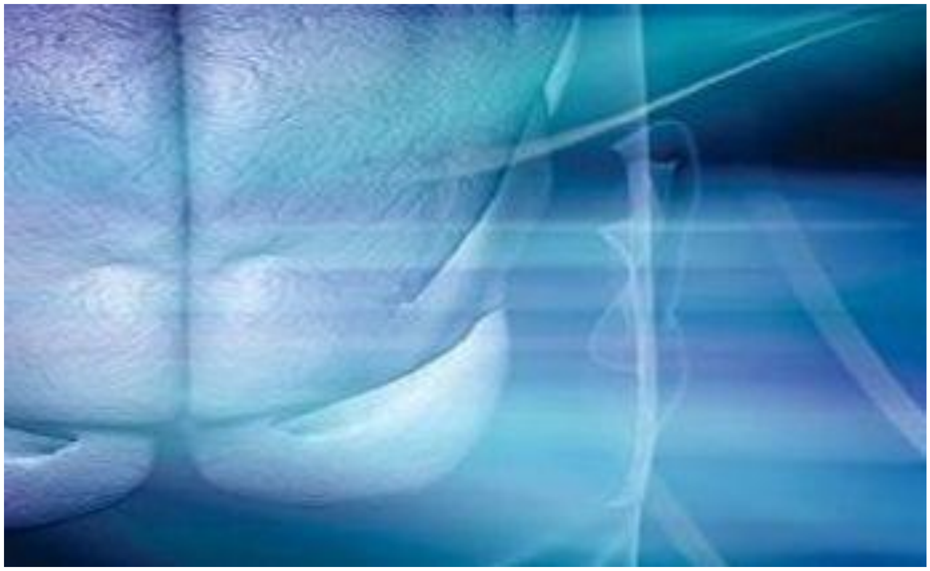

OFFICIAL JOURNAL OF THE AMERICAN ORGANIZATION OF
NEUROLOGICAL SURGEONS And ACOS NEUROSURGICAL SECTION

VOLUME 10, 2010

INSTRUCTIONS FOR AUTHORS

Papers submitted should be original documentation, including photographs. The papers should be single column, double-spaced. The title should be in title case and bold, followed by Authors, degree, organization and city, state.

The papers should contain an abstract and be separated into sections with bold typing of the section title. The page set-up should be 0-6.5 inches. Paragraphs should be indented 0.5 inches. All tables should be submitted separate from the paper. If possible make the tables up to 3 inches wide so that they could fit into a column. This will allow quicker scanning and preparation.

References should be numbered, tab, name of authors. Title of paper. Journal. Year volume:pages.

All papers, correspondence and DUES can be submitted to the:

American Organization of Neurological Surgeons

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EDITOR'S PAGE

Physicians in training, learn and practice research "To formulate, ingrain, and measure, a method of thought, investigation, and evaluation necessary for physicians to have multi-lateral information exchange and communication with experts in areas of scientific and medical discovery, knowledge, and analysis, in order to continuously and efficiently improve human health and patient care." Understanding and performing quality research provides students and residents the tools to propel quality medical care into the community and into the future.

Welcome to the Journal of the American Organization of Neurological Surgeons and the American College of Osteopathic Surgeons Neurosurgical Section. This volume is composed of the Residents' annual papers that were submitted but not published elsewhere. It is therefore dedicated to the future Neurosurgeons and their education. All papers were reviewed by the peer review committee and selected for awards. The papers submitted are excellent, representing some of our talented colleagues. Issues will be published annually. I hope that this issue will spread the knowledge of our residents and our section. We will continue to solicit annual papers and all papers submitted at the annual meeting. This is your Journal paid for by your annual dues. This issue is available on our website AOANeurosurgery.org. This is your organization; please support it as you can.

Thank you,

Dan Miulli, D.O, F.A.C.O.S
Editor

After reviewing many papers this year we have ranked these papers as the top three for the 2012 Annual Neurosurgery Resident Paper Award.

The awards will be presented in person at the ACOS-NSD Reception on Saturday September 29, 2012 at 6:30 PM. The Residents are expected to give a 10 minute Powerpoint Presentation on Sunday September 30, 2012 in the afternoon during the Neurosurgery Discipline meeting. First place receives $1500.00; Second Place $1000.00; and Third Place $500.00.

1st Place
Salvatore Zavarella, DO, Identification of the Rho guanine nucleotide exchange factor, Trio as novel therapeutic target for medulloblastoma invasion, Hofstra North Shore-LIJ Hospital, New Hyde Park, NY

2nd Place
Sudhakar Vadivelu, DO, Occipital nerve stimulation for refractory headache in the Chiari malformation population, Hofstra North Shore-LIJ Hospital, New Hyde Park, NY

3rd Place
Kamran Parsa DO, Incidence of Vertebral Artery Injury with Traumatic Cervical Spine Subluxations, Arrowhead Regional Medical Center, Colton, CA

We wish to congratulate the many residents who submitted excellent papers.

Incidence of Vertebral Artery Injury with Traumatic Cervical Spine Subluxations

Kamran Parsa DO, Omid Hariri DO MSc, Farid Jamshidian PhD, Dan Miulli DO, Javed Siddiqi MD PhD

Arrowhead Regional Medical Center, Department of Neurosurgery

Abstract

Introduction:

The incidence of vertebral artery injuries in traumatic cervical spine subluxations has been reported to be highly variable, 3%-88% [1-6]. These arterial injuries can be potentially devastating. Therefore, the purpose of this study was to investigate the incidence of vertebral artery injuries at our institution, the second busiest trauma center in Southern California.

Methods

Retrospective data analysis was collected from our institution's trauma registry from January 2000-June 2011 to analyze the incidence of vertebral artery injury, Blunt Cerebrovascular Injury (BCVI) Grading, and the anatomical extent of injury.

Results

A total 852 patients (mean age: 40.2 ± 1.30, 582 male, 270 female) presented with traumatic cervical spine fractures. 102 (12%) patients had cervical spine subluxation injuries**.** 13 patients had subluxed cervical spine injuries with vertebral artery injuries**.** This is 1.5% [$P < 0.01$, 95% confidence interval (CI) of 0.00-0.02] of all cervical spine fractures presenting to Emergency Department, and 12.7% of all traumatically cervical subluxation patients. Injuries according to the Blunt Cerebrovascular Injury (BCVI) Grading were: 1 (6.6%) Grade V (transection), 9 (69.2%) Grade IV (occluded), 3 (23.1%) Grade II (dissection).

Conclusions

As far as we can tell, this is the largest study that specifically evaluates incidence of vertebral artery injuries in traumatic fracture-subluxations of the cervical spines. At our institution over the past 11.5 years, our data suggests that we have a 12.7% incidence of vertebral artery injury in patients with traumatic fracture-subluxations of the cervical spine. We found no VA injuries secondary to isolated linear or chip fractures into the foramen transversarium (which has traditionally been our most common indication for CTA to rule out VA injury). With exception noted below, there was no incidence of vertebral artery injury with fracture alone. All VA injuries in our series were in the face of fracture-subluxation or subluxation without fracture. All of the vertebral artery injuries in our data where due to subluxations, except for gunshot wounds (n=2). All vertebral artery injuries were unilateral. Occlusion (Grade IV) was the most common form of vertebral artery injury associated with traumatic subluxation. Our frequency of VA injury by location in the C-spine varies from classical teaching. VA injury seems to be more common in patients older than 20 yrs, than those younger (despite the fact that younger patients are disproportionately represented in our trauma cohort)

Introduction

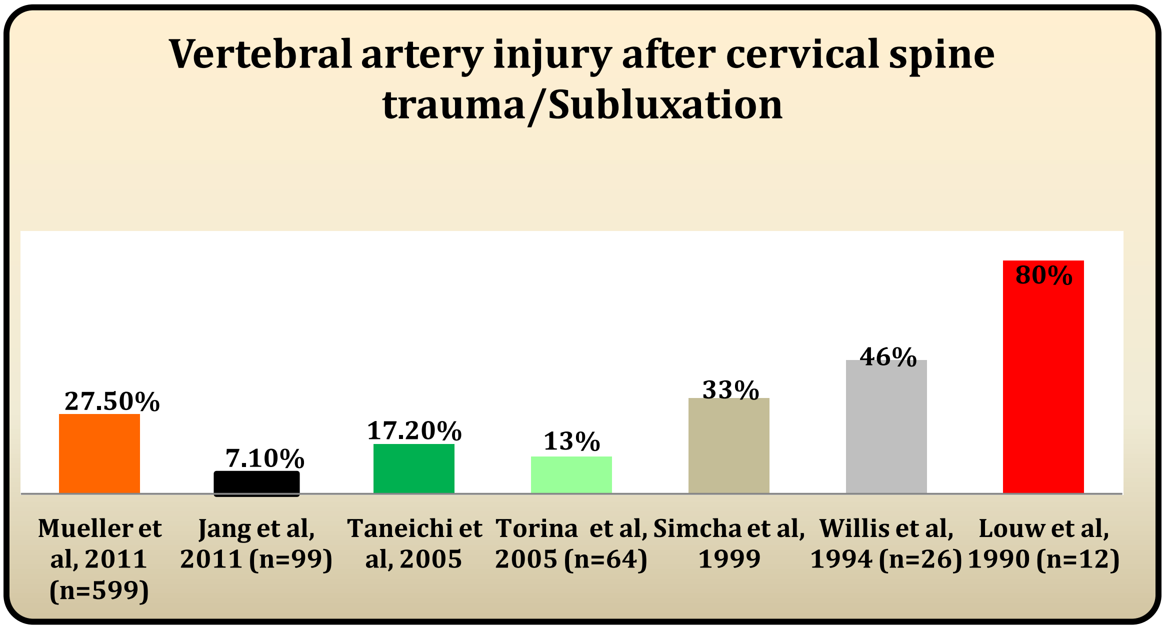
Historically the incidence of vertebral artery injuries in traumatic cervical subluxations has been reported to be highly variable, 3-88% (1-6). In fact, none of the studies that we could find in the literature directly evaluated vertebral artery injuries in traumatic events. Instead these studies reported the incidence of such injuries indirectly as part of another study they were evaluating.

