Pathological Diagnoses of Biopsied Samples in Intracerebral Hemorrhage

Adam C. Lieber BA; Jacopo Scaggiante MD; Robert J. Rothrock MD; Mary Fowkes MD, PhD; Jonathan S. Pan BA; J Mocco MD; Christopher P. Kellner MD

Icahn School of Medicine at Mount Sinai Department of Neurosurgery

Icahn School of Medicine at Mount Sinai

Introduction

- Current treatment of intracerebral hemorrhage (ICH) involves medical management or surgery depending on the accessibility of the bleeding for surgical evacuation
- Minimally invasive surgery (MIS) for ICH clot evacuation is a new operative approach that allows for the retrieval of biopsies for pathological analysis
- Pathologic analysis of parenchymal and clot biopsies from ICH patients can provide a more definitive determination of disease etiology and clinically relevant features
- This abstract reviews the diagnostic utility of obtaining biopsies in ICH clot evacuation surgery

Methods

- From October 2016 to March 2018, a single surgeon operating at two Manhattan hospitals collected clot and brain parenchymal samples for 43 patients undergoing evacuation of an ICH
- Of these 43 patients, 40 patients underwent clot evacuation by a minimally invasive approach and 3 patients underwent clot evacuation by an open approach.
- Age, sex, history of ICH and other cerebrovascular accidents, history of hypertension, diabetes, EtOH abuse, smoking, renal disease, liver disease, medication use, and illicit drug use were collected prospectively
- Imaging characteristics, such as intra-ventricular hemorrhage (IVH), midline shift, and hemorrhage location were collected prospectively on head CT or MRI
- Histopathological staining methods included an H&E stain, as well as a further use of Congo Red stain to identify apple-green birefringence with polarized light and beta-amyloid immunohistochemical stain to determine whether a sample had evidence of cerebral amyloid angiopathy
- Statistical Analysis: Fisher exact test was used to determine inter-group differences of categorical variables. Statistical significance was set at $p<0.05$.

Results

Demographics

- Forty-three patients were enrolled in the study with an average age of 62.9 years
- There were 27 men (63%) and 16 women (37%) enrolled
- Thirty-seven patients (86%) had a history of hypertension, Six patients (14%) had a history of an ICH, 11 patients (26%) had diabetes mellitus, 3 patients had renal disease (7%), and one patient had liver disease (3%)
- Nine patients (21%) were using at least one anticoagulant medication at baseline, 10 patients were using at least one antiplatelet medication (23%), and 14 patients (33%) were using at least one statin medication
- Ten patients (23%) had a history of smoking, 3 patients had a history of alcohol abuse (7%), and 2 patients had a history of cocaine abuse (5%)
- Fourteen patients (33%) had midline shift evaluated on computed tomography (CT) scan
- Hemorrhage location was categorized as basal ganglia (n=17, 40%), parietal (n=10, 23%), thalamic (n=7, 16%), frontal (n=6, 14%), temporal (n=4, 9%), occipital (n=3, 7%), and extreme capsule (n=1, 2%). Twenty patients (47%) had IVH.

Pathology Sample Analysis

- Five out of the 43 samples (12%) were determined to have amyloid on histopathological sample analysis
- 23% of patients had >50% Gliosis (n=10)
- 12% of patients had ischemic change (n=5)
- 12% of patients had hypertensive changes (n=5)

Figure 1
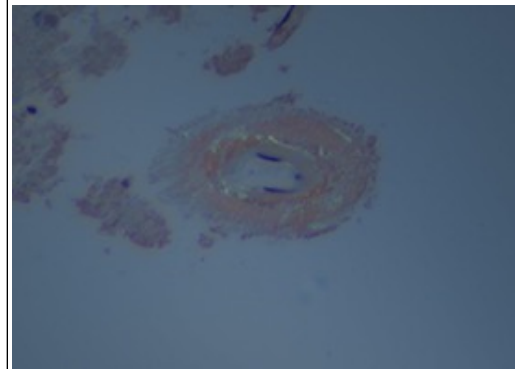
Beta-Amyloid Congo Red with Apple-Green Birefringence

