

Case Study

Brain Attack

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A 34-year-old woman with no significant past medical history collapses while showering. The family immediately notes right-sided complete paralysis and inability to speak. The family calls 911, and the patient comes to the emergency department, where a massive left middle cerebral artery stroke is diagnosed.

Traditionally, this patient would have been started on an antithrombotic agent, such as intravenous (IV) heparin and admitted to the hospital. If she survived (> 60% chance of mortality), she almost certainly would have spent the remainder of her life fully disabled and confined to a nursing home (1). Fortunately, there are now more options available.

The 1996 National Institute of Neurological Disorders and Stroke (NINDS) Tissue Plasminogen Activator (tPA) Trial (2) was the first to show a positive benefit with acute stroke therapy. Patients who received thrombolytic therapy had a robust 31% return to complete normality versus 20% in the placebo group. This benefit continued even when patients who experienced intracerebral hemorrhage (ICH) were included. Total disability was reduced in the treatment arm as well. Several post-marketing studies have

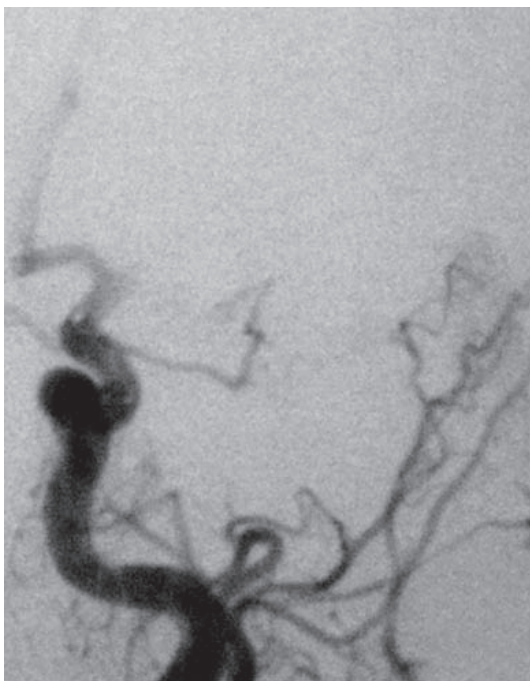
confirmed the initial result of IV-tPA. When given to properly selected patients, IV-tPA reduces disability.

There has been heightened concern over potential ICH with IV-tPA use. Despite a 6.7% symptomatic ICH rate in the initial NINDS tPA trial, disability was reduced and mortality showed a non-significant beneficial trend in treated patients. A large post-marketing trial showed the ICH rate to be 3.3%, nearly half of the original trial (3).

THE STROKE TEAM

The Stroke Center at Ochsner is consulted and the patient has an urgent CT scan of her head showing evidence of a thrombus in her middle cerebral artery. There is no evidence of hemorrhage. The patient is moved immediately to the cardiology angiology suite where an initial cerebral angiogram shows an occlusion of the

A.



B.

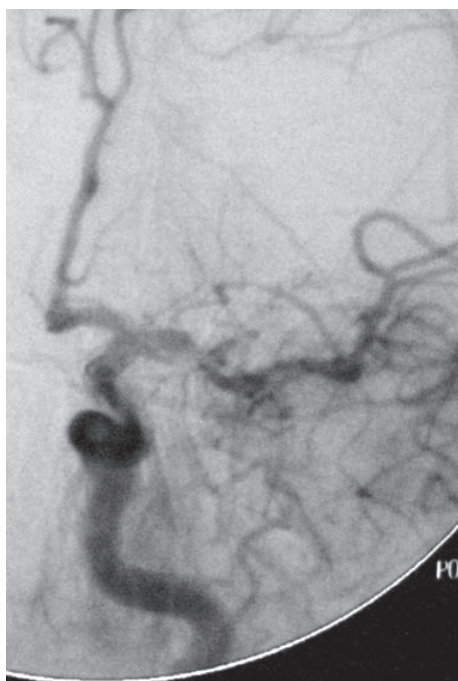


Figure 1. Initial cerebral angiogram. **A.** The internal carotid artery is patent up to the bifurcation where there is a near total occlusion. **B.** Restoration of flow through the middle cerebral artery following thrombolysis and mechanical disruption.

distal portion of her internal carotid artery near the bifurcation (Figure 1).

Numerous studies have shown that the single most important factor influencing outcome is early recanalization of the affected vessel (4). Typically, good outcome is noted when time from onset of symptoms until recanalization is less than 300 minutes (5).

Due to this time-sensitive requirement, the concept of a "Brain Attack Team" or "Stroke Team" has been devised (6). This multidisciplinary team made up of Neurology, Emergency Medicine, Cardiology, Radiology, and Rehabilitation staff allows for 24-hour/7-day availability, with urgent consults seen within 20 minutes. The Ochsner team also accepts acute transfers and can advise on initial therapy.

THERAPY

After informed consent is obtained, tPA is locally infused through a catheter at the site of the occlusion. Following thrombolytic therapy and mechanical disruption, flow through the affected arteries is restored (Figure 2).

