

Ether Day Revisited

The Surgical Records of Edward Gilbert Abbott

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Background: The details of the public demonstration of the effects of ether that initiated the modern era of surgery and anesthesia are often misreported. Existing published transcripts of the clinical records are incomplete or inaccurate.

Methods: The patient notes of Gilbert Abbott were photographed, transcribed, and reviewed.

Results: The records are handwritten in "Surgical Records for 1846; Volume 30," of the Massachusetts General Hospital. The patient was admitted on September 25. The presenting condition was a congenital, mobile, compressible, multilobed, small lesion at the angle of the left mandible, and base of tongue. The operation on October 16 was an attempted ligation of the blood supply to the lesion. The postoperative diagnosis was a vascular lesion ("erectile tumor"). Postoperative management included application of sclerosants. The mass was unchanged in size on discharge on December 7. There is no documentation of the anesthetic administration in the progress note but a retrospective report of the anesthetic is pasted into the Records book. This account reported that the patient did not respond to the initial incision. He moved and cried out during the latter part of the procedure. Although he was aware of the operation taking place, he later said he had not experienced pain. The commentary concluded that the demonstration of the analgesic effectiveness of ether was inconclusive but that subsequently ether was shown to be effective.

Conclusions: The surgery on October 16, an unsuccessful ligation of a congenital lymphovascular malformation, was performed under incomplete general anesthesia. Examination of the primary documents may allow for more accurate accounts of circumstances surrounding the discovery of anesthesia.

Keywords: anesthesia, ether, history, inhalational anesthesia, pediatric surgery

INTRODUCTION

Henry Jacob Bigelow's 1846 publication "Insensibility during surgical operations produced by inhalation" is a case series of operations performed under ether anesthesia. The series included 4 operations performed in public in the operating theater of the Massachusetts General Hospital (MGH).¹ Before this time, surgical operations were generally performed with minimal or ineffective pain relief. This seminal publication launched the modern era of anesthesia and surgery.

The date of the first operation at the MGH, October 16, is celebrated annually in Boston as Ether Day, and around the world as World Anesthesia Day. On the side wall of the operating theater, now known as the Ether Dome, is a commemorative bronze plaque, which reads:

On October 16, 1846 in this room, the operating theatre of the hospital, was given the first public demonstration of anaesthesia to the extent of producing insensibility to pain during a serious surgical operation. Sulphuric ether was administered by William Thomas Green Morton a Boston dentist. The patient was Gilbert Abbott. The operation was the removal of a tumor under the jaw. The surgeon was John Collins Warren. The patient declared that he had felt no pain during the operation and was discharged well, December 7. Knowledge of this discovery spread from this room throughout the civilized world and a new era for surgery began.

Morton's authorized biography, "Trials of a Public Benefactor," was first published in 1859.² Written to enhance Morton's reputation and to support his campaign for recognition as the sole discover of ether anesthesia, this book provided a highly influential account of the events of October 16. An excerpt reads:

At length the operation was finished, and the blood having been washed from his face, the patient was gradually allowed to come from his anaesthetic state. When fully restored to consciousness and able to answer questions, he gave the triumphant and gratifying intelligence, "I have experienced no pain, but only a sensation like that of scraping the part with a blunt instrument." ... With the patient still lying like a log upon the table, Dr. Warren turned to the audience and said slowly and emphatically "Gentlemen! this is no humbug." This was a proud moment for the hitherto unnoticed dentist.... now was the practicality of what he had imagined fully and satisfactorily proved to the world... Thus was this 16th day of October 1846, made ever memorable and glorious, as long as man shall suffer pain.

The modern era of anesthesia therefore appeared to have arrived with a sudden and dramatic successful public demonstration of the effects of ether. Similar descriptions have been widely reproduced in multiple history books and academic articles—including recent MGH accounts.^{3,4} However, assorted authors have also variously reported, examined, or debated the nature of Abbott's disease, the effectiveness of the anesthetic, the circumstances of his perioperative management, and even the significance and primacy of this public demonstration of anesthesia.

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Disclosure: The author declares that there is nothing to disclose.

SDC Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.annalsofsurgery.com).

