You Won't Feel a Thing

"Gentlemen, this is no humbug!" Most of us remember having heard this quotation, but the circumstances and the speaker don't immediately come to mind. This was the exclamation of Dr. John Collins Warren, a justifiably famous surgeon in Boston, at the Masachussets General Hospital. The date was October 16, 1846. Dr. Warren had just completed an operation to remove a tumor from the neck of a man who experienced no pain. A milestone was reached after centuries of suffering through operations. It opened the possibility of great change in surgical technique, patient and physician expectations, and surgical outcomes. There follows a brief timeline of contributions to the control of pain by a variety of scientists of many disciplines. Some are directly related and others are merely contributory to the cause. In 2250 B.C. a clay tablet described the use of henbane seed mixed with gum mastic to relieve pain. By 800 A.D. there was a recipe containing a mixture of opium, hyoscyamus, mulberry juice, hemlock, mandragora, and ivy, which were dried, placed in a sponge, and then moistened and inhaled by the patient. It was helpful, but inadequate. By 1562 there was the first mention in a British book of the term "anesthetic agent". A great step forward was the discovery of oxygen in 1772. By the turn of the 19th century great strides were being made by a variety of scientists. It was discovered that nitrous oxide could have interesting and desirable effects. Noticing at a nitrous oxide "party" that one of the celebrants severely injured his leg without realizing it caused Humphrey Davy to speculate that it might serve to reduce the pain of tooth extraction. It was tried and soon gained common use in several London hospitals. Around this time John Collins Warren was using ether to relieve the late stages of pulmonary inflammation with success. In 1818 a paper was published describing the pain-relieving effects of ether. This was followed in ten years by the discovery of chloroform, and its effects. By 1842 W.E. Clarke used ether inhalation for the extraction of a tooth with no pain In the same year Crawford Long painlessly removed a tumor in Atlanta, but did not think it significant, and did not announce it or write about it in a journal. A great mistake! By 1844 Horace Wells used nitrous oxide obtained from a circus performer, to have one of his own teeth extracted without pain. The following year he attempted to do the same thing with Dr. Warren's patient with disastrous results. He was ridiculed and mortified at the time, and never recovered from the event. At the same time Charles T. Jackson, a famous, brilliant, scientist was experimenting with ether. He mentioned its use and suggested to W.T.G. Morton, a

dentist, that he use it in an operation. Morton did so with Dr. Warren. At that time Morton claimed to be the discoverer of the technique which in fact he had inherited. These four men were to constitute the cast of a real-life melodrama which followed. As a result of greed and a desire for recognition each of the men participated in the prolonged ugly spat to claim credit for the discovery which would change world. Thus the four: Long, Jackson, Wells, and Morton, would be as well known for their in-fighting as for their discovery. Crawford Long was born in Georgia and attended University of Pennsylvania. He came from a wealthy family. After initially practicing surgery in New York, he returned to practice in Jefferson, Georgia in response to family request. He was involved in “ether frolics” when he noticed that ether seemed to obliterate pain. He initiated the use of ether in his practice first using it on March 30, 1842. He incorporated it successfully in his practice for seven years, and first reported it in 1849. There is a statue of him in the Statuary Hall in the U.S. Capitol, as well as an obelisk erected in his honor in Jefferson, Georgia. He was a peripheral participant the controversy.

Horace Wells opened a dental practice in Hartford, Connecticut with W.T.G. Morton. Following exposure to Nitrous Oxide by Gardner Colton, a traveling performer, he experimented with both Nitrous Oxide and ether. In January, 1845 he and Morton demonstrated the technique at Massachusetts General Hospital, which ended in disaster with the patient screaming and the witnesses jeering. Wells continued to experiment on himself with Nitrous Oxide, ether, and chloroform.All of these actions led to his deterioration and his sad end in prison, where he took his own life. He had been convicted of assaulting a prostitute with acid.

