

## Department of Forensic Medicine

---

Kimiharu Iwadate, *Professor*

Kenji Fukui, *Assistant Professor*

### General Summary

Our main research projects in 2009 have focused on sudden unexpected infant death due to milk aspiration, the diagnosis of drowning by detection of specific DNA fragments of aquatic bacteria from blood samples, the analysis of death associated with medical adverse events, personal identification of war-dead remains by means of DNA analysis, the objective evaluation of the limits of DNA typing based on the intensity of ninhydrin treatment, and the quantitative analyses of medicines and poisonous substances in forensic autopsy cases.

### Research Activities

#### *Forensic pathology*

#### 1. Sudden unexpected infant death due to milk aspiration

To examine longitudinal changes in pathological findings of the lung and other organs in cases of milk aspiration, an experimental study using a murine model was performed. The results of immunostaining with an anti-human  $\alpha$  lactalbumin antibody indicated that the kidneys and spleen, as well as the lung, showed positive reactions against the antibody over time. The detection of aspirated milk in organs other than the lung would be clear evidence of intravital milk aspiration and suggests previous or recurrent milk aspiration.

#### 2. Diagnosis of drowning by detection of specific DNA fragments of aquatic bacteria

In general, the diagnosis of death by drowning is established with the detection of diatoms in organs other than the lungs. We speculate that bacteria are more useful markers than are plankton for the diagnosis of death by drowning. From the preserved blood samples from 30 cases of freshwater drowning, specific DNA fragments of *Aeromonas sobria*, a common aquatic bacteria, were examined with the polymerase chain reaction. The DNA fragments of the bacterium were detected from most of the cases with the nested polymerase chain reaction.

#### 3. Analysis of death associated with medical adverse events

Public concerns about medical safety have recently increased as the Ministry of Health, Labour and Welfare have implemented associated projects. This study focused on the characteristics of deaths associated with medical adverse events and was based on autopsies performed by the department of forensic medicine. We identified cases associated with potential diagnostic errors and system errors as well as cases associated with performance errors.

#### *DNA analysis*

#### 1. Identification of war-dead remains with DNA analysis

As part of the war-dead remains return project of the Ministry of Health, and Labour and Welfare, we used DNA analysis to identify war-dead remains buried in the former Soviet Union. For genetic markers we used single nucleotide polymorphisms of hypervariable regions of mitochondrial DNA and short tandem repeats of nuclear DNA.

## 2. Objective evaluation of the limits of DNA typing based on the intensity of ninhydrin treatment

Shed epithelial cells on a sheet of paper were stained with ninhydrin reagent, and DNA typing was performed. We studied the relationship between the intensity of the purple staining after ninhydrin treatment and the limits of DNA typing as mitochondrial DNA polymorphisms, and we attempted to perform an objective evaluation to determine the target of the staining area for DNA analysis.

### *Forensic toxicology*

#### 1. Quantitative analyses of medicines and poisonous substances

Medicines and poisonous substances (abused drugs, alcohol, carbon monoxide, cyanide, and agricultural chemicals) suspected to have caused deaths were quantitatively analyzed with gas chromatography (GC), GC/mass spectrometry (MS), and spectrum photometry in samples obtained at autopsy.

#### 2. Qualitative and quantitative analyses of hydrogen sulfide

We performed autopsies in 17 cases of fatal hydrogen sulfide poisoning due to the inhalation of intentionally generated hydrogen sulfide gas. The concentrations of sulfide and thiosulfate in blood, urine, cerebrospinal fluid, and pleural effusion were examined with GC/MS. In previous reports, the blood concentration of thiosulfate was higher than that of sulfide in cases of hydrogen sulfide poisoning, although in the present study the concentration of sulfide was higher than that of thiosulfate in 8 of the 14 cases examined.

#### 3. Applicability of a CO oximeter to forensic autopsy cases

The applicability to forensic autopsy cases of the CO oximeter was examined. The carboxyhemoglobin (COHb) saturation was examined in cases of death by fire, of CO intoxication other than death by fire, and of other causes of death, by means of 2 types of CO oximeters and a spectrophotometer. The COHb saturation could be measured with the CO oximeters in all samples except for those with putrefaction or heat denaturation. The COHb saturation measured with the CO oximeters tended to be somewhat lower than that measured with spectrophotometry. In conclusion, the CO oximeter is useful clinically and forensically for the measurement of COHb saturation.

### *Radiocarbon analysis*

#### 1. Establishment of age estimation

We studied the estimation of date of birth from the quantity of radiocarbon isolated from tooth enamel. We examined the application of this technique to age estimation for forensic medicine.

### Publications

**Aoyagi M, Iwate K, Fukui K, Abe S, Sakai K, Maebashi K, Ochiai E, Nakamura M.** A novel method for the diagnosis of drowning by detec-

tion of *Aeromonas sobria* with PCR method. *Legal Med* 2009; **11**: 257-9.