The two most recent studies that were applicable to our study were the ones performed by Jang et al and Mueller et al. As shown in figure 1, these studies reported the incidence of vertebral artery injuries to be 7.1% and 27.5% respectively.

Jang et al looked at vertebral artery injuries after all types of cervical spine traumas. Their study was performed in Korea as a prospective study evaluating all cervical spine traumas with a CTA on arrival to the ED. Within their study they reported only 2 patients with fracture subluxations that sustained a vertebral artery injury. They did not report on the characteristics of the subluxations or the characteristics of the vertebral artery injuries. Their result of 7.1% was from all types of spine trauma resulting in vertebral artery injuries, which was not specific to subluxations.

Mueller et al also performed a prospective study to evaluate the vertebral artery injuries in cervical spine traumas. Their study, which was performed in Germany, involved performing formal angiograms on all patients with suspected vertebral artery injuries. They did not specifically report the number of subluxations, just mentioning that half of the vertebral artery injuries were associated with an unstable spine requiring surgical intervention. Just like Jang et al, this study did not specifically look at subluxations, however it did have a large subject number, 599 over a 16 year period.

Figure 1:



Therefore, the purpose of our study is to specifically report the incidence of vertebral artery injuries with cervical spine traumatic subluxations. Our study, also has the largest subject number over any previous studies (n = 852) over a 10 year period. In addition, we were able to use the data to look at the most common type of cervical spine injuries and classify their fractures. Also we were able to use standard grading to evaluate the type of vertebral artery injury and associated neurological deficits.

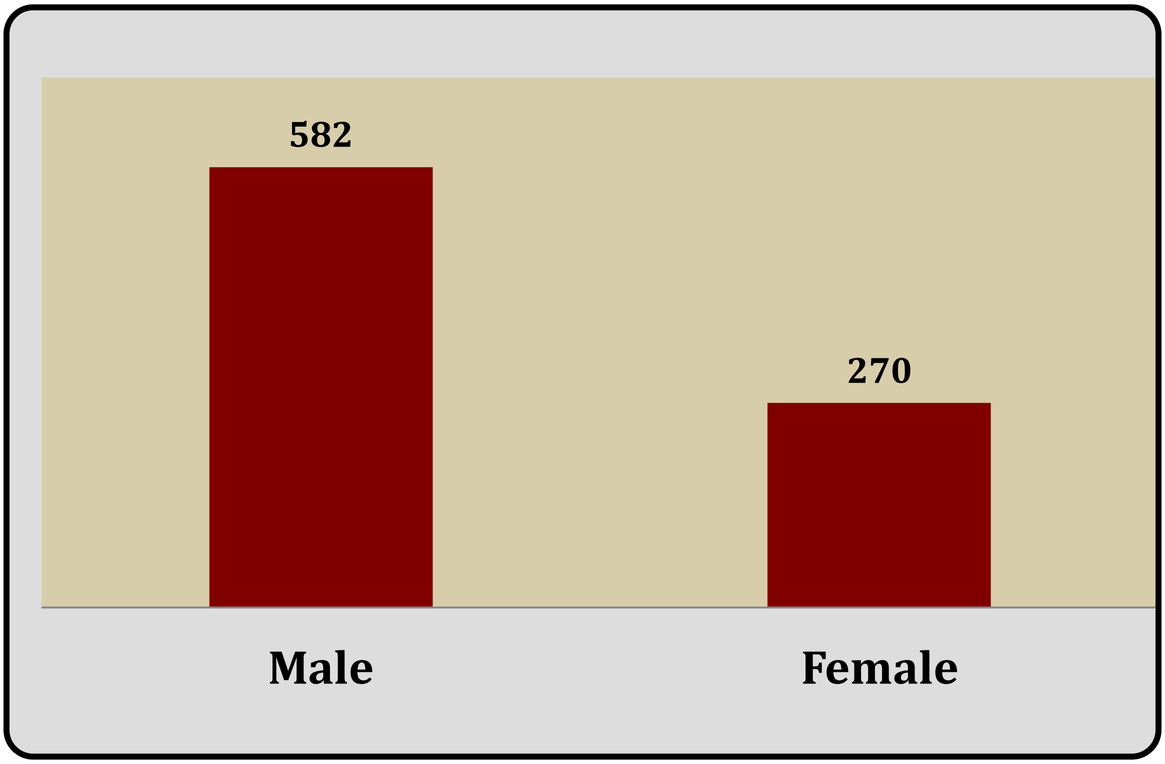
Methods

Our study is a retrospective data analysis that was collected from our institution's trauma registry from January 2000-June 2011. The Search criteria included:_ (1) All traumatic cervical spine fractures presenting to the emergency room or transferred from other hospitals. (2) All traumatic subluxed cervical spine patients. (3) All traumatic vertebral artery injuries.

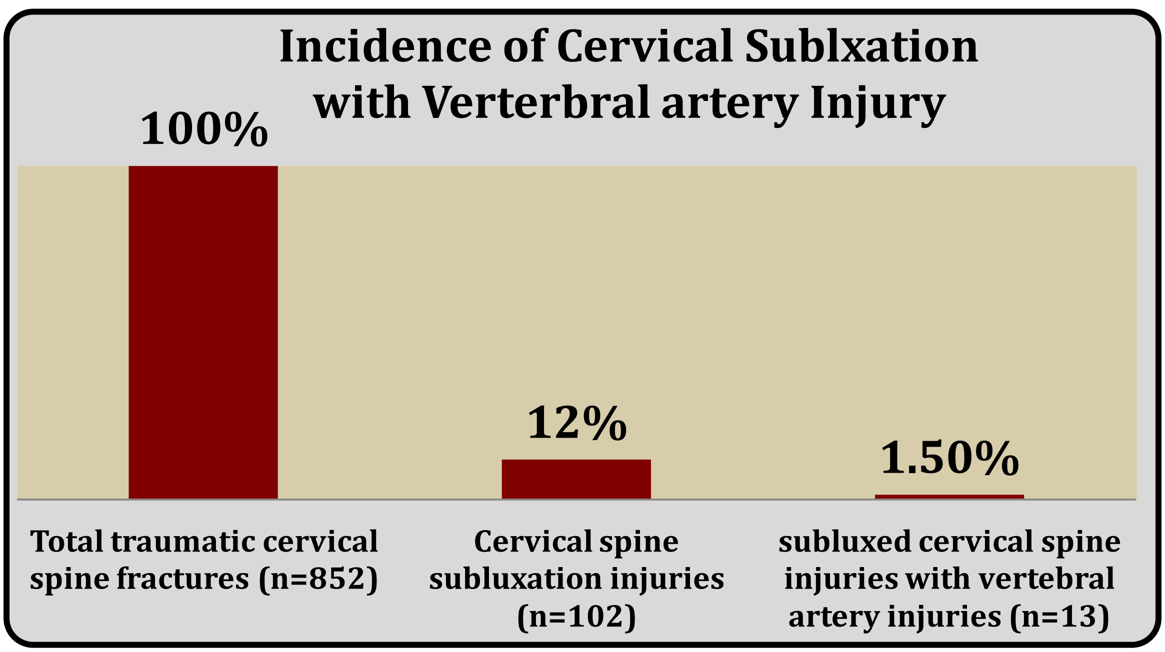
The Exclusion criteria included:_ (1) No radiology imaging report available to review (n=5). (2) Injury occurring because of damage to subclavian artery (n=3). (3) Injury occurring because of damage to neck soft tissue without fracture (n=2). (4) Imaging radiology report not consistent with reported injury in records (which was the most common exclusion criteria) (n=15).

All diagnosis was made via CT and CT angiogram. The radiologist determined final diagnosis of whether vertebral artery injury had occurred.

Results

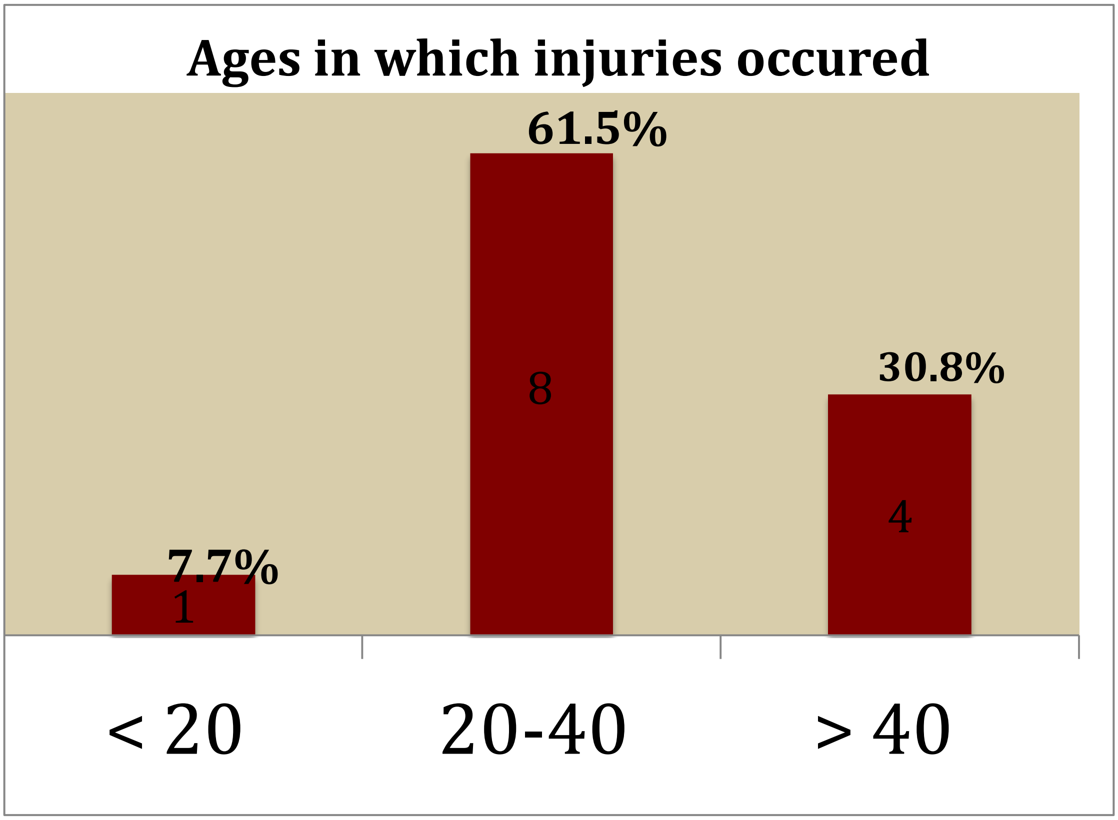


A total 852 patients (mean age: 40.2; 582 male, 270 female) presented with traumatic cervical spine fractures.

