

# Hepatic Effects in Hyperlipidemic Patients

Shih-Wei Lai, Chee-Keong Tan<sup>1</sup>, Kim-Choy Ng<sup>2</sup>

Department of Community Medicine; <sup>2</sup>Department of Emergency Medicine, China Medical College Hospital;

<sup>1</sup>Department of Family Medicine, Jen-Ai Hospital, Taichung, Taiwan.

**Background.** This study was conducted to demonstrate the relationship between nonalcoholic fatty liver and hyperlipidemia.

**Methods.** We retrospectively analyzed patients receiving periodic health checkups at China Medical College Hospital from January to December, 2000. Subjects with a medical history of diabetes mellitus or alcohol abuse were excluded. Totally, 186 patients (men: 60.8%; women: 39.2%) were included in this study. The mean age was 44.5 years old with a standard deviation of 12.5 years (age range, 18–78). Fatty liver was diagnosed by sonography. The primary factors studied were total cholesterol, triglyceride, low density lipoprotein cholesterol and high density lipoprotein cholesterol. The *t* test, chi-square and multivariate logistic regression were used for statistical analysis.

**Results.** The proportion of the subjects having nonalcoholic fatty liver was 32.8%. According to univariate analysis, male gender, hypercholesterolemia and hypertriglyceridemia were related to nonalcoholic fatty liver. After controlling for other covariates, multivariate logistic regression analysis showed that the significant factors related to nonalcoholic fatty liver were male gender (odds ratio = 4.0, 95% confidence interval = 1.8–8.8,  $p < 0.001$ ) and hypertriglyceridemia (odds ratio = 5.8, 95% confidence interval = 1.8–19.0,  $p < 0.01$ ).

**Conclusions.** A large detailed investigation is needed in the future to reveal the other related factors of nonalcoholic fatty liver. (Mid Taiwan J Med 2002;7:160-4)

## Key words

hyperlipidemia, nonalcoholic fatty liver

## INTRODUCTION

Nonalcoholic fatty liver is one of the most common liver diseases in western countries and is considerably common in Taiwan [1-5]. Generally speaking, nonalcoholic fatty liver is a benign clinical condition with little progression and no mortality risk [3]. However, cases of nonalcoholic fatty liver progressing to liver cirrhosis or liver failure have been reported [6-9]. Therefore, the natural course of this disease is still poorly understood. Nonalcoholic fatty liver has been

associated with female gender, obesity, non insulin-dependent diabetes mellitus/hyperglycemia and hyperlipidemia [3,7,9,10]. Up to date, little is known about the correlation between nonalcoholic fatty liver and hyperlipidemia. As a result, the method of intervention remains controversial. Thus, we conducted a study to observe the correlation between nonalcoholic fatty liver and hyperlipidemia.

## SUBJECTS AND METHODS

This was a cross-sectional study. From January to December, 2000, we retrospectively analyzed the medical records of 186 patients receiving periodic health checkups at the Department of Family Medicine of China

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Address reprint requests to : Kim-Choy Ng, Department of Emergency Medicine, China Medical College Hospital, No 2, Yuh-Der Road, Taichung 404, Taiwan.

**Table 1. The lipid profiles in subjects with nonalcoholic fatty liver**

| Variable                   | Non-fatty liver | Fatty liver | <i>p</i> value |
|----------------------------|-----------------|-------------|----------------|
| Total cholesterol (mmol/L) | 5.0 ± 1.1       | 5.4 ± 0.9   | 0.0047         |
| Triglyceride (mmol/L)      | 1.0 ± 0.6       | 1.7 ± 0.7   | 0.0001         |
| LDL (mmol/L)               | 3.1 ± 1.0       | 3.4 ± 0.8   | 0.0183         |
| HDL (mmol/L)               | 1.4 ± 0.3       | 1.2 ± 0.3   | 0.0001         |

LDL = low density lipoprotein cholesterol; HDL = high density lipoprotein cholesterol.

