

Entertaining Mummies: Embalming for the Sideshow

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Abstract

This presentations examines a group of five mummies that were not prepared for the journey to the afterlife but rather preserved and exhibited for commercial enterprise, the sideshow. The study originally comprised five episodes of a forty episode series, «The Mummy Road Show» broadcast on the National Geographic Channel in the United States and internationally. A brief history of the sideshow will be presented to demonstrate the mummies' roles in the development of that unique segment of the entertainment industry. The method of embalming will be discussed from both its historical context and ability to preserve internal organs. The use of conventional radiography, computed tomography and videoendoscopy to examine the skeletons and well preserved internal organs will be considered in an attempt to substantiate or refute the stories associated with each mummy. In addition, an autopsy conducted on one of the mummies will be correlated to the imaging studies.

Introduction

Unlike societies that prepared the remains of the deceased for the journey to the afterlife or as a form of ancestral reverence, mummified remains that found their way into the American side show during the late 19th and early 20th centuries were more victims of circumstance. Among the conditions that resulted in the exhibition of these mummies were the creation of a middle class, development of the dime museum and introduction of embalming during the Civil War.

As early as the 1830's, the Industrial Revolution began changing the New England and North Atlantic regions of the United States (Yates, 1963). Sons and daughters were drawn from pastoral rural communities to the industrial hubs of Boston, New York and Philadelphia. By the 1840's, they were joined by the flood of immigrants that poured into the same cities that also served as ports-of-entry into the United States. The combined effects of industrialization and urbanization resulted in profound societal changes. A middle class was created composed of positions such as clerks, sales and office personnel. Along with the factory worker, they crowded into tenements and boarding houses. Dennett (1997) pointed out that the rise of the dime museum, the predecessor to the sideshow, was the result of these enormous changes. Instead of families gathering in the parlors of their rural single-family dwellings, the new urbanites had to find commercial entertainment as a place to gather on days off. Dennett (1997) noted that no previous form of entertainment, under a single roof, spanned the gap between the society's elite and the lowly factory worker. Phineas T. Barnum best exemplifies the entrepreneurial spirit behind this new form of entertainment. In 1835, he learned that a 161 year old Negro woman who claimed to be the

nurse of George Washington was on exhibit in Philadelphia and her owner was interested in selling her for \$1000.

Barnum traveled to Philadelphia, purchased Joice Heth, as she was known, and began to exhibit her in New York. Prior to showing her in Boston, Barnum used posters to prepare for her arrival. Newspapers heralded her appearance. When ticket sales began to drop, he used novel advertisement to keep Joice fresh in the mind of the public. At one point he sent an anonymous letter to a newspaper stating that Joice was a "humbug", nothing more than a "curiously constructed automation" operated by a ventriloquist (Barnum, 1927). He concluded that "the public appears disposed to be amused even when they are conscious of being deceived" (Barnum, 1927). In 1841 Barnum opened the American Museum in New York. By employing all the tactics such as, advertising, marketing and word-of-mouth, that kept the public coming back for another look at Joice, within a year he owned the property and established the standard for the entire entertainment industry.

Because of the competition to draw in audiences, dime museums had to include live performances, living and preserved human oddities, taxidermic specimens of animals and animal oddities and of course mummified human remains from Egypt. When the dime museum went on the road to become the sideshow, the best of the attractions were included. Unfortunately, Egyptian mummies were relatively fragile and didn't travel well. A more durable mummy was needed.

The United States Civil War, which began in 1861, created another set of factors that contributed to the eventual exhibition of mummified human remains. Prior to the War, embalming was limited to the preservation of animals and human cadavers for dissection. At the time, the primary method to delay decomposition was to pack the body in cracked ice (Strunb and Frederick, 1959). Since Union soldiers were dying in the South, a long way from home, a method was needed to preserve the bodies for transport. Within a month of the beginning of the conflict, a close friend of Abraham Lincoln was killed in Alexandria, Virginia. According to an article published in a Washington newspaper ("Brutal Assassination", 1961), the distraught president had the body of the fallen hero taken to the Executive Mansion and prepared by a "Dr. Holmes" for viewing in the East Room of the President's home. The article quoted the President's wife as saying "he seemed to be enjoying a brief pleasant sleep". News spread quickly and before long Dr. Thomas Holmes and several other embalmers usually appeared a few hours after a battle (Garrison, 2000). Ward *et al* (1990) wrote that "itinerant embalmers followed the armies advertising their services". When tragedy struck the Lincoln family in February, 1862, with the death of their 12 year old son, William Wallace (Willie), Dr. Charles Brown was selected to embalm the child (Kunhardt and Kunhardt, 1965). Dr. Brown's services were requested again following the assassination of the President. Since the body of the fallen leader was to take a 1700 mile circuitous route from Washington to include every city the President-elect stopped while traveling in February 1861, every effort was made to prevent

decomposition. By the time Lincoln reached his final resting place, it is estimated that 7,000,000 people or approximately one-fifth of the nation's population viewed the remains.

