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Inside

Surgical Correction of Adult Thoracolumbar Idiopathic Scoliosis

BY MATTHEW GECK, MD

Patient History

The following case study involves a 54-year-old female with a long history of thoracolumbar idiopathic scoliosis (Figure 1). Because of the abnormal loading and stresses across the lumbar spine with everyday walking and activities of daily living, her lumbar spine has degenerated far faster than it would have without the scoliosis. **The patient experienced severe back pain from a combination of lumbar degeneration below the scoliosis, an "accordion" collapsing spine syndrome, as well as progressive lumbar spinal stenosis. Her lumbar spinal stenosis gave her a combined syndrome of classic neurogenic claudication as well as more focal radiculopathy with walking.**

The patient initially underwent conservative treatments that included physical therapy and epidural steroid injections. These treatments were successful at preventing the need for surgery for approximately two years. Her ability to walk significant distances, perform at her teaching job and live life to her satisfaction was preserved.

After two years, the injection therapy and physical therapy began to lose their effectiveness. Her walking tolerance fell to less than 25 yards because of her back and leg pain. She failed conservative treatment and began to feel incapacitated by her scoliosis. Risks, benefits and

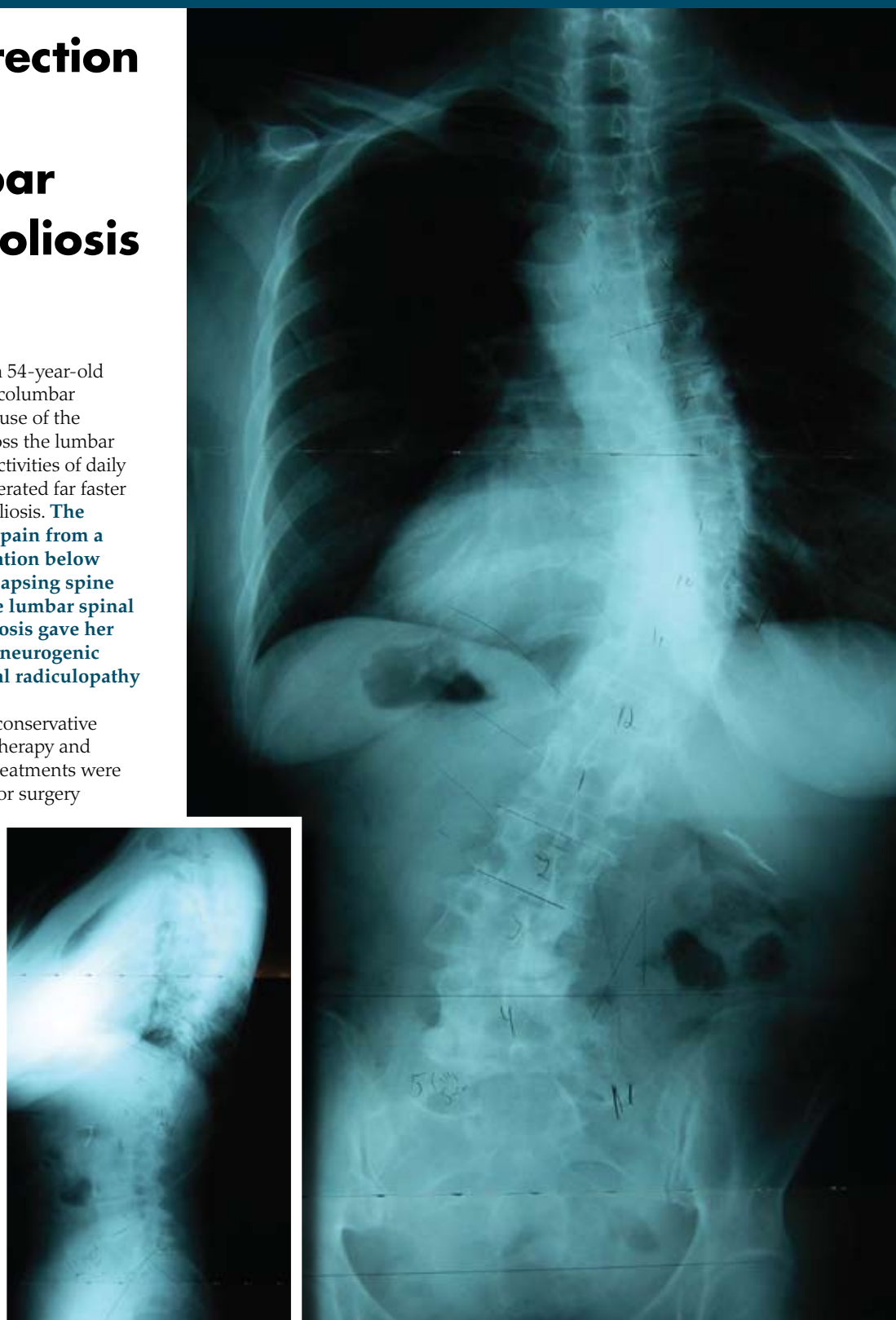

Figure 1A (far right): Pre-op PA View

Figure 1B (right): Pre-op Lateral View

alternatives were discussed, and ultimately surgery was scheduled. Smoking cessation was a requirement for the surgery and did cause a delay because of relapse.

Her lumbar spine showed a classic pattern of degeneration below the scoliosis (Figure 2). Her lumbar myelogram showed she had severe right rotoscoliosis with multilevel degeneration and canal stenosis at L2-3 and L3-4 (Figure 3).

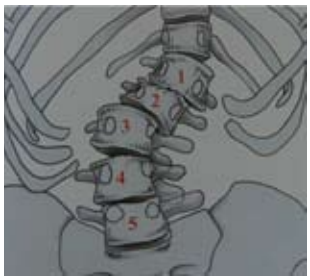

Figure 2: Lumbar Degeneration Below Scoliosis

Figure 3: Myelogram Lumbar Spine

Discussion

