A meningioma and its consequences for American history and the rise of neurosurgery

Historical vignette


Goodman Campbell Brain and Spine, Department of Neurological Surgery, Indiana University, Indianapolis, Indiana

The case of General Leonard Wood is notable both for its contribution to the field of neurosurgery and its historical significance. As one of Harvey Cushing’s first successful brain tumor operations in 1910, Wood’s surgery was part of the case series that culminated in Cushing’s monograph Meningioma. This case was important to the rise of Cushing’s career and his recognition as a member of the next generation of neurosurgeons who did not settle for mere bony decompression to taper intracranial tension but who dared to pursue intradural resections—operations that had been performed by surgeons for decades but were frowned upon because of the attendant risks.

Cushing’s operation to remove a recurrent brain tumor ended Wood’s life in 1927. The authors discuss the effects the tumor may have had on Wood’s life and career, explore an alternate explanation for the cause of Wood’s death, and provide a brief account of the life of General Wood, highlighting events in his military and administrative career juxtaposed against the progression of his illness. Furthermore, the case history of the General is reviewed, using information drawn from the original patient notes and recently discovered images from the Cushing Brain Tumor Registry that elucidate more details about General Wood’s story, from the injury that caused his first tumor to his final surgery, leading to his demise. (DOI: 10.3171/2011.7.JNS102067)

KEY WORDS • General Leonard Wood • Harvey Cushing • brain tumor • history

General Leonard Wood was a man of many talents. Trained as a physician at Harvard Medical School, he began his career in the Army as a surgeon in the Medical Corps, at the rank of First Lieutenant. His efforts against Geronimo and the Apaches in the 1890s resulted in his receipt of the Congressional Medal of Honor. He was also given command of an infantry division and spent the next several years developing his skills in military science.

Later, Wood served as the personal physician for Presidents Cleveland and McKinley. It was McKinley who appointed Wood to the Governorship of Cuba following the Spanish-American War (incidentally by-passing a number of superior officers). The formation of the “Rough Riders” during this war propelled both Roosevelt and Wood to national fame, carrying Roosevelt to the White House and beginning Wood’s career as an administrator.

As the military governor of Cuba from 1900 to 1902, Wood made some significant accomplishments. He eradicated yellow fever (incidentally enabling the construction of the Panama Canal), founded a public school system, worked to eliminate the corruption left over from the Spanish occupation of the island, improved the condition of the prisons and orphanages, and set the foundation for a republican form of government. With high energy and focus on the task at hand, Wood was able to bring people together to work toward the improvement of living conditions for the Cubans.

Early in his career, Wood earned the ardent loyalty of many of his subordinates, largely because he put himself out in the field with his men, often being the first to cross a stream or wade into a swamp. Notably, at that time, he was able to convert enemies into allies, turning the subordinates of his predecessor, who had opposed his coming to the island, into valuable assistants. (In contrast, later in his career, Wood managed to drive people away rather than bring them together, and had he carried out some of the actions today that he did in the early 1900s, he might have been put on trial for crimes against humanity.)

Wood’s Meningioma

While in Cuba, General Wood had the first occurrence of what would later become known as a meningioma, possibly the result of a trauma to the head that he had sustained in 1898—upon standing quickly from his desk,
he struck his head on a low-hanging chandelier. Following this injury, he developed a spastic paresis of his left leg and some numbness of his left arm.

Always a robust specimen of physical fitness with a fanatical devotion to maintaining his body, Wood decided to ignore these signs and continued with his daily activities. He shaved with his left hand to ensure some fine movement in the limb, and exercised even more vigorously. In spite of the numbness in his left hand, he was still a more able marksman than those who dared challenge him.

It was not until well after his transfer to the Philippines in 1902 to serve as a provincial governor that Wood’s disability worsened to the point where he decided he must act. During those years, as governor of the Moro province and while his symptoms were intensifying, Wood carried out a number of brutal expeditions against the local inhabitants. In an effort to subdue the Moros (a community of Filipino Muslims) to the control of American laws, he set out with 1250 men, 3 Gatling guns, and 40,000 rounds of ammunition. The march was long and grueling, and the troops fought their way through the jungle, indiscriminately killing Moro men, women, and children. The official estimate of Moro deaths was 1500, although several different numbers are cited in various reports and letters. Although the Moro people were said to be subservient and difficult to control, one must question the need for tactics such as shelling a Moro fortress down to the last man and several instances when General Wood sent his soldiers from house to house in Moro villages with orders to leave none alive.

