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Effect of a Specific Questionnaire Sheet on Subclassification of Osteonecrosis of the Femoral Head

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Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
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Background: This study examined whether use of a specific questionnaire sheet for nontraumatic osteonecrosis of the femoral head (ONFH) could affect the subclassification of ONFH compared with a conventional medical interview.

Material/Methods: Study participants consisted of 400 patients with ONFH who visited our hospital between February 2011 and March 2015. Data on history of systemic steroid therapy and habitual alcohol intake were obtained during a conventional medical interview at the first visit and were re-evaluated using a specific questionnaire sheet at another visit. Patients were subclassified into 4 groups: steroid-associated, alcohol-associated, steroid/alcohol-associated, or idiopathic ONFH.

Results: Use of the specific questionnaire sheet resulted in a 4.0% increase in the proportion of patients with a history of systemic steroid therapy, from 57.3% (n=229) to 61.3% (n=245), and a 14.3% increase for history of habitual alcohol intake, from 35.0% (n=140) to 49.3% (n=197). The proportion of patients with steroid/alcohol-associated ONFH increased from 2.5% (n=10) to 17.8% (n=71), while the proportion in the other 3 groups decreased: steroid-associated ONFH from 54.8% (n=219) to 43.5% (n=174); alcohol-associated ONFH from 32.5% (n=130) to 31.5% (n=126); and idiopathic ONFH from 10.2% (n=41) to 7.2% (n=29). Ninety-six patients (24.0%) were classified into a different subgroup based on the specific questionnaire sheet.

Conclusions: The use of a specific questionnaire sheet can change the distribution of ONFH subclassifications compared with use of a conventional medical history interview. Use of a specific questionnaire sheet can allow for more detailed self-reporting regarding potential causative factors for nontraumatic ONFH, especially habitual alcohol intake.

MeSH Keywords: Alcohols • Cyclosteroids • Femur Head Necrosis • Osteonecrosis • Questionnaires • Self Report

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Background

Nontraumatic osteonecrosis of the femoral head (ONFH) is an ischemic disease that causes progression of femoral head collapse and destruction of the hip joint. It occasionally requires surgical treatment [1]. Although the precise pathologic mechanism remains unclear, systemic steroid therapy and high habitual alcohol intake are well-known causes of ONFH [2]. Therefore, nontraumatic ONFH has been conventionally subclassified as steroid-associated, alcohol-associated, or idiopathic.

Epidemiologic surveys on nontraumatic ONFH have been conducted in several countries based on this subclassification system. In Japan, a nationwide epidemiologic survey reported that the most common causative factor was systemic steroid therapy (51%), followed by habitual alcohol intake (31%) [3]. By contrast, habitual alcohol intake was the most common causative factor in Taiwan, China, and Korea [4–6]. In addition, several studies have found differences in pathology between steroid-associated and non-steroid-associated ONFH [7,8]. Thus, subclassification of ONFH by potential causative factor is considered to be clinically important.

Subclassification of nontraumatic ONFH by potential causative factor has been mainly based on patient self-report during a medical interview at the time of diagnosis. However, patient self-report based on their recall of alcohol intake and history of prescribed medications is sometimes inaccurate. In addition, patient responses are also influenced by question format, type, and context [9]. There have been no reports regarding the reproducibility of ONFH subclassification results.

In this study, we compared the distribution of ONFH subclassifications based on a questionnaire with specific questions about alcohol and steroid use versus a conventional medical interview.

Material and Methods

Patients

This study was approved by our Institutional Review Board. All study participants provided the necessary consent. Between February 2011 and March 2015, there were 412 patients with nontraumatic ONFH who visited our hospital for regular follow-up and agreed to participate in this study. All patients met the diagnostic criteria for nontraumatic ONFH proposed by the Research Committee on Idiopathic Osteonecrosis of the Femoral Head in Japan [10]. Twelve patients were excluded because of insufficient information on their history of systemic steroid therapy or habitual alcohol intake obtained from medical records at the time of diagnosis. Consequently, 400 patients with nontraumatic ONFH (155 females and 245 males; mean age, 51.8±13.9 years; range, 16 to 86 years) were included in this study. No patients with dementia or a history of hospitalization for alcoholism were included.