This case illustrates several issues. The first is the desirability of correcting spinal deformities when patients are young in order to give them a "better back" later in life. These pre- and post-operative X-rays show a near identical curve fixed in a 23-year-old woman (Figure 4). Spinal correction surgery at a young age could have prevented any abnormal degeneration of the lumbar spine, and long-term data on scoliosis correction shows that spine health and function is excellent after a properly performed, balanced and corrected scoliosis surgery. An earlier corrective surgery could have prevented the large reconstruction necessary for the adult patient in this case study.

The second issue is the effectiveness of conservative therapy in preventing surgery. In this case, the patient had maintenance of function for more than two years with a combination of physical and occasional injection therapy.

Third, in adults, the importance of function is the decision making. As long as function can be maintained, most adult scoliosis surgery can be avoided. Unless the deformity is progressing and spinal balance threatened, or unless some weakness or paralysis occurs, function is the primary issue for these patients.

Finally, this case demonstrates the importance of multidisciplinary pre-operative workup in the care of adult scoliosis. To minimize peri-operative morbidity, patients routinely get a pulmonary evaluation and cardiology clearance with a stress test. Smoking cessation is mandatory to prevent pulmonary complications and to optimize the environment for fusion healing and wound healing. Pre-operative nutrition is optimized if any problems occur due to chronic pain.

Treatment

This patient underwent T3 to the pelvis reconstruction with Ponte osteotomies (Figure 5), scoliosis correction as well as decompression of her lumbar spinal stenosis in a single posterior stage. Fourth-generation instrumentation was used.

Figure 5: Ponte Osteotomies

Outcome and Follow-up

The patient's spinal balance was excellent in the coronal and sagittal planes post-operatively (Figure 6). Her leg pain was also relieved and she needed no bracing. Her intensive care unit stay was 24 hours and her hospital stay was six days, at which point she was discharged to a rehabilitation facility.

