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Smallpox and Vaccination in the Civil War

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Throughout the Civil War, the fear of smallpox was uppermost among the medical concerns of both Armies and for good reason. For more than three centuries, smallpox had enjoyed preeminence as the most feared of all pestilential diseases. For a brief period, plague, the Black Death, had rivaled it but plague outbreaks were intermittent and infrequent whereas smallpox was a relentless visitor. Thirty percent or more died; there was no treatment. As Lord McCauley wrote in his History of England, referring to smallpox in the 17th century: "That disease was then the most terrible of the ministers of death...filling the churchyard with corpses...and making the eyes and cheeks of the betrothed maiden objects of horror to the lover." He was, of course, referring to the disfiguring scars which more than 75% of all victims bore throughout life.

It was smallpox which had literally decimated the native American population, reducing populations by 80 to 90% and resulting in the elimination of entire tribal groups. Native Americans appear to have been unusually susceptible to the disease with extraordinarily high death rates in North America as elsewhere in the New World. One suspects an underlying genetic cause. Whatever, without smallpox as an ally, European settlers would have written a very different history in the settlement of North America. Smallpox played a vital role in the French and Indian Wars and was no less decisive at a number of points during the American Revolutionary War. Smallpox could spread in any climate and at any time. Eventually, everyone succumbed to infection. If not infected as an infant or child, the individual acquired the disease as an adult.

In 1796, Edward Jenner, an English country physician, performed an

interesting experiment. Country folklore held that dairy maids did not acquire smallpox infection and some believed that it was because, while milking, they had been infected with a disease of cows, called cowpox. That disease produced on the hand a rather nasty looking pustule but this healed uneventfully after 10 to 14 days. Subsequently, the milk maids appeared not to contract smallpox even when in contact with cases. The fact that the milkmaids remained unscarred was visible testimony to the efficacy of cowpox protection. The perfect complexions of the milkmaids, regularly cited in literature had nothing to do with their drinking milk.

Jenner took some of the pustular material from the hand of a milkmaid named Sarah Nelms who had been infected from a cow named Blossom. (Yes, even the cow has been memorialized and, indeed, its hide can be viewed in the St. George's Hospital Medical Museum in London). Jenner inoculated the material into the arm of a young boy, James Phipps, who was later tested and found to be protected from smallpox. After additional trial inoculations, Jenner published his results just 200 years ago. He called the material "vaccinia", deriving from the Latin "vacca", meaning cow. Eventually, thanks later to Pasteur, the term vaccination was applied to all preventive inoculations of microbial organisms. Jenner's vaccine was the first and, understandably, this achievement was hailed as one of the greatest advances in medicine.

Within five years, the vaccine had been transported to all continents, a remarkable feat of technology transfer in an era of sailing ships. And, in fact, a time table for vaccine development and application which could not begin to be approached today!

A common view is that the availability of the new vaccine effectively closed the chapter on smallpox and, in so doing, makes a discussion regarding smallpox during the Civil War a non-event. The Union records show that throughout the conflict only 18 952 cases and 7058 deaths occurred, substantially fewer than the 109 000 who died from diarrheal diseases, malaria and pneumonia. The Confederate records were largely destroyed and although the numbers of cases probably were significantly greater than those in the North, it is doubtful that the outcome of any of battles was

altered by smallpox alone. However, throughout the Civil War, the control of smallpox through vaccination and patient isolation, was a continuing preoccupation; widespread vaccination problems proved to be disastrous with undocumented longer-term adverse consequences; and, finally, an event at the White House itself came perilously close to altering history at an unexpected time.

To understand why smallpox throughout most of the 19th century, continued to be a vexing problem to countries throughout the world despite Jenner's discovery, one needs to understand the mechanics and realities of producing vaccine and of mounting and sustaining a vaccination program during this period.

