Cerebral extracellular chemistry and outcome following traumatic brain injury: a microdialysis study of 223 patients

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Secondary insults can adversely influence outcome following severe traumatic brain injury. Monitoring of cerebral extracellularchemistry with microdialysis has the potential for early detection of metabolic derangements associated with such events. Theobjective of this study was to determine the relationship between the fundamental biochemical markers and neurologicaloutcome in a large cohort of patients with traumatic brain injury. Prospectively collected observational neuromonitoring datafrom 223 patients were analysed. Monitoring modalities included digitally recorded intracranial pressure, cerebral erfusion pressure, cerebrovascular pressure reactivity index and microdialysis markers glucose, lactate, pyruvate, glutamate, glycerol and the lactate/pyruvate ratio. Outcome was assessed using the Glasgow Outcome Scale at 6 months post-injury. Patient-averaged values of parameters were used in statistical analysis, which included univariate non-parametric methods and multivariate logistic regression. Monitoring with microdialysis commenced on median (interquartile range) Day 1 (1–2) from injury and median (interquartile range) duration of monitoring was 4 (2–7) days. Averaged over the total monitoring period levels of glutamate ($P = 0.048$), lactate/pyruvate ratio ($P = 0.044$), intracranial pressure ($P = 0.006$) and cerebrovascular pressure reactivity index ($P = 0.01$) were significantly higher in patients who died. During the initial 72 h of monitoring, median glycerol levels were also higher in the mortality group ($P = 0.014$) and median lactate/pyruvate ratio ($P = 0.026$) and lactate ($P = 0.033$) levels were significantly lower in patients with favourable outcome. In a multivariate logistic regression model ($P5 0.0001$), which employed data averaged over the whole monitoring period, significant independent positive predictors of mortality were glucose ($P = 0.024$), lactate/pyruvate ratio ($P = 0.016$), intracranial pressure ($P = 0.029$), cerebrovascular pressure reactivity index ($P = 0.036$) and age ($P = 0.003$), while pyruvate was a significant independent negative predictor of mortality ($P = 0.004$). The results of this study suggest that extracellular metabolic markers are independently associated with outcome following traumatic brain injury. Whether treatment-related improvement in biochemistry translates into better outcome remains to be established.