Six weeks later, the patient had a mini-open anterior grafting of her distal levels in her lumbar spine to ensure healing. The patient could walk more than one mile at two months, and she also began teaching again with limitations in her activities mainly due to stiffness from the reconstruction. Her one year follow-up showed solid fusion and satisfaction with her outcome.

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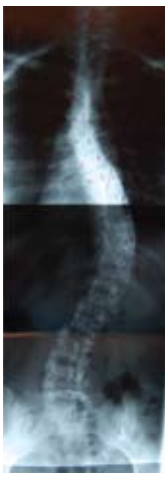

Figure 4A: Pre-op PA View

Figure 4B: Post-op PA View

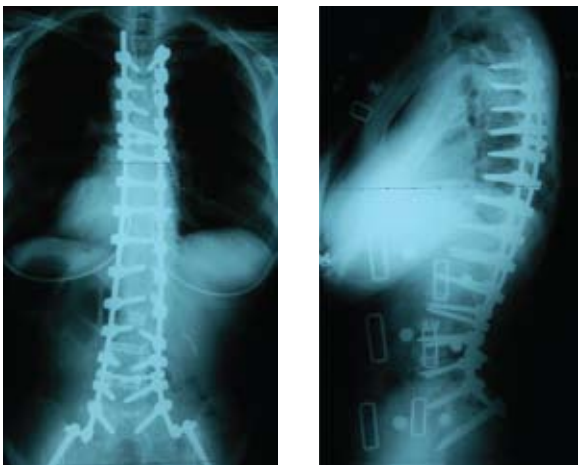

Figure 6: Spine Decompressed, Straight and Balanced

Abdomen Tumor

Malignant Nerve Sheath Tumor in Patient with Neurofibromatosis

BY JOHN UECKER, MD

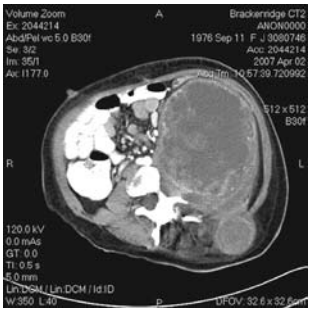

IMAGE A: CT scan (Axial view) of abdomen revealing large retroperitoneal mass with satellite lesion.

IMAGE B: CT scan (Coronal view) of abdomen demonstrating large left-sided retroperitoneal mass.

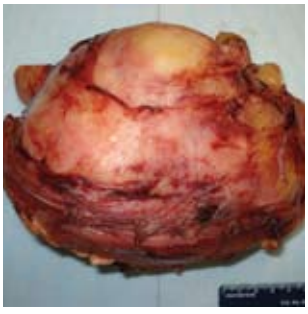

IMAGE C: Tumor Photo of entire malignant nerve sheath tumor after surgical excision.

IMAGE D: Follow-up Four-month follow-up CT scan showing no evidence of recurrence of tumor.

Patient History

A 30-year-old Latin American female presented with an enlarging left flank mass that had increased in size during the two months prior to presentation to the surgery clinic.

Her medical history included severe scoliosis as well as hydrocephalus. Her surgical history is significant for placement of a ventriculo-peritoneal shunt as a young child.

A review of her symptoms confirmed left flank discomfort and left-side abdominal discomfort and fullness. On physical exam, she is a pleasant Hispanic female with severe scoliosis. If standing straight as possible, she is approximately 4 feet 6 inches tall. She had a large palpable fullness in the left side of her abdomen and a baseball-sized subcutaneous mass in her left flank.

Diagnostic studies included a CT scan of her abdomen and pelvis that revealed a large left-sided retroperitoneal mass with what appeared to be satellite lesions in the left flank and small bowel. CT-guided biopsy of the retroperitoneal mass was suggestive of a schwannoma.