Methods to evaluate ONFH subclassifications

The first evaluation was based on information regarding alcohol consumption and steroid use in the outpatient medical records as documented by the attending physician at the time of diagnosis. The second evaluation was conducted during an interview using a specific questionnaire sheet (Figure 1) performed on a different day by another orthopedic surgeon. Questions concerning habitual alcohol intake focused on the following: usual frequency of alcohol intake, age when the patient started drinking, age or period when the patient drank the most, amount of daily alcoholic intake, and types of alcoholic beverages consumed (beer, wine, Japanese *sake*, *shochu* [Japanese spirits made from sweet potato, wheat, or rice], or whiskey). Questions concerning steroid use consisted of the following: age at the time of initial steroid therapy, total duration of steroid therapy, history of pulse steroid therapy, underlying illness that necessitated steroid therapy, history of hospitalization, and other relevant medical history.

Definition of the presence or absence of each causative factor and subclassification into 4 groups

Patients who had received systemic steroid therapy were deemed to have a history of systemic steroid therapy, according to a nationwide epidemiologic study of ONFH [3]. Presence of habitual alcohol intake was defined as ethanol intake >320 g (400 mL) of ethanol per week at the time of diagnosis or during peak intake [11]. Weekly ethanol intake was calculated based on the alcohol content of each beverage. Next, patients were classified into 4 groups: steroid-associated (history of systemic steroid therapy and no history of habitual alcohol intake), alcohol-associated (history of habitual alcohol intake and no history of systemic steroid therapy), steroid/alcohol-associated (history of systemic steroid therapy and habitual alcohol intake), and idiopathic (no history of systemic steroid therapy and habitual alcohol intake). The proportion of patients in these 4 subgroups based on the conventional interview and specific questionnaire sheet was compared.

Statistical analysis

McNemar's test was used to evaluate the change in the proportion of patients with a history of steroid therapy, habitual alcohol intake, or both between the 2 evaluations. $P<0.05$ was considered to indicate statistical significance. Statistical analyses were performed using JMP software, version 13 (SAS Institute, Cary, NC, USA).

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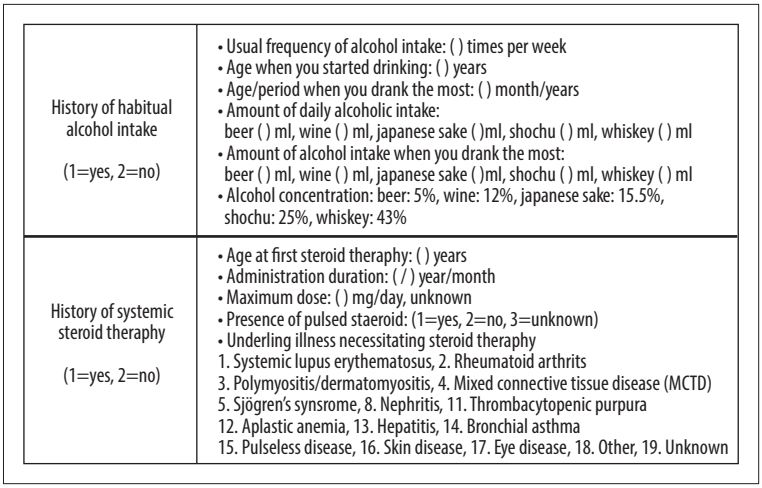

