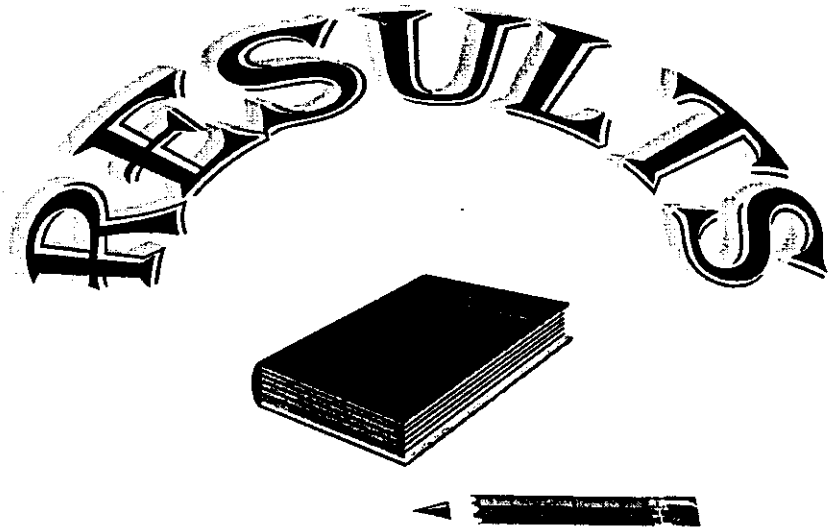
RESULTS

RESULTS

The study included 50 cases 25 cases (50%) were males and 25 cases (50%) were females, 26 cases (52%) were in active carditis, 17 cases (34%) were in heart failure, 20 cases (40%) were cold cases with history of confirmed diagnosis as rheumatic fever by revised Jones Criteria and laboratory findings, coming to cardiology clinic for follow up and taking benzathin penicillin periodically, 4 cases (8%) had rheumatic arthritis. Their ages ranged between 5-12 years with a mean length 131.06±11.40 cm and with a mean weight 27.28±8.01 kg.

The control group was 40 normal children, 20 children (50%) were males and 20 children (50%) were females, their ages ranged between 5-12 years with a mean length 127.45±13.04 cm and with a mean weight 25.35±6.22 kg.

Seventeen cases (34%) were presenting by dyspenea 10 cases (20%) were presenting by cough, 5 cases (10%) were presenting by chest infection, 3 cases (6%) were presenting by congested neck veins, 3 cases (6%) were presenting by right hypochondrial pain, 1 case (2%) was presenting by L.L. oedema, 4 cases (8%) were presenting by drowziness, 3cases (6%) were presenting by syncope, 34 cases (68%) were presenting by palpitation and 46 cases (92%) had audible murmurs on the heart, pansystolic on the apex propagated to the axilla or mid diastolic on the apex or early diastolic left parasternal, some patients have more than one

audible murmur according to the type of valve affection. No patient gave a history of similar condition in the family, 34 cases (68%) admitted once to a hospital, 16 cases (32%) admitted more than one time to a hospital.

Ten cases (20%) had arthralgia and 17 cases (34%) had arthritis (fleeting painful inflamed joints) 28 cases (56%) had sore throat and 49 cases (98%) had repeated history of sore throat.

Fifty cases (100%) were under treatment of benzathin penicillin, 27 cases (54%) were under treatment of steroids, 21 cases (42%) were under treatment of digoxin, 17 cases (34%) were under treatment of angiotensin converting enzyme inhibitors, and 4 cases (8%) under treatment of salicylates.

The age of onset of the disease was variable between cases, 2 cases (4%) at the age of 4 years, 17 cases (34%) at the age of 5 years, 9 cases (18%) at the age of 6 years, 7 cases (14%) at the age of 7 years, 9 cases (18%) at the age of 8 years, 3 cases (6%) at the age of 9 years, 2 cases (4%) at the age of 11 years, and 1 case (2%) at the age of 12 years.

Some laboratory investigations were done as:

1. Erythrocyte sedimentation rate (ESR). Thirty cases who had active rheumatic carditis and rheumatic arthritis (60%) had elevated ESR>50mm/h. It means that (ESR) should be elevated in cases with rheumatic arthritis and carditis.

2. Antistreptolysin Otitre (ASOT). Thirty five cases (70%) had elevated (ASOT) >333 todds units, 30 cases had rheumatic carditis and rheumatic arthritis and 5 cases had cold rheumatic heart disease. It means that (ASOT) may elevated in cases with no active carditis or arthritis.
3. C-reactive protein (CRP). Fifteen cases (30%) had +ve CRP and 30 cases (60%) had –ve CRP. It mean that CRP is not specific in cases with rheumatic fever.

X-ray chest and heart for every patient showed that 21 cases (42%) had cardiomegally and 7 cases (14%) had pulmonary congestion. Electro cardiogram for all cases and controls showed that the ECG findings are insignificant for cases, 50 cases (100%) had no abnormal T wave, 49 cases (98%) had no abnormal ST segment but 1 case (2%) had abnormal ST segment.

The following tables (2-3-4-6) showing comparison of ECG (average rate-PR interval) between cases and controls, between cases with heart failure and cases with no heart failure, between cases with active carditis and cases with no active carditis and between cases with rheumatic arthritis and controls. The statistical data are significant when P value is less than 0.05.

Table (2): Comparison of ECG (AV rate-PR) between cases of rheumatic heart disease and control.

Variable	Cases N=46	Control N=40	P value
AV rate/min	101.22±16.68	92.05±9.82	0.002808
PR in sec	0.13±0.02	0.15±0.03	0.0045

The average rate of cases showed significant increase in comparison to controls, the PR interval in cases showed significant decrease in comparison to controls.

Table (3): Comparison of ECG (AV rate-PR) between cases of rheumatic heart disease with heart failure and cases with no heart failure.

Variable	Heart Failure N=17	No Heart Failure N=29	P value
AV rate/min	115.47±9.47	93.88±14.75	<0.0001
PR in sec	0.12±0.01	0.14±0.02	0.000435

The average rate of cases with heart failure showed significant increase in comparison to cases with no heart failure, the PR interval in cases with heart failure showed significant decrease in comparison to cases with no heart failure.

Table (4): Comparison of ECG (AV rate-PR) between cases with active carditis and cases with no active carditis (cold cases).

Variable Rate/min	Active Carditis N=26	No Active carditis N=20	P value
AV rate/min	111.54±13.46	90.04±12.04	<0.0001
PR in sec	0.13±0.02	0.15±0.03	0.001005

The average rate in cases with active carditis showed significant increase in comparison to cases with no active carditis, the PR interval showed significant decrease in comparison to cases with no active carditis (cold cases).

Table (5): Comparison of ECG (AV rate-PR) between cases with rheumatic arthritis and controls.

Variable	Rheumatic Arthritis N=4	Control N=40	P value
AV rate/min	99.00±11.37	92.05±9.82	0.189624
PR in sec	0.14±0.02	0.15±0.02	0.359254

The average rate and the PR interval in cases with rheumatic arthritis showed insignificant decrease in comparison to controls.

According to the average rate and PR interval, the patients of rheumatic heart disease showed significant increase of average heart rate

and consequently significant decrease of PR interval but the value was still within a normal range (0.13±0.02) sec.