Treatment

The patient underwent exploratory laparotomy and resection of the retroperitoneal mass. Branches of the left femoral nerve were incorporated into the mass and had to be sacrificed to completely resect the mass. At the same time, the left flank mass was excised as well as two small bowel masses. Additionally, three small skin lesions overlying her left flank mass were removed simultaneously. Her post-operative course was uneventful with the exception of anticipated left lower-extremity weakness.

The pathology revealed that the retroperitoneal mass was a malignant peripheral nerve sheath tumor. The small bowel masses were gastrointestinal stromal tumors. The left flank mass was an atypical neurofibroma and the overlying skin lesions were dermal neurofibromas.

Her case was discussed at the multi-disciplinary adult cancer conference and it was decided that she would receive adjuvant radiation therapy.

Discussion

Malignant nerve sheath tumors are uncommon and most are associated with neurofibromatosis. They are treated with radical surgical excision with wide radial margins when possible. If unable to completely excise, subtotal excision is performed, followed by radiation therapy. Unfortunately, these tumors are not usually very responsive to radiation therapy or chemotherapy.

Neurofibromatosis is a rare genetic disorder characterized by multiple benign tumors (neurofibromas) in the skin and soft tissues. There are different types of neurofibromatosis and this patient meets the criteria for Neurofibromatosis Type 1. Rarely, they can develop malignant nerve sheath tumors as this patient did. Additionally, patients can have a variety of intracranial abnormalities including stenosis of the aqueduct of Sylvius leading to hydrocephalus as this patient has. Other associated conditions include skeletal malformations such as progressive curvature of the spine (scoliosis).

Outcome and Follow-up

At four months post-op, the patient is doing well with increasing strength in her left leg with the help of physical therapy. Thus far, there is no evidence of recurrence of any of her tumors. She will continue to get close follow-up and routine imaging studies to detect any evidence of recurrence of her disease.

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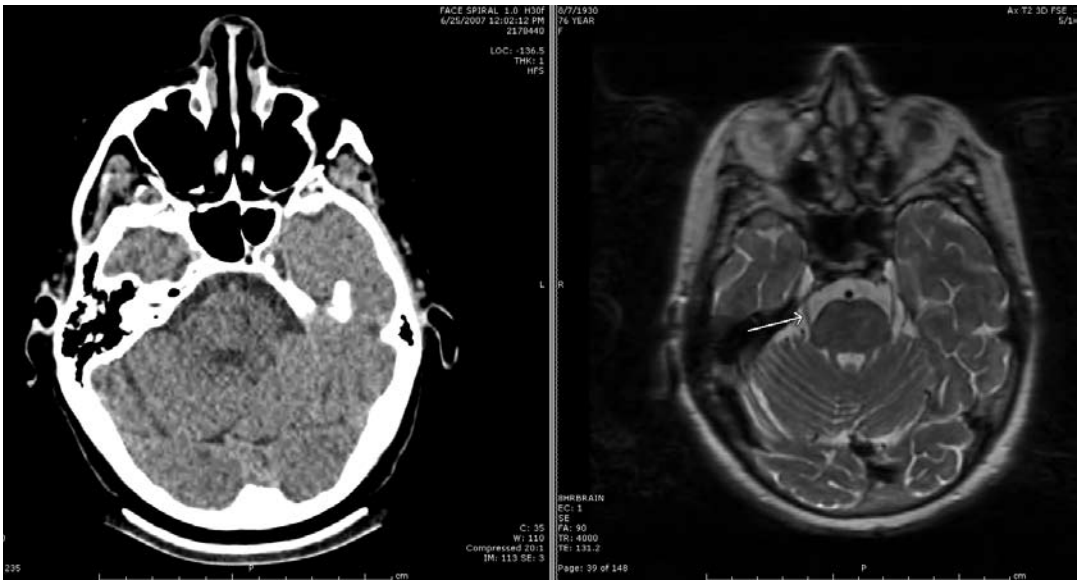
STEREOTACTIC ROBOTIC RADIOSURGERY

Successfully Treats Trigeminal Neuralgia

BY RONALD J. WILSON, MD
MEDICAL DIRECTOR, BRAIN & SPINE CENTER CYBERKNIFE™ PROGRAM, BRACKENRIDGE HOSPITAL

Demographics
Sex: F
Age: 77
Prior Treatment: Neurontin, Tegretol

Clinical History:
Referred by: Neurosurgeon
Treatment Date: July 2007



Preoperative imaging: CT and MRI. Arrow: right trigeminal nerve without apparent compression.

