Copeptin in Traumatic brain injury

Six relevant studies with data from 552 patients were included in this meta-analysis.

RESULTS: The plasma copeptin levels were found to be significantly higher in patients who died than in the survivors (standardized mean difference [SMD], 1.80). In the four studies reporting Glasgow outcome scale (GOS) data, patients with unfavorable outcomes had significantly higher copeptin levels than those with favorable outcomes (SMD, 1.62). The plasma copeptin level predicted mortality and unfavorable outcomes (AUC, 0.873; AUC, 0.876).

CONCLUSIONS: The present meta-analysis suggests that early measurement of plasma copeptin levels can provide better prognostic information about the functional outcome and mortality in patients with TBI [1)].

Zhang et al., recruited 102 healthy controls and 102 acute patients with severe traumatic brain injury. Plasma concentrations of these biomarkers were determined using enzyme-linked immunosorbent assay. Their prognostic predictive performances of 6-month mortality and unfavorable outcome (Glasgow Outcome Scale score of 1-3) were compared. Plasma concentrations of these biomarkers were statistically significantly higher in all patients than in healthy controls, in non-survivors than in survivors and in patients with unfavorable outcome than with favorable outcome. Areas under receiver operating characteristic curves of plasma concentrations of these biomarkers were similar to those of Glasgow Coma Scale score for prognostic prediction. Except plasma copeptin concentration, other biomarkers concentrations in plasma did not statistically significantly improve prognostic predictive value of Glasgow Coma Scale score. Copeptin levels may be a useful tool to predict long-term clinical outcomes after severe traumatic brain injury and have a potential to assist clinicians [2)].

Yang et al., prospectively studied 100 consecutive patients presenting within 6h from head trauma. Progressive hemorrhagic injury was present when the follow-up computerized tomography scan reported any increase in size or number of the hemorrhagic lesion, including newly developed ones. Acute traumatic coagulopathy was defined as an activated partial thromboplastic time greater than 40s and/or international normalized ratio greater than 1.2 and/or a platelet count less than 120×10(9)/L. We measured plasma copeptin levels on admission using an enzyme-linked immunosorbent assay in a blinded fashion. In multivariate logistic regression analysis, plasma copeptin level emerged as an independent predictor of progressive hemorrhagic injury and acute traumatic coagulopathy. Using receiver operating characteristic curves, we calculated areas under the curve for progressive hemorrhagic injury and acute traumatic coagulopathy. The predictive performance of copeptin was similar to that of Glasgow Coma Scale score. However, copeptin did not obviously improve the predictive value of Glasgow Coma Scale score. Thus, copeptin may help in the prediction of progressive hemorrhagic injury and acute traumatic coagulopathy after traumatic brain injury [3)].

Higher plasma copeptin levels correlate with poor clinical outcomes after traumatic brain injury. Nevertheless, their links with acute traumatic coagulopathy and progressive hemorrhagic injury are

unknown.

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53 patients who were admitted to the emergency department with isolated TBI. Forty-two of these patients (group I) survived at least 1 month after the TBI; the other 11 (group II) did not. Plasma levels of copeptin were measured in these TBI patients at admission and 6 h after trauma, and were compared with those of healthy volunteers (group III).

RESULTS: At admission, the copeptin levels of the TBI patients (groups I and II combined) were not statistically significantly different from those of the control group (III). The copeptin levels 6 h after trauma were also not statistically significantly different from those at admission. Δ-Copeptin levels (the difference between the copeptin level at the 6th hour after trauma and that at admission) were higher in the patients who died within a month of the TBI. Further, Δ-copeptin levels were higher in patients who showed no improvement in the modified Rankin score when compared with patients with an improved modified Rankin score. The best cutoff point for Δ-copeptin was 0.51 ng/ml for predicting mortality and 0.23 ng/ml for predicting improvement in the modified Rankin score.

CONCLUSIONS: Plasma Δ-copeptin levels may help physicians predict the prognoses of patients suffering from traumatic brain injury [5)].

Plasma copeptin concentrations of 126 healthy children and 126 children with acute severe TBI were measured by enzyme-linked immunosorbent assay. Twenty-one patients (16.7%) died and 38 patients (30.2%) had an unfavorable outcome (Glasgow Outcome Scale score of 1-3) at 6 months. Plasma copeptin level was obviously higher in patients than in healthy children (46.2±20.8 pmol/L vs. 9.6±3.0 pmol/L, P<0.001). Plasma copeptin level was identified as an independent predictor for 6-month mortality [odds ratio (OR) 1.261, 95% confidence interval (CI) 1.112-1.538, P=0.005] and unfavorable outcome (OR 1.313, 95% CI 1.146-1.659, P=0.003). The predictive value of copeptin was similar to that of Glasgow Coma Scale (GCS) score for 6-month mortality [area under curve (AUC) 0.832, 95% CI 0.755-0.892 vs. AUC 0.873, 95% CI 0.802-0.926, P=0.412] and unfavorable outcome (AUC 0.863, 95% CI 0.790-0.918 vs. AUC 0.885, 95% CI 0.816-0.935, P=0.596). Copeptin improved the AUC of GCS score for 6-month unfavorable outcome (AUC 0.929, 95% CI 0.869-0.967, P=0.013), but not for 6-month mortality (AUC 0.887, 95% CI 0.818-0.936, P=0.600). Thus, plasma copeptin level represents a novel biomarker for predicting 6-month clinical outcome in children with TBI [6)].