Echocardiogram for all cases and controls showed that 7 cases (14%) had pericardial effusion and 46 cases (92%) had valves affection, 14 cases (28%) had one valve affection, 28 cases (56%) had two valves affection, and 4 cases (8%) had three valves affection. In every normal control the echocardiogram was normal, no cardiomegally, no effusion and no valve affection.

The following tables (6-7-8-10) are showing the comparison of ejection fraction (EF%) and fractional shortening (FS%) between cases of rheumatic heart disease and controls, between cases with heart failure and cases with no heart failure, between cases with active carditis and cases with no active carditis and cases with rheumatic arthritis and controls. The P-Value is significant when less than 0.05. The normal of (EF%) is >60% and the normal of FS%) is >28%.

Table (6): Comparison of ejection fraction (EF%) and fractional shortening (FS%) between cases and control.

Variable	**Cases N=46**	**Control N=40**	**P value**
FS (%)	37.84±13.47	42.90±8.36	0.040852
EF (%)	59.98±10.32	70.55±5.12	<0.0001

The (FS%) in cases showed significant decrease in comparison to controls and the (EF%) in cases showed significant decrease in comparison to controls.

Table (7): Comparison of ejection fraction (EF%) and fractional shortening (FS%) between cases of rheumatic heart disease with heart failure and cases with no heart failure.

Variable	Heart Failure N=17	No Heart Failure N=29	P value
FS (%)	34.69±9.24	43.94±18.03	0.019937
EF (%)	55.47±11.90	62.30±8.71	0.024993

The (FS%) in cases with heart failure showed significant decrease in comparison to cases with no heart failure and the (EF%) in cases with heart failure showed significant decrease in comparison to cases with no heart failure.

Table (8): Comparison of ejection fraction (EF%) and fractional shortening (FS%) between cases with active carditis and cases with no active carditis (cold cases).

Variable	Active Carditis N=26	No Active Carditis N=20	P value
FS (%)	36.12±10.44	39.423±15.81	0.392752
EF (%)	57.65±10.19	62.50±10.06	0.097516

The (FS%) in cases with active carditis showed insignificant decrease in comparison to cases with no active carditis, the (EF%) in cases with active carditis showed insignificant decrease in comparison to cases with no active carditis.

Table (9): Comparison of ejection (EF%) and fractional shortening (FS%) between cases with rheumatic arthritis and controls.

Variable	Rheumatic Arthritis N=4	Controls N=40	P value
FS (%)	39.85±6.84	42.90±8.36	0.241205
EF (%)	67.75±7.84	70.55±5.13	0.32641

The (FS%) and (EF%) in cases with rheumatic arthritis showed insignificant decrease in comparison to controls.

As regards the comparative analysis of HRV between cases and controls Table (10) and Figure (2 a, b, c). Show that all indicators of HRV, **RR tach** (average value (AV), standard deviation (SDNN), mean deviation (M.D) and median), **d RR tach** (average value (AV), standard deviation (SDNN), mean deviation (M.D), portion derive by dividing number of interval differences of successive NN (normal to normal beat) greater than 50msec by total number of NN intervals (PNN50) and square root of the mean squared difference of successive NN (normal to normal beat) interval (RMS. sd)) and **Power Spectrum** (very low frequency (VLF), low frequency (LF), high frequency (HF), show highly significant

impairment in cases with rheumatic fever in comparison to controls, as the P-values are less than 0.05.

As regards study of (SDNN), Table (10) and Figure (2 a, b) show that RR tach (SDDN) and dRR tach (SDNN) in cases are significantly decreased in comparison to controls as the P-values are less than 0.05.

As regards study of the (LF), (HF) and (LF/HF). Table (10) and Figure (2c) show significant decrease in (LF), (HF) in cases in comparison to controls and there is significant increase in (LF/HF).

Table (10): Comparative analysis of HRV between cases of rheumatic heart disease and controls.

Variable	Patients N=46	Control N=40	P value
RR tach			
AV	606.00±113.59	658.65±88.17	0.018157
SDNN	30.52±18.61	58.12±26.53	<0.0001
M.D	24.06±15.04	45.50±21.05	<0.0001
Median	592.54±127.40	654.25±84.54	0.009989
d RR tach			
AV	21.16±19.37	44.05±26.85	<0.0001
SDNN	15.95±13.33	37.60±24.21	<0.0001
M.D	12.42±10.60	29.37±19.35	<0.0001
PNN50	8.90±13.41	37.82±72.77	0.007105
RMS.sd	26.82±23.40	57.80±35.86	<0.0001
Power Spectrum			
VLF	501.56±378.24	1061.30±708.69	<0.0001
LF	585.44±488.96	1666.20±898.01	<0.0001
HF	373.20±380.26	2274.92±2908.44	<0.0001
LF/HF	2.80±2.95	1.43±0.98	0.005926

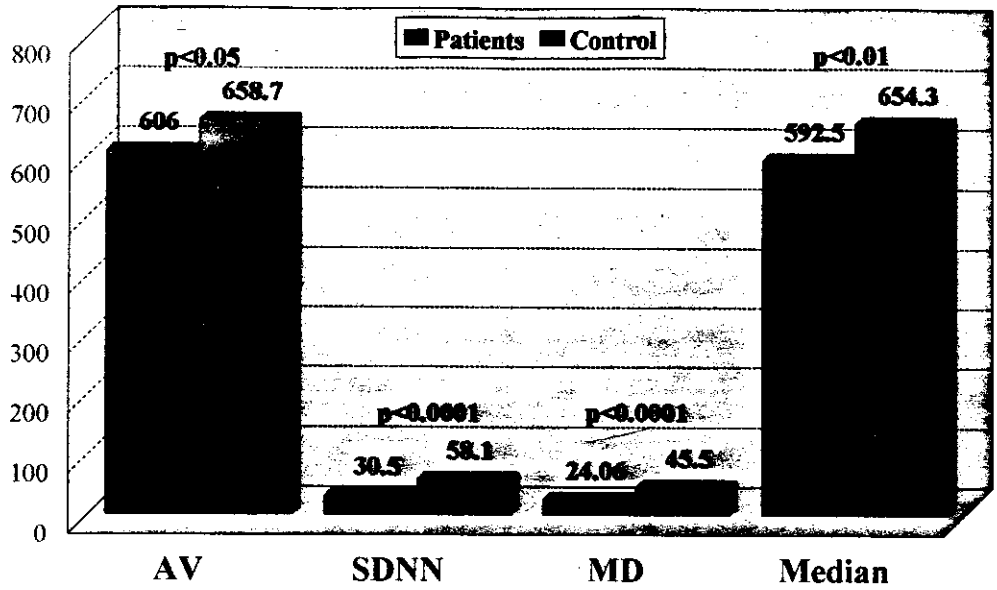

Fig. (2a): Indicators of heart rate variability (RR Tach) in patients with rheumatic heart disease and controls

