The Shooting of President Reagan: A Radiologic Chronology of His Medical Care

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Radiography of the chest played a central role in the care of President Ronald Reagan who, in 1981, became the only president of the United States to survive being struck by a would-be assassin’s bullet. These radiographs not only illustrate the medical events that followed the gunshot wound to the president’s chest, but also provide graphic documentation of the president’s medical care, suspected complications, and recovery following this near-fatal wound. This report constitutes the only complete pictorial record of the care of President Reagan during that historic episode.

■ INTRODUCTION

Being president of the United States carries with it mortal risks. Of 40 presidents from 1789 to 1992, four—Presidents Roosevelt, Truman, Nixon, and Ford—were attacked but not hit by bullets. Five presidents were actually struck by bullets. Of these, four died: Presidents Lincoln, Garfield, McKinley, and Kennedy.

Incubation or death of a president raises crucial issues of governance and succession (1), as well as of the safety of the country (2). This article deals with the assassination attempt on the life of President Ronald Reagan, who, in 1981 at the age of 70 years, was the oldest man ever inaugurated into the office. As a result of the assassination attempt, he also became the sole presidential survivor of being struck by an assassin’s bullet (3). Although this event has been examined from multiple perspectives (1–12), President Reagan has kindly authorized us, the thoracic surgeon (B.L.A.) and the thoracic radiologist (S.D.R.) who took daily care of him, to present the firsthand account of the medical care that he received following the shooting. We recently reported the details of day-to-day medical and surgical care, as well as other issues that arose during the hospitalization, in the Journal of the American Medical Association (4). The article presented herein is a unique report of the assassination attempt because we use the radiologic studies, which played a key role in the medical management of the near-fatal bullet wound, to provide a firsthand, pictorial record of the medical chronology following this historic event.

Abbreviation: PEEP = positive end-expiratory pressure

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Figures 1, 2. (1) Frontal supine chest radiograph obtained in the emergency room (at 1458 on March 30, 1981) shows a hazy left hemithorax with a single chest tube in place and considerable subcutaneous emphysema. A deformed bullet fragment is seen adjacent to the border of the left side of the heart. (Reprinted, with permission, from reference 4.) (2) Anteroposterior supine abdominal radiograph (obtained at 1530 on March 30, 1981) shows no free air or metallic fragments. However, a sclerotic area is seen in the left pedicle of the L-1 vertebra (arrow). This finding was unrelated to the trauma.

THE ASSASSINATION ATTEMPT
On March 30, 1981, 70 days after taking office, President Reagan exited the Hilton Hotel in Washington, DC, at 1425 hours after addressing the AFL-CIO (American Federation of Labor and Congress of Industrial Organizations). As he left the hotel, he lifted his left arm to wave to the crowd. At that instant, he; Press Secretary James Brady; Secret Service Agent Timothy McCarthy; and a Washington, DC, police officer, Thomas Delahanty, were shot by a would-be assassin, John Hinckley (1). The president was unaware that he had been shot (7) and thought that the pain in his left chest was due to being hurled into his limousine by his Secret Service man, who landed on top of him. When he coughed up blood, he believed that a fractured rib had punctured his lung. The limousine driver was ordered by the Secret Service to go the nine blocks to The George Washington University Medical Center.

IN THE EMERGENCY ROOM
On arrival at the emergency room at 1435 hours, the president was short of breath and gasping for air (1). He collapsed and was carried to the trauma room, where he likely passed out briefly (7). The first impression was that the president had suffered a heart attack because of his report of chest pain and his blood pressure of 80 mm Hg/palpable. However, blood was seen on his teeth, and examination of his exposed chest revealed a 1.5-cm gunshot entrance wound in the left posterior axillary line at the fourth intercostal space, but no exit wound was found. Oxygen, blood, and crystalloid fluids were immediately administered. Breath sounds were absent on the left.

A chest tube was inserted into the left hemithorax, and a total of 2,275 mL of blood was drained. Breath sounds became audible, but brisk bleeding continued. After infusion of 3,000 mL of crystalloid fluids and two units of packed red cells, the president's blood pressure rose to 160/100 mm Hg within 15 minutes. However, the hematocrit, which had been 39.8 at admission, dropped to 29.6 when the president left the emergency room some 30 minutes later.

