The Art of Anaesthesia

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Last week I went to the funeral of my great aunt Florence. I had only met her twice in my life and on both occasions she didn’t utter a word, but lay still in her bed that she had occupied for the past twenty years in the Star and Garter nursing home for retired service people. When she eventually passed away she had reached the ripe old age of one hundred and three, just over a month away from celebrating her one hundred and fourth birthday. She was the seventh child of Sir Vincent Nash, himself a doctor, the last surviving member of her generation and my final link with the past. What a change she must have experienced during her lifetime which spanned almost all of the 20th century. Even at her funeral, these changes, these gargantuan leaps forward in science and technology that we take almost for granted today, were shamelessly obvious. The traffic held up, at a standstill as people stared at the horse-drawn hearse making its way slowly from the church, a rare sight today, but commonplace when my great-aunt was growing up. The camera phones appearing in the hands of mourners from other funerals as we entered the cemetery seemed almost grotesque.

In her lifetime this woman lived though an era, a scientific époque unequalled by any other century. The advances seem almost mind-boggling if you see them all appearing on a timeline. When she was born, the life expectancy of a man was forty eight years and that of a woman was fifty two. Today those figures have almost doubled and during her lifetime the face of medicine has also changed dramatically. When one watches a period drama such as Downton Abbey set in the early 1900s, it seems almost an anathema that people could die of so many trivial illnesses.

Even thought the 20th century was marred by the travesty of two world wars, the advances in medicine still remained unwavering. The first use of electrocardiographs in
clinical medicine was 1908, Paul Ehrlich discovered the potential of chemotherapeutic agents in 1910, insulin was used to treat diabetes mellitus in 1922 and, importantly, in 1928 the famous Scot, Alexander Fleming, accidentally noticed that a stray piece of mold on a plate culture of staphylococcus had inhibitory effects on it. Though he could not prove the direct therapeutic effects of penicillin at the time, his incidental finding would revolutionise the way we treat infections and would spawn a multi-billion pound industry. In the latter half of the 20th century we saw advances such as transplant surgery and drafting of the human genome, but also the unfortunate rise of the AIDS epidemic and outbreak of viruses such a SARS and, more recently, Ebola which has been frighteningly documented through the media.

Our perceptions of medicine have changed drastically over the past twenty years through the advent of the Internet and social media, let alone the past one hundred years with medical advances. It is coming more to the forefront that public experience and perception of medicine is now of great importance to the public health services. Do patients feel satisfied with the services they are paying for with their taxes? Is money being spent wisely and efficiently? Can this service be improved and ultimately are voters happy with how the government is running the health service? The role of a doctor has experienced an almost one hundred and eighty degree turn over the past hundred years or so, from that of a leader and an authoritarian to that of a service provider, a vassal. People tend to demand more from their medical services and have much higher expectations while doctors remain painfully aware of the limitations of modern medicine, regardless of the awesome advances.
So what of anaesthesia? What is the public perception of anaesthesia? In the majority of cases, patients can't even remember their perioperative period, let alone their time in the anaesthetic room or the anaesthetist. The well-versed line uttered by the returning patient is “when do I start counting back from ten doctor?” Little is remembered by patients due to all the medications administered, so how aware are they of what the anaesthetist did, or what went on in the operating theatre. In many cases, this knowledge comes through different forms in the media and one of the most vivid portrayals of that is through art. If you take a look at how anaesthetics have been portrayed over the past few hundred years, you can get a sense of how anaesthesia has developed and changed and, with it, its public perception.

The first example of this that I would like to use is “The Tooth Puller”, painted in 1627 by the Dutch Baroque painter Gerard van Honthorst. This gives us a clear insight to one of the first operations to occur commonly in the baroque period and how the genesis of the surgeon from the barber occurred. Here we see a well-dressed man, without gloves or barrier protection, trying to remove a middle-aged gentleman’s tooth, presumably due to infection. The man is sitting and appears to be in distress as evidenced by the flailing of his hands and the expression on his face as he looks towards the surgeon seems to suggest the question “is it almost over?” This procedure is being observed by five on-lookers as if it were a public spectacle. A mother figure is clutching her child in a protective manor as the front row of viewers quietly think to themselves that they would never wish to be in that chair. Meanwhile, a jovial character seizes the opportunity to try and steal a duck from the distracted woman. What this representation acutely shows is that there was a need to sedate patients for such procedures and that many procedures at the time were fraught and limited by the
patient’s pain tolerance at the time. It would not be until 1859 that cocaine was first isolated by the German chemist Albert Niemann (1) and some twenty years further again until its use would be popularised in the medical community. He published his dissertation entitled “Über eine neue organische Base in den Cocablättern” in 1860 which earned him a Ph.D.

