

H125 Pancreatic Subcapsular/Interstitial Hemorrhage Associated With Acute Systemic Hypoxia and Its Impact on Endocrine Organs

Fumiya Morioka*, Osaka City University Medical School, Osaka, JAPAN; Naoto Tani, MA, Osaka City University Medical School, Osaka 545-8585, JAPAN; Tomoya Ikeda, PhD, MD, Osaka City University Medical School Legal Medicine, Osaka 545-8585, JAPAN; Aoki Aoki, BA, Osaka City University Medical School Legal Medicine, Osaka 545-8585, JAPAN; Alissa M. Shida, MS, Osaka City University Medical School, Osaka 545-8585, JAPAN; Kei Ikeda, MD, Osaka City University Medical School, Osaka 545-8585, JAPAN; Tatsuya Hirokawa, PhD, Osaka City University Medical School, Osaka 545-8585, JAPAN; Takaki Ishikawa, MD, PhD, Osaka City University, Osaka 545-8585, JAPAN

Learning Overview: The goal of this presentation is to show the impact of acute systemic hypoxia on the endocrine organs by means of biochemical and pathological examination.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by identifying additional morphological and pathological findings in regard to acute systemic hypoxia.

Introduction: Previous investigations have demonstrated that pancreatic subcapsular/interstitial hemorrhage was associated with acute systemic hypoxia, during which blood amylase secretion from the exocrine glands was elevated. However, the frequency at which acute pancreatic subcapsular/interstitial hemorrhage occurs under systemic hypoxia, histopathological changes in pancreatic tissues under a hypoxic state, and the impact of hypoxia on endocrine organs have remained unclear. Therefore, changes in the pancreas associated with acute systemic hypoxia were analyzed.

Methods: Among the autopsies performed in the laboratory (104 cases; median age at death, 63 years; range 6–96 years), those involving sharp instrument injuries (hemorrhagic shock: $n = 11$), blunt injuries ($n = 15$), fire fatalities ($n = 23$), asphyxia ($n = 32$), drowning ($n = 11$), and acute cardiac deaths ($n = 12$) were analyzed. The level of pancreatic interstitial hemorrhage for each case was then scored; blood insulin, glucagon, and glucose were measured. Apart from pathological changes, changes in the percentage of insulin- and glucagon-positive pancreatic islet cells were examined using immunohistochemistry. Given the frequent confirmation of pancreatic subcapsular/interstitial hemorrhage in previous asphyxia cases, a culture of rat pancreatic cells was used to conduct a hypoxic experiment (5% oxygen), analyze insulin messenger RNA (mRNA) expression, examine insulin secretion in the cultured cells, and observe microstructural changes under an electron microscope.

Results: Analysis of pancreatic subcapsular/interstitial hemorrhage according to each cause of death revealed that those who died from acute and subacute asphyxia experienced hemorrhage more often than those who died from other causes. Those who died from acute asphyxia had higher blood insulin levels (1.1–26.4 $\mu\text{IU/mL}$, median 6.0 $\mu\text{IU/mL}$) than those who died from subacute asphyxia (0.3–6.4 $\mu\text{IU/mL}$, median 0.9 $\mu\text{IU/mL}$) and other causes of deaths (0.3–24.4 $\mu\text{IU/mL}$, median 2.0 $\mu\text{IU/mL}$). In contrast, no differences in blood glucagon concentrations and percentage of insulin- and glucagon-positive pancreatic islet cells were observed among the causes of death. The increase in blood insulin showed no relationship with glucose. The hypoxia experiment using cultured rat pancreatic cells showed that insulin mRNA expression became notable within 10min of hypoxia, while insulin concentration in the culture supernatant became elevated. Electron microscopy revealed mitochondrial swelling in the cultured rat pancreatic cells after 15min of hypoxia.

Conclusion: Pancreatic subcapsular/interstitial hemorrhage was observed more frequently in acute/subacute asphyxia cases, with insulin levels being higher in acute asphyxia cases than in cases of other causes of death. The results presented suggest that an acute/subacute systemic hypoxic condition affects mechanisms involved in pancreatic insulin secretion. These findings suggest that acute asphyxia increases serum insulin levels, at least in part, by promoting mechanisms involved in insulin secretion. The aforementioned results indicate that blood insulin secretion level could be an indicator of systemic hypoxia.

Hypoxia, Ischemia, Endocrine