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Annals of Surgery Open (2022) 2:e166

Received: 26 October 2021; Accepted 18 April 2022

Published online 17 May 2022

DOI: 10.1097/AS9.000000000000166

The primary documents of the events surrounding October 16 include the hospital admission records of the patient, Gilbert Abbott. Although transcripts of these records have been published, these are either partial or inaccurate versions.^{2,5} In order to address conflicting accounts of the events surrounding this famous public use of ether for surgical analgesia, the original surgical records were reviewed in detail.

SOURCE MATERIAL

The surgical records are held in the archives of the MGH. As the records are of a person who died more than 50 years previously, the data are not subject to federal regulation by the Health Insurance Portability and Accountability Act of 1996.⁶ Massachusetts state law follows federal guidelines. Since the investigation was not human subject research, human research ethics oversight was waived by the hospital’s Institutional Review Board. Because the specifics of the patient, admission and operation are long in the public domain,^{5,7-9} permission was granted by the MGH Archives administration to publish direct transcripts and reproductions of the records (Figs. 1–7; Appendix 1, <http://links.lww.com/AOSO/A129>; Appendix 2, <http://links.lww.com/AOSO/A129>; Supplemental Figures 1–17, <http://links.lww.com/AOSO/A129>).

Abbott’s surgical records are contained in a bound volume, “Surgical Records, 30, 1846” (Supplemental Figures 1 and 2, Appendix 1, <http://links.lww.com/AOSO/A129>). The volume documents surgical admissions from February 2 to December 4, 1846. Abbott’s records consist of 3 pages of in-patient notes, and listings in the admission-discharge and operation indexes. The notes were handwritten by the surgical intern, Dr Charles Fredrick Heywood (Supplemental Figure 3, Appendix 1, <http://links.lww.com/AOSO/A129>). An addendum to the progress notes is pasted into the book after the admission entry (Supplemental Figure 4, Appendix 1, <http://links.lww.com/AOSO/A129>).

A TUMOR UNDER THE JAW

Abbott’s hospital record begins with his admission note of September 25, 1846 (Fig. 1; Appendix 1, <http://links.lww.com/AOSO/A129>). There were some errors in the admission record. The patient’s correct name was Edward Gilbert Abbott.¹⁰ Born on September 2, 1825, Abbott was recently 21 years of age, or “aet.,” on the day of admission, not 20 years old as reported.

The admission diagnosis, documented both in the admission note title and in the index of admissions, was a congenital “tumor on face.” In 1839, Warren published an extensive textbook on surgical diseases and treatments “Surgical Observations on Tumours, with Cases and Operations.”¹¹ He defined a tumor as “an unnatural enlargement in some part of the human body,” with benign and malignant growths a subcategory of tumors. The word “tumor” in that era therefore described any abnormal mass or swelling, rather the current typical meaning of a neoplasm.

The admission note continues for a page-and-a-half, and describes in detail the presentation and characteristics of a congenital submandibular mass (Fig. 2; Supplemental Figures 5–8, Appendix 1, <http://links.lww.com/AOSO/A129>):

This man has had from birth a tumor under the jaw on the left side _ It occupies all the space anterior to neck _ bounded on the inside by median line _ on outside is even é edge of jaw _below on level é Pomum Adami _ & in front tapers gradually as far as anterior edge of jaw_ Integuments not adherent to it_ Skin smooth & of natural color_ It is uniformly soft except in centre where a small hard lump can be felt, corresponding in size & situation é submaxillary Glands_ Can be made to disappear by compression, but seems rather to be displaced than emptied _ The edge of the lower jaw bone can be felt thro’ the tumor to be irregular

On examination on inside of mouth find a soft smooth tumor_ a hemisphere about 5 lines in diameter _ of a livid color _ on the left lobe of tongue about an inch behind tip _That portion of the organ in front & underneath the tumor is of a dark purple color _

This tumor is readily emptied by slight pressure, but fills again in one or two seconds but not sooner when pressure is made simultaneously upon the external tumor