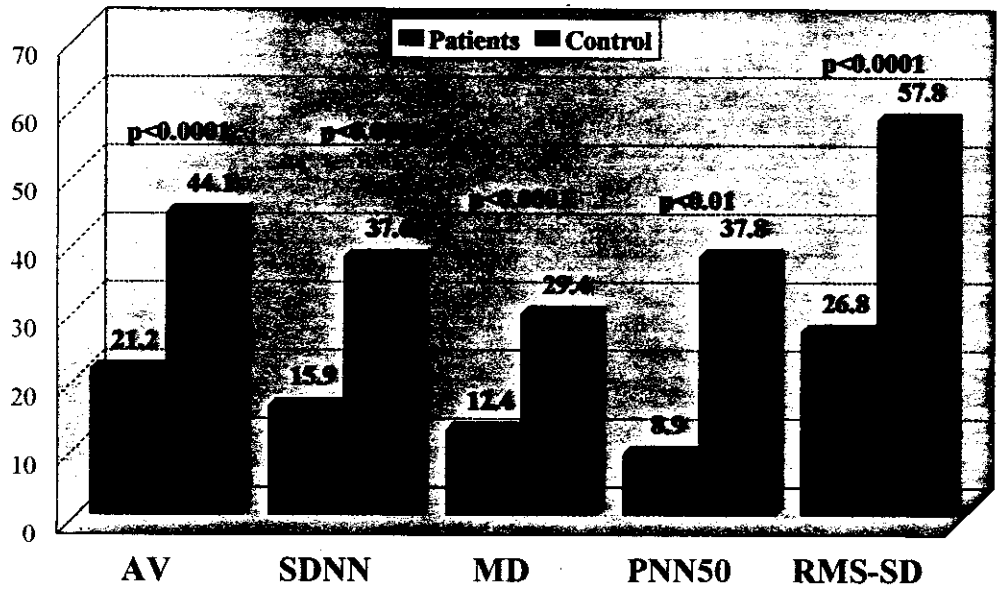

Fig. (2b): Indicators of heart rate variability (dRR Tach) in patients with rheumatic heart disease and controls

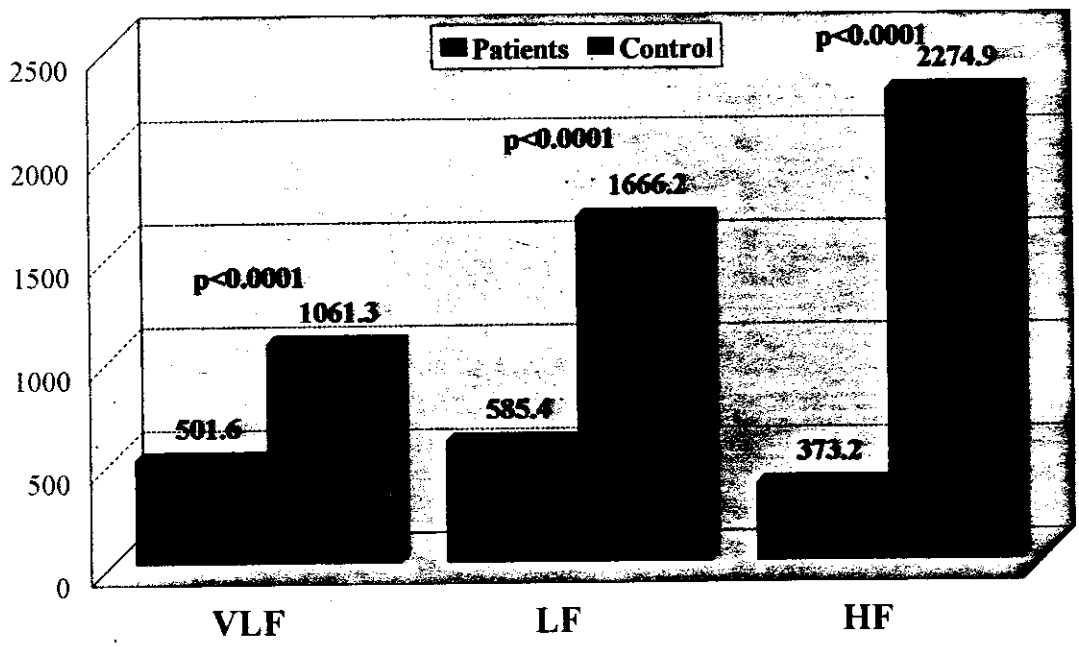

Fig. (2c): Indicators of heart rate variability (Power Spectrum) in patients with rheumatic heart disease and controls.

Table (11): Comparative analysis of HRV between cases of rheumatic heart disease with heart failure and cases with no heart failure.

Variable	Heart failure N=17	No heart failure N=29	P value
RR tach			
AV	512.65±36.96	654.09±109.81	<0.0001
SDNN	14.12±8.07	38.96±16.77	<0.0001
M.D	10.94±5.93	30.81±13.79	<0.0001
Median	525.88±44.29	626.87±142.46	0.006588
d RR tach			
AV	8.12±4.81	27.88±20.64	0.000323
SDNN	6.23±4.15	20.91±13.72	<0.0001
M.D	4.76±3.15	16.36±10.94	<0.001
PNN50	0.26±0.85	13.33±14.68	0.000666
RMS.sd	10.53±6.41	35.21±24.58	0.000185
Power Spectrum			
VLF	318.35±287.48	595.94±388.24	0.012398
LF	286.06±252.36	739.67±511.96	0.001241
HF	157.00±256.45	484.57±388.47	0.002934
LF/HF	3.28±2.45	1.55±3.18	0.021799

Table (11) and Figure (3 a, b, c) show highly significant impairment, (P-values are less than 0.05) in most indicators of HRV in cases with heart failure in comparison to cases with no heart failure.

The RR tach (SDNN) and d RR tach (SDNN) in cases with heart failure show significant decrease in comparison to cases with no heart failure (Table 11 and Figure 3 a, b).

The LF and HF show significant decrease and LF/HF shows significant increase in cases with heart failure in comparison to cases with no heart failure (Table 11 and Figure 3 c).

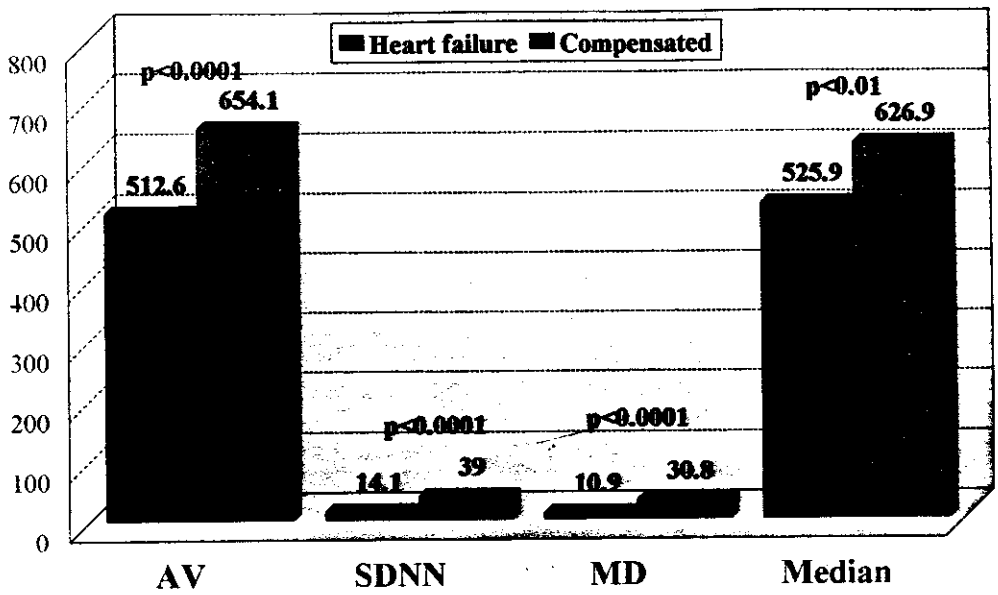

Fig. (3a): Indicators of heart rate variability (RR Tach) in patients with rheumatic heart disease with heart failure and patients with no heart failure.

