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# Postprandial Hyperglycemia is a Possible Contributor to Paroxysmal Atrial Fibrillation: A Case Report

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**Abstract**

Atrial fibrillation, a major risk factor for stroke, is believed to occur first as paroxysmal episodes, gradually becoming more persistent, and finally progressing to chronic atrial fibrillation. Treatment of paroxysmal atrial fibrillation is an important target to prevent chronic atrial fibrillation. We describe a very unique case with postprandial hyperglycemia and obesity associated with drug-refractory paroxysmal atrial fibrillation. A 73-year-old Japanese woman with postprandial hyperglycemia suffered from drug-refractory paroxysmal atrial fibrillation. A 1,600 kcal/day diet and walking three times/day for more than 30 min eliminated paroxysmal atrial fibrillation after 6 months. Diet and exercise should be considered as the initial therapy in patients with paroxysmal atrial fibrillation who also have postprandial hyperglycemia. This case suggests that postprandial hyperglycemia and insulin resistance might be one of the possible underlying mechanisms of paroxysmal atrial fibrillation.

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**Key Words**

■**Atrial fibrillation** ■**Glucose** (**postprandial hyperglycemia**) ■**Obesity** ■**Insulin** (**resistance**)

## INTRODUCTION

Atrial fibrillation (AF) is an important cause of thromboembolism and is a major risk factor for stroke.[1] The prevalence of AF increases with age in the general population.[2] AF is believed to occur first as paroxysmal episodes, gradually becoming persistent, and finally progressing into chronic AF.[3] Thus, the treatment of paroxysmal AF is an important target to prevent chronic AF. A community-based, cross-sectional observational study conducted in Sweden revealed that AF was associated with the combined occurrence of type 2 diabetes and hypertension.[4] Patients with AF were more insulin-resistant than those with sinus rhythm in the whole study population. Recent evidence suggests that postprandial hyperglycemia may also increase cardiovascular risk, similar to, or even more frequently than fasting hyperglycemia.[5] A recent prospective study demonstrated that obesity was also an important, potentially modifiable, risk factor for AF.[6] This raises the possibility that control of body weight may reduce the burden of chronic AF in the general population. Here we describe a very unique case with postprandial hyperglycemia and obesity associated with drug-refractory paroxysmal AF.

## CASE REPORT

A 73-year-old woman was admitted to our clinic complaining of palpitations. Electrocardiography on admission showed no abnormalities except for

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**Table 1 Patient characteristics before and after diet and exercise therapy**

| | Before | After 3 months | After 6 months |
|---|---|---|---|
| Height (cm) | 150 | 150 | 150 |
| Weight (kg) | 61.4 | 55.0 | 53.8 |
| Body mass index (kg/m$^2$) | 27.3 | 24.4 | 23.9 |
| Systolic blood pressure (mmHg) | 130 | 134 | 130 |
| Fast plasma glucose (mg/d*l*) | 105 | 85 | 92 |
| One-hour plasma glucose (mg/d*l*) | 265 | 178 | 175 |
| Two-hour plasma glucose (mg/d*l*) | 238 | 144 | 117 |
| Fast serum insulin (μU/m*l*) | 10.6 | 11.9 | 9.4 |
| One-hour serum insulin (μU/m*l*) | 112.6 | 126.3 | 94.3 |
| Two-hour serum insulin (μU/m*l*) | 341.0 | 217.3 | 98.5 |
| HOMA-IRI | 2.74 | 2.49 | 2.13 |
| TC (mg/d*l*) | 234 | 176 | 181 |
| TG (mg/d*l*) | 54 | 63 | 59 |
| HDL-C (mg/d*l*) | 63 | 56 | 66 |
| LDL-C (mg/d*l*) | 160 | 107 | 103 |

HOMA-IRI = homeostasis model assessment insulin resistance index; TC = total cholesterol; TG = triglyceride; HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol.

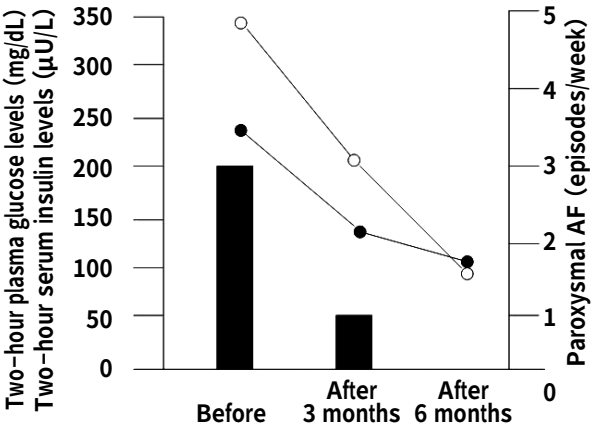


**Fig. 1 Changes in plasma glucose (*closed circles*) and insulin (*open circles*) levels at 2-hour in the 75 g glucose tolerance test before, and 3 months and 6 months after diet and exercise therapy**
*Solid bars* represent the frequency of paroxysmal atrial fibrillation episodes per week.
AF = atrial fibrillation.

