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SPHEX Club
March 4, 2021

Need a Haircut?

slide of barber

It has become common to say, particularly in the scientific fields, “We stand on the shoulders of those who have gone before.” So as a surgeon, I'd like to envision a long line of adventuresome academic physicians of the great universities of Europe as my forebears, perhaps going back to Hippocrates. But in reality, that's not quite right. Surgery really has more in common with the tradition of this gentleman than the academics of America or Europe. The discipline of surgery really traces its origins to the barbers of the Middle Ages. They were clearly a separate class and profession from those who were termed physicians.

slide of OR

The question to be asked is, “How did we get from medieval barbers to where we are now with this level of technology?” Over 50 million surgical procedures are performed in the United States every year and the average number of surgical procedures in a person's lifetime in the United States is now 9.2

Slide of Barber surgeon

The role of Barber surgeon was first noted in the records of the monasteries of Europe about 1000 AD. They served the monks providing distinctive haircuts required of that era and did minor surgical procedures which would include pulling teeth, lancing boils, bloodletting and taking care of minor wounds.

Slide of instruments

The reason they were anointed for this kind of work was probably due to the fact they had the sharp instruments and presumably the dexterity. Well, we should say they had the relatively sharp instruments.

Slide of Barber surgeon tooth pull

There were very limited advances over the 1st few centuries. What was learned was usually in the course of wars and the care of battlefield injuries. This is a recurring theme in the advancement of the surgery as war has repeatedly been an impetus for the leaps forward. The surgeons gradually learned to do some additional procedures including amputations, frequently required on the battlefield. In between the periods of conflict, Caesarean sections could be performed, usually in situations where the mother either died or was dying in childbirth. There

was also the problem of bladder stones which were remarkably common in this era and extremely painful. If the patient could tolerate it, the stones could be removed by placing an incision in lower abdomen and entering the bladder directly, call “cutting for stones “.

Some formal recognition was eventually established in England by 1540 when the Fellowship of Surgeons was established. This later became the Royal College of Surgeons which is what we have now in Great Britain. The craft, however, remained clearly separate from physicians. They were of lower class and received only apprenticeship, no academic training. They might be called on by physicians to do bloodletting or minor procedures but remained distinct.

Slide of Barber poles

There are still vestiges of this relationship despite the merging of surgeons with the medical profession in the early 1800s. The origin of barber pole, although somewhat obscure, is still thought to represent the bloody bandages of the barber’s surgical procedures. I found a more graphic explanation that went as follows:

The traditional striped barber’s pole harks back to that era, when it served as an advertisement for their proficiency as bloodletters. The pole represents the rod that the patient gripped to make their veins bulge, and the brass ball at the top symbolizes the basin used to collect the blood. The red and white stripes represent the bloodied bandages. Once washed and hung to dry on the rod outside the shop, they would twist in the wind, forming the familiar spiral pattern adorning modern poles.

Another vestige of the remote ties to non-physicians, is the tradition of British surgeons, at least the males, to be referred to as Mr. So, you have this strange situation where a medical student in training begins as Mr. and then as he qualifies as a physician he becomes “doctor”. Then when he finishes his surgical training, he becomes Mr. again. It's kind of a reverse snobbery but I think is now finally on the wane.

Slide of Ambrose Pare

Ambrose Pare was one of the late medieval surgeons traveling with the army in the service of the French King, Henry II. In about 1545 he made one of the first useful observations on the battlefield. Amputations were common and were normally treated with boiling oil or a hot cautering iron at the end of the procedure. On one occasion the boiling oil had been depleted and he came up with a substitute salve to put on the wounds which contained turpentine. Fortuitously, turpentine is an antiseptic. When he returned to the battlefield the next day, instead of finding the wounds covered with the necrotic dead tissue he expected, they looked relatively clean and capable of healing possibly without infection. This principle was widely adopted in the care of all wounds, avoiding the application of cautery. Pare went on to devise the technique of ligating blood vessels rather than using cautery to stop bleeding.

Slide of operating Theatre

But 300 years later, there is still a very limited number of operations that could be done. The operating theatre was a gruesome place where the patients had to be miserable and desperate for relief to even consider entering. They were usually fortified with lots of Brandy or other alcohol. As you can see, first you needed several strong men to hold the patient down. There was no anesthesia and no antisepsis. Frequent terrible complications occurred. Speed was the primary requirement of the surgeon. 30 seconds was a reasonable time frame for the amputation of a leg. With a tourniquet in place, the surgeon would use a large blade to divide the posterior muscles of the leg in one fell swoop, then the anterior muscles. Then he would take a saw quickly to the bone and he was done. The wound is left open, hopefully to heal, but probably to get infected. There was no washing of the hands or the instruments, except perhaps at the end of the procedure. The blood stains and soiling of the surgeon's frock was taken as a sign of experience. Hung on a hook, it was use over and over again.

Slide of the three barriers

There had been centuries of little progress. Clearly, three main barriers stood in the way. First, pain prevented people from seeking help except in the most desperate situation. If they were to survive the surgery, infecrions were common, sometimes fatal. Then then there was blood loss, although not necessarily seen as a problem. Bloodletting was more a therapy than a cause for concern.

Slide of laughing gas

Both ether and nitrous oxide are gasses that had been known for some time. Sir Humphrey Davy, a chemist and inventor in England, was the first to describe the effects of nitrous oxide on himself and colleagues in 1800. He even suggested that it might be of use in surgery, but that recommendation went unnoticed, published in an obscure Journal. Instead, what was termed "laughing gas" became popular at parties and for entertainment.