Charles Jackson studied medicine and geology and was a distinguished contributor to both fields. In 1842 he reported that he had used ether to make himself unconscious while searching for its anesthetic properties. A month before Morton’s demonstration Jackson suggested to him that he utilize ether and instructed him on its use. With Morton’s demonstration and claim that it was he who had discovered the technique and the properties of ether, Jackson was enraged. There ensued a battle including debates, advertisements, pamphlets, and presentation to scholarly societies, all with the aim of each to discredit the other. Jackson was the most vigorous challenger to Morton’s claim of discovery, and he went to great length to present, justify, and support his own claim to discovery of the properties of ether.

William Thomas Green Morton was the son of a New England farmer. He had various jobs before deciding to study and practice dentistry. He joined Horace Wells in 1842 as a partner and in 1844 studied with Charles Jackson. In 1845 Morton perfected a denture which required the removal of all teeth for its placement. The pain of this process caused him to look into anesthesia including Wells' technique of Nitrous Oxide. It was, at best, only partially successful. He then consulted Charles Jackson who apprised him of the ether technique which he employed with success. Instead of working within the scientific community to advance knowledge, Morton chose to market and sell it, hoping to reap great wealth. He immediately named the agent Letheon. He altered the ether by adding various fruit odors to it. By doing this he sought and received a patent for Letheon - thus able to exclusively market the technique to other practitioners. His fantasy of great wealth quickly evaporated when it was discovered that Letheon was in reality nothing more than ether available at most pharmacies. This didn't deter Morton. He proceeded to appeal to Congress to receive an award for the monumental discovery. Congress disappointed him. It had several heated debates about the legitimacy of Morton's claim, but eventually decided against him. With the pursuit of rewards and attempts to bolster his claims, Morton neglected his dental practice. It was after his third unsuccessful attempt to influence Congress that Morton stopped practicing in Boston. He moved to Needham, having purchased property there, and with his extended family entered the business of pig farming. At the same time he delved into the buying and selling of land, but his problem of over-estimating his wealth and his ability to pay his debts initiated his eventual downfall. In 1856 the sheriff seized his property and put it up for auction to cover his debts. This was the first of many troublesome ventures in a long list of degrading activities.

In his scholarly, exhaustive biography of Morton, "TARNISHED IDOL", Richard Wolf confirmed some of the many rumored exploits of Morton, whose checkered career belied his claims of scientific accomplishment, and contribution to the welfare of his brethren. At that period it was published that Morton had been posted for swindling and fraud in Rochester, New York. He was posted for swindling in Cincinnati. He possessed counterfeit post office seals of the Boston and Rochester post offices, which were discovered while he was in Baltimore. In St. Louis he had been posted as a "scoundrel, liar, swindler, and forger". Over the next two years he moved from St. Louis to Baltimore,

and Washington, D.C. where he continued to embezzle in the dry goods business with which he was associated until he was discovered, fired, and punished.

With this capsule of the inauspicious start of general anesthesia as an introduction, we can explore the current realities of the topic. Today it is possible to provide general anesthesia, regional anesthesia, local anesthesia, and sedation with a wide variety of techniques. In a recent discussion with my grandson (15) I was informed that this was pretty simple and straightforward. " All you do is put a mask on the face and the patient goes to sleep, and when you take it off he wakes up." Of course, that is exactly right. However he did not choose to explore what transpires between the putting on and taking off of the mask. While anesthetists' first interests are the safety and comfort of patients, one must consider the requirements of the surgeon and the procedure. Different procedures can have widely different requirements and certainly surgeons can have different needs. The first requirement of general anesthesia is that the patient be anesthetized and unaware of what is occurring. A second requirement may include muscle relaxation. There may be a need for large amounts of fluid infusion - sometimes including blood. For procedures involving the brain or spinal cord it may be necessary to have the patient awake and respond during the procedure, and then return to the anesthetized state. Of course, surgeons being surgeons, express varying degrees of likes or dislikes to the type of anesthetic, the technique used, and/or the drug or drugs employed. It must be noted that while anesthetists frequently discount these opinions and remind surgeons that they know less about anesthesia than do the anesthetists, one principle must be recalled: surgeons are anesthetists' raison d'être. It is the operation or other procedure that surgeons perform that require our services and knowledge. Recently the expansion of duties outside the operating room such as pain management, and critical care, have changed and expanded the job description of anesthetists.