As these events unfolded, Wood displayed more signs of illness. In October 1904, he had a seizure and noticed increasing weakness in his left arm. A divisional surgeon noted that the symptoms may have been related to the growing protuberance on Wood’s head. This leaves one to wonder if the tumor itself might have fueled Wood’s increasing intolerance. In May 1905, under pressure from the divisional surgeons in the Philippines, Wood agreed to return to the US for evaluation.

First Surgery, 1905

Wood was seen by Dr. Arthur Cabot in Boston and underwent excision of what was described as a “psammoma.” The operation by Dr. Cabot did not pierce the dura because of the high mortality rate at the time associated with such operations. After the surgery, Wood seemingly returned to normal, visiting the President before leaving the country again for the Philippines.

Second Surgery, 1910

In 1908, Wood was transferred back home to command the Department of the East. A year later, he once again began to develop the old hemiparesis on his left side. In late 1909, he was referred by Dr. Cabot to see Dr. Harvey Cushing, who eventually operated on him. A review of Cushing’s original notes (made at Cushing’s first encounter with the General in 1909) shows that Cushing described a cramping sensation that “began along the outer border of the foot” and then slowly spread over the rest of the foot. Then a similar feeling passed up the leg and over the side of the abdomen and chest” (H Cushing, original chart of Leonard Wood, Cushing Brain Tumor Registry, 1927). Accompanying this sensation was a muscular twitching that caused a sense of suffocation as it worked its way up Wood’s body. Wood carried a vial of chloroform, which worked well to stave off the attacks. The physical examination at the time revealed a bony swelling at the vertex of the head, just to the right of the midline. The conclusion made based on the physical examination was “cortical or subcortical irritation of the posterior Rolandic convolution, or the parts adjacent to that, on the right side, near the median fissure.” Cushing noted his examination of Wood at the time as follows:

“Examination showed characteristic steppage gait of a pyramidal tract palsy on the left side. There was some evident difficulty in the fine coordination of the left arm as well as of the foot, though there was no marked muscular weakness. The grasp was strong in the hand and the movements of the foot were powerfully made. The patient is a powerful and muscular fellow. The deep reflexes were exaggerated, particularly on the left, where there was an ankle clonus and a typical dorsal flexion of the toe on plantar stimulation.”

Drs. William Osler, of Johns Hopkins, and S. Weir Mitchell, of Philadelphia, examined Wood and concluded that the patient did not have a brain tumor. As a result of their evaluation and the limited experience of surgeons in dealing with this kind of lesion, Cushing decided against an exploratory operation. A few months later, symptoms worsening, Wood contacted Cushing and requested that the surgery be performed as soon as possible. The reason for this abrupt decision was that during a drill the previous day, Wood had been unable to climb a scaling ladder. He had been forced to use his arms to pull himself up, and as a result decided that he must undergo surgery immediately.

The operation was performed in 2 stages: the first stage, on February 4, 1910, involved exposure of the tumor by removing the bone in the area overlying the tumor (Fig. 1A). The dura was not violated at this time, as a large amount of bleeding from the scalp and bone necessitated halting the operation. Wood was distressed when he awoke to discover that his operation was not yet finished. The second stage was undertaken 5 days later, on February 9, 1910, after both “the patient and the physician had some time to recover.” The brain bulged out through the incision in the dura, and Cushing initially believed that the tumor was a glioma. He found, though, that he was able to work around the margins of the mass and separate them from the surrounding brain tissue. He ultimately was able to tilt out the mass and sever its stalk-like attachment to the dura near the superior sagittal sinus (Fig. 1B and C).

