REMINISCENCES OF A FLIGHT SURGEON

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I have been asked to reminisce about some of my experiences as a flight surgeon in the United States Air Force. Since a flight surgeon is a preventive medicine officer, I would like to weave some of the history of the scientific basis of medicine into my account. I do this because of the critical role that advances in medicine, particularly in preventive medicine, have had in bettering the lot of the soldier... In the past two decades, the prospective, randomized, controlled clinical trial has emerged as the preeminent clinical research tool. It is vital that the clinical trial - whether small and specialized or large and multidisciplinary -continues as a valuable instrument in the conquest of disease.

The first such trial is recorded in the Book of Kings where a dispute between the followers of Elijah and Ahab over the identity of the true God is related. The conflicting hypotheses were to be tested at Mount Carmel, circa 800 B.C., by laying two bullocks on piles of wood. Ahab and his advocates called on the name of Baal, and Elijah and his followers called on the name of the Lord to answer by fire. The prophets of Baal cried aloud, cut themselves with knives and lancets, and leaped upon the altar for most of the day, but "there was neither voice, nor any to answer, nor any that regarded." Whereupon Elijah, not lacking in confidence, poured four barrels of water, not once, but three times, on his bullock and the wood. When he called on the true God, "The fire of the Lord fell and consumed the burnt sacrifice and the wood and the stones and the dust and licked up the water." Statistical calculations were scarcely needed to determine a significant P value! The unfortunate prophets of Baal were forthwith "brought down to the brook Kishon and slain." Perhaps the grisly fate which befell the losers accounts for the passing of so many centuries before the clinical trial achieved its current widespread popularity.

An 18th century account from Japan stresses the ethical decisions made in these early efforts to place medical practice on a firm scientific foundation. "According to Japanese legend, Seishu Hanaoka (1760-1835) chose his wife, rather than his mother, who expected to die shortly anyway, for his clinical trial of drug-induced anesthesia because all agreed that he could find another wife, but that he could never get another mother!"

Although estimates of the effect of disease on soldiers during Colonial and Revolutionary times varied, Duncan, in *Medical Men In the Revolution*, calculated the

annual death rate at 100/1000 with 90% of the deaths due to disease, rather than battle wounds. Smallpox is mentioned again and again as one of the most devastating of these diseases. The advent of immunization in the Colonial period was barely in time. How this came about is a fascinating tale. Eighteenth century America was beset with smallpox epidemics discrete in time, recurrent, and frequent. Most affected were the young and the very elderly. Mortality was 15 to 50 percent. Destructive abscesses left survivors with loss of hair, loss of eyebrows, and disfigurement of facial features. Young women were marred for life; suicide was common.

There was no word for what we call “immunity” but it was known that those scarred by the disease were safe and secure from reinfection when they nursed the sick. The Purtian-Calvinist doctrine of “suffer and be saved” was confirmed by smallpox, and it was a minister of the gospel who brought to a surgeon the idea of using a small operation to control the disease.

The idea came to America from several sources: Turkey, China, and Africa. The wife of the British Ambassador to Constantinople, Mary Montagu, observed the Turkish physicians using inoculation and wrote of it to the Royal Society. As a corresponding member of the Royal Society, Reverend Cotton Mather of the Salem witch hunt fame, learned about this technique. He claimed that one of his manservants, Onesimus, also told him of the practice used in his native African tribe.

In 1716 there had not been a smallpox epidemic for several years, and Mather suspected a new epidemic was about due. He wrote the 12 physicians and surgeons of Boston to seek their “considersation” of his “suggestion” that a trial of smallpox inoculation be undertaken to protect the colonists from the next epidemic. They turned him down.

In 1721, the crisis struck. A ship infected with smallpox had anchored in Boston Harbor. Some of the crew had escaped. An infected sailor was seen in a public house on the waterfront. Hundreds would die, on that all agreed. Within days, the epidemic began. Knowing that Boston's physicians would refuse his proposal, Cotton Mather drove his buggy 5 miles west to Muddy River, a wilderness township now known as Brookline.

There he found a well-established surgeon, Zabdiel Boylston, who listened with more sympathy to his plea. Mather wanted the surgeon to put a drop of the active pock exudate into a cut in the skin of healthy people. He hoped to produce a discrete or localized case of smallpox and yet confer the immunity enjoyed by survivors of the natural disease.

Against violent opposition, Boylston followed the detailed rules of the Turkish physicians. Since he had had the disease in childhood, he began by inoculating his son

Thomas on June 26, 1721. The son developed only a discrete case and was not very ill. Boylston assumed the boy would be protected for life, and over the next six months he inoculated 286 people. Now six of these died, but study revealed that most of these were sick or enfeebled or died of other natural causes.

As the epidemic raged throughout the summer, it became obvious that Boylston's patients were safe and secure. Not a single one who had been inoculated contracted the epidemic disease which afflicted almost 6000 other Bostonians. While six of the 286 persons he inoculated died, 844 of the 5,759 who got the natural disease died. The mortality of the inoculated persons was 2. 1%, while the mortality of those unprotected was 9.6%, almost five times greater. Boylston was able to present his work to the Royal Society and was elected to membership in that august body.

