

Remote Transcranial Doppler Monitoring for Carotid Interventions: First Demonstration of Feasibility and Efficacy

Daniel Santirso, Zsolt Garami, Alan Lumsden

Cardiovascular Surgery Department. Houston Methodist DeBakey Heart and Vascular Center, Houston (Texas), USA.

Introduction

Transcranial Doppler (TCD) is an important tool in monitoring carotid interventions. One of the limitations is the need of a Neurosonology expert during procedures. This observational study is intended to address 2 issues: 1) can the TCD-headframe be placed by a non-expert with remote advice from the expert, 2) can the remote expert observe the monitoring and communicate with the surgeon effectively.

Methods

With the VisitOR1[®] teleproctoring technology (Karl Storz Endoscope, Tuttlingen, Germany), a Neurosonology expert in a remote place, and a non-expert physician in the operating room monitored 10 carotid procedures with TCD. We registered if the non-expert was able to place headframe and obtained a proper MCA signal. We classified interactions of the remote expert as 1) major, if the interaction influenced in technical aspects of the surgery, and 2) minor, in the rest of the cases. As safety end-point, we registered stroke or death of any cause until the patient was discharged. Besides, we asked the participants to complete an experience survey.

Results

The monitoring was completed in 9 of the 10 cases. Mean value of major interactions per procedure was 1,22 (range 0-2) and mean value of minor interventions was 6,78 (range 1-15). No stroke or death of any cause was registered. The participating parties evaluated the experience as positive with an overall grade of satisfaction from 90% to 100%.

Conclusions

Remote TCD monitoring proved to be a useful modality. This technology demonstrated that it can be used to teach the basic skills to conduct TCD monitoring. This study also showed that is a safe alternative when a Neurosonology expert is not available to perform an on-site TCD monitoring in the operating room.

A Survey of Intersocietal Accreditation Commission (IAC) Accredited MRI Facility Safety Practice

Mary Beth Farrell, Corey Mabry, Nancy Merrill, Mary Lally

Intersocietal Accreditation Commission, Ellicott City, USA.

Background

Magnetic Resonance Imaging (MRI) is considered to be one of the safest diagnostic imaging tests; that is until something goes wrong. Serious accidents are rare, but the risk of injury from the magnet is real. Experts estimate that 85% of injuries are preventable. MRI accidents can be avoided by strict adherence to safety standards. In the past, there have been calls for accreditation organizations to be more involved in compelling facilities to follow MRI safety standards.

The *IAC Standards and Guidelines for MRI Accreditation* (Standards) are the foundation of the Intersocietal Accreditation Commission (IAC) accreditation process. To become accredited, facilities must have written policies and procedures that ensure patient and personnel safety. Laboratories must enforce and review safety policies annually as part of required quality improvement activities. The effect of IAC required safety measures on facility operation is unknown. The aim of this survey is to assess accredited facilities' perception of the impact of the IAC Standards and accreditation process on awareness of MRI safety.

Methods

In June 2017, an electronic survey was sent to 605 technical directors of IAC accredited MRI facilities. The survey comprised 23 questions related to safety (7), quality improvement (QI) (9), and demographic information (7).

Results

There were 193 respondents to the survey (31.9%). A majority of those surveyed (84.7%) agreed the IAC Standards and accreditation process led to an increased awareness or scrutiny of their facility's MRI safety practices (Figure 1).

Before accreditation, 31.2% of respondent facilities did not have a QI plan to assess MRI safety. 19.4% of respondent facilities had never carried out QI activities before seeking accreditation, and 8.3% only assessed QI every 2 – 3 years (Figure 2). Further, 44.1% of facilities did not hold quality improvement meetings to discuss the results of QI assessments.

Related to safety, 7.8% of facilities did not have a written policy for identifying patients or other individuals with potential contraindications for the MRI environment. Of laboratories that administer gadolinium contrast, 10.2% did not have a written screening policy for contraindications, renal toxicity or allergies.

Conclusion

The results of a survey of IAC accredited MRI facilities demonstrates that most respondents believe the IAC Standards and the accreditation process led to an increased awareness and scrutiny of MRI safety practices. Facilities without formal MRI safety policies or that did not assess MRI safety before seeking IAC accreditation are now required to assess safety regularly.

Figure 1. Accreditation Improved Awareness of MRI Safety

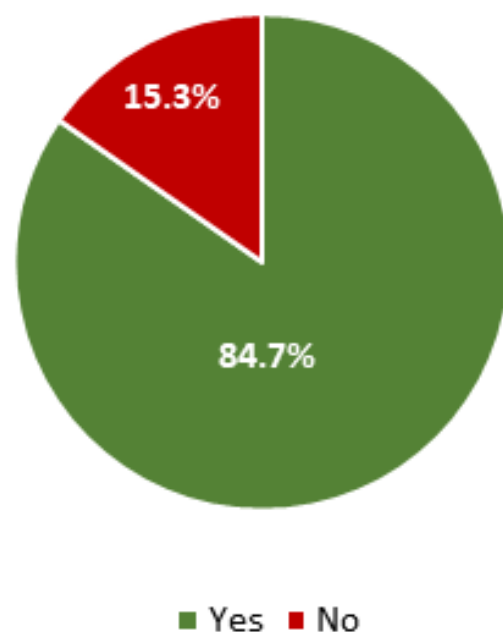
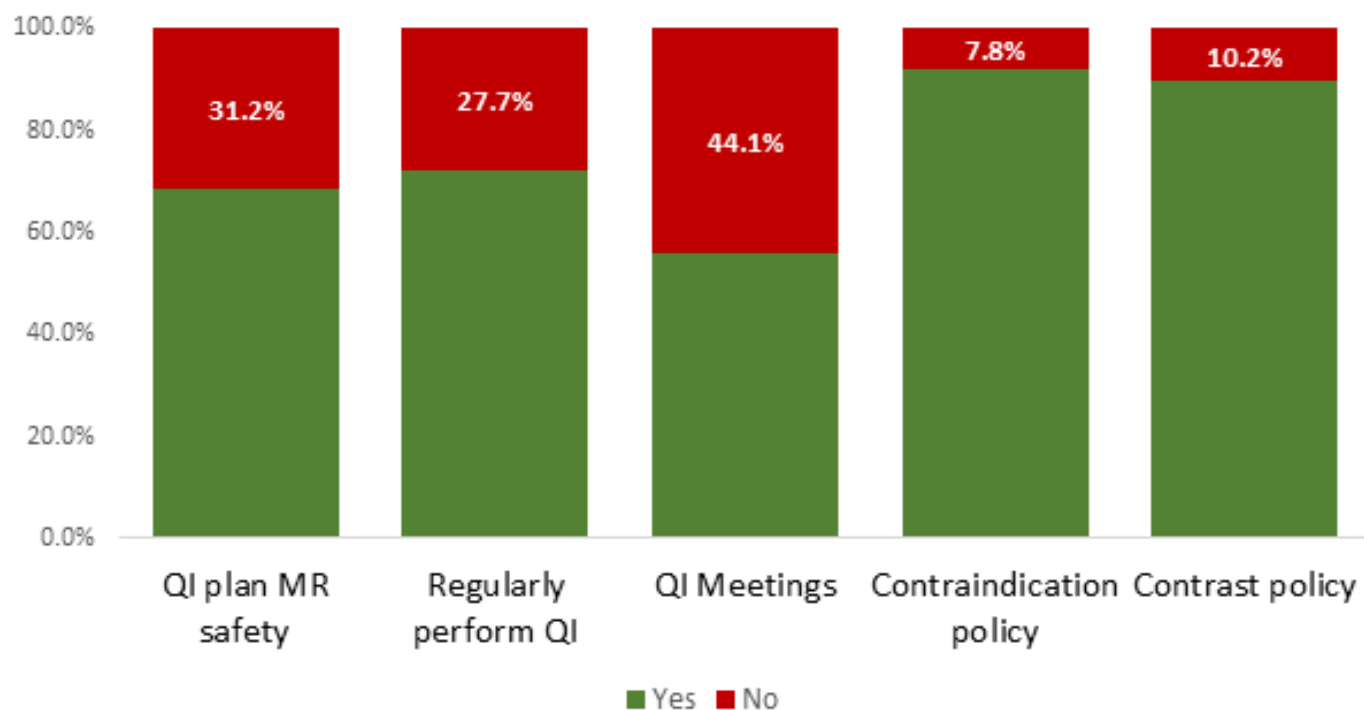


Figure 2. MRI Safety Practices Prior to Accreditation



7 Month Old Infant with Arupted 2cm MCA Aneurysm with Subarachnoid Hemorrhage and Subdural Hematoma: CT, CTA, MRI and MRA

Peter Kalina

Mayo Clinic, Rochester, USA.

A 7 month old infant was brought to the emergency department after what her mother described as “she was sitting at home and suddenly fell flat on her face seizing.” She was a full-term infant with past history of an uncomplicated delivery. At birth, a bulging fontanelle was noted although cranial ultrasound was unrevealing. She presented to the ED with generalized tonic-clonic seizures for which a CT was obtained demonstrating a round 2cm diameter high density in the left MCA region along with a subarachnoid hemorrhage and left hemispheric subdural hematoma. This was promptly confirmed on MRI, MRA and CTA to represent a 2cm diameter ruptured left MCA aneurysm. Very shortly after the imaging work-up was completed, she had a significant re-bleed necessitating an emergent life-saving decompressive craniectomy and aneurysm clipping. The patient remains stable although with a large left MCA territory infarct. Ruptured aneurysms in children are extremely rare, accounting for less than 1% of all subarachnoid hemorrhages. Aneurysms in children tend to be larger at presentation than those in adults. Theories for their etiology include congenital defects, birth trauma or connective tissue disorders. Additional data on pediatric aneurysms, comprehensive multimodality imaging, and a literature review will all be incorporated into this oral or poster presentation. This case is educational by way of: 1) the extreme rarity of ruptured aneurysms in this age, 2) presentation with subdural hematoma (in addition to subarachnoid hemorrhage) and 3) the rapid multimodality imaging evaluation prior to emergency surgery that did NOT include a catheter angiogram.

Results of Transcranial Doppler Studies Post-Code Stroke Embolectomy

Thomas Alexander, Kendall Nixon, Lisa Hutchison, Lester Collins, Allison Hennigan, George Plotkin
East Texas Medical Center Neurological Institute, Tyler, TX, USA.

Transcranial Doppler (TCD) is a noninvasive bedside tool for evaluating in real-time the circulation in the large arteries of the Circle of Willis. Mechanical embolectomy for intracranial clot retrieval and stenting of extracranial carotid artery lesions are becoming tools for rapid therapy in Code Stroke patients. This study looks at TCD findings in Code Stroke patients that underwent emergent neuroradiological embolectomy one to six hours post-procedure from January-2017 through September-2017 at a Level 1 trauma center.

Methods

24 patients with focal neurologic deficits were studied between 1 and 5 hours post- mechanical embolectomy with bedside TCD. Mean velocities were measured in the large arteries of the Circle of Willis, with analysis of the waveform shapes, and the presence or absence of microemboli, documented. Patients were categorized as: 1. Rapidly improved 2. Minimal improved. 3. No improvement 4. Cerebral Circulatory arrest.

Results

Ten (42%) showed rapid improvement. Three of these patients had both stented extracranial internal carotid arteries and embolectomy in the ipsilateral MCA. All 10 had mean flow velocities within the normal range. Five of the 10 had microembolic events detected flowing through the repaired arteries. Six (25%) showed minimal improvement. All had normal TCD studies except for microembolic events detected in 4 of the 6 flowing through the repaired arteries. Five (21%) patients showed no improvement with 2 having normal TCD studies and 3 showing re-stenosis. Three (12.5%) patients had reverbatory TCD waveforms, relatable to cerebral circulatory arrest.

Conclusions

TCD following emergent embolectomy is an excellent tool for assessing post-procedure outcomes. Rapidly improving patients had normal TCD studies. The presence of native embolic events in this patient group was surprising and supports the importance of intensive follow-up medical management.

Intraorbital Perineural Cyst of the Oculomotor Nerve

Sarthak Mittal, Laszlo Mechtler, Yathish Haralur

Dent Neurologic Institute, Buffalo, USA.

Perineural cysts are benign, cerebrospinal fluid (CSF) filled cysts, between the perineurium and the epineurium layers of the nerve sheath. They are most commonly found incidentally at the lumbo-sacral levels of the spine, and are usually asymptomatic. When present in the lumbosacral spine, it's referred to as a Tarlov Cyst. We are describing a case of bilateral intraorbital perineural cysts of the oculomotor nerve. To our knowledge, a case of bilateral perineural cysts in the orbits has not been described.

Case

39 year old female, a known case of Multiple Sclerosis presented with a headache for 3 weeks. Her symptoms were indicative of left sided Trigeminal Neuralgia. She did not see any improvement with over-the-counter anti-inflammatory medications and did not tolerate gabapentin. She did not describe any change in vision, photophobia, phonophobia, nausea, or vomiting.

On ophthalmologic examination, the pupils were equal, round, and reactive to light and accommodation. Extra-ocular movements were intact. Visual fields were intact on confrontation. No nystagmus or strabismus was noted.

On magnetic resonance imaging (to rule out optic neuritis) bilateral cyst-like structures of the oculomotor nerve, extending from the cavernous sinus and continuing into the orbits, were seen. These cystic structures do not compress any structures and none of the patient's symptoms appear to be as their consequence.

Conclusion

The intraorbital location of the cyst makes it important to monitor. It might acutely compress the optic nerve and as a result cause severe symptoms, even blindness.

Improved Quality at Intersocietal Accreditation Commission (IAC) Carotid Artery Stenting Facilities

Mary Beth Farrell¹, Nancy Merrill¹, Mary Lally¹, Barry Katzen², David Sacks³

¹*Intersocietal Accreditation Commission, Ellicott City, USA.* ²*Miami Cardiac & Vascular Institute, Miami, USA.*

³*Reading Hospital and Medical Center, West Reading, USA.*

Objective

The Intersocietal Accreditation Commission (IAC) began accrediting carotid artery stenting (CAS) facilities in 2011. The accreditation process rigorously evaluates staff qualifications, facility operation, equipment quality control, safety, appropriate patient selection, procedure performance, clinical outcomes, and quality improvement. Accreditation is determined based on compliance with the IAC Standards for Carotid Stenting Accreditation. To date, a small number of facilities performing CAS have achieved accreditation.

The aim of this abstract is to report accreditation findings of the first facilities applying for IAC CAS accreditation.

Methods

The IAC database was used to extract the peer review findings of case studies and quality improvement of facilities applying for CAS accreditation and subsequent reaccreditation three years later. Eight neurologic testing issues and five procedure performance issues were assessed. The number and percentage of facilities with issues at the time of first accreditation were compared to reaccreditation.

Results: Between 2012 and 2013, eight facilities applied for IAC CAS facility accreditation with six successfully achieving accreditation. Of those six accredited facilities, all completed the reaccreditation process between 2014 and 2015.

At the time of initial accreditation, approximately two-thirds of the case studies demonstrated neurologic testing using the National Institute of Health Stroke Scale (NIHSS) pre-CAS, post-CAS, and at 30-day follow-up (71%, 71%, and 63%, respectively) (Figure 1). At the time of reaccreditation, the number of cases measuring NIHSS pre-CAS and post-CAS increased (pre-CAS - 93%, post-CAS - 90%). The performance of NIHSS at 30-day follow-up did not change appreciably (1st accreditation - 63%, reaccreditation - 64%). At the time of initial accreditation, the number of cases with neurologic status measurement using the Modified Rankin Scale (mRS) pre-CAS, post-CAS, and at 30-day follow-up was low (13% for all three). However, at reaccreditation, measurement of mRS rose considerably (85%, 78%, and 61%, respectively). Unfortunately, the data for 30-day follow-up and imaging at 30-day follow-up were not available for initial accreditation. However, at reaccreditation, for 91% of the cases, patients were evaluated at 30-day follow-up and of those, 87% had imaging performed at 30-day follow-up.

For procedure performance, no change was seen between initial accreditation and reaccreditation for appropriate patient selection, reporting of intracranial vasculature, and accurate % stenosis (75% for all measurements) (Figure 2). At initial accreditation, adequate image quality of digital subtracted angiography was found in 50% of facilities. That number rose to 75% at reaccreditation. At first time accreditation, only 25% of facilities documented both the pre- and post-CAS anterior-posterior and lateral intracranial images. At reaccreditation, the number rose to 50%.

Conclusion

Although few facilities have achieved IAC CAS accreditation, facilities that completed the accreditation process demonstrated meaningful improvement in quality related to neurologic testing and procedure performance. However, continued improvement is needed in several areas.

The Diagnostic Dilemma of Space-Occupying Lesion of Brain in a Patient with Testicular Carcinoma

Sufana Shikdar, Oumoul Barry, Eugene Choi

Mercy Catholic Medical Center, Darby, USA.

