

Early hemorrhagic progression of traumatic brain contusions: frequency, correlation with coagulation disorders and patient outcome – a prospective study

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Introduction

The focus of this study is to identify and quantify risk factors for early hemorrhagic progression of brain contusions (HPC) in patients with traumatic brain injuries (TBI) and to evaluate their impact on patients' outcome. Further, based on abnormal values in routine blood tests, the role of trauma induced coagulopathy (TIC) is analyzed in detail.

Methods

A prospective study of 153 TBI patients was completed at one institution between January 2008 and June 2012. The collected data included: demographics, initial GCS, pupillary response, initial and 6 hour follow-up CT scan findings, coagulation parameters (INR, PTT, platelet count, fibrinogen, D-Dimer and factor XIII), as well as outcome data using the modified Rankin score (mRS) at discharge and after one year.

Results

The current study is a prospective study with a large patient cohort reporting a high rate of 43.5% of early progression of cerebral contusions based on two early CT scans upon admission. The frequency of coagulopathy was 47.1%. When analyzing for risk factors which independently influenced outcome in the form of mRS=4 at both points, the following variables appeared: elevated D-Dimer level ($=10.000\mu\text{g/L}$), HPC and initial brain contusions $\geq 3\text{cm}$. Patients sustaining early HPC had a HR of 5.4 for unfavorable outcome at discharge ($p=0.002$) and of 3.9 after one year ($p=0.006$). Overall, patients who developed early HPC were significantly more likely to be gravely disabled or to die.

Conclusions

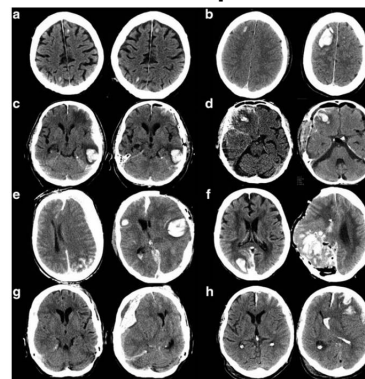
Unfavorable neurological outcome after an isolated TBI is determined largely by early HPC and TIC, which seem to occur very frequently in TBI patients, irrespective of the trauma severity. For these reasons, extended laboratory tests should be determined early in TBI patients with cerebral contusions in the baseline CT -, regardless of the trauma grade, in order to be able to prevent early HPC before it develops.

Learning Objectives

Frequency of early hemorrhagic progression of traumatic brain contusions

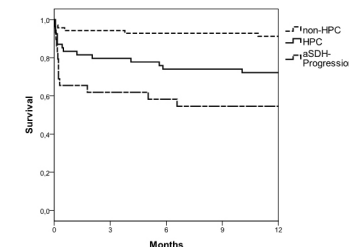
Frequency of trauma induced coagulopathy after TBI and its role in hemorrhagic progression of traumatic brain contusions

Patients' groups regarding the initial and follow-up CT scans



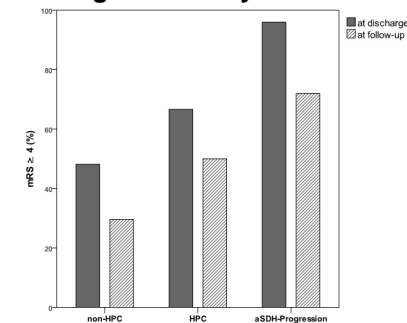
Group 1 A: Only brain contusions, no acute subdural hematomas and no hemorrhagic progression of contusions
Group 1 B: Only brain contusions, no acute subdural hematomas, but with hemorrhagic progression of contusions
Group 2 A: Brain contusions, acute subdural hematomas and no hemorrhagic progression of contusions
Group 2 B: Brain contusions, acute subdural hematomas, but with hemorrhagic progression of contusions
Group 3: Patients who presented with either progression of acute subdural hematomas or secondary acute subdural hematomas

Figure 2: Kaplan-Meier estimates overall survival of all patients in the first year after trauma.



Group 1 A (patients with only BC, no aSDH and no early HPC), Group 1 B (only BC, no aSDH but with early HPC), Group 2 A (BC, aSDH and no early HPC), Group 2 B (BC, aSDH and early HPC), and Group 3 (early progression of aSDH).

Figure 3: Patients' groups in relation to modified Rankin scale (mRS) at discharge and one year thereafter.



Group 1 A (patients with only BC, no aSDH, and no early HPC), Group 1 B (only BC, no aSDH but with early HPC), Group 2 A (BC, aSDH, and no early HPC), Group 2 B (BC, aSDH, and early HPC), and Group 3 (early progression of aSDH).