Vaccination is accomplished by inoculating live vaccinia(or cowpox) virus into the superficial layers of the skin. It should be noted that the cowpox virus, as it came to be used in vaccination, was called "vaccinia" and that is how it will be referred to in this paper. The vaccinia virus grows slowly forming a small papule by the fourth day which becomes a pustule by the ninth day. A scab then forms and this falls off in the third week leaving a vaccination scar on the skin which almost all of you who are more than 25 years of age undoubtedly bear today. The pustule and the scab both contain large amounts of vaccinia virus. This material could be used to inoculate other persons.

Jenner's original vaccine was first transported to the Americas and to Asia vaccinating one after the other of a group of susceptible orphans who were placed aboard ship and, on arrival, were handed over to religious or other care takers. Arm to arm vaccination of the local population was then begun. This proved to be a reasonably straightforward proposition and yielded generally satisfactory results. But there were problems of every imaginable sort. Periodically, failure was experienced in transmitting the virus from one arm to the next and so vaccinators had to obtain additional material. When they sought to obtain the material from a cow, they discovered that cowpox in cows occurred only very sporadically and would sometimes be absent for months to years at a time. Moreover, it gradually became apparent that cowpox, as such, existed only in Europe so that if new material was needed, it had to come from Europe. Meanwhile, in many areas, cowpox-like lesions were periodically

found on cows which did not produce the typical reactions in humans and did not protect against smallpox. When vaccine failures occurred, questions arose as to whether it was a result of using the so-called "pseudo-cowpox" or whether the vaccine itself had not been properly preserved.

Early in the 1800's, it was discovered that if the vaccinia material was dried on slides or threads, it could sometimes be sent long distances, mixed with a bit of water on arrival and inoculated successfully. This was a far better approach than having to utilize orphans but often, the virus did not survive shipment, thus necessitating further considerable delays as additional material was obtained.

Besides the considerable logistical problems in sustaining the chain of arm to arm infection to keep the virus alive, widespread vaccination was impeded by religious leaders who fought bitterly against preventing disease by vaccination, arguing that it was an unnatural interference with God's will; others objected to inoculating something from a cow and claimed that those inoculated would grow horns and a tail; others protested when vaccination was made compulsory in different areas. Thus, vaccination was, more often than not, performed only on a large scale when epidemics threatened. Because, of the fact that the U.S. was so sparsely populated, 10 to 15 years between outbreaks was not unusual, even in cities. The ultimate result was that large populations remained unvaccinated and, thus, periodic waves of epidemic smallpox recurred.

As the Civil War began, the military was well aware of the fact that there were large numbers who were unvaccinated. Noted, in particular, were the frontiersmen who, it was said, generally showed neither inclination nor facilities for vaccination. The colored troops, as they were then identified, were probably the least well protected as they eventually suffered rates of smallpox which were three to four times greater than those among white regiments.

For the Union troops, army regulations required that every man be vaccinated but it was noted that, under the pressure of time, only some of the State authorities succeeded in fulfilling the requirement. In May, 1861, the Surgeon General of Virginia ordered the vaccination of all troops not already vaccinated and all medical officers in

the state were asked to provide vaccination crusts. Such crusts, customarily, were obtained from children after they had been vaccinated. One year later, the Confederate Surgeon General directed that a Medical Officer be detailed in Department of Army areas to superintend vaccination. Whatever the orders, significant numbers on both sides remained unvaccinated. A major part of the problem was the lack of crusts for vaccination, an especially difficult problem in the South.

Smallpox was eventually reported as having been present in virtually every military department during almost every year of the war although the disease incidence remained surprisingly low. It would appear, as the war broke out, that smallpox was present but at a comparatively low level of incidence in the Union Army; the Confederate Armies of Northern Virginia and the Potomac were reported to be free of smallpox until following the Maryland campaign which culminated in the battle of Antietam in September, 1862. Thereafter, smallpox spread soon to Charlottesville, Lynchberg, Richmond and Fredericksburg. During the week of 12 December alone, 250- cases of smallpox were admitted to the Richmond Hospital of whom 110 died. With the onset of winter, smallpox spread further among both troops and the civilian population. One medical officer reported that the Army was panic stricken by the spread.

