Protein Blood Biomarkers in Paediatric Mild Traumatic Brain Injury for Patient Triage at Admission

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PURPOSE / OBJECTIVES

Children are especially at risk of mild traumatic brain injury (mTBI). Few studies on TBI were however conducted in this **vulnerable population**. mTBI can lead to **intracranial injury (ICI) such as haemorrhage** and must be identified and managed quickly at the emergency room (ER). Symptoms are not specific and can evolve within hours after the trauma. This period is stressful for children and families as well as time and cost consuming for the hospitals. **ICI is diagnosed by cranial CT scan**. However, this exam must be avoided as much as possible in children due to the risks of irradiation.

Here we investigate in a paediatric population the performance of four proteins, previously studied in adult mTBI: HFABP, GFAP, S100b and IL10 (*L. Lagerstedt et al. 2018).* The aim is to avoid the use of unnecessary CT scan or to keep patient at the ER.

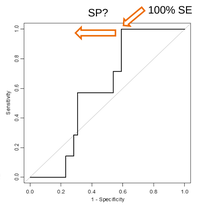
MATERIAL & METHODS

Proteins blood levels were measured using commercial immunoassays in **eighty-seven patients from two paediatric studies (pilot-tBIOMAP and BIOTRABIS).** Blood samples were collected within twenty-four hours after mTBI. Patients were dichotomized into CT-positive (PECARN rules) and CT-negative or no-CT groups. Statistical analysis was performed on both merged cohorts using ROC curves on R software.

1) Identify all patients with ICI ⇨ **100% Sensitivity**

2) Allow a maximum of patients to get back home :

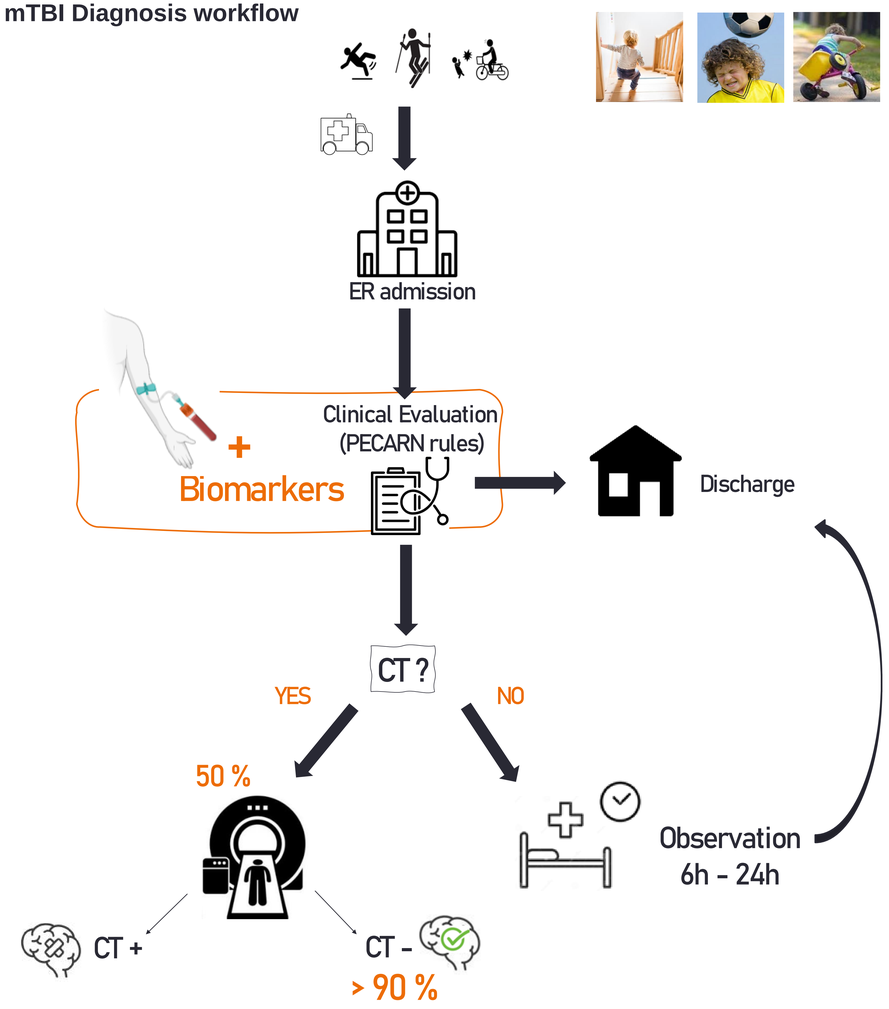
{ without CT scan / without long term at ER } ⇨ **Highest % Specificity possible**



