Strawberry Shaped Lorenz Plots Discovery and Apply in the Diagnosis of Atrial Fibrillation （AF）and AF with Two Degree Atrioventricular**

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Abstract: **Background and objective:** At present, using Lorenz plot to diagnosis the persistent atrial fibrillation (AF) and AF merged with II degree atrioventricular block is still a difficult and controversial. The purpose of the study is to analyses the single quadrant scatter data mapping Lorenz Plots of AECG data, from 98 AF patients (mean age is 76.5 years old) diagnosed and AF accompanied with the second degree atrioventricular block, and to try to find the unique Lorenz scatter diagram to have a clear diagnosis for the AF patients and AF accompanied with the second degree atrioventricular block. **Methods**: Used the ECGLAB HOLTER 12. TOP version of the dynamic ECG analyzer for Heart rate variability in analysis of plate loading Lorenz scatter diagram of software, the single quadrant plot each patient with AF AECG data analysis, to observe the graphics features for the diagnosis and application on the AF and AF patients accompanied with the second degree atrioventricular block patients. **Result；** Unique "without stalk strawberry" Lorenz scatter diagram of single quadrant scatter diagram from the AF patients 24 hours AECG data show; and The unique "with stalk hand strawberry" Lorenz scatter diagram of single quadrant scatter diagram from 24 hours AECG of the AF patient with two degree atrioventricular block. **Conclusion：** 1. The first report of AF in patients with AECG data of single quadrant plot shows "without stalk strawberry " Lorenz Plots, AF and AF merged with II degree atrioventricular block patients with AECG data of single quadrant scatter plot showed that the "with stalk strawberry" Lorenz scatter diagram; 2. The study of AF patients with AECG data to form a "strawberry shaped Lorenz Plots "and Esperer et al AF reported AECG patients formed the" fan Lorenz plots "for different reasons, may be related to age with the AF long disease history, atrioventricular node function decreased seriously, cause P-R prolongation associated with. For the mechanism to be further study.
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Keywords: Strawberry Shaped Lorenz Plots (SSLP), Diagnosis of Atrial Fibrillation, Lorenz plots; Poincare plot; arrhythmias; Heart Rate Variability; 24-hour Halter Monitoring; ambulatory electrocardiogram（AECG）.

1. Introduction:

With the research of Lorenz scatter diagram for HRV (Heart Rate Variability) analysis and the application, that has provided many useful data as for the clinical diagnosis and treatment of heart disease[1], and it has been as the diagnosis and evaluation of value as 24 hours Halter monitoring one of the means of [2]. There was reports using Lorenz scatter diagram for HRV (Heart Rate variability) analysis when applied to the diagnosis of Atrial and/or ventricular tachyarrhythmia has found that there are ten types of Lorenz scatter diagram[3]. However, it is in diagnosis of the controversial to be using the Lorenz plot for persistent atrial fibrillation with the second degree atrioventricular block (AF) [4]. And it is also a lack of typical Lorenz scatter pattern used to be as the diagnosis and application on the atrial fibrillation (AF) and atrial fibrillation combined with the II degree atrioventricular block [5]. This study reported 98 cases of persistent AF and AF merged with II degree atrioventricular block patients 24 hours AECG data using the Lorenz scatter diagram analysis and research, the purpose is based on the data of our study to find out a typical pattern Lorenz Plot to be used as the diagnosis of sustained AF and AF merged with II degree atrioventricular block, in order to facilitate clinical diagnosis on the AF and AF merged with II degree atrioventricular block.

2. Patients and Methods:

2.1. Instruments; the scatter diagram software plate loading Lorenz Plots were analyzed using the Beijing DMS Software Technology Co. Ltd. ECGLAB HOLTER 12. TOP version of the dynamic ECG analyzer on heart rate variability, single quadrant plot each data analysis, to observe its characteristics.

2.2. The object of study; The 24 hours AECG data of 98 (83-70, average is 76.5 years old) persistent AF patients with long R-R interval of ECG, from the 2nd Hospital of Zhengzhou University, China, during

2010.10～2012.10, were as the observation object, and that were assured to be excluding persistent AF with ventricular premature beat, pre excitation syndrome, cardiac pacemakers and wide QRS wave diagnosis is not clear.