The risks of smallpox transmission in hospitals and the importance of isolation of patients appear to have been fully appreciated and appropriate measures taken. These measures almost certainly had more to do with the degree of smallpox control achieved than did vaccination. Provision was made for all patients to be isolated in separate buildings or tents at least 50 yards distant from any other structure. One such "pest house", as they were called, was the one here in Lynchberg supervised by Dr. Terrell. In February 1862, the Surgeon General had decreed that all hospital patients be vaccinated against smallpox and in November, he directed that all sick and wounded undergo a 15 day quarantine in a special hospital. As the smallpox epidemic grew worse, leaves and furloughs were canceled for all officers and men who had been exposed to infection in the field or in hospital. Records detailing the

course of the epidemic have been lost but it appears that the measures taken at least averted a major epidemic catastrophe.

There was a clamor for vaccine virus but nowhere to obtain virus except by taking crusts (scabs) or pustular material from a recent vaccinee. In the North, a system had been established for medical dispensaries to obtain crusts from vaccinated infants and to ship individual crusts with a certificate bearing the name of the dispensary, the name of the child from whom the scab was obtained and the date it was procured. A similar system was known to have been in place in Virginia during the 1850s but, overall, the supply of crusts in the Confederacy appears to have been severely limited. However, with smallpox spreading rapidly through the Army of Northern Virginia, the Surgeon General had no choice but to order a general vaccination campaign. With little vaccine available from recently vaccinated children, there was no choice but to begin arm to arm vaccination among the troops themselves. This was a process usually discouraged because of the risk of transmitting other infections, especially syphilis.

In selecting the pustular lesions from which material would be taken, vaccinators expressed a preference for taking material from the larger sores as it was felt that this material would provide better protection against smallpox. There was, in addition, a preference for taking material from lesions which provided the largest quantities of material. Unfortunately, chancroid lesions of syphilis may sometimes resemble the pustule of a primary vaccination take but with the added "favorable" characteristic of being large and of providing a large amount of pustular material for inoculation. Thus, large numbers of troops came to be vaccinated with what was termed "spurious vaccine", the most heavily afflicted initially being troops from Georgia. The original source was identified as a soldier who had been vaccinated either from a lesion on his wife's arm or from a lesion on the arm of a woman in a house of ill repute.

Vaccination with this material resulted in an infection which was generally characterized as an indolent, persistent draining ulcer, as much as 3 to 4 inches in depth with an angry-looking red cellulitis surrounding the lesion. Often additional

ulcers developed on the arms and sometimes the legs; the axillary and inguinal glands were often swollen and sometimes suppurated. The ulcers usually drained for weeks to some months. Amputation was sometimes required. At the Battle of Chancellorsville, May 1862, some 5000 Confederate troops were said to have been incapacitated by the inoculations. The problems were further compounded by the fact that many troops undertook to inoculate themselves and others using whatever knives or nails were at hand, thus further contributing to the spread of septic infection and the so-called spurious vaccinia.

Syphilis was thus widely spread among Confederate troops in the East but extending, as well to the Army of Texas and the Army of Tennessee. Concern about the dangers of "vaccination", as the troops had experienced it, persisted into the post-war period with both citizens and physicians manifesting a fear of reverting to this preventive measure. Undoubtedly, there were many longer-term complications from syphilis but these were never documented.

The cause of the spurious vaccination was argued heatedly by medical authorities in arguments that extended long past the end of the war. There were a number who were certain that the cause was syphilis, either mixed with vaccinia or transmitted alone. Others, however, asserted variously that the cause was impure or partially deteriorated vaccinia virus or was the result of vaccinating troops who were suffering from scurvy, poor diets, or fatigue. Ample experience subsequent to the Civil War clearly demonstrated that neither deteriorated vaccine nor vaccination of those who were malnourished ever resulted in lesions like those described. Syphilis was primarily responsible for the problem and this appears finally to have been the decision reached by the Surgeon General. In 1864, he ordered medical directors, if practicable, "to promptly assign one Assistant Surgeon in each of the larger cities of the Confederacy to the temporary and special duty of vaccinating gratis...all healthy children, white and black, who have not been previously vaccinated." Large numbers of crusts were obtained, mostly from the arms of African-American children. It was reported that following some 1300 vaccinations performed with this material, no abnormal lesions were seen. Less than one month before the close of the war,

medical officers were authorized to pay private physicians \$5 for each reliable scab they could provide. Even then, supply did not meet demand.