As an exercise let us consider that you or a similar seventh decade male is found to have an inguinal hernia. It is recommended that it be surgically repaired to reduce the possibility of complications. Your health has always been normal. Your thoughts turn to the procedure - "Will there be a large incision? Will there be a lot of pain? How long will you be in the hospital? What about infection? When can you get back to work, and/or golf?" Well down on the list may be: "I wonder about the anesthetic." Most frequently it is not until the patient is in the waiting area just before going to sleep that worries about anesthesia become paramount. Most adult anesthetics today begin with a rapid-acting

intravenous drug which induces sleep in the time that it takes to get from the IV where it is injected to the brain where it acts. This usually takes 15 - 30 seconds. It is after that that a mask is placed on the face. Starting out with a mask in an adult is not particularly pleasant. Patients don't like the odors, they have a feeling of smothering and claustrophobia, and it takes longer to get to sleep. Why is this? If one looks at the makeup of the body, and the physics of the gases used it becomes evident. The body is made of a variety of compartments. If we think of these as boxes to be filled before proceeding to the brain to act, we can explain a lot. Three main contents of the boxes are: fat, muscle, and other soft tissue, and bone. In order for the agent to enter the body it must pass through the lung into the blood stream. Once that has occurred it makes it into and through the various boxes. Depending upon the contents of the box, it will either fill the box quickly and get on its way to the brain, or be held by the box until it can' t hold any more. As an example we can look at the fat box. We will add consideration of another physical principle: solubility - the amount of substance that dissolves in another substance. To a varying degree all gas anesthetic agents are extremely fat soluble.Very few agents are at all soluble in bone. If one proceeds to the next thought it would be that very fat people tend to need more inhaled anesthetic to fill the "fat box". Clinically this is accurate. Obese people go to sleep quickly but are anesthetized slowly.

As the process continues it reaches certain milestones. After passing through the initial changes in vital signs one approaches cardiovascular stability and anesthetic equilibrium. The instability of the induction period is unavoidable. In a system accustomed to awake function, introduction of potent depressant agents can cause significant alteration of vital signs. This usually accompanies the uptake phase, and smooths out as the concentration equalizes with the same concentration The next milestone in the anesthetic is the beginning of the operation - the incision. This is a challenge to the physiology of the patient as well as to the anesthetic. In the presence of an inadequate level of anesthesia there can be a variety of responses including sharp increases breathing, pulse, and blood pressure, as well as involuntary movement of the patient. If, as planned, the level of anesthesia is appropriate, there should be virtually no patient response. Throughout the procedure all measures of the patient's status are consistently followed. The needs of the surgeon such as more muscle relaxation and higher or lower blood pressure. must be accomodated. It is interesting to see the reduction in need for relaxation that has accompanied the development of fibreoptic

technique which permits the surgeon to have an adequate view by-passing the obstruction of abdominal musculature.

As new drugs and new types of drugs are developed they are initially incorporated into their use in anesthesia. This is done with the realization that they may have their own effects or combine with other components of the anesthetic to produce desired effects or undesirable ones. We have seen both muscle relaxants and “short acting” narcotics produce prolonged post-anesthetic respiratory depression. Other initially interesting and desirable drugs have turned out to be unacceptable because of interaction with necessary drugs.

