

Saving President Lincoln: An Update for Clinicians

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On the evening of April 14, 1865, John Wilkes Booth fired a half-inch lead ball from a single-shot brass derringer pistol into the left side of the head of U.S. President Abraham Lincoln. Dr. Charles A. Leale, a 23-year-old assistant surgeon, U.S. volunteers, reached Lincoln within minutes of the shooting and was accosted immediately by a distraught Mrs. Lincoln crying: “Oh physician! Is he dead? Can he recover?” The President was not yet dead. However, after a cursory examination, Leale concluded that “His wound is mortal: it is impossible for him to recover.¹”

Lincoln’s wound, of course, was mortal, for in 1865, little could be done for patients with such wounds. Today modern advances in trauma care have greatly expanded our capacity to manage traumatic brain injuries and also radically altered the prognosis of patients with brain injuries such as Lincoln’s.

In the present exercise, we review the measures that would be taken in 2007 by the staff of the R. Adams Cowley Shock Trauma Center in Baltimore, the oldest trauma center in the country, in treating a wound like that of President Lincoln. We also speculate as to how Lincoln’s prognosis might have been altered by such care and how the transition of executive power after his assassination might have been different if Lincoln had survived his injury but been mentally incapacitated.

CASE PRESENTATION

President Abraham Lincoln was seated in a private box in Ford’s Theater in Washington DC when shot. The bullet from Booth’s derringer entered his skull to the left of the mid-line and just above the left lateral sinus, which it severed (Figure 1). It penetrated the dura mater, passed through the left posterior lobe of the cerebrum into the left lateral ventricle, lodging in the white matter of the cerebrum, just above the anterior portion of the left corpus striatum. It fractured both orbital plates of the frontal bone, causing the orbits to become engorged with blood, and pushing fragments of bone up toward the brain.²

According to Dr. Charles Leale: when he reached the President, he was in a state of general paralysis; his eyes were closed and he was deeply comatose; his breathing was intermittent and exceedingly stertorous. Leale put his finger on the right radial pulse but could perceive no movement of the artery. With assistance, he placed the President in a recumbent position, and as he held the President’s head and shoulders, his hand came in contact with a clot of blood

near the left shoulder. Supposing that Lincoln had been stabbed there, Leale had the President's coat and shirt cut away to identify the source of the hemorrhage, which he suspected originated from the subclavian artery or 1 of its branches. As no wound was found near the shoulder, he began examining the head and soon passed his fingers over a large firm clot of blood situated about 1 in. below the superior curved line of the occipital bone and an inch and a half to the left of the median line of the same bone. He removed the coagula easily and passed the little finger of his left hand through the perfectly smooth opening made by the ball, which had entered the brain. As soon as he removed his finger, a slight oozing of blood followed, and Lincoln's breathing became more regular and less stertorous. He then placed a small quantity of brandy and water in the President's mouth, which passed into the stomach, where it was retained.

At this point, the President was transported to the house of Mr. Peterson, opposite Ford's Theatre, shortly after 10:00 PM, less than 20 minutes after he had been shot. His clothes were removed, and he was covered with blankets. Because his lower extremities were cold from his feet to a distance several inches above his knees, bottles of hot water and hot blankets were applied to his legs and abdomen. When the President was first laid in bed, a slight ecchymosis was noticed on his left eyelid and the pupil of that eye was slightly dilated, while the pupil of the right eye was contracted. About 11:00 PM, the right eye began to protrude, which was rapidly followed by an increase of the ecchymosis until it encircled the orbit extending above the supra-orbital ridge and below the infra-orbital foramen. The wound was kept open by means of a silver probe. About 2:00 AM, the President's wound was probed to a distance of about $2\frac{1}{2}$ in., when the instrument came in contact with a foreign substance, which lay across the track of the ball. This being easily passed, the probe was introduced several inches further, when it again touched a hard substance, which was at first supposed to be the ball, but as the bulb of the probe on its withdrawal did not indicate the mark of lead, it was generally thought to be another piece of loose bone. The probe was introduced a second time and the ball was supposed to be distinctly felt. Nothing further was done with the wound except to keep the opening free from coagula, which if allowed to form and remain for a very short time would produce signs of increased compression; the breathing became profoundly stertorous and intermittent and the pulse more feeble and irregular. Before midnight, the pulse ranged from 40 to 64/min; the respirations were loud and stertorous at a frequency of about 24/min. At 1:00 AM, the pulse suddenly increased to 100/min, but soon diminished gradually until 2:54 AM when it was 48 and hardly perceptible. At 6:40 AM, the pulse could not be counted, it being very intermittent; 2 or 3 pulsations being felt and followed by an intermission, when not the slightest movement of the artery could be felt. The inspiration now became very short and the expirations very prolonged and labored accompanied by a guttural sound. At 6:50 AM, the respirations ceased for some time and then there was a prolonged inspiration, which was soon

