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# Impact of blunt chest trauma on outcome after traumatic brain injury– a matched-pair analysis of the TraumaRegister DGU®

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## Abstract

**Background:** Traumatic brain injury (TBI) is associated with high rates of long-term disability and mortality. Our aim was to investigate the effects of thoracic trauma on the in-hospital course and outcome of patients with TBI.

**Methods:** We performed a matched pair analysis of the multicenter trauma database TraumaRegisterDGU® (TR-DGU) in the 5-year period from 2012 to 2016. We included adult patients ( $\geq 18$  years of age) with moderate to severe TBI (abbreviated injury scale (AIS) = 3–5). Patients with isolated TBI (group 1) were compared to patients with TBI and varying degrees of additional blunt thoracic trauma (AIS<sub>Thorax</sub> = 2–5) (group 2). Matching criteria were gender, age, severity of TBI, initial GCS and presence/absence of shock. The  $\chi^2$ -test was used for comparing categorical variables and the Mann-Whitney-U-test was chosen for continuous parameters. Statistical significance was defined by a  $p$ -value  $< 0.05$ .

**Results:** A total of 5414 matched pairs (10,828 patients) were included. The presence of additional thoracic injuries in patients with TBI was associated with a longer duration of mechanical ventilation and a prolonged ICU and hospital length of stay. Additional thoracic trauma was also associated with higher mortality rates. These effects were most pronounced in thoracic AIS subgroups 4 and 5. Additional thoracic trauma, regardless of its severity (AIS<sub>Thorax</sub>  $\geq 2$ ) was associated with significantly decreased rates of good neurologic recovery (GOS = 5) after TBI.

**Conclusions:** Chest trauma in general, regardless of its initial severity (AIS<sub>Thorax</sub> = 2–5), is associated with decreased chance of good neurologic recovery after TBI. Affected patients should be considered “at risk” and vigilance for the maintenance of optimal neuro-protective measures should be high.

**Keywords:** Traumatic brain injury, Thoracic injury, Glasgow Outcome Scale, Critical care, Registry

## Background

Traumatic brain injury (TBI) is associated with high rates of long-term disability and mortality. Main interventions in critical care, such as early tracheal intubation, mechanical ventilation, intracranial pressure monitoring - in order to quantify cerebral perfusion pressure - aim to reduce the risk for secondary neurologic injuries. Avoiding hypoxemia, hypercarbia and arterial hypotension are essential to maintain adequate

tissue oxygenation and intracranial pressure (ICP) homeostasis. Presumably, the integrity of the respiratory system is a substantial element for optimal respiratory care in patients with moderate to severe TBI. In thoracic trauma, however, impaired alveolar gas exchange occurs frequently, resulting from lung contusions, pleural pathologies, disturbed ventilation mechanics or the development of acute respiratory distress syndrome (ARDS). A recently published retrospective analysis found severe thoracic trauma to be a risk factor for early-onset ventilator-associated pneumonia with negative consequences on cerebral oxygenation [1].

In addition, established supportive measures in respiratory care, such as lung protective ventilation,

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