AF that spontaneously reverted to sinus rhythm on the next day. After admission, various antiarrhythmic agents including digoxin, disopyramide or pilsicainide were prescribed. Despite drug therapy, her symptoms continued and paroxysmal AF recurred more than three times per week. On admission, she was mildly obese with a body weight of 61.4 kg and a body mass index (BMI) of 27.3. Her blood test showed hypercholesterolemia with total cholesterol of 236 mg/d*l* and low-density lipoprotein (LDL) cholesterol of 160 mg/d*l*. Although her fasting plasma glucose was within the normal range, she had insulin resistance as shown by the high value of 2.74 in the homeostasis model assessment of insulin resistance (HOMA-IR). In addition, the oral glucose tolerance test with a 75 g glucose equivalent load showed postprandial hyperglycemia and hyperinsulinemia.

We initiated a 1,600 kcal/day diet and an exercise regimen of walking three times/day for more than 30 min. After 6 months of diet and exercise, decrease were seen in her body weight to 53.8 kg, body mass index to 23.9, total cholesterol levels to 181 mg/d*l*, LDL cholesterol levels to 103 mg/d*l*, and HOMA-IR to 2.13. All antiarrhythmic agents were unchanged during this period. **Table 1** shows her clinical characteristics before and after diet and exercise therapy. The oral glucose tolerance test at both 3 and 6 months after the diet and exercise therapy revealed that postprandial hyperglycemia was markedly improved. During the diet and exercise regimen, the frequency of paroxysmal AF episodes decreased in association with the improvement of postprandial hyperglycemia and the decrease of body weight. After 6 months of diet and exercise, her paroxysmal AF had completely disappeared (**Fig. 1**).

## DISCUSSION

This case report suggests that postprandial hyperglycemia and insulin resistance might be one of the underlying mechanisms of paroxysmal AF. Patients with AF have more insulin resistance than those with sinus rhythm.[4] Insulin resistance is also associated with sick sinus syndrome.[7] Therefore, impaired glucose metabolism may be related to electrophysiological instability in the atrial myocardium as well as in the ventricular myocardium.[8] In the present case, obesity may have been a factor in the occurrence of AF, because obesity is often accompanied by postprandial hyperglycemia and insulin resistance. Obesity is associated with elevated C-reactive protein level, which has a strong association with paroxysmal AF.[9] Obesity may also lead to development of AF through obstructive sleep apnea, which predisposes to a

number of arrhythmogenic events, including hypoxia, hypercapnea, increasing sympathetic tone, and transient atrial dilation.[10] In addition, adipocyte-specific substances such as leptin and adiponectin might be related to the occurrence of paroxysmal AF. However, we did not evaluate either obstructive sleep apnea or adipocytokines in the present patient.

In the present case, paroxysmal AF was refractory to antiarrhythmic medications such as digoxin, disopyramide or pilsicainide. The diet and exercise therapy targeting postprandial hyperglycemia caused a decrease in BMI from 27.3 to 23.9, and the disappearance of AF. This finding suggests that postprandial hyperglycemia may be a new target to prevent chronic AF. Postprandial hyperglycemia or insulin resistance now needs to be considered as a risk factor for the development of AF. Lifestyle modification, including diet and exercise, that promotes weight control may have an impact on the epidemiology as well as the morbidity and mortality of AF. Furthermore, newly developed oral antidiabetic agents, such as thiazolidine-dione, glinide, or alpha-glucosidase inhibitor may be important tools to prevent the progression of paroxysmal AF to chronic AF, if the patient has postprandial hyperglycemia or insulin resistance.


## 要　　約

### 食後高血糖は発作性心房細動の誘発因子である：症例報告

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心房細動は脳卒中の主な危険因子であり，最初は発作性心房細動として始まるが，やがて持続性となり，最終的に慢性心房細動になる．慢性心房細動の予防には，発作性心房細動の治療が重要である．今回我々は，食後高血糖と肥満を合併した薬剤抵抗性の心房細動症例で減量に伴う食後高血糖改善に伴い心房細動発作が起こらなくなった興味深い症例を経験したので報告する．症例は，食後高血糖を有する73歳の日本人女性で，薬剤抵抗性心房細動を呈していた．1日1,600 kcalの食事療法と，1日3回30分間歩行という運動療法で，6ヵ月後に心房細動は消失した．食後高血糖を有する発作性心房細動患者においては，食事療法と運動療法を含む食後高血糖治療に努めるべきであろう．この症例から，発作性心房細動の発症メカニズムの一つに，食後高血糖とインスリン抵抗性があると考えられた．


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