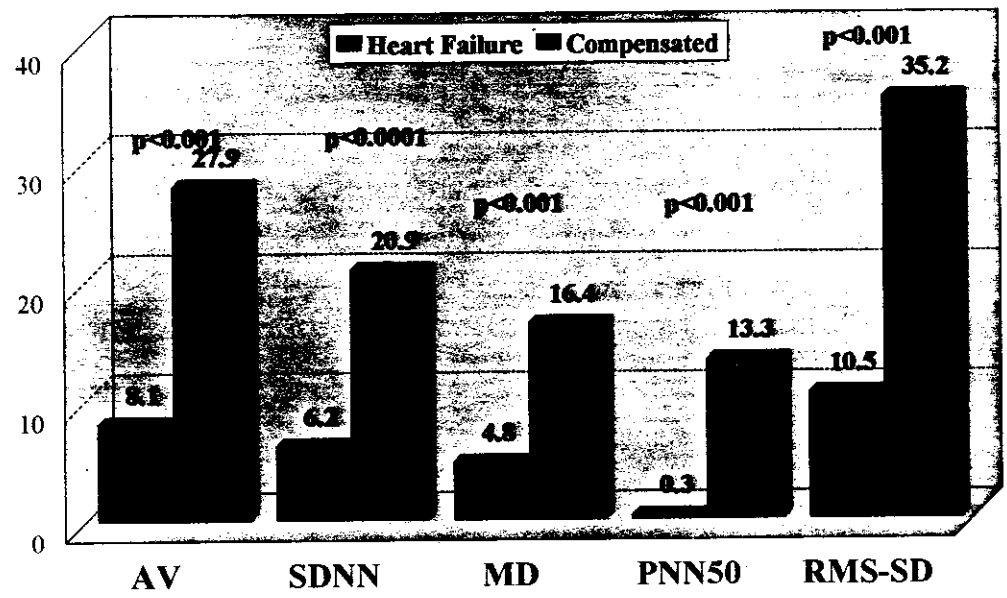

Fig. (3b): Indicators of heart rate variability (dRR Tach) in patients with rheumatic heart disease with heart failure and patients with no heart failure.

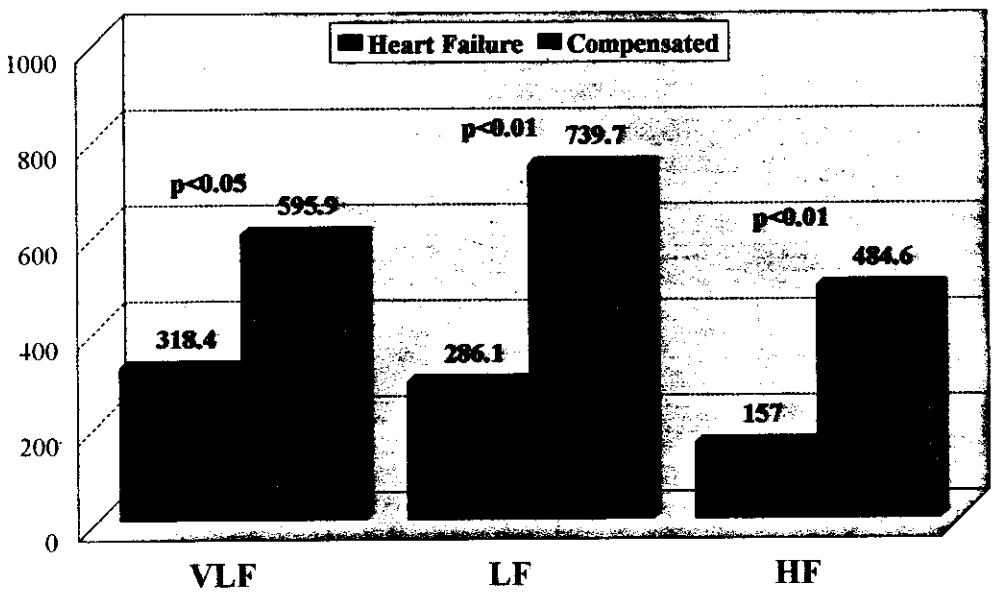

Fig. (3c): Indicators of heart rate variability (Power Spectrum) in patients with rheumatic heart disease with heart failure and patients with no heart failure

Table (12): Comparative analysis of HRV between cases with active carditis and cases with no active carditis (cold cases).

Variable	Active Carditis N=26	No Active Carditis N=20	P value
RR tach			
AV	539.96±74.06	677.54±106.09	<0.0001
SDNN	18.73±11.96	43.29±15.97	<0.0001
M.D	14.31±8.51	34.62±13.38	<0.001
Median	548.27±72.65	640.50±155.64	0.009079
d RR tach			
AV	11.50±10.64	31.62±21.37	<0.0001
SDNN	9.35±10.04	23.04±12.94	0.000115
M.D	7.08±7.30	18.21±10.68	<0.0001
PNN50	2.73±7.54	15.58±15.23	0.000375
RMS.sd	15.08±14.59	39.54±24.70	<0.0001
Power Spectrum			
VLF	377.69±315.34	635.75±400.71	0.014345
LF	365.80±297.39	823.37±547.36	0.000535
HF	183.42±254.29	578.79±391.10	<0.0001
LF/HF	3.66±3.71	1.864±1.33	0.029522

This Table (12) shows highly significant impairment, (P values are less than 0.05) in all indicators of HRV in cases with active carditis in comparison to cases with no active carditis.

As regards RR tach (SDNN) and dRR tach (SDNN) Table (12) and Figure (4 a, b) show significant decreases of (SDNN) in cases with active carditis in comparison to cases with no active carditis.

The LF and HF show significant decrease but LF/HF shows significant increase in cases with active carditis in comparison to cases with no active carditis (Table 12) and Figure (4 c).