Figure 1.

Like everything, necessity is the mother of all invention and so started the investigation and experimentation into substances that could bring about anaesthesia. One such investigator was the English Unitarian minister and scientist, Joseph Priestly, who discovered ten new “airs”, the most notable of which was nitrous oxide. This was during his ministry in Calne between 1774 and 1786 where he published six volumes on his experiments (2). He himself felt that “very great medicinal use will be made of the
application of these different kinds of airs..." Other substances were also being used at the time, one of which was mandrake root which has origins going back to biblical times. Its first reference is in the Book of Genesis when it was used by Rachael to treat infertility, but in the modern era of the eighteen hundreds it was used for its anaesthetic properties (3). Mandrake root contains hyoscine which has the ability to cause hallucinations, delirium and, in larger doses, coma. Its effects and uses were strikingly portrayed in the painting of Dr. José Ignacio Quevedo performing the first Caesarian section in Colombia in 1844 by Enrique Grau. This is in stark contrast to “The Tooth Puller”. The setting has changed dramatically, the woman is draped, the physicians and assistants are wearing aprons and the woman to the left seems to occupy the role of a scrub nurse. The woman having the Caesarian section has obviously been sedated by mandrake root which appears in a washbowl beneath her bed. Although she appears to be restrained by two gentlemen, her countenance appears placid and peaceful as the Caesarian section is being carried out. The scene suggests a feeling of control by the physicians and reverence for the procedure being performed. But, regardless of the advances that were occurring in the Victorian era, death still had a significant presence. There is a priest to the far right who more than likely is administering the last rites to the woman because childbirth still posed a massive risk to the life of a mother, some may even say a death sentence. This picture gives its viewer the idea that, yes there have been advances in medicine, but there is still a high risk associated with it. It gives the onlooker as sense of slight comfort that these learned individuals were doing their utmost to care for their patient. One interesting point of note is the addition of a woman to the setting in what appears to be an assistant role. She is quietly carrying out her duties and unlike many paintings of surgical procedures prior to that time, she doesn’t seem to occupy the role of the hysteric or the weeper.
It was quite quickly after this event that one of the most important breakthroughs in surgical anaesthesia was to occur. That was to take place in Boston, thanks to the work of the dentist William Morton. During the 1840s, dental surgery was awash with various methods of anaesthetizing patients, among them mesmerism and inhaled substances such as ether and nitrous oxide. One such dentist was Horace Wells who, tried as he might, was no mesmerist so therefore focused on the inhalation techniques. He had noticed at the time that subjects drunk on nitrous oxide appeared to feel no pain and, seizing the opportunity, arranged a public demonstration claiming it would spawn a “new era of tooth pulling!” Unfortunately this was not the case and it was an abysmal
failure, but his former dental partner William Morton, on observing this demonstration, was incited to carry out his own experiments, this time with ether, and the results can be observed in the famous painting by Robert Hinckley entitled “The First Operation Under Ether.” This supposedly intensely accurate painting of William Morton’s triumph in 1846 currently hangs in the Countway Library of Medicine in Boston. Hinckley agonized over this painting for eleven years, wanting to make it historically accurate. It lay abandoned for many years, until 1903, when the Boston Medical Library eventually accepted it. This is quite a pivotal piece in the history of anaesthesia, not only due to the fact that it is such a resplendent oil painting, but also because of its depiction of a monumental scene.

“It has long been an important problem in medical science to devise some method of mitigating the pain of surgical operations (4).”