The means to make a flawless mummified individual had been developed and the technique amply demonstrated. The next step was to connect the perfect mummy with the showman. The following paper will attempt to make that connection while using medical imaging techniques to demonstrate the internal structure of these anatomic time capsules.

Materials and methods

A total of five mummified individuals were examined and originally presented as five episodes of a forty episode series, «The Mummy Road Show» broadcast on the National Geographic Channel in the United States and internationally. Four of the mummies had traveled extensively on the sideshow circuit in the late 19th and early 20th. Each had extraordinary stories associated with their sideshow "persona". The remaining two, although exhibited in sideshows, were used primarily as a demonstration of the preservation technique developed to replace arsenic embalming solutions.

Sylvester

The sideshow "pitch" described him as a card cheat who had been shot after a questionable deal, escaped out of town on his horse only to fall off and die. His body was buried by the shifting desert sands near the town of Gila Bend, Arizona, United States, naturally desiccated and subsequently mummified. A 6mm opening in the left upper quadrant of the abdomen was said to be the entrance wound from the shot that killed him. Following an extensive period of sideshow touring, the mummified remains ended up in Ye Olde Curiosity Shoppe in Seattle, Washington, United States where he was examined for the present study.

Marie O'Day

The legend claimed that in 1925 Marie O'Day, a night club entertainer in Salt Lake City, Utah, was stabbed in the back below the scapula and her throat slit by her common-law husband. To hide the crime, he dumped the lifeless body into the Great Salt Lake. Twelve years later, the body, preserved by the high salinity of the Lake, washed up on shore. The murderer was sentenced to 99 years in the Utah State Penitentiary and Marie's body ended up on the sideshow circuit. After touring 38 States and Canada she was sold to Captain Harvey Lee Boswell in 1975 and continued her career as part of the Palace of Wonders. Following Boswell's death in late 2001, Marie and the remaining sideshow exhibits were stored on his property in Wilson, North Carolina where the present study was carried out.

Andy

Andy, was housed, at the time of the study, at the Ripley's Believe it or Not warehouse in Orlando, Florida and had two stories associated with it. The first was that he was a 1000

year old petrified man. The other version claimed he was a carnival worker who performed the "human blockhead". The act consisted of the performer inserting a large nail into his nose and hammering it in until only the head of the nail protruded from his nostril. Upon his death, Andy's dying wish to remain with the sideshow was granted.

Hazel Farris

Hazel Farris, the tale stated, had a stormy marriage. One night, during a drunken argument, she shot her husband, killing him. Responding to the disturbance, three sheriff's deputies went to the house and all were shot dead by the enraged woman. Next the Sheriff arrived and in the ensuing scuffle Hazel's finger was shot off before she killed law enforcement officer. In an attempt to escape, she fled from Nashville, Tennessee to Bessemer Alabama, her original home, and became a "Lady of the Evening". One night, Hazel confided in her new beau. When he learned there was a five hundred dollar reward for her capture, he turned her in to the local authorities. As the police were coming to arrest Hazel, she drank a mixture of whiskey and arsenic which transformed her body into a mummy. The body was transported to a Bessemer furniture store where it remained for some time without being claimed. One day a sideshow man stopped by and purchased the remains of Hazel Farris for five dollars and spent an fifteen dollars for the wooden coffin she was in. She toured the country complete with banners and fabricated wanted posters for several decades. After the last tour, her remains were stored on a farm near Nashville where she was alternately kept in a barn or under a couch, or at times, under the kitchen table. The children of this family apparently played with the mummy as if it were a life size doll, dressing her, washing and combing her hair, and, when she showed signs of mildew, was hosed off and cleaned. Hazel was still taken on an occasional road trip to help raise money for the local historical society in her hometown of Bessemer Alabama.