For the distance of 5 lines from angle of mouth on Rt side the lower lip is of a livid hue _ this seems to be a continuation of a stripe, similar in appearance which extends from angle of jaw on Rt side about on a level é lower teeth _ it is about 4 lines wide & is slightly raised _ its color seems to depend upon small spots, like granulations, of a livid color, set on mucous membrane of ordinary appearance

He reports, that he never has p(a)in, except when he has taken cold & then, he perceives the center of the external tumor to be larger & harder than usual

Patient has a strumous appearance _ is tall and thin _ Both parents died of Phthisis _Has no reason to think (^inserted that any of) the appearances that have been described are hereditary _ Has always been weak and sickly _ Has been obliged frequently to give up work on account of ill health _ but has never had any acute disease _has frequent colds é sore throat _ Cervical glands never enlarged Never cgh of any note _

Physical examination therefore revealed a soft, compressible, mobile lesion associated with tortuous blood vessels and located lateral to the midline. An additional discolored compressible mass, “about 5 lines in diameter” (approximately ½ inch or 2 centimeters), and communicating with the submandibular lesion, was noted near the base of the left tongue. Dark discolorations were present anterior and deep to the left tongue mass, as well as below the angle of the right lip and inside the right cheek.

The differential diagnosis of a neck mass includes a congenital, inflammatory, or neoplastic lesion.¹²⁻¹⁵ Based on the combination of the congenital history, the location of the mass inferior to the angle of the mandible, and the soft, compressible consistency of the lesion, the most likely diagnosis is a left-sided congenital lymphovascular malformation, with a coexisting right-sided vascular malformation.¹⁶ An alternative diagnosis of a congenital paramedian cystic mass in the submandibular area would include a second branchial arch cyst,

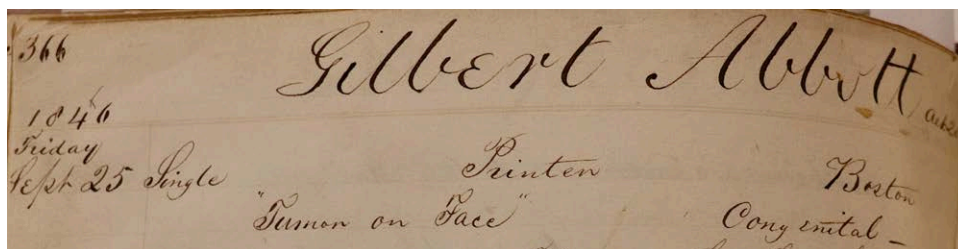


FIGURE 1. Heading, admission note, September 25, 1846.

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This man has had from birth a tumor ~~xxx~~ ^{under} the jaw on the left side - It occupies all the space anterior to neck - bounded on the inside by median line - on outside it even to edge of jaw - below on a level to Promontory Adami - & in front tapers gradually as far as anterior edge of jaw - Integuments not adherent to it - Skin smooth & of natural color - It is uniformly soft, except in centre where a small hard lump can be felt, corresponding in size & situation to Submaxillary Glands - Can be made to disappear by compression, but seems rather to be displaced than emptied - The edge of the lower jaw bone can be felt thro' the tumor to be irregular

FIGURE 2. Text, admission note, page 367.

although extensive vascular malformations are less frequently associated with this anomaly.

While the history suggests an infectious etiology was considered, this diagnosis as a primary cause seems less probable. Abbott reported that the mass was painless, except when an infection occurred. Lymphatic malformations may encompass lymph nodes, which may swell and become tender when infections occur. Despite the family history of “phthisis” (tuberculosis) and the “strumous appearance” (an overt neck swelling, typically due to tuberculous lymph nodes) of the patient, the congenital presentation and unchanged condition over many years make tuberculosis an unlikely diagnosis. Abbott died of tuberculosis several years later,¹⁰ but this was probably unrelated to this presentation.

The unchanged nature of the lesion over a prolonged time, as well as the cystic consistency, makes a diagnosis of a benign or malignant neoplasm similarly less likely.

The admission assessment of a “congenital tumor” was, however, simply a nonspecific initial diagnosis of a congenital neck mass. A more definitive finding would await operative management.