**Table 2. Correlates of nonalcoholic fatty liver by chi-square analysis**

| Variable                         | Non-fatty liver | Fatty liver | <i>p</i> value |
|----------------------------------|-----------------|-------------|----------------|
|                                  | N (%)           | N (%)       |                |
| Gender                           |                 |             |                |
| Men                              | 63 (55.7)       | 50 (44.3)   | 0.001          |
| Women                            | 62 (84.9)       | 11 (15.1)   |                |
| Total cholesterol ≥ 5.2 (mmol/L) |                 |             |                |
| No                               | 76 (74.5)       | 26 (25.5)   | 0.029          |
| Yes                              | 49 (58.3)       | 35 (41.7)   |                |
| Triglyceride ≥ 2.3 (mmol/L)      |                 |             |                |
| No                               | 120 (71.9)      | 47 (28.1)   | 0.001          |
| Yes                              | 5 (26.3)        | 14 (73.7)   |                |
| LDL ≥ 3.4 (mmol/L)               |                 |             |                |
| No                               | 82 (68.3)       | 38 (31.7)   | 0.780          |
| Yes                              | 43 (65.1)       | 23 (34.9)   |                |
| HDL < 0.9 (mmol/L)               |                 |             |                |
| No                               | 121 (68.7)      | 55 (31.3)   | 0.124          |
| Yes                              | 4 (40.0)        | 6 (60.0)    |                |

Medical College Hospital in Taichung City, Taiwan. Information about the subjects' medical history, family history, and smoking or alcohol abuse, was collected by a family physician. Subjects with a medical history of diabetes mellitus or alcohol abuse were excluded.

Out of the 186 patients, 60.8% were men and 39.2% were women. The mean age was 44.5 years old with a standard deviation of 12.5 years (age range 18–78). Blood samples were obtained in the morning after a 12-hour overnight fast. A number of biochemical markers, such as total cholesterol, triglyceride and high density lipoprotein cholesterol (HDL), were analyzed by a biochemical autoanalyser (Hitachi 736-15, Tokyo, Japan) at the Department of Clinical Laboratory of China Medical College Hospital within 4 hours of collection. If triglyceride < 400 mg/dL, low density lipoprotein cholesterol (LDL) was calculated by the formula suggested by

Friedewald et al,  $LDL = TC - (HDL + TG/5)$  [11]. Normal and abnormal values are shown in Table 2 [12]. Abdominal sonography was performed by gastroenterologists using a high resolution real-time machine (TOSHIBA Sonolayer SSA-270A, convex-type 3.5 MHz transducer, Tochigi-Ken, Japan). Fatty liver was diagnosed according to the international criteria [4,13].

Statistical analysis was performed with a SAS package (Version 6.12, SAS Institute Inc., Cary, North Carolina). The *t* test, chi-square and multivariate logistic regression were used for statistical analysis. A *p* value less than 0.05 was considered statistically significant.

## RESULTS

The proportion of the subjects having nonalcoholic fatty liver was 32.8%.

Subjects with nonalcoholic fatty liver had higher levels of total cholesterol, triglyceride and LDL than subjects with non-

**Table 3. Multivariate logistic regression of nonalcoholic fatty liver**

| Variable                                      | EP (SE)    | OR  | 95% CI    |
|---|------------|-----|-----------|
| Intercept                                     | -2.1 (0.4) |     |           |
| Gender (women as reference)                   |            |     |           |
| men   | 1.4 (0.4)  | 4.0 | 1.8–8.8** |
| Total cholesterol (< 5.2 mmol/L as reference) |            |     |           |
| ≥ 5.2   | 0.9 (0.5)  | 2.5 | 0.9–7.0   |
| Triglyceride (< 2.3 mmol/L as reference)      |            |     |           |
| ≥ 2.3   | 1.8 (0.6)  | 5.8 | 1.8–19.0* |
| LDL (< 3.4 mmol/L as reference)               |            |     |           |
| ≥ 3.4   | -0.7 (0.5) | 0.5 | 0.2–1.4   |
| HDL (≥ 0.9 mmol/L as reference)               |            |     |           |
| < 0.9   | 1.1 (0.7)  | 3.0 | 0.7–12.2  |

EP = estimated parameter; SE = standard error; OR = odds ratio; CI = confidence interval. \* $p < 0.01$ , \*\* $p < 0.001$ .

fatty liver ( $p < 0.01$ ,  $p < 0.001$  and  $p < 0.05$ , respectively). Subjects with nonalcoholic fatty liver had lower levels of HDL than those with non-fatty liver ( $p < 0.001$ ) (Table 1).