Introduction

Encountering space-occupying lesion (SOL) of the brain poses a diagnostic challenge clinically, radiologically and pathologically; hence it is often misdiagnosed. We report a case of space-occupying lesion (SOL) of the brain in a patient with a recent history of testicular cancer posed a diagnostic dilemma.

Case Description

A 38 year-old male with a past medical history of testicular seminoma (2015) status post right orchiectomy and chemotherapy with bleomycin presented with cough with shortness of breath for 2 days. Physical examination was unremarkable. CT chest revealed ground glass infiltrates on both upper and lower lobes, and patient was started on levofloxacin for atypical pneumonia. In the emergency department, he had a period of mild confusion prompting a CT brain which showed small hyperenhancing lesion. MRI brain demonstrated two new small enhancing masses in the frontal and temporal lobe. Considering the high susceptibility of testicular metastasis in brain, CT abdomen/pelvis, B HCG, AFP were obtained as a part of metastatic workup, which came out negative. Patient remained asymptomatic at that time and was discharged with hemato-oncology and neurosurgery follow-up. Three months later, patient was readmitted with an episode of seizure without any neurological deficit. MRI brain revealed interval increase in the size of the lesions. Brain biopsy was negative for malignancy and revealed reactive gliosis and focal fibrinoid necrosis. He was started on levetiracetam. He was readmitted after one month with cough and shortness of breath without significant physical finding. CT chest showed extensive bilateral infiltrates. Infectious Disease was consulted and suggested HIV workup despite the patient denying all the risk factors of HIV. HIV screen was positive with total CD4 suppressed at 18. Additional serologies revealed positive toxoplasma IgG and the brain biopsy was rechecked with immunologic stain came back positive for toxoplasmosis. He was subsequently treated with pyremethamine for toxoplasma encephalitis.

Discussion

HIV remains the leading cause of mortality despite significant treatment advancement. There are still significant barriers in early disease recognition and timely diagnostic approach. Although our patient did not have any risk factors of HIV, high index of clinical suspicion should always be exercised to avoid devastating consequences. Given the wide differential diagnosis of ring-enhancing space occupying lesions in the brain imaging including metastatic lesions, glioma, abscess, and toxoplasmosis, a brain biopsy is required to confirm the diagnosis. We recommending obtaining the HIV screening test early in SOL of the brain before advancing for any invasive procedure.

Benedikt's mimic syndrome in the Thalamus infarction

Reza Bavarsad Shahripour, Ali Kerro, Payam Moein, Andrei Alexandrov

University of Tennessee, Memphis, USA.

" Benedikt syndrome" by definition is typically caused by a pathology in the tegmentum of the paramedian midbrain affecting the oculomotor fasciculi, peduncle and the [red nucleus](#) that leads to a contralateral choreathetoid movements, ataxia and hemiparesis with an ipsilateral ptosis. We present a 63-year-old right-handed African American male who had an acute onset involuntary left upper extremity choreathetosis and associated with a right sided ptosis, however, the MRI showed a right anterior thalamus infarction. Anterior thalamus is supplied by the the tuberothalamic artery (TTA) which also feeds the Hypothalamus. We believe that our patient's presentation was a result of concomitant insult to the thalamus and hypothalamus for the TTA territory infarction, which mimicked the Benedikt syndrome. His right sided ptosis was secondary to a partial Horner's syndrome from the hypothalamus injury and his left-sided choreathetosis was from right thalamus involvement. Our case is highlighting that TTA territory infarction including anterior thalamus and partially hypothalamus can also mimic the Benedikt syndrome and to our knowledge, this is the first case report of this mimicked syndrome in the thalamus lesion.

Proton Magnetic Resonance Spectroscopy Metabolites Predict Tissue Loss after Experimental Acute Traumatic Brain Injury

Matthew Sharrock¹, Janna Harris², William Brooks²

¹*Johns Hopkins University, Baltimore, USA.* ²*University of Kansas Medical Center, Kansas City, USA.*

Similar injuries among patients with Traumatic Brain Injury (TBI) can lead to a wide variety of pathological and clinical outcomes. Proton Magnetic Resonance Spectroscopy (¹H-MRS) can provide a metabolic profile that correlates with injury severity and cognitive outcomes in chronic human TBI. Experimental models of acute TBI have shown heterogeneity with regards to tissue loss measured using T2-weighted MRI and histopathology despite the same experimental parameters. Our goal was to determine whether an early ¹H-MRS spectroscopic profile could predict the subsequent volume of tissue loss after experimental acute TBI.

Adult rats were subjected to controlled cortical impact (CCI) of the sensorimotor cortex. A Varian 9.4 Tesla spectrometer was used at one hour, one day and three days post-injury. Spectra were obtained from two sites 1) lesional in the cortex and 2) peri-lesional in the hippocampus and dorsal thalamus. Whole brain T2 images taken 2 weeks post-injury were analyzed to determine tissue loss.

We found variability in tissue loss consistent with previously published studies on the natural progression of the CCI lesion. Several proton MRS metabolites showed significant correlation ($p < 0.05$) with tissue loss. A selection of these correlations and their putative roles include: at the perilesional site at one hour Lactate and Serine indicating early disruption in the glycolytic pathway; at one day Glutamate, Aspartate and Phosphocreatine were negatively correlated likely indicating the consumption of metabolites as secondary energy sources; at three days Glutathione was negatively correlated indicating the effects of oxidative stress. In the lesional site at one hour there was a low signal to noise ratio. At one day Phosphocreatine, Creatine and N-acetyl aspartate (NAA) were negatively correlated and Lactate was correlated with tissue loss. At three days 14 metabolites were correlated with tissue loss including Lactate, Serine and negatively correlated were Glucose, NAA, Phosphocreatine, Aspartate, Ascorbate, Taurine and Phosphocholine indicating disruption in multiple metabolic pathways.

Our results show differences in the ¹H-MRS spectroscopic profile of directly injured tissue and tissue adjacent to it. These results contribute to the understanding of the drivers of tissue loss after TBI, may help differentiate viable from non-viable tissue and could help target therapies used in the acute stages of TBI.

Administration of IV Alteplase In a Patient with History of Secured Aneurysmal Subarachnoid Hemorrhage

Mohammad Hajighasemi-Ossareh, MD, Peter Tsou, Robert Burt, Geoffrey Konye, MD, Sebina Bulic, MD
University of Southern California/Keck School of Medicine, Los Angeles, USA.

Case Report

A 67-year-old woman with a history of hypertension and aneurysmal subarachnoid hemorrhage (aSAH) status-post aneurysmal clipping presented with acute onset slurred speech and left hemiparesis. Clinical examination at presentation revealed a National Institutes of Health Stroke Scale (NIHSS) of 5. Cranial computer tomography (CT) revealed no acute intracranial pathology. Cranial computed tomography angiography (CTA) revealed no large vessel occlusion. The risks and benefits of IV alteplase administration were weighed and the patient received IV alteplase within 3.5 hours of her last known well time. The following morning the patient had improved motor strength and her dysarthria had improved with a NIHSS of 2. Her repeat cranial CT revealed no interval change. The patient had an unremarkable hospital course, able to participate with physical therapy, and was discharged home.

Background

The safety and efficacy of thrombolytic therapy with intravenous (IV) alteplase for acute ischemic stroke is well established. However, only a small fraction of patients receive treatment due to contraindications. Guidelines for the use of IV alteplase from American Heart Association/American Stroke Association (AHA/ASA) have changed over the years. The AHA/ASA acute stroke management guidelines from 2013 viewed a history of previous intracranial hemorrhage (ICH) as an exclusion for the use of the IV alteplase. However, a statement for healthcare professionals from the AHA/ASA from 2016 views IV alteplase in patients who have a history of ICH as potentially harmful. The 2016 AHA/ASA statement does not specify if the history of aneurysmal subarachnoid hemorrhage (aSAH) would pose a risk of increased hemorrhage. However, providers at times deny alteplase for patients with acute ischemic stroke because of lack of clear distinction between intraparenchymal hemorrhage and subarachnoid hemorrhage. Unfortunately, given the paucity of available safety studies or even case reports for the use of alteplase in the setting of secured aSAH makes the decision to administer IV alteplase difficult for providers.

Methods

Several small sample size publications in recent years have observed the risk of hemorrhagic complications after off-label IV alteplase administration in patients who have contraindications to the AHA/ASA guidelines. These studies are summarized in Table 1. The review of six publications reveals that in a summated total of 12 patients with history of ICH, subarachnoid hemorrhage (SAH), or secured SAH who received IV or intra-arterial (IA) alteplase, only 2 of the 12 patients had a symptomatic ICH (SICH). Given this small sample size, it is clear that further observational studies need to be published and randomized clinical trials need to be performed to assess the risk of administering IV or IA alteplase in the setting of a patient with history of ICH, both parenchymal and secured aneurysmal. Current guidelines do not specify the etiology of ICH as aSAH or parenchymal hemorrhage and do not comment if aneurysmal causes of ICH have been secured by coiling or clipping.

Discussion

We encountered a patient with a history of aSAH that was secured a decade prior with clipping who presented for concern of acute ischemic stroke, clipping is shown in Image 1. The management strategy involved weighing the risks and benefits of IV alteplase administration in a patient with history of secured aSAH. After IV alteplase administration, our patient's cranial CT did not reveal a new or symptomatic ICH nor did it reveal evidence of an ischemic stroke. We argue that patients who have a history of secured aSAH should be

considered strongly for the use of IV alteplase as the current body of observational studies to date reports a low frequency of spontaneous ICH after IV alteplase administration.

Conclusion

Current guidelines consider IV alteplase administration in patients with a history of ICH potentially harmful and previously were a contraindication to IV alteplase administration. Over the last decade observation studies have found that patients with a history of ICH can be administered IV alteplase with a low frequency of spontaneous ICH, which we also observed in our patient presented herein. We recommend considering strongly IV alteplase in patients with a history of aneurysmal ICH that has been secured with coiling or clipping in the setting of concern for an acute ischemic stroke.

Table and Image:

Sample Size (N)	Intracranial Lesion	Therapy Administered	SICH After IVT or IAT	Reference
3	ICH or SAH	IVT	0	<i>Meretoja et al., 2010</i>
3	ICH	IVT	1	<i>Kvistad et al., 2013</i>
1	ICH	IVT	1	<i>Buchan et al., 2000</i>
3	Secured SAH	IVT	0	<i>Aleu et al., 2007</i>
1	Secured SAH	IVT	0	<i>Kutlu et al., 2003</i>
1	Secured SAH	IAT	0	<i>McLaughlin et al., 2008</i>

Table 1: ICH: Intracranial Hemorrhage. SAH: Subarachnoid Hemorrhage. IVT: Intravenous thrombolysis. IAT: Intra-arterial thrombolysis. SICH: Symptomatic Intracranial Hemorrhage. Secured SAH, patients who had a SAH that was secured either by coiling or clipping.



Image 1: Cranial computer tomography (CT) of patient in case report showing clipping of MCA aneurysm.

Fetal MRI, MRA and Ultrasound of a large facial Hemangioma.

Peter Kalina

Mayo Clinic, Rochester, USA.

At 33-weeks gestation, multiplanar fetal MRI was performed to evaluate a very large facial mass contiguous with the orbit noted on intrauterine ultrasound. At delivery, repeat MRI and MRA confirmed the clinical diagnosis of a large congenital facial hemangioma. The imaging will serve as the basis for a discussion of the use of fetal MRI as well as the optimal techniques to achieve diagnostic images. Correlation will be made with the ultrasound as well as the post-delivery photographs. The MRI and US differential diagnosis will also be discussed.

Cavernous malformation – A rare complication of gamma knife surgery for Arterio-venous malformations

Nagaraj Sanchitha Honganur, Yathish Sreekantaiah Haralur, Laszlo Mechtler

Dent Neurologic Institute, Buffalo, USA.

Objective

Cerebral arterio-venous malformations, a type of cerebral vascular malformations is the most symptomatic of all vascular malformations and can present with various neurological manifestations similar to a lobar hemorrhage or any space occupying lesion. The treatment modalities in general include endovascular embolization, microsurgical resection and radiosurgery. Although surgical resection is the main stay of treatment, stereotactic radiosurgery also known as gamma knife surgery is a commonly employed method for smaller lesions and those located in deep regions of the brain. Several complications associated with gamma knife surgery have been described in literature, and one of the rarest complications is the development of a secondary vascular malformation i.e a cavernous malformation or a cavernoma. The purpose of this article is to report such a case of gamma knife induced cavernous malformation, discuss the diagnostic pitfalls of such rare presentations and literature review.

Methods

Case report.

Results

We describe a 52 yr old male with arterio venous malformation who underwent multiple embolizations failing which he was treated with gamma knife surgery. A year later he developed vasogenic edema around the post-surgical site which was initially thought to be radiation necrosis and was managed conservatively using steroids. The vasogenic edema unresponsive to steroids, subsequently worsened and underwent symptomatic hemorrhagic transformation involving the right fronto-parietal regions. He later developed malignant cerebral edema unresponsive to steroids and hyperbaric oxygen with an impending herniation. Patient then underwent surgical resection of the hemorrhagic mass with in the vasogenic edema. The pathology of the resected mass demonstrated a newly developed cavernous malformation as a complication of the gamma knife surgery. In retrospect it was concluded that the bleeding from this cavernoma caused the vasogenic edema which was unresponsive to conservative management and eventually developed malignant cerebral edema. Following the surgical resection patient markedly improved with remarkable resolution of cerebral edema.

Conclusion

While the development of vasogenic edema as a post-surgical complication of the gamma-knife surgery is commonly due to radiation necrosis, unresponsiveness to the conventional anti-inflammatory therapy such as intravenous steroids should raise the suspicion for an alternative diagnosis such as development of a newer different vascular malformation, as in our case, a cavernous malformation. Prompt recognition and surgical resection of such malformations can alleviate the patient symptoms and reduce the morbidity and mortality.

Keywords

Arterio venous malformation, gamma knife surgery, cavernous malformation, stereotactic radiosurgery.

Marchiafava Bignami Disease, a Rare Cause of Callosal Damage, Even More Rare and Deadly if Not Considered.

Tigran Kesayan^{1,2}, Matthew Chung^{1,2}, Yazan Suradi^{1,2}

¹University of South Florida (USF), Tampa, USA. ²J.A. Haley VA, Tampa, USA.

Background

Marchiafava Bignami (MB) disease is characterized by demyelination and later necrosis of the corpus callosum seen mainly in alcohol misuse. In the acute presentation there is a risk of seizures and coma. In most cases the lesion occurs in the body of the corpus callosum, however cases have been reported with lesions in the genu and splenium. About 8% of cases are fatal; with prompt treatment there is recovery to some degree, but with majority of patients showing some long-term disability. MRI findings in MB include T1-weighted hypo-intensity and T2-weighted and FLAIR hyper-intensity within the corpus callosum; acute cases show restricted diffusion on DWI sequence.

Methods/Case

A 38yo woman without stroke risk factors presents after being discharged from another hospital without a clear diagnosis; she has several months of declining cognition and appetite, and two weeks of impaired speech and gait. She is cachectic, with dysarthria, spasticity, and ataxia.

Results

MRI of the brain shows restricted diffusion in the splenium with a corresponding hypo-intense region on ADC sequence. T1 sequence shows hypo-intensity in the splenium with corresponding hyper-intensity on T2 and FLAIR sequences. A contrasted study did not show enhancements. Serum studies revealed low B1 level, otherwise no gross abnormality; likewise, cerebrospinal fluid evaluation was unremarkable. She was diagnosed with MB disease, treated with high dose IV vitamins, and over a course of several weeks regained her speech and gait, and was discharged home.

Conclusions

Although MB disease is rare, with only several hundred reported cases, it is imperative to consider it in the differential diagnosis of the encephalopathic patient with a callosal lesion as early diagnosis and treatment may decrease mortality and lead to better recovery.

Utility of Neuromuscular Ultrasound in the Evaluation Peripheral Nerve Sheath Tumors in Neurofibromatosis type 1

Elina Zakin, Susan Shin, Jesse Weinberger

Icahn School of Medicine at Mount Sinai, New York, USA.

Objective

To determine ultrasonographic peripheral nerve involvement in patients with neurofibromatosis type 1 (NF1).

Background

NF1 is a neurogenetic disorder in which individuals may develop a variety of benign and malignant tumors. Peripheral nerve sheath tumors are encountered most frequently in this patient population. Previous literature has proposed whole body magnetic resonance imaging (MRI) as the reference standard to identify nerve sheath tumors in NF1 (Salamon, 2015). Evaluation of peripheral nerve with high-resolution ultrasonography (HRUS) has been explored in asymptomatic or minimally symptomatic individuals with NF1 (Telleman, 2017). Our study reports a series of four individuals with NF1, all with varying phenotypic presentations of cutaneous findings, who had relatively unremarkable electrophysiologic studies. HRUS was used to visualize peripheral nerves in these patients.