PREOPERATIVE MANAGEMENT

Abbott initially consulted Warren about his neck mass on September 7, 1846,¹⁷ and was admitted to the MGH 3 weeks prior to the operation. This preoperative admission time was far longer than usual; other patient records in Volume 30 document that most patients were typically admitted shortly before elective procedures.

Warren had written in his 1839 textbook: “Encysted tumours of the neck...have one common characteristic—a difficulty in distinguishing their character before cutting into them...(the

surgeon) should examine the tumour at different times before operation, for he will find, in each view, something new; and after he has made his plan of operation, he should re-examine with a view to this plan.”¹¹ The prolonged preoperative admission therefore may have been to allow for a close diagnostic observation of the mass.

THE OPERATION WAS THE REMOVAL OF A TUMOR

There are no entries following the admission note until the day of the operation, October 16. The operative note describes the procedure performed by Warren (Fig. 3; Appendix 1, <http://links.lww.com/AOSO/A129>), with no mention of the administration of ether or the presence of Morton.

The operative note reads:

The patient having been placed in the operating chair in the amphitheatre an incision two inches & a half (inserted above: three or four inches) in length was made over centre of external tumor just beneath the edge of the jaw - extending thro skin & subcutaneous tissue - A layer of fascia was then dissected off and disclosed a congeries of large veins & small arteries - Haemorrhage was slight - No vessel required ligature - A curved needle armed with ligature—size n° 6 - was passed under the mass & the tumor included under a knot & considerable compression - The wound was then filled & a small compress and lint & the patient returned to bed

Warren made a small incision, dissected through the immediate subcutaneous fascia and platysma, and found a “congeries” or jumbled mass of vessels. He later wrote that the mass “seemed to be composed of tortuous, indurated veins, extending from the surface quite deeply under the tongue. My plan was to expose these veins by dissection sufficiently to enable me to pass a ligature around them.”¹⁸

10
 Operation by Dr Warren—
 The patient having been placed in the operating chair in the amphitheatre an incision ^{three or four inches} two inches ^{or four inches} a half in length was made over centre of external tumor just beneath the edge of the jaw - extending thro' skin & subcutaneous tissue - A layer of fascia was then dissected off and disclosed a congeries of large Veins & small arteries -
 Haemorrhage was slight - No vessel required ligature -
 A curved needle armed wth a ligature - size N^o 11 - was passed under the mass & the tumor included under a knob & considerable compression -
 The wound was then filled wth a small compress and lint & the patient returned to bed

FIGURE 3. Operative note, October 16, 1846.

11	Gilbert Abbott	Oct. 16	Ligature of Erectile Tumor	Pg. 366.
12	Out patient	" 17	Removal of large steatomatous tumor from	Hummered -

FIGURE 4. Operative index.

Nov. 10 Doing well -
 Dec 7 Cicatrix perfect Tumor of same size as on Entrance but no vessels to be detected in it - Tumor on tongue not altered - nor is the appearance on inside of Rt cheek - Gen^l health m. improved
 Discharged Well -

FIGURE 5. Discharge note December 7, 1846.

The procedure was recorded in the index of operations as “Ligature of Erectile Tumor” (Fig. 4; Appendix 1, <http://links.lww.com/AOSO/A129>). An erectile tumor was the term for what today would be called a vascular lesion.¹¹ The effective

treatment of vascular malformations by ligation of the feeder vessels was clearly described in Warren’s 1839 surgical textbook.¹¹ The operation was therefore not strictly the “removal of a tumor under the jaw” but could more precisely be described in

This case is remarkable in the annals of Surgery. It was the first Surgical operation performed under the influence of ether. Dr. Warren had been applied to by Mr. Morton, a dentist, with the request that he would try the inhalation of a fluid which, he said, he had found to be effectual in preventing pain during operations on the teeth. Dr. Warren having satisfied himself that the breathing of the fluid would be harmless, agreed to employ it when an opportunity presented. None occurring in private practice within a day or two, he determined to use it on this patient.

FIGURE 6. Addendum.