RESULTS

Nine patients had ICI on CT (= CT positive). Proteins were not significantly increased in this group compared to all other patients (table1). At 100% of sensitivity, the **best biomarker was GFAP with 52% of specificity to predict ICI** (S100b 21%, IL-10 15% and HFABP 5% SP) (table2).

mTBI Diagnosis workflow



RESULTS

Table 1: Descriptive table

	CT- or Observation (N=78)	CT+ (N=9)	P-value
AGE			
Mean (SD)	7.93 (4.96)	7.00 (5.50)	0.531
Median [Min, Max]	6.62 [0.0800, 16.0]	8.10 [0.0600, 15.0]	
sex			
Boys	45 (57.7%)	6 (66.7%)	0.873
Girls	33 (42.3%)	3 (33.3%)	
Severity of injury			
GCS14	5 (6.4%)	2 (22.2%)	0.315
GCS15	73 (93.6%)	7 (77.8%)	
CT scan exam			
no CT scan	52 (66.7%)	0 (0%)	<0.001
CT scan	26 (33.3%)	9 (100%)	
GFAP_pgml			
Mean (SD)	599 (896)	1620 (2590)	0.056
Median [Min, Max]	299 [8.15, 6070]	461 [314, 8040]	
Missing	1 (1.3%)	0 (0%)	
S100b_pgml			
Mean (SD)	131 (133)	237 (334)	0.296
Median [Min, Max]	82.1 [14.0, 851]	94.5 [56.9, 1100]	
HFABP_pgml			
Mean (SD)	5360 (5490)	4890 (3530)	0.989
Median [Min, Max]	3600 [1300, 34600]	4630 [1680, 12900]	
IL10_pgml			
Mean (SD)	1.19 (2.15)	1.38 (2.27)	0.526
Median [Min, Max]	0.312 [0.0357, 13.1]	0.426 [0.167, 7.23]	

Figure 1: Pourcentage of mTBI patients with CT scan.

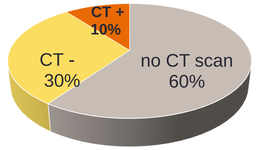
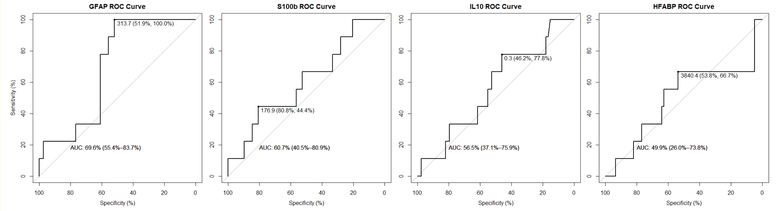


Table 2: Biomarkers performance to predict intracranial injury on CT scan : Rule out.

variable	Sensitivity (%)	Specificity (%)	Cut_off
GFAP (pg/ml)	100	51,95	313,68
S100b (pg/ml)	100	20,51	56,79
IL10 (pg/ml)	100	15,38	0,17
HFABP (pg/ml)	100	5,13	1622,97

Figure 2: ROC curves of potential intracranial injury's predictors on CT scan



SUMMARY / CONCLUSION

GFAP yields the overall best performance of the studied biomarkers in separating children with ICI from CT- or no CT patients**. In the studied population, half of the children kept in observation at the ER for symptom follow-up after mTBI might had been discharged with the help of biomarker measurement**.