Hamrick's Mummies

Two mummies were produced by Graham Hamrick, an eccentric farmer in rural West Virginia, United States. He was attempting to find an alternative embalming method to those popular in the late 19th century that contained arsenic. The chemical compound and technique he patented in 1892 (Mendelsohn, 1940), involved a solution of sublimed sulfur, which was poured into an opening in the abdominal wall before the remains were placed in an airtight encasement and smoked with fumes from ignited sulfur. Hamrick wrote that, depending on the stage of decomposition in the abdominal cavity, it might be necessary to remove the abdominal viscera prior to embalming. He practiced his technique on various food items and farm animals prior to attempting it on human bodies. In 1888, he acquired two female cadavers from the West Virginia Hospital for the Insane and embalmed the pair. Although Hamrick's results were exceptional, his procedure never became mainstream. The two well -preserved mummies toured the sideshow circuit in an attempt to educate and advertise Hamrick's

substitute to arsenic embalming. After touring on the sideshow circuit ended, the mummies were forgotten until a flood in 1985 washed them out of the barn in which they had been stored. The present study was carried out where the mummies now reside in glass and wooden cases in a small museum in a converted train depot in Philippi, West Virginia.

Each mummy in the study was examined physically, followed by conventional radiography, and when appropriate, video endoscopy on site. On site radiography was accomplished with a 1954 vintage Picker Mobile Army Field Radiographic Unit. Images were capture on 8 x 10 inch Polaroid photographic film which eliminated the need for darkroom processing. Video endoscopy was conducted using a 6mm Olympus industrial videoendoscopic system that captured images on a digital recording system. The remains were then transported to a nearby diagnostic imaging center for a computed tomography (CT) examination. Although CT systems varied from center to center, in all cases image slices were never less than 5mm. Tissue samples were obtained from three of the mummies and sent for analysis to either Surface Systems lab or the University of Michigan.

Results

Sylvester

Physical examination ruled out the possibility of Sylvester being a desert dried individual, as the mummy weighed approximately 100 pounds. The external exam further revealed an extremely well preserved, male individual who was deep to golden brown in hue. The integument was extremely hard to the touch and did not give to modest pressure when applied. Numerous small diameter elevations were noted on the right side of his face, which were initially thought to be a dermatologic condition. There was a 6mm diameter opening in the left upper quadrant of the anterior abdominal cavity with a purplish stain around its perimeter. The mummy was stored in an upright position and below the feet was a small pool of a sticky dark substance. Conventional radiographs of the skull revealed a remarkably well preserved brain which was approximately two-thirds normal size indicating minimal desiccation or decomposition. CT scan of the head confirmed the presence and excellent preservation of the brain with clearly identifiable gyri and sulci. The degree of radiopacity within each of the elevated areas on the right side of the face indicated imbedded pellets from a shotgun blast. An anterior-posterior view of the skull and subsequent CT images of the same area demonstrated that the pellets did not penetrate the cranial vault. Additionally, the pellets were not flattened suggesting steel rather than lead composition. Given that the integument had healed over the pellets, the wound to the face occurred long before death. Conventional radiographs of the chest and abdomen revealed well -preserved internal organs including the lungs, heart, great vessels, liver and spleen. As with the brain within the cranial vault, these organs were about two thirds of their normal size iconfirming minimal desiccation or

decomposition. Additionally, a pellet or bullet was demonstrated just under the second rib at the mid-clavicular line. CT was unable to demonstrate a path from the supposed entrance wound on the abdominal surface to the location of the projectile high in the thoracic cavity. The videoendoscope was passed through the opening in the abdominal wall and confirmed the excellent preservation status of the liver, spleen and diaphragm. SEM-EDX of skin samples taken from the inner aspect of the thigh as well as from the pool of material beneath the mummy revealed the presence of arsenic in both samples.

Marie O'Day

Conventional radiographs of the skull not only revealed dura mater and brain remnants, but also a radiopaque upper denture that provided the only definitive temporal context for mummified remains. Prior to the 1940's, dentures were manufactured with a material known as "Vulcanite" (Creighton University, n.d.). Although the sulfur harden, rubber material was introduced by Nelson Goodyear in 1851, it became popular in the latter portion of the 19th century.

