



# Vomiting with head trauma and risk of traumatic brain injury

Meredith Borland

# Thanks to all the staff at the sites

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**Child and Adolescent Health Service**



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# Mild to moderate blunt head injuries in children

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- Common presentation to EDs worldwide
- Dilemma re CT scanning vs against the risks of ionising radiation, risk of sedation
- Vomiting associated with increased risk of more severe head injury
  - ? indication CT to exclude Traumatic Brain Injury
- International decision rules include vomiting episodes as a predictor variable
- PECARN (USA) study showed 15.1% had **isolated** vomiting and had a rate of TBI-on-CT of 1.7%

# Australasian Paediatric Head Injury Study

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Prospective observational study compare and externally validate 3 CDRs

- PECARN
- CHALICE
- CATCH

## Accuracy of PECARN, CATCH, and CHALICE head injury decision rules in children: a prospective cohort study

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[www.thelancet.com](http://www.thelancet.com) **Published online April 11, 2017**

# Aim of this study

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## **Planned secondary analysis**

### Primary Aim

- Determine prevalence of clinically important traumatic brain injury in children presenting with vomiting and the relationship between age, frequency of vomiting, mechanism of injury and ciTBI

### Secondary aim

- Determine PECARN and CHALICE predictor variables that increase the risk of TBI-CT or ciTBI in the setting of vomiting

# Methods

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- **Inclusion criteria**

<18 yrs, presenting to ED < 24hours post injury, GCS 13-15

- **History / characteristics of vomiting episodes**

Correlated with

- mechanism of injury
- presence of decision rule variables
  - LOC, headache, abnormal behaviour (<2yr), amnesia, seizures, NAI concerns, signs of skull fracture, abnormal GCS, scalp haematoma
- number of vomiting episodes (1,2 or  $\geq 3$ )
- age <2 and  $\geq 2$  years

- **Multivariate logistic regression to assess independent associations in vomiting and other variables traumatic brain injury**

# Definitions

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## TBI-CT

- Intracranial haem/contusion
- Cerebral oedema
- Diffuse axonal injury
- Shearing injury
- Sigmoid thrombosis
- Signs of brain herniation
- Midline shift
- Diastasis of skull
- Pneumocephalus
- Depressed skull fracture

## ciTBI

- Death
- Intubation > 24h
- Neurosurgery
- Hospital admission  $\geq$  2 nights

## Isolated vomiting

- Vomiting in the setting of HI with no other decision rule variables

# Results

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19,920 children with HI eligible

3,389 (17.0%) had **any** vomiting

41.3% girls

2446 (72.2%)  $\geq 2$  yrs

1,006 (5.0%) had **isolated** vomiting with no other CDR  
predictors

457 (45.4%)  $< 2$  yrs

549 (54.6%)  $\geq 2$  yrs



# Presence of Traumatic Brain Injury

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285 children had TBI-CT

- 123 (43.2%) had vomiting
- 2 (0.6%) children with TBI-CT had **isolated** vomiting
- No child with isolated vomiting was < 2yrs

172 children had ciTBI

- 76 (44.2%) had vomiting
- 1 (0.3%) child had **isolated** vomiting

# Significant Associations with ciTBI by vomiting episodes (CHALICE variables)

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## Vomiting < 3 times

- seizure – 6/45 (13.3%)
- altered GCS – 5/43 (11.6%)
- abnormal drowsiness - 16/158 (10.1%)
- suspicion depressed # - 9/34 (26.5%)
- signs of base of skull # - 7/17 (17.7%)
  
- high speed MVC 10/90 (11.1%)
- fall > 3m 9/145 (6.2%)

## Vomiting ≥ 3 times

- seizure - 2/15 (13.5%)
- altered GCS - 3/35 (8.6%)
- abnormal drowsiness - 14/158 (8.9%)
  
- high speed MVC - 3/35 (8.6%)
- fall > 3m - 9/102 (8.8%)

# Association with ciTBI by age $<$ or $\geq$ 2 yrs (PECARN variables)

## Age $<$ 2 years

Isolated vomiting – 0/457 (0%)

Vomiting + one of:

- altered mental status 10/124 (8.1%)
- non-frontal haematoma 6/175 (3.4%)
- palpable skull fracture 4/34 (11.8%)
- not acting normally 8/196 (4.1%)
- severe mechanism 2/8 (25.0%)

## Age $\geq$ 2 years

Isolated vomiting – 1/549 (0.2%)

Vomiting + one of:

- altered mental status 39/460 (8.5%)
- any LOC 17/307 (5.5%)
- signs of BOS fracture 4/30 (13.3%)
- severe headache 42/1104 (3.8%)
- severe mechanism 17/75 (22.7%)

# Diagnostic testing of ciTBI from CDR predictor variables in presence of vomiting

	<b>Sens.</b>	<b>Spec.</b>	<b>aOR</b>	<b>95%CI</b>	<b>p</b>
<b>Headache</b>	<b>45.35</b>	<b>79.64</b>	<b>2.29</b>	<b>(1.28-4.11)</b>	<b>0.005</b>
<b>Acting abnormally &lt; 2yrs</b>	<b>40.12</b>	<b>87.10</b>	<b>1.86</b>	<b>(1.03-3.37)</b>	<b>0.040</b>
<b>Altered mental status</b>	<b>27.33</b>	<b>98.00</b>	<b>2.35</b>	<b>(1.04-5.33)</b>	<b>0.041</b>
<b>Skull fracture (palpable, depressed or base of skull)</b>	<b>76.16</b>	<b>98.66</b>	<b>80.13</b>	<b>(43.38-148.61)</b>	<b>&lt;0.001</b>

# Discussion

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- Vomiting is a common symptom in children with minor HI
- Incidence of ciTBI and TBI-CT without other symptoms is infrequent
- Features signalling greater risk of significant injury are:
  - Signs suggestive of skull fracture
  - Altered consciousness
  - Altered behaviour in those < 2yrs
  - Headache

# Conclusion

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- ciTBI is uncommon in children with minor head injury where vomiting is their only symptom
- Careful evaluation and observation is a suitable strategy prior to CT scanning in children with isolated vomiting

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# Vomiting With Head Trauma and Risk of Traumatic Brain Injury

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*Pediatrics.* 2018;141(4):e20173123

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