As the procedure continues the fact is noted that the patient has usually been fasting for many hours. Caloric needs are not great, but absence of fluids can have great effects on blood volume. With prolonged deficits of fluid the heart and blood vessels must work increasingly hard to keep circulation intact. When this is combined with blood loss and evaporative fluid loss in can have significant deleterious effects. Of course, this problem is best avoided rather than treated. IV fluids and their management are important ingredients in anesthetic management. Anticipation of fluid requirements is standard in all but very short procedures. “Short” is in the range of five to fifteen minutes.

Throughout the procedure one seeks stability or homeostasis. When the surgical objective is reached and it is time to close, one again goes through a phase of instability. Changing and decreasing the concentration of the inhaled anesthetic disturbs the equilibrium and once again vital signs can become tumultuous. If one doesn’t anticipate the end of the operation by making changes and diminishing anesthetic concentration the result is commensurate prolongation of wake-up time. It is also the time to begin post-operative pain management. Analgesics of several types are started to avoid acute pain upon emergence. Surgeons also may inject local anesthetics in and around the wound which will reduce pain impulses from the operative site.

The patient can now be transferred from the operating room to the recovery room. Here issues are directed at guiding the patient as he rids his body of the anesthetic. The removal of the anesthetic is simply the reverse of the induction. however there are limiting factors to the removal. Most anesthetic drugs depress the respiration. Respiration is the main route of flushing the body. If respiration is compromised by

medicine and/or lung disease the emptying may take many hours. If we think back to the various boxes involved in the transport of anesthetic, the fat box again becomes an important factor. It must release anesthetic into the blood stream so that it can be transported to the lung and breathed out. Once again obesity becomes a problem - extremely large patients can have physical compression of the diaphragm and lung, as well as compromised upper airway with snoring and obstruction. These may be combined with chronic brain changes which tolerate inadequate ventilation without causing the body to react Without close observation and frequent assisted respiration decompensation is a real hazard. Nausea and vomiting can be uncomfortable, painful, and lead to other problems. Nausea and vomiting can certainly be a side effect of anesthetic and analgesic drugs. It can also follow manipulation of the gut and other abdominal organs. There are effective drugs which can reduce or control nausea and vomiting. There is a definite incidence of direct, serious problems from these drugs as well.

Following discharge from the recovery room patients may continue to have symptoms related to the anesthetic and analgesic administration. There are now methods to continue pain control via infusion of analgesic drugs on demand by the patient. The patient is given a trigger to cause a dose of analgesic to be administered by IV infusion pump, with a lockout mechanism on the pump to prevent excessive dosage. Another recent technique is the placement of catheters near key nerves while the patient is anesthetized enabling a continuous infusion of local anesthetics to interrupt pain impulses, frequently avoiding narcotic use.

Post-op patients who are not troubled by pain may wonder why there is lethargy and mental confusion long after they have awakened from the anesthetic. Think again of the “fat box”. The movement of anesthetic out of the body is not nearly as linear a process as is movement in. Retained drug is not enough to cause sleep and anesthesia, but it is certainly enough to cause sedation and mental dysfunction. Eventually these go completely away.

Experience in anesthetic management teaches certain “truths”. One cannot rush natural processes - no matter how much the schedule or the surgeon would desire. Stability and equilibrium are always good. Drugs - old and new - are always two edged swords, and frequently the patient and the anesthetist are victims of the second edge.

The more things one includes in the technique, the more they can and do go wrong. The mark of a good anesthetist is not only that he or she is familiar with the technique and the drugs, but is able to anticipate possible problems and avoid rather than having to treat them.

One can view the topic and practice of anesthesia as necessary evils. Risks inherent in its application are diverse, real, and may be significant. The alternative is a level of pain and physical and psychological suffering which are untenable. As memorably stated in Hamlet: “For some must watch, while some must sleep: So runs the world away.”

Wolfe, Richard J.: Tarnished Idol: William Thomas Green Morton and the Introduction of Surgical Anesthesia: a Chronicle of the Controversy, Norman Publishing, 2000.

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