The procedure he pioneered was gradually adopted in both North America and Europe and was the standard of care for 75 years. Colonial leaders supported his efforts. Benjamin Franklin spread word of this innovation to New York, Philadelphia, and south. Thomas Jefferson brought his family in to Philadelphia for inoculation and Washington used it at Valley Forge. The procedure was not always uneventful and isolation hospitals were built to contain contagion caused at times by inoculation.

This is why Edward Jenner's observation in 1796 was so significant. He found that the English milkmaids with cowpox on their hands never contracted smallpox. In 1798 he reported his procedure of taking material from the cow (vacca) and using it for inoculation, or “vaccination” as this method came to be called. But again there was an outcry of opposition. So a “controlled clinical trial” was conducted in Boston Harbor on Noddle's Island (now part of Logan Airport). Teenage boys were vaccinated and then exposed to real smallpox pus. None came down with the disease. Waterhouse, somewhat in the spirit of Elijah, felt that he must prove that the “matter from the pocks” truly was active smallpox inoculum. So two boys who had not received vaccination were inoculated with the smallpox matter to demonstrate that the substance was potent. This was the most dangerous phase of the experiment. Although the boys had a life- threatening illness, both survived.

Both of these developments established *insight* with *experimentation* to advance the cause of preventive medicine.

How did flight medicine get started? The first modem aeronauts were a sheep, a rooster, and a duck who served as passengers in the Montgolfier brothers' invention, the hot air balloon. The year was 1783, the setting rural France. Men followed, and two years later in 1785 a Boston physician, John Jefferies, crossed the English Channel as a passenger in a hot air balloon, perhaps as the first flight surgeon. Flight surgeons continue as members of flight crews to this day, principally to monitor the

aircraft's environment and the stresses experienced by the flight crews. We do physical examinations on the flyers each year and advise commanders about the health of their men.

Early reactions to manned flight were mixed, but our colonial leaders were quick to see the possibilities. Benjamin Franklin was in France during the early years of ballooning, and it was at one of these flights he was asked, “What good is it?” He retorted in the idiom of the day, “What good is a newborn baby?”, and went on to speculate that fighting men carried to an enemy's country by air might convince sovereigns of the folly of war! In this country George Washington presumably provided the first airmail letter carried by balloon across the Delaware River. Washington was most likely interested in the balloon as an observation platform for counting enemy troops and gun placements, now called aerial reconnaissance. Yet powered flight was more than a century away.

While the foundations of scientific medicine were being laid throughout the 19th century, quite a different development, critical to the wounded warrior, was taking place. This was the evolution of the ground and, in the 20th century, aerial ambulances.

Although surgeons often accompanied the professional armies of the 18th century, the large citizen armies of the 19th century suffered massive casualties and needed the first medical evacuation systems. Two of Napoleon's officers, Barons Dominique Jean Larrey and Pierre Francois Percy designed light, well-sprung carriages for swift evacuation of the wounded. Napoleon insured that each of his divisions received an ambulance corps of about 170 men, headed by a chief surgeon and equipped with the new horse-drawn carriages. Later in the century, the four-wheeled ambulance was used in the American West.

Early in the American Civil War, however, recovery of casualties was accomplished by friends and relatives using the family carriage or by terrified military band members assigned as stretcher bearers. Civilian drifters and volunteer drivers pressed into medical service either fled the scene or broke into the medical supplies and stole the liquor. But over the course of the War, Maj. Jonathan Letterman, Medical Director of the Army of the Potomac, reformed the ambulance system and created an orderly series of clearing stations immediately behind each battlefront. The aid station would triage the wounded. Surgeons would then work first on those deemed savable while the most seriously wounded were set aside. The lightly wounded were treated and retained near the front. Two principles governed this system: 1) Reduction of time between wounding and life-saving surgery, and 2) Evacuation of a casualty no farther to the rear than his wounds demanded. A hierarchy of medical services was established with increasingly specialized care given as the

patient was moved farther back from the front. This concept still governs medical operations today.

Apparently the first aeromedical evacuation was achieved during the Franco-Prussian War of 1870-71. During a siege of Paris, observation balloons carried mail and 160 casualties out of the city. When the airplane was invented, it wasn't long before its potential for evacuating the wounded was recognized. Implementation during WW I, however, was sporadic. During the 1920's, autogiros, or primitive helicopters, were tried and further developed as ambulances. Not limited by roads, autogiros were better able to open advanced landing posts than motor ambulances. They could maneuver behind cover and “potter around in the dark” at night, presumably undisturbed by enemy fire until they located the landing zone, outlined by flashlights of the collecting company. Nonetheless it was late in WW II before air evacuation systems were put in place either for evacuation of the wounded or for rescue of downed pilots and aircrews. Of course, the discovery of antibiotics and the use of blood transfusions during this same period did much to enhance survival of the wounded. During the Korean War, helicopter evacuation from the front combined with Mobile Army Surgical Hospital (MASH units) achieved the coordination necessary to make a difference in survival.