Methods

Four patients with NF1 were included in this study to detect asymptomatic abnormalities of upper and lower extremity nerves. Patients underwent clinical examination, nerve conduction studies with needle electromyography, along with high-resolution ultrasonography using a Terason 15L4 linear array transducer at the highest frequency (15-10MHz), with nerve visualization in both the transverse and longitudinal planes. Power Doppler was applied to evaluate for any vascular anomalies and/or hyperemia within the nerve.

Results

We present the ultrasonographic imaging findings of peripheral nerves anomalies in a series of four patients with NF1. All patients underwent ultrasound examination of the median, ulnar, radial, brachial plexus, sciatic, tibial, peroneal, and sural nerves in all extremities.

Neuromuscular ultrasound made the diagnosis of NF1 for one patient with minimal cutaneous findings which showed diffuseplexiform neurofibromas in nearly every peripheral nerve imaged. Two siblings with genetically confirmed NF1 were also evaluated. One sibling showed multiple neurofibromas and nonspecific fascicular enlargement along multiple peripheral nerves. Peripheral nerve imaging in the other sibling showed minimal changes of fascicular enlargement in multiple nerves without neurofibromas, as well as an ulnar neuropathy across the elbow (compressive site). One patient with striking cutaneous fibromas had a nearly normal ultrasound examination of her peripheral nerves; with only mild non-specific fascicular enlargement in a few nerves. There was no increase in vascularity on Power Doppler in any of the visualized neurofibromas or plexiform neurofibromas. Electrophysiologic correlation was performed.

Conclusion

In our case series of four individuals with NF1, of varying clinical phenotypes, we evaluated peripheral nerves using HRUS. Peripheral nerve abnormalities, including evidence of neurofibromas, plexiform neurofibromas, and abnormal fascicular patterns, were seen in all four individuals. Interestingly the most prominent nerve changes was seen in the individual with the least clinically evident neurofibromatosis, whereas the patient with marked cutaneous findings had minimal changes on peripheral nerve ultrasound examination. Neuromuscular ultrasonography is a cost and time-effective diagnostic tool that can assist the electromyographer in localization of nerve pathology, and should be used in the evaluation of peripheral nerve sheath tumors in individuals with neurofibromatosis type 1.

Rhombencephalitis (Brain stem encephalitis) due to *Listeria Monocytogenes*

Poornachand Veerapaneni, Pradeep Kumbham, Rohan Samant, Sanjeeva reddy Onteddu, Karthika Veerapaneni, Krishna Nalleballe
UAMS, Little Rock, USA.

Background and Purpose

To present and describe a case of *Listeria* rhombencephalitis with classic MRI findings. *Listeria* rhombencephalitis is a rare and potentially life threatening food borne infection of CNS with frequent serious sequela in survivor. We report the MRI findings in a case of *Listeria* rhombencephalitis that showed multiple ring enhancing lesions.

Methods

This is a 44 y/o male who presented from OSH with fever, chills, dizziness and double vision from 2 weeks. An initial MRI revealed a single gray mater lesion within the left inferior midbrain tectum with ring enhancement and surrounding vasogenic edema. A second MRI 3 days later revealed a progression of the previously identified abnormality involving the pons which has now spread to involve the area of the midbrain and bilateral thalami, cerebellar peduncle and cerebellar vermis. LP revealed 181 WBC, 60% lymphocytes, glucose 52 and protein 64.

Results

Final diagnosis was made with MRI findings and positive blood culture for Gram positive rod, *Listeria monocytogenes* and started ampicillin and gentamicin. Gentamicin was discontinued after 14 days while ampicillin continued for 6 weeks IV with patient returning to baseline except for mild dysarthria and diplopia.

Conclusion

Our case emphasizes the importance of considering *Listeria* rhombencephalitis in patients with meningitis involving the brain stem with ring enhancing lesions. Ampicillin should be considered in the empiric regimen in these patients and outcome is good with early initiation of treatment.

Rapid Growth of New Neurovascular Ultrasound Services at an Urban Comprehensive Stroke Center

Kim Hodge¹, Maitri Desai¹, Karen Seagraves¹, Craig Tindall¹, Michael Frankel^{1,2}, Aaron Anderson^{1,2}

¹Grady Memorial Hospital - Marcus Stroke & Neuroscience Center, Atlanta, USA. ²Emory University School of Medicine, Atlanta, USA.

Background/Purpose

- The establishment of a Comprehensive Neurovascular Ultrasound Lab which allows for neurophysiologic studies with established safety, efficacy and clinical relevance.
- Utilization of Transcranial Doppler (TCD) and Carotid Doppler Ultrasound (CDUS) to assist with treatment diagnosis and stroke prevention of patients.
- Our goal was to identify where our services were needed and how to provide results in a timely manner, while also increasing our service line within the hospital.

Methods

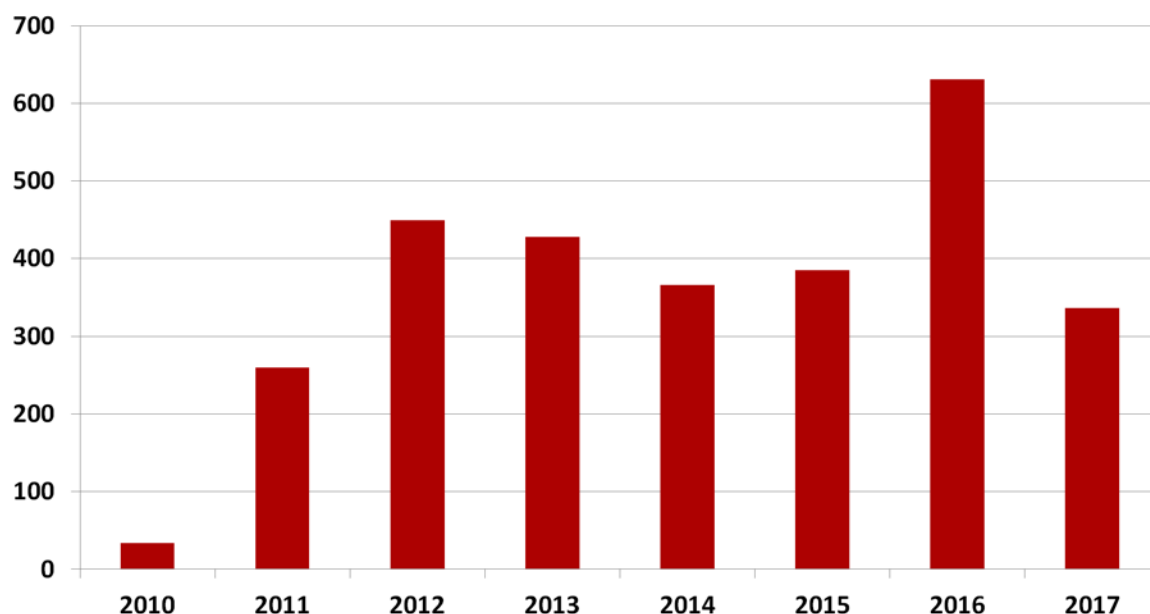
- We researched whether our services were provided elsewhere and how accurate and timely they were completed.
- We started with one machine in the Neurology department, accumulated a patient log and added that data to our findings.
- We then took our findings to the Neurology leadership followed by the hospital budget committee to obtain updated equipment and expand our services.
- We partnered with other departments such as Vascular Surgery and Neuroendovascular services to expand Carotid Ultrasound services.
- We worked with administration, IT, Biomed, scheduling and billing to continue the growth of our lab.

Results

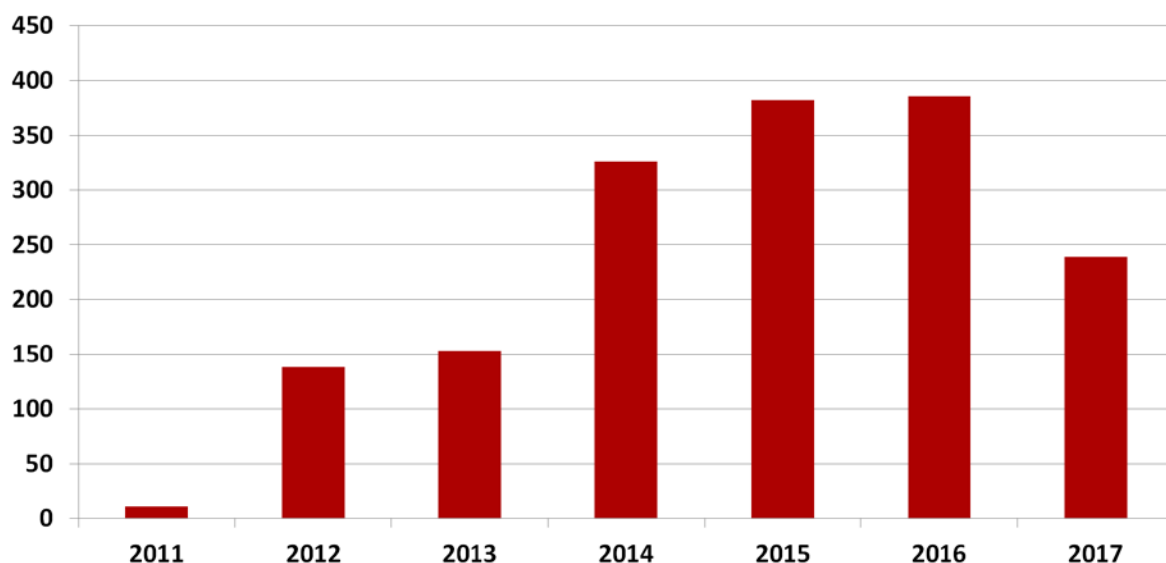
- September 2010, we started with Sonosite Turbo for performing Transcranial Color Doppler (TCCD) and completed 34 studies for the Neurology ICU that year.
- December of 2011 we added CDUS and did a total of 11 patients. Our volume of TCD studies increased to 260 patients with the addition of a new TCD machine (Spencer ST3).
- 2012 we had a significant increase in volume by adding Vascular and Cardiothoracic surgery departments to our service line. Volume of CDUS was 153 and TCD was 428 for that year.
- As we continued to grow and more departments became aware of our lab, in 2016 we completed, 631 TCDs and 386 CDUS.

In 2017, Vascular Surgery opened their own lab and has resulted in a decrease in volume of CDUS. TCD volume is driven by SAH admission and appear to be down from 2016.

TCD 2010-17



Carotid Doppler 2011-17



Discussion

- TCD & CDUS can serve as an extension of the Neurology/Neuroradiology Department for the care of our patients. Moreover, the Neurovascular Ultrasound Lab can enhance the clinical care of patients and expand the service line for the department.
- Hurdles to overcome included leadership buy-in, budget limitations, and skeptical physicians about the usefulness of neurovascular ultrasound. Educational and Technical meetings with leadership, and treatment teams helped explain the utility of the Neurovascular Ultrasound Lab.
- Grass-roots efforts by the neurovascular ultrasound technologist and physician director to highlight growth potential and educate hospital administration and physicians led to a major growth in volume of clinical procedures and contributed to the mission of the Comprehensive Stroke Center.

Novel Neuroimaging Pattern in a Patient with Cerebral Autosomal Dominant Arteriopathy with Subcortical Infarcts and Leukoencephalopathy

Rodica E. Petrea¹, Dharani Mudugal¹, Sanjay P. Singh¹, Angel Mironov²

¹Creighton University, Department of Neurology, Omaha, USA. ²Creighton University, Department of Neuroradiology, Omaha, USA.

Objective

To report bilateral confluent T2 hyperintensities in medial temporal lobes on brain magnetic resonance imaging (MRI) in a patient with newly diagnosed cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL).

Background

Literature search to date did not report T2/FLAIR hyperintensities in medial temporal lobes on brain MRI in CADASIL.

Design/Methods

Case report. A 58-year-old woman with lifelong complex migraine headaches, significant family history of suspected degenerative dementia, presented to emergency department with one-week history of intractable complicated migraines. Brain MRI disclosed extensive, confluent T2/FLAIR white matter disease, including the bilateral medial temporal lobes.

Results

Genetic testing confirmed CADASIL with a positive notch 3 c.3062A>G; p. Tyr1021Cys heterozygous missense mutation, pathogenic and autosomal dominant. A panel for vanishing demyelinating disorders was negative. Lumbar puncture was negative for multiple sclerosis, acute meningitis, encephalitis or active vasculitis but mild nonspecific hyperactive IgG in cerebrospinal fluid (CSF) in this patient with also chronic scleroderma. Comparison with prior brain MRIs revealed progression of the white matter disease over years, comprising also T2 bilateral medial temporal lobe hyperintensities.

Conclusions

Bilateral medial temporal lobe T2/FLAIR hyperintensities in this patient with newly diagnosed CADASIL expose a novel neuroimaging pattern in CADASIL and highlight the benefit for CADASIL testing even in patients with only partial clinical features in association with extensive white matter disease. A correlation between progression of white matter disease, activity of Ig G, other CSF markers and co-morbidities in patients with CADASIL is still unknown and can be studied further.

Neurosonographic Diagnosis of Lückenschädel and Lemon Sign in Neonates

Trassanee Chatmethakul, Paul Maertens

Department of Pediatrics, University of South Alabama, Mobile, USA.

Lückenschädel and lemon sign are thought to result from intracranial hypotension with subsequent dysplasia of the membranous skull. Both conditions have been described in neural tube defects and encephalocele. Lückenschädel typically lies in thickest part of frontal, parietal and upper occipital bone forming groups of round, oval or finger shaped pits on the inner surface of the cranial vault. Lemon sign is an inward scalloping of the frontal bone resulting from abnormal frontal bone development. Both conditions are self-limiting with the lemon sign disappearing early and lückenschädel typically resolving after 6 months of age. Postnatal neurosonographic diagnosis of lemon sign and luckenschädel has never been attempted.

Cranial ultrasounds of infants with encephalocele or myelomeningocele performed shortly after birth over the last 5 years were reviewed. The anterior, posterior and temporal windows were obtained. Mean gestational age was 36 weeks with studies done at mean age of 1.6 days. Neurosonographic evaluation was obtained in 14 infants: 10 had Chiari 2 with myelomeningocele; 2 had Chiari 3 with encephalocele and 2 had isolated encephalocele. Ventriculomegaly was present in 12 infants. Lemon sign was best appreciated through the posterior fontanelle. All three windows were necessary to appreciate lückenschädel. In 2 infants with mild lückenschädel, lemon sign was absent while in all infants with moderate to severe lückenschädel, lemon sign was present.

We conclude that in the neonates, neurosonography allows for effective non-invasive recognition of lemon sign and lückenschädel. Moreover, the lemon sign appears to persist longer in infants with moderate to severe lückenschädel.

Tarlov Cysts: The Underlying Etiology of Persistent Genital Arousal Syndrome.

Olga Khodakivska¹, Kunal V Desai²

¹Montefiore Medical center, Bronx, USA. ²Yale School of Medicine, New Haven, USA.

Introduction

Persistent genital arousal syndrome (PGAS), a newly recognized condition, can be described as persistent physiological arousal in the absence of conscious feelings of sexual desire. PGAS consists of extended periods of sexual excitement that neither diminish on their own nor resolve with ordinary orgasmic experiences. The majority of PGAS cases have been identified in women, 73.9% of whom had a Tarlov cyst in the sacral spine. Cysts most commonly arise at the S2 or S3 junction of the dorsal nerve root ganglion and can compress the S2 nerve root, which innervates the clitoris.

Patient and Methods

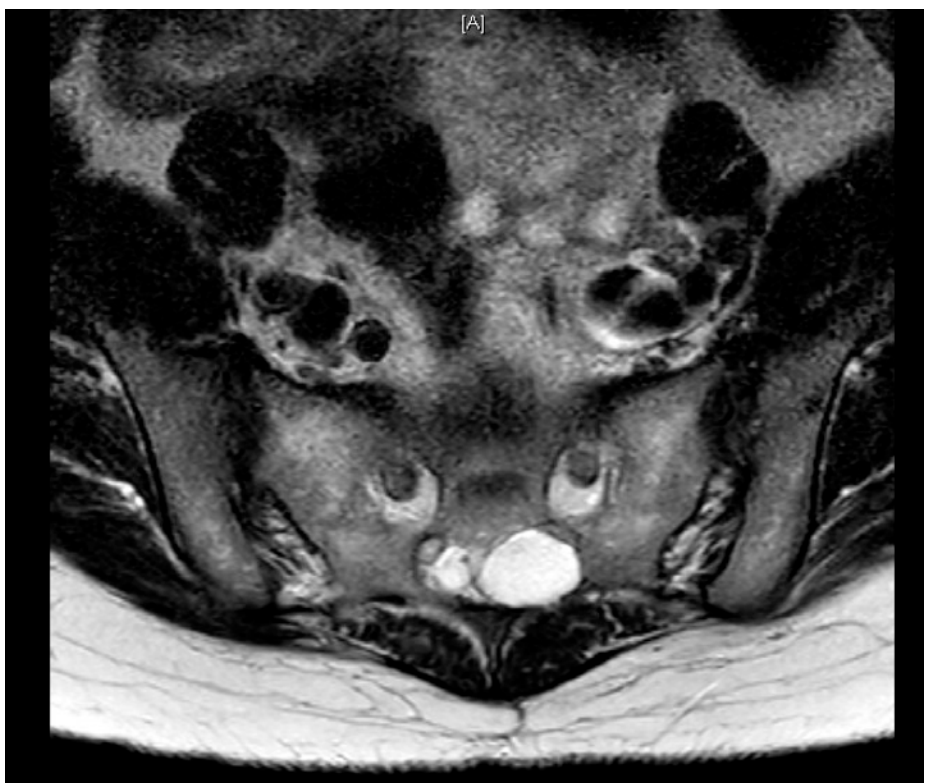
52 year old woman presented with perineal numbness along with a spontaneous sensation of orgasm without actually achieving it. This sensation was noted to occur in nonsexual situations and was causing her significant discomfort. The abnormal sensation was not associated with position, activity, thoughts, physical stimulation of the genitals or time of day. It occurred 4-7 times a day and would last as long as 20 minutes.