The results of the chi-square analysis for nonalcoholic fatty liver are shown in Table 2. The related factors of nonalcoholic fatty liver were male gender, hypercholesterolemia and hypertriglyceridemia.

The results of multivariate logistic regression for nonalcoholic fatty liver are shown in Table 3. After controlling for other covariates, the significant factors related to nonalcoholic fatty liver were male gender (odds ratio = 4.0, 95% confidence interval = 1.8–8.8,  $p < 0.001$ ) and hypertriglyceridemia (odds ratio = 5.8, 95% confidence interval = 1.8–19.0,  $p < 0.01$ ). That is, men were more likely to suffer from nonalcoholic fatty liver than women. People with hypertriglyceridemia were more likely to have nonalcoholic fatty liver than people with normal triglyceride levels. No significant correlation was found between nonalcoholic fatty liver and hypercholesterolemia, abnormal LDL or abnormal HDL.

### DISCUSSION

In our study, one significant factor related to nonalcoholic fatty liver was hypertriglyceridemia, a finding consistent with previous reports [3,7,9,10]. This indicates that triglyceride has a substantial effect on the

liver. Fatty liver is reversible if the precipitating factors are modified [14]. Undoubtedly, it is advisable to check serum triglyceride levels when considering intervention for nonalcoholic fatty liver. On the other hand, we found that male gender was also a related factor of nonalcoholic fatty liver, a factor not supported by previous reports [3,9].

There were several limitations in this study. First, because the study was based on a hospital basis and the sample size was relatively small, these subjects were not representative of the general Taiwanese population. Whether these subjects had a higher inherent risk of nonalcoholic fatty liver still needs further evaluation. If so, the true prevalence of nonalcoholic fatty liver might not be truly reflected. However, this study does provide background data for further studies on the epidemiology of nonalcoholic fatty liver in Taiwanese people. Second, the gastroenterologists in our hospital did not classify the degree of fatty liver in every case when performing abdominal sonography. Thus, we could not evaluate the relationship between the degree of nonalcoholic fatty liver and lipid profiles. Third, many other potential factors, such as dietary habits, obesity, and diabetes mellitus, all of which might influence the hepatic effect, were not considered in detail.

We conclude that the significant factors

related to nonalcoholic fatty liver are male gender and hypertriglyceridemia. Whether there are still other detailed correlates of nonalcoholic fatty liver needs further large-scale investigation.

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# 高脂血症對於肝臟效應之研究

賴世偉 陳志強<sup>1</sup> 黃金財<sup>2</sup>

中國醫藥學院附設醫院 社區醫學部 急診部<sup>2</sup>

大里仁愛醫院 家庭醫學科<sup>1</sup>

**背景** 爲了瞭解非酒精性脂肪肝與高脂血症之間的相關性。

**方法** 於西元2000年1月至12月曾經到中國醫藥學院附設醫院作定期健康檢查的民衆爲樣本，有糖尿病病史與酒癮的民衆不列入本次研究的對象，總共有186位民衆納入本次研究中。非酒精性脂肪肝是以超音波診斷，研究變項包括：血清總膽固醇值、三酸甘油酯、低密度脂蛋白膽固醇值與高密度脂蛋白膽固醇值，統計方法採用 *t* 檢定，卡方檢定與多變項羅吉斯迴歸分析。

**結果** 其中男性佔60.8%，女性佔39.2%，年齡爲44.5 ± 12.5歲。非酒精性脂肪肝的盛行率爲32.8%。在單變項分析中，男性、高膽固醇血症和高三酸甘油酯血症是非酒精性脂肪肝的相關因子。在控制其他變項之後，以多變項羅吉斯迴歸分析來看，非酒精性脂肪肝的相關因子爲男性和高三酸甘油酯血症。

**結論** 未來需要更大型的研究來探討非酒精性脂肪肝是否尚其他的相關因子。(中台灣醫誌 2002;7:160-4)

**關鍵詞**

非酒精性脂肪肝，高脂血症

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聯絡作者：黃金財

地址：404台中市北區育德路2號

中國醫藥學院附設醫院 急診部

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