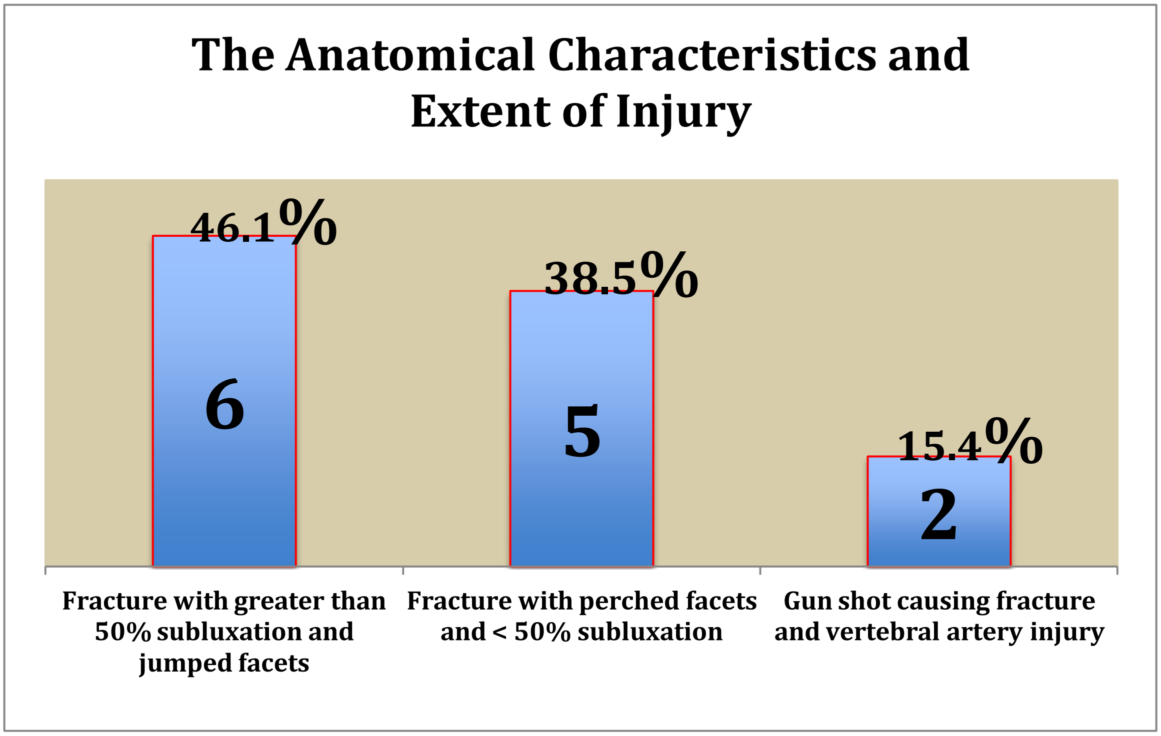


102 (12%) patients had cervical spine subluxation injuries. 13 patients had subluxed cervical spine injuries with vertebral artery injuries. This is 1.5% [$P < 0.01$, 95% confidence interval (CI)

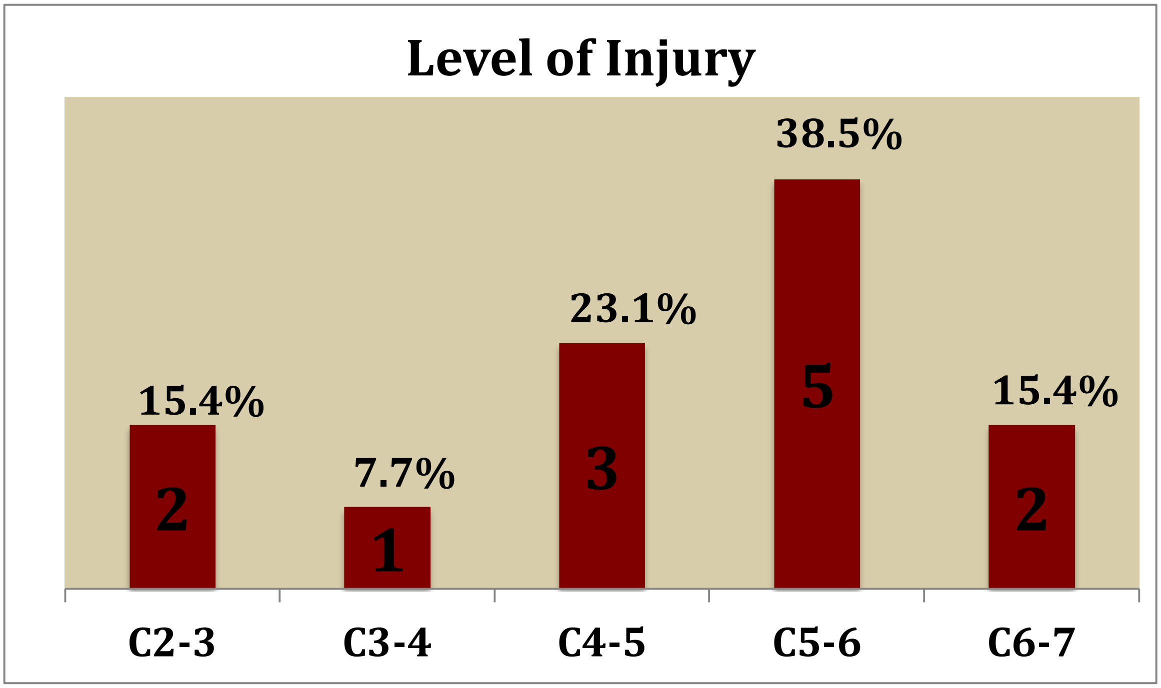
of 0.00-0.02] of all cervical spine fractures and 12.7% of all traumatically cervical subluxation patients.



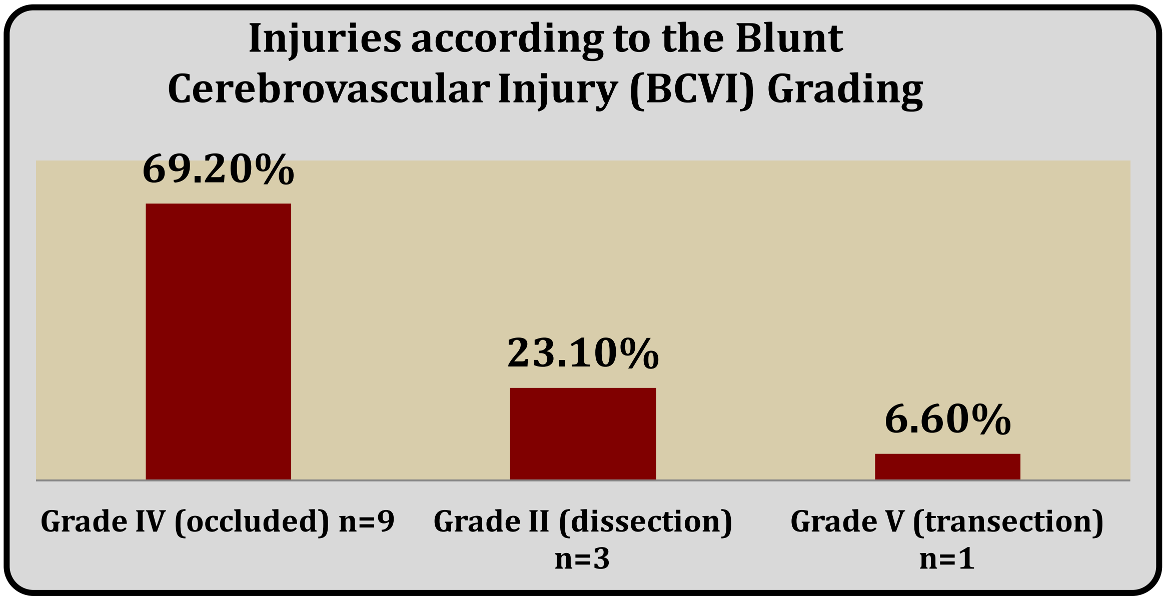
The most common age range in which vertebral artery injuries occurred as a result of cervical spine subluxations was between 20-40, 61.5% (n=8). 30.8% (n=4) were greater 40 years of age and only 1 (7.7%) was less than 20 years. Even though there was a proportionately higher number of cervical spine fractures in this age group n= 250 from 852 (29%). 51% were in the 20-40 year range and 20% in the greater than 40 range.



Injury characteristics from the left column included 4 patients that had bilateral jumped facets. The other 2 had unilateral jumped facets and the other facets were perched. In these two patients the vertebral artery injuries occurred on the side of the jumped facets. Injury characteristic from the middle column included all 5 patients having bilateral jumped facets.



C6-7 subluxations/fractures were the most common level (32/102: 31.4%), yet they had a relatively low incidence of vertebral artery injuries. This is likely secondary to the anatomy as the vertebral artery enters the C6 transverse foramen and therefore is more mobile and less susceptible to injury at this level.