It wasn't till 40 years later, in 1845, that Horace wells, a dentist in Hartford CT, recognized that among the effects that nitrous oxide had on people was analgesia. In addition to the euphoria that was induced he saw that people were insensitive to pain. He therefore began using it with success in his dental practice and ventured to demonstrate its utility to the Boston medical community. A demonstration was set up and with a crowded room watching him administered nitrous oxide to a young medical student who needed a tooth pulled. Unfortunately, the student either cried out or showed some evidence pain with the extraction. The demonstration was generally felt to be a failure with ensuing skepticism concerning nitrous anesthesia.

slide of William Morton

William Morton was another dentist and surgeon in Boston and a friend and former partner of Wells. Initially a skeptic, he conducted this very famous demonstration of ether anesthesia at Massachusetts General Hospital just one year later in 1846. A young man with a neck mass, variously described as a cyst or a tumor, was administered ether by doctor Morton, seen at the left of the picture near the patient's head, and doctor John Collins Warren preceded to remove the mass. Reportedly, the patient then awoke and described having no pain barely noticing that

the operation was completed. Dr. Warren is said to have exclaimed to the crowd, “Gentlemen, this is no humbug “.

This was a dramatic demonstration, and it was immediately evident this was a game-changing advance. The principals involved understood the significance and so regathered the next day for a photograph to recreate and commemorate the event.

Slide of Morton’s diffuser

Administration of these gasses was difficult. Most often, the anesthetic was dripped into a cloth covering the patient’s nose and mouth. Morton’s inhaler was glass globe with the ether dripped onto a sponge and then inhaled through a mouthpiece by the patient.

Problems were encountered with ether. It was found to be somewhat irritating and had a very distinctive smell. Sir James Young Simpson was a Scottish obstetrician who with two colleagues was searching for effective anesthetic gasses at the same time as Wells and Morton. Choroform had been discovered 15 years earlier, but it’s effects only observed in animals. Simpson and his colleagues performed their search by spending their evenings in the dining room sniffing various gasses for effect.

Slide of Simpson and colleagues

In August of 1847, and evening with chloroform did the trick. When they awoke in the morning they knew they had a useful compound. Chloroform was gradually substituted as it was much better tolerated, more pleasant and not flammable. Chloroform was famously used for Queen Victoria’s delivery of her 8th child. It became the prominent anesthetic used by both armies during the Civil War. It proved to be much more dangerous, however, as multiple unexpected deaths occurred, presumably due to respiratory depression. Therefore, they went back to ether and ether remained the leading anesthetic agent for the next 100 years.

Now things are dramatically changed as surgeons had TIME. No longer was there a need for 30 second procedures. Many more operations could be performed including removal of tumors. However, this in fact, lead to a black period for the practice of surgery, as even the simplest procedures could result in devastating and sometimes fatal infections. It got to the point where some hospitals even banned the performance of any surgeries.

The cause for this plague of infections was pure conjecture theorizing a vapor in the air or miasma that might arise from the wounds. They did not consider the hands or the instruments or the frocks of the surgeons who would go from patient to patient changing bandages and probing wounds. In fact, the process of wound healing so often included infection that the term “laudable pus” was used. This implied that when pus would finally drain from the wound it perhaps had turned the corner and could then begin healing as opposed to the formation of an abscess deep in the tissues and continued sepsis leading to death.

Slide of Louis Pasteur

Of course, it was Louis Pasteur that disproved the idea of spontaneous generation and he made the connection between contamination by microscopic organisms and the spoilage of beverages such as wine, milk, and beer. He ultimately showed the link between bacteria and disease publishing his treatise on the Germ Theory of Disease in 1862.

slide of Joseph Lister

It fell to Joseph Lister a British Quaker, who was working in Glasgow, to do something about this in the field is surgery. He read Pasteur and recognized in 1865 that the contamination and infection that Pasteur spoke of could be the same process that was occurring in his wounds. The problem was certainly front and center as the mortality rate for amputations was 45 to 50% with patients dying of sepsis.

He saw no evidence for the idea of vapors or a miasma causing the infections. He noted the stench of the sewers and garbage heaps in Glasgow were similar to what he observed in his patients' wounds. It was a practice to spray carbolic acid on the garbage heaps to keep their smell down and he therefore adopted a technique of using this for his operations.

slide of carbolic spray

This was his technique of carbolic acid sprayed over the wounds and in the air during operations. You see the anesthesia being administered in the standard technique with just a soaked rag at the left of the picture. An assistant sprays the carbolic acid into the air and over the wound as the surgeon tries to work through the mist.

Fortunately, he approached the proof of the technique scientifically choosing a series of patients who had compound fractures. In these fractures the bone has actually come through the skin and so they were invariably infected and ultimately required amputations. It was a perfect group to start with since if the treatment were unsuccessful the amputation could then subsequently be performed. He waited until he had a series of 11 patients who had suffered compound fractures, treated with the carbolic acid, reducing the fractures and closing the wounds. He recorded surprisingly good results with salvage of their limbs, and only 2 deaths. Excellent results for the time! His subsequent series of amputations for which he used the carbolic acid technique reduced the mortality for that procedure from 45 to just 15%.

This experience was still met with skepticism and resistance, particularly in the US and Great Britain. The technique was awkward and unpleasant for the surgical team, and lingering doubts about the Germ Theory remained for some time. The conservative medical communities in Great Britain and the US were particularly slow to adopt. Yet the "Listerian" ideas ultimately prevailed and he was lionized as the father of antiseptic techniques and dramatic improvements in surgical care.