Case History

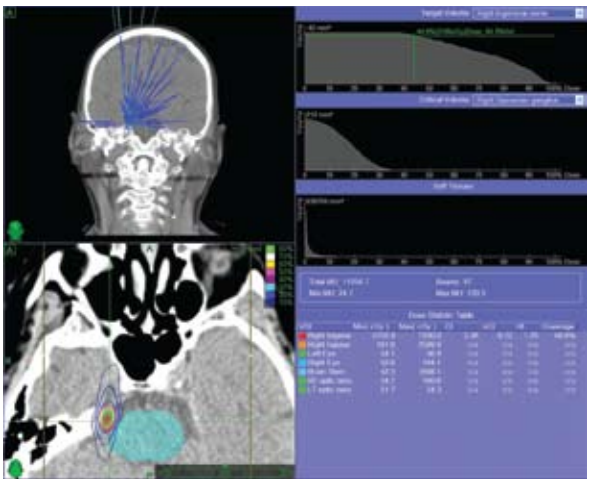
This patient presented in 2005 with right malar pain that was severe and electric-like. She was started on gabapentin, and after several months discontinued it due to excessive sedation. Carbamazepine was then started and the dose escalated, but her pain persisted, increased in frequency and decreased somewhat in severity. In November 2006, she requested a neurosurgical evaluation. She was not felt to be a surgical candidate because of her coronary artery disease and treatment with antiplatelet agents that could not be safely discontinued. She had a normal neurologic examination. CT and MRI scans of the brain showed no evidence of tumor, multiple sclerosis or vascular compression.

Treatment Rationale

The lesion was already known to be surgically inoperable given her comorbidities, and further medical therapy was associated with unacceptable side effects. CyberKnife radiosurgery was considered to be safe in this case given the high conformality and dose gradient achieved. Treatment was delivered with the intention of palliating the pain symptoms.

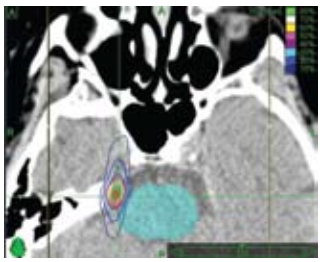
Treatment Details

Target Volume: 42mm3
lmaging Technique(s): CT, MRI(T2)
Rx Dose & lsodose: 5760 cGy to 80 percent
Conformality Index: 3.76
Lesion Coverage: 49 percent
Fractions/Treatment Time: 1/45min
Path Template: Trigeminal
Tracking Method: 60 skull
Collimator(s): 7.5mm
Number of Beams: 97



Treatment Planning Process

A planning CT and T2-weighted MRI were acquired with the patient in the supine position. The Clinical Target Volume was defined as the right trigeminal nerve in the peripontine cistern. A 3 mm margin to the brainstem was established. The brainstem and Gasserian ganglion were defined as organs at risk, together with the left and right optic nerves and optic chiasm. A conformal treatment plan was developed using inverse optimization. This plan included 97 beams, each of 7.5 mm diameter. A dose of 5760 cGy was prescribed to the 80 percent isodose and delivered in one fraction.