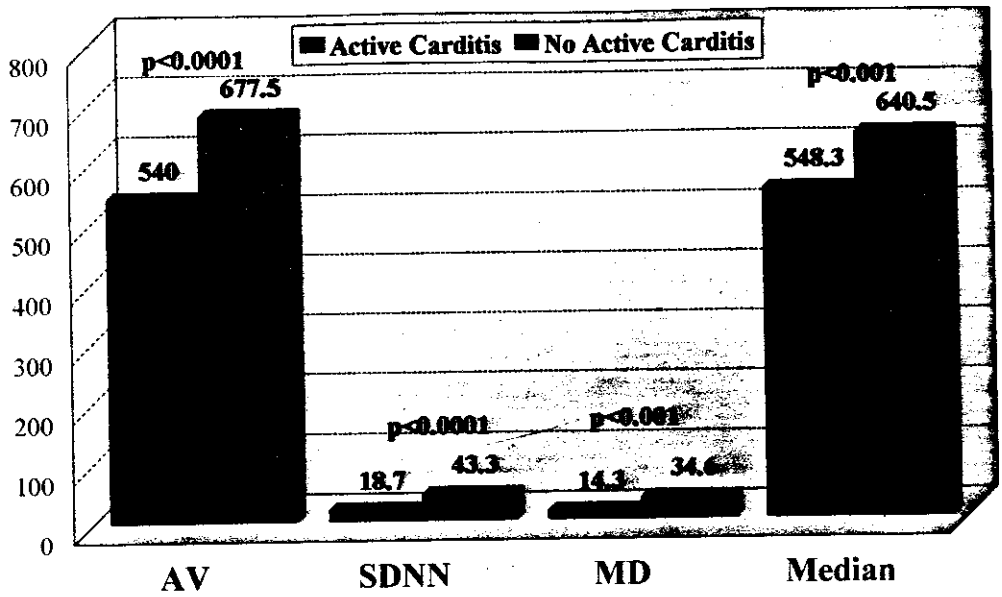

Fig. (4a): Indicators of heart rate variability (RR Tach) in patients with rheumatic active carditis and cold rheumatic heart disease.

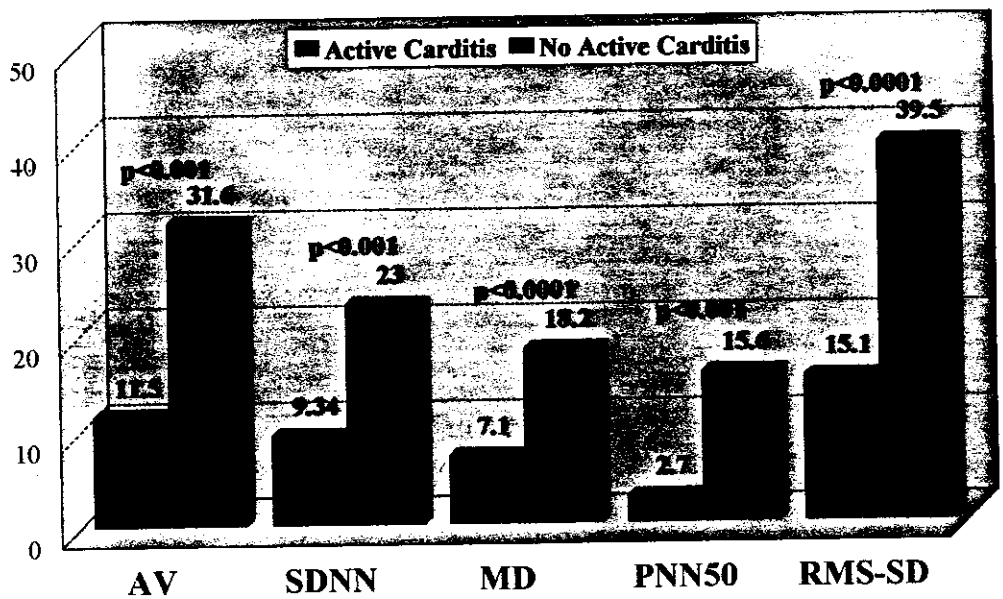

Fig. (4b): Indicators of heart rate variability (dRR Tach) in patients with rheumatic active carditis and cold rheumatic heart disease.

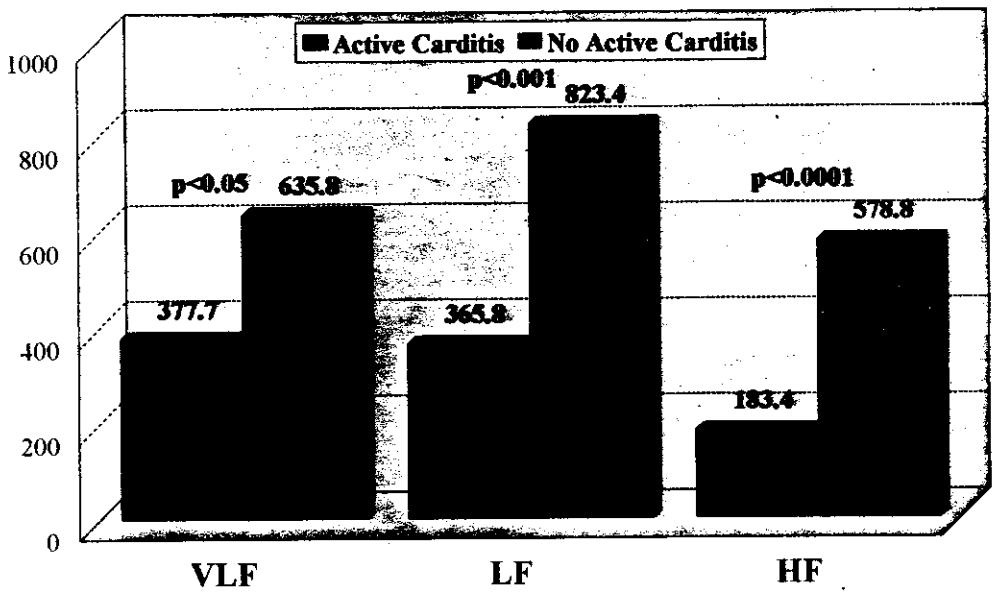

Fig. (4c): Indicators of heart rate variability (Power Spectrum) in patients with rheumatic active carditis and cold rheumatic heart disease.

Table (13): Comparative analysis of HRV between cases with rheumatic arthritis and controls.

Variable	Rheumatic Arthritis N=4	Controls N=40	P value
RR tach			
AV	612.00±71.53	658.65±88.17	0.312855
SDNN	39.50±21.06	58.12±26.53	0.182154
M.D	30.50±16.46	45.50±21.05	0.175481
Median	611.50±69.10	654.25±84.54	0.334667
d RR tach			
AV	22.50±11.39	44.05±26.85	0.122229
SDNN	18.25±11.76	37.06±24.21	0.124571
M.D	14.25±9.10	29.37±19.35	0.132561
PNN50	9.00±9.83	37.82±72.77	0.437849
RMS.sd	29.25±15.86	57.80±35.86	0.12541
Power Spectrum			
VLF	620.00±443.14	1061.30±708.69	0.699422
LF	1027.25±623.21	1666.20±898.01	0.174084
HF	763.00±803.18	2274.92±2908.44	0.310898
LF/HF	2.02±1.27	1.43±0.98	0.264741

Table (13) and Figure (5 a, b, c) show highly insignificant decrease in all indicators of HRV but insignificant increase in (LF/HF) in cases with rheumatic arthritis in comparison to controls as the P-values are more than 0.05 in all the parameters of HRV.