Table 1

Characteristic	Total (N=43)	Non-CAA (N=38)	CAA (N=5)	P Value
Age – yr. (SD)	62.9 (12.4)	60.7 (11.2)	80.0 (6.1)	**0.002**
Female sex – no. (%)	16 (37%)	15 (39%)	1 (20%)	0.635
Previous ICH – no. (%)	6 (14%)	5 (13%)	1 (20%)	0.547
Previous CVA – no. (%)	8 (19%)	5 (13%)	3 (60%)	0.037
Hypertension – no. (%)	37 (86%)	33 (87%)	4 (80%)	0.488
Diabetes Mellitus – no. (%)	11 (26%)	9 (24%)	2 (40%)	0.589
EtOH Abuse – no. (%)	3 (7%)	2 (5%)	1 (20%)	0.316
History of Smoking – no. (%)	10 (23%)	7 (18%)	3 (60%)	0.073
Renal Disease – no. (%)	3 (7%)	2 (5%)	1 (20%)	0.316
Liver Disease – no. (%)	1 (2%)	1 (3%)	0 (0%)	1
Anticoagulant at baseline – no. (%)	9 (21%)	7 (18%)	2 (40%)	0.277
Antiplatelet at baseline – no. (%)	10 (23%)	8 (21%)	2 (40%)	0.574
Statin – no. (%)	14 (33%)	12 (32%)	2 (40%)	0.706
Cocaine – no. (%)	2 (5%)	2 (5%)	0 (0%)	1
IVH – no. (%)	20 (47%)	18 (47%)	2 (40%)	1
Midline Shift – no. (%)	14 (33%)	13 (34%)	1 (20%)	1
Frontal Involvement – no. (%)	6 (14%)	4 (11%)	2 (40%)	0.135
Parietal Involvement – no. (%)	9 (21%)	5 (12%)	4 (80%)	0.005
Temporal Involvement – no. (%)	7 (16%)	6 (16%)	1 (20%)	1
Occipital Involvement – no. (%)	3 (7%)	0 (0%)	3 (60%)	0.001
Basal Ganglia Involvement – no. (%)	18 (42%)	18 (47%)	0 (0%)	0.064
Extreme Capsule Involvement – no. (%)	1 (2%)	1 (3%)	0 (0%)	1
Thalamic Involvement – no. (%)	7 (16%)	7 (18%)	0 (0%)	0.571

CAA-positive patients were older (p=.002), had a higher prevalence of previous CVA (p=.037), had a higher prevalence of parietal lobe hemorrhage (p=.005) and occipital lobe hemorrhage (p=.001) than CAA-negative patients.

Figure 2
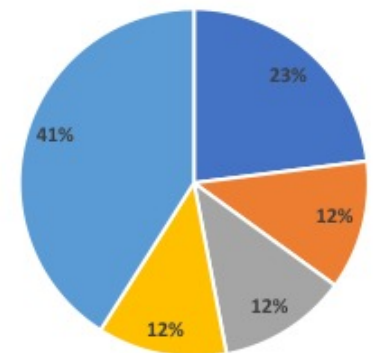
- Gliosis >50% — 23%
- Ischemic Change — 12%
- Hypertensive Etiology/Arteriosclerosis — 12%
- Cerebral Amyloid Angiopathy (CAA) — 12%
- Other/No Findings — 41%

Distribution of Biopsy Results

Learning Objectives

- The reader will understand the value of performing a brain biopsy during minimally invasive intracerebral hemorrhage evacuation and will understand the incidence of cerebral amyloid angiopathy in this population

Conclusions

- Aside from no pathological finding, the most common finding on pathology sample analysis was gliosis/reactive microglia
- Cerebral amyloid angiopathy was found among 12% of samples, within the range of reported prevalence of CAA in ICH
- Further analysis is needed to determine the predictive value of CT/MR on etiology

References

- Kellner CP, Chartrain AG, Nistal DA, et al. The