Injuries according to the Blunt Cerebrovascular Injury (BCVI) Grading were:
1 (6.6%) Grade V (transection), 9 (69.2%) Grade IV (occluded), 3 (23.1%) Grade II (dissection). All injuries were to one vertebral artery and there were no patients with bilateral vertebral artery injuries. There were no intracranial vertebral artery injury, no subarachnoid hemorrhage, and only one dissection that did not extend or throw emboli.

Conclusion

At our institution over the past 11.5 years, our data suggests that we have a 12.7% incidence of vertebral artery injuries when associated with traumatic subluxation and fractures. This is the largest study conducted that specifically evaluated incidence of vertebral artery injuries in traumatically subluxed cervical spines. There was no incidence of vertebral artery injury without a fracture. All of the vertebral artery injuries in the data set where due to subluxations, except for gunshot wounds. None were a result of linear or chip fractures into the foramen transversarium. All vertebral artery injuries were unilateral. Occlusion (Grade IV) was the most common form of vertebral artery injury associated with traumatic subluxation. Cervical 6/7 subluxations had a relatively low incidence.

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Hydrogen Peroxide Solution as an Inexpensive, Intraoperative Hemostatic Agent during Complex Spine Surgery: Technical note and Report of 50 cases

Samer El Fallal D.O., Mohammed Al Shardan & Haroon F. Choudhri M.D.
Department of Neurosurgery, Georgia Health Sciences University, Augusta Georgia USA

The authors describe their routine use of a 50:50 solution of Hydrogen Peroxide and Saline as an adjunct to intraoperative hemostasis in spine surgery. This solution is widely used in intracranial Neurosurgery and its use has been described in other fields such as Dermatology, Plastic Surgery and Dentistry, however, there have been no reports describing its use in spinal surgery.

KEY WORDS: HYDROGEN PEROXIDE – HEMOSTASIS – BLOOD LOSS – SPINE SURGERY

INTRODUCTION

Intraoperative hemostasis is a vital part of almost any surgery and spine surgery represents a number of unique challenges in this regard. Large fields of exposure with diffuse bleeding from muscle and bone are commonly encountered as well as delicate structures and tiny spaces where avoiding cautery would be preferable. Commonly used strategies to achieve hemostasis include thermocoagulation, mechanical and chemical techniques. Thermocoagulation typically involves monopolar and bipolar cautery. Bone wax and suture ligature represent common mechanical hemostatic techniques(18). Chemical methods using thrombin, oxidized cellulose as well as various starches and gelatins (microfibrillar collagen) are also used. Each of these has its own advantages and disadvantages. For example, many surgeons wish to avoid bone wax while performing fusions and when the risk of infection is elevated.

A review of the literature does not reveal any papers describing the use of hydrogen peroxide:saline solution for hemostasis in spinal surgery. Although this solution has been commonly used in intracranial neurosurgery to control diffuse bleeding where coagulation and tamponade are not suitable. Although there are no clinical reports of problems with this technique, in some laboratory investigations there are reports of injury to arachnoid and stroma as well as neuronal and glial injury to a depth of 1 mm in rats(6). One report in humans using a 3% (undiluted) hydrogen peroxide irrigation described similar findings. The hemostatic mechanism of hydrogen peroxide is not fully understood. Some theories include thermal injury to vessels, liberation of intimal lipid deposits, air embolization, formation of fibrin thrombi and spasm of small arterioles.

Complex spine surgery, in particular multilevel fusions, involve wide exposure with the potential for substantial bleeding. After initial subperiosteal dissection, small amounts of diffuse bleeding aggregated over a large incision can result in substantial oozing during decompression.

Similarly, boney bleeding, especially if bone wax is avoided, can result in troublesome and continuous bleeding. Thrombin soaked gelfoam is very useful for diffuse bleeding from focal areas where cautery is ineffective or undesired, however, when the bleeding is more diffuse or coming from muscle, this technique is less effective(17). We do not utilize hypotensive anesthetic techniques due to the increased risks of pressure sores, cardiac events, compromised wound healing and blindness.(5)

TECHNIQUE

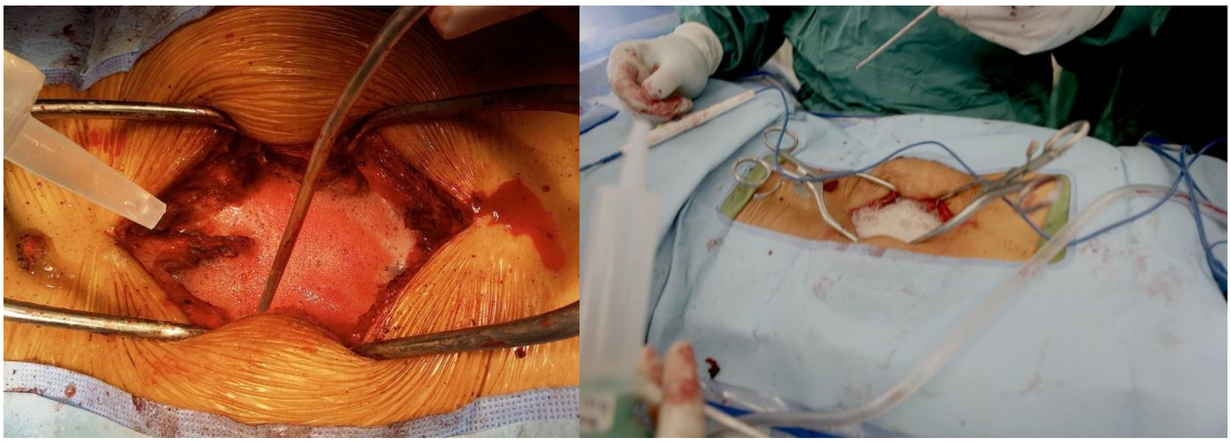

Figure 1: Intraoperative pictures of lumbar exposure after irrigation with peroxide solution.

We reviewed fifty consecutive cases with attention to fusion rates, infections and wound healing. No adverse effects were noted in any of these cases which consisted of a mix of anterior cervical, posterior cervical as well as thoracic and lumbar spinal surgeries. Approaches were standard anterior cervical and posterior midline exposures. In all cases, a 50:50 solution of 3% Hydrogen Peroxide and Saline was used to irrigate the surgical field. Typically, the field is irrigated after the exposure is completed, after the decompression is completed and after all hardware is in place prior to closure. Additional rinses are used as needed when there is diffuse bleeding or a pause in the operation such as while waiting for radiographic images. The field is flooded with 150 cc of the solution and copious bubbles are noted. The excess solution is removed by suction and the wound is left full of solution for a dwell time of 5-10 seconds which is followed by removal of the remaining solution and irrigation with an antibiotic solution (typically Bacitracin and Gentamycin) to remove most remaining bubbles.

We have found that after irrigating the field, adequate hemostasis is obtained in both soft tissue and boney surfaces. Isolated persisting bleeding is usually readily controlled at this point. We did not identify any adverse reactions in this series.

DISCUSSION

Hemostasis remains an important aspect of the practice of surgery. Excessive blood loss is associated with transfusions, increased infections, longer operative times and increased complications associated with the resulting impaired visualization of the surgical field. Although a variety of hemostatic agents are available, there are associated costs and drawbacks to each. For the unique need to control diffuse bleeding from muscle and bone as well as the epidural space in a large wound, we have found that 50:50 solution of Hydrogen Peroxide and saline is extremely effective and inexpensive. Although Bone wax is commonly used in spinal surgery to control bleeding from boney surfaces, particularly cancellous bone, this physical barrier inhibits osteogenesis and bone union. (1,2) In the presence of bone wax, osteoblasts will be absent in a bone defect (3). In defects were bone wax was applied and removed after 10 minutes, there was complete inhibition of bone regeneration (4). For this reason, many surgeons opt not to utilize bone wax in regions where bone fusion is critical. We continue to utilize thrombin and gelfoam, however, the ability to cover large areas of diffuse bleeding is limited with this technique. Excessive use of electrocautery also is associated with tissue injury

Hydrogen Peroxide is a nonallergenic, inexpensive and is readily available in most operating rooms and yields excellent hemostasis without significant associated risks of toxicity(8,9,10,11). In our institution, such a solution is developed from a small or large bottle of Hydrogen Peroxide costing 10 and 30 cents respectively. A further advantage of hydrogen peroxide is that it is easily inactivated and decomposed by living tissue and does not persist in a wound or impair fusion. The rapid degeneration of hydrogen peroxide to water and oxygen is facilitated by the ubiquitous enzyme catalase. In this series of 50 patients, we noted successful hemostasis with no associated adverse events in terms of wound healing and fusion.

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Use of a tubular retractor system during an awake craniotomy for resection of Glioblastoma Multiforme

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Division of Neurosurgery, Arrowhead Regional Medical Center, Colton, CA and Department of Neurosurgery, Kaiser Permanente Fontana Medical Center, Fontana, CA

INTRODUCTION

Self-retaining retractors came to widespread use in neurosurgery during the early 1980's, as first described by Greenberg, for removal of intraparenchymal tumors. It is well known, however, that aggressive retraction can lead to significant cortical injury from direct compression or secondary to local ischemia from vessel compression. There have been several techniques introduced to lessen the effects of aggressive retraction. In 1987, Kelly et al. documented the first use of tubular retractors for removal of brain tumors. Various tubular retractor systems have been documented in the literature to serve the purpose of minimizing the negative effects of compression by distributing pressure equally in surrounding brain tissue.

