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# HEART RATE TURBULANCE AS A PREDICTOR OF REDUCED CIRCADIAN INDEX IN ELDERLY AND SENILE PATIENTS

***Introduction***

Cardiovascular diseases remain the leading cause of illness and death among elderly and senile patients [1]. As people age, the heart gradually undergoes structural and functional changes, while the regulatory influence of the autonomic nervous system becomes weaker [1, 2]. These age-related changes increase the likelihood of arrhythmias, myocardial ischemia, and sudden cardiac death. Therefore, the early detection of subtle cardiovascular disturbances has become an important goal in modern internal medicine [3, 4].

One useful indicator of autonomic regulation is the circadian index (CI), obtained through 24-hour Holter monitoring. This index reflects the normal day-night variations in heart rate and provides valuable information about autonomic balance [5]. A reduced CI suggests impaired autonomic control, characterized by diminished parasympathetic activity and relative sympathetic predominance, a pattern associated with poorer cardiovascular outcomes [5, 6].

Heart rate turbulence (HRT) is another non-invasive electrocardiographic parameter used to evaluate baroreflex sensitivity and the autonomic response following premature ventricular contractions. It is assessed using two measurements: turbulence onset (TO, %) and turbulence slope (TS, ms/RR) [5]. Abnormal HRT values indicate autonomic dysfunction and have been linked to increased cardiovascular risk and mortality in various heart diseases [5, 6].

Although both HRT abnormalities and disturbances in circadian rhythm are recognized markers of cardiovascular risk, their relationship in elderly and senile patients has not been adequately explored. Investigating HRT as a potential predictor of a reduced may improve risk assessment and support earlier prevention of cardiovascular complications in this vulnerable population [4].

***Goal***

The goal of this article is to assess HRT as a predictor of reduced CI in elderly and senile patients based on the analysis of 24-hour Holter monitoring data obtained from 108 patients.

***Material and methods of research***

This retrospective observational study was carried out among elderly and senile patients aged 70–88 years (77.9±4.9) suffering from coronary heart disease (CHD) who were examined and treated at the Gomel City Clinical Hospital No.3. The analysis was based on real clinical data obtained from 24-hour Holter ECG monitoring records.

A total of 108 patients 77 (71.3%) female and 31 (28.7%) male with complete Holter recordings and preserved sinus rhythm were included in the study. We analyzed HRT parameters – TO and TS – as well as the CI.

The CI was calculated as the ratio of mean daytime to nighttime heart rate and was categorized as normal or reduced. HRT was evaluated according to standard diagnostic criteria, where TO $\geq$0% and/or TS $\leq$2.5 ms/RR were considered signs of impaired autonomic regulation. Statistical analysis was performed using Microsoft Office Excel.

***The results of the research and their discussion***

A total of 108 patients aged 70-88 years (mean age 77.9±4.9 years) were included in the analysis (Table 1). The study population consisted of 31 males (28.7%) and 77 females (71.3%). Based on CI values, patients were divided into two groups: normal CI (CI ≥1.24, n=24, 22.2%) and reduced CI (CI <1.24, n=84, 77.8%). The mean CI in the normal group was 1.28±0.07, while in the reduced group it was 1.10±0.08 ($p<0.001$). Patients with reduced CI demonstrated significantly less negative (or positive) TO values, indicating impaired initial acceleration response. TS values were markedly lower in the reduced CI group, reflecting blunted baroreflex-mediated deceleration. The proportion of patients with abnormal HRT parameters was substantially higher in the reduced CI group. Significant correlations were observed between CI and HRT parameters: CI was negatively correlated with TO ($r= –0.48$, $p<0.001$), CI was positively correlated with TS ($r=0.56$, $p<0.001$).