A 3-hour time window limits intravenous thrombolytic therapy. Studies involving intra-arterial (IA) thrombolysis suggest that this window can be extended out to 5-6 hours (7). The Stroke Center at Ochsner has extensive experience in both IV and IA therapy. IA therapy will likely gain prominence as evidence mounts for its use. However, few centers have experienced stroke teams and interventionalists, placing potential constraints on general availability. It is imperative to consider triaging stroke patients to hospitals with full-time stroke team availability.

FUTURE DIRECTIONS

The patient is placed in intensive care where bedside cardiac echocardiography with agitated saline is performed. A right-to-left shunt is diagnosed consistent with a patent foramen ovale (PFO) (Figure 3). The patient recovers complete movement on her right side. Other than a mild stutter, she returns to complete normalcy. Four weeks after her stroke, she undergoes catheter-based closure of her PFO. Within 6 weeks of her initially devastating stroke, she goes on to make a complete recovery.

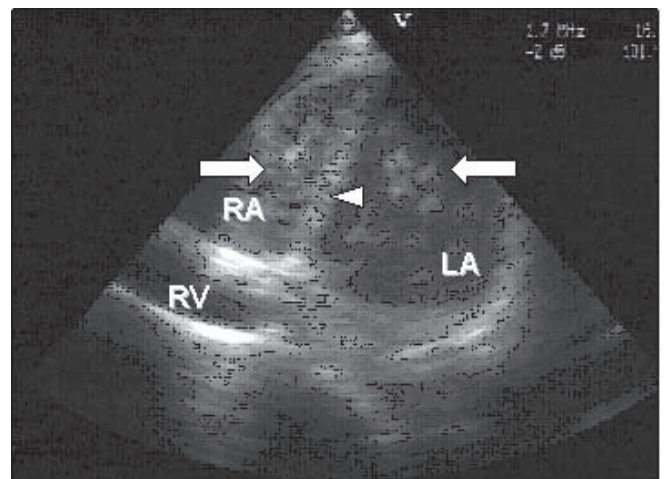


Figure 2. Echocardiography showing agitated saline contrast (arrows) on both sides of the atrial septum (arrowhead) consistent with a Right to Left shunt. RA=Right Atrium. RV=Right Ventricle. LA= Left Atrium.

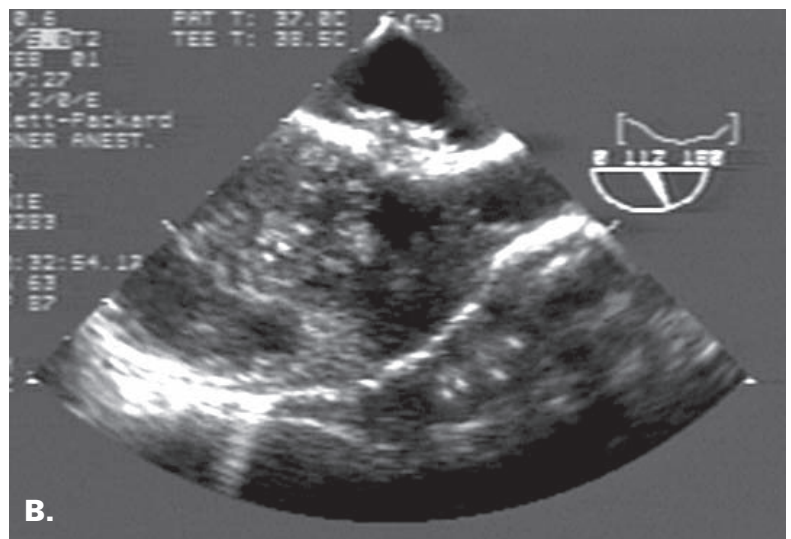


Figure 3. A. Fluoroscopic view of the patent foramen ovale closure device. **B.** Echocardiographic view of the closure device. Note the contrast bubbles are not crossing into the left heart.

REFERENCES

1. Adams HP Jr, Davis PH, Leira EC, et al. Baseline NIH Stroke Scale score strongly predicts outcome after stroke: A report of the Trial of Org 10172 in Acute Stroke Treatment (TOAST). *Neurology* 1999; 53:126-131.
2. Tissue plasminogen activator for acute ischemic stroke. The National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. *N Engl J Med* 1995; 333:1581-1587.
3. Albers GW, Bates VE, Clark WM, et al. Intravenous tissue-type plasminogen activator for treatment of acute stroke: the Standard Treatment with Alteplase to Reverse Stroke (STARS) study. *JAMA* 2000; 283:1145-1150.
4. Marler JR, Tilley BC, Lu M, et al. Early stroke treatment associated with better outcome: the NINDS rt-PA stroke study. *Neurology* 2000; 55:1649-1655.
5. Christou I, Alexandrov AV, Burgin WS, et al. Timing of recanalization after tissue plasminogen activator therapy determined by transcranial doppler correlates with clinical recovery from ischemic stroke. *Stroke* 2000; 31:1812-1816.
6. Albers MJ, Hademenos G, Latchaw RE, et al. Recommendations for the establishment of primary stroke centers. Brain Attack Coalition. *JAMA* 2000; 283:3102-3109.
7. Furlan A, Higashida R, Wechsler L, et al. Intra-arterial prourokinase for acute ischemic stroke. The PROACT II study: a randomized controlled trial. *Prolyse in Acute Cerebral Thromboembolism*. *JAMA* 1999; 282:2003-2011.



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