ELSEVIER

Legal Medicine 7 (2005) 299–305

LEGAL MEDICINE

www.elsevier.com/locate/legalmed

Problems in blood alcohol testing of severely injured drivers brought to emergency departments in Japan

Akiko Higuchi[a], Rina Kurihara[a], Takashi Yoshimoto[a], Toshiyuki Sano[b], Kazuo Katsumata[c], Akira Ishii[d], Yoshinao Katsumata[a,*]

[a]*Department of Legal Medicine and Bioethics, Nagoya University Graduate School of Medicine, 65 Tsurumai-cho, Showa-ku, Nagoya 466-8550, Japan*
[b]*Criminal Investigation Laboratory, Aichi Prefectural Police Headquarters, Nagoya 460-8502, Japan*
[c]*Katsumata Hospital, Nagoya 460-0007, Japan*
[d]*Department of Legal Medicine, Fujita Health University School of Medicine, Toyoake city, Aichi 470-1192, Japan*

Received 2 March 2005; received in revised form 5 May 2005; accepted 6 May 2005
Available online 28 July 2005

Abstract

Breath alcohol tests are widely used to control DUI (driving under the influence) in Japan. However, this test is not applied to injured drivers transported to emergency hospitals. In such cases, BAC (blood alcohol concentration) testing should be done to prove DUI. In this paper, we tried to clarify two important issues on the BAC testing in Japan using a questionnaire survey and experiments about contamination of antiseptic ethanol. First, we have described the doctor's dilemma with DUI cases; our present questionnaire survey showed that the police often request the doctor to volunteer blood samples of the suspected drunk drivers brought to emergency hospitals since they have not been granted the right to order blood sampling in Japan. Then, doctors face a serious dilemma whether comply with the police request or not, resulting in widely different responses. Secondly, we have estimated the effects of antiseptic ethanol routinely used as a dermal antiseptic on the BAC tests. Our present experiments showed that uptake of ethanol can occur under certain conditions. Given the actual conditions outlined in the questionnaire, there seem to be a definite risk of ethanol contamination in BAC testing. Obviously, the time has come to discuss problems in BAC testing of injured drivers brought to emergency hospitals in Japan.

Keywords: DUI; BAC testing; Dermal antiseptic; Contamination of alcohol; Police request

1. Introduction

Injuries and fatalities from traffic accidents have become problematic as transportation has advanced. In developed countries, however, the improvement of roads, traffic signals and the like, together with various measures to control DUI (driving under the influence) of alcohol, have recently tended to reduce the number of traffic fatalities [1].

In Japan, the number of traffic accidents and traffic fatalities increased in 1970s, and the designated BAC (blood alcohol concentration) limit was set at 0.5 mg/ml [2]. Surprise breath tests have also been introduced on a broad scale. As a result, fatalities dropped sharply to 10,792 in 1975, from 16,765 in 1970. In 1996, however, there were still 10,000 fatalities. Effective June 2002, the BAC limit was again lowered to 0.3 mg/ml, and the fines were also raised from the former 50,000 to 300,000 yen or less [3]. These tougher penalties reportedly have led to fewer fatalities.

DUI has thus come under quite strict control in Japan. Breath tests are used extensively to enforce DUI control at local checkpoints, and the results are reliable enough to hold up in court. When a driver is injured and brought to emergency hospitals, however, medical treatment takes precedence, and no breath test is given at the hospital. If a hospitalized driver is suspected of having been drinking, the police request the doctor to volunteer a sample of any remaining blood drawn from the driver under treatment at the hospital, which they then use to determine the BAC. This is done because there is no legal precedent allowing

Abbreviations: DUI, driving under the influence; BAC, blood alcohol concentration; GC-FID, gas chromatography-flame ionization detection.

* Corresponding author. Tel.: +81 52 744 2121; fax: +81 52 744 2121.
E-mail address: ykatsuma@med.nagoya-u.ac.jp (Y. Katsumata).

1344-6223/$ - see front matter © 2005 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.legalmed.2005.05.003

police to draw blood for BAC testing without the patient's consent in case of lacking a court-ordered warrant. At such police request, it is left to the discretion of the individual doctor as to whether or not he or she will comply with the request for a patient's blood sample.