History of habitual alcohol intake (1=yes, 2=no)	• Usual frequency of alcohol intake: ( ) times per week • Age when you started drinking: ( ) years • Age/period when you drank the most: ( ) month/years • Amount of daily alcoholic intake: beer ( ) ml, wine ( ) ml, japanese sake ( )ml, shochu ( ) ml, whiskey ( ) ml • Amount of alcohol intake when you drank the most: beer ( ) ml, wine ( ) ml, japanese sake ( )ml, shochu ( ) ml, whiskey ( ) ml • Alcohol concentration: beer: 5%, wine: 12%, japanese sake: 15.5%, shochu: 25%, whiskey: 43%
History of systemic steroid theraphy (1=yes, 2=no)	• Age at first steroid theraphy: ( ) years • Administration duration: (/) year/month • Maximum dose: ( ) mg/day, unknown • Presence of pulsed staeroid: (1=yes, 2=no, 3=unknown) • Underling illness necessitating steroid theraphy 1. Systemic lupus erythematosus, 2. Rheumatoid arthrits 3. Polymyositis/dermatomyositis, 4. Mixed connective tissue disease (MCTD) 5. Sjögren's synsrome, 8. Nephritis, 11. Thrombacytopenic purpura 12. Aplastic anemia, 13. Hepatitis, 14. Bronchial asthma 15. Pulseless disease, 16. Skin disease, 17. Eye disease, 18. Other, 19. Unknown

Figure 1. Questionnaire sheet prepared for the second evaluation.

Table 1. Changes in the proportion of patients with a history of systemic steroid therapy or habitual alcohol intake in the first evaluation (conventional medical interview) versus second evaluation (specific questionnaire sheet).

History of	Proportion		*P* value
	First evaluation (conventional medical interview)	Second evaluation (specific questionnaire sheet)	
Systemic steroid therapy	57.3%	61.3%	<0.001*
Habitual alcohol intake	35.0%	49.3%	<0.001*

Results

The proportion of patients with a history of systemic steroid therapy and habitual alcohol intake based on the first evaluation using conventional interviews was 57.3% (n=229) and 35.0 % (n=140), respectively. Based on the second evaluation using a specific questionnaire sheet, the proportion of patients with a history of systemic steroid therapy increased by 4.0%, from 57.3% (n=229) to 61.3% (n=245). The proportion of patients with a history of habitual alcohol intake increased by 14.3%, from 35.0% (n=140) to 49.3% (n=197). Both increases were statistically significant (Table 1).

Regarding the 4 subclassification groups, the proportion of patients with steroid/alcohol-associated ONFH increased from 2.5% (n=10) to 17.8% (n=71). The proportion in the other 3 subgroups decreased: steroid-associated ONFH, from 54.8% (n=219) to 43.5% (n=174); alcohol-associated ONFH, from 32.5% (n=130) to 31.5% (n=126); and idiopathic ONFH from 10.2% (n=41) to 7.2% (n=29) (Figure 2). Ninety-six patients (24.0%) were classified into a different subgroup after the use of the specific questionnaire sheet.

Discussion

This is the first study to evaluate the proportion of patients with ONFH by history of systemic steroid therapy and habitual alcohol intake using 2 different interview methods. The use of a specific questionnaire sheet identified more patients with ONFH who had a history of habitual alcohol intake (14.3% increase) and systemic steroid therapy (4.0% increase). The proportion of steroid/alcohol-associated ONFH increased by 15.3%, along with a decrease in the proportion of patients in the other subgroups. There are several possible reasons for these changes. One possibility is patient underreporting of alcohol consumption due to decreased recall during conventional interviews. Previous reports have shown that the actual amount of alcohol intake generally exceeds the amount that individuals report [12,13]. Another reason might be that the attending orthopedist omitted questions about habitual alcohol intake when there is a clear history of steroid use because there is a common recognition in Japan that steroid use is an overwhelmingly stronger risk factor for ONFH than alcohol intake [14]. Such patients would have been classified as having steroid-associated ONFH instead of steroid/alcohol-associated ONFH at the time of diagnosis.

