



### H57 Exacerbation of Traumatic Brain Injury in the Presence of Diabetes Mellitus: An Experimental Study of Mice

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**Learning Overview:** After attending this presentation, attendees will understand the relationships between pre-existing natural diseases and traumatic injuries and the possible exacerbation of injuries after experiencing trauma.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by providing evidence that diabetes mellitus is a possible condition that contributes to death due to Traumatic Brain Injury (TBI).

TBI can occur as a result of falls, traffic accidents, and blows. An assessment of severity is required to determine the prognosis and elucidating cause of death. It is known that age is a risk factor for TBI. Elderly people sometimes have diabetes mellitus as a pre-existing co-morbid disease. Diagnosis of a coexisting or pre-existing condition that contributes to underlying cause of death is required in completing the cause-of-death statement. It was supposed that TBI is exacerbated by pre-existing diabetes mellitus due to microcirculation dysfunction and prolonged inflammation. This study investigated the change in brain function and extent of brain contusion after TBI in diabetic and non-diabetic mice.

Ten-week-old male KKAY (type 2 diabetic) and C57BL/6J (non-diabetic) mice were used in this study. A Controlled Cortical Impact (CCI) device was used to induce TBI in each mouse (CCI model). Sham-operated (craniotomy without impact) and naive (did not undergo any operation) animals were used as controls. This study measured the volume of brain contusion using Magnetic Resonance (MR) imaging, which was performed using the Bruker® Icon 1T MR imaging system. This study then assessed changes in nerve function using the Neurological Severity Score (NSS) for motor function and cognitive deficits, learning and memory using the Morris Water Maze (MWM), depression/helplessness using the Forced Swim Test (FST), and motor function using Beam Walking (BW). These experiments were performed from 1 to 112 days after surgery ( $n=4-10$  per timepoint for each group).

Brain contusion was produced in the ipsilateral cerebral cortex of the diabetic and the non-diabetic mice. Compared with those in the non-diabetic mice, the diabetic mice had significantly higher volumes of brain contusion based on the MR imaging and significantly greater deterioration in NSSs after TBI. There were no significant differences in MWM, FST, or BW performances between the diabetic and non-diabetic mice. The results of this present study suggest that pre-existing diabetes is a factor that worsens TBI. Exacerbation of TBI should be monitored in patients with diabetes mellitus. This experimental study also suggests that coexisting diabetes mellitus is a condition that contributes to death due to TBI.

#### **Cause of Death, Diabetes Mellitus, Traumatic Brain Injury**