2.3. Group; Following the patient's ECG R-R interval and the patients with and without the second degree Atrioventricular Block, the 98 patients were divided into three groups (table-1):

Group A: 17 cases, R-R interval < 1.5 seconds (s), no equal R-R interval, and not second degree atrioventricular block;

Group B: 75 cases, R-R interval < or > 1.5s, no equal R-R interval, not two degree atrioventricular block;

Group C: 6 cases, R-R interval < or > 1.5s, have the same R-R interval and with second degree atrioventricular block.

Table1. Patients Characteristics on each group

Group	Case	Time of R-R Interval	Equal R-R interval	2nd degree atrioventricular block
A	17	< 1.5s	not	without
B	75	< or > 1.5s	not	without
C	6	< or > 1.5s	yes	with

2.4. The 24 Hours AECG data's Lorenz Plots drawing and its feature comparison;

Using the computer automatic measurement of continuous beat a considerable number of R-R interval, RR interval to first as a horizontal coordinate (R-Rn for the X axis), second RR interval as a vertical coordinate (RRn+1 for the Y axis), the first stroke points in the coordinate, and then to second R-R interval as abscissa, third a R-R interval as a vertical coordinate out of second beats, and then followed by analogy, X axis R-Rn, axis Y of R-Rn+1, a certain period of time (short for 1 hours, the length of time was 24 hours) coordinate all beat 2 draw scatter known scatter diagram as the Lorenz Plots[4].

2.5. Analysis of age and AECG characteristics of the three groups were compared:

1) Lorenz Plots features; 2) Correlation of junctional escape beat and Lorenz Plots characteristics; 3) the slowest average ventricular rate (SVR); 4) The fastest average ventricular rate（FVR）; 5) 24 hours average ventricular rate（24hVR）; 6) The shortest R-R interval atrioventricular nodal functional refractory periods（FRPs); 7) 1000ms R-R interval atrioventricular nodal functional refractory periods (FRP_{1000}); 8) The numbers of long R-R interval (R-R ≥ 1.5s) during 24 hours AECG;

2.6. Statistical processing; Using SPSS software (version 10) were analyzed statistically, reference parameters to mean + standard deviation（ $\bar{\chi}\pm s$ ） said, was tested using independent samples t test, with P <0.05 as the difference has statistical significance.

3. Results:

3.1. The Feature of Lorenz Plots in Three Groups of the AF patients;

3.1.1. The "No Stalk Strawberry Shaped" Lorenz Plots found from 24 hour AECG data in Group A (17/98) and Group B (75/98) ; The patients with persistent Atrial fibrillation (Fig. 1-1, Fig. 2-1). The AECG data identical characteristics of group A and B showed that there is no equal R-R interval and no two degree atrioventricular block occurred. Yet, the different characteristics showed that there was the all of R-R interval in group A to be less than 1.5s, but that there was the R-R interval in group B partially to be less than the 1.5s (Fig.1-2), and in group B partially to be also greater than 1.5s (Fig.2-2).

1.0S

Fig.1-2: From Group A, The Longest R_3-R_4=1.32s，R-R never equal, all of the R-R Interval is less than 1.5s.

1.0S Fig.1-1: Group A，Patients with persistent atrial fibrillation, the all of interval of R-R < 1.5s, The "No Stalk Strawberry shape" -Lorenz Plots were drawn from 24 hours AECG data.

1.0S

Fig. 2-2: The Longest R_2-R_3=1.96s，R-R never equal，R_4-R_5 interval to be less Than 1.5s.

1.0S Fig.2-1: Patients with persistent Atrial fibrillation, R-R≤或＞1.5s，the all of R-R interval < 1.5s, the "No Stalk Strawberry shaped" Lorenz Plots were drawn from 24 hours AECG data.

