SMALLPOX AND BALTIMORE IN THE 19TH CENTURY*

Yellow fever was the proximate reason for Baltimore Town taking its first formal measures to deal with health problems but as immigrants increased in number and the country and city grew, smallpox became an ever more frequent visitor. Soon it came to be characterized as the most dreaded of all the epidemic diseases.

MacAuley

In severity, the disease appears to have been at least as severe as was observed in Asia as recently as the 1970's. (Clinical slides of smallpox) Data for 19th century Baltimore are sparse but in Baltimore's last epidemic, one occurring in 1882-83, an overall case fatality rate of 26% was recorded. Among those never vaccinated, fully 40% succumbed as well as nearly half of those admitted to hospital.

But let us return to a day in May 1796 when a remarkable experiment took place, one which was to have a profound effect on the practice of medicine. On the 14th of May, an English physician, Edward Jenner (slide) took material from the cowpox lesion of an accidentally infected dairy maid, Sarah Nelms, (slide) and inoculated this material into the arm of a young boy, James Phipps. Phipps, too, developed a cowpox lesion (slide) but

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with few symptoms. Subsequently, Jenner inoculated Phipps with material from a smallpox pustule, in an attempt to induce disease--a process known as variolation. But Phipps developed no symptoms. He was protected from smallpox infection. Jenner subsequently inoculated others with cowpox and with similar satisfactory results. In 1798 he published his famous treatise.

Jenner's findings were at first skeptically received but, as others quickly and successfully repeated his experiment, it became apparent that here, at last, was a means for protection against the feared smallpox. As one writer observed "it was as if an Angel's trumpet had sounded over the earth." Pustular material from cowpox lesions was dried on impregnated threads, slides and silver lancets and dispatched to physicians around the world.

Baltimore's first vaccinations were performed only four years after that first vaccination, in the summer of 1800. For the next two decades, physicians from the Medical and Chirurgical faculty voluntarily vaccinated residents. In fact, during an epidemic in 1812, they also gave 25 cents to each child presenting proof of vaccination.

One might assume that given the prevalent fear of the disease and the availability of vaccine, smallpox would have been quickly put to rest. But it was not. Epidemics recurred every 8-10 years

culminating finally with one of the most severe of them all in 1882-83 during which 6,000 cases and 1,500 deaths were recorded.

The problems in 19th century Baltimore paralleled those in other parts of the country and in many other industrialized nations. The problems were threefold: 1) There were problems with the availability and quality of the vaccine; 2) There was less than full compliance of the population in accepting vaccination; and finally (3) cooperation of the medical establishment was not wholehearted. Indeed, many of these problems closely resembled those with which we were faced only 25 years ago when the global smallpox eradication campaign was launched.

The vaccine virus was initially propagated by arm to arm vaccination. Pustular material or a scab was taken from a vaccinee and inoculated into the arms of others and then additional material was harvested from them and the process repeated in a continuing chain of arm-to-arm propagation. The virus was relatively resistant to inactivation--but only relatively. Some preparations proved ineffective, thus requiring another source to be sought to renew the supply.

The Congress sought to solve this problem, enacting a bill in February 1813, which authorized the President to appoint an agent to preserve the genuine vaccine matter and to furnish it to any citizen of the United States through the medium of the post

office. Exactly how he was expected to perform the function of preserving the vaccine matter was not elaborated. Maryland's agent for vaccination, a James Smith, promptly posted a public notice indicating that vaccine crusts would be sent to any person who applied, albeit requiring that a fee of $5.00 must accompany each application. (User fees were popular even then.) He also noted that a fee of 50 cents would be charged for the examination of any crust that might be derived from other sources. He pointed out that the procedure was the simplest imaginable, without danger, and indicated for persons of all ages. In brief, anyone could perform vaccination.

How James Smith obtained all the vaccine crusts he needed and what the public response might have been are unknown. However, the persistence of smallpox was testimony alone that this was not an adequate solution to the prevention of a disease which Smith described in his notice as "the most loathsome and destructive disease which has ever afflicted the human race."

Eventually, Maryland, as many other states, established a state vaccine institute to assure that vaccine crusts were properly collected and distributed but in 1872, the state vaccine itself was declared to be impotent and other sources of the virus had to be sought.

Public response to vaccination was undoubtedly hampered by the not infrequent simultaneous occurrence of erysipelas and sometimes the transmission of syphilis and hepatitis by inoculation. Some objected to vaccination in principle believing God had sent smallpox to chastise the population and that one should not interfere artificially with God's will. Others objected to inoculating humans with an animal disease and popular cartoons depicted people growing horns or tails after being vaccinated.

One might assume that efforts would have been made to propagate the virus by innoculation or scarification of calves. It was, after all, recognized as a cowpox virus and cows did develop cutaneous lesions when inoculated. In fact, cowpox virus was grown on calves in Italy as early as 1810 but for unknown reasons, this practice did not catch on elsewhere until after a Medical Congress in 1864. Soon, thereafter, many European countries began growing the vaccine on calves. However, the first commercial facility in the U.S. was not established until 1882, 18 years later, and this was in Marietta, Pennsylvania--called Dr. Alexander's Lancaster County Vaccine Farm--later known as Wyeth Laboratories.

Vaccine production was a simple, crude but effective process. Scarifications were made on the abdomen of a cow or calf,

vaccinial material was rubbed into the lesions and 7 to 10 days later, the pustular material was scraped off, filtered and packaged for delivery. In fact, with only minor modifications for purposes of quality control, almost all vaccine was produced in this manner until 1980 when production finally ceased.