However, ethanol is routinely used as a dermal antiseptic during blood testing in Japan, and the effect of ethanol on BAC results is problematic. In England, the use of ethanol as a dermal antiseptic has long been prohibited in BAC testing [4]. Nevertheless, this prohibition has not always been strictly followed, and became an issue in 1989 [5]. In that and the following year, the results were reported for total three experiments examining whether or not antiseptic ethanol had contaminated blood samples [6,7]. The experimental results indicated that antiseptic ethanol had somewhat contaminated the blood sample, sometimes resulting in highly elevated BAC test levels. The experiments, however, did not always make it definitely clear in what instances a large degree of contamination occurs.

In general, police must carry out BAC tests for investigations in which a driver hospitalized for a traffic accident is suspected of having consumed ethanol. On the other hand, whether or not the attending doctor should assist in these tests is a difficult decision. In other words, whether to assist in prosecution (something not part of patient treatment) is a medical ethics issue, with doctors facing the dilemma of possibly interfering in the control of DUIs. This dilemma is a global problem that is being dealt with differently in each country [8–12].

In the present study, using an on-site questionnaire survey, we examined the current status of BAC testing for drivers hospitalized in Japan for emergency treatment in connection with a traffic accident, and experimentally investigated in detail the exact circumstances in which antiseptic ethanol may be mixed with blood during blood sampling. Moreover, we also discuss the proper way to deal with the aforementioned dilemma.

2. Materials and methods

2.1. Questionnaire survey

The questionnaire survey was conducted at 117 institutions with sufficient emergency medical facilities (category 2 and 3) in Aichi Prefecture. Using an on-site questionnaire, we examined whether and how blood is being provided in compliance with police requests for control of DUIs and what antiseptic method etc. is used when drawing blood.

2.2. Materials

Sterile swabs were prepared according to the Japanese Pharmacopoeia from cotton swabs (mean 0.21 g) impregnated with from 76.9 to 81.4% of antiseptic ethanol or from 70% of antiseptic iso-propanol. The amount of alcohol used was 1 or 3 ml.

Forty healthy subjects who had given their informed consent and were not drinking were used under the way reviewed by the ethics committees of the two universities. In addition, a blood collection simulator (Kyoto Kagaku Co., Ltd., M66 blood collection and intravenous injection simulator) was used as a blood sampler model. Five millilitre disposable syringes affixed with 22-g needles were used.

2.3. Experiments for ethanol contamination

For comparison, blood was collected from subjects' cubital fossa veins, when either swabbed with ethanol on the right and the paired iso-propanol on the left. In particular, the blood sampling conditions 1 min and 5 s after swabbing, respectively, were compared. The syringe plunger was not to be touched. These alcohols had mostly evaporated on the skin when blood was collected 1 min after swabbing but still remained when blood was collected 5 s after swabbing.

The blood sampling model was arranged so that tubes were filled with physiological saline solution below the skin model to simulate blood vessels, making it possible to do the blood sampling after swabbing. In the same way as for the subject blood sampling, we extracted about 2.5 ml of the physiological saline via syringe using the model. Only antiseptic ethanol was used with the model; no iso-propanol was applied. In the actual sampling, a comparison was made between first drawing saline into the syringe without touching the plunger, and then while working the plunger only lightly so that some amount of antiseptic could be sucked into the syringe. Next, a test was conducted in which the needle was withdrawn while applying pressure to the venipuncture site with a sterile cotton swab, and then while wiping the needle once with the sterile swab before sampling.

Using the same conditions for both the subjects and the blood sampling model, the blood draw was repeated five times each by two individual examiners (total 10 times) to confirm repeatability.

2.4. The determination of BAC

Two millilitre of the collected blood or physiological saline was gathered to the 2-ml vacuum tubes by inserting a needle into the tubes. Vacuum tubes of collected blood were stored in a cool dark location, and BAC testing was performed by gas chromatography-flame ionization detection (GC-FID). The concentration of iso-propanol in blood was also performed by GC-FID.

3. Results

3.1. Questionnaire survey

For the questionnaire forms mailed out to 117 institutions, valid replies were received by fax from 93 institutions with a 79.5% response rate.