These were the words written by Dr. Henry Bigelow in 1846 in a paper that went on to describe the procedure in the picture. This depicts Gilbert Abbott who, under the effects of ether, was having a vascular tumour removed from the jaw and lower neck (5). This delicate operation could not have been performed without sulfuric ether. The surgeon performing the procedure is Dr. John Collins Warren who can be seen at the centre of the painting as he delicately dissects out the tumour. Slightly to the left of the painting we see, standing behind the patient’s chair, William Morton who is holding an inhaler, which was used to administer the ether. This is a glass bottle with two openings contains a sponge soaked in ether for the patient to inhale like a draw over technique. Morton is already adopting the customary position of the anaesthetist at the head of the patient ready to administer the ether as needed and also preventing it from leaking out.
Dr. Warren is operating calmly on the sedated patient who is showing no signs of distress. Another physician seems to be feeling the pulse of Gilbert Abbott, as ether was thought to have cardiovascular side effects. The noted surgical anaesthetist Henry Bigelow is seen to the right of the picture clutching his chest and averting his gaze almost in disbelief, while many other noted physicians are clambering around the patient to observe the procedure. In the background there are men anxiously looking on from the pews of an amphitheatre, which later became known as the Ether Dome because of the events that occurred in the painting.

This snapshot in time was not as historically accurate as Hinckley led us to believe. Supposedly Gilbert Abbott had to be restrained with leather straps around his wrists for the procedure and there was a lot more commotion from the spectators as they jostled with each other to view the demonstration. Also many of the more noted physicians were not present on the day but Hinckley’s intention was actually to produce a composite piece of the most distinguished medical professionals of the day, while painting the era’s most notable medical discovery.

This painting demonstrates a landmark event in the development of anaesthesia almost akin to the invention of the wheel. It showed the public that there were new methods of sedating patients effectively for surgical procedures. Though this case was not quite as pain-free as Hinckley would like us to believe, the essence of the painting is accurate. Later Gilbert said the pain afterwards was considerable, though mitigated “as though the skin had been scratched with a hoe!” (4). The following day another procedure was carried out to remove a lipoma from a woman with a lot more success!
The American physician Samuel Guthrie had also discovered another compound in 1831 and it later became known as chloroform. This was just months later independently discovered by two Europeans, Eugène Soubeiran and Justus von Leibig, but it was Sir James Young Simpson, a Scottish obstetrician, who discovered its anaesthetic properties in 1847. Unfortunately, there were still great risks associated with the use of inhalational anaesthetic agents, especially if administered by untrained practitioners. Ether was flammable and, as a consequence, an explosion hazard, on the other hand chloroform was not safe pharmacologically and was associated with fatal cardiac arrhythmias commonly referred to as “sudden sniffer’s death.” The first
recorded fatality due to chloroform was of a young girl called Hannah Greener from Newcastle who required the removal of a toenail after having a similar procedure done a few months previously under ether.

Figure 4.

This etching, done of the event in 1848, documents the fatality that is solely attributed to the use of chloroform. Hannah was, to all intents and purposes, a healthy girl, but within minutes of receiving the chloroform she died. The physician is seen holding the murder weapon, a bottle of chloroform and a cloth. He seems almost dismissive of the situation as he gently holds her wrist checking for a pulse. The surgeon is still holding her foot as if he has just been alerted to the fact that her body lies lifeless in the chair.
This etching makes the viewer overtly aware of the risks one takes when stepping into the anaesthetic chair. Though chloroform lost some of its popularity in the following years, it gained resurgence when in 1853 John Snow, an English physician, administered it to Queen Victoria during the birth of Prince Leopold. Snow went on to publish many articles on the use of ether and the need to develop ways of safely administering inhalational agents and these led to the development of the anaesthetic machine (6).

