals over 24 hours.

The Fire of Life
SCHILLER has developed the “Fire of Life”, an uncompressed graphical representation of the entire information contained in a 24-hour heart rate signal. This approach enables a highly differentiated representation of the functions of the autonomic nervous system, paving the way for a wide range of clinical applications.

- Assessment of autonomic balance: ratio of sympathetic to parasympathetic activation/24-hour rhythm
- Analysis of sleep architecture/sleep quality/respiratory events
- Generation of a baroreceptor graph/status of blood pressure regulation
- Stress and recovery management (burn-out prevention)
- Quantification of an autonomic dysfunction, e.g. diabetes mellitus

A wide variety of applications
Many different clinics and prominent physicians already use SCHILLER’s HRV analysis program. One of them is Dr. med. René Hefiti, specialist for internal medicine, psychosomatics SAPP, medical director and head physician at the SGM Clinic Langenthal. According to Dr. Hefiti, in addition to its high resolution and innovative technology, a major benefit of SCHILLER’s tool is that it enables a differentiated evaluation of the regulatory capacity of the autonomic nervous system, and thus of the whole body. This HRV analysis can thus be applied to such different medical specialties as internal medicine, cardiology, occupational medicine, psychiatry and psychosomatics, as well as sleep medicine. The patient’s ability to recover at night is a crucial indicator of healthy regulatory processes. In the daytime, the analysis focuses on the body’s regulatory capacity under everyday stress.

Thanks to the clear data representation in the spectrogram, even patients with no medical knowledge are able to read the results and identify signs of progress.

The following HRV case study, courtesy of Dr. med. Albrecht Seiler M.Sc. (specialist FMH for internal medicine, senior physician of psychosomatic outpatient clinic), illustrates the benefits mentioned above: 43-year-old woman with chronic fatigue syndrome and depression, under psychosocial stress, probably post-traumatic stress, eating disorder, etc.

HRV reference values

<table>
<thead>
<tr>
<th></th>
<th>Point in time</th>
<th>10 months later</th>
</tr>
</thead>
<tbody>
<tr>
<td>average HR</td>
<td>93/min</td>
<td>73/min</td>
</tr>
<tr>
<td>diurnal HR</td>
<td>98/min</td>
<td>68/min</td>
</tr>
<tr>
<td>nocturnal HR</td>
<td>85/min</td>
<td>65/min</td>
</tr>
<tr>
<td>SDNN</td>
<td>80.0 ms</td>
<td>133.2 ms</td>
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<td>PNN50</td>
<td>1.5%</td>
<td>10.97%</td>
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<tr>
<td>RMSSD</td>
<td>15.4 ms</td>
<td>32.8 ms</td>
</tr>
</tbody>
</table>
Initial findings

Heart rate trend

RR histogram

HRV spectrogram

Scatterplot

Progression 10 months after clinical stabilization

Heart rate trend

RR histogram

HRV spectrogram

Scatterplot

SCHILLER
The Art of Diagnostics