Results

MRI lumbar spine showed a bilateral S2 sacral Tarlov cysts. Lumbar puncture was performed which was unremarkable. Needle EMG showed abnormal spontaneous activity in the right S1 and S2 paraspinal muscles.

Conclusion

This case demonstrates the importance of MRI in patient with PGAS to evaluate for the presence of Tarlov cysts, which occur predominantly at the S2-S3 levels of the spine.



The Significance of Contrast Density of the Computed Tomography- Angiographic Spot Sign: The Spot Sign Ratio

Omar Hussein, Khalid Sawalha, Ahmed Abd Elazim, Mohammad Hamed

The Ohio State University Wexner Medical Center, Columbus, OH, USA.

Introduction

Hematoma expansion is a known complication of intracerebral hemorrhage (ICH) associated with high morbidity and mortality. The Computed Tomography Angiographic (CTA) "Spot Sign" has been shown to predict hematoma expansion in patients with ICH with a sensitivity and specificity of 91% and 89% respectively. The significance of the contrast density ratio of the spot sign to the surrounding hematoma hasn't been explored.

Objective

To explore the significance of the spot sign ratio as a predictor of hematoma growth or outcome at discharge.

Methods

We retrospectively reviewed 296 patients who presented over 30-month-period. We identified 19 patients with CTA spot sign with at least one follow up CT head (CTH) compared to baseline. Baseline demographics and variables known to affect hematoma volume and outcomes were assessed. Hematoma volumes in the CTH obtained at presentation, 6 hours and 24 hours were calculated using the ABC/2 formula. The Spot Sign Ratio (SSR) was calculated by dividing the density (in Hounsfield Units) of the surrounding hematoma over the spot sign density. The data was analyzed using SAS version 9.3, the mixed effect model with repeated measures and the linear regression model.

Results

We identified spot sign in 24/232 patients (10.2%). A total of 19 patients were included in our final analysis. The median initial hematoma volume and NIHSS were 27.5 (cc) and 19 respectively. Total of 58% patients developed hematoma expansion. Our analysis suggested that the SSR is not a significant predictor of volume expansion ($P=0.98$). Furthermore, no significant association was noted between the SSR and NIHSS at discharge ($P=0.33$).

Conclusion

Our study suggests that the SSR may not be a significant predictor of hematoma growth or outcome at discharge. However, our findings were limited due to a small sample size. A follow up study involving larger number of patients is in progress.

Multi-focal recurrent strokes in Cerebral Vasculitis and Intravascular Large B-cell Lymphoma of Central Nervous System, mimicking similar clinical and radiologic findings: Case series

Samra Vazirian, Alejandro Magadan, Ty Shang, Mark Johnson, Antonieta Rueda

UT Southwestern Medical Center, Dallas, USA.

Cerebral vasculitis or Primary Angiitis of the Central Nervous System (PACNS) is a rare disorder affecting both medium and small sized vessels. About 700 cases have been published worldwide. Major symptoms of PACNS are stroke, headache and encephalopathy. Neither neuroradiological findings nor laboratory tests allow a definite diagnosis of the disorder. PACNS can be mimicked closely in clinical presentation as well as neuro-radiological manifestations by a group of disorders and also neoplasms including Intravascular lymphocytic B Cell lymphoma (IVBCL)

IVBCL is poorly understood with non-specific presentations, and lack of specific non-invasive diagnostic tests. It is often not considered in vivo and usually diagnosed on autopsy. Brain biopsy is the diagnostic procedure of choice in suspected IVLBCL affecting the CNS, as CSF analysis, brain MRI/CT scans, MR angiography and even conventional cerebral angiography lack specificity to differentiate IVLBCL from cerebral vasculitis. We report five cases, two of which are biopsy proven primary angiitis of CNS and three cases of Intravascular lymphocytic B Cell lymphoma, diagnosed through biopsy in vivo. All five cases had similar clinical presentation and mimicked similar radiologic findings. Our case series implies that it is integral to differentiate PACNS and consider IVLBCL in differentials early on, because treatment with steroids or immunosuppressive treatment may critically delay the diagnosis of IVLBCL due to transient remission of neurological symptoms and result in fatal outcomes.

Variability of Extracranial Flow Velocity Measurements in Sonographic Vasospasm Screening

Oana Dumitrascu, Brenda Rinsky, Konrad Schlick

Cedars-Sinai Medical Center, Los Angeles, USA.

Background

Transcranial Doppler (TCD) is routinely used to screen for vasospasm in subarachnoid hemorrhage (SAH). The diagnosis of sonographic vasospasm relies in part on velocity measurements in the extracranial internal carotid arteries (eICA) and vertebral arteries (eVA) in order to determine intracranial/extracranial velocity ratios (such as Lindegaard and Soustiel ratios). Variability in vessel tortuosity between individuals may impact these measurements. We sought to determine the variability of extracranial mean flow velocity (MFV) measurements, that could impact vasospasm grading.

Methods

We included all TCD studies performed for SAH in which measurements of the eICA and eVA MFV at two depths (5-10 mm apart) were available. Most patients had at least three measurements, and the average MFV was computed for the analyses. We calculated the mean absolute and mean percentage difference between the MFVs at the two depths in the eICA and eVA respectively, as well as the average absolute and average percentage deviation from the mean. We used Pearson's test to determine the normality of MFV distribution and two-tailed paired Student's t-test to compare the mean values.

Results

We included 25 patients (mean age 59 years; 69.2% female) with serial TCDs for vasospasm screening. SAH etiologies included aneurysm (80.7%), trauma (3.8%), and unknown etiology (15.3%). There was no significant difference between the two-depth MFVs for the eVA (3.3 cm/sec [-1.7; 8.3]; df=52; p=0.19) or eICA (-0.49 cm/sec [-5.2; -0.2]; df=50; p=0.8). Mean absolute and percent difference between the two depths were normally distributed (p>0.1). There was no significant difference between the left and right eVA (0.51 cm/sec [-0.9; 1.9], df 47, p=0.47) and respectively, left and right eICA (-0.06 cm/sec [-1.24; 1.12]; df 48; p=0.9) mean absolute differences. However, the mean absolute difference between eVA and eICA was statistically significant (-1.43 cm/sec [-2.3; 0.51]; df=98; p=0.002). The mean percentage difference between the eVA and eICA was also significant (-7.93 [-11.1; 4.6]; df=98; p<0.0001). Average absolute deviation from the mean (-0.7 [-1.3; 0.08], t=-2.2, df=94, p=0.02) and average percent deviation from the mean (-5.29 [-7.6; 2.9], t=-4.4, df=94, p<0.0001) were significantly less in the eICA compared to eVA.

Discussion

We found that eVA velocities were significantly more variable than eICA velocities. The commonly used intracranial/extracranial MFV ratios to screen for vasospasm might be subject to this variability. Our study suggests that multiple sampling of extracranial vessels might be important in sonographic vasospasm monitoring, especially in the vertebral arteries.

Vanishing White Matter with Progressive Cavitation: a Unique Neuroimaging Pattern of Neurofibromatosis type 1

Tanaporn Wilaisakditipakorn, Paul Maertens

University of South Alabama, Mobile, USA.

Vanishing white matter diseases (VWM) is characterized by progressive symmetrical rarefaction and cystic transformation of the cerebral white matter except for relative sparing of temporal lobes and subcortical arcuate fibers. VWM has not been previously reported in patient with Neurofibromatosis type 1 (NF1). Our patient was a male infant born small for gestational age at 22 weeks gestation. Multiple café au lait spots were noted with maternal history of NF1. Cranial ultrasounds were considered normal until day 28. There was no periventricular leukomalacia or intracranial hemorrhage. Cranial ultrasound was repeated on day 53 due to clinical deterioration and showed early diffuse bilateral white matter changes with small cyst formation extending close to cortex. Over time, cysts became coalescent involving the entire white matter forming large cavities resembling butterfly wings while corpus callosum became thin and short. There was relative sparing of the temporal lobes. Brain MRI at 22 months showed optic glioma and T2 signal changes in basal ganglia thalami and brainstem which is typical of NF1 in addition to previously described VWM. NF 1 is an autosomal dominant neurocutaneous disorder caused by mutation in the Neurofibromin gene (NF1 gene). The oligodendrocyte myelin glycoprotein (OGMP) gene is also embedded within the NF1 gene. We postulate that under stress at an early phase of the brain development, the dysfunction of the OGMP gene embedded in a mutant NF1 gene may provokes a break-down of the oligodendrocytes leading to vanishing white matter in patient with NF1.

Recurrence of Pituitary Germinoma with Drop Metastasis

Olivia Tong, Mark Milstein

Montefiore Medical Center, Bronx, USA.

Background

Pineal tumors are rare and account for <1% of intracranial neoplasms. The large majority of these tumors have a germ cell line origin. These tumors generally present due to mass effect with headache, nausea, vomiting, lethargy, and a dorsal midbrain (Parinaud) syndrome. Treatment includes radiation, to which pineal tumors are exquisitely sensitive. Prognosis is good with survival rates of 79-90%. Rates of recurrence intracranially or spinally are dependent on pathology but spinal progression of disease is relatively uncommon.

Methods

A case report from a tertiary medical center.

Results

This is a 36-year-old man with a history of treated pineal germinoma. Pathology was thought to be benign. Over the course of a year, he developed progressive weakness and sensory disturbances. At the time of presentation to the emergency room, he was using a walker to ambulate. MRI of his lumbosacral spine showed an enhancing mass that filled the entire thecal sac to about L2. He received radiation therapy and subsequently chemotherapy due to inadequate response.

Conclusions

This case reiterates drop metastases as an important, though rare complication of pineal tumors.

fNCI: Assessing Concussion Biomarkers to Treat Dysregulation of NVC in PCS

Alina K Fong^{1,2}, Mark E Strong^{1,3}, Mark D Allen^{1,4}, E Bruce McIlff^{1,2}

¹Cognitive FX, Provo, USA. ²Utah Valley Regional Medical Center, Provo, USA. ³Brigham Young University, Provo, USA. ⁴NOTUS Neuropsychological Imaging, Orem, USA.

Purpose

Scientists have questioned the reliability of functional magnetic resonance imaging (fMRI) in assessing PCS because it is considered an indirect measure of neuronal activation.¹ However, current research shows that the predominant source of chronic post-concussion syndrome (PCS) results from a pathological dysregulation of NeuroVascular Coupling (NVC).^{2,3} Since fMRI is a direct measure of NVC, it provides a unique and reliable method for assessing and treating mild traumatic brain injury (mTBI) in PCS patients. Functional Neurocognitive Imaging (fNCI) is a task-related form of fMRI that localizes dysregulation of NVC by measuring the blood oxygen level dependent (BOLD) signaling during the performance of neuropsychological evaluations. We have discovered areas of the brain with specific abnormal patterns of activation which reliably correlate with PCS pathology. We assess these concussion 'biomarkers' using fNCI and compare them to a healthy control to compute a Severity Index Score (SIS). The SIS is used to design Enhanced Performance in Cognition (EPIC) treatment, a week-long, all-day 'boot camp' system designed to combine cardiovascular, neuromuscular, and cognitive therapies. fNCI has proven to be a successful diagnostic tool to assess and treat PCS.

Methods and Materials

551 concussed patients participated in fNCI scanning and EPIC treatment. PCS severity was measured objectively using the SIS and subjectively using a self-reported post-concussion symptom scale (PCSS) score. Initial PCSS and SIS scores were used to develop individualized, targeted, sustained, and cyclical week-long EPIC therapy incorporating cognitive, occupational, and neuromuscular modalities. These scores were also used to establish pre-treatment benchmarks and measure post-treatment improvement.

Results

PCSS and SIS changes were assessed and calculated in percent change from pre to post-treatment. PCSS scores showed a mean improvement of 65.7 percent, $\sigma = 23.3$. Objective SIS findings showed a mean improvement of 76.5 percent, $\sigma = 23.3$. Longitudinal reassessment of patients shows maintained SIS improvement as measured in an average of 7.6 months post-treatment.

Conclusions

fNCI provides a reliable assessment of concussion biomarkers and measurement of dysregulation of NVC, allowing for identification of concussion pathology. Additionally, fNCI derived SIS scores direct tailored EPIC therapy to restore NVC and subsequently resolve chronic PCS resulting from mTBI.

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The Breath Hold Acceleration Index (BHAi): A New Index to Evaluate Cerebrovascular Reactivity Using a Breath Hold Maneuver

Mohammed Alwatban¹, Edward Truemper², Abdullah Al-rethaia³, Daniel Murman⁴, Greg Bashford^{1,2}

¹University of Nebraska-Lincoln, Lincoln, USA. ²Children's Hospital & Medical Center, Omaha, USA. ³Qassim University, Buraidah, Saudi Arabia. ⁴University of Nebraska Medical Center, Omaha, USA.

Background & Purpose

Cerebrovascular reactivity (CVR) is an ideal biomarker to detect cerebrovascular damage. CVR can be quantified by measuring changes in cerebral blood flow velocity (CBFV) in response to a CO₂ challenge. These changes are detected using transcranial Doppler (TCD) in the middle cerebral artery (MCA), often during breath-holding (BH). The breath-holding index (BHI) is the maximum percentage increase in CBFV divided by BH time. Despite the convenience of BH methodology, BHI has high variability. In addition, changing body position may change CVR. It is important to determine if CVR changes in different body positions. The aims of this study were: first, to propose an alternative index to evaluate CVR using the BH maneuver; and second, to investigate the effect of body position in CVR using a head-up (HUT) and head-down (HDT) tilt table.

Methods

Ten healthy young volunteers (21.4 ± 1.7 years) held their breath for 30 seconds on a tilt table. CBFV data (Fig A) were collected from the MCAs using TCD at five body positions (45, 30, 15 deg HUT, supine position and 15 deg HDT). The mean velocity (V_m) was calculated by averaging the CBFV samples within each cardiac cycle (Fig B). CVR was calculated using two methods: the standard BHI, and the breath holding acceleration index (BHAi), a new index obtained by linear regression of the most linear portion of the CBFV envelope during the BH maneuver (Fig C). The regression represents acceleration as it is the change in blood flow velocity per unit time. (Note: Figure accessible at <https://unl.box.com/s/p288dtjb3hjman7a7ufh9auieca949e3>)

Results

The mean coefficient of variation was 82.5% lower in BHAi in comparison with BHI. Values of BHAi and BHI were not statistically significant between body positions ($p=0.24$ and $p=0.5$).

Conclusions

In this study, we proposed a new index (BHAi) to assess CVR using a breath holding maneuver. This index has considerably less variability in comparison with the conventional standard BHI. Additionally, we demonstrated that CVR does not significantly change due to body position. This is interesting considering cerebral perfusion pressure may be higher in HDT due to induced gravity-dependent shifts in blood volume distribution.

Full Body MRI Imaging in a Patient with Neurofibromatosis Type I (NF1)

Rick Magun, Amar Anand, Amir Mazhari, Laszlo Metchler

Dent Neurological Institute, Amherst, USA.

We present a 26 year old female with past medical history of relapsing remitting multiple sclerosis early onset at age of 13. During her diagnostic investigations for MS, imaging studies of her spine at this age showed significant abnormalities that were diagnostic of NF1. She was also noted to have cutaneous manifestations of NF1 including café au lait spots, axillary freckles, and surgically confirmed neurofibromas. There was no family history of NF1 and she was thought to have a spontaneous mutation. A full body scan was ordered which showed extensive changes of neurofibromatosis with bulk of disease in the lower extremities, pelvis extending in to the paraspinal lumbar region. Extensive neurofibromatosis were found tracking along the sciatic nerve and lumbar paraspinal soft tissues. The right leg is affected more than the left leg. The brain showed prominent CSF spaces with chronic hydrocephalus. The bulk of the disease is centered on the lower extremities and paraspinal regions of the lumbar and to a lesser extent the thoracic spine. Intercostal regions showed significant disease and in paraspinal regions in the thorax extending into the neural foramina. No cord compression is seen. The cutaneous manifestations of disease are present but appear less extensive than the deeper involvement particularly in the lower extremity which is primarily posterior along the expected location of the sciatic nerve. Interestingly, she is noted to have limited symptoms given the bulk of her disease but it is monitored in follow up with whole body MRIs.