As development of safer methods of anaesthesia occurred, so did the complexities of surgeries. Though anaesthetists were viewed at the time with little respect and the anaesthetics usually administered by poorly paid GPs, the complexity of delivering an anaesthetic was becoming more specialized and the need for development of a professional body for anaesthetists was needed. This led to the founding of the Association of Anaesthetists of Great Britain and Ireland in 1932 by Dr. Henry Featherstone and Sir Ivan Magill, ensuring that anaesthetists received consultant status with full establishment of the NHS in 1948. Both Featherstone and Magill were very much influenced by their experiences during the two World Wars which saw the need for significant advances in anaesthesia. During World War 1 ether, chloroform and nitrous oxide were the anaesthetic agents used, with nitrous oxide being the preferred choice as it was the least likely to cause "shock and exhaustion." A Connell anaesthetic machine was commonly used to deliver the gases (7). From the picture one can see the development of the modern anaesthetic machine with a rotary type flowmeter, suction apparatus and Schimmel-bush ether mask all grouped together on a little cart. Due to the lack of emphasis placed upon anaesthesia in World War 1, it was under-represented in the medical corps (8) and there is therefore limited information available about it.
This helps lead on to the evolution of anaesthesia and its role in World War 2 during which, although only twenty years after the Great War, significant changes had occurred. Thiopentone had been discovered by Ernest H. Volwiler and Donalee L. Tabern (9) and was first being used on humans in 1934 by Dr. Ralph Waters. Advances in endotracheal intubation were occurring, but its use in the operating theatre was not commonplace at that time.
The following picture helps to portray the development of general anaesthesia. In it, Archibald Mcindoe, Consultant Plastic Surgeon to the RAF, is operating at the Queen Victoria Plastic and Jaw Injury centre, East Grinstead. This painting, which is part of the Imperial War Museum’s collection, was completed in 1944 by Anna Katrina Zinkeisen. She was a Scottish painter who worked as a medical artist and nursing auxiliary during World War 2. She helped to document a considerable amount of medical activity during the war. As we can see, there are quite a few advances which have been made. Again, the anaesthetist is seen at the head of the operating table holding the facemask on the patient to maintain anaesthesia, assisted by what appear to be hooks on the mask to allow it to be attached to the patient’s face. The placement of the anaesthetist’s hand allows him to hold the mask, lift the jaw and feel for the patient’s pulse, all at the same
time. The anaesthetic trolley is simple and compact with smaller cylinders to make the machine more mobile.

There are the beginnings of an anaesthetic circuit being developed from the machine to the patient. No longer is a mask being held over the face with a cloth soaked in ether and a closed system has been developed with a carbon dioxide absorber. This permitted the anaesthetist to maintain positive pressure ventilation and to control the patient’s respiration at will. Still, the need for monitoring of the patient was needed and this underpinned the advances that led to improved patient safety after the war. Gowning was starting to occur and the uses of facemasks drove the push for sterility and reduced infection rates.

The development of the modern theatre set-up is shown here and, with that, clearer definitions of roles. Theatres were no longer areas for public display and operations could easily take part at any hour of the day as electricity made it possible. We know the hypodermic needles had been around since the Victorian times, thanks to the work of Francis Rynd, an Irish physician (10), and the introduction of intravenous induction was starting to occur, but there is the obvious lack of a hanging bag of intravenous fluids.

It was the advances in the post-war era that led to huge progression in patient safety as developments of new chemical compounds had and were occurring at a feverish pace, leading to the development of the intravenous cannula. First reports can be dated back to 1950 when David Massa described details of a plastic needle and thus the beginnings of the intravenous cannula (11). The basic monitoring of patients under anaesthesia changed dramatically from the 1950s. Up to this point, the pulse was checked by the
anaesthetist’s hand, blood pressure was checked manually, breathing was monitored by watching respiration and awareness was kept track of by observing pupils, patient movement and sweating (12). ECG monitoring began in the 1950s, invasive arterial blood pressure monitoring in the 1970s and pulse oximetry, along with end tidal CO2, in the 1980s. Each of these discoveries led to improvements in patient safety and thus allowed the surgeon to proceed with more difficult and invasive surgical procedures.

The second half of the 20th century has paved the way for some of the most mind-boggling advances ever seen in medicine. The advances in areas such cardio-thoracic surgery and transplantation surgery could not have been made possible, let alone considered, were it not for anaesthesia. The results of all of these advances are perfectly shown in the stunning oil painting by Joel Babb, “Coronary Bypass Surgery in Brigham and Women’s, Boston” painted in 2010.