followed by a sonorous expiration. At 7:20 AM, the President breathed his last and the spirit fled to God who gave it.³

A MODERN SHOCK TRAUMA CENTER APPROACH

Thomas M. Scalea, M.D.

Advances in trauma care such as the advent of trauma systems, the proliferation of trauma centers, and dissemination of courses such as the Advanced Trauma Life Support Course have all greatly improved American trauma care and almost certainly saved countless lives.⁴ Such advances are particularly impressive when compared with the trauma care available to President Abraham Lincoln at the time of his assassination.

Lincoln was shot in the left occiput at close range with a relatively low-velocity bullet. Two young physicians, Dr. Charles Leale, who had graduated from medical school only days before, and Dr. Charles Taft, just 30 years old, cared for Lincoln. Considering the tools available to them in 1865, any experienced clinician has to be impressed with the quality of the observations they made in struggling to save the President's life. One of their observations was that, despite his age, the President had a "remarkably strong physique." At 56, he still had the chest and arms of an athlete." They believed that had Lincoln not possessed such vital power, he would have died in 10 minutes.⁵

After performing a cursory examination and stabilization measures, Leale and Taft had the President moved to a nearby house, where they administered brandy and water and also applied mustard plasters and warm water to stimulate the circulation. According to the medical practice of the day, they also repeatedly probed the President's wound to allow blood accumulating intracranially to escape and intermittently relieve their patient's respiratory distress.

It seems clear that the majority of President Lincoln's initial symptoms and his unilaterally dilated pupil were due to cerebral herniation, in that his physicians remarked that, "as long as bleeding continued, the President's condition remained stable. When the flow stopped, the vital signs weakened."⁵

It would produce signs of increased compression. The breathing became stertorous and intermittent and the pulse became more feeble and irregular."⁵ As illustrated in Figure 1, the most likely path of the bullet that killed Lincoln was through the left lateral sinus, where it created cortical pressure waves which damaged the brain stem and also produced intraventricular hemorrhage, a deep laceration of the left cerebrum, and bilateral subdural hematomas (likely greater on the right than on the left). In time, these primary injuries (ie, those occurring at the time of impact) were likely magnified by inadequate cerebral

oxygenation resulting from the repeated episodes of hypotension and hypoxia. Such secondary brain injury increases intracranial pressure (ICP) and markedly increases mortality.⁶

Lincoln's intracerebral hemorrhage combined with his subdural hematomas would have caused his ICP to soar. Whereas maintaining egress of blood from the bullet's entrance wound intermittently lowered the President's ICP, it also resulted in substantial blood loss. The brain is an extremely vascular organ and when injured bleeds profusely. In fact, Lincoln's attendants commented that his sheets were crimson and his bed surrounded by a pool of blood. Thus, it is likely that the President died of both cerebral herniation and massive hemorrhage.

Modern trauma care involves a continuum of activities, which can be artificially divided into several phases. The process begins with recognition of the injury and activation of the trauma system. Prehospital providers arrive at the scene, assess the patient, and administer immediate lifesaving care. Appropriate patients are then transported to trauma centers for specialized care. In accordance with Advanced Trauma Life Support guidelines, initial care involves a quick primary survey intended to identify immediately life-threatening injuries, which are treated as they are discovered. Next, resuscitation measures are administered as needed, and then a secondary survey involving a head-to-toe physical examination is performed, appropriate radiographic diagnostics studies are obtained and, finally, definitive care is given.