MRI Sequences to Detect and Differentiate Post-operative Internal Acoustic Canal Mass After Microvascular Decompression Surgery

Istvan Tomachek¹, Yathish Haralur², Nandor Pinter², Laszlo Mechtler²

¹University of Buffalo, Buffalo, USA. ²Dent Neurological Institute, Amherst, USA.

Objective

Microvascular decompression is the mainstay in medical treatment for both trigeminal and glossopharyngeal neuralgia in medically refractory cases. One of the postoperative complications includes cranial neuropathy due to accidental nerve damage or compression from a hematoma. We report a case of facial nerve palsy as a post-operative complication of microvascular decompression surgery of 5 th and 9 th cranial nerves and discuss the role of MRI and special sequences to diagnosing the pathology.

Methods

Case report

Results

We describe a 46 yr old female with medically refractory trigeminal and glossopharyngeal neuralgia who underwent microvascular decompression surgery with Teflon placement. Postoperatively patient awoke with a left sided facial palsy which was suspected to be intraoperative facial nerve damage. MRI of the brain however demonstrated a mass with in the left internal acoustic canal (IAC) which was thought to be either a blood clot or a dislodged piece of the Teflon. MRI of the brain with special sequences which included IAC drive superimposed with MRA, axial and coronal 3D FLAIR images, coronal DWI, susceptibility weighted sequences and 3D T1 sequences were utilized to differentiate a clot from the Teflon. Furthermore the serial images at immediate postoperative period, at 1 month and 3 months, demonstrated the evolution and resolution of the clot with subsequent clinical improvement.

Conclusion

MRI of the brain with special sequences is an important tool in detecting and differentiating post-operative intracranial pathology secondary to microvascular decompression surgery in the posterior cranial fossa.

Safety and Clinical outcomes after Transverse Venous Sinus Stenting for Treatment of Idiopathic Intracranial Hypertension: Single Center Experience

Ashish Kulhari, Siddhart Mehta, Rebekah Amarini, Spozhmy Panezai, Jawad F Kirmani

JFK Stroke & Neurovascular Center, Seton Hall Hackensack Meridian School of Medicine, Edison, USA.

Background and Objective

Idiopathic intracranial hypertension (IIH) is a disorder characterized by signs and symptoms of increased intracranial pressure without structural cause seen on conventional imaging. Unilateral or bilateral transverse sinus or transverse-sigmoid junction stenosis is a very common finding in these patients. There is ongoing debate whether venous sinus stenosis is the cause of IIH or result of it. Multiple case reports and case series have proven venous sinus stenting to be very effective in medically refractory IIH. Through this study, we want to share our experience with venous stenting in patients with IIH who had transverse sinus or transverse-sigmoid sinus junction stenosis.

Methods

All patient with medically refractory IIH who underwent venous sinus stenting (VSS) at our university affiliate community comprehensive stroke center in 2017 were analyzed.

Results

Our neuroophthalmology services identified four patients that had medically refractory IIH and underwent VSS or angioplasty. Mean age was 47. Seventy five percent of patients were women (n=3). Headache was the most common symptom (100%) followed by transient visual obscurations (75%, n=3) and pulsatile tinnitus (25%; n=1). All patients were found to have bilateral papilledema. Mean lumbar opening pressure was 36.25 (SD= 4.65; 95% CI = 30.98-41.5). All patients were on maximum doses of acetazolamide and diuretics. Half of the patients had right transverse sinus stenosis with hypoplastic left transverse sinus stenosis (n=2) and other half had bilateral transverse sinus stenosis (n=2). Mean pressure gradient across the transverse sinus was 17 (32 \diamond 15). Three patients were treated with transverse sinus stenting and one with angioplasty. All patients were able to come off their medications with significant improvement in symptoms and visual fields (Mann-Whitney test; p value = 0.028). No complications occurred during intervention.

Conclusion

Transverse sinus angioplasty +/- stenting is a safe and effective means of treating IIH. Larger studies are required to support our results.

Role of Thin-sliced Reformatted CT Imaging for Acute Ischemic Stroke Patients, Do We Need CT Angiography Before Deciding for Acute Neurointervention

Siddhart Mehta, Ashish Kulhari, Amrinder Singh, Rafia Jawed, Sara Strauss, Spozhmy Panezai, Jawad F. Kirmani
JFK Stroke & Neurovascular Center, Seton Hall Hackensack Meridian School of Medicine, Edison, USA.

Background and Objective

Thin-sliced reformatted non-contrast CT head are not considered sensitive enough for thrombus detection. CTA is done to confirm large vessel occlusion. CTA adds extra radiation and contrast. Through this study, we want to investigate if thin-sliced reformatted non-contrast CT scans could be reliably used to detect and measure size of the thrombus in patients with LVOs.

Methods

Retrospective analysis of patients who underwent acute endovascular intervention for LVOs at a community based, university affiliated comprehensive stroke center during two year period (Jan 2015-Dec 2016) was done. The raw data of non-enhanced CT scans and CTAs were collected. All raw data were reconstructed with thin slices of 0.625 mm using standard GE software. Vessel diameter and clot length were measured on both CT and CTA. (5-mm maximum intensity projections of the thin slices on CT and axial/coronal projections on CTA). Each patient's CT and CTA were paired for length and diameter in millimeters. Paired two sample hypothesis test was run on SPSS.

Results

926 patients presented with acute ischemic stroke during the specified time period. Of those 99 were LVOs that received endovascular treatment of which, 37 had both CT and CTA done and had intracranial lesions. Mean clot length was 13.99 (SD 5.34) on thin slices CT and 14.18 (SD 5.64) on CTA. Vessel diameter was 2.83 (SD 0.54) on thin sliced CT and 2.55 (SD 0.51) on CTA. There was no significant difference in estimated clot length done on CT as compared with CTA. ($P=0.601$). There was significant difference in estimated vessel diameter on CT as compared with CTA.

Conclusion

Thin-sliced reconstructions of standard cranial nonenhanced CT raw data can be reliably used to detect and measure the thrombus size in LVOs. It does slightly overestimate the vessel diameter but still making intervention planning possible. Larger multicenter trials are needed to validate our data.

Role of Flat Panel Cone Beam Computed Tomography in Detecting ICH: Single Center Experience

Amrinder Singh, Ashish Kulhari, Siddhart Mehta, Briana Decarvalho, Anna Barminova, Hemal Patel, Spozhmy Panezai, Jawad F. Kirmani

JFK Stroke & Neurovascular Center, Seton Hall Hackensack Meridian School of Medicine, Edison, USA.

Background and Objective

Symptomatic Intracerebral hemorrhage occurs in about 6-10% of thrombectomy cases. Intracranial hemorrhage is a known complication of other neuroendovascular procedures like aneurysm embolization. Conventionally a CT head is done post procedure especially thrombectomy to rule out peri procedure hemorrhage. A new C- arm system with 3D functionality extends the capability of C-arm imaging to include soft-tissue applications by facilitating the detection of low-contrast objects on Cone Beam CT (CBCT). Our goal was to evaluate the application of this technology in detection of Intracranial hemorrhage in patients undergoing neurointervention.

Methods

Between 2011-2016, CBCT was performed in 8 patients during neurointervention procedures at our university affiliated community based comprehensive stroke center, for early detection of Intracerebral Hemorrhage.

Results

Of a total 221 stroke patient that received acute stroke intervention, a total of 8 patients received CBCT. Six of 8 patients (75%) patients presented with acute ischemic stroke, 1 with cerebral aneurysm and 1 with SAH. Mean age was 73 years (Range 49-93); 62.5 % (5/8) were females. With the use of CBCT intra-operatively, Left basal ganglia hemorrhage, IVH with midline shift was detected in patient who underwent L ICA stenting and Left M1 mechanical thrombectomy. SAH patient's CBCT revealed worsening diffuse SAH with hydrocephalus. All patients had thin sliced CT head prior and after procedure for comparison of ICH with CBCT. These findings were confirmed on thin sliced CT.

Conclusion

We found that implementation of CBCT was successful in detecting intracranial hematomas. Our study was limited due to small population. Given the opportunity for expediting decision making in this critical setting, the use of intra-operative CBCT for inclusion or exclusion of hemorrhage warrants further large population based prospective trial.

Potential Role of MRI in Motor Neuron Disease diagnosis; Two Case Reports

Khalid Sawalha, Omar Hussein, Chad Hoyle

The Ohio State University Wexner Medical Center, Columbus, USA.

Background

Motor Neuron Diseases (MNDs) are a group of devastating neurological disorders that cause specific damage to motor neuron cells. The diagnosis of MNDs remains clinical. Neurophysiologic studies play an integral ancillary diagnostic role, yet diagnostic delays and uncertainty still exist in many cases. The role of imaging remains limited to exclusion of other pathologies. MRI findings specific for MNDs remains controversial as it lacks sensitivity and specificity. Advanced MRI sequences have more promising results and may confirm a MND when diagnosis is in doubt.

Methods

We present two case-reports and a review of the literature illustrating the role of MRI in aiding in the diagnosis of MNDs. The first case is a 63 year old female patient with progressive bilateral lower extremity weakness and difficulty swallowing for six months. Her examination revealed diffuse muscle weakness in all four extremities with no atrophy or fasciculations. Though an upgoing plantar was noted on the right, there were no clear upper motor neuron findings, otherwise (normal upper extremity reflexes and absent lower extremity reflexes). Her electromyography (EMG) study demonstrated an axonal polyneuropathy. There was chronic and active motor denervation out of proportion to the polyneuropathy suggestive of motor neuron disease, but some diagnostic uncertainty remained. The second case describes a 52 year old female patient with a complicated medical presentation with many confounding variables. As part of her presentation on exam, she had upper motor neuron findings, such as a brisk jaw jerk and hyperreflexia in the arms not explained by conventional imaging. EMG did not reveal new or evolving lower motor neuron changes. The possibility of primary lateral sclerosis superimposed on her other medical conditions was raised clinically, but difficult to tease out given the confounding variables of the case.

Results

Conventional MRI T2 susceptibility image of the first case showed a hypointense rim in the right precentral gyrus. The Diffusion tensor imaging (DTI) showed decreased fractional anisotropy (FA) in Brodmann area 4 (motor) on the left as well as decreased motor fibers in the body of corpus callosum bilaterally with bilateral motor cortical thinning on T1 three dimensional reconstruction. The conventional MRI of the second case did not show any abnormality, but the advanced imaging of this patient also displayed bilateral motor cortical thinning on T1. Additionally, tractography showed asymmetric truncation of motor fibers. Based on the advanced MRI findings, the diagnosis of ALS in the first patient and primary lateral sclerosis in the second became more likely.

Conclusion

Incorporating advanced MRI imaging techniques with the current diagnostic criteria of MNDs might increase the sensitivity and specificity of both and help in providing an earlier and more confident diagnosis of the disease.

Flat- Panel Cone Beam Computed Tomography is a NOT a Reliable Predictor for Early Changes in Ischemic Stroke Patients with Large Vessel Occlusions (LVO)

Amrinder Singh, Ashish Kulhari, Siddhart Mehta, Briana Decarvalho, Hemal Patel, Spozhmy Panezai, Jawad F. Kirmani

JFK Stroke & Neurovascular Center, Seton Hall Hackensack Meridian School of Medicine, Edison, USA.

Background and Objective

ASPECTS is a standardized tool to quantify the core infarct in MCA territory stroke. CBCT (Cone Beam CT) is a new C-arm system with 3D functionality extends the capability of C-arm imaging to include soft-tissue applications by facilitating the detection of low-contrast objects. Through this study, our goal was to evaluate for early ischemic signs on Cone Beam CT.

Methods

All acute ischemic stroke patients who had CBCT prior to intervention at our university affiliated community based comprehensive stroke center were retrospectively analyzed from 2011-2016.

Results

Of a total of 221 patients, five (females; n=3) received CBCT prior to intervention. 4 out of 5 patients had proximal MCA occlusion and one had distal vertebral artery occlusion. Mean age was 81.2 years. 60% were females. All patients had CT head prior to CBCT. Separate ASPECTS were calculated and compared based on CT head and CBCT. Mean ASPECTS for all MCA occlusion was 9. Three (75 %) MCA occlusion had early changes in deep structures (Caudate, Internal Capsule, Lentiform nucleus, Insular cortex) and one (25%) had M3 hypodensity based on CT head. None of the CBCT showed early ischemic changes in deep structures. CBCT did show the M5-M6 hypodensity.

Conclusion

We concluded that the CBCT could provide useful information for early infarcts in M1-M6 areas of MCA. Early deep cortical infarcts can be easily missed. A large population based prospective study is needed to analyze future use of CBCT to expedite decision making.

Case of Postpartum Bifrontal Intracerebral Hemorrhage: Where's the Thrombus?

Kristie Wang, Charlotte Zhong, May Kim-Tenser, Benjamin Emanuel, Sebina Bulic

Keck Medical Center, University of Southern California, Los Angeles, USA.

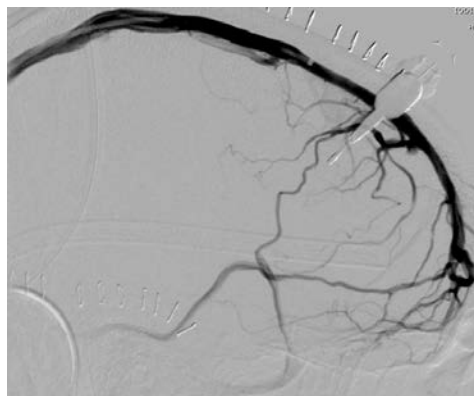
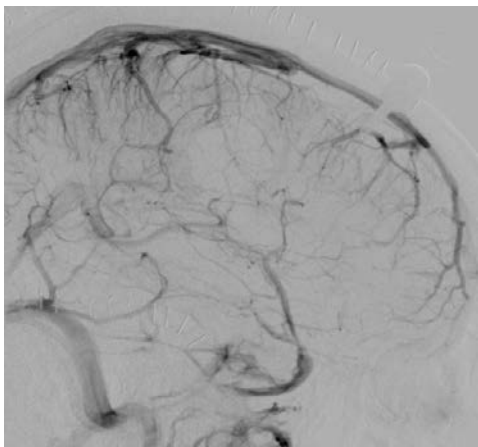
Pregnancy-associated stroke affects approximately 34 of 100,000 pregnancies.¹ The delivery and postpartum period confer the greatest risk of pregnancy-associated stroke, with a higher number of hemorrhagic than ischemic strokes. Intracerebral hemorrhage (ICH) accounts for approximately 7.1% of all pregnancy-related maternal deaths.² Pregnancy-related ICH that is bilateral or multifocal is even more rare.

We report a case of a postpartum 23-year old previously healthy African American female with bifrontal ICH of unclear etiology.

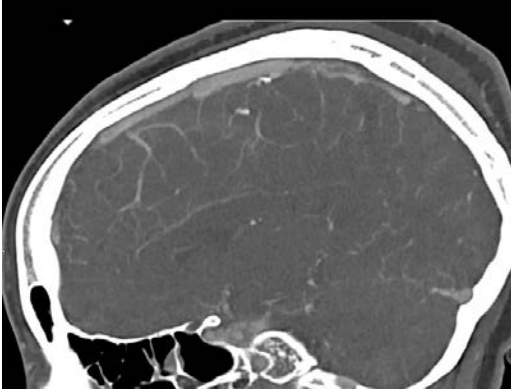
A 23 year-old African American female who was 1 week postpartum was found unconscious after complaining of a sudden onset headache hours prior. On arrival, patient was GCS 4T with extensor posturing. Non-contrast CT Head showed large bifrontal parenchymal hematomas with pronounced mass effect. CT Angiography was negative for vascular abnormalities. She underwent an emergent right hemicraniectomy.



Diagnostic cerebral angiogram and venogram were performed, showing narrowing of the anterior segment of the superior sagittal sinus (SSS). Clot retriever device was deployed with no return of thrombus; however afterwards, SSS appeared to be widely patent.



Repeat imaging 2 days later again demonstrated filling of the anterior SSS with persistent abrupt transition to a larger sinus posteriorly, but now also noted diffuse vasospasm.



Therapeutic anticoagulation was deferred since no definitive dural sinus thrombosis was identified. Urine toxicology screen was negative. There was no clear hematologic or rheumatologic pathology though her von Willebrand factor and Rheumatoid factor levels were mildly elevated. Throughout her hospital stay, she was noted with episodes of hypertension and sinus tachycardia, which were attributed to sympathetic storming and improved with clonidine patch. She underwent tracheostomy and PEG placement. Her condition gradually improved to a point where she completed acute rehab and was discharged home, communicative and able to perform most ADLs. Nearly 6 weeks after discharge, she presented again with PEA arrest and subsequent diffuse anoxic brain injury in the setting of a possible seizure after running out of her seizure medications. Patient ultimately passed away on comfort care.