Table 1 – HRT Parameters by CI Group

| Parameter | Normal CI (n=24) | Reduced CI (n=84) | p-value |
|---|---|---|---|
| Turbulence onset (TO, %) | –1.84±1.26 | 0.52±2.13 | <0.001 |
| Patients with abnormal TO (≥0%), n (%) | 4 (16.7%) | 42 (50.0%) | <0.01 |
| Turbulence slope (TS, ms/RR) | 4.86±2.31 | 2.14±1.48 | <0.001 |
| Patients with abnormal TS (≤2.5 ms/RR), n (%) | 3 (12.5%) | 48 (57.1%) | <0.001 |

Table 1 show people with a reduced CI tend to have significantly more abnormal HRT values. For example, their average TO was 0.52±2.13%, which falls within the abnormal range (≥0%). In contrast, those with a normal CI had a healthier average TO of –1.84±1.26%. This difference was highly statistically significant ($p <0.001$). In practical terms, half of the individuals (50.0%) in the reduced CI group had abnormal TO values, compared with only 16.7% in the normal CI group.

The difference was even more striking when looking at TS. Individuals with a reduced CI had a much lower average TS (2.14±1.48 ms/RR) compared to those with a normal CI (4.86±2.31 ms/RR), again with strong statistical significance ($p<0.001$). More than half (57.1%) of the reduced CI group had abnormal TS values, whereas only 12.5% of the normal CI group did.

Odds ratios were calculated to assess the risk of having reduced CI based on abnormal HRT parameters (Table 2). Abnormal TS demonstrated a strong association with reduced CI, with patients having TS ≤2.5 ms/RR showing more than eightfold increased odds of having blunted circadian variation.

Table 2 – Odds Ratios for Reduced CI Based on Abnormal HRT Parameters

| Parameter | Odds Ratio (OR) | 95% Confidence Interval | p-value |
|---|---|---|---|
| Abnormal TO (≥0%) | 4.12 | 1.28–13.26 | <0.05 |
| Abnormal TS (≤2.5 ms/RR) | 8.16 | 2.24–29.78 | <0.01 |

Table 2 shows how much the risk increases with abnormal HRT parameters. People with an abnormal TO (≥0%) were about four times more likely (4.12-fold higher odds) to have a reduced CI. The association was even stronger for TS: individuals with abnormally low TS (≤2.5 ms/RR) had over eight times higher odds (8.16-fold increase) of having a reduced CI.

***Conclusions***

The results of the study indicate a close relationship between a decrease in circadian rhythm variability and a violation of the autonomic function of the heart.

Abnormal HRT parameters – especially a low TS – appear to be powerful indicators of circadian dysfunction. Clinically, this suggests that measuring HRT could help identify patients

with disrupted circadian regulation who may be at higher risk for cardiovascular complications. Incorporating these measures into routine assessment may therefore improve risk stratification and support earlier, more targeted interventions.

**LITERATURE**

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## CLINICAL CHARACTERISTICS AND DIAGNOSTIC PROFILES IN HOSPITALIZED PATIENTS WITH INFLAMMATORY BOWEL DISEASE

***Introduction***

Ulcerative colitis (UC) and Crohn's disease (CD) are the two main forms of inflammatory bowel disease (IBD). They are chronic, idiopathic characterized by relapsing-remitting intestinal inflammation [1]. Hospitalization often reflects a severe flare or failure of outpatient management, and accurate differentiation between UC and CD is essential for appropriate treatment selection [2]. The clinical presentation of IBD ranges from mild distal disease to severe pancolitis or extensive small bowel involvement with systemic complications. Early and accurate diagnostic profiling incorporating clinical symptoms, endoscopic findings, laboratory biomarkers, and histology is crucial for risk stratification and timely initiation of appropriate therapy. Non-invasive biomarkers such as C-reactive protein (CRP) and fecal calprotectin (FC) have emerged as valuable tools for monitoring disease activity, with recent studies demonstrating their correlation with endoscopic and histologic healing endpoints [3]. Age at disease onset significantly influences clinical course. Pediatric-onset IBD often exhibits more extensive and aggressive disease compared to adult-onset cases. Older patients (≥60 years), who now comprise up to 25–35% of the IBD population, frequently present with distinct challenges including comorbidities and increased treatment-related risks [4].

Therapeutic approaches have evolved substantially over the past decade. While 5-aminosalicylates (5-ASA) remain first-line therapy for mild-to-moderate UC, immunomodulators and biologic agents are increasingly utilized for steroid-dependent or refractory cases in both UC and CD. Despite advances, corticosteroid overuse remains problematic, with prolonged exposure