3. 1.2. The Stalk Strawberry Shape Lorenz Plots found from 24 hour AECG Data in Group C:

The Group C (6/98) AECG data in patients with persistent Atrial fibrillation showed that The Stalk strawberry shape Lorenz plots (Fig. 3-1, 4-1, 5-1, 6-1, 7-1, 8-1). There are of equal R-R interval and the patient with the two degree atrioventricular block occurred in Group C, and there is the equal R-R interval happened between the junctional escape beat that caused by the two degree atrioventricular block in Group C too, but that there is not occurred in Group A and B (Fig. 3-2, 4-2, 5-2, 6-2, 3, 7-2, 8-2). There is R-R interval to be either greater than or less than 1.5s (Fig. 3-2, 4-2, 5-2, 6-2, 7-2, 8-2) in Group C, that is same Group B.

1.0S

Fig.3-2: R_2-R_3 = R_3-R_4= R_4-R_5=1.76s, junctional escape beat caused from the Two degree atrioventricular block.

1.0S Fig.3-1: Patients with persistent AF, R-R < or > 1.5s, the stalk strawberry shaped Lorenz Plot was drawn From 24 hours ACCG data.

1.0S

Fig.4-2: R_1-R_2 = R_2-R_3= R_3-R_4=1.76s, junctional escape beat caused from the 2nd degree atrioventricular block.

Fig.4-1: Patients with persistent AF, R-R≤或＞1.5s，the "strawberry shaped" Lorenz were drawn from 24 Hours ACCG data.

1.0S

1.0S

Fig.5-2: R_2-R_3 = R_3-R_4= R_4-R_5=1.7s，junctional escape beat caused from the Second degree atrioventricular block.

1.0S Fig.5-1: Patients with persistent AF, R-R≤或＞1.5s，the "strawberry shaped" Lorenz were drawn from 24 Hours ACCG data.

Fig.6-2: R_1-R_2 = R_2-R_3= R_3-R_4=1.85s，junctional escape beat caused from the second degree atrioventricular block，that is the patient's longest escape beat interval, but is also the slowest mean rate of VR mean, that is 33/ Min.

Fig.6-1: Patients with persistent AF, R-R≤或＞1.5s，the "strawberry shape" Lorenz were drawn from 24 Hours ACCG data.

1.0S

Fig.6-3; R_2-R_3 = R_3-R_4= R_4-R_5=1.66s，junctional escape beat caused from the second Degree atrioventricular block，That is the patients with the shortest escape beat interval.

Fig.6-4; junctional escape beat caused from the second degree atrioventricular block, The VR is 96/minute to be the fastest mean rate of VR.

Fig.7-2; R_3-R_4 = R_4-R_5= R_5-R_6=1.56s，junctional escape beat caused from the Second degree atrioventricular block. 1.0S Fig.7-1; Patients with persistent AF R-R≤or＞1.5s, the Stalk strawberry shaped Lorenz were drawn From 24 Hours ACCG data.

Fig. 8-2; R_2-R_3 = R_3-R_4= R_4-R_5=1.80s，junctional escape beat caused from the Second degree atrioventricular block. 1.0S Fig.8-1; Patients with persistent AF R-R≤or＞1.5s, the Stalk strawberry shaped Lorenz were drawn From 24 Hours ACCG data.

3.2. In the C group patients, The Stalk Strawberry Shape Lorenz scatter diagram formed with the consistent on the occurrence of junctional escape rhythm, and shows the junctional escape rhythm rate's high incidence companied with AECG to form the more typical Lorenz plot of The Stalk Strawberry shape.

The comparison of escape rhythm rate's incidence (%) with the corresponding "The Stalk Strawberry Shaped" Lorenz scatter diagram in Table 2; Fig.3-2 corresponding to Fig.3-1; Fig.4-2 corresponding to Fig.4-1; Fig.5-2 corresponding Fig 5-1; Fig. 6-2 corresponding to Fig. 6-1, FIG. 7-2 corresponding to Fig. 7-1, FIG. 8-2 graph corresponding to Fig.8-1.