The majority of pregnancy-related ICH is caused by a pre-existing vascular lesion such as an aneurysm or arteriovenous malformation.³ Less frequent causes include preeclampsia/eclampsia, coagulopathy, trauma, cerebral venous thrombosis, reversible cerebral vasoconstriction syndrome, and autoimmune vasculitis. We perform an extensive literature review of pregnancy-related ICH, particularly focusing on risk factors, pathophysiology and radiological features of the differential diagnoses of our patient's ICH.

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Tolosa Hunt Syndrome: Important diagnosis often missed with incorrect MRI sequences!

Vishal Mandge, David Kaufman, Michael Swerdlow

Montefiore Medical Center, Bronx, USA.

Objective

To review the clinical presentation, radiographic features, and treatment response of two patients with Tolosa Hunt Syndrome.

Background

The Tolosa Hunt Syndrome is defined as “unilateral orbital pain associated with paresis of one or more of the IIIrd, IVth and/or VIth cranial nerves caused by a granulomatous inflammation in the cavernous sinus, superior orbital fissure or orbit”¹. The estimated prevalence of Tolosa Hunt Syndrome is one in a million. When the disorder involves the orbital apex without the cavernous sinus, neurologists sometimes refer to it as “orbital pseudotumor.” It usually presents as retro-orbital pain radiating to the back of the head. Neurologists often do not suspect Tolosa Hunt as the cause of the headache, until ophthalmoplegia develops a few days later. A new onset of a severe headache in these patients usually leads to an MRI of brain with and without contrast; however, this study often misses the inflammation in the small region of orbital apex and/or cavernous sinus, leading to false reassurance to clinicians and patients about the benign nature of headache. Special MRI sequences, which may not be available in all hospitals, show improved sensitivity in detecting Tolosa Hunt syndrome.^{2,3}

Design/Methods

Case series from a tertiary medical center.

Results

Patient 1: A 28 year-old woman presented to an outside hospital with left retro-orbital pain and diplopia. After a negative MRI brain with and without contrast, the Neurology and Ophthalmology services diagnosed diabetic third nerve palsy due to newly discovered hyperglycemia. Subsequently, her ophthalmoplegia worsened and MRI of orbits with and without contrast at our hospital showed abnormal enhancement along the lateral margin of the left orbital apex extending along the dural margin of the adjacent cavernous sinus and sphenoid bone, leading to the diagnosis of Tolosa Hunt Syndrome. Her pain improved after 24 hours of steroid treatment and her ophthalmoplegia improved a few weeks later. Four months later, an MRI showed complete resolution of the enhancement.

Patient 2: A 51 year-old woman presented with four days of headache and two days of diplopia. Neurologic examination found a complete third nerve palsy with partial pupillary involvement, and partial sixth nerve palsy. After an unremarkable MRI of the brain without contrast, an MRI brain and orbits with contrast showed focal soft tissue enhancement at the left orbital apex involving the optic canal and orbital apex. Her headache improved within two days of starting steroid treatment and her ophthalmoplegia started improving within a week of starting steroids.

Each of these patients underwent an extensive evaluation to exclude other etiologies of retro-orbital inflammation, including serum and CSF analysis for inflammatory, rheumatological, vascular, metabolic, neoplastic, autoimmune and infectious etiologies.

Conclusions

Neurologists should consider Tolosa Hunt Syndrome in the differential diagnosis of patients presenting with retro-orbital pain with or without ophthalmoplegia. MRI is the mainstay of diagnosis. MRI sequences of orbits

along with MRI of brain, with and without contrast, which is available in most hospitals, improve the chances of detection of Tolosa Hunt syndrome, which is often misdiagnosed as diabetic ophthalmoplegia when MRI brain does not show any abnormalities. Correct identification and steroid treatment leads to rapid improvement of headache, and gradual resolution of ophthalmoplegia.

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Distinct Purposes of Perfusion Imaging in the Management of Delayed Cerebral Ischemia After Subarachnoid Hemorrhage

Lily Chau, Gregory Kapinos

SUNY Downstate Medical Center, Brooklyn, NY, USA.

Perfusion imaging by CT or MR has been proven to be useful for prediction and early detection of delayed cerebral ischemia (DCI) after subarachnoid hemorrhage (SAH), attributed to vasospasm. Only recently have systematic reviews differentiated prognostic models from early detection of subclinical ischemia. Here we distinguish the value of perfusion imaging in (1) prognostication of DCI, (2) early detection of DCI, (3) quantifying ischemia to gauge therapeutic response to hemodynamic augmentation, (4) targeting regions at higher ischemic risk for angioplasty or intraventricular nicardipine, (5) ascertaining blood-brain-barrier leakage to measure the risk of reperfusion injury and hemorrhagic insult, and (6) identifying blood-brain-barrier dysfunction responsible for edema and perfusion metabolic decoupling.

We use an alarm system based on age, clinical status, and clinical measures including blood pressure, fever/SIRS, salt wasting, transcranial doppler and intracranial pressure. When suspicion of ischemia is raised, CT Perfusion is performed to confirm and characterize the lesion - including focal vs. global, proximal vs. distal, punctate vs. territorial, cortical vs. subcortical ischemia - and guide therapeutic management. For example, only ischemic foci with risk of imminent infarction and proximal narrowing will undergo angioplasty. This protocol leads to (1) less premature recourse to prosaic management with intravenous fluids, hemodynamic monitoring and neuroimaging, (2) judicious use of neurocognitive scales, quantitative EEG and intracranial monitoring, and (3) tailored treatment between hemodynamic augmentation and endovascular therapy based on severity of DCI.

Perfusion imaging is not the panacea for DCI detection if used indiscriminately, as poor sensitivity and specificity have been reported. However, it is a tremendously useful tool when used discriminately along with other modalities for evaluating DCI. Perfusion imaging may become the gold standard for diagnostic confirmation and characterization of ischemia, leading to targeted therapeutic strategy.

Advanced Neuroimaging of a Rare Chordoid Glioma of the Third ventricle

Jishnu Nair, [Rick Magun](#), Laszlo Metchler, Nandor Pinter

Dent Neurological Institute, Amherst, USA.

A 67 year old female presented with persistent non-productive cough and nasal discharge. Her neurological exam was unremarkable. CT of the sinuses showed a well-defined hyperdense mass of the anterior aspect of the 3rd ventricle. MRI showed a T2 and FLAIR hyperintense heterogenous abnormality measuring 22 x 30 x 23mm which enhanced with gadolinium and showed no diffusion restriction or abnormal SWI signal. The lateral ventricles were moderately enlarged and moderate mass effect was seen with displacement of the optic chiasm, pituitary stalk and both A1 segments. 3D Arterial Spin Labeling (ASL) showed no abnormal hyperperfusion. MR spectroscopy showed low metabolite levels with relative lower NAA and higher choline. Diffusion Tensor Imaging and tractography showed poor visualization of the anterior commissure. The overall appearance was suggestive of a non-infiltrative tumor. PET scan showed hypermetabolism in the mass, similar to behavior of the low end of a high grade gliomas. Endoscopic biopsy was obtained and verified choroid glioma of third ventricle. Chordoid gliomas are rare, slow growing well circumscribed low-grade tumors that arise from the anterior wall or roof of the third ventricle. Given the low grade of this tumor and lack of clinical symptoms on this patient, surgical resection was delayed and patient will be monitored clinically with repeat neuroimaging.

A Case Of Cerebral Hyper Perfusion Syndrome Following Carotid Endarterectomy

Pradeep Kumbham, Poornachand Veerapaneni, Rohan Samant, Krishna Nalleballe, Sanjeeva Onteddu

University of Arkansas for Medical sciences, Little Rock, USA.

Background and Purpose

To present a case of cerebral hyper perfusion syndrome following carotid endarterectomy with interesting neuro imaging findings.

Methods

Patient is a 64 year old woman with a history of CAD, carotid stenosis s/p CEA a week prior presented with seizure and speech difficulties from OSH. She also had two seizure like episodes and was treated with Keppra prior to transfer. Significant exam findings were prominent receptive aphasia, mild right facial droop and right upper extremity weakness.

Results

CT Head without contrast showed Low attenuation in the left parietal lobe concerning for ischemic infarction. CT angiogram (Image 1) showed patent left ICA and stenotic right ICA. However, MRI brain showed abnormal T2/FLAIR hyper intense signal (Images 2 and 3) and edema within the posterior left parietal lobe/superior left occipital lobe without associated restricted diffusion (Image 4) suggestive of hyper perfusion syndrome secondary to left carotid endarterectomy a week ago. Her presentation improved in the hospital and aphasia and weakness have resolved and had no further seizures. She was discharged home on Keppra and Aspirin with further follow-up.

Conclusions

Carotid hyper perfusion syndrome is seen in around 0-3% of cases after carotid endarterectomy. It is most common in patients with increases of more than 100% in perfusion compared with baseline after carotid endarterectomy. Carotid hyper perfusion syndrome usually presents with ipsilateral headache, hypertension, seizures, and focal neurological deficits. MRI brain typically shows T2 / FLAIR hyper intense signal with edema and no associated diffusion restriction.

A Penny for Your Thoughts

Amar Anand, Rick Magun, Amir Mazhari

DENT Neurologic Institute, Buffalo, USA.

Objective

We present a case of copper deficiency myelopathy and a literature review of the clinical and imaging findings associated with different etiologies of long segment T2 hyperintense dorsal column lesions.

Methods

Case report and literature review.

Discussion

We present the case of a 41-year-old female with history of hyperthyroidism and anxiety presenting with vague complaints of transient episodes of numbness primarily affecting her extremities. Sensory neurologic examination was unremarkable however, MRI revealed a discrete T2/STIR hyperintense lesion involving the C1-C7 posterior columns bilaterally, without enhancement or cord edema. Labs were sent to evaluate for vitamin deficiencies, autoimmune and postinfectious etiologies. Results included an undetectable copper level and low normal B12 level. On return visit 6 months later both B12 and copper levels had normalized with symptom improvement. In the interim, patient had been taking both oral B12 replacement and over the counter multivitamins, thus the underlying etiology was still unclear. Ultimately close examination of the imaging characteristics played a significant role in diagnosing the patient with copper deficiency myelopathy.

Conclusion

The underlying etiology of long segment T2 hyperintense dorsal column lesions identified on imaging are classically determined on serum testing. Confounding variables however such as lab error, replacement of multiple nutrients simultaneously or insufficient history can occasionally make identifying an underlying etiology difficult. This case illustrates the importance of understanding the subtle clinical and imaging findings associated with different etiologies of long segment T2 hyperintense dorsal column lesions when serum testing is not clearly diagnostic.

Carotid Ultrasound with Concurrent Transcranial Doppler in Risk Stratification of Carotid Artery Stenosis: A Case Report

Andrew Lockey¹, Adrian Fawcett², Dawn Whyte³, Demetrios Sahlas⁴

¹University of Calgary, Calgary, Canada. ²Trillium Health Centre, Mississauga, Canada. ³Hamilton Health Sciences, Hamilton, Canada. ⁴McMaster University, Hamilton, Canada.

Background

Patients with Transient Ischemic Attack (TIA) require carotid imaging to evaluate for symptomatic internal carotid artery (ICA) stenosis. This can be performed with carotid ultrasound (CUS) or CT angiography (CTA). The decision to proceed with carotid revascularization can sometimes be challenging in cases where the degree of stenosis falls within the 'moderate range' (50-69%).

Case

A 71-year-old male on aspirin presented with recurrent episodes of transient right-sided numbness and weakness. Initial CUS revealed 50-69% ICA stenosis bilaterally, correlating with CTA demonstrating a 65% on the right and a 67% stenosis on the left. The patient was initiated on dual antiplatelet therapy, although had recurrent events 7 days later, and a repeat CUS was ordered with concurrent transcranial Doppler ultrasound (TCD). During insonation of the left ICA, multiple microembolic signals (MES) were observed in the left middle cerebral artery on TCD. The patient simultaneously experienced a recurrent episode of right-sided numbness and weakness during insonation. The patient was referred for left carotid endarterectomy. Following successful intervention, the patient has not experienced another episode consistent with TIA.

Discussion

The use of CUS with concurrent TCD has, to our knowledge, not been previously reported. Our case raises consideration of a novel approach to stratifying the risks of recurrent stroke in symptomatic patients with moderate ICA stenosis using TCD.

Lateral Projection is Superior to Oblique Groin Projection in Femoral Angiography for Identification of Arteriotomy Site

Vikram Jadhav¹, Adnan Qureshi^{2,3}, Muhammad Fareed Suri¹

¹CentraCare Health, St. Cloud, MN, USA. ²Mercy Health, Rockford, IL, USA. ³Rockford Health System, Rockford, IL, USA.

Background

Femoral arteriography is the critical initial conduit for catheter based cerebral angiography. After securing access, angiography is performed over the groin in oblique projection through sheath to evaluate for desired arteriotomy site below the inguinal ligament and above the common femoral artery bifurcation. Knowledge of site insertion is also needed to determine suitability of closure device. However, the exact entry point may not be frequently visualized due to catheter - vessel or vessel - vessel overlap. Hardware and implants may also obscure the field. We investigated whether lateral projection was superior to oblique projection in groin for accurate identification of the arteriotomy site.

Methods

We performed groin angiography in oblique and lateral projections after securing femoral access in patient undergoing cerebral angiography procedures. Best representative images of angiographic runs in oblique and lateral projections from 115 patients were interpreted in blinded fashion by an Interventional Neurologist. Data was recorded whether insertion site was precisely identified in oblique and lateral projections. The reason for inability to identify site of insertion was also identified.

Results

Precise site of insertion was identified in 111/115 (96.5%) lateral projection angiograms compared to 87/115 (75.6%) oblique projection femoral angiograms ($\chi^2 = 20.90$, $p < 0.05$). Oblique projection frequently had catheter - vessel overlap (18.2%), vessel - vessel overlap (3.4%), or hardware obscuration of field (2.6%). In lateral projection, we encountered only 2 cases each (1.74%) of catheter - vessel overlap and vessel - vessel overlap. None of the lateral projection angiograms were obscured by hardware and implants. In lateral projection, common femoral artery – 74.7% was commonest site of insertion followed by femoral bifurcation – 10.4%, superficial femoral artery – 9.5%, and deep femoral artery – 1.7%.

Conclusion

Lateral projection is superior to oblique projection in femoral angiography for accurate assessment of arteriotomy site and entry of sheath.

High Grade Critical Basilar Stenosis in a Young Female with History of Systemic Lupus Erythematosus and Basilar Migraine

Rick Magun¹, Amar Anand¹, Amir Mazhari², Laszlo Metchler¹

¹*Dent Neurological Institute, Amherst, USA.* ²*Dent Neurological Institute.*

We present this challenging case of a 49 year old female with history of Systemic Lupus Erythematosus (SLE), chronic migraine, basilar migraine, and depression. She presented with a stroke in 2003 and was later discovered to have Basilar Artery stenosis. A follow up CT angiogram in 2015 showed a very small caliber, proximal two thirds Basilar Artery. CT perfusion showed hypo-perfusion with prolonged time to peak enhancement, bilaterally in the posterior inferior cerebellar artery territory. The superior cerebellar artery and posterior cerebral arteries appear normally perfused. The Basilar tip was normal in appearance due to collateral flow from large posterior communicating arteries. The distal left posterior cerebral artery is narrow causing stroke in this vascular territory. The patient was treated with Coumadin for SLE induced coagulopathy and has not had a second stroke. She continues to have syncopal events thought to be from basilar migraine however. She currently maintained on Topiramate for chronic migraine and remains stable. She does have exacerbation of her lupus which is being treated with prednisone and plaquenil. We review the neuroimaging this patient and the challenges with her management.

Pre-existing White Matter Disease Burden Impacts Cognitive Outcome after Inpatient Rehabilitation for Ischemic Stroke

Muhib Khan¹, Heather Heiser², Laurel Packard¹, Nate Bernicchi¹

¹*Spectrum Health, Grand Rapids, USA.* ²*Rush University, Chicago, USA.*

Background

White matter hyperintensities (WMH) have been shown to impact functional outcomes after ischemic stroke. However, their role in cognitive recovery after ischemic stroke is unclear. Therefore, it is important to evaluate if WMH can predict the degree of cognitive recovery after inpatient rehabilitation.

Methods

We retrospectively studied 162 patients admitted to inpatient rehabilitation after an acute ischemic stroke. We reviewed patient demographics, presence of co-morbidities, infarct volume, pre-admission Modified Rankin Scale, TOAST criteria, acute interventions for their stroke, rehabilitation length of stay, and Functional Independence Measure (FIM) scores (motor and cognitive) at admission and discharge from rehab. WMH were graded according to the Fazekas scale on the basis of visual assessment in both periventricular and subcortical areas.

Results

162 patient charts reviewed, 53 were excluded due to primary intracerebral hemorrhage and insufficient imaging. 109 patients were included in the final analysis. Multiple linear regression analysis revealed that, when adjusted for infarct volume, NIHSS stroke scale and age; severity of WMH as graded on Fazekas scale independently predicted Functional Independence Measure (FIM) cognitive scores at discharge ($p < 0.0084$). WMH severity did not predict Functional Independence (FIM) motor scores.