When Viet Nam heated up, the air evac business had to be geared up again. The call sign “Dust Off “ was chosen from a list of call words in a signal operations instruction book because helicopter pickups in the dry countryside blew dust, blankets, and pup tents all over.

If it wasn't dust, it was often fog that shrouded the mountains of Viet Nam. The effect of fog on air evac missions is exemplified by this account: “West of Chu Lai, an enemy force hit a reconnaissance patrol and inflicted several casualties. The patrol limped back to camp, and the medic tended the two most critically wounded while radioing for a Dustoff ship. Several attempts to land were foiled first by fog and then by darkness. At dawn, visibility was still zero. A second crew tried to land and withdrew. Then an unusually resourceful pilot named Patrick Brady agreed to give it a try. They flew from Chu Lai to the mountains at low level just under the cloud base, then turned northward to Phy Tho where a trail wound westward through the mountains to the reconnaissance camp. The fog was so thick that the crew couldn't even see the tips of the rotors. To improve visibility, Brady lowered the side window and tilted his ship sideways at a sharp angle from the ground. The rotor blades blew away enough fog for him to see the trail beneath the ship. Hovering slowly above the trail and occasionally drawing startled enemy fire, Dust Off 55 finally reached the valley and the reconnaissance camp. The visibility was so poor that the ship missed the camp's landing zone and set down in a smaller clearing between the inner and outer defensive wires of the camp. The outpost had been taking mortar rounds all

morning and was still under sniper fire. The medic said it was hazardous even without the fog, but Dust Off 55 loaded up two critically wounded men and four other patients, climbed out through the soup, and got them all to surgical care.

Brady then completed evacuation of 18 litter and 21 ambulatory patients during four trips to a fire base elsewhere in the valley to the West, then went to a third site to the South. After changing ships, he was called to the southwest where a platoon had been decimated by mines. An initial try by helicopter set off another mine. So Brady took over, flew out, landed in the mine field, and dispatched his crew to retrieve the casualties. As they neared the ship with one soldier, a mine five meters away detonated hurling men into the air and perforating the aircraft with shrapnel. The crewmen stoop up, shaken but unhurt, and placed their casualty on board. Brady returned to the Chu Lai hospital with a full load. Brady used yet a third aircraft for two more missions that day during which he evacuated 51 wounded men. For this extraordinary day's work, he was awarded the Medal of Honor.

This same Brady developed a specialized technique for night pickups in the mountains. He recognized the limitations of flying under the weather. He would on occasion have to come down through the fog and rain with the mountains surrounding him. He took his aircraft up to 4500 feet and vectored out to the mountains on instruments. As he approached the mountain, he went up to 7000 feet. An FM homing device told him when he was over the pickup site. He called in an Air Force flare ship to drop basketball-sized flares on parachutes. Brady would pick out one of these flares and circle it with his ship, dropping lower and lower through the fog, mist, and rain. The flare's brilliant light reflecting off the fog and rain wrapped the helicopter in a ball of luminous haze. Brady gazed out the side window, alert for crags or peaks. Suddenly the ship broke through the clouds and the signal lights were below. He could pick up casualties and fly back to Chu Lai under the clouds.

Meanwhile, I served as a flight surgeon in Thailand for a year and a half. My job was to be a friend and physician to the aircrews. A word on the origins of flight medicine, a branch of preventive medicine, will explain this a bit further. Flight medicine got underway in WW I when it was discovered that not everyone who wanted to fly an airplane could see and hear well enough to do so. It was during this period that minimal physical standards were established and survivability improved. In the early years of military aviation, accidents, like disease in early centuries, claimed a disproportionate share of the casualties. Visual acuity was paramount, but depth perception, color vision, peripheral vision, and night vision were and still are critical for the pilot. A new visual component, contrast sensitivity, has recently been found to vary considerably among individuals and to decline with age.

My memories of duty in Thailand in the 1960's include caring for the health of military personnel and the surrounding community. Sick call for the troops was leisurely in the mornings, but we processed 25 men in 45 minutes during the evening sessions. MEDCAP, the medical civic action program, was like a monthly school health examination for whole villages located around the base perimeter. We pulled rotted teeth and handed out soap to combat skin infection. Local women were inspected weekly by a Thai physician and given clearance to return to work when they had clean fingernails, etc.

More recently in the Air Force Reserve, I've served two weeks in the Cotswolds, a week in Dakar, Senegal, popular as a French Colonial tropical beach resort, and a week on Ascension Island shortly before the Faulkland Islands War.

This year l took command of a Tactical Clinic in Columbus, Ohio, and was immediately given a dragon to slay - the Officers' Club. The Club was closed because of sanitation problems. Our job was to insure cleanup and train the personnel as food handlers. We are still concerned with communicable diseases better prevented than treated in epidemic proportions.

How does all this tie together? In peacetime, my clinic does physical examinations, evaluates fitness, and gives immunizations. In wartime, we deploy as a collecting company for air base casualties. We first endeavor to detect infirmity or prevent illness which would keep the airman from doing his job. Then we help with the treatment and evacuation of the wounded if needed. May we ever pursue the former and eternally postpone the latter.

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