Table 2：The junctional escape rhythm in the shortest, the longest R-R interval and its difference and junctional escape occurred rate % in The Group C

Legend	Fig.3-1	Fig.4-1	Fig.5-1	Fig.6-1	Fig.7-1	Fig.8-1
Longest	1.90	1.83	1.72	1.85	1.66	1.80
Shortest	1.70	1.62	1.58	1.66	1.56	1.67
Difference	0.20	0.21	0.14	0.19	0.10	0.13
Rate	14.06	7.46	8.51	4.15	1.73	9.33

3.3. Compared the relation between the data of patients 24 hours AECG and the formation of the strawberry Lorenz Plot.

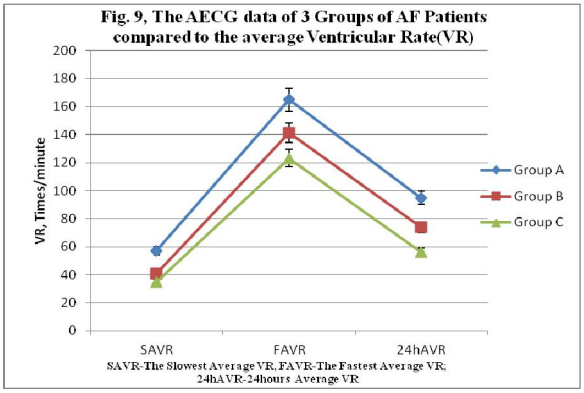
3.3.1. The slowest average ventricular rate (SVR)

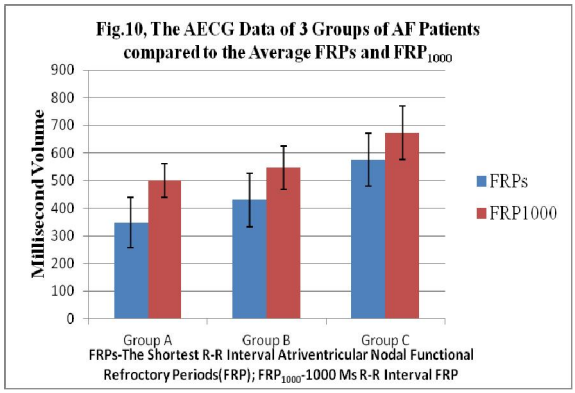
The SVR showed that the Group A > Group B>Group C；The Group C was compared with Group A and B respectively, that to be showed with statistical significance（P< 0.05) Table 2，Fig.9 and Fig.10) both the Group C vs. Group A and Group C vs. Group B.

Table 2; comparison of average value from three groups of patients AECG data（ $\bar{\chi}$±s）

Group	Case	Age	The Slowest VR Mean Value	The Fastest VR Mean Value	24H VR Mean Value	FRP_s	FRP_{1000}
A	17	75±5	$57.23±8.71^{*△}$	$164.88±3.80^{*△}$	$94.94±18.59^{*△}$	$347.06±91.50^{*△}$	$500.00±61.14^{*△}$
B	75	75±5	$40.80±5.27^{△}$	141.44±30.39	$73.83± 9.49^{△}$	$429.87±97.54^{△}$	$547.07±79.13^{△}$
C	6	78±5	35.00±4.69	123.17±51.24	56.17± 5.49	575.00±165.62	671.67±96.63

Notice：$^{△}$：Group C compared with Group A and B，P＜0.05; $^{*△}$：Group B compared with Group A, *P＜0.05; *: ventricular rate; **: The shortest R-R interval atrioventricular nodal functional refractory Periods; ***: 1000ms R-R interval atrioventricular nodal functional refractory periods.





3.3.2. The fastest average ventricular rate（FVR）;

The FVR showed that the Group A > Group B>Group C, The Group C was compared with Group A and Group B respectively, that to be showed with statistical significance（P< 0.05), Table 2，Fig.9 and Fig.10) in Group C vs. Group only;

3.3.3. 24 hours average ventricular rate （24h AVR);

The 24VR showed that the Group A > Group B>Group C，The Group C was compared with Group A and B respectively, that to be showed with statistical significance（P< 0.05) Table 2，Fig.9 and Fig.10) both the Group C vs. Group A and Group C vs. Group

B;

3.3.4. The shortest R-R interval atrioventricular nodal functional refractory periods（FRPs);

The FRPs showed that the Group A > Group B>Group C，The Group C was compared with Group A and B respectively, that to be showed with statistical significance（P< 0.05) Table 2，Fig.9 and Fig.10) both the Group C vs. Group A and Group C vs. Group B;

3.3.5. FRP1000, 1000ms R-R interval atrioventricular nodal functional refractory periods (FRP_{1000});

The FRP_{1000} showed that the Group A > Group B>Group C，The Group C was compared with Group A and B respectively, that to be showed with statistical significance（P< 0.05) Table 2，Fig.9 and Fig.10) both the Group C vs. Group A and Group C vs. Group B.