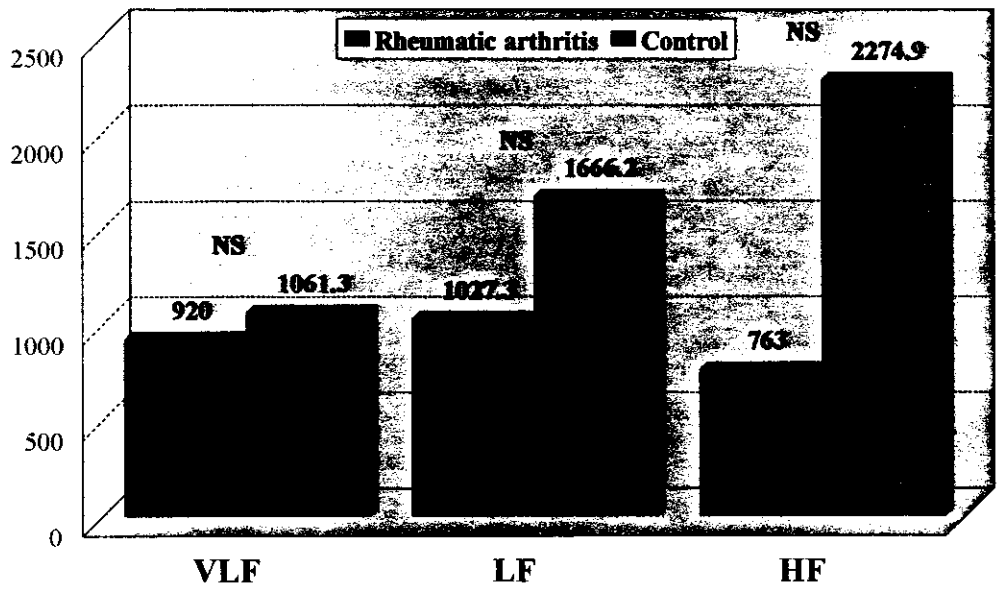

Fig. (5c): Indicators of Heart Rate Variability (Power Spectrum) Patients with rheumatic arthritis and control subjects.

As regards the HRV print out, Figure (6) shows HRV print out of normal control, Figure (7) shows HRV print out of patient with rheumatic arthritis, Figure (8) shows HRV print out of patient with cold rheumatic heart disease, Figure (9) shows HRV print out of patient with active rheumatic carditis with no heart failure and Figure (10) shows HRV print out of patient with active carditis with heart failure.

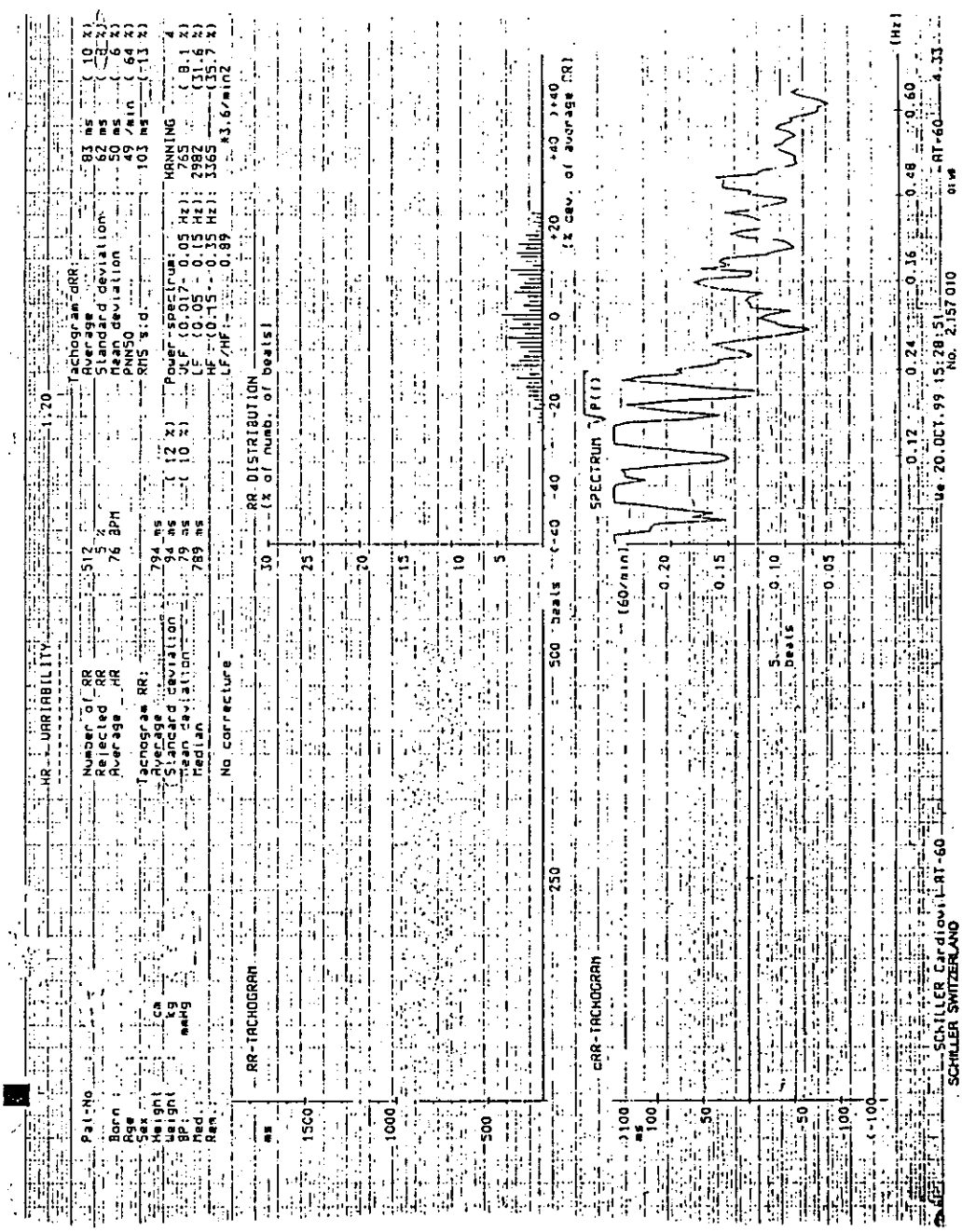

Figure (6): Print out of HRV of normal control.