In 2007, a trauma system of this kind would be activated immediately if our President were injured. In fact, whenever the President leaves the White House, area trauma centers are alerted and are immediately available in case of illness or injury. When the President travels in Maryland, our own Shock Trauma Center is the one alerted and remains on standby, ready to provide immediate care if necessary.

Although the advantages of in-field stabilization (so-called "stay-and-play") versus rapid transport (so-called "scoop-and-run") might be debated in injuries as severe as Lincoln's, there is no question that in an urban environment like the Baltimore/Washington DC area, in which a trauma center is literally minutes away, rapid transport is the wisest choice. One might expect, for example, that patients with brain injuries like Lincoln's should have definitive airway control established in the field. However, in a recent survey of patients with severe brain injuries treated in the Maryland trauma system, an organization with considerable airway management skills, survival was significantly better if patients were intubated upon arrival at the trauma center rather than in the field.⁷ Therefore, Lincoln's initial respiratory distress would have been best managed by establishing intravenous access and administering bag mask ventilation until he arrived at our Shock Trauma Center, where immediate endotracheal intubation would have been performed by a trained trauma anesthesiologist.

Although hyperventilation has traditionally been used to reduce brain swelling in patients with severe head injuries, it has not been shown to improve outcome.⁸ Hyperventilation does reduce ICP but, unfortunately, does so by diminishing cerebral blood flow and producing some degree of global hypoxia. Nevertheless, in patients with impending herniation, hyperventilation may be the only way of lowering ICP rapidly enough to prevent herniation.

President Lincoln's unilaterally dilated pupil was indicative of impending herniation, and suggests that he would have profited from volume expansion with hypertonic saline to both increase preload and decrease ICP. In view of his apparent marked intracranial hypertension, he also would have been treated with modest hyperventilation. A chest x-ray would have been performed, along with an array of routine blood tests. After a quick physical examination (searching for other injuries), the President would have been rushed to the computerized tomography scanner for a definitive examination of his head injury.

In that acute subdural hematomas are operative lesions, and because of the President's signs of impending herniation, he would next have been wheeled into the operating room for an emergency craniotomy, ideally within 15 minutes of his arrival in the Shock Trauma Center. His surgery would have been performed in a room permanently on standby for such emergencies, by in-house senior neurosurgery residents assisted by faculty continuously on-call as back-up.

In the operating room, Lincoln's subdural hematomas would have been evacuated, the entrance wound debrided and the dura repaired. An intraventricular catheter would have been placed, both for cerebral spinal fluid drainage and for monitoring intraventricular/intracranial pressure. Finally, a Licox monitor would have been inserted for second-to-second assessment of microvascular cerebral blood flow and oxygenation. The President would next have had another head computed tomography scan looking for evolution of secondary damage requiring additional operative intervention. He would have been taken then to the intensive care unit.

Traumatic brain injury, even when isolated, is a systemic disorder, in that it activates a neuro-humoral cascade capable of causing dysfunction of virtually every organ system. Respiratory failure and cardiovascular failure are some of its more common consequences. In certain cases, a full-blown systemic inflammatory response syndrome develops, accompanied by intestinal dysmotility, renal failure, and a capillary leak syndrome. Coagulopathy also occurs, both as a consequence of the brain injury itself and a complication of transfusions given to replace cerebral and intraoperative blood losses.

In the intensive care unit, measures would have been taken to keep Lincoln's ICP below 20 mm Hg and his cerebral perfusion pressure (ie, mean arterial pressure minus ICP) above 55 mm Hg, while optimizing cerebral oxygenation and maintaining an approximately normal PCO₂. The President would have received prophylactic antibiotics peri-operatively, along with prophylactic

dilantin for a week. Because traumatic brain injury is an extremely catabolic event, he would also have received early parenteral nutrition. Finally, deep vein thrombosis prophylaxis would have been instituted using sequential compression devices immediately and low-molecular weight heparin approximately 72 hours later.

Figures 2 and 3 depict the R. Adams Cowley Shock Trauma Center management algorithms followed in patients with severe brain injuries. President Lincoln's care would have been guided by these algorithms. Nevertheless, in some patients, intracranial hypertension is refractory and 1 or more recently devised innovative interventions may be required to lower ICP.