Increased brain retraction times have been shown to correlate with significant brain injury secondary to worsened cerebral edema, infarcts, seizures, among others. Animal studies have demonstrated that the flat, self-retaining brain retractors may lead to lower regional cerebral blood flow, especially with brain retraction pressures ranging 20-30 mm Hg. Rosenorn et al. demonstrated brain ischemia with brain retraction pressure 20-30 mm Hg for longer than 6-8 minutes. Andrews and Bringas report a 5% and 10% retraction associated injury with aneurysm and cranial base tumor cases, respectively. Ogura et al's findings document that the tubular retractor system has less than 10 mm Hg pressure surrounding the cylinder at all times. The versatility of the tubular retractor system and improvement on outcome has been recently gaining momentum.

In this article, we report a positive initial experience of utilizing frameless navigation paired with a tubular retractor system for resection of a Glioblastoma Multiforme during an awake craniotomy.

ILLUSTRATIVE CASE

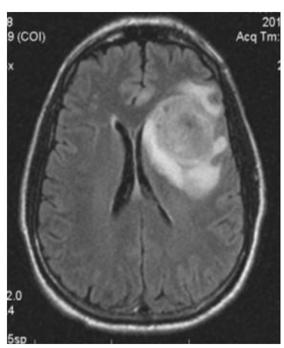
A 53 year old highly educated Caucasian male presented with speech difficulties, cognitive decline, and seizure over several weeks, found to have a LEFT frontal/parietal mass highly suggestive of glioma. Speech improved to an extent with high dose steroid treatment. Given the location of the tumor, it was recommended that the patient undergo an awake craniotomy with a frontal approach to avoid critical speech and language areas. Functional MRI obtained pre operatively demonstrated that language area, particularly Broca's area, was just over the tumor. Patient also underwent pre operative baseline neuropsychatric testing in preparation for an awake craniotomy. Post operatively, patient had no evidence of speech or motor compromise. The patient spent one of a total of two days in the ICU post operatively, before being discharged home. Final pathology was Glioblastoma Multiforme, WHO Grade IV.

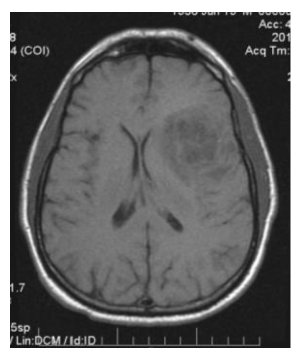
OPERATIVE TECHNIQUE

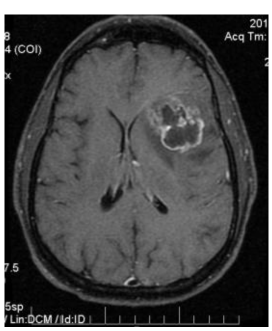
Preoperative MRI images were acquired for frameless sterotactic navigation and planning of trajectory via a left frontal approach. Patient's head was immobilized with Mayfield head holder. Frameless stereotactic navigation was utilized, tumor was marked out on the scalp, and incision was planned. A small linear scalp incision was made. Navigation was utilized to plan a small craniotomy. After the dura was opened, the patient was woken up. Language function was tested. The arachnoid over a sulcus was opened and using navigation, dissection was performed down to the tumor. An 11 mm Thoracoport was placed and a mass lesion consistent with tumor was directly visualized. The tumor was resected in piecemeal fashion. During this time, language and motor function were assessed throughout the surgery. A plane of dissection was made around the tumor which was followed down to the white matter. Tumor was removed from normal tissue. Hemostasis was obtained. Intraoperative ultrasound was also utilized for smaller areas of tumor which were resected under ultrasound guidance. There were no changes in language or motor function throughout the case. The patient was placed back to sleep. Hemostasis was achieved in the tumor cavity. The Thoracoport was removed slowly to allow for coagulation and hemostasis prior to inward collapse of the walls along the tract.

IMAGING

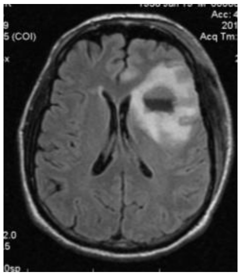
Preoperative :

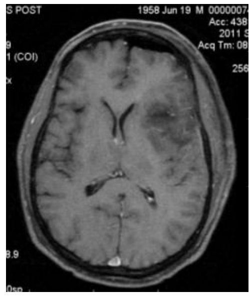


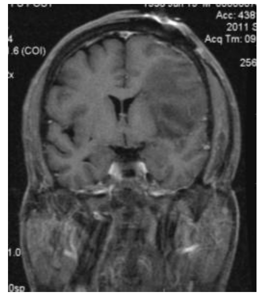


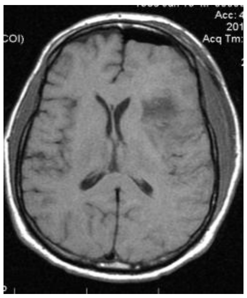


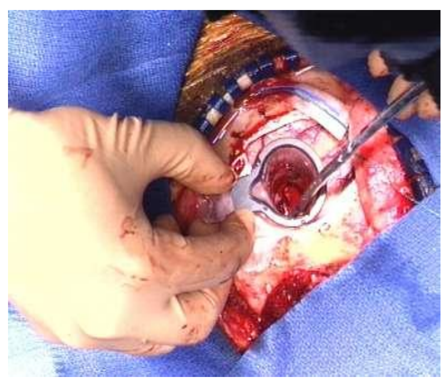
Postoperative:











DISCUSSION

The use of a tubular retractor system for resection of intraparenchymal and intraventricular brain tumors have been well described in the literature. This minimally invasive technique for brain surgery has been developed as a way to lessen the negative effects of compression on surrounding brain tissue. Brain retraction for extended periods of time has been shown to correlate with significant brain injury, contributing to cerebral edema, seizures, arterial and venous infarcts, and worsened cognitive and neurologic deficit. Multiple studies have compared the tubular retractor system with conventional retraction, with overwhelming support that tubular retractor systems not only provide a corridor for direct visualization of the tumor with the ability to freely move the port without causing damage, but also lessen the effects of aggressive retraction on brain tissue. The use of a tubular retractor system during an awake craniotomy has never been previously documented. The ability to combine this technique of retraction with an awake craniotomy for resection of a high grade neoplasm in eloquent tissue, shows promise in providing patients with a minimally invasive craniotomy, helping to prevent damage to surrounding eloquent brain tissue, while still allowing for complete or near complete resection of highly aggressive tumors.

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Spontaneous Superior Sagittal Sinus thrombosis after Lumboperitoneal Shunt Insertion for Pseudotumor Cerebri

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Pseudotumor cerebri, originally described as meningitis serosa by Quincke in 1893 (Quincke), is the syndrome of raised intracranial pressure in the absence of intracranial pathological findings. Clinically, it manifests with headache and papilledema accompanied by visual disturbance that may culminate in blindness. The Modified Dandy criteria must be met to diagnose a patient wih pseudotumor cerebri. The criteria are symptoms of increased intracranial pressure, no localizing findings in the neurologic exam (except for false localizing signs such as abducens or facial palsy), awake and alert patient, normal CT/MRI without evidence of dural sinus thrombosis, ICP of > 250mm H20 with normal cerebrospinal fluid and cytological and chemical findings (Binder). Conservative therapy consists of fluid and salt restriction, carbonic anhydrase inhibitors, weight loss and serial lumbar punctures When medical therapies fail, surgical options such as lumboperitoneal shunting, ventriculoperitoneal shunting, optic nerve fenestration are employed.

We describe the case of a 24 year old female patient with pseudotumor cerebri who had failed conservative treatment and received a lumboperitoneal shunt with revision two days later due to over-shunting. Two days later, she developed severe, constant headaches that were no longer postural in nature. CT of the head showed a large superior sagittal sinus thrombosis.

Case report

A 24 year old female with history of headaches since November 2010 was diagnosed with pseudotumor cerebri by her neurologist. The headaches were tension-like, weekly, worse with coughing or straining, associated with nausea, dizziness and occasional blurry vision. he patient was originally on therapy with acetazolamide and serial lumbar punctures, with minimal relief of her headaches. Fundoscopic exam was originally normal but she later developed bilateral papilledema. She presented for neurosurgical evaluation and consideration for lumbo-peritoneal shunt in March 2011. At the time, she was eight months pregnant complaining of headaches, poor visual acuity and diplopia. On exam, she was obese with mild bilateral papilledema, otherwise non-focal. MRI of the brain showed bilateral focal luminal stenosis of the transverse sinus. Considering the patient was three weeks away from delivery, the plan was to continue with serial lumbar punctures and to proceed with optic nerve fenestration if her vision worsened. The patient would be re-evaluated for lumboperitoneal shunt post partum. In February 2012, the patient underwent lumboperitoneal shunt insertion. In the first two post-operative days, the patient developed severe postural headaches suggestive of over-shunting. Decision was made to take patient to the operating room for revision of the shunt with insertion of a medium pressure strata valve. The headaches had completely resolved until the fifth post-operative day when the patient developed severe headaches, no longer postural in nature. Immediate head CT demonstrated large superior sagittal sinus thrombosis. The patient was transferred to the intensive care unit and anticoagulation with intravenous heparin was initiated. Hematology's hypercoagulable workup was negative. The patient remained neurologically stable and without any focal deficits throughout the hospital stay. She was discharged home on post-operative day twelve with an anticoagulation regimen. On follow up appointments, she is doing well, her headaches have resolved and remains on chronic anticoagulation.

Discussion

Lumboperitoneal shunting is a common efficacious procedure for the management of pseudotumor cerebri. In large reviews (Chumas, Johnston I, Rosenberg), the most common complication of lumboperitoneal shunting was obstruction, accounting for 65% of revisions. Other less common complications are infection, low-pressure headaches, acquired Chiari 1 malformation, syringomyelia, subdural hematomas and shunt migration (Binder).