Importantly, Cushing replaced the involved bone at the time, not knowing that meningiomas often involve the overlying bone. Furthermore, the fact that Cushing cut the tumor off of the dura and left the dura intact, rather than removing the dura from which the tumor initially grew, likely contributed to tumor recurrence (which later, in 1927, again brought Wood under Cushing’s knife). In the immediate aftermath of the 1910 operation, the patient’s symptoms seemed to worsen, but soon disap-
Within 2 weeks, Wood was able to stand and take steps around his room, and within 1 month he was able to identify a quarter in his pocket by touch (Fig. 1D). The pathology report of the tumor showed a gritty surface with fibroendothelial cells arranged in whorls with calcified psammoma bodies, all characteristics of the type of tumor Cushing would later name “meningioma.”

**Wood's Political Campaigns**

In the years to follow, Wood attacked his job with characteristic vigor, traveling around the country to alert people to the state of unpreparedness in which the US found itself in the face of inevitable war in Europe. This campaigning resulted in a great deal of trouble for Wood, who clashed with the Wilson administration. The fallout from this conflict was that when the US ultimately entered the war in Europe, President Wilson chose General Pershing over General Wood to command the American Expeditionary Force. Wood was later allowed to make a tour of inspection in France, but the damage was done, and the clashes with the President and the Congress would create further political problems for him.

At the end of the war, reassigned from the Department of the East to the Central Department and headquartered...
in Chicago, Wood predicted the challenges of the return of hundreds of thousands of veterans from Europe and moved swiftly to deal with them. He worked to get veterans educated and back into the workforce, ensuring that they would be well taken care of by their government. His efforts in this area earned him national prestige and served as the impetus for his presidential campaign in 1920.1

With a reputation as a man of competence and a history of effective but brutal management in Cuba and the Philippines, Wood was not welcome in the political establishment of post–World War I America, perhaps because of his close association with Roosevelt and well-known espousal of military preparedness. As the 1920 presidential primaries began, Wood seemed to be a strong candidate behind whom most of the nation might rally, despite the fact that he entered as a candidate outside of the established political machine,7 and he emerged as the front-runner in the campaign. However, Wood’s campaign did not survive the Republican convention of 1920 with all of its intricate and convoluted deal making and politicking. The result of the convention was that Warren Harding, with vice presidential nominee Coolidge, was ultimately nominated and elected President, and Wood’s political career was likely at an end.5

Within weeks of his election, Harding requested that Wood return to the Philippines to clean up corruption and the anti-American sentiment that had set in since he had left the islands, held by some to be a result of Democratic mismanagement of the island under the Wilson administration.7 At the same time, Wood gave serious consideration to an offer to become the President of the University of Pennsylvania, but he eventually chose to return to Manila.7

Wood spent the next 6 years “cleaning up the mess,” during which time his disability slowly returned. When word of this recurrence reached Cushing, he immediately cabled Wood and requested that the General return to the States for an examination. Wood denied the request at the time, but his condition only worsened. At the time in Manila, those who surrounded Wood saw his deterioration physically and mentally. He was unable to exercise and gained a great deal of weight.7 It was said that he became “overbearing, tactless, and intensely jealous of the prerogatives of office.”7 He refused to meet with any Filipino without a “white man” as a witness, and his colleagues found him generally very difficult to get along with7—once again revealing the potential behavioral effects of the tumor.

Final Surgery, 1927

When Wood could avoid it no longer, he returned to the US in 1927. At this time, his disability had worsened to the point at which he could barely walk and had to be helped off of the ship when he arrived in Seattle. As he traveled east across the country, friends and old enemies alike welcomed him warmly. As he waited for Cushing to return from his tour of Europe,3 he continued working as vigorously as ever.4

Cushing finally saw Wood in August 1927, noting that the General’s mental faculties were diminished and that he could rise from his chair and walk only with assistance. Cushing further noted that Wood was “bloated in body and face…crumpled up on a couch with face distorted, eyes almost closed, a grotesque and pitiful figure,”7 and yet the General displayed his characteristic stoicism.7 There was a moderate contracture of his left arm and hand, in addition to the spastic hemiparesis on the same side. Cushing further noted:

“his left side is practically useless, though with great effort he can raise his arm and he has some grip with his fingers. The entire side is extremely spastic. It latterly (sic) has been limbered up they say somewhat by excessive massage which has left him with a bad infection of the hair follicles over the whole thigh”