Before the operation began sometime was lost in waiting for Mr. Morton, and ultimately it was thought he would not appear. At length he arrived and explained his detention by informing Dr. Warren that he had been occupied in preparing his apparatus, which consisted of a tube connected with a glass globe. This apparatus he then proceeded to apply, and after four or five minutes the patient appeared to be asleep, and the operation was performed, as herein described. To the surprise of Dr. Warren and the other gentlemen present, the patient did not shrink nor cry out, but during the insulation of the veins he began to move his limbs, and utter extraordinary expressions, and these movements seemed to indicate the existence of pain; but after he had recovered his faculties, he said he had experienced none, but only a sensation like that of scraping the part with a blunt instrument, and he ever after continued to say he had not felt any pain.

FIGURE 7. Continuation of addendum.

contemporary terminology as the attempted ligation of a congenital lymphovascular malformation.

DISCHARGED WELL

Abbott's progress note continues on postoperative day 1. Wound dressings were removed and the wound was filled with a caustic solution in an attempt to sclerose the blood vessels and cyst. Potassa cum calce and potassa fusa were applied regularly to the open wound for several days (Supplemental Figures 9–12, Appendix 1, <http://links.lww.com/AOSO/A129>).

By October 31, the notes record that the wound had largely healed: "Slough has separated _ Surface is healthy _ Dress é Lint dipped in w. water & covered with pledget & cerate _ Touch é Nitrate of Silver to keep down granulation_". However, Abbott stayed in hospital until early December. In his admission notes, it was noted the patient "Has always been weak and sickly Has been obliged frequently to give up work on account of ill health." Abbott had been orphaned at the age of 10 and had presumably living in straitened circumstances.¹⁰ Perhaps social as much as surgical determinants prompted a hospital stay of over 2 months, the rest and steady nourishing diet helping an overall improvement in health.

By December, the progress notes report the patient's general health was "m(uch) improved." His primary surgical problem, however, was little changed. The neck mass was of unchanged size, albeit with less vascular discoloration, since admission: "Tumor of same size as on Entrance but no vessels to be detected in it Tumor on Tongue not altered_ nor is the appearance on inside of Rt cheek" (Fig. 5; Appendix 1, <http://links.lww.com/AOSO/A129>).

The management of Abbott's lesion had approximated the modern management of complex lymphovascular malformations: a combination of ligation of feeder vessels and lymphatic channels, surgical removal of excisable cysts and vessels, and injection of local sclerosing agents into persistent cystic accumulations of fluid, often with ultrasound guidance.^{15,19} However, complex lymphatic malformations and branchial cysts may be difficult to eradicate completely, as cystic fluid reaccumulates from various inflows. The ligature alone had not been successful in ablating Abbott's multilobed neck mass. Without the benefit of modern technologies of radiological guidance and directed injection of sclerosants, the follow-up application of sclerosants onto the surface of the wound appeared to have been unsuccessful in eliminating fluid accumulation.

Despite this setback, the December 7 note records "cicatrix perfect"—the wound scar had formed without infection. Abbott was "discharged well"—although not cured of his presenting congenital condition (Fig. 5; Supplemental Figures 13 and 14, Appendix 1, <http://links.lww.com/AOSO/A129>).

PUBLIC

Although there is no record in Abbott's progress notes of the use of ether on October 16, an unsigned, undated retrospective report—written after the effectiveness of ether surgical anesthesia became clear—was added to Abbott's records (Figs. 6 and 7; Supplemental Figures 15 and 16, Appendix 1, Appendix 2, <http://links.lww.com/AOSO/A129>). The codicil was probably written in early 1847 by John Mason Warren, a junior surgeon at the MGH and the son of John Collins Warren (Appendix 2, <http://links.lww.com/AOSO/A129>). He may also have amended the operative note clarify the incision length (Supplemental Figure 17, Appendix 2, <http://links.lww.com/AOSO/A129>). Although not an eyewitness to the operation, Mason Warren was in practice with his father, worked closely with him, and would have been aware of the previously published details of the case.²⁰ The account is therefore not a primary source but does provide some details of the anesthetic.