To our knowledge, this is the first case report of superior sinus thrombosis after lumboperitoneal shunting. Risk factors in our patient were obesity, recent surgery, occasional smoking, recent pregnancy and use of intra-uterine devise (progesterone only). The incidence of sinus thrombosis during pregnancy has been reported from 1 in 10,000 to 1 in 25,000 representing 160-400 episodes per year (Manthous CA). During the puerperium, venous sinus thrombosis usually occurs during the first seven postpartum days (Bansal BC). Our patient was five months post partum. The etiology of puerperal sinus thrombosis is unclear but the suggested mechanisms are damage to the sinuses due to fluctuations in intracranial pressure during delivery and an increase in thrombotic tendency due to changes in coagulation factors. There is increased platelet adhesion and an increase in clotting factors (fibrinogen and factors VII, VIII and X) (Borum SE). The underlying pathology consists of nodural hyperplasia of eccentric distribution, with increased acid mucopolysaccharides and replication of the internal elastic lamina (Irey).

Intracranial hypotension may result in cerebral venous thrombosis by several hypothesized mechanisms. According to the Kellie-Monroe doctrine, intracranial hypotension is associated with venous engorgement due to cerebrospinal fluid (CSF) loss. The dilatation of cerebral veins and sinuses decreases venous blood flow. Transcranial Doppler ultrasound measurements have shown halved blood flow velocities after lumbar punctures (Canhao P). The bulk of CSF is absorbed from the subarachnoid space through the arachnoid villi of the superior sagittal sinus. The absorption of CSF at this location is determined by the equation of Davson et al:

CSF absorption = (Pressure of CSF – Pressure of superior sagittal sinus)/ Resistance across arachnoid villi.

The equation above suggests that with healthy arachnoid villi a gradient of 3mm Hg is needed for absorption to occur at this site (Owler). Therefore, CSF absorption and CSF pressure are governed by the venous pressure in the superior sagittal sinus. In addition, reduced buoyant forces in supporting the brain underlie these vascular complications. The downward displacement of brain from depleted CSF volume and traction on dural veins causes the cerebral veins to dilate in order to compensate for the decreased intracranial volume.

On the other hand, increased blood volume and stagnant flow in engorged cerebral veins may predispose to venous thrombosis. The resulting higher pressure of the thrombosed sinuses impedes the absorption and circulation of CSF from subarachnoid space to the cerebral venous circulation via the arachnoid granulations. In addition, the thrombosis of cerebral veins disrupts the blood brain barrier leading to intracranial hypertension. The thrombosed cerebral veins increase cerebral pressure, reduce the capillary perfusion pressure and increase blood volume (Fillipidis A). The most commonly affected sinus is the superior sagittal sinus because of turbulent blood flow in this area (Lockman LA).

Early diagnosis in cerebral venous sinus thrombosis is critical yet challenging because the presentation is highly non specific. The importance in making this diagnosis is reflected in the 2004 the International Study on Cerebral Vein and Dural Sinus Thrombosis (ISCVT) study. The median delay from onset of symptoms to the diagnosis was seven days (Ferro JM). The severity of the cerebral sinus thrombosis and the presenting symptoms are affected by the patient’s age and medical condition, the anatomical location of the involved sinus and the extent of thrombosis/parenchymal involvement. Headache is the most common presenting symptom. Nausea, vomiting, papilledema, visual disturbances and possibly a sixth cranial nerve palsy also predominate. The picture becomes even more complicated in patients with underlying headaches and non specific neurologic complaints. Our patient complained of a different kind of headache than her baseline chronic headaches.

Conclusion

To our knowledge, this is the first reported case of superior sagittal sinus thrombosis as a complication of lumboperitoneal shunt insertion for pseudotumor cerebri. In this patient, the cerebrospinal fluid dynamics and intracranial pressures changed from high pressures pre-operatively to over-draining and intracranial hypotension post-operatively, followed by normalization of pressures after revision surgery with valve insertion. The clinical picture and neurologic exam can be very non-specific, therefore a high index of suspicion is crucial.

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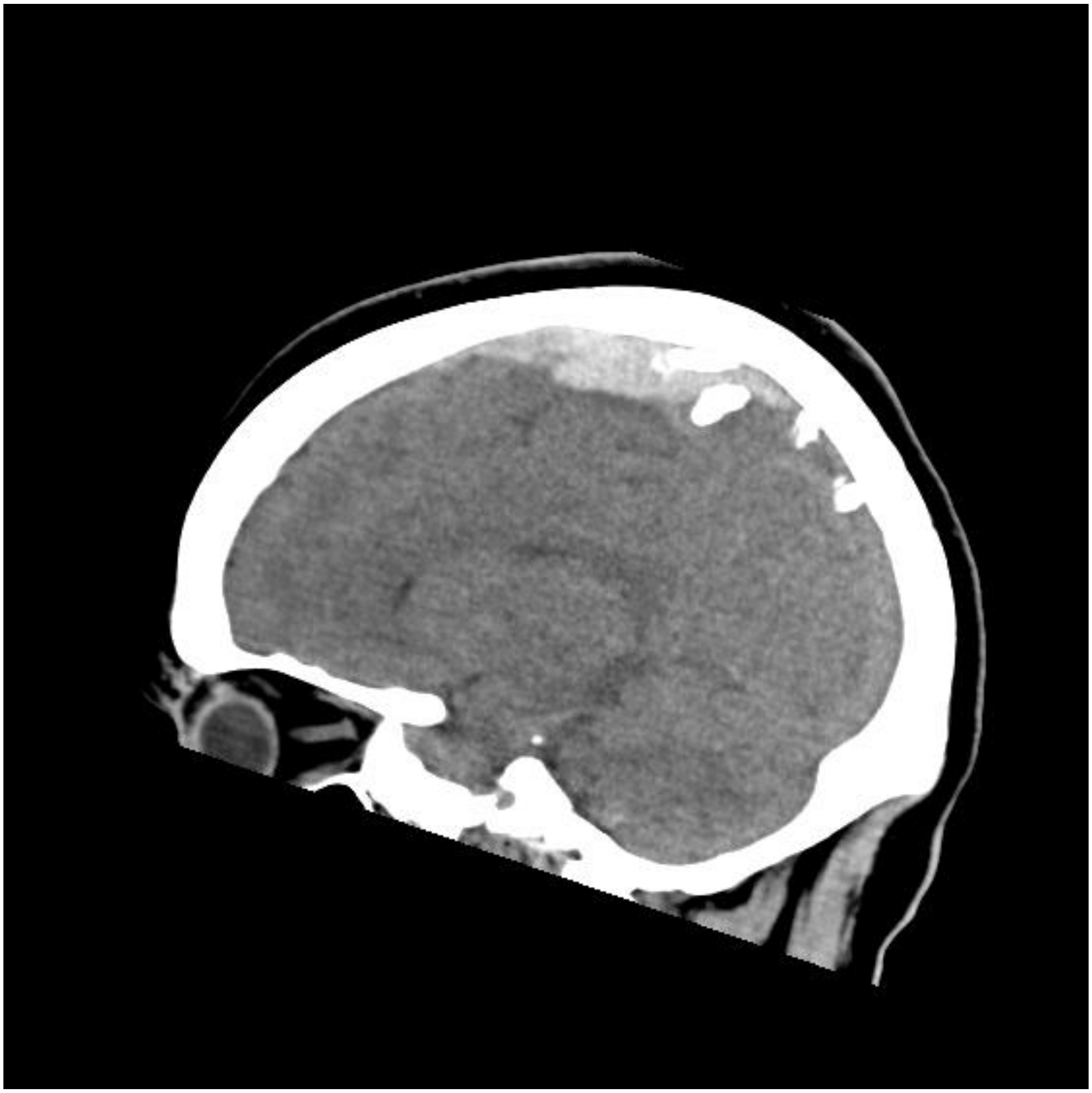

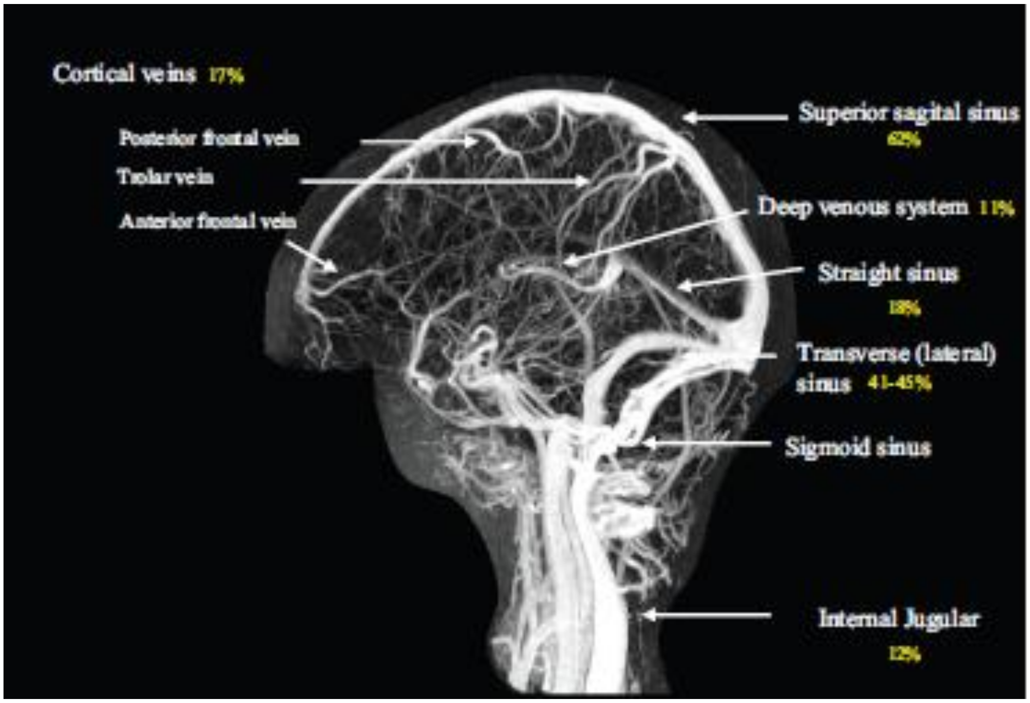

Stroke, 2011 , 42, 1158-1192

Case Report: Synovial Chondromatosis causing L5 radiculopathy

Joey Watson, MD; Josh Martin, MD; Joseph Chabot, DO, Ricky Madhok, MD

Abstract: Synovial chondromatosis is a rare, benign metaplastic condition involving the proliferation of cartilaginous tissue from joint spaces. This condition, which has also been referred to as osteochondromatosis, is only rarely found in the spine. A review of the literature reveals only eleven such cases, 2 located in the lumbar spine. We describe a report of the twelfth case, the third found in the lumbar spine, with a review of literature.