Decompressive craniectomy is one such intervention. It involves removing the skull to permit the brain to swell unimpeded within a distensible chamber composed only of reunited dura and skin. This intervention not only lowers ICP, but also improves glucose and oxygen utilization by simultaneously increasing cerebral blood flow and decreasing cerebral vascular resistance. In our hands, 80% of patients with refractory traumatic intracranial hypertension have responded to decompressive craniectomy with substantial decreases in ICP and a survival rate of 78% (over 50% with good neurologic outcomes).⁹ In view of these results, we now use decompressive craniectomy routinely in such patients, banking their bone flaps, so that they can be replaced at a later date.

Our group has long been impressed by how closely ICP correlates with intraabdominal pressure in patients with severe head trauma.¹⁰ In all likelihood, this relationship exists because of communication of the intracranial space with the thorax via the large cerebral venous system. This same system also influences intrathoracic pressure, particularly when the diaphragms are displaced cephalad. In an effort to harness these relationships therapeutically, we sometimes use intrathoracic or intraabdominal release procedures to lower ICP. In a recent series of 17 patients with refractory intracranial hypertension, abdominal decompression produced a statistically significant decrease in ICP (from 30.0 to 17.5 mm Hg), despite only modest preoperative elevation in average intraabdominal pressure (approximately 25 mm Hg).¹¹

Combining decompressive craniectomy, thoracotomy and laparotomy may be necessary to relieve intracranial hypertension in patients with multiple compartment syndrome (ie, elevations in intracranial, intrathoracic and intraabdominal pressure). In a recent series of 102 patients with multiple compartment syndrome, we observed reductions in both ICP and mean airway pressure after combined decompressive procedures, irrespective of the order in which the procedures were performed.¹²

Even with optimal management combining early mobilization, a multidisciplinary approach to treatment and early aggressive rehabilitation, President Lincoln's injury would almost certainly have resulted in at least some permanent neurologic deficits. Likely, he would have had right

hemiplegia and homonymous hemianopsia, in addition to persistent dyslexia, dysgraphia, and dysphasia. However, because his frontal lobe was largely spared, his cognition should have remained reasonably intact.

Given the status of trauma care in 1865, there was nothing Lincoln's physicians could have done to save him. Had he had access to the kind of care routinely given to similar patients in our own Shock Trauma Center, the President might well have survived his injury. Moreover, I have seen patients with brain injuries as severe as Lincoln's make miraculous recoveries. It is possible that in the hands of a trauma team like ours, he too would have done so.

HISTORICAL PERSPECTIVE

Steven Lee Carson

If Lincoln were saved using the interventions described by Dr. Scalea, he still would have had to deal with the problem of an inability to speak, all the more devastating for him because of his life-long struggle with depression. Humor was his antidote for his depression and his refuge in the sea of blood that was America's bloodiest war. It was also a diplomatic tool he used to defuse difficult situations. If he had survived, his injury would have been a "double-whammy" by both robbing him of his power to communicate and taking from him the means by which he kept his depression in check. Lincoln, in fact, often said that if he could not joke he would die.

Although one might speculate *ad nauseam* about how much more Lincoln might have accomplished had he not been shot, his legacy as America's greatest president was already assured by the time he died. He united not just North and South by defeating the Confederate armies but also East and West with his authorization of the transcontinental railroad, which would bring into existence new towns and cities across the continent. He stimulated free public education by endorsing Land Grant Colleges and in seeing to the passage of the Homestead Act, made it possible for legions of settlers to acquire 160 acres of land simply by living on it and working it for 5 years. Moreover, by ending slavery and preserving the Union, he created a social and economic revolution, the promise of which began attracting people to our shores from all over the world.

Lincoln's assassination ended his good works. It also left chaos and consternation in its wake; for when Lincoln died, the war had not yet ended despite Lee's surrender at Appomattox, and many feared the assassination was but part of a larger plan to perpetuate the conflict. Thousands of armed Confederate troops remained in the field; Confederate ships still plied the high seas; and Confederate President Jefferson Davis remained at large hoping to unite his remaining armies into a guerilla force, which might possibly carry on the war indefinitely. If Lincoln had lived but been disabled, the situation might well have been even more chaotic, because in 1865 no provision existed for the Vice President or anyone else to take over as chief

executive for an incapacitated president. At that time, the Constitution contained provisions for the transfer of such power only when a president died. Not until 1967 was the 25th Amendment passed, which specifies the procedures by which the government deals with an incapacitated president (see Appendix).

