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MYCOBACTERIUM TUBERCULOSIS: An In-depth Discussion for Embalmers Part 1

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ABSTRACT: Tuberculosis and related mycobacterial disease states is comprehensively covered. The ancient and recent history of mycobacteria and their relationship to man and society is delineated. The impact of tuberculosis during the white plague centuries and the debilitating effects on U.S. society in the 40's and 50's is discussed. The tuberculosis organism, itself, and its pathophysiology is reviewed. The impact from the new epidemic of the 90's with drug resistant strains is explained and commented on. The dangers in embalming and appropriate safety protocol for embalming is discussed and charted with recommendations for safe precautionary embalming .

INTRODUCTION: Mycobacterium tuberculosis holds the dubious distinction as the number one killer of all time, throughout the history of mankind. The death toll from this organism stands at a staggering thousand million people throughout recorded history. This total is, no doubt, underestimated and the numbers continually increase with every passing year that is logged by mankind.

The ancient history of tuberculosis is voluminous, with its impact and description in the earliest of recordings of human history. In the 1600-1800's it was aptly named the "White Plague" defining its immense impact on human society worldwide. Tuberculosis persisted as a continual threat to the developed countries until the late 40's to early 50's, when effective control measures were implemented.

Mycobacterium tuberculosis is one example of a diverse group of unusual microorganisms that impact man in various ways and still pose a serious threat worldwide despite scientific advances. The new worldwide epidemic threatens to devastate and alter life on the planet throughout this century and in the foreseeable future. The seriousness of tuberculosis is usually downplayed in the U.S. because of the relative obscurity of

the disease and the low number of cases documented yearly in our highly developed society. This relaxed attitude pervades the embalming profession and tuberculosis, more often than not, is viewed as just another disease state that passes through the embalming room. I disagree with this assessment and assert that tuberculosis, especially the MDR (multi-drug-resistant) strains, present a definite danger during embalming and demand close attention to infection control that exceeds universal precautions as they are routinely and half-heartedly applied during most embalming scenarios. There are simple but effective precautions that can be used in addition to standard procedures that will greatly enhance safety and allow almost risk-free embalming in almost all situations. These will be discussed in detail.

AN ANCIENT DISEASE: Tuberculosis and the related mycobacteria have been with mankind since before recorded history. Egyptian mummies show spinal bone ulcerations and long bone ulcerates that would have been painful and disfiguring to the bearer of the affliction. This characteristic hunchback look is depicted in hieroglyphics and tomb paintings dating back to 3000 B.C.. One child mummy dated at approximately 4000 B.C. actually harvested tubercle bacilli. Another mummy even shows tracks of pustular discharge along the spinal psoas muscle (which occurs only in T.B.). This particular mummy was highly investigated as he was identified as a High Priest of Amon.

The actual earliest neolithic grave site that implicates tuberculosis is located in Heidelberg, Germany and shows vertebral destruction indicative of T.B. and is dated at 5000 B.C.. Several additional stone age skeletons dated at 4000 B.C. in various locations throughout Europe show characteristic tubercular vertebral destruction. Tuberculosis appeared in Britain during Roman times and exerted a serious impact on health to the entire Roman Empire.

The Bible is very explicit in numerous passages (Deuteronomy and others) in siting both the disease and the characteristic aftermaths that afflicted the bearer of tuberculosis. Numerous sites also exist for tuberculosis' close relative - leprosy.

Tuberculosis was present in the Americas long before Columbus' landings in the late 1400's and early 1500's. Peruvian mummies have been confirmed to be carriers of T.B. by DNA analysis of the remains. Numerous examples of Mayan art and drawings depict symptomology of tuberculosis. Several American Indian graves have rendered skeletons with tubercular signs (the most definitive being an Ohio Indian gravesite with a 1275 A.D. date). Epidemics of the Ontario Hurons and New York Indians are well documented in historical literature. Mummy studies indicate that the affliction rate was 1-10% of the total population in various Indian cultures.

Globally, tuberculosis is definitively demonstrated in Indian elephant skeletons dating prior to 2000 B.C.. It was present in prehistory Asia and has been implicated in protohistory Japan in the ancient Ainu tribes. Numerous references to tuberculosis-like disease in India and China (2000-1300 B.C.) include commentary about the symptoms and characteristics of the disease and notes its incurability. Hippocrates coined the term tubercula for consumptive disease or "the phthisis" which means literally to spit. The link between spinal and pulmonary symptoms was delineated in the 400 B.C.'s. Galen later described T.B. in more detail and attempted treatments without success.

Mycobacteria was probably a soil bacteria that developed infectious capability in humans very early on in mankind's history. Mycobacteria also affects cattle, birds, fish, frogs and small reptiles. There has been a constant danger from infection from the bovine strains through the ingestion of milk and dairy products. Mycobacteria is destroyed by sunlight and ultraviolet irradiation, but can survive weeks and months in dust and air.

THE WHITE PLAGUE: Tuberculosis' place in society was aptly defined poetically as "The Captain of Death", such was its immense impact on the suffering and misery of mankind. The White Plague refers to the term given tuberculosis during the 1600's to late 1800's. During this time the only thing thought possible for the affliction was divine intervention. The symptoms were debilitating and disfiguring and coined "lupus vulgaris" for the grotesque thickening and reddening of the facial tissues that was indicative of advanced tuberculosis. Scrofula is the term used for the tuberculous swollen and discharging lymph glands at the surface of the neck region in a person suffering from T.B..