Wood had insisted that his operation be undertaken in one session, despite Cushing’s reservations to this effect, as he was anxious to get back to his work.4 On shaving the patient’s head, Cushing noted that there was significant protrusion all around the old area of tumor. He elevated the same bone flap as previously, as this had been pushed out by the growth. He proceeded quickly, but the patient hemorrhaged a great deal at the start, requiring a blood transfusion donated by a medical student.7 Despite this complication, Cushing continued and eventually extricated the whole mass. There was some bleeding from the posterior aspect of the tumor, where it may have attached to the superior sagittal sinus. From here, it seems the patient’s condition deteriorated, as bleeding from the sinus was difficult to control, and his blood pressure and respirations dropped after closure of the flap.7 Cushing had packed the wound and began to close, but had to re-elevate the flap upon this drop in pressure and evacuate the clot he was certain had formed. On later reflection, he determined that it would have been best to pursue the extraction in a second session in spite of the patient’s insistence otherwise. Successful removal of the tumor notwithstanding, General Wood had not withstood the 8-hour operation well. Over the course of the next several hours, he developed a large intraventricular hemorrhage and eventually died, as described by Cushing, “in the early hours of the morning, a ship pushed quietly into the great stream.”7 The death of his friend due to his own failure affected Cushing greatly, and he could not bring himself to operate for weeks,3 as he lay awake at night going over the details of the operations in his head7 and chided himself for not waiting longer after his return from abroad to perform this major operation (Fig. 1E).6

Recent Developments

A review of recently discovered original patient records and one of Cushing’s “diary books”7 in the Cushing Brain Tumor Registry dedicated to General Wood reveals further details about Wood’s death. An examination of the brain of General Wood, which is presently housed in the Cushing Center at Yale (Fig. 1F and G), showed no obvious connection between the blood in the resection cavity and intraventricular space, making us believe that the cause of General Wood’s death may have been disseminated intravascular coagulation leading to intraventricular hemorrhage, rather than bleeding from the superior sagittal sinus as previously suggested. This theory may also explain why Cushing could not stop the bleeding as he attempted to
A meningioma and consequences

finish the case. The fact that Cushing prepared a special diary book for General Wood further underscores the importance of this case in Cushing’s career and this person in Cushing’s life.

It is worthwhile to consider the historical significance of this case for neurosurgery in America. The case of General Wood was remarkable for involving one of the first uses of silver clips for hemostasis within the cranium, which Cushing developed in the same year as the first operation. Cushing considered the first operation somewhat of a turning point in his own life and career, as it was one of his first successful meningioma resections, and ultimately he blamed himself for Wood’s death as the result of replacing the bone flap (and dura) during the first surgery.

The case of General Leonard Wood has made an unquestionable contribution to neurosurgery: it brought attention to Cushing’s work as he sought to further develop techniques and procedures to operate on the brain. This case was the forerunner of Cushing’s wartime surgical experiences, when he was able to operate on thousands of head trauma cases and develop protocols and staging systems for such wounds and their sequelae, as well as his later operations on brain tumors. It also left its mark on American politics—the course of events following the development of the tumor, as well as many of the decisions the General made, may be viewed differently in light of the presence of the tumor. The question that remains unanswerable is: how much of Wood’s career and decision making was the result of the tumor and its effects on his brain? It is possible that without the tumor, the General may have made different decisions, pursuing more palatable courses of action (for example, in the Philippines). He may have been more tolerant and more tolerable to the American people and to the political establishment. However, it is simply not known what might have become of American history and Wood’s career (including his presidential aspirations) had the tumor not occurred. As it is, the memory of the General is stated eloquently by McCallum—“silence.”

Conclusions

The case of General Wood was important to Cushing and the rise of his career during the early years of neurosurgery. The results of General Wood’s tumor on American history can only be speculated on.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author contributions to the study and manuscript preparation include the following. Conception and design: Cohen-Gadol. Acquisition of data: Cohen-Gadol. Analysis and interpretation of data: all authors. Drafting the article: all authors. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Cohen-Gadol. Study supervision: Cohen-Gadol.

References


Address correspondence to: Aaron A. Cohen-Gadol, M.D., M.Sc., Goodman Campbell Brain and Spine, Department of Neurosurgery, Indiana University, 1801 North Senate Boulevard #610, Indianapolis, Indiana 46202. email: acohenmd@gmail.com.