When Lincoln died, he was succeeded as president by Andrew Johnson, a man poorly suited for the job. A month earlier, when sworn in as Vice President, Johnson was so drunk that he hid his face behind his hat when an official photograph was taken during Lincoln's immortal "With malice towards none, with charity for all" address. He was publicly vulgar, lacked diplomatic skills, and was incapable of compromise. Worst of all, he was a racist to the core, at a time when others were trying desperately to improve the lot of ex-slaves. Although wholly loyal to the Union, he was, nevertheless, a Southern Democrat, chosen as Lincoln's running mate in 1864 in the interest of a unity ticket, rather than because he represented a political partner who shared the principles and goals of the party he would lead all too soon.

Another source of chaos and consternation in the aftermath of Lincoln's assassination was the nation's First Lady, Mary Todd Lincoln, who her husband's secretaries dubbed "Her Satanic Majesty." Poll after poll of historians rating Lincoln as our greatest president, dismissed his wife as America's worst First Lady, perhaps too harshly, given the fragile psyche which eventually forced her to be placed in an asylum. Moreover, her life was plagued by 1 tragic death after another: her mother's when she was but 6 years old and 2 young sons; then in the War, 3 brothers and a brother-in-law killed fighting for the South; and, of course, her husband, shot while holding her hand in Ford's Theater. She also lost another son after the war, leaving just 1 to survive her.

Mrs. Lincoln fought like a tigress to "protect" her husband during their years in Washington and would not likely have allowed the presidency to have been taken from him if he had survived, no matter how incapacitated mentally his wound might have left him. Moreover, before the assassination, she had voiced her disdain for Vice President Johnson repeatedly in public, and after the assassination she accused him of complicity in the attack. Nevertheless, although she might very well have fought to retain presidential power for her husband, regardless of his disability after being shot, she was too unstable mentally to have managed his executive responsibilities herself.¹³

In reality, 1 man, unheralded today except by Civil War historians, saved the day, or at least prevented the country from falling under military rule in the aftermath of Lincoln's assassination—Secretary of War, Edwin McMasters Stanton. An incorruptible, plain-spoken man, Stanton did not suffer fools gladly. He was brought into the cabinet to clean up a corrupt War Department, which he did with a vengeance. Lincoln maintained that the war could not have been won without him.¹⁴

In the chaos that followed Lincoln's assassination, Stanton assumed personal command of the country for roughly 24 hours and then indirectly for considerably longer. At that time, Vice President Johnson was secluded and had to be guarded. He had been a target of one of Booth's accomplices, but was not attacked because his intended assassin became drunk and fled, before being captured and executed along with the other conspirators. Secretary of State William H. Seward was not nearly so fortunate. He was badly wounded in a vicious attack in his home, which also left 2 of his sons and several servants and aides wounded, some near death.

During his time in charge, Stanton had to contend not just with Lincoln's dying, the attacks on Seward and his entire household, and an assassination plot of uncertain size and purpose, but also he arranged for the testimonies of eyewitnesses, saw to the protection of the Vice President, cabinet members, and other government officials (there being no Secret Service at that time to take responsibility for such tasks), commandeered telegraph lines, organized the pursuit of the assassins (the whereabouts of whom he had no idea), ordered Provost Marshals to close the country's borders to the extent possible, saw to heightened military security at forts, ammunition depots, transportation networks, and other vital facilities, informed the nation and the world of the assassination, and prepared for the trial of the conspirators if and when they might be captured. He had to do all of this while continuing to wage war against Confederate troops still in the field. When General William Tecumseh Sherman allowed military rule to supersede civil policy in the terms of surrender imposed on the Confederate army in North Carolina, it was Stanton who upheld the supremacy of civilian control of the military by ordering Sherman to emulate the purely military terms of surrender Grant had imposed on General Lee.^{15,16}

If Lincoln had lived but been incapacitated (ie, could reason but not verbalize his thoughts), the country might still have profited from his stature as a victorious and much-revered war president. His presence, even though silent, might have helped contain the fires of hate and bigotry that engulfed the country during reconstruction and were fanned by an arrogant and unrepentant South. If Lincoln had been able to exert even limited influence over this period, he would, no doubt, have hardened his policies in response to forces opposing his vision of a society dedicated to the proposition that all men are created equal, just as he had done in response to the tactics of forces that opposed him during the War.

