Department of Forensic Medicine

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General Summary

Our main research projects in 2011 have focused on sudden unexpected infant death due to milk aspiration, diagnosis of drowning by detection of specific DNA fragments of aquatic bacteria from blood samples, analysis of the ubiquitin proteasome system and the autophagy lysosome system in the central nervous system, identification of war-dead remains through DNA analysis, the objective evaluation of the limits of DNA typing based on the intensity of ninhydrin treatment, and 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 the pathological findings of the lung and other organs in cases of milk aspiration, we performed an experimental study in a murine model. Immunostaining with an antibody against human α lactalbumin showed reactions over time in the lung, kidney, and spleen. 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

Death by drowning is generally diagnosed on the basis of diatoms detected in organs other than the lung. We speculate that bacteria are more useful than plankton as markers for diagnosing death by drowning. From the preserved blood samples of 30 cases of freshwater drowning, specific DNA fragments of *Aeromonas sobria*, a common aquatic bacteria, were examined by means of the polymerase chain reaction. The DNA fragments of the bacterium were detected in most cases with the nested polymerase chain reaction.

3. Analysis of the ubiquitin proteasome system and the autopahgy lysosome system in the central nervous system

Research associated with the ubiquitin proteasome system and the autophagy lysosome system, which play major roles in the degradation of intracellular proteins and organelles, has advanced in the various areas of medical science. Autopsies cases of traumatic intracranial injury at the Department of Forensic Medicine were examined regarding how the ubiquitin proteasome system and the autopahgy lysosome system are induced in traumatic intracranial injury. Both degradation pathways were induced in the injured cerebral cortex soon after trauma, and the pathway involved in the degradation of unnecessary substances or the cells in which degradation is activated were suggested to be different or altered over time after the traumatic event in the central nervous system.

DNA analysis

1. Identification of war-dead remains by means of DNA analysis

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

2. The objective evaluation of the limit 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 limit of DNA typing as mitochondrial DNA polymorphisms, and we performed 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, gas chromatography/mass spectrometry, and spectrum photometry in tissue specimens obtained at autopsy.

2. Examination of a method for analyzing sertraline

We detected sertraline in 4 cases at autopsy. Sertraline is an antidepressant of the selective serotonin reuptake inhibitor class. Qualitative and quantitative methods of analyzing sertraline with gas chromatography/mass spectrometry were examined. With quantitative analysis, high concentrations of sertraline were detected.

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 have succeeded in specifying the age range from only a single tooth by measuring carbon-14 separately in incisal (occlusal) and cervical regions of the enamel.

Publications

Maebashi K, Iwadate K, Sakai K, Takatsu A, Fukui K, Aoyagi M, Ochiai E, Nagai T. Toxicological analysis of 17 autopsy cases of hydrogen sulfide poisoning resulting from the inhalation of intentionally-generated hydrogen sulfide gas. *Forensic Sci Int.* 2011; **207:** 91-5.

Nagai T, Aoyagi M, Ochiai E, Sakai K, Maruyama-Maebashi K, Fukui K, Iwadate K. Longitudinal evaluation of immunohistochemical findings of milk aspiration: an experimental study using a murine model. *Forensic Sci Int.* 2011; **209:** 183-5.

Asakura K, Nagai T, Ozawa M, Ochiai E, Sakai K, Maebashi K, Fukui K, Iwadate K. Autopsy case of a suspected suicide by dry ice (in Japanese). *Hoigaku no Jissai to Kenkyu.* 2011; **54:** 123-7.