Case Report

History and Presentation: A 29 year-old otherwise healthy female presented with left-sided radicular pain radiating to the lateral aspect of her left leg. These symptoms had been intermittent for the last two years, but worsened over the last month. Physical exam revealed decreased pinprick sensation in the L5 distribution, with mild EHL weakness. The straight leg raise test was normal, but the patient had an antalgic gait favoring the left side. Reflexes were normal, and all other muscle groups were normal. MRI revealed a paraspinal mass in the left L5-S1 region. The lesion was removed completely and had significant relief from her symptoms peri-operatively. 6 month follow-up revealed no recurrence on MRI, and complete symptomatic resolution.

Radiology: MRI revealed a well-circumscribed 3x3x3.5 cm septated, partially cystic mass, in the left L5-S1 paraspinal space entering the L5-S1 neural foramen. T2-weighted images were hyperintense (Figures 3 and 4), and T1-weighted images isointense (Figure 1). The lesion enhanced peripherally with gadolinium (Figure 2). It appears exophytic from the neural foramen and its adjacent facet.

Differential Diagnosis: The differential diagnosis should include extraskeletal chondroma, degenerative joint disease, along with the more aggressive chondrosarcoma[8, 12]. Chondromatosis, like chondrosarcoma, display prominent nuclear polymorphism and hypercellularity.[12] The presence of spindle-shaped epithelial cells points to the synovia as the origin and a nature that is more often than not benign[8,10]. Degenerative joint disease (DJD) often has osteocartilagenous loose bodies that resemble chondromatosis, however DJD lacks the nuclear polymorphism associated with chondromatosis[12]. Soft-part chondromas resemble chondromatosis in that islets of cartilage characterize them both, however the chondromas rarely involve bone.[12] Vascular malformations, particularly low-flow venous malformations can appear similar on MRI, but have characteristic ultrasound findings.

Surgery: The patient was placed in a prone position and the lesion localized using Ultrasound. Flouroscopy was also used to verify the correct spinal level. A paramedian approach was taken to approach the lesion laterally and posteriorly. Once the muscles were dissected, a firm rubbery mass, could be palpated. The lateral and posterior edges were dissected, and the lesion was traced toward the L5-S1 neural foramen. The lesion was then stimulated to see if there was any EMG recording indicative of L5 nerve root involvement. There was a portion of the lesion entering into the L5-S1 neural foramen abutting the exiting nerve root. The lesion was debulked, and the remainder was dissected from the L5 nerve using a Kartush stimulating dissector. There was no visible tumor left, and the neural foramen was grossly patent.

Pathology: Grossly, the specimen was a whitish, lobulated mass that appeared cartilaginous. (Figures 5 and 6). Histologic examination of these lesions showed bizarre chondrocytes with lobules of hyaline cartilage with calcification consistent with chondromatosis[8,12] (Figure 7) The presence of epithelial cells within our specimen confirmed that its origin was indeed synovial (Figure 8).

Review of Literature: A Pubmed search was performed using the terms "osteochondromatosis" and "spine" and "synovial chondromatosis" and "spine"At the time of this case report only 11 cases of vertebral chondromatosis had been previously published in English literature, with our case being the twelfth. Six cases involved the cervical spine, three thoracic, and two in the lumbar spine[12]. From cases described thus far there appears to be a greater incidence of the development of these tumors in the cervical spine. The age-range of the data collected has been from 22-60 years of age, with most patients in the fourth decade of life. There is no attributable gender predilection (6 male, 6 female).[12] There was also no report of recurrence, once resected.

Discussion: Synovial chondromatosis is often a benign entity, but at times can prove to be aggressive in nature. It is often slow growing and confined to the joint spaces, in which the only presenting symptoms are pain or limited range of motion. The etiology is often idiopathic, and is characterized by a metaplastic transformation of synovial cells into cartilage cells[8] Although rare, extra-articular manifestations of chondromatosis have been reported, especially in the hands, feet, and wrist.[8] Although rarely occurring in the spine, its presence is marked by compromise of adjacent neural elements.

Conclusion: Synovial chondromatosis is a rare entity, especially in the lumbar spine. Since there has been no report of recurrence after surgical resection, the prognosis is generally good. Since in some cases it can radiographically mimic other lesions, especially low-flow vascular lesions, diagnostic modalities such as ultrasound may be used to aid in the diagnosis. However, since there is no data regarding treatment with radiation or chemotherapy, gross total resection remains the mainstay of treatment.

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Figure 1 (Axial T1 without gadolinium)

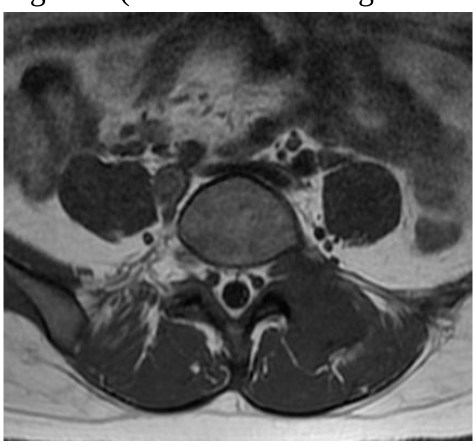


Figure 2 (Axial T1 with gadolinium)

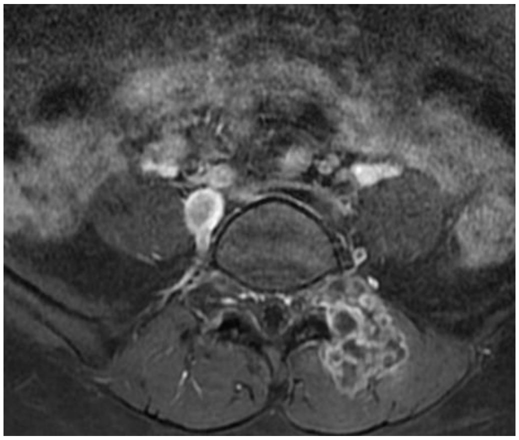


Figure 3 (Sagittal T2)

Figure 4 (Axial T2)

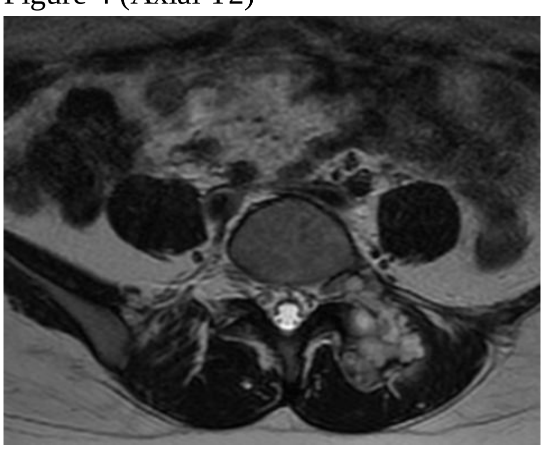


Figure 5

Figure 6

Figure 7

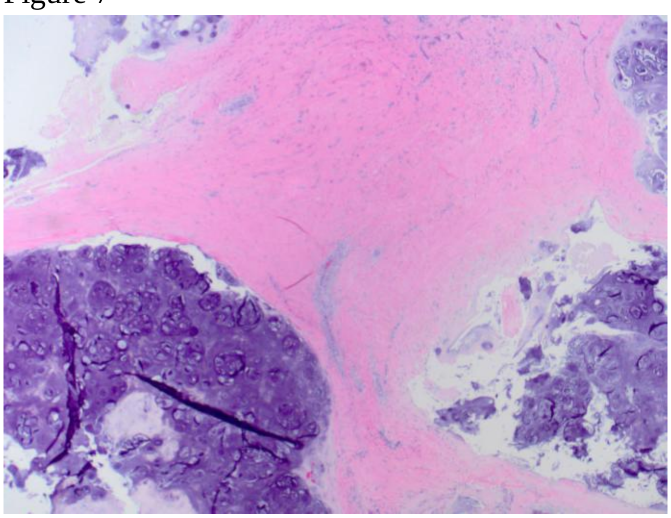
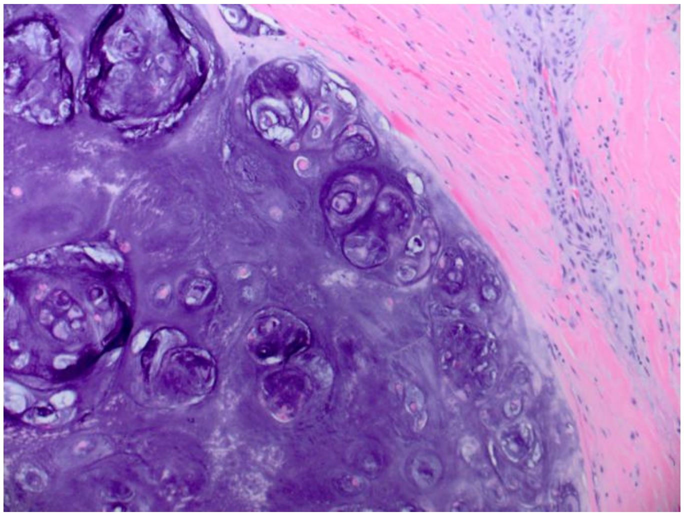