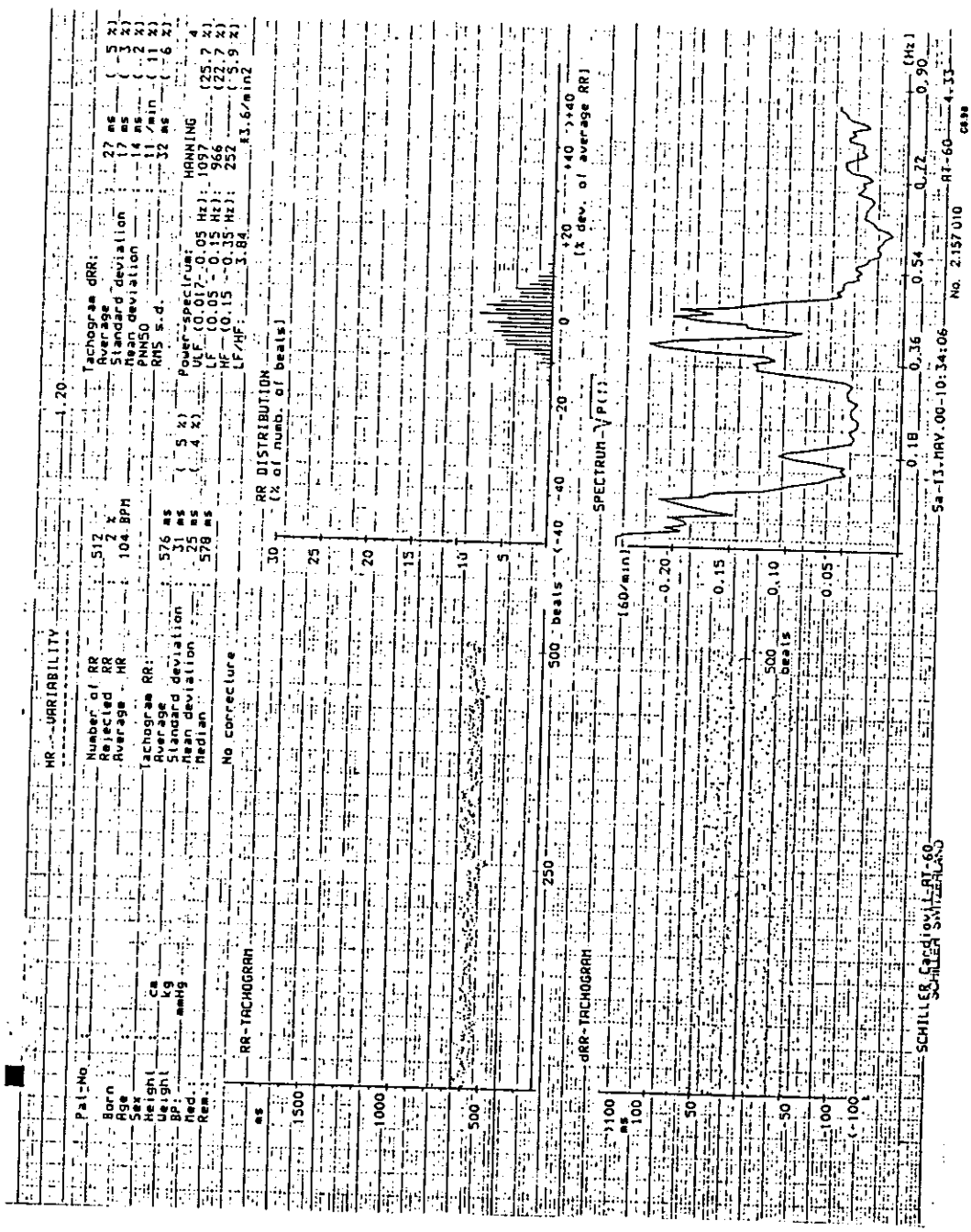

Figure (7): Print out of HRV of patient with rheumatic arthritis.

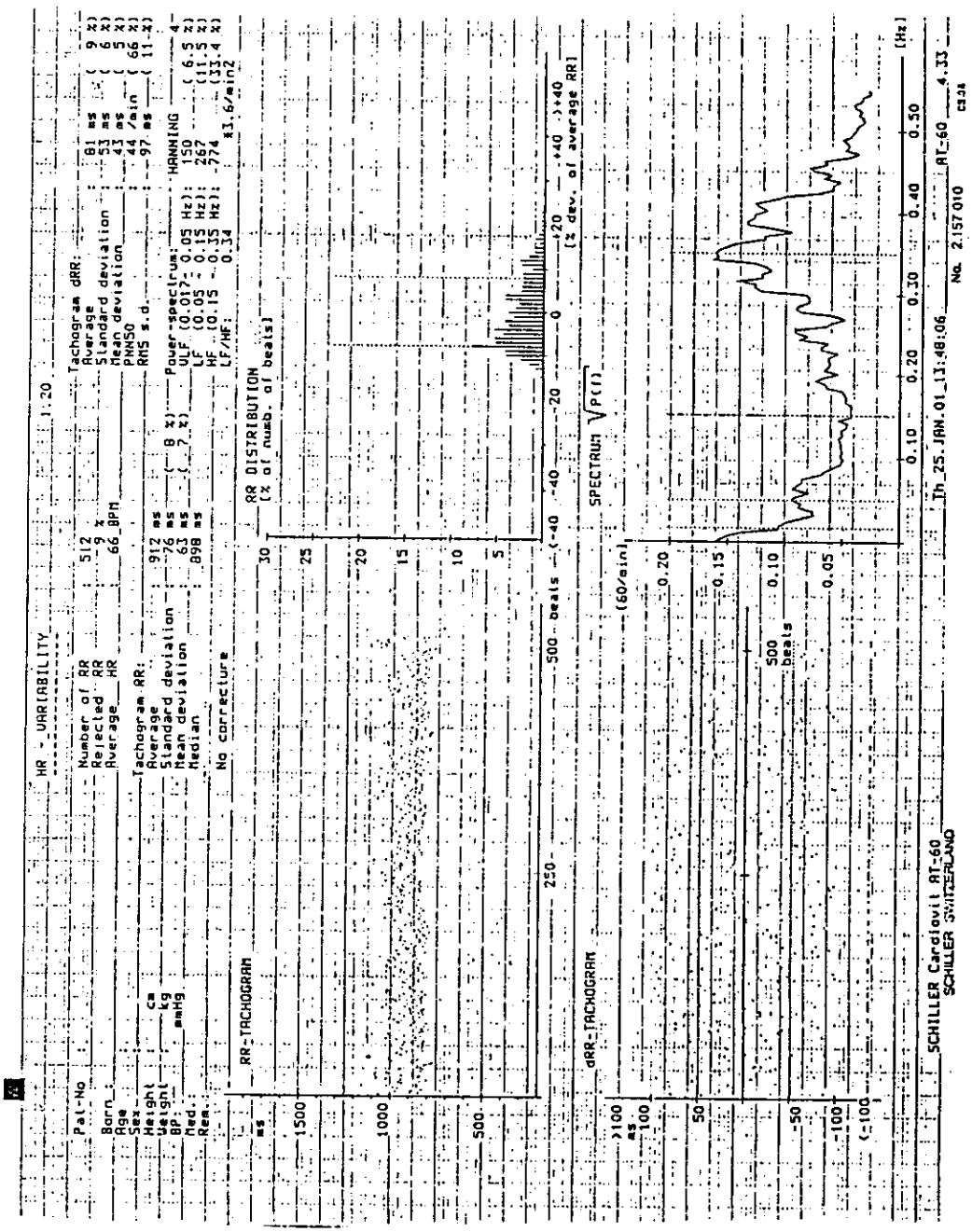

Figure (8): Print out of HRV of patient with cold rheumatic heart disease.