In a portable anteroposterior supine chest radiograph obtained after the insertion of the chest tube (Fig 1: 1458 hours), the inferior two-thirds of the left lung appeared hazy, and a metallic fragment superimposed on the border of the left side of the heart was seen. Because of
uncertainty about the caliber and completeness of the bullet fragment, a portable frontal abdominal radiograph (Fig 2: 1530 hours) was obtained. No metallic fragments or free air were seen, but an incidental, benign-appearing sclerotic density was noted in the left pedicle of the L-1 vertebra.

Confusion about the caliber of the bullet in the president’s chest occurred because the amount of lead seen in the radiograph (Fig 1) could account for a .22-caliber bullet, but initial information had suggested that the would-be assassin’s gun had been a .38 caliber. The correct caliber of the bullet became apparent when an intact .22-caliber “devastator” bullet was removed from Agent Timothy McCarthy. This type of bullet was designed to explode on impact (1). Fortunately for the president, the bullet that struck him failed to explode.

The likely explanation for the early confusion about the caliber of the gun used was that one of the U.S. Park Police officers had dropped his .38-caliber revolver as he helped subdue the gunman, and his weapon was initially thought to have been the revolver used by Hinckley (1).

**IN THE OPERATING ROOM**

In the operating room, a peritoneal lavage was performed to exclude injury to intraabdominal organs and produced clear fluid. A left anterolateral thoracotomy revealed approximately 500 mL of clotted blood. The major intrathoracic structures were intact. Early inability to locate the bullet in the lung led to consideration that the bullet might have entered a central pulmonary vein and embolized to the heart or beyond. However, a portable radiograph obtained with the president in the left oblique position and his lung partially collapsed showed that the missile was still in the lung but now was projected several centimeters away from the heart (Fig 3). The missile was then located in the left lower lobe and removed through a small pleural incision. The largely intact but symmetrically flattened .22-caliber bullet (Fig 4) was handed to the waiting Secret Service agents.
Diagrammatic reconstructions of the path taken by the bullet and its final location are shown in Figure 5. The entrance site in the lung was sutured, two chest tubes were placed, and the president was sent to the recovery room in stable condition.

**IN THE RECOVERY ROOM AND INTENSIVE CARE UNIT**

On arrival in the recovery room at 1820 hours, the president was placed on a ventilator. Measurement of blood gases indicated a large intrapulmonary shunt, and bibasilar breath sounds were absent. A chest radiograph (Fig 6; 1820) revealed evidence of extensive airlessness of both lower lobes. After manual hyperinflation and positive end-expiratory pressure (PEEP), the arterial partial pressure of oxygen increased and a repeat radiograph (Fig 7; 2140) showed markedly improved aeration. In the next few hours, the president gradually awakened and was finally alert enough to write messages to the nursing personnel.

By the next day (March 31), with 10 cm of PEEP, the atelectasis was almost entirely cleared radiographically (Fig 8; 1300) and blood gases were improved. After the endotracheal tube was removed, some hypoventilation occurred as expected but the lungs remained clear. The president was moved to the intensive care unit, where an air leak continued with minimal drainage of blood. Despite respiratory therapy, considerable airlessness of the left lower lobe developed (Fig 9; 1600), but the president was breathing easily.
Figures 6–9. (6) Portable radiograph obtained in the recovery room (at 1820 on March 30, 1981) shows the marked amount of hypventilation in each lung base, much more marked on the left. An endotracheal tube and two chest tubes are in place, with the lateral tube being obscured by the lung opacity. (7) Portable radiograph (at 2140 on March 30, 1981) demonstrates improved aeration of the lungs after manual hyperinflation and PEEP but continued opacity in the left lung base. (8) Portable radiograph obtained after 10 cm of PEEP (at 1300 on March 31, 1981) shows better aeration of the lungs with only minimal lung opacity being seen laterally on the left. The costophrenic angle is clearer. (9) Portable radiograph obtained after removal of the endotracheal tube and administration of respiratory therapy (at 1600 on March 31, 1981) demonstrates increased airlessness in the left lower lobe.
Figures 10–12. (10) Portable radiograph (at 0615 on April 1, 1981) shows improved aeration of the lungs. The chest tubes are still in place. (11) Portable radiograph (at 0730 on April 2, 1981) shows a slightly increased amount of opacity in the left lower lobe. The chest tubes are still in place. (12) Portable radiograph (at 0730 on April 3, 1981) demonstrates a greater amount of increased opacity in the left lower lobe.

- IN THE PRESIDENTIAL SUITE
The president was moved at 2145 on March 31, 1981, to a new secure hospital area, “the presidential suite,” which was created by isolating several contiguous hospital rooms. To provide a secure, convenient location in which to obtain reasonably high-quality radiographs, a temporary x-ray room was established in the presidential suite by using a dedicated portable radiography unit that was available at all hours.