3. 4. The Comparison of long R-R interval (R-R ≥1.5s) data during 24 hours AECG in Group B and C;

3.4.1. R-R≧1.5s Frequency，Group C is higher than Group B，that was Compared with statistical significance (P<0.05) between the Group C and Group B (table 3).

3.4.2. The R-R≧2.0s Frequency of occurred; the Group C is higher than the Group B, but that was Compared without statistical significance （P>0.05) between the Group C and B（table 3）;

3.4.3. The Frequency of The longest R-R interval occurred; the Group B is higher than the Group C, but there was not statistical significance to be compared between the Group B and C(table 5);

3.4.4. The 1.5-1.9s R-R% in Total R-R Interval; The Group C is little lower than the Group B, but the Group C was compared with the Group B to be not statistical significance (P>0.050), （Table 3）;

3.4.5. The 1.5-1.9s R-R% in Total R-R≧1.5s, Group C is higher than Group B，that was Compared with statistical significance （P< 0.05)between the group C and B（table 3）;

Table 3：Comparison of long R-R interval data during 24 Hour AECG in patient's （ $\bar{\chi}$±s）

Group	Cases	R-R≧1.5s Frequency	R-R≧2.0s Frequency	The Longest R-R（s）	1.5-1.9s R-R% In Total R-R	1.5-1.9s R-R% In Total R-R ≧1.5s
B	75	1610. 28±1694.19	112.36±251.13	2.50±0.50	7.77±0. 91	37. 36±12.13
C	6	8251.00±3338.22△	146.67±284. 27	2.21±0.28	7. 54±0.4.29	61.12±15.16△

△: compared with Group B， P＜0.05

4. Discuss:

4.1. The main findings our study are the Strawberry Pattern Lorenz Plots exhibited in.

Atrial Fibrillation（AF），and that is first finding in the world;

Since the Lorenz scatter diagram for the evaluation of AECG, although there are 10 different Lorenz Scatter found in patients with different types of arrhythmia[3], but there are never an application and report of "strawberry shaped" Lorenz plots in diagnosis of arrhythmia[6]. The study found that the "without stalk strawberry shaped" Lorenz plots in 92/98 of the Patients suffered with atrial ventricular fibrillation, the "with stalk strawberry shaped" Lorenz scatter occurs in 6/98 of atrial ventricular fibrillation in patients with atrioventricular block (Fig. 9). The results of this study are a newly discovery on the Lorenz scatter diagram for the diagnosis of cardiac arrhythmia in patients. At present, there were not any report to show the "strawberry shaped Lorenz plots" on the diagnosis for patients with arrhythmia[6, 7].

4.2．Patients with persistent AF formed the mechanism of the "without stalk strawberry shaped" and the "with stalk strawberry shaped" Lorenz plots;

From 98 cases of patients with AF AECG to form a Lorenz chart can be seen, if the angle between the edge and the X level of scattered point axis is big, that showed the ventricular rate in patients with slow，and the changes of heart rate range is larger, the scatter diagram of high position, graphics, due to the overall ventricular rate changes in a large range, the scatter diagram on the edge (relative vertical margin), and the angle of Y axis is also high, away from the Y axis, so the plot is not a fan, and a change of the "strawberry shaped ". In addition, because of the age of the patients is relatively high (over 60 years old), atrioventricular nodal function decrease, and the other to the AV node conduction function is low, should not be extended to the number of F wave cannot be reached under ventricular increased factors (such as drugs, atrioventricular block, concealed conduction, increase vagal tone increased higher). Effect of prolonged R-R interval, which caused by the slowing of ventricular rate, so the changes of heart rate range is larger, which formed the "strawberry shaped " Lorenz scatter diagram 。If there are AF with two degree atrioventricular block, there is a continuous emergence of long R-R interval, R-R interval and F wave length due to not transfer，that is below two degree atrioventricular block area of spike caused by, so is the junctional or ventricular escape rhythm, because as

long as the R-R intervals of junctional or ventricular escape rhythm but also by the effect of autonomic nerve, but the effective is smaller, so long R-R interval changes in different time periods is also small, there is a small short rod line on the 45° line. Small short rod from the origin of the scatter in R-R interval is short, escape rhythm faster, from scattered point far long R-R interval, escape rhythm slower, So, the "with Stalk strawberry shaped " Lorenz plot were formed from the AF with two degree atrioventricular block; The" without Stalk strawberry type" Lorenz Plots were formed from the AF without two degree atrioventricular block.