Figure 7.
Little is known from the initial years of cardiac surgery and the anaesthetic delivered. Patients were induced either by intravenous Pentothal or through inhalation with nitrous oxide/cyclopropane and maintained with Pentothal and curare. Monitoring was limited, with a needle in the brachial artery attached to a mercury manometer used to assess blood pressure (13).

It was Dr. Wynands of Montreal who published the first paper on managing patients undergoing coronary artery revascularization. He put emphasis on adequate depth of anaesthesia, invasive monitoring and regular blood gas sampling (14). This oil painting gives the viewer the anaesthetist’s bird’s eye view of the operation. The medical staff are fully gowned, the patient is draped and the image of a sterile operating theatre is produced. Intravenous fluids are hanging which became commonplace since the 1950s, based on research by Hirschfeld, Hyman and Wagner from the 1930s (15). A fully closed ventilation circuit is present with a carbon dioxide absorber and sevoflurane is being used for maintenance. Sevoflurane was only introduced into clinical practice in 1990 after being discovered over twenty years previously in 1968 by Regan (16) and is now the most commonly used volatile agent for maintenance of anaesthesia. There is invasive blood pressure monitoring with central venous access and arterial lines. Pacing box is present, if needed post-operatively. Infusion pumps are attached to the drip stands and pulse oximetry is attached to the patient’s nose. Many anaesthetists view pulse oximetry as a kernel in the development of patient safety under anaesthesia. Though its origins can be dated back to Karl Matthes in 1935 (17), the modern version draws its direct descent from the work of two bio-engineers Takuo Aoyagi and Michio Kishi in 1972. The anaesthetic machine has become a lot more complex with pressure, carbon dioxide and oximetry waveforms. This painting is a demonstration to the public
as to the complexity of general anaesthesia and the ability of the anaesthetist to monitor and control the physiology of the patient. It shows how the anaesthetist is able to create the optimal operating conditions for the surgery to take place, while also ensuring that the safety of the patient is not compromised. The surgeon is able to concentrate on the procedure at hand while working in tandem with the anaesthetist. Comparing this painting to the “First Operation Under Ether” shows us how, through the titanic advances in anaesthesia, such complex and invasive procedures could be made possible. The development of anaesthesia from its origins as an assistant to the surgeon with varying degrees of ability, to its recognition as its own speciality and further still in its evolution to allow great advances in its fellow specialities, is an impressive feat. If you take a look back to the early years of development of surgery in the nineteenth century, surgery was seen almost as a last resort procedure in treatment of many ailments. Between the years of 1821 and 1846 the annual reports of Massachusetts General recorded only three hundred and thirty three procedures were performed during this time period, representing barely more than one case per month (18).

It is quite obvious to see the advances that occurred when one compares the beginning and the present in terms of anaesthesia. It gives the public a snapshot of what happens to them during their procedure and how intricate and advanced monitoring has become. Much of the monitoring and display, as well as the set-up of anaesthesia, can be a lot for patients to take in, along with understanding the role of the anaesthetist in their care. A study was published of three thousand, nine hundred and fifty patients from three German hospitals on patients’ perceptions of anaesthetists last year (19). It showed that patients had a poor perception of the role of the anaesthetist, but hopefully, through patient education and through various forms of media, including art, we can
improve their understanding of the role of the anaesthetist, especially in the theatre environment.


(4) Bigelow, H. J., Insensibility during surgical operations produced by inhalation. The Boston Medical and Surgical Journal Nov 1846 Vol 35 No. 16.


Note regarding John Snow and Queen Victoria- the Connor and Connor paper suggested that social pressure did not cause the change in attitude of physician towards obstetric
anaesthesia as few contemporary newspapers mentioned the Queens anaesthetic. But Donald Caton in his paper in Anesthesiology 2000 on “John Snow's Practice of Obstetric Anaesthesia” puts forward the idea that although the influence of Queen Victoria has been overstated it did seem to have had some influence on the upper classes and thus people of influence. Yes, there were no contemporaneous accounts in the newspapers but it was announced in the Court Circular and more titled women received obstetric anaesthesia after it had been administered to the Queen. Added to this it was Snow’s careful and meticulous approach to that won over his colleagues to allow him to administer it to the Queen in the first place.