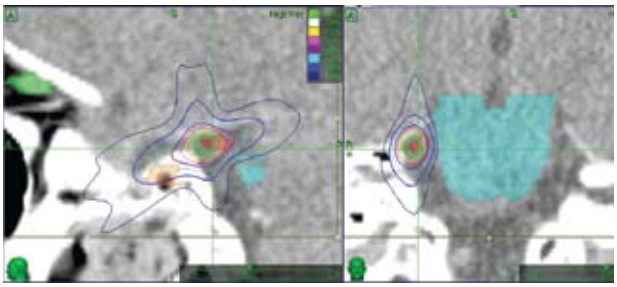
The target is red, the 80 percent isodose line green and 10 percent isodose line blue.

Treatment Delivery

The patient was treated in July 2007 using the CyberKnife system without the need for headframe. She was positioned supine using an Aquaplast mask. The treatment was delivered in about one hour including set-up and was performed as an outpatient procedure.

Outcome and Follow-up

On clinical examination in August 2007, the patient reported complete cessation of pain within one week of treatment. She was weaned off carbamazepine without reccurence of her pain. Her neurologic examination remained normal.



Conclusion and Advantages

The CyberKnife system delivered a painless treatment for her medically intractable trigeminal neuralgia and achieved significant symptom and medication dose reduction. In such cases, the treatment options are usually ablative surgical techniques. Radiosurgery offers potentially significant clinical advantages over these alternatives.

About the CyberKnife System

CyberKnife Radiosurgery is a precise, painless, non-invasive radiation treatment that can be an alternative to open surgery in certain cases. The CyberKnife can treat tumors and lesions anywhere in the body. For more information on CyberKnife, contact Dr. Ron Wilson at (512) 324-8060 or go to *www.brainandspine.net/cyberknife/physicians.* Patients and physicians may also e-mail *cyberinfo@seton.org.*

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Cocaine Cardiac Arrest and Hypothermia:

Overdose Patient Survives with Near-Full Neurologic Recovery

BY TJ MILLING, MD

Patient History

A 28-year-old female was brought to the Brackenridge Emergency Department after a suspected cocaine-induced cardiac arrest. Approximately 30 minutes prior to the EMS call, the patient had an encounter with the local police for suspicion of crack cocaine distribution. A local police officer responding to the ED stated she was chewing on and swallowed what she claimed were breath mints during this encounter. EMS responded to a call shortly afterward from a taxi driver stating the patient vomited and became unresponsive inside his vehicle. On EMS arrival, the patient was in ventricular fibrillation. After defibrillation, intubation, chest compressions and administration of epinephrine and atropine, she had vital signs but remained in a coma.

Treatment

The patient arrived in the ED 13 minutes after initial EMS arrival on scene, again pulseless with a sinus rhythm on monitor, so resuscitation from PEA arrest was initiated. Chest compressions were started, endotracheal tube placement confirmed and vital signs were recovered with administration of intravenous epinephrine and atropine per ACLS protocol. Initial arterial blood gas was as follows: pH 6.529 pCO2 87 pO2 339 HCO3 7.2 base excess -32.9 lactate 24.97. The first recorded temperature, approximately 30 minutes after the initial call to EMS, was 35.8 C.

The initial EKG in the ED showed a widened QRS complex and a large R' in lead aVR, classically known as a finding of tricyclic overdose, but also a hallmark of sodium channel blockade in massive cocaine overdoses. Insertion of a nasogastric tube with gastric lavage produced a large quantity of what appeared to be crack cocaine. Multiple ampules of sodium bicarbonate were administered, followed by a continuous sodium bicarbonate infusion resulting in narrowing of the QRS complex.

Throughout the episodes of cardiac arrest and resuscitation the patient remained comatose with fixed and dilated pupils. Although the primary insult was an overdose of cocaine, the patient's initial rhythm was ventricular fibrillation with return of vital signs and a persistent comatose state, so the hospital's induced hypothermia protocol was initiated using the Arctic Sun, an innovative device that lowers a patient's body temperature. Rectal temperature prior to initiation of active cooling was 34.7 C. The patient was further cooled to 32-33 C for 24 hours, then gradually warmed for six hours.