Johnson vetoed (unsuccessfully) many of the Civil Rights bills Lincoln would have endorsed. He also ignored passage of "Black Codes" by Southern states, whereby blacks were prevented from leaving current jobs or owning land. He tried to force provisional governors to turn over state control to former Confederate leaders and vetoed legislation creating both the Freedmen's Bureau (which was trying to help newly liberated blacks assimilate into a free society) and the

Civil Rights Act of 1866. He also vetoed 3 Reconstruction Acts designed to empower blacks with the right to vote, before congress finally passed the 14th Amendment.¹⁵⁻¹⁸

Two U.S. presidents disabled while in office illustrate how the problem of an incapacitated chief executive was handled before the advent of the 25th Amendment— James A. Garfield and Woodrow Wilson. President Garfield was shot on July 2, 1881. Although he managed to live until September 19, 1881, he was no longer capable of performing the duties of president. His cabinet (which, ironically, included Robert Todd Lincoln as Secretary of War) assumed executive authority during his incapacitation.^{19,20}

President Wilson suffered a massive stroke on October 2, 1919 but survived to complete his term of office, which ended on March 4, 1921. In this instance, it was the President's wife, Edith Bolling Galt Wilson, who largely managed executive affairs for the disabled president. She vehemently denied reports that she was de facto president during this period. Rather she referred to her activities then as her "stewardship," claiming that her husband made all the major decisions . . . in those matters she chose to present to him. Her goal, she maintained, was simply to follow doctors' orders and spare her husband as many upsetting problems as possible during his convalescence.²¹

If Lincoln had not died as quickly as he did but had lingered on, unable to perform his executive duties, one can only guess who might have taken over for him as president, because no official procedure existed for dealing with such situations in 1865. Possibly Secretary Stanton or Lincoln's cabinet together would have fulfilled the role played by Mrs. Wilson over half a century later. Mary Lincoln was too unstable to have done so. Fortunately, the 25th Amendment to the Constitution now delineates in detail how presidential authority is to be transferred and to whom, when a president is unable to carry out the duties of the office.

COMMENT

Philip A. Mackowiak, M.D.

On January 4, 2006, Ariel Sharon, then Prime Minister of Israel, suffered a massive stroke. The Israeli health care system, arguably one of the best in the world, reacted quickly and decisively with a series of sophisticated interventions, hoping for the kind of miraculous recovery sometimes seen in such patients. In spite of a host of aggressive measures, including several surgeries related to his comatose state, Sharon never regained his cognitive abilities. He was placed in a long-term care facility on November 6, 2007, where he has since resided in a persistent vegetative state.

Abraham Lincoln suffered his massive brain injury almost a century and a half earlier. The health care system in which his physicians operated was far less sophisticated than that of

modern-day Israel or the R. Adams Cowley Shock Trauma Center. It had neither the knowledge nor the tools to save Lincoln's life, much less preserve his cognitive abilities in the aftermath of Booth's attack.

If Dr. Scalea's team had had access to Lincoln at the time of the assassination, the President might well have survived, albeit with right-sided hemiplegia and homonymous hemianopsia, along with persistent dyslexia, dysgraphia, and dysphasia. If so, he might yet have retained enough cognitive and communicative function to have restrained the forces of prejudice and vindictiveness that marred Johnson's period of reconstruction. Lincoln's genius, according to Carl Sandburg, was that: "In the cave of winds in which he saw history in the making, he was more a listener than a talker."²¹

However, in medicine as in politics, nothing is certain. Although Lincoln might have made a miraculous recovery under the care of a trauma team like Dr. Scalea's, he might also have fared no better, or even worse, than under the care of Doctors Leale and Taft. As in the case of Ariel Sharon, modern technology produces tragic failures along with spectacular successes. Sometimes a life is saved only to leave the patient "to linger in dying.... never again [to] speak, see, hear, or awaken into a conscious being." It is because of such uncertainty that knowing when not to treat can be more difficult than knowing how to treat.