4.3. Why this study in patients with AF to form a "without Stalk strawberry shaped" Lorenz scatter diagram, which is different from the Hans D. Esperer et al [3] reported that the patients with AF to form the "fan shaped"?

4.3.1. The reason might be associated with the history of illness AF;

Analysis of the Hans D Esaperer et al. reported 1255 AF patients showed the" fan shaped" Lorenz plots[3], their average age was 53 + 7 years; that is lower than the 20 years old to compared with this study reported with the AF patients to have the average age 76 + 7 years old. In fact, in the circumstances to determine accurately the onset time of each AF were difficult, age is an important determinant of patient with AF duration, the high age group of patients with AF were more likely to have AF long disease history, a long history of patients with AF may be involved in the cardiac conduction system, thus affecting the formation of AECG -Lorenz plots the detailed mechanism remains to be further studied;

4.3.2. The reason might be related with the atrioventricular node function;

There is the "strawberry shaped" Lorenz Plot rather than "Fan shaped" in this study of the AF patient, which might be happened with the atrioventricular nodal function and then, that was related with the age of patients and some medicine using, whether there are many and the vagal nerve tension effects of atrioventricular block, the concealed conduction. According to the composition and principle of the Lorenz Plots, the Lorenz Plots horizontal edge is formed by the minimum R-R interval from the bases of the different R-R interval, The small angle composed from the scatter diagram horizontal edge and X axis that showed the patient was with fast heart rat, and the changes of heart rate range is small, scattered point diagram position is low and small graphics, due to changes in the overall rate of ventricle smaller, scatter on the edge (relative vertical margin), also small and the angle of Y axis, Y axis is close to, such as the age of the patients is relatively small. The average age of Hans D. Esperer et as reported was less 60 years old, (average is 53 + 7 years old) [3], and These patients were with short AF history, and so the patients AV node function were still in normal, which wouldn't showed the R-R interval prolongation to result the heart rate slowly down, so the changes of heart rate range is small, scattered point diagram is a typical fan shaped Lorenz Plots. Therefore, Hans D. Esperer fan et al reported the patients with AF that demonstrated the "Fan shaped" Lorenz Plots[3, 7].

The patients with AF Lorenz plots and Hans D. Esperer et al reported[3] in comparison, The AF patient age reported in this study were higher, their average were 76 ±7 years old. there were a Lorenz Scatted diagram, formed from the AECG of patient, can be seen, if the angle between the edge and the X level of scattered point axis, showed that the ventricular rate in patients with slow, and the changes of heart rate range is larger, the scatter diagram of high position, graphics, due to the overall ventricular rate changes in a large range, the scatter diagram on the edge (relative vertical margin), and the angle of Y axis is also high, away from the Y axis, so the Lorenz plot is not a fan, other than the Lorenz is a "strawberry" changing. In addition, because of the age of the patients is relatively higher (60 years old), atrioventricular nodal function decrease, and the other to the AV node conduction function is low, should not be extended to the number of F wave cannot be reached under ventricular increased factors (such as drugs, atrioventricular block, concealed conduction, increase vagal tone increased higher)[6,8]. Effect of prolonged R-R interval, which caused by the slowing of ventricular rate, so the changes of heart rate range is large. The Lorenz plots were "strawberry" change without a typical fan type, whether the "fan" and "strawberry shaped" Lorenz plot formation to be related with atrioventricular node function that will need further study to be proving.