Toward the end of the war, vaccine in the North began to be produced successfully in calves by a Dr. Ephraim Cutter of Woburn, Massachusetts. His approach was to make 50 to 75 separate insertions of virus in the hairless spaces under the tail and about the perineum of calves and to collect the scabs from each of these lesions on the twelfth day. In 1865, an inspection of his operations by military authorities disclosed some 50 cows then under observation but the number of satisfactory scabs obtained from each numbered only a few to 20 or 30 per cow. Eventually it was reported that some 16 000 in the Northern Department of the Army had been vaccinated with the material.

The timing of Cutter's efforts is of special interest. Throughout Europe, except in Naples, Italy, the vaccinia virus had been propagated, as in the United States, by arm to arm vaccination. In Naples, however, calves began to be used as a production source for vaccinia as early as 1805 but this approach never found favor elsewhere in Europe until 60 years later. It had been recognized as early as 1814 that with arm to arm vaccination, there was a risk of transmitting the spirochete of syphilis, as well as organisms causing erysipelas. However, the numbers so infected were probably not large because large scale vaccination using a single donor, such as occurred in 1862 in Virginia, was rare. Moreover, there was considerable emphasis placed on obtaining material from what was felt to be a characteristic pustular lesion, a precaution overlooked in the Confederacy in the 1862-64 period.

In Europe, in 1861, a disastrous outbreak of syphilis occurred in Rivalta, Italy, in which material from a child with unrecognized syphilis was used to vaccinate 63 children. Forty-four developed syphilis, several died and some infected their mothers and nurses. This triggered a major debate with regard to the safety of vaccination at an 1864 Medical Congress in Lyons, France. There, Italian scientists described their method of producing the virus in calves, a method which assured that syphilis would not be transmitted because the spirochete cannot grow on calf skin. By the^v_λ Ephraim Cutter had already begun to grow vaccinia on cows. Production of the vaccine virus

was subsequently transformed. Over the next 20 years, most countries shifted ~~the~~^{to} this method for propagating vaccinia virus. In 1870, in the United States, Henry Austin Martin in Boston introduced the practice of transmitting the vaccine from calf to calf in serial passage, a technique which continued until 1980 when smallpox vaccine ceased to be produced.

Although smallpox itself proved not to be a major factor in influencing the ultimate outcome of the Civil War, it came very close to having a decisive role in altering the political leadership.

As the war progressed, the population in Washington and the surrounding area grew rapidly, many coming from farms and rural areas where they had not encountered many of the common childhood diseases. Epidemics of measles, mumps and chicken pox occurred and, in 1863, smallpox began to spread. A special isolation camp had to be established for patients; the Federal vaccine supplies ran out; and it was said that "scarcely a neighborhood" was "wholly free of smallpox". By January 1864, the Chicago Tribune reported there was great terror in the city because of smallpox. By then, smallpox had spread to the White House.

On 18 November, President Lincoln departed Washington for Gettysburg by train and that night wrote the last half of the memorable speech which he gave the following day. En route back to Washington on the evening of the 19th, he lay down in the drawing room with his head bathed in cold water because of severe headache. That night he went to bed with fever and aching pains in his head and back. Two days later a rash appeared. Smallpox was diagnosed. There is no record of Lincoln ever having been vaccinated. The President remained in bed for the following two weeks, receiving no visitors. In early January, William Johnson, Lincoln's personal valet, developed smallpox and died; and, on January 2, Senator Lemuel Bowden of Virginia likewise died of smallpox. It was the virulent form of the disease, variola major, and had it chosen its victims differently, who knows what might have been the subsequent course for the War and for the Union and for the Confederacy.