One hundred and six healthy controls and 106 patients with acute severe traumatic brain injury were included. Plasma samples were obtained on admission. Its concentration was measured by enzyme-linked immunosorbent assay. Forty-eight patients (45.3%) suffered from unfavorable outcome (Glasgow Outcome Scale score of 1-3) and 31 patients (29.2%) died in 1 year after traumatic brain injury. Upon admission, plasma copeptin level in patients was substantially higher than that in healthy controls. A forward stepwise logistic regression selected plasma copeptin level as an independent predictor for 1-year unfavorable outcome and mortality of patients. A receiver operating characteristic curve analysis showed plasma copeptin level predicted 1-year unfavorable outcome and mortality obviously. The predictive value of the copeptin concentration was thus similar to that of Glasgow Coma Scale score for the prediction of unfavorable outcome and mortality after 1 year. In a combined logistic-regression model, copeptin improved the area under curve of Glasgow Coma Scale score for the prediction of unfavorable outcome and mortality after 1 year, but the differences were not significant. Thus, copeptin level is a useful, complementary tool to predict functional outcome and mortality 1 year after traumatic brain injury [7)].

Fifty healthy controls and 94 patients with acute severe TBI were included. Plasma samples were obtained on admission and at days 1, 2, 3, 5, and 7. Its concentration was measured by enzyme-linked immunosorbent assay.

RESULTS: Twenty-six patients (27.7%) died from TBI in a month. After brain injury, plasma copeptin level in patients increased during the 6-hour period immediately, peaked in 24 hours, plateaued at day 2, decreased gradually thereafter, and was substantially higher than that in healthy controls during the 7-day period. A forward stepwise logistic regression selected plasma copeptin level (odds ratio, 1.008; 95% confidence interval, 1.002-1.014; $p = 0.010$) as an independent predictor for 1-month mortality of patients. A multivariate linear regression showed that plasma copeptin level was negatively associated with Glasgow Coma Scale (GCS) score ($t = -7.161$; $p < 0.001$). A receiver operating characteristic curve identified plasma copeptin cutoff level (451.8 pg/mL) that predicted 1-month mortality with the optimal sensitivity (88.5%) and specificity (75.0%) values (area under curve, 0.874; 95% confidence interval, 0.789-0.933; $p < 0.001$). The area under curve of plasma copeptin level was similar to that of GCS score ($p = 0.299$). However, copeptin did not statistically significantly improve the area under curve of GCS score ($p = 0.413$).

CONCLUSIONS: Increased plasma copeptin levels are associated with mortality after TBI [8)].

The incidence of water and electrolyte disturbances following traumatic brain injury (TBI) is considerable and has been attributed to a dysregulation of the hypothalamic peptide arginine-vasopressin (AVP). Copeptin, the C-terminal part of the AVP prohormone, reflects AVP activity. In 71 TBI patients we measured copeptin in serum by a sandwich immunoassay. Injury severity was assessed by Glasgow Coma Score (GCS) and computed tomography, and recovery by Glasgow Outcome Score (GOS). Neuroendocrine and osmoregulation regulation were examined on day 0, 3 and 7, and 24 months post-injury. Copeptin was highest on admission (40.0 +/- 72.3 pmol/l), stabilized on day 3 and 7 (21.2 +/- 18.3 resp. 20.3 +/- 17.1 pmol/l), and normalized at follow-up (4.2 +/- 1.7 pmol/l). On admission, there was a correlation between serum sodium and urine excretion ($p = 0.003$), but the correlation got lost on day 3 and 7. Copeptin did not reflect the individual 24 h urine excretion or serum sodium levels indicating an uncoupling of copeptin/AVP release and renal water

excretion. High copeptin level on day 3 were correlated with a low GCS ($p < 0.001$), midline shift ($p = 0.019$), intracerebral hemorrhage ($p = 0.026$), SAPS score ($p = 0.001$), as well as with a low GOS ($p = 0.031$). Copeptin was significantly decreased following skullbase fracture ($p = 0.016$).Our data reveal a loss of hypothalamic osmoregulation following TBI. The measurement of Copeptin/AVP release reveals a significant predictive function for the severity of TBI [9].

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