Conclusions

In this retrospective analysis, we found that severity of WMH hyperintensities as graded by Fazekas scale is an independent predictor of cognitive FIM scores after inpatient rehabilitation for acute ischemic stroke.

The Road Less Traveled: A Bizarre Trajectory of Intracardiac Thrombi in a Patient With Bilateral Common and Internal Carotid Artery Occlusion

Michael C.Y. Juan¹, Arshdeep Sidhu², Sonia G. Fernando¹

¹*St. Mary Mercy Hospital, Livonia, USA.* ²*Providence-Providence Park Hospital, Southfield, USA.*

Background & Purpose

Among all incidents of ischemic stroke, cardioembolic phenomena are responsible for approximately 14-30% of the cases. This particular etiology of stroke is especially challenging owing to its associated increased risk of early and long term stroke recurrence, persistent neurologic sequelae at hospital discharge, and high mortality rate. We present a unique case of cardioembolic stroke in a patient with bilateral carotid artery occlusion.

Methods

Case report and review of the literature.

Results

86 year-old female with history of mitral valve prolapse and anteroseptal infarct was admitted due to acute four-day history of slurred speech, left-sided facial droop and confusion. Neurological examination was remarkable for dysarthria and left-sided facial paralysis. Unenhanced MRI of the brain demonstrated multiple small infarcts in the right cerebral hemisphere, and CT angiography of the head and neck showed complete occlusion of the common and internal carotid arteries bilaterally (Fig. 1 and 2). Transthoracic echocardiogram revealed anteroseptal wall akinesis, a left ventricle thrombus measuring 1.7 x 0.8 cm, and ejection fraction of 30-35%. Warfarin was initiated and bridged with intravenous low-molecular-weight heparin, with no planned intervention. On day 5 of hospitalization, the patient experienced a new onset of left-sided hemiparesis and visual neglect. Repeat unenhanced CT head revealed no new acute finding, and CT angiogram was unchanged. No additional treatment was initiated beyond continued anticoagulation. Patient was subsequently transferred to inpatient rehabilitation and eventually discharged on day 21 of hospitalization with lifelong warfarin therapy to a skilled nursing facility due to persistent neurological deficits.

Conclusions

Imaging findings such as combined anterior and posterior circulation infarcts are highly suggestive of cardioembolism. The current case illustrates a unique presentation of cardioembolic ischemic stroke in a patient with complete blockage of the carotid arteries. Prompt diagnosis via physical examination and neuroimaging is imperative to determining the most appropriate treatment for optimal clinical outcome.

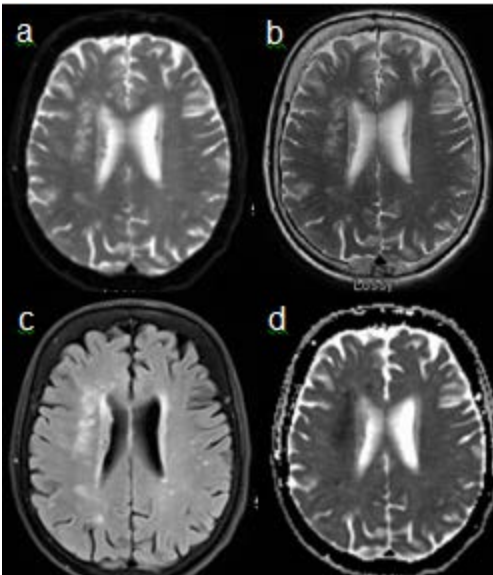


Figure 1. Magnetic resonance image (MRI) of the brain with T2WI (a), DWI (b), FLAIR (c) and ADC (d) sequences showing numerous small acute infarctions in the right cerebral hemisphere within the centrum semiovale and corona radiata.

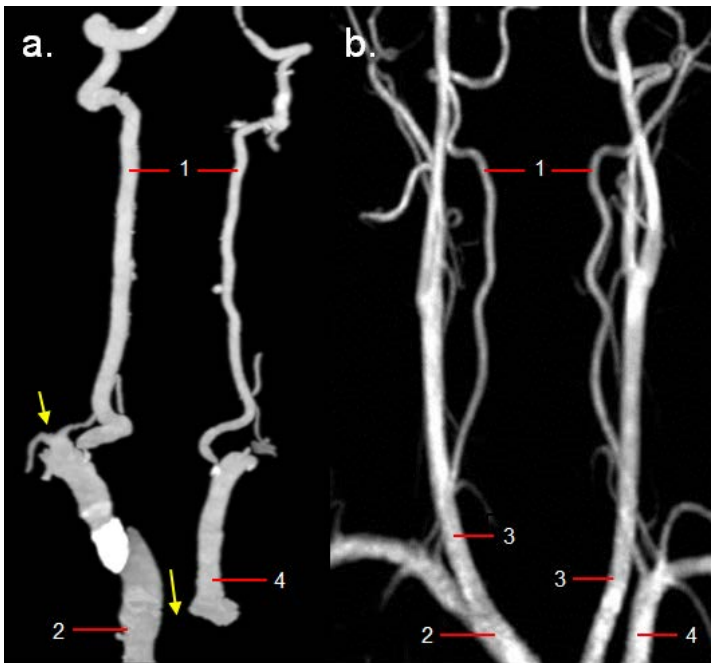


Figure 2. Computed tomography (CT) angiography showing bilateral occlusion of the common carotid arteries (a, yellow arrows) compared to normal anatomy (b). Vertebral arteries (1), right brachiocephalic arteries (2), common carotid arteries (3) and left subclavian artery (4) are shown.

Focal Hyperemia on CT-Perfusion Scan Helps Differentiate Ischemic Stroke from Stroke Mimics

Gabriela Trifan MD, Fernando Testai MD PhD, Laura Pedelty MD PhD

University of Illinois at Chicago College of Medicine, Chicago, USA.

Introduction

Acute onset of neurologic deficits raises high clinical suspicion for ischemic stroke, characterized by decreased cerebral blood volume (CBV) and flow (CBF) on CT-perfusion (CTP) studies, but stroke mimics should be in differential. Among these, ictal negative phenomena can be associated with focal hyperemia on CTP.

Case report

68-year-old female developed sudden onset of global aphasia, confusion and mild right sided facial palsy while at work. NIHSS on hospital presentation was 8. Non-contrast CT scan was unremarkable. She was deemed t-PA candidate and received IV thrombolysis. CT-angiogram head and neck revealed no occlusion or flow limiting stenosis. CTP revealed increased left temporo-parieto-occipital CBV and CBF. MRI was negative for ischemic stroke but revealed non-enhancing signal change in the left temporo-parietal area. Lumbar puncture was unremarkable. EEG showed an active left posterior temporal epileptogenic focus, congruent with the CTP hyperemic focus. Symptoms resolved with AED (levetiracetam) load. She was discharged on levetiracetam with a diagnoses of complex partial seizure (CPS). One month later she again presented with global aphasia and stroke code was initiated. Repeat CTP again revealed focal left temporo-occipital hyperemia. IV t-PA was not offered. Repeat MRI brain revealed left temporal ring-enhancing lesions and repeat EEG again revealed the left temporal epileptogenic focus. The patient acknowledged non-compliance with levetiracetam. Lacosamide was instituted, with complete resolution of symptoms. She subsequently underwent stereotactic brain biopsy with pathology revealing grade-IV glioblastoma, thought to be the substrate for the seizures.

Discussion

Transient aphasia due to CPS was initially diagnosed as ischemic stroke. CTP revealed focal hyperemia, inconsistent with an ischemic etiology. CTP hyperemia reflects a hypermetabolic state, and has been reported in complex partial seizures and high-grade neoplasms. In the absence of interictal CTP studies we cannot distinguish between these two possible etiologies of focal hyperemia in this case.

Conclusion

Focal hyperemia on CT-perfusion scan during acute stroke work-up should raise suspicion for a non-ischemic etiology.

Reorganization of Cerebellar Afferent Pathway in the Postacute Rehabilitation Phase of Stroke

Juana Chung¹, Taehong Kim¹, Sehong Kim¹, Youngkook Kim²

¹The Catholic University of Korea, Seoul, Korea, Republic of. ²RHIN hospital, Suwon, Korea, Republic of.

Objective

To identify structural modifications of the cortico-ponto-cerebellar tract (CPCT) and the relationship between CPCT and corticospinal tract (CST) integrity as well as motor function after supratentorial stroke.

Methods

A total of 33 stroke patients (18 left, 15 right hemispheric lesions) who underwent diffusion tensor imaging within 2 months of stroke onset and 17 age- and sex-matched healthy controls were retrospectively enrolled. Tract volume and the asymmetry index based on tract volume (AITV) of the CST and CPCT were used to identify structural changes in individual tracts and the correlation between those tracts. Motor function was assessed using the MRC muscle scale, manual function test (MFT), functional ambulation category, and modified Barthel index.

Results

The volume of the affected CPCT was lower, and that of the unaffected CPCT was higher than the volumes in the control group ($p < 0.001$, $p = 0.001$, respectively). The CPCT AITV showed a strong positive correlation with the CST AITV in patients with either left or right hemispheric lesions ($r_s = 0.779$, $p < 0.001$; $r_s = 0.732$, $p = 0.003$, respectively). The CPCT AITV negatively correlated with the MRC scale of the shoulder, wrist, and ankle muscles ($r = -0.490$, -0.490 , -0.416 ; $p = 0.004$, 0.004 , 0.016 , respectively). A higher unaffected CPCT volume was indicative of less affected upper extremity function, as assessed by MFT ($r_s = -0.546$, $p = 0.029$).

Conclusions

Reorganization of the CPCT depended on CST integrity and was associated with the severity of hemiplegia and hemiplegic upper extremity function. For both affected and unaffected CPCT, reorganization may complement the role of the CST and help to predict motor outcome.

Dysphagia and Tongue Deviation: A Rare Case of Collette-Sicard Syndrome After Blunt Head Trauma

Eric Tamrazian, Bijal Mehta

Harbor-UCLA Medical Center, Torrance, USA.

Introduction

The jugular foramen and the hypoglossal canal are both apertures located at the base of the skull. The jugular foramen contains the cranial nerves, IX, X and XI, involved in normal cough and gag reflex. The hypoglossal canal contains the cranial nerve XII, responsible for movements of the tongue. Therefore, multiple lower cranial nerve palsies tend to occur with injuries to these structures. The pattern of injuries tend to correlate with the combination of nerves damaged.

Case Report

A 28 y/o male was involved in an AVP injury while crossing the highway. Patient was brought to a local Level I Trauma Center. On admission, he was complaining of a headache and inability to swallow his own saliva. Exam showed a GCS of 15 AAOx3, with dysphagia, tongue deviation to the right, uvula deviation to the left and a depressed palate. No other abnormal findings were noted. Initial imaging showed B/L frontal tSAH, Left Frontal EDH and a basilar Skull Fracture. On HD 4, he was transferred out of the ICU with persistent tongue deviation and inability to swallow. Initial radiology read by a radiologist did not reveal any further structural abnormalities then the ones stated above. Neurology was consulted and imaging was reviewed by Neuroimaging trained Neurologist, which demonstrated injury to the wall of the Jugular foramen and the Hypoglossal canal. Nasogastric tube feeding was initiated and patient had PEG tube placed on HD 17 and discharged home. At 3 month follow up, patient's tongue normalized to midline and his dysphagia resolved.

Discussion

Collette-Sicard syndrome is a rare condition/syndrome characterized by unilateral palsy of CN: IX, X, XII and XI first described by Dr. Collete in 1915 and by Dr. Sicard. This condition was historically attributed to tumors of the skull base, coiling and dissections of the internal carotid artery, multiple myeloma, vasculitis, carotid fibromuscular dysplasia, shotgun injuries, idiopathic cranial polyneuropathy, atlas fractures, and occipital condyle fractures. This condition has been rarely described as a consequence of blunt head trauma. Injuries to the jugular foramen and the hypoglossal canal are rare as most blunt head traumas resulting in basilar skull fracture involve the condyles. In most cases, the condition is self-limiting with patients regaining most to all of their neurological functions within 6 months. Several theories have been proposed for the pathophysiology of this syndrome. Nerve traction injuries and soft tissue edema compressing the cranial nerves are the leading two hypothesis. In conclusion, injuries with focal neurological deficits which were not apparent on initial imaging should be reviewed by relevant experts with concomitant knowledge of the patient's history.

Periictal Changes in Neuroimaging During Seizure May Mimic Stroke, a Case Study

Adrian Burgos¹, Kristie Wang¹, Adnan Bulic², Benjamin Emanuel¹, May Kim-Tenser¹, Sebina Bulic¹

¹*University of Southern California, Los Angeles, USA.* ²*Pasadena City College, Pasadena, USA.*

Introduction

Neuroimaging plays an important role in the work up of many neurological conditions, including stroke and epilepsy. Stroke is often described as a hypodensity or hypoattenuation of signal on CT head, or as a diffusion restriction lesion with T2 FLAIR hyperintensities on MRI brain. In epilepsy, neuroimaging is often used to identify brain pathologies that lead to a seizure focus. During seizures, periictal changes on neuroimaging have been described, including effacement of gyral markings that may be confused as brain tumors, stroke, or encephalitis. The current case study shows periictal changes on neuroimaging that may mimic stroke in a patient that presents with stroke like symptoms.

Case Study

JG is a 39yo female with history of epilepsy, HTN, DLD, and type A aortic dissection s/p repair with replacement of the ascending aorta, resuspension of aortic valve and bypass to the innominate artery who was admitted for redo of aortic replacement with preceding subclavian-carotid transposition. During the surgery, pump time was 188 minutes, clamp time was 122 minutes. No complications noted during surgery. Post operatively, the patient developed sudden onset of left hemiplegia concerning for stroke. Initial CT head imaging showed sulcal effacement of the right frontal-parietal cortices. CTA head and neck was also performed which showed a large arterial dissection involving the right common carotid artery but no evidence of large vessel occlusion. Given her recent aortic replacement surgery, no evidence of large vessel occlusion, and her LKWT was beyond the 4.5 hour window, patient was not a candidate for IV tPA or mechanical thrombectomy. MRI brain without contrast showed diffusion restriction, FLAIR signal abnormality, and mass effect within the right middle cerebral artery territory. Right sided claustrum FLAIR signal abnormalities supports the possibility of seizure activity. Repeat CT head two days later showed persistent effacement of the right temporal lobes. Patient was started on Versed drip and started on Keppra and Vimpat. EEG showed diffuse slowing along with periodic lateralized discharges and epileptiform discharges suggestive of electrographic seizure activity. Doses of Keppra and Vimpat were increased. EEG eventually improved. Patient improved with no focal neurological deficits after seizures were treated.

Discussion

Periictal imaging findings is important to know as it may mimic other disease pathologies that may lead to different treatment and work up.

Not All That is Bright is an Abscess and not All That Enhances is a Lymphoma! A Rare Case of Double Biopsy Proven Acute Hemorrhagic Leukoencephalitis (AHEM)

Robin Wright, Haris Kamal

University of Texas McGovern Medical School, Houston, USA.

Background

We present the evolution of neuroimaging findings from diagnosis to treatment in a rare case of biopsy proven acute hemorrhagic encephalomyelitis that originally raised concerns for an intracerebral abscess and later in the hospital course, a CNS lymphoma.

Case

52 year old Vietnamese male presented to the ED with a two week history of left-sided weakness, numbness, headache and dizziness. On exam, the patient had left sided hemiplegia and left facial droop.

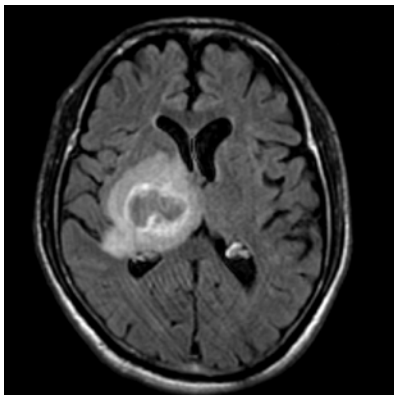
MRI Brain revealed a 3.4 cm peripherally enhancing lesion at the right thalamocapsular junction with perilesional edema and mass effect with leftward midline shift. DWI showed restricted diffusion with an ADC correlate. The patient was started on broad-spectrum antibiotics for suspicion of an intracerebral abscess. Initial LP showed WBC 63 (92% lymphocytes), 2 RBC, 100 glucose (serum glucose was 296), protein of 41. The patient continued to clinically worsen and thus a biopsy was obtained which showed lymphocytic infiltration with abundant macrophages, microglial and astrocytic activation, myelin pallor and loss and flecks of hemosiderin suggesting microhemorrhages, which was consistent with a hemorrhagic encephalomyelitis (AHEM). The patient was started on high dose IV steroids. Repeat MRI Brain showed new contrast enhancing hyperintensities near the occipital horn of the right ventricle concerning for seeding of a possible CNS lymphoma. Repeat biopsy was done which confirmed the initial findings of AHEM and no evidence of a lymphoma. MRI Brain done after 5 cycles of plasmapheresis and cyclophosphamide infusions over 6 months showed significant reduction in the lesion size and enhancement.