Since the superior surface of the denture was not against the palate, it prevented a clear view of the dentition. However, several general observations were possible. The lack of teeth between the molars and canines suggested dental disease and bone attrition in both the maxillae and mandible. The CT images provided an unobstructed view of the dentition and confirmed the initial radiographic findings. Due to the state of preservation of the thorax, several structures were seen on the chest radiographs. On the AP image, a slightly irregularly crescent-shaped radiopaque structure was noted extending from the right 7th to 8th rib interspace close to the margin of the thoracic spine. Ill defined, "wispy" radiopaque shadows were seen at the same level of the left thorax. The right diaphragm was clearly demonstrated. The thoracic aorta and margin of the right atrium also appeared well defined. The CT images not only confirmed the presence of thoracic organs, but also shed light on the identity of the other shadows noted within the chest. The crescent-shaped object in the right chest was identified as a vertical group of calcifications outside of the circulatory system, possibly within lymph nodes. Since CT is a quantitative modality, it was possible to obtain a numerical value that represents the actual x-ray attenuation of the tissue. With a pixel value of 1869 for one of the calcifications, it suggested a lymph node that had undergone a pathologic process. The wispy shadows in the left thorax were due to a cluster of cavernous lesions in the left lung. Since each cavity had a well-defined margin, it was determined to be premortem lesions and not due to postmortem changes. A fine needle CT guided biopsy was attempted to recover tissue from the site of one of the calcifications. Although tissue was obtained, the sample size was insufficient for a conclusive analysis. Evidence of the lack of decomposition was clearly demonstrated in the radiographs of the abdomen. The liver was plainly seen extending from the diaphragm to just above the iliac crest. Other shadows were visible within the

abdomen, but individual structures couldn't be identified. The soft tissue defect in the back, over the lumbar spine, where a skin sample had been taken, couldn't be visualized with the plain radiographs. CT images of the same region confirmed the level of preservation, however, in addition to the liver, the kidneys were clearly noted. Other, less solid, soft tissue structures were present, but not easily discernable. In addition, the soft tissue defect, not visualized on conventional radiographs, was well delineated on the CT images.

Andy

On physical examination the mummy appeared well preserved and dark skinned with embalming incisions on the neck (Fig. 1), abdomen and along the inner aspects of both thighs. Because of the appearance, the suture style used to close the incisions was termed 'baseball stitch' and introduced into mortuary practices in around 1900. Conventional radiographs and CT images demonstrated a nail within the nasal cavity. The head of the nail was at about the mid-turbinate level and the distal tip resting on the posterior nasopharyngeal wall (Figs. 2-3). However, due to the location, it was ruled out as a contributing factor in the death of the individual.

The plain x-rays revealed significant dental attrition. The thoracic and lumbar spine, were relatively free of arthritic changes. However, the right hip showed early arthritic changes suggesting that the individual was likely in his early to mid thirties at the time of death. In addition to minor arthritic changes a fractured sternum or anterior rib was noted on the left thorax. By eliminating the superimposition of shadows, the CT cleared away any confusion regarding

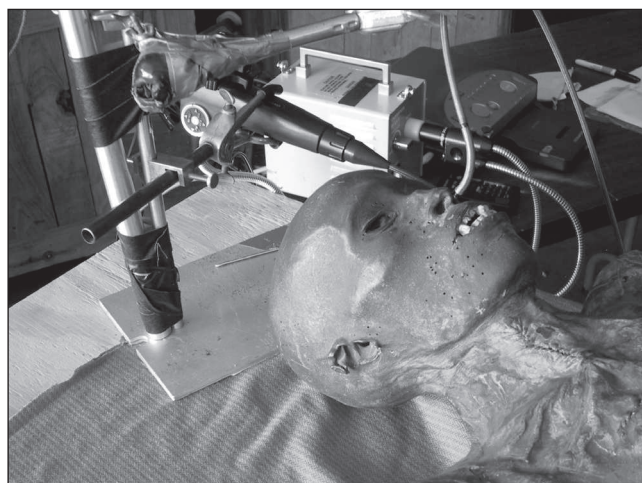


Fig. 1 - Photographic demonstration of embalming site on neck of "Andy".

the location of the break. The fractured rib had penetrated the thoracic cavity. In addition, the possible circumstances surrounding the individual's death were recorded by the remarkable preservation of his thoracic organs. CT images showed a collapsed left lung and a shift of the mediastinal structures to the right with the heart more midline than normal. The right lung was still expanded and filled the right hemithorax. All the signs indicated a tension pneumothorax.