Figure 8



Cavernous internal carotid artery mirror aneurysms: A case study

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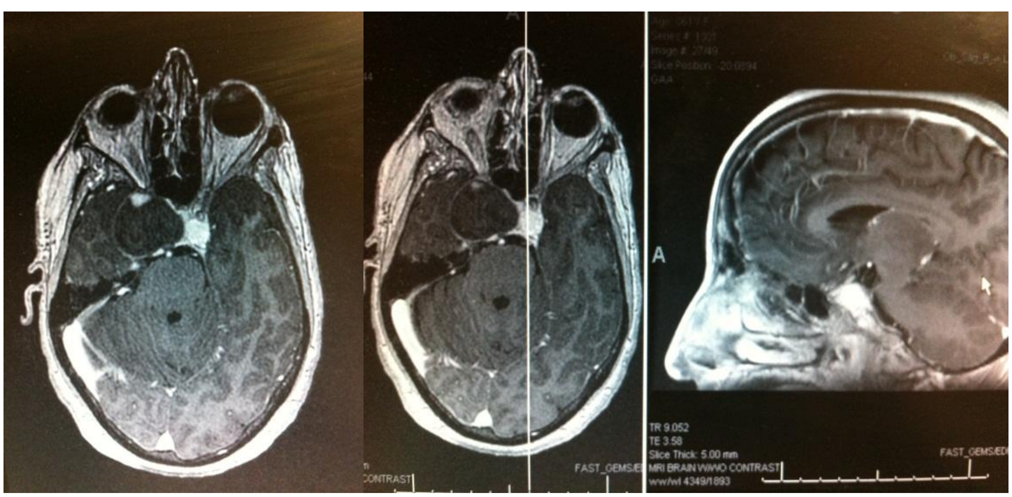
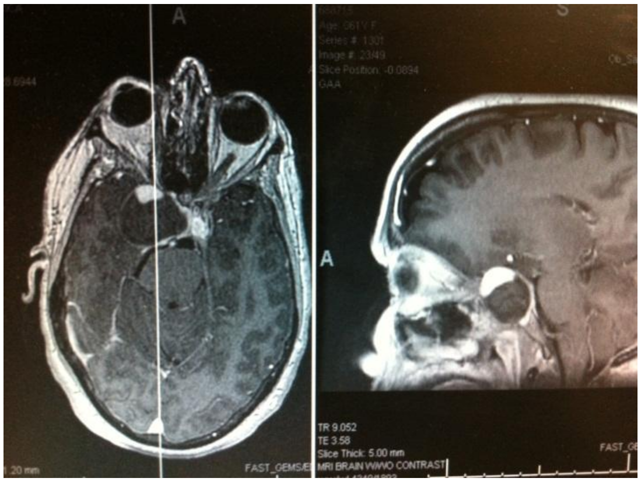
Introduction

PB, a 55 year old Caucasian American female presented for 3 day onset of ptosis in her right eye, patient complained of intermittent headaches and mild blurry vision. She reported positive history of migraines however, never accompanied by such symptoms. No loss of visual fields, no diplopia, no dizziness or light headedness. The patient had never experienced these symptoms before.

Upon physical examination, pupils were anisocoric; 6-4 mm & brisk on the right, 3-2 mm & brisk on the left. Her face was asymmetric with noticeable ptosis of the right eye. Extraocular muscles were intact. All myotomes and dermatomes were intact to strength and epicritic and protopathic stimulation. CT brain revealed right sided sellar hyperdensity suspicious for a mass. An MRI with contrast was ordered to rule out a mass and revealed a giant right sided thrombosed saccular aneurysm in the cavernous segment of the right ICA with good distal collateral flow. Unexpectedly however, the contrast study also revealed a mirror saccular aneurysm in the cavernous segment of the left Internal Carotid Artery, with the dome oriented medially. MRA revealed no signs of hemorrhage at this time. Contrast study revealed partial filling of the right sided partially thrombosed aneurysm. Mass effect on the right oculomotor nerve created the constellation of symptoms described above. Mass effect on the medial temporal lobe was seen due to the right sided aneurysm.





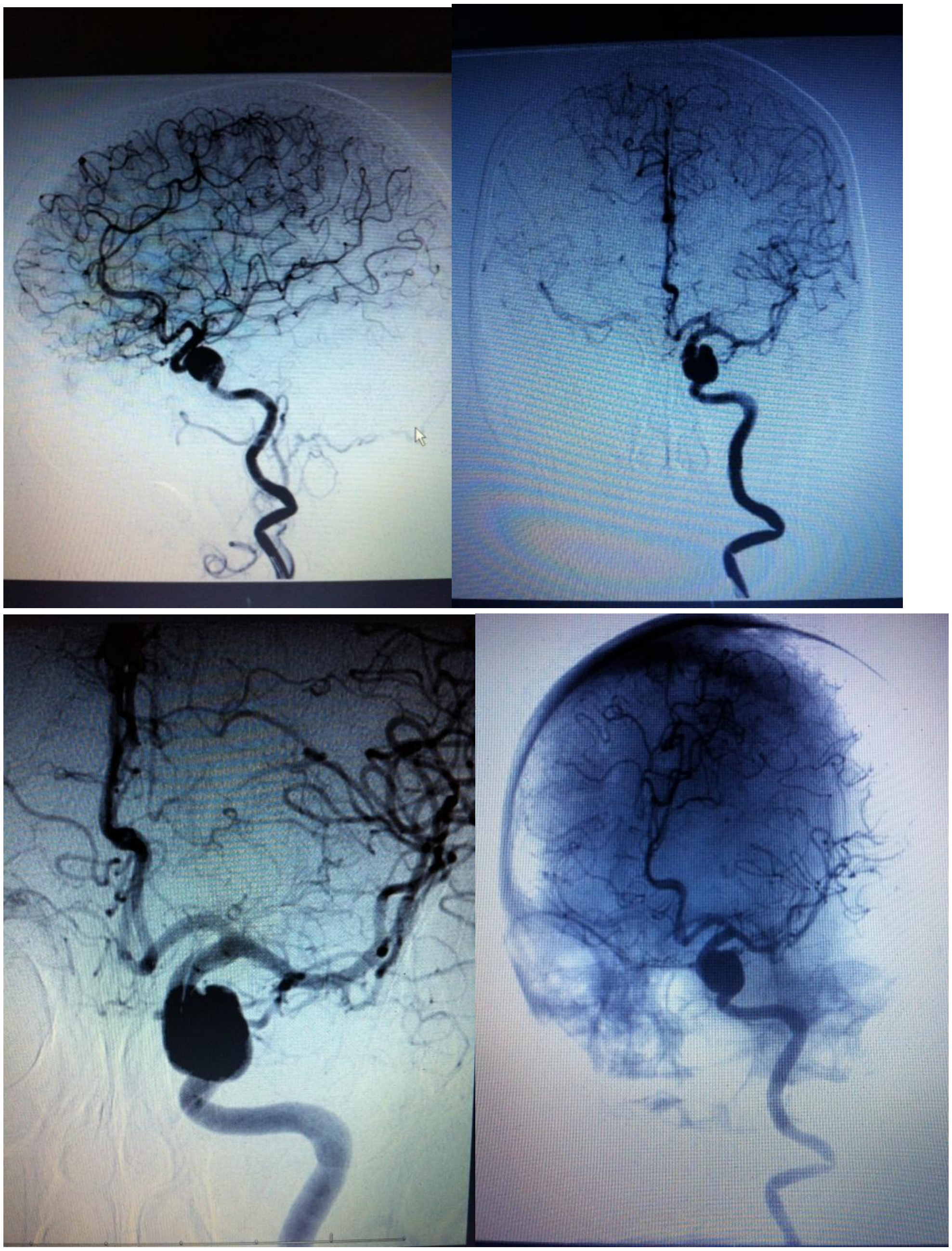
Mirror aneurysms are an infrequently encountered phenomenon in neurosurgical practice. In one study of 3120 patients with aneurysms treated in 61 centers, 376 (12% had mirror aneurysms). The location for the aneurysms in our case study was unusual as well. The most common distribution for mirror aneurysms was the middle cerebral artery (34% [126 patients]) followed by noncavernous internal carotid artery (32% [121]), posterior communicating artery (16% [60]), cavernous internal carotid artery (13% [48]), anterior cerebral artery/anterior communicating artery (3% [13]), and vertebrobasilar circulation (2% [8]).)

Gender distribution is predominantly female. These aneurysms are more common in women than men (82% [n = 308] vs 73% [n = 1992], respectively; p <0.001) and in patients with a family history of aneurysm or aneurysmal SAH (p <0.001).

Our Right sided giant aneurysm measured 3.4cm x 2.9cm x 2.8 cm, and the left measured 1.2 x 1.2 cm. Compared with patients with nonmirror saccular aneurysms, a greater percentage of patients with mirror aneurysms had larger (>10 mm) aneurysms (mean maximum diameter 11.7 vs 10.4 mm, respectively; p <0.001). When these patients were compared with patients without mirror aneurysms, no statistically significant differences were found in age (mean age 54 years in both groups), blood pressure, smoking history, or cardiac disease. Aneurysm rupture rates were similar (3.0% for patients with mirror aneurysms vs 2.8% for those without)

A neurointerventionalist was then consulted for a formal angiogram and an evaluation for coiling of the aneurysm and well as a balloon occlusion test. The angiogram revealed physiologic occlusion of the right petrous and lacerum segments of the right ICA due to mass effect from the large intercavernous thrombosed right ICA aneurysm. However, restoration of flow to the right ACA and PCA territories was re-established through the anterior communicating and posterior communicating segments. This made a possible future rupture of the left sided ICA aneurysm not only an emergency in and of itself, but an event that would jeopardize flow to the opposite side in the ACA and PCA distributions. Balloon occlusion test was therefore not performed. The patient was recommended to follow up with the neurointerventionist as an outpatient for coiling of the left sided aneurysm. A suggested method of approach to repair was stent assisted coiling of the aneurysm.

Upon follow up in our clinic, the patients right sided symptoms were much alleviated, however the coiling procedure has not yet been performed.



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