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Discussion

Induced hypothermia in comatose survivors of cardiac arrest is a relatively new treatment modality. It has generated much excitement due to the large mortality and functionality benefits compared to the generally poor outcomes previously seen in survivors of out of hospital cardiac arrest. Induced hypothermia is thought to reduce the amount of reperfusion injury by reducing anoxia induced cell necrosis, free radical generation, cerebral oxygen demand, cerebral edema or a combination of the above.

A common exclusion criteria in the studies was any alternative cause for persistent coma to include potential drug overdose. The first study excluded "drug overdose as a possible cause of coma." The second had similar language, but also excluded all women under 50 for the possibility of pregnancy. A study at another center also excluded patients "with a comatose state due to drugs that suppress the central nervous system" and pregnant women. It is clear that a patient such as she, a young female with arrest due to massive cocaine overdose, was not included in these

studies, which made the decision to use the hypothermia protocol at Brackenridge all the more tenuous.

However, cocaine-related cardiac arrest may have better potential outcomes than non-cocaine related arrest. A review of cases of cocaine-related cardiac arrests that were resuscitated at San Francisco General Hospital from 1994 to 2006 found improved neurologic outcomes versus unmatched controls as well as age-matched controls that were resuscitated from non-cocaine related cardiac arrest during the same period. This study, while retrospective, dependent on patient report of cocaine use and including only those patients who were successfully resuscitated, suggests the potential for full physiologic and neurologic recovery in these patients.

The Arctic Sun Temperature Management System from Medivance, Inc.

Ingestion of cocaine is generally delineated into body packing and body stuffing. Body packing is the ingestion of specifically prepared packets of illicit substances for the intent of undetected transport, while body stuffing is the impulsive ingestion of unprepared amounts of drugs for the purpose of immediate evasion of arrest. Development of symptoms in body stuffers is common due to the minimal preparation of the ingested cocaine, but the majority develops only sympathomimetic symptoms such as hypertension and tachycardia.

Cardiac arrest due to cocaine can be due to myocardial infarction, either by thrombus or vasospasm as well as dysrhythmia. As most cocaine-related deaths occur out of hospital, myocardial infarction can be proven on autopsy, but dysrhythmias must be observed in hospital to document their presence. As a result, knowledge of cocaine-related dysrhythmias comes from the few reported hospital cases and animal studies from the laboratory.

Cocaine-related dysrhythmias are differentiated by their physiologic mechanisms, being sodium channel and potassium channel blockade resulting from cocaine's local anesthetic properties. Prolongation of the QT interval as well as torsades de pointes is associated with cocaine's potassium channel blockade properties and appears to be associated with recreational use doses rather than overdose scenarios.

Large overdoses of cocaine such as in the case presentation present as wide-QRS complex dysrhythmias – to include monomorphic ventricular tachycardia and slow idioventricular rhythms. These particular dysrhythmias are due to sodium channel blockade that resolves slowly, similar to that seen with tricyclic antidepressant overdoses and class Ic antiarrhythmic medications. Sodium bicarbonate, often used to treat tricyclic overdoses, has been shown to be useful in cocaine overdoses. This may be an alkalinization effect due to the pH dependence of cocaine-induced sodium channel blockade or from the immediate sodium load overwhelming the blockade. This patient's post-resuscitation EKG clearly demonstrated the sodium channel blocking effects of cocaine overdose with improvement after a dministration of sodium bicarbonate.

The Austin/Travis County EMS is looking to introduce body-cooling therapy to the EMS system in the near future. The hope is to provide a consistent application of this therapy (when clinically appropriate) to all resuscitated, out-of-hospital, cardiac arrest patients transported to an Austin-area hospital.

Outcome and Follow-up

This patient was extubated 48 hours after initial arrival in the ED and demonstrated near-complete neurologic recovery with only a mild deficit in short-term memory and orientation. The patient was also treated for pneumonia and a urinary tract infection during her hospital course and discharged to police custody on the sixth day.