Department of Forensic Medicine

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General Summary

Our main research projects in 2014 have mainly focused on forensic pathology, DNA analysis, and forensic toxicology as has happened in the past. Much of the research was based on forensic practice. The details of our research are described below.

Research Activities

Forensic pathology

1. An experimental study of ligature marks

The macroscopic findings of ligature marks are mainly affected by 3 factors: the characteristics of the ligature, the severity of external force upon the ligature, and the length of time the neck was pressed by the ligature. However, few quantitative or experimental studies have examined which of the latter 2 factors contributes more significantly to determine the appearance of ligature marks. We experimentally made artificial ligature marks by hanging on legs of rats, both intravitally and posthumously. Macroscopic examination and statistical analysis revealed that the appearance of ligature marks is not affected by whether the marks are formed intravitally or postmortemly, but equally affected by the severity of force and the duration of force application. Histological examination, with hematoxylin and eosin stain and Elastica Masson-Goldner（EMG）stain, revealed that we could distinguish the compressed area from the other area but could not distinguish intracitally or postmortemly. Immunostaining methods for fibronectine, α1-antichymotrypsin, and CD31 could not distinguish either the area or the time.

DNA analysis

1. Identification of war-dead remains with 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, and 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. Studies of a simple DNA extraction method from various types of forensic samples: Application to chewing gum

We have investigated an extraction method from chewing gum to obtain a sufficient amount of DNA for analyzing mitochondrial DNA and short tandem repeats. In particular, we have focused on preventing contamination with, for example, foreign DNA and polymerase chain reaction inhibitors.

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 meconin

We detected meconin in an autopsy case. Meconin is an organic compound included in opium which can be detected in the urine after opium inhalation. Therefore, detecting meconin from biological specimens is important in opiate diagnosis. Qualitative and quantitative methods of analyzing meconin with gas chromatography/mass spectrometry were examined.

3. Examination of a method for analyzing 4′-methyl-α-pyrrolidinohexiophenone and citalopram

We detected metabolites of 4′-methyl-α-pyrrolidinohexiophenone, which is a designer drug, and citalopram, which is an antidepressant drug of the selective serotonin reuptake inhibitor class, in autopsy cases. Qualitative and quantitative methods of analyzing these drugs were examined with gas chromatography/mass spectrometry.

Radiocarbon analysis

1. Establishment of age estimation

We studied estimating the date of birth from carbon-14 isolated from a tooth. The duration of enamel formation is generally shorter than that of dentin formation. Therefore, to estimate the date of birth with greater precision, enamel should be used instead of dentin. On the other hand, to establish whether the age range was before or after the peak atmospheric concentration of carbon-14 in 1963, when above-ground nuclear bomb tests were banned, the use of dentin is better because dentin formation occurs over a longer time. We have investigated a method of specifying the age range from a tooth by combining the measured carbon-14 level of enamel and dentin.

Publications

Kanto-Nishimaki Y, Saito H, Watanabe-Aoyagi M, Toda R, Iwadate K. Investigation of oxyhemoglobin and carboxyhemoglobin ratios in right and left cardiac blood for diagnosis of fatal hypothermia and death by fire. *Leg Med* (Tokyo). 2014; **16:** 321-5.