12 236 cases / 4717 deaths

Aver. annual rate = 5.5 / 1.95 per 1000 strength p.a.

Higher among colored 6716 cases / 2341 deaths
36.6 / 12.2

largest ^{EFR = 38.5%} outbreak - Jan - Apr. 1864.

Why thousands? - Army regts, called for every man to be vaccinated but many Regiments said & sent to the front.
VACCINE (p.626)

Lymph-coated points and vaccine crests -

Crests sometimes melt and so two crests "rubbed together for insertion", hoping one of the two would have sufficient virus.

No problems w/ potency when "fresh vaccine lymph" was used.

R - prompt isolation, all clothes, bedding & shelter burned. Isolation in tent ward or temporary post-house.

Disease most prevalent among troops in the act is

e.g. as many cases among 30000 in Dept. of Washington as among 104000 in Army of Potomac.

No cases in 49394 men of Confederate Army of the Potomac July 61 - Mar 62

but 380 cases in Union Army facing it.

infected during MD campaign, p. Antietam.

Oct 62 - Jan 64 2513 / 1020 of variola
1196 / 34 - varioloid.

First cases in Winchester VA

Considerable spread p. Fredericksburg in Dec. 62 - ~~1862~~

no record of cases but spread extensively both in military & civilian
said that "Confederate Army was panic-stricken by the spread."

Confederate prisoners of war in 9 camps - variously 62-65

(table shown)

9830 cases / 2624 deaths.

Surgeon Sanford Hunt U.S. Vols. - "Spox is not contagious in its early stages. If the patient is secluded at the earliest period when the disease can be recognized by the scientific eye, another and an unprotected person can sleep in the same bedding with very little danger. We have seen this tested on a large scale"

VACCINE - supplied in the form of crests (p.634). Stock was wholly from infants.

"each crest was accompanied by a certificate bearing the name of the donor, that of the child from whom it was procured and the date of its removal"

A small percentage furnished by Dr. Ephraim Cutter of MBS who raised crests from the calf by vaccinating with humanized virus.

long description of Cutter method provided (p 634)

Stables in Lincoln, Lexington, North Woburn, Jamaica Plain, Brookline.

Went to see 28 infected cows in April 65

Used virus taken from a child

In March 15, found actual cowpox - proposed that Cutter put up the two

Kind of cowpox and give them to Army for comparison

Takes lymph on day 8 or extract on day 12-13. Rubs in H₂O & make a cream
makes 50-75 insects "in the hairless spaces under the tail"; about the perineum
and in the commissures between the hind legs. "More than half fail to take"

One cow → 4 to 20 crabs - collected on day 12
scabs then embedded in wax

Lymph collected on day 8 in capillary glass tube - later sealed hermetically
→ 104 reports later received - absolutely no clear cut result.

Vaccination exs. - syphilis, ulcers, erysipelas

"Many of the soldiers had vaccinated themselves"

Principal problem - syphilis

FEAR of vaccination among civilians p. 638

At battle of Chancellorsville 5000 Confederates disabled because of present in

"ulcerations, pustular, resembled Newtonian chancre"

227 from material taken from pustule in soldier who had been vac. from wep 2

"scabs & pustular material from large sores was prepared in belief that atom
the size of the sore was related to the degree of protection."

long report, vivid re: syphilitic pustules. - involved many in the Army of Virginia
Ulcer formed, spread, fever, edema - said to be the result of vaccination
of individual with weakened constitution.

Federal soldiers said not to have had the problem.

Steps taken (p. 146) to collect more vacs from children.

Flu segment 1/2 on sick list & D and fever and ? syphilis.

Problem - principally the South, esp. GA, early years of war.

3 "Since introduction of the Brangency stock in this country by Dr. Henry Markie large armies may be protected from varicella without the use of crusts."