Touching by Kings and Queens to cure the so-called "King's evil" started in England with Edward The Confessor in 1050 A.D. and continued up to Queen Anne. Clovis, of France, however, was probably the first European monarch to actually touch - doing so in his coronation ceremony in 496 A.D.. Charles II in the 1680's is known to have touched an average of 90 of his subjects per week during much of his reign. Scrofula was a very visible and common symptom of T.B. and more often than not self-resolved as the disease subsided. This disappearance of scrofula was, no doubt, the cause for the belief in the efficacy of the King's touch. Interestingly, Samuel Johnson was one of the last to ever be touched, having been so as a boy in 1712.

In London in the 1700's, 1 out of every 5 deaths was attributed to consumption and the term White Plague was born. Tuberculosis peaked in England in 1780 with a total yearly death toll of 1-2% of the entire population. In 1815 it was estimated that 1/4 of all the population of Europe had tuberculosis in one form or another. By the turn of the 19th century, the death toll was 7 million with 50 million infected in London and New York alone. In the United States from the American Revolution to the 1800's tuberculosis accounted for 20-25% of all deaths.

In 1882, Robert Koch isolated and identified *Mycobacterium tuberculosis* and elucidated much microbiological knowledge about this unusual bacteria. T.B. grows very slowly (1/30th the normal rate for most other bacteria) and reproduces as slowly. It is very difficult to stain due to its waxy coating and is very difficult to culture and keep alive in the lab. The two ways of infection in society are inhalation and ingestion (mostly cows milk) and casual contact is enough to transmit infection. This is exemplified by the fact that 1/3 of the world's population is skin test positive for T.B.. Inhalation dangers exist due to the inclusion in droplet nuclei of 1-5 microns and the fact that the organism survives very well dried and in fomites (but this is not the usual method of transmittal).

The death toll of famous and influential people is truly staggering. Poet John Keats died at 25. Vivian Leigh, wife of Laurence Olivier and star of *Gone With The Wind* died from pulmonary tuberculosis. St. Francis of Assisi, Eleanor Roosevelt, Louis XIII of France, Spinoza, Kafka - all sufferers and deaths attributed to T.B.. Simonetta Vespucci, the 23 year old model for Botticelli's *Venus* died from tuberculosis. Botticelli's serpent around the neck of the sculpture signified the death sentence of T.B.. Cardinal Richelieu, Sterne, Shelley, Poe, Eugene

O'Neill, Sir Walter Scott, Emily and Charlotte Bronte all succumbed to tuberculosis. Additionally, D.H. Lawrence, George Orwell, Thoreau, and Hawthorne were also victims. Rousseau, Anton Chekhov, Schiller, Emerson and Paganini were all life long sufferers. Chopin suffered and died from tuberculosis. The operas "LaBoheme" and "La Traviatta" (which was adapted from Alexander Dumas' Camille) are both patterned after real life tragedies.

In the late 1800's, the sanatorium movement started in Europe. The tenets of this movement were fresh air, nutrition, relaxation, bedrest, rural life style and quarantine. The most famous sanatorium ever was in Davos, Switzerland and is the basis for Thomas Mann's novel Magic Mountain. Robert Louis Stevenson was a resident at Davos prior to his death in Samoa at age 43 from T.B..

T.B. IN THE 40's: The 1940's and 1950's are historically interesting for the enormous impact that T.B. had on the lifestyle of the United States during this time period. It was a time of traditional cures and radical and exotic treatments most of which were of doubtful value coupled with fear and apprehension and misunderstanding of American society.

The sanatorium movement was slow to start in the United States compared to Europe, but once it did, it became a major factor in a short time. The most famous U.S. sanatorium was Trudeau's Saranac Lake Retreat. Almost all states had at least one or more sanatoriums, some states having numerous. The heyday for sanatoriums in the United States was the year 1953. A total of 839 sanatoria existed with over 130,000 beds available and most were full. Over one million dollars per day was spent on T.B. in the United States in 1953 - an enormous sum considering inflation and today's dollar buying power. The sanatorium concept in the United States was similar in design to European sanatoria in that diet, regimented exercise, high altitude, bedrest, sunlight and cold air were all stressed as beneficial to the tuberculous condition. Looking back, of course, most of these ideas were unfounded and of dubious value.

Several medical treatments were in vogue during this heyday of tuberculosis treatment. One of them was pneumothorax - a treatment that was quite fashionable from its beginnings in the 1910's and extending to the 50's. Essentially this procedure was purposeful medical lung collapse which was thought to allow the lung to rest, however, it usually did nothing except to worsen the condition of the patient. Even more drastic was thoracoplasty - surgical rib removal with resultant permanent lung collapse. Again, dubious results were achieved but medical science firmly believed in the procedure. An even more bizarre modification of this type of procedure was called extrapleural plombage wherein paraffin was injected into the pleural cavity to permanently collapse one lung. Even plastic ping pong balls were used for the very same reason in the 1940's. Another procedure was a unilateral phrenic nerve crush which resulted in a shutdown of diaphragmatic action on one side only for the same type purpose - to allow the lung to rest. Despite what looks ridiculous to us now, it was firmly believed at that time that all these procedures were beneficial and based on sound medical reasoning.

CONTINUED: Mycobacterium Tuberculosis: An In-depth Discussion for Embalmers.
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