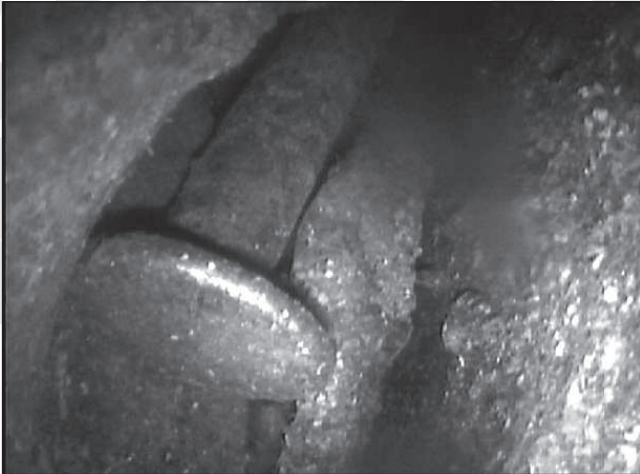


Fig. 2 - Endoscopic view of nail head within the nasal cavity.

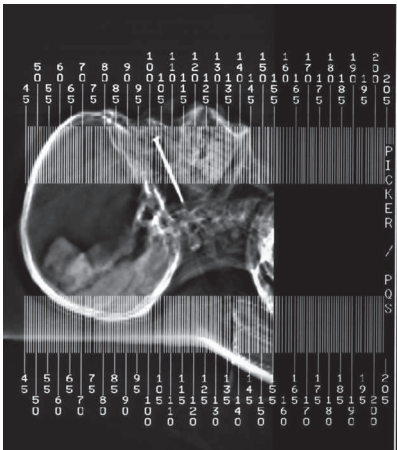


Fig. 3 - CT scan 'scout' image showing the location of the nail in its proximity to the posterior nasopharyngeal wall.

The pleural space is only a potential space with a serous-like fluid separating the visceral and parietal layers of the pleura. In this mummy, the thorax was disrupted from the rib fracture allowing air to enter the pleural space. During the sub-atmospheric pressure period created by inspiratory effort, air was drawn into the pleural space. On expiration the opening in the chest wall closes, trapping air in the pleural space. The opening acts as a one-way valve allowing air to only enter the pleural space and not exit. Repeated respiratory cycles cause a build up of air and therefore pressure within the thoracic cavity causing the contents of the affected side to shift away from the pressure build up. As the pressure builds within the thorax the lung on the affected side collapses since it cannot overcome the increased intrathoracic pressure. A tremendous shunt (perfusion without ventilation) of pulmonary blood would develop causing a decrease in oxygen in the blood. The pressure within the thorax would also compress the great veins decreasing venous return to the heart, which would in turn decrease cardiac output and systemic blood pressure. Poor blood oxygen levels coupled with poor cardiac output and decreased blood pressure would cause perfusion and oxygen deficits in virtually all tissues and organs necessitating anaerobic metabolism resulting in a lactic acidosis throughout the body. The body's natural stress response to this lack of oxygen would cause the individual to breath more deeply and rapidly in an attempt to attain more

oxygen. This increase in ventilation worsens the condition. If not treated, the individual will die from anoxia and the resulting organ system failures. A tension pneumothorax is treated by reversing the one-way valve with a device called a chest tube, which decompresses the pressure within the thorax and allows the lung to re-expand, reverses the shift of mediastinal structures, and returns the cardiopulmonary status to near normal function. Without the chest tube the prognosis is grave. This mummy's untreated tension pneumothorax was the most likely cause of death.

Hazel Farris

Physical exam revealed a highly preserved female individual, dark in color, tough skin, golden hair, amputated ring finger of the right hand at the level of the articulation between the proximal and middle phalange. Mold was present on the surface of her body. No obvious entry points for embalming were noted.

Radiographs of her skull revealed remnants of brain and dura at the base of the skull suggesting an upright positioning following the embalming and before the tissues hardened by the preservation process. CT scan confirmed the presence of residual brain matter and dura within the skull and revealed that the globe of the eye was maintained suggesting rapid embalming near the time of death. Extensive periodontal disease was noted as well as nominal attrition of the teeth on the radiographs of the maxillae and mandible. Radiographs of the right hand revealed an old amputation of the ring finger with evidence of minor bony reformation and the distal end of the proximal phalange.