Thus, throughout much of the 19th century, vaccination was anything but a simple and certain procedure. Smallpox deaths continued to be recorded every year in Baltimore with epidemics occurring every 8 to 10 years.

Baltimore's largest and last three epidemics occurred in 1863-64; nine years later in 1872-73; and a decade later in 1882-83. The first was coincident with the Civil War, an epidemic which afflicted Washington as well. Its most notable victim fell ill with the disease on November 19, 1863, shortly before he left Washington to deliver a speech. He returned to Washington and to two weeks in confinement. The victim was Abraham Lincoln and the speech he delivered was the Gettysburg address.

Baltimore had begun to employ public vaccinators or vaccine physicians, as they were sometimes called, in 1821. They were part-time employees responsible for vaccinating in their assigned ward those who could be so persuaded and contacts of cases which

were discovered. There were many who argued for compulsory vaccination of all but this was rejected until the time of the last of three major epidemics.

The epidemic of 1863-64 resulted in 688 recorded deaths but the second epidemic, nine years later killed 2,051, more than three times as many. Public vaccinators went house to house, eventually vaccinating more than 138,000 persons, roughly half the population. Problems with the vaccine persisted. Vaccinators reported that only 72% of the vaccinations were "successful," judged presumably by the development of a pustular lesion. This almost certainly is an overestimate. As we were to discover in India in the 1960's, pustular lesions could be induced by contaminated vaccine, even without living virus present, often leaving what appeared to be a typical vaccination scar.

As the epidemic of smallpox subsided, so did the epidemic of vaccination. The public vaccinators reported 88,000 vaccinations in 1873 but only 1,000 to 3,000 each year over the next 6 years. The stage was set for the next and last epidemic which began in January 1882. It continued almost unabated throughout the summer and intensified further as the cold weather settled in.

Seventeen vaccination physicians were working when the epidemic began; a number which increased to 69 by August and 119 by

January 1883. In October, vaccination was made compulsory and unvaccinated children were excluded from school. Some 312,000 persons were vaccinated, amounting to 88% of the population. The quality of vaccine clearly represented a continuing problem. Indeed, 58% of all cases were said to have been previously vaccinated. Perhaps the most significant action taken by the health department was the purchase in January 1883 of a new supply of what was called "the purest animal virus." Presumably this came from Dr. Alexander's Lancaster County Vaccine Farm which had begun production less than two years before. Whether the result of greater efforts or better vaccine, the epidemic subsided rapidly and at a time when there is customarily a seasonal increase in smallpox.

Effective control of smallpox requires that cases be promptly reported, the patient isolated and his contacts vaccinated. And this was recognized at a very early date. Cooperation in reporting left much to be desired, perhaps no different from what pertains today. In 1820, an ordinance was passed which required physicians to report all cases of malignant, pestilential and contagious illness, stipulating a penalty of $100 for non-compliance. Nineteen days later, this was rescinded in response to objections by physicians in Fells Point and reporting returned to being voluntary. In 1834, an ordinance called for physicians to report cases of smallpox within 24 hours and called for the names of those failing to comply to be published in the

newspaper. This, too, was soon deleted and in 1868, even the request for physicians to report cases was omitted from the ordinance. Not until the epidemic of 1882 was reporting of cases made compulsory and then apparently only transiently.

Deaths due to smallpox continued to occur after the 1883 epidemic but malignant smallpox never again appeared in epidemic form. A better quality vaccine undoubtedly had something to do with this but there was another event of significance--the appearance of variola minor or alastrim.

In 1896, Pensacola, Florida witnessed the first outbreak of a new form of smallpox which clinically resembled the classic form but which caused few deaths. In contrast to case fatality rates of 25% or more with variola major--what some called the "true smallpox", alastrim or variola minor was associated with case fatality rates of less than 1%. The origin of variola minor remains obscure although some suspect that it came from South Africa which had recently began to experience a similar disease which they called Kaffir pox. Whatever, variola minor spread rapidly across the United States, reaching Baltimore only three years later. Cases of the severe form--variola major--diminished rapidly and thereafter disappeared completely in 1929. Under the pressure of increasing levels of compulsory vaccination, variola minor itself was finally eliminated but not until the 1940's.

Smallpox vaccination continued, however--and was mandatory for school entry up until 1972. Indeed, it is probably safe to say that Baltimoreans of the 1950s and 1960s were better vaccinated than those residents in the 19th century. Then in 1967, the global eradication campaign began, smallpox incidence fell and in 1972, compulsory vaccination in the U.S. ceased. Five years later, the last smallpox case occurred, and in 1980 smallpox was declared to have been eradicated. Vaccination stopped throughout the world and now the old buildings of the Lancaster County Vaccine Farm are a small museum.

Nineteenth century Baltimore's record of performance with smallpox was reasonably characteristic of that exhibited elsewhere and the attitudes were characteristic even today of attitudes exhibited both by the public and by health care providers. All would acknowledge that vaccination is a wondrous tool, more effective in preventing illness and death than <u>any</u> other available medical procedure. However, there was and is a remarkable complacency about performing vaccination <u>until</u> an epidemic occurs. So, throughout history, there has been a monotonous record of epidemics of disease <u>followed</u> by epidemics of vaccination. The epidemic stops and vaccination is then all but forgotten. Such indeed led to the 19th century smallpox epidemics in Baltimore and to the 1990 measles epidemic in this country. Will we ever learn?

References

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