4.4. The relation between "with stalk strawberry shaped" Lorenz scatter diagram forming and the junctional escape rhythm in the AF patients with two degree atrioventricular block；

AECG data, from the AF patients with of two degree atrioventricular block induced junctional escape and escape rhythm, formed the Lorenz Plots, and formed a parallel to X axis "dense band the in the 45 degree line left that is the "with stalk strawberry shaped" scatter Lorenz Plot, that indicate the Y value (R-Rn+1) is relatively constant, the value of X (R-Rn) changes with the different time. The lower right 45 degree line parallel to Y axis with the dense scattered on the contrary, the scatter angle of 45 degrees on the short tight zone, indicating that X value equal to the value of Y, and the continuous appearance; the corresponding ECG, R-R interval equal (Figure 3-2), These feature of above from the AF patients have a

relatively fixed rhythm in not uniform the rhythm. The rhythm and the rhythm of atrioventricular node to transmit the combination of short long, long short, long-long interval and to form the dense area to be parallel to the X axis and Y axis(fig, 4-1, 5-1, 6-1, 7-1, 8-1 and 3-1, so that the same principle), and that tends to the "fan shaped "Lorenz scatter diagram, in turn, to form a "with stalk strawberry shaped " scatter diagram[7,8,9]. When the QRS wave showed supraventricular rhythm, the rhythm showed the point of junctional escape; when the QRS wave is the room, the rhythm is ventricular escape, therefore, patients in group C were junctional escape; there are dense area happened between the 1.5-1.9 s R-T interval in the "with stalk strawberry shaped " Lorenz Plots; that above is why the different patients with "dense area （the Stalk of strawberry） " in the width and length of inconsistent (Figure 3-1, 4-1, 5-1, 6-1, 7-1, 8-1); Different patients escape interval is regulated by the autonomic nervous system effects of the different heart rate, as a result of different forms of each powder. At the same time also shows that different patients and patients with junctional escape beat intervals change is small, is relatively stable[10,11,12]. A, B both groups corresponding to the ECG R-R interval range, so no two degree atrioventricular block caused by the escape and escape rhythm occurred (Fig. 1-2, 2-2).

4.5. To discuss the feasibility of the "strawberry shaped" Lorenz plots in clinical application；

According to the research results of 98 cases of AF patients and analysis, see the C group was (6/98) AF with the formation of II degree atrioventricular block in patients with AECG data "with stalk strawberry shaped" Lorenz Plots and A with B group (92/98) no II degree atrioventricular block in patients with AF AECG data form the "without Stalk strawberry shaped" Lorenz Plots is the Lorenz Plots for the latest reported AF patient with the specific graphics. The research results show that not only the "strawberry shaped" Lorenz Plots can provide an accurate diagnosis of patients with AF, and according to the" without stalk strawberry shaped" and the" with stalk strawberry shaped" to distinguish Lorenz Plots clear whether AF patients complicated with II degree atrioventricular block[15], therefore, this research is the result of clinical Lorenz Plots is an important basis for wide application of AF and AF with II degree atrioventricular block patients.

5. Conclusion:

5.1. The AECG data from the AF Patients accompanied with the atrioventricular node dysfunction formed the formation of "without stalk strawberry shaped" Plots Lorenz；

5.2. The AECG data from the AF Patients accompanied with the atrioventricular node dysfunction and II degree atrioventricular block formed the formation of "with stalk strawberry shaped" Lorenz Plots ；

5.3. The “Strawberry shaped Lorenz plots" is used for the diagnosis of AF in patients with unique pattern of the latest research results, and we still did not see a similar report. The research results show that not only according to the "strawberry" Lorenz plots can be a more accurate diagnosis of patients with AF, and according to the "without Stalk strawberry shape" and” with stalk strawberry shaped" Lorenz plots, a clear distinction diagnosis will be in the patients with AF and merged with second degree atrioventricular block. Therefore, that is the important basic data on the Lorenz plots for AF and AF with the second degree atrioventricular block in the clinical diagnosis and treatment.

5.4. The different reasons of the AF patients (mean age 76 + 7 years old) of AECG data formed the "strawberry shaped" Lorenz plots and Hans D. sparer et al reported that patients with AF AECG (mean age 53 + 7 years old) formed the "fan Lorenz plots", that may be related to the ages, the age is bigger, the long history of AF disease and atrioventricular node function decreased and associated prolongation of the P-R interval and the mechanism needs to do further research.

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