Abstract

Prognostic value of major extracranial injury in traumatic brain injury: An individual patient data meta-analysis in 39,274 patients

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Introduction

Although major extracranial injury (MEI) is common in Traumatic Brain Injury (TBI) patients, its effect on outcome is controversial. We aimed to study the prognostic effect of MEI on mortality after TBI.

Methods

We included individual patients with TBI from three observational studies (EBIC, UK4 and TCDB, included in the IMPACT* database), one recent Randomized Controlled Trial (CRASH**), and one trauma registry (TARN***). MEI was defined as any extracranial injury with an Abbreviated Injury Score ≥ 3 or "requiring hospital admission on its own". We related MEI to mortality (14 day in TARN and 6 month in IMPACT and CRASH) with logistic regression analysis, adjusted for age, motor score and pupillary reactivity, stratified by brain injury severity (mild, moderate and severe TBI). We pooled the odds ratios in IMPACT and CRASH with random effect meta-analysis. To assess heterogeneity between CRASH and IMPACT we calculated the between-study variance $\tau^2$. We did not include TARN in the pooled analysis, because this study included patients who died before or shortly after admission. We also calculated partial $R^2$ statistics to indicate the amount of variance explained by MEI.

Results

We included 17,132 (44%) severe, 7,229 (18%) moderate, 14,909 (38%) mild TBI patients, 39,274 in total. Mortality was 25% and 32% had MEI. MEI was a strong prognostic factor for mortality in TARN, adjusted odds ratio (OR) and 95% confidence interval (95%CI) were 2.81 (2.44-3.23) in mild, 2.18 (1.80-2.65) in moderate and 2.14 (1.95-2.35) in severe TBI patients. The prognostic effect was smaller in IMPACT and CRASH with pooled adjusted ORs and 95%CIs of 2.14 (0.93-4.91) in mild, 1.46 (1.14-1.85) in moderate and 1.18 (1.03-1.55) in severe TBI patients (Figure 1). The between-study variances $\tau^2$ and p-values for heterogeneity were 0.39 ($p=0.02$) for the mild, 0.11 ($p=0.10$) for the moderate and 0.0 ($p=0.98$) for the severe TBI studies. The prognostic value of MEI in terms of univariable $R^2$ was varying from 0.0% (in severe patients in IMPACT and CRASH) to 3.4% (in severe patients in TARN).

Conclusion

MEI is a prognostic factor in patients with TBI, but the strength of the effect decreases with brain injury severity. The large prognostic effect in TARN compared to IMPACT and CRASH for patients with severe head injury is possibly explained by inclusion of patients who die before or shortly after admission. In the total TBI population the incremental prognostic value of MEI compared to known predictors of mortality is limited.

* IMPACT - International Mission on Prognosis and Clinical Trial design in TBI studies, www.tbi-impact.org
** CRASH - Medical Research Council Corticosteroid Randomization after Significant Head Injury trial, www.crash.lshtm.ac.uk
*** TARN - Trauma Audit & Research Network registry, www.tarn.ac.uk