The presence of thoracic organs were revealed on the conventional radiographs and confirmed by the CT images. In addition, the latter demonstrated that the lungs completely filled the hemi-thoracic spaces, and but were in contact with the interior thoracic wall suggesting minimal to no decomposition and pulmonary adhesions. CT scan of the heart and great vessels showed areas of increased densities within the heart and great vessels including the pulmonary veins and left atrium suggesting changes in clotted blood due to the presents of the embalming compound. CT scan of the pelvis demonstrated an identifiable uterine body and fundus and confirmed the remarkable state of preservation extended into the pelvic contents. Videoendoscopy provided direct visual verification of the internal preservation seen on the CT images. At autopsy, after the superior aspect of the calvarium was removed, the exact position of the collapsed dura and brain remnants, first noted on the conventional radiographs and later seen on the CT images were corroborated. However insect casings, not seen on with the imaging studies, were also found within the calvarium. Prior to the opening of the thorax, the videoendoscope was passed between the interior chest wall and the lung surface revealing extensive pleural adhesions throughout the thorax. Once opened, direct observation of the lungs demonstrated more than extensive pulmonary adhesions. When depressed, the highly elastic nature of the pulmonary tissue suggested a massive consolidating process, such as pneumonia, was present at the time of death and may have contributed to her demise.

The radiopacities seen on the CT images in the left atrium and pulmonary veins were found to be very dense blood clots located within the vessels. Since the clots didn't adhere to the vascular wall, it suggested the clots were formed post mortem. An examination of the abdominal and pelvic cavities confirmed the intact liver, stomach, intestines, uterus and urinary bladder, which was apparently full at the time of death. No calcifications were noted in any of these structures.

SEM-EDX analysis of a skin sample indicated the presence of arsenic suggesting that arsenic was a component of the embalming fluid.

All the evidence combined suggests that this individual was embalmed shortly after death with arsenic as a component in the embalming fluid and that the cause of death was likely a massive consolidating pneumonia.

Hamrick

Physical exam revealed two well preserved female mummies with dark and harden skin. An incision could be seen on the abdomens of both mummies. Little hair remained perhaps as a result of damage due to the 1985 flood. The mummies were only labeled as 'short' and 'tall', no other form of identification was recorded.

Conventional radiographs of the skull of the short mummy demonstrated what appeared to be dura. CT scan confirmed the presence of preserved dura and further revealed remnants of brain tissue in the region of the venous sinus over the occipital bone. X-rays of the thorax suggested the presence heart and lungs. A lesion was noted on the posterior aspect left lung. A CT image confirmed the presence and location of the 10cm by 5cm lesion, which was not biopsied at this time.

Radiographs of the abdomen failed to demonstrate the presence of viscera within the cavity. Videoendoscopy confirmed that the abdominal viscera had likely been removed as part of the embalming procedure. However, endoscopy also revealed vegetable matter within the abdomen, suggesting debris found its way into the empty cavity during the flood.

Discussion

Conventional radiography obtained by using a mobile radiographic unit and Polaroid photographic film enabled a fast, easy method to evaluate the mummified remains. This approach provided a means to identify such factors as the presents of possible skeletal pathologies, an assessment of dentition to determine age at the time of death, and the location of radiopaque objects. Unfortunately, conventional radiography has several disadvantages. Because a radiograph is a two-dimensional image of a three-dimensional object, superimposition of the shadows on an x-ray makes it impossible to establish the spatial orientation of an object or structure. Therefore, either the x-ray tube or the mummy

must be moved to obtain a second image at a 90° angle to the first.

Conventional x-rays can easily document the presence of bones and air, however due to scatter radiation generated during image production, soft tissue structures may not be discernable. This situation is exacerbated when the tissues loose density following the process of dehydration. For example, in the region of the thorax, unless a structure has become calcified, such as a lymph node, it is extremely difficult to identify existing soft tissue structures.

CT enabled the demonstration of soft tissue structures not seen on conventional radiographs and eliminates the superimposition of other structures in the imaging plane. CT is a quantitative modality but also provided the ability to sample tissue under CT guidance. The major drawbacks to the use of CT scans are issues of accessibility and cost. The CT unit is not practical for fieldwork.

A field research alternative to the CT scan is the Videoendoscope, which can provide spatial relationships, color and texture of target organs or artifacts providing the body cavities are accessible. The field application of videoendoscopy, as is true of all technologies, evolves with each case. The use of the videoendoscope in conjunction with autopsy, CT, and conventional radiography, continues to expand with new research ideas and applications. As a result of this study new approaches are being developed.

All the arsenic mummies had the same appearance and color. The surface of each mummy was very firm and the state of preservation of the internal organs was excellent. Because of the arsenic embalming, a rare opportunity to gather data from the remains was provided. The study of this unique group of mummies contributes to our understanding of arsenic embalmed bodies and provides a glimpse of early entertainment industry modes of operation.

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