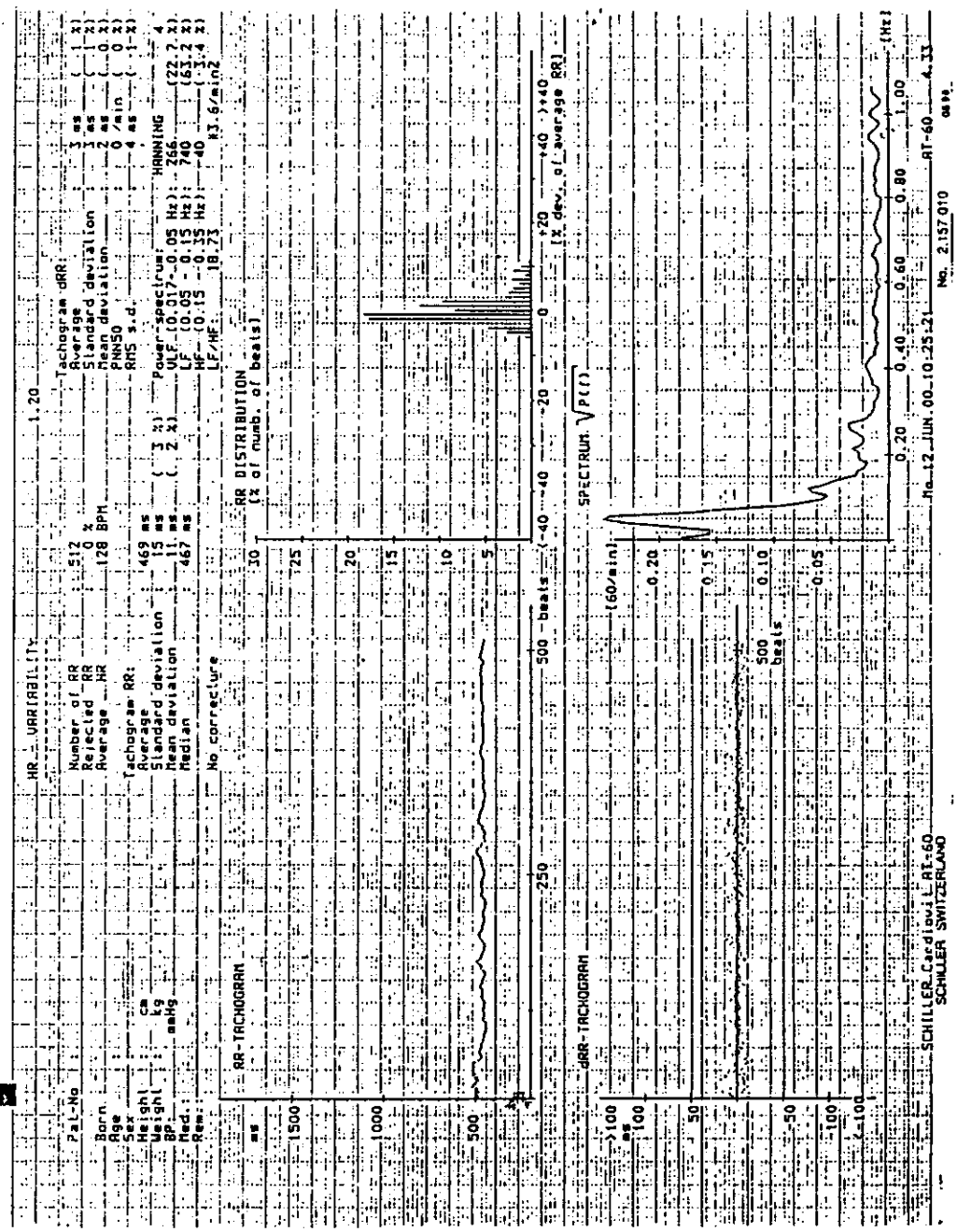

Figure (9): Print out of HRV of patient with active carditis with no heart failure

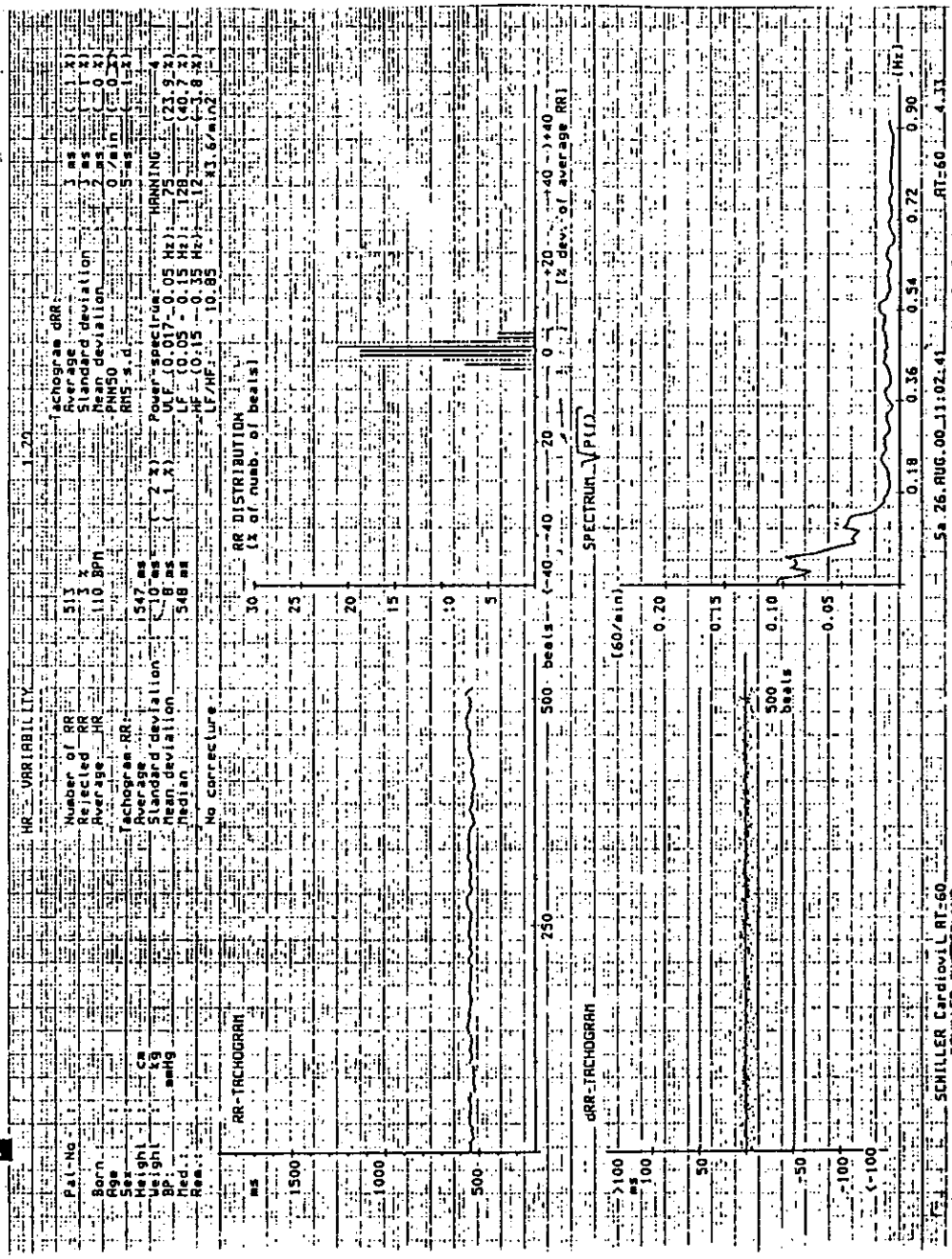

Figure (10): Print out of HRV of patient with active rheumatic carditis with heart failure.