Clinically, the president continued to improve through April 1, with the radiographic appearance of the lung improving (Fig 10; 0615) and the air leak nearly gone. However, on April 2, he became flushed and his temperature rose to 39°C without chills, although the radiographic appearance of the left lower lobe remained relatively unchanged (Fig 11; 0730). More vigorous chest physiotherapy was started, and the continued air leak required return to chest suction.

By 0730 on April 3, the fever continued and drainage from the chest tube had decreased. A chest radiograph (Fig 12) showed increased opacity in the left lung base, leading to concern about a possible pulmonary infection. However, concern was allayed when the president’s temperature decreased later in the day.

- COMPLICATIONS OCCUR
One of the chest tubes was removed on April 3, 1981, in the early morning hours, and the radiographic appearance of the left lower lobe substantially worsened (Fig 13: 1025). By evening rounds that day, the president had developed chills and his temperature had spiked to 39°C.
For the first time, he did not feel well and was anorexic. Sputum production had simultaneously fallen off, leading to concern about an obstructing mucus or blood clot plug. Bronchoscopy was performed at 1730, yielding a moderate amount of bloody secretions, and three small bronchial casts were removed from the left lower lobe. Treatment with cephalosporin, which had been discontinued 48 hours earlier, was begun.

At 0300 hours on April 4, the president expectorated 2 mL of thick old blood and did not feel hot. By 0700, he felt somewhat better, but his temperature was still around 38.9°C and he had chills and malaise. The white blood cell count went from 10,000 to 13,000/mm³ with a moderate left shift. Pneumonia or lung abscess became serious considerations. However, the blood and sputum cultures showed no pathogens, and analysis of stained sputum specimens showed only scant gram-positive organisms. The appearance of the chest radiograph (Fig 13; 0730) remained essentially unchanged, compared with the radiograph obtained the preceding day. No air leak was present, and only a small amount of drainage was occurring. The second left-sided chest tube was removed after this radiographic examination.

Because of the unexplained fever and the amount of blood products that the president had received intravenously (eight bags of blood, three bags of plasma, and one bag of platelets), concern arose about the possibility of the development of hepatitis. Therefore, the empty bags were sent to a special Centers for Disease Control laboratory for testing. The results of these tests showed that three of the bags were "suspicious" and one was "possible" for antigens to hepatitis B. The president was therefore given γ-globulin and hyperimmune β-globulin without adverse reaction.
Figures 15, 16. (15) Standard frontal (a) and lateral (b) radiographs of the chest obtained in the radiology department (at 0730 on April 5, 1981) show the true extent of the left lower lobe opacity and some right basilar hypoventilation. (16) One of a series of linear tomograms obtained through the lumbar spine (April 5, 1981) demonstrates density in the left pedicle of the L-1 vertebra without expansion or erosion.

CONTINUED TREATMENT AND GRADUAL IMPROVEMENT

By April 5, 1981, the president’s temperature was 37.2°C, and he felt better and had increased expectoration. However, to help clarify the nature and extent of the opacity noted in the left lower lobe, it was decided to take the president to the radiology department to obtain better-quality posteroanterior and lateral radiographs of the chest. To accomplish this, the hospital corridors leading to the radiology department and the department itself were cleared of all patients and all personnel not involved in examining the president. The radiology department was also thoroughly searched by Secret Service agents.

The resultant radiographs (Fig 15; 0730) showed that the left lower lobe was more opacified than had been seen in the portable studies. These findings tended to reinforce the concern of some of the team members caring for the president that pneumonia was present.

While the president was in the radiology department, it was decided to obtain some linear tomograms through the lumbar spine to examine the opacity of the L-1 vertebra that had been noted on the admission abdominal radiograph (Fig 2). The tomograms helped confirm that this finding was a nonexpansible sclerosis and was most likely a benign process and, therefore, of no further clinical concern (Fig 16).
Figure 17. Standard frontal (a) and lateral (b) radiographs of the chest (at 1130 on April 7, 1981) show some improvement but still a relatively opaque left lower lobe.

On the basis of the clinical and radiographic findings, the cephalosporin therapy was discontinued, and treatment with penicillin (1 million units every 4 hours) and tobramycin (80 mg every 8 hours) was initiated. However, all cultures obtained to this point had been negative for significant pathogens, except for sparse colonies of *Escherichia coli* found in the urine. Also, although the president's temperature was about 39°C at 1200 hours, by 1700 it had decreased to 37°C. The collective opinion was that the fever had most likely been due to a contused, hemorrhagic lung, perhaps with secondary bacterial overgrowth.