Morton had first successfully administered ether to a patient in his dental office for the extraction of a molar tooth on

September 30. In early October, Morton called by Warren's office and asked for an opportunity to demonstrate his method of producing analgesia. The supplemental note reads: "Dr Warren had been applied to by Mr. Morton, a dentist, with the request that he would try the inhalation of a fluid which, he said, he had found to be effectual in preventing pain during operations on the teeth. Dr Warren having satisfied himself that the breathing of the fluid would be harmless, agreed to employ it when an opportunity presented. None occurring in private practice within a day or two, he determined to use it on this patient" (Fig. 6; Appendix 1, <http://links.lww.com/AOSO/A129>).

Mason Warren later published more details of Abbott's care, albeit perhaps with some artistic license. On October 13, Abbott "was brought into the operating theater, all the arrangements made for the operation, and Dr Warren was about to begin, when he arrested his hand, saying,—'I now recollect, that I promised Dr Morton to give him the earliest opportunity of trying a mode for prevention of pain in surgical operations, and if the patient consents I shall defer this operation to another day, and invite Dr M. to administer his application.'"²¹

Abbott had been admitted to the MGH 5 days before Morton's first use of ether in his dental office on September 30 and was in hospital awaiting surgery when Morton called at Warren's office. The choice of the patient, as well as the public setting of the anesthetic, were thus largely accidents of circumstance and operative scheduling.

DEMONSTRATION

Warren's surgical intern Heywood wrote a letter to Morton on October 14, inviting him to demonstrate his technique for a surgical operation at the MGH on Friday 16.^{18,22} This opportunity presented a challenge to Morton. Following the advice of Harvard physician and chemist, Dr Charles Thomas Jackson, Morton had initially induced anesthesia in his dental office by pouring ether onto a handkerchief, which was then held over the patient's mouth and nose. This administered a small dose of the volatile agent, sufficient to induce a light depth of anesthesia. The effect was short lived but long enough to extract a tooth. A surgical procedure would last longer and would require a greater degree of analgesia. A method to deliver a deeper and more prolonged depth of anesthesia was required.

Morton had been boarding at the home of Dr Augustus Addison Gould, a Boston physician, who advised Morton on the design of a vaporizer.⁸ Morton ordered an inhaler from a local glassmaker. However, the inhaler was not ready by early Friday 16, and Morton was delayed while waiting for the completion.

The summary added to Abbott's record notes: "Before the operation began some time was lost in waiting for Mr. Morton, and ultimately it was thought he would not appear. At length he arrived and explained his detention by informing Dr. Warren that he had been occupied in preparing his apparatus, which consisted of a tube connected with a glass globe" (Fig. 7; Appendix 1, <http://links.lww.com/AOSO/A129>).

Bigelow described the apparatus in his publication: "A small two-necked glass globe contains the prepared vapor, together with sponges to enlarge the evaporating surface. One aperture admits the air to the interior of the globe, whence, charged with vapor, it is drawn through the second into the lungs. The inspired air thus passes through the bottle, but the expiration is diverted by a valve in the mouth piece, and escaping into the apartment is thus prevented from vitiating the medicated vapor."¹

Morton had therefore never used the inhaler, nor experimented with the inhalation of a high dose of ether. He had no way of knowing the effects or duration of this high concentration of inhaled drug. The first use of this technique at the MGH was therefore not the public demonstration of a proven and polished method but rather the experimental trial of an untried procedure.

INSENSIBILITY TO PAIN

The effectiveness of ether analgesia was not immediately apparent. Bigelow reported in his publication: “During the operation the patient muttered, as in a semi-conscious state, and afterwards stated that the pain was considerable, though mitigated; in his own words as if the skin had been scratched with a hoe.”¹

Warren later wrote that there was initial “doubt about the success of the application, and in truth I was not satisfied myself, until I had, soon after the operation, and on various other occasions, asked the question, whether he suffered any pain.”¹⁸

The account added to Abbott’s records describes the anesthetic: “This apparatus he then proceeded to apply, and after four or five minutes the patient appeared to be asleep, and the operation was performed as herein described. To the surprise of Dr. Warren and the other gentlemen present, the patient did not shrink nor cry out, but during the insulation of the veins he began to move his limbs and utter extraordinary expressions, and these movements seemed to indicate the existence of pain; but after he had recovered his faculties, he said he had experienced none, but only a sensation like that of scraping the part with a blunt instrument, and he ever after continued to say he had not felt any pain” (Fig. 7; Appendix 1, <http://links.lww.com/AOSO/A129>).