A more detailed questionnaire has been introduced to obtain precise patient information [15]. Incorporating questions about

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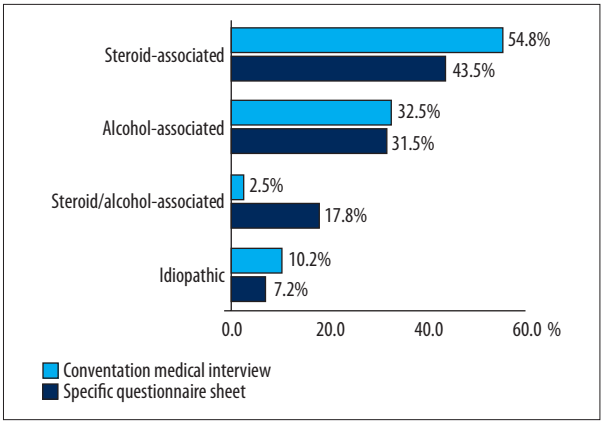

Figure 2. Proportions of patients in the 4 subgroups based on the information obtained from a conventional medical interview versus a specific questionnaire sheet. Based on the specific questionnaire sheet, the proportion of patients with steroid/alcohol-associated ONFH (Osteonecrosis of the femoral head) increased from 2.5% to 17.8% while the proportion of patients in the other 3 groups decreased: steroid-associated ONFH, from 54.8% to 43.5%; alcohol-associated ONFH, from 32.5% to 31.5%; and idiopathic ONFH, from 10.2% to 7.2%.based on the information obtained from a conventional medical interview versus a specific questionnaire sheet. Based on the specific questionnaire sheet, the proportion of patients with steroid/alcohol-associated ONFH (Osteonecrosis of the femoral head) increased from 2.5% to 17.8% while the proportion of patients in the other 3 groups decreased: steroid-associated ONFH, from 54.8% to 43.5%; alcohol-associated ONFH, from 32.5% to 31.5%; and idiopathic ONFH, from 10.2% to 7.2%..

alcohol intake in a general diet questionnaire may neutralize the negative feelings toward reporting alcohol consumption and increase the number of cues that can enhance recall [16–18]. Several studies on recall of prescription drugs have assessed recall integrity using different questionnaire formats [19–21]. In those studies, recall sensitivity was higher with indication-oriented questions versus open-ended questions [19–21]. In addition, recall accuracy differed by drug type; steroid therapy was reported to have high agreement with the medical record [22]. Since the questionnaire sheet in our study used indication-oriented questions and the drug in question was a steroid, it is reasonable that the difference in the proportion of patients who reported steroid use between the 2 evaluation methods was small.

Evaluating potential causative factors for nontraumatic ONFH is important when considering its pathologic features. Several studies have demonstrated differences in pathologic features by causative factor. Chernetsky et al. [8] reported that steroid-associated ONFH is associated with a more rapid repair reaction than non-steroid-associated ONFH. Similarly, Hastings and MacNab [7] reported more rapid progression of the pathologic lesion in steroid-associated ONFH. In addition, a previous study showed differences in molecular structure based on ONFH etiology [23]. Therefore, subclassification of ONFH by potential causative factor is considered to be a clinically important task for identifying the characteristics of ONFH.

Study limitations include the retrospective cross-sectional design without standardization of the timing of the second evaluation. The first evaluation was performed before the second evaluation was planned and was not standardized because each attending physician asked about the patient's medical history based on his or her usual clinical practice. Second, the questionnaire sheet was originally created at our institution, so its generalizability could not be shown in this study. However, since this questionnaire sheet was able to identify more patients with habitual alcohol intake and history of steroid therapy than conventional evaluations, this questionnaire sheet can be considered effective. Lastly, a clear definition of steroid-associated ONFH has not yet been established. It has been recently proposed that information about steroid dose and duration should be included in the definition of steroid-associated ONFH [24]; however, even small doses of steroids have been demonstrated to cause ONFH [25]. Therefore, it is desirable to develop a more effective questionnaire sheet that aligns with a standard definition of steroid-associated ONFH.

Conclusions

Our results suggest that the use of a specific questionnaire sheet can affect the distribution of ONFH subclassifications compared with conventional medical history interviews. Introduction of a specific questionnaire sheet for evaluating patients with nontraumatic ONFH may allow for more detailed self-reporting regarding potential causative factors, especially habitual alcohol intake.

Conflict of interest

None.

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