Conclusions

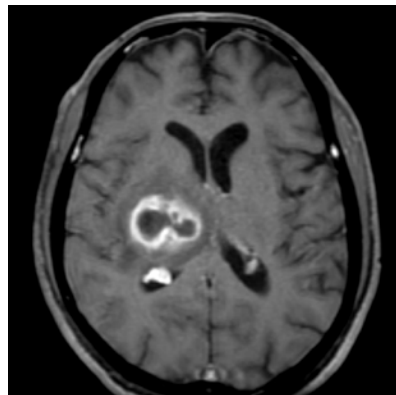
AHEM is a rare condition with a high mortality and morbidity if not diagnosed and treated early. Neuroimaging can be effectively utilized to narrow the diagnosis in this high acuity illness.

Initial MRI Brain:

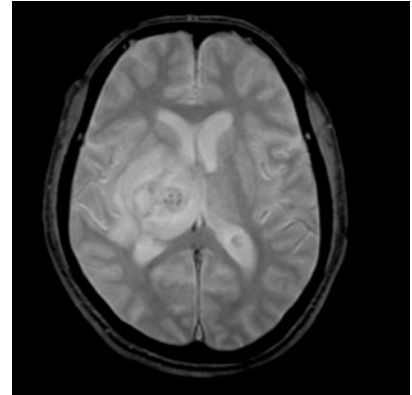
FLAIR



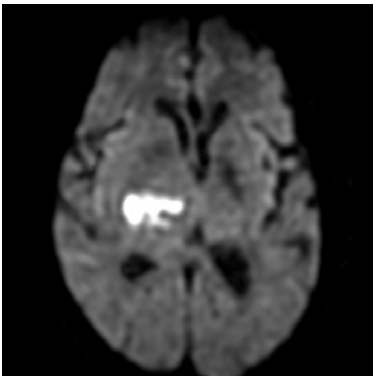
T1+C



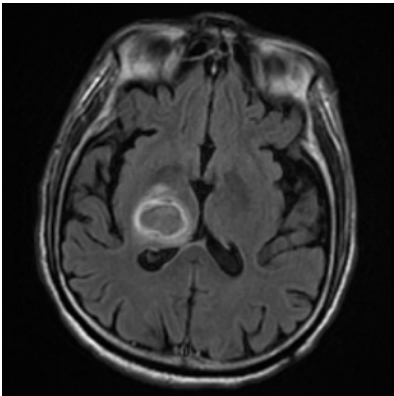
GRE



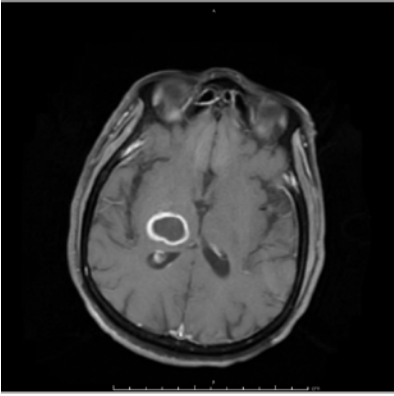
DWI



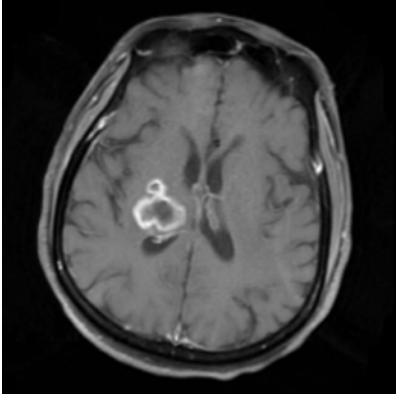
Subsequent MRI:
FLAIR



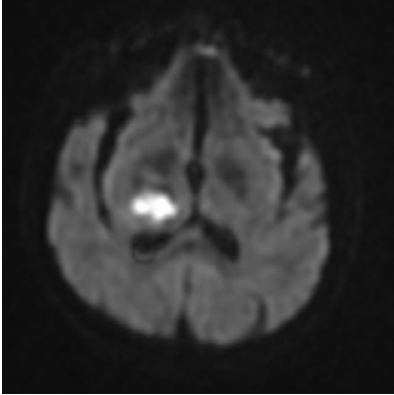
T1+ C



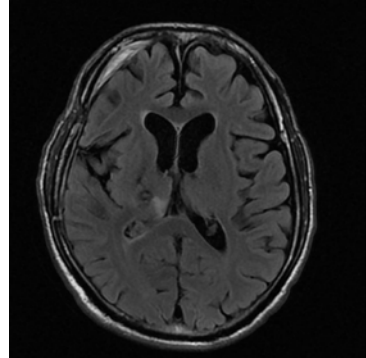
T1+C



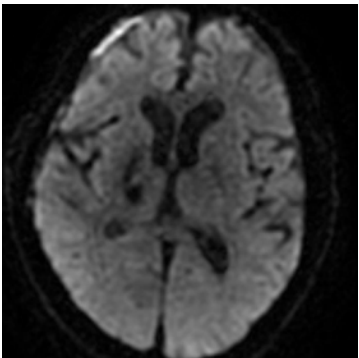
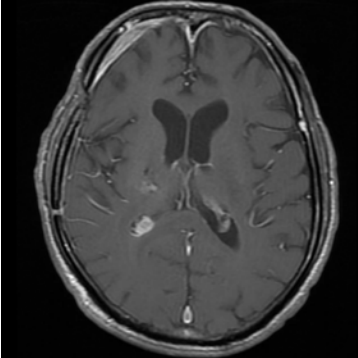
DWI



Post Treatment MRI at 6 months
T1+C



FLAIR



Neuroimaging Outcomes of a Cognitive Rehabilitation Training Program

Christina Ledbetter¹, Amy Moore²

¹LSU Health Science Center, Shreveport, USA. ²Gibson Institute of Cognitive Research, Colorado Springs, USA.

Cognitive training has shown promise in the remediation of cognitive skill deficits resulting from injury or neuropathology. It is presumed that intensive cognitive training can drive neuroplasticity and thus is the mechanism underlying associated gains. MRI is a non-invasive technique by which the manifestation of changes in neuroplasticity can be assessed, and while the majority of MRI studies assessing cognitive training outcomes are group studies, MRI techniques may be sensitive enough to assess effects of a robust cognitive training program, such as ThinkRx, at the single subject level.

ThinkRx (LearningRx®) is an intensive, 60+ hour, one-on-one, clinician-delivered cognitive training program based on the Cattell-Horn-Carroll (CHC) theory of cognitive abilities, and targets multiple cognitive skills including attention, working memory, processing speed, logic and reasoning, auditory processing, and visual processing. Observational results in a TBI population (n=273) found a mean increase of 10 points in IQ score, and a retrospective chart review of 11 soldiers with brain injury found a mean increase of 23 points, as well as reliable and clinically significant change (Ledbetter, Moore, & Mitchell, 2017).

To investigate if aberrant brain connectivity and changes in brain connectivity (a neuroimaging marker of neuroplasticity), were evident prior to and after completion of a robust cognitive training program, a series of case studies were carried out in subjects with varying degrees of traumatic brain injuries (n=5) and cognitive impairment (n=5).

An MRI image acquisition protocol optimized for single subject imaging and sensitive enough to allow for repeat visualization of the resting-state default mode network (DMN) was developed on a 3T Siemens Skyra MR system and included acquisition of the following: a T1-weighted sequence for high-resolution anatomical imaging, a diffusion-weighted sequence for identification of white matter fiber tracts, and an EPI-BOLD sequence (TR=3 sec, 240 acquisitions, scan time=12 min) for assessment of resting-state brain connectivity. MR exams were acquired on all subjects prior to and upon completion of the cognitive training program. MRI data were processed and analyzed using FreeSurfer and the CONN toolbox. In addition to MR exams, all subjects completed pre/post neuropsychological testing (WJ-IV) and condition-specific rating scales.

For all cases and a control subject, the DMN was visualized and within network connectivity quantified. Pre-training scans of the more severely impaired cases revealed varying degrees of aberrant DMN connectivity, including hyper-connectivity, hypo-connectivity, and a loss of anticorrelated (or negative) connectivity. Pre-training scans of the less impaired cases did not suggest the involvement of the DMN nor vastly abnormal brain connectivity. As such, pre/post scans of the more homogeneous least impaired cases were analyzed at the group level. For all cases neuropsychological testing and qualitative outcomes measures increased, supporting that the robustness of the training program held for each imaged case study. Normalization of DMN connectivity, including decreased hyper-connectivity and reoccurrence of anticorrelated activity, was evident in the most severe TBI case. At the group level, significant training-induced changes in neural connectivity were identified. Two of the notable changes included (1) a significant (p-FDR=0.002) increase in anticorrelated activity between the posterior cingulate and the left anterior temporal fusiform, and (2) a significant increase (p-FDR=0.007) in language network connectivity specifically between the right frontal gyrus and the left supramarginal gyrus.

In conclusion, quantitative and qualitative gains across subjects suggest that ThinkRx is a robust cognitive rehabilitative training program. Further, these results support the hypothesis that MRI can be used to visualize default mode network connectivity, even at the single subject level, and to quantify changes in resting-state brain connectivity at both the single subject and group level.

Primary Diffuse Large B-Cell Lymphoma of the CNS in an Immunocompetent Patient Presenting with Abulia and Falls

Tanner Anderson, Sunil Mutgi

Gundersen Health System, La Crosse, USA.

Introduction

Primary Central Nervous System Lymphoma (PCNSL) is a rare malignancy representing approximately 2% of all central nervous system (CNS) malignancies. Early identification and management of this condition are crucial. Establishing this diagnosis is often challenging due to the diverse clinical presentation. We present an unusual case of a patient with PCNSL exhibiting prominent abulia and falls.

Patients (or Materials and Methods)

A 70 year old man presented to movement disorder clinic with a 6 month history of falls, tremor and progressive loss of interest. On examination he demonstrated diffuse paratonia and hyperreflexia. He had right sided apraxia but no other focal neurological features. His affect was flattened, and he displayed complete indifference to his current situation. He continued to rapidly decline over the following two weeks becoming more withdrawn, near catatonic in appearance, and was admitted for further evaluation. While awaiting results of testing he continued to decline. He underwent a trial of steroid therapy without improvement. Ultimately, he was discharged with hospice and succumbed to his illness.

Results

MRI brain demonstrated edema in the posterior fossa with nodular parenchymal and curvilinear leptomeningeal enhancement as well as subtle leptomeningeal enhancement along the precentral gyrus of the left hemisphere. MRA brain demonstrated subtle non-specific vascular irregularity. Lumbar puncture pathology demonstrated mild lymphocyte-predominant mononuclear pleocytosis without evidence of malignant cells on flow cytometry analysis. Brain biopsy demonstrated diffuse large cell B-cell lymphoma, germinal center cell phenotype.

Conclusion

Primary central nervous system lymphoma is a rare malignancy with unique diagnostic challenges. Our patient demonstrated symptoms that could easily be mistaken for a neuropsychiatric condition. This case provides the opportunity to review an atypical presentation of PCNSL and to review the benefits of MRI imaging when used in conjunction with other testing to aid in diagnosing this clinically diverse condition.

Could CT Cerebral Angiogram be used as a Surrogate for CT Perfusion?

Zerlene Lim, Andrew Bonura

Liverpool Hospital, Sydney, Australia.

Noncontrast CT brain is most commonly used to assess for cerebral changes in cases of suspected CVA; being readily available and allow for rapid image acquisition.

Cerebral perfusion CT and MRI are increasingly being used to identify the cerebral penumbra or ischaemic tissue, that may be amenable to reperfusion with thrombolysis.

However, availability of MRI and CT perfusion in suspected cases of CVA is often limited to tertiary centres, due to cost, time and personnel constraints. Availability of these services is also often limited to business hours.

We postulate that parenchymal changes can be seen on CT cerebral/carotid angiogram that are not apparent or poorly visualised on the noncontrast CT brain. And thus propose that CT cerebral angiogram may act as a "substitute" for CT cerebral perfusion studies/ arterial phase study in cases of suspected cerebral ischaemia/infarct. This will allow radiologists to increase their diagnostic confidence of there being an acute ischaemic event, even before assessment of the cerebral vasculature is performed.

Use of CT cerebral angiogram/carotid angiogram in this manner may be particularly be useful in institutions without MRI/ CT cerebral perfusion capabilities, and after (business) hours. This may improve patient access to thrombolytic therapy.

Identification of a penumbra using this method would also increase diagnostic confidence of the radiologist in there being an acute ischaemic event.

A secondary aim of the study is to assess for interobserver variability in assessing for cerebral perfusion changes-in this case between a senior (4th year) registrar and a senior consultant (>10 year post FRANZCR experience).

A series of MRI brain/noncontrast CT brain/CT cerebral angiograms will be selected by a third party (Senior Staff Specialist), with a set number of positive (cerebral infarct/ ischaemia) and control studies.

These will be reviewed by the blinded Senior staff specialist and registrar.

The noncontrast CT brain will be individually assessed for parenchymal changes suggestive of infarction or ischaemia. Data recorded for each case will include: side of changes (right or left), vascular territory of parenchymal changes, and size of infarct (small/medium/large).

The CT cerebral angiogram will also be assessed with a similar criteria.

The data will be analysed as follows:

1. infarct seen on noncontrast CT brain and CT cerebral angiogram=cerebral infarct.
2. no infarct/ischaemia on noncontrast CT brain and ischaemic changes on CT cerebral angiogram=ischaemia/penumbra
3. The findings of each case will be correlated with findings on subsequent CT brain or DWI MRI sequence, to assess whether there is a true cerebral infarct.

Data will also be analysed to assess whether there is significant interobserver variability between radiology consultant and registrar.

Aorto-tracheo/pulmonic Fistula from Squamous Cell Carcinoma Leading to Cerebral Air Embolism

Ryan Hakimi¹, Sarah Hierholzer²

¹*University of South Carolina-Greenville Health System, Greenville, USA.* ²*Greenville Health System, Greenville, USA.*

Introduction

Cerebral air embolism is most often associated with invasive procedures or surgery. Spontaneous cerebral air embolism is an uncommon occurrence.

Materials and Methods

64-year-old female with a history of CAD, COPD, HTN, DM-II, tobacco abuse presented to the ED after being discovered comatose by her family with last known well one hour prior. Head CT showed subarachnoid air consistent with cerebral air embolism. CTA chest revealed a 7x8cm mediastinal mass, with supraclavicular lymphadenopathy. Biopsy of the mass confirmed the diagnosis of squamous cell carcinoma. Neurological examination continued to decline as the patient had a STEMI and repeat head CT revealed diffuse cerebral edema. Family chose to pursue comfort care.

Results

Cerebral air embolism is often quickly considered in the per-procedural time period when acute neurological change is noted. In patients presenting with acute neurological change in which there is no antecedent procedure, pulmonary vascular imaging should be considered to identify the source of the cerebral air embolism.

Conclusion

Primary pulmonary sources of cerebral air embolism are rare and should be considered when there is no antecedent procedure.

Lumbar Puncture as a Treatment for IVH in Patients with a Good Neurological Examination

Mahsa Pahlavanzadeh¹, Ryan Hakimi²

¹*Clemson University, Clemson, USA.* ²*University of South Carolina-Greenville Health System, USA.*

Introduction

Isolated intraventricular hemorrhage in the absence of an identifiable parenchymal or subarachnoid component is only seen in 3% of ICH cases. Treatment of such patients remains quite variable and includes observation, EVD drainage, and EVD combined with fibrinolysis.

Materials and Methods

A 57-year-old male with history of hypertension presented with a severe headache, non-focal neurological examination, and malignant hypertension. Head CT showed IVH with mild obstructive hydrocephalus. CTA head was negative for AVM or aneurysm. Neurosurgery declined EVD placement due to GCS of 14 and a non-focal neurological exam. Lumbar puncture was performed to reduce the intraventricular blood burden and alleviate the obstructive hydrocephalus. CSF opening pressure was 34 cm H₂O and after removal of 28 mL of bloody CSF the closing pressure was 17 cm H₂O. A second LP was performed on the following day and 15 mL of bloody CSF was removed. Ultimately, the patient improved and was transferred out of the ICU and later to home with home health.

Results

This patient's overall good neurological exam did not justify EVD placement but the extensive IVH placed him at risk for worsening obstructive hydrocephalus and possible shunt placement. Serial lumbar puncture was able to reduce the intraventricular blood burden while minimizing the procedural risk to the patient.

Conclusion

Treatment of patients with large IVH and good neurological examination remains unclear. Serial lumbar puncture may serve as option in patients in whom the procedural risk of EVD placement would not be justified due to the patient's good neurological exam.