While there is some discrepancy as to how complete the analgesic effect was, the accounts agree that the observers felt the trial was suggestive but inconclusive. Inhaled anesthetics produce a variety of dose-dependent effects. At lower doses, they induce loss of explicit memory and perceptive awareness, while higher doses abolish movement in response to pain.²³ Observing an entirely novel condition for the first time, the witnesses were unclear on how to assess the clinical impact. This initial experiment was a first step, rather than a definitive demonstration of insensibility to pain.

A SERIOUS SURGICAL OPERATION

Bigelow described Abbott’s operation as “comparatively slight, involved an incision near the lower jaw of some inches in extent.”¹ The next operation, performed the following day, was the excision of a “steatomatous tumor,” or lipoma, from the upper arm. Warren invited his colleague, MGH surgeon George Hayward, to perform the operation under ether.²⁴

As the operation was performed as day surgery on an outpatient, there are no admission notes. Primary documentation is limited to a listing in the operative index (Fig. 4; Appendix 1, <http://links.lww.com/AOSO/A129>), again with no mention of the use of ether. However, Bigelow later reported that “the vapor was administered to another patient with complete success. A fatty tumor of considerable size was removed, by Dr. Hayward, from the arm of a woman near the deltoid muscle. The operation lasted four or five minutes, during which time the patient betrayed occasional marks of uneasiness; but upon subsequently regaining her consciousness, professed not only to have felt no pain, but to have been insensible to surrounding objects, to have known nothing of the operation.”¹

It was the use of ether in this operation therefore that was more clearly “the first public demonstration of anaesthesia to the extent of producing insensibility to pain during a ... surgical operation.” The second operation could also be more accurately described as “the removal of a tumor” than the previous day’s attempted ligation of a lymphovascular malformation.

While the analgesic effect of ether seemed clearer, Hayward noted that this second operation “could not be regarded as a very severe one.”²⁴ The decisive public demonstration of the efficacy of ether in a “severe”¹ or “serious” operation occurred on November 7, when Hayward performed an above-knee amputation of a leg under ether.

A fourth public operation was also performed under ether on November 7, the excision of a jaw mass by Warren. However, once again, the use of ether achieved partial analgesic

efficacy^{1,18,25} “The patient was insensible to the pain of the first incision, though she recovered her consciousness in the course of a few minutes.”¹

Warren was a tremendously accomplished clinician and academic,^{26–28} part of a storied family dynasty of doctors who played a prominent role at the MGH and in medical science.²⁹ His extensive personal papers, preserved at the Countway Library of Medicine,³⁰ are available to researchers. His prominent role in the discovery of anesthesia has been widely and deservedly recognized, both by the MGH and by historians. However, the 2 public procedures that clearly demonstrated ether’s ability to produce insensibility to pain during a serious surgical operation were performed not by Warren but by Hayward.

KNOWLEDGE ABOUT THIS DISCOVERY SPREAD THROUGHOUT THE WORLD

On November 18, while Abbott was still in hospital, Bigelow published the series of 4 operations under ether at the MGH.¹ Further reports of the successful use of ether followed shortly after.^{25,31} Before Abbott was discharged from hospital, the paddle steamer “Acadia” left Boston for Canada and England on December 3, carrying letters and publications detailing the use of ether.³² By the end of the month, ether had been used for surgical anesthesia in Britain and France,³³ and within a year, in many countries around the world.

If information about discovery spread rapidly, misinformation spread with similar speed. Morton patented the use of ether for anesthesia in November 1846, and, after his patent was ruled unenforceable, later attempted to claim a large monetary award the US Congress considered issuing to the discoverer of anesthesia.¹⁷ A serial fraudster and con artist, Morton began a vigorous campaign to assume sole recognition for the discovery of ether’s potent analgesic effects and to discredit the contributions of others.