APPENDIX: 25TH AMENDMENT TO THE CONSTITUTION (1967)

Passed by Congress July 6, 1965. Ratified February 10, 1967. Replaced part of Article II, section 1 of the Constitution, originally written in 1783.

Section 1

In case of the removal of the President from office or of his death or resignation, the Vice President shall become President.

Section 2

Whenever there is a vacancy in the office of the Vice President, the President shall nominate a Vice President who shall take office upon confirmation by a majority vote of both Houses of Congress.

Section 3

Whenever the President transmits to the President pro tempore of the Senate and the Speaker of the House of Representatives his written declaration that he is unable to discharge the powers and duties of his office, and until he transmits to them a written declaration to the contrary, such powers and duties shall be discharged by the Vice President as Acting President.

Section 4

Whenever the Vice President and a majority of either the principal officers of the executive departments or of such other body as Congress may by law provide, transmits to the President pro tempore of the Senate and the Speaker of the House of Representatives their written declaration that the President is unable to discharge the powers and duties of his office, the Vice President shall immediately assume the powers and duties of the office as Acting President.

Thereafter, when the President transmits to the President pro tempore of the Senate and the Speaker of the House of Representatives his written declaration that no inability exists, he shall resume the powers and duties of his office unless the Vice President and a majority of either the principal officers of the executive department or of such other body as Congress may by law provide, transmit within 4 days to the President pro tempore of the Senate and the Speaker of the House of Representatives their written declaration that the President is unable to discharge the powers and duties of his office. Thereupon, Congress shall decide the issue, assembling within 48 hours for that purpose if not in session. If the Congress, within 21 days after receipt of the latter written declaration, or, if Congress is not in session, within 21 days after Congress is required to assemble, determines by two-thirds vote of both Houses that the President is unable to discharge the powers and duties of his office, the Vice President shall continue to discharge the same as Acting President; otherwise, the President shall resume the powers and duties of his office.

Source: National Archives

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Figure 1. Likely path of the bullet that killed U.S. President Abraham Lincoln and the associated damaged based on autopsy results (Adapted from Surg Neurol 2000;53:514).

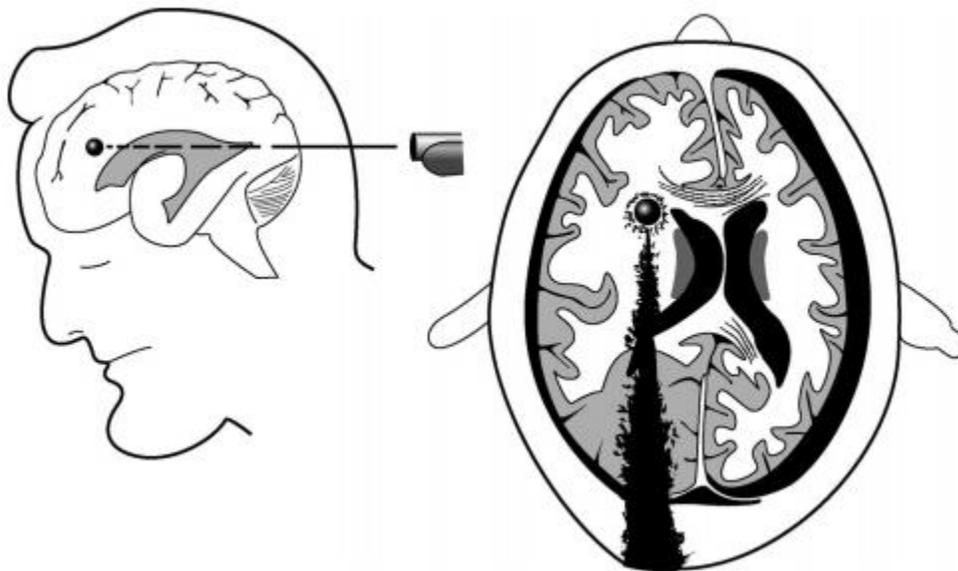


Figure 2. R. Adams Cowley Shock Trauma Center ICP management algorithm for severe brain injuries. IVC, intraventricular catheter; ICP, intracranial pressure; CPP, cerebral perfusion pressure; CSF, cerebrospinal fluid; SjO₂, jugular venous oxygen saturation; PbrO₂, cerebral oxygenation; CBF, cerebral blood flow.

