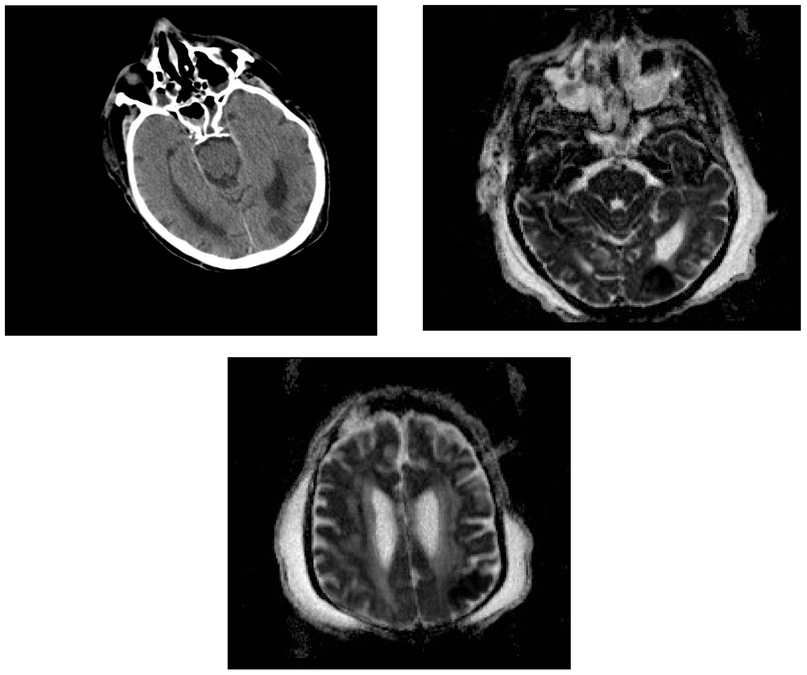
Intracranial Injuries and the Effect of Fluid Resuscitation in Burn Patients

LTC Alicia Williams MD, Capt Brian Stephens MD, Anthony Frattalone MD, COL Kevin K. Chung MD, Craig Ainsworth MD, MAJ(P) Julie A. Rizzo MD, Leopoldo C. Cancio MD

US Army Institute of Surgical Research, JBSA Fort Sam Houston, TX

Introduction

- Burn injuries cause ~180,000 deaths/year worldwide
- Practice guidelines recommend 2-4 ml/kg/%TBSA within the first 24 hours
- Over-resuscitation has led to many complications including compartment syndrome, cardiac failure and ARDS
- The most common CNS complication in burn patients is encephalopathy.
- It is not known whether postburn CNS pathology is related to the volume of fluid received for resuscitation.



Example of occipital infarct on CT and MRI of 63-year-old man from house fire, with 49% TBSA burns. This patient had initial parietal lobe infarct on CT, then had multiple subacute infarcts of parietal, occipital lobe and cerebellum on MRI imaging 2 days later.

Objectives

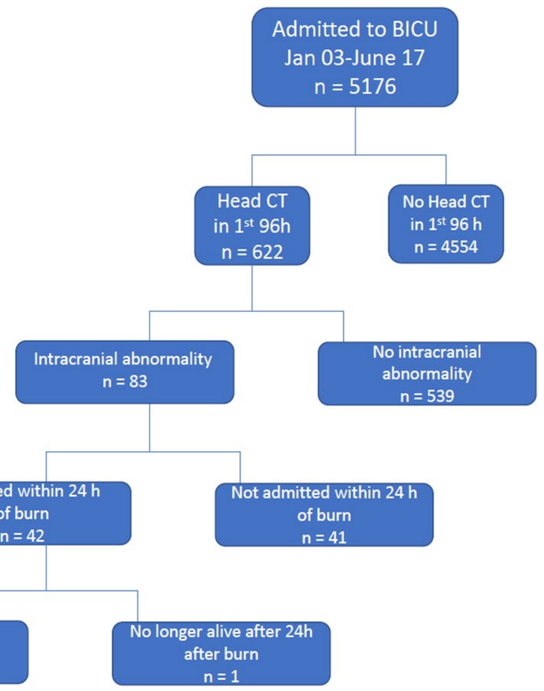
- To determine whether there is any correlation between increased fluid resuscitation volumes and new or worsened intracranial radiologic findings (based on sequential CT and/or MRI scans, done for clinical indications).