Morton initially attempted to dismiss the contribution of Jackson, the chemist who had suggested the use of ether to Morton. He also derided the prior work of his former dental partner, Horace Wells. The Connecticut dentist had successfully used nitrous oxide for dental analgesia in 1845 and demonstrated the practice in Boston in January 1846.³⁴

The book “Trials of a Public Benefactor”² was a part of Morton’s sustained effort to promote his role in the discovery.¹⁷ He made unlikely claims to have performed extensive prior animal experiments, to have used ether clinically for a prolonged period—and that the first surgical experiment with ether at the MGH represented a decisive demonstration of his completed work.

This book also contained the first account that Warren exclaimed “Gentlemen! This is no humbug,” to the audience after the operation.¹⁷ The publication in 1859—13 years after the event—was also issued after the death of Warren in 1856, who was therefore not able to confirm or refute the report. There is no convincing prior evidence to support the contention that Warren ever made such a statement.³⁵ As the contemporaneous accounts suggest, the story seems rather to be “humbug.”

The spread of “knowledge about this discovery,” in the sense of accurate accounts of the events surrounding the introduction of ether, was therefore disrupted by Morton’s disinformation campaign.¹⁷ Spread of “knowledge about this discovery,” in the sense of how to safely and effectively deliver anesthesia, was also not as smooth and rapid as Morton suggested.³⁶

The surgeons involved in the initial uses of ether noted the potential dangers and documented several dangerous and life-threatening mishaps.^{1,18,24} The introduction of ether into broader practice required a progression of experience in administration of anesthesia,^{18,21} rather than stemming from a single event. Ether was not immediately universally used for surgical anesthesia in the United States—or even in Boston.³⁶ Caution about the dangers of anesthesia, combined with slowly changing

attitudes to the role of pain during surgery, may have contributed to this slow spread.

The intermittent and incomplete initial spread in America of knowledge of the safe administration of anesthesia has echoes in the current unfinished spread throughout the world. There remains a profound lack of trained anesthetic providers in the low- and middle-income countries, particularly in those of sub-Saharan Africa and South-East Asia.³⁷ In consequence, an estimated 5 billion people lack timely access to safe anesthesia³⁸—and by extension, effective obstetric, surgical, and critical care.³⁹

THE FIRST

Frustration of Morton's attempts to monopolize credit and financial reward for the discovery of inhalational anesthesia came from various other sources besides Wells's use and public demonstration of nitrous oxide.³⁴ Ether had been employed for dental surgery previously,¹⁷ while Georgia physician Crawford Williamson Long had used ether for surgical anesthesia on several occasions from 1842 onwards.⁴⁰ Long and Wells had demonstrated their practice to their colleagues. However, none of these clinicians had initially published their results, and these successful uses of inhalational anesthesia did not achieve broader impact.

The experiment with ether on October 16 was therefore not the first successful public demonstration of inhalational anesthesia. However, Bigelow's publication¹ of the 4 public demonstrations was the catalyst that initiated the modern era of anesthesia and surgery. Abbott's public anesthetic was the first of a series, one of a progression of experiments with profound impact.

CONCLUSIONS

Examination of the primary and secondary accounts of the events of 1846 therefore suggests that some changes to the received narrative are needed. As a more accurate account, the inscription on the wall of the Ether Dome might better read:

On October 16, 1846 in this room, the operating theatre of the hospital, was performed in public an influential experiment in producing insensibility to pain during a surgical operation. Sulphuric ether was administered by William Thomas Green Morton a Boston dentist. The patient was Edward Gilbert Abbott. The operation was the attempted ligation of a congenital lymphovascular malformation under the jaw. The surgeon was John Collins Warren. The patient declared that he had felt no pain during the operation, and was discharged well, but not cured, December 7. The experiment led to subsequent operations by surgeon George Hayward where the analgesic effect of ether was conclusively demonstrated. While a new era for surgery began, the spread of knowledge about this discovery from this room throughout the civilized world remains incomplete at present.

The operation of October 16 can rightly be described as being "remarkable in the annals of surgery." However, it was not the decisive and definitive surgical and anesthetic demonstration that has widely been portrayed. Rather, the event is significant as the first of a series of operations under ether that collectively initiated the modern era of surgery and anesthesia.

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