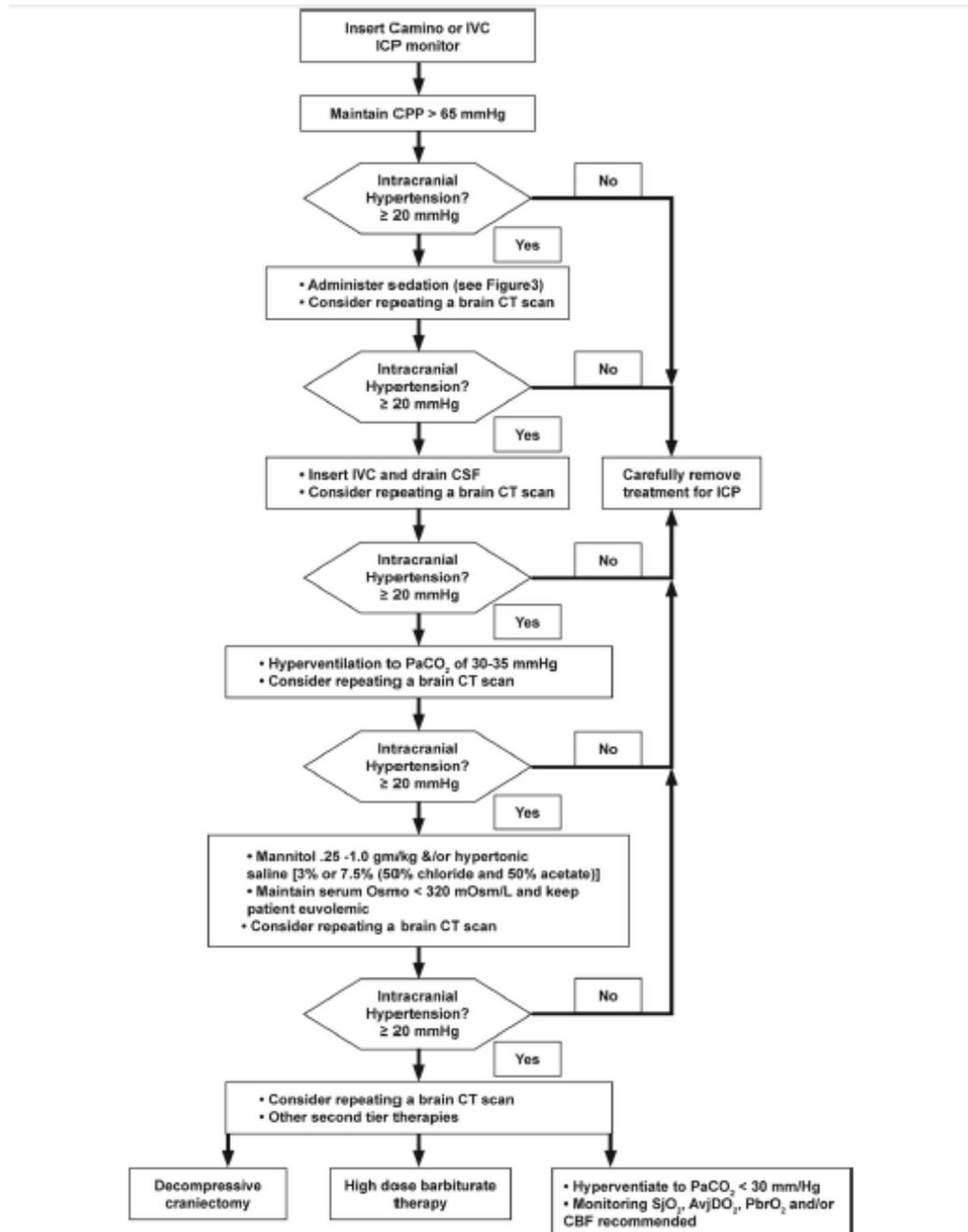


Figure 3. R. Adams Cowley Trauma Center hemodynamic management algorithm. MABP, mean arterial blood pressure; CPP, cerebral perfusion pressure; ICP, intracranial pressure; PAWP, pulmonary artery wedge pressure; EDVI, end-diastolic volume index; WNL, within normal limits; BP, blood pressure.