Methods

- Retrospective analysis of all burn patients admitted to a Level 1 Trauma Center and American Burn Association Verified Burn Center from January 2003 and July 2017
- Received a CT of the head within 96 hours of hospitalization and admitted within 24 hours of the time of burn/injury
- Radiology report indicating an abnormality on head imaging at some point during their care
- Determined by review of radiology reports. Examples of verbiage include the following:
  - "frontal subdural hematoma causing mild mass-effect" – new finding"
  - "new focal area of infarct" – new finding
  - "herniation"
  - "progression of intraparenchymal hemorrhage"
  - "areas of restricted diffusion…" – not seen on initial scan
- Verbiage indicated a new or worsening finding from the initial scan
- Statistical analysis was done with Fisher's Exact Test
- This retrospective study is an approved protocol by the RHC-C IRB.

Results

- 41 patients with initial head CT with intracranial abnormality, admitted within 24 hours of burn and alive 24 hours after burn
- IV Fluids Received:
  - <100 cc/kg = 17 patients
  - 100-150 cc/kg = 10
  - 150-200 cc/kg = 3
  - 200-250 cc/kg = 5
  - >250 cc/kg = 6
- 7 Patients with worsening radiologic findings
  - Age average: 57
  - Average TBSA: 30%
  - Mechanism of injury
    - House Fire
    - Gasoline Ignition
    - Found down- hot pavement burns
  - Resuscitation average 7.4 cc/kg/%TBSA



Types of Intracranial Abnormalities on Initial Imaging Study

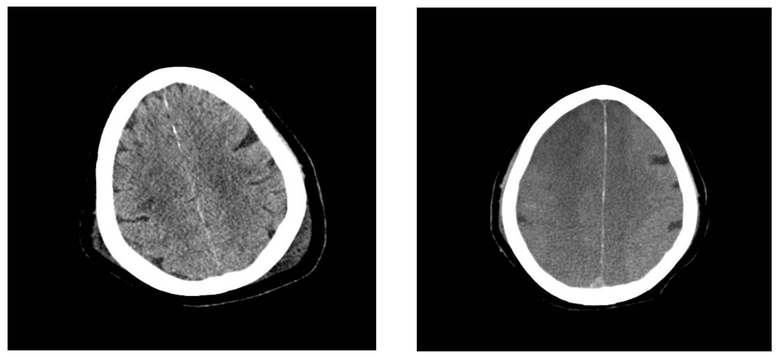
	Subarachnoid Hemorrhage	Intraparenchymal Hemorrhage	Subdural /Epidural	Edema	Infarction/Ischemia	Diffuse Axonal Injury	Uncertain Initial but not seen on f/u	Not Acute / Likely Chronic
0-100 cc/kg	6	5	4	4	0	1	1	4
100-150 cc/kg	1	2	0	3	4	1	1	1
150-200 cc/kg	0	0	0	0	1	0	0	2
200-250 cc/kg	0	1	0	0	2	0	0	1
>250 cc/kg	1	1	1	2	2	2	0	1

Radiologic Worsening as Determined by Radiology Reports

	Total Patients (N=41)	Follow up Worse or with New Findings? (N=7)	Dead within 24 hours? (N=5)	Dead within 1 week? (N=4)
0-100 cc/kg	17	1 (6%)	3	0
100-150 cc/kg	10	1 (6%)	0	3
150-200 cc/kg	3	0	0	0
200-250 cc/kg	5	2 (12%)	1	0
>250 cc/kg	6	3 (18%)	1	1

Conclusions

- Patients who received greater than 200 cc/kg of fluid resuscitation in the first 24 hours after burn injury were more likely to have radiologic worsening or new findings on repeat imaging than those who received less
- Limitations with standardization of follow up imaging with CT vs MRI
- Future studies to possibly image all patients with over 20% TBSA to follow for resuscitation morbidity.



CT Image of 70-year-old woman with 19.3% TBSA flame burn. Initial CT normal. Subsequent CT 5 days later with hypoattenuation of the right hemisphere and loss of gray-white differentiation.

Acknowledgements

The authors acknowledge the Burn Program for the ABA v6 registry data for this study.

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Statements

This study was conducted under a protocol reviewed and approved by the Brooke Army Medical Center Institutional Review Board and in accordance with the approved protocol.