It was therefore of some concern that early on the morning of April 6, the president awoke from a restless night with a temperature of 39°C and coughed up old blood. The white blood cell count was 15,700/mm³ with a moderate left shift. However, the chest radiograph showed slight improvement in the appearance of the left lower lobe, and by 2100 hours, he was feeling better, with a temperature of 37.3°C.

On April 7, his temperature was near normal, the white blood cell count had dropped, and the president looked and felt better. Administration of oxygen was discontinued. However, from a radiographic standpoint, the left lower lobe was slightly improved but remained relatively opaque (Fig 17: 1130).

A low-grade fever continued through April 8, but the president was gradually improving clinically. Chest radiographs demonstrated lucent areas within the left lower lobe opacification, which were interpreted, in light of the clinical improvement, as representing inhomogeneous resolution of the nonaerated lung. Subsequent chest radiographs showed continuous improvement through April 10.
Figures 18, 19. (18) Standard frontal (a) and lateral (b) radiographs of the chest made at discharge from the hospital (April 11, 1981) demonstrate considerable improvement in the appearance of the left lower lobe. (19) Standard frontal (a) and lateral (b) radiographs of the chest obtained 1 month after discharge from the hospital (May 13, 1981) show further continued opacity in the left lower lobe, with developing fibrotic bands in the left lung base.

**DISCHARGE FROM THE HOSPITAL**

By the time the president was discharged from the hospital on April 11, 1981, 12 days after being shot, the left lower lobe had mostly cleared (Fig 18). He walked out of the hospital wearing a bulletproof vest, escorted by a carefully screened group of hospital personnel, press corps, and governmental staff. A heparin venous lock was left in place for completion of a course of intravenous penicillin therapy, to be followed by oral penicillin treatment.

After his discharge, the president was seen in the White House twice by one of us (B.L.A.). During the follow-up period, improvement was
noted in the radiographic appearance of the left lung, but there were some prominent residual changes remaining in the left lower lobe (Fig 19; May 13, 1981). The surgical wounds were healing well, and the breath sounds at the left lung base, as expected, remained slightly reduced. His continued treatment included the use of incentive spirometry throughout the day.

Five months after being shot, the president had fully recovered clinically, and radiographs of the chest (Fig 20; August 31, 1981) showed only a rather thick fibrous band in the left lower lobe and some haziness of the left hemithorax, most likely due to some pleural thickening.

**DISCUSSION**

Patients with bullet wounds to the chest are seen daily in emergency rooms. The historical importance of this article derives from the identity of the victim, the potential impact of the event on society, and the great interest that the event elicited (1-12). However, only this and our prior article (4) represent firsthand medical accounts of the event. This article is further unique in that it provides the only pictorial record of the event, including all of the relevant radiographic images that formed the basis for the president’s medical care following the shooting.

Most important, this presentation provides a visual illustration of the medical care that the president received and the important role played by chest radiography in his care. The major issues clarified radiographically included the exact location and number of bullets in the president, the condition of the underlying lung, and the presence of complications. The use of radiography to locate the bullet was crucial: During surgery, the bullet could not be located in the collapsed lung until the intraoperative chest radiograph showed that the bullet had not migrated out of the lung. With its position identified radiographically, the bullet was then extracted.

Radiography also played an important role in addressing the issue of whether the president suffered from a postoperative infection of his lung. A close interaction between the clinicians and the radiologist was required to reach what proved to be the correct conclusions: (a) that the president did not suffer an actual infection of the lung after thoracotomy, despite postop-
erative fever and chills and the radiographic appearance, and (b) that the opacities in the left lower lobe were likely the result of the trauma and airlessness of the lung due to the effect of the bullet and its subsequent removal.

As physicians intimately involved in President Reagan's care at the time, it is our goal to provide an authoritative, firsthand, pictorial record of the saving of the president following the assassination attempt in 1981, stressing the important role played by radiology in his care and ultimate survival. Also, by reviewing the course of events as illustrated herein, the reader can obtain a clearer picture of the injury that occurred at the time and the course of the illness following the assassination attempt.

Acknowledgment: The authors appreciate the willingness of President Reagan to permit us to publish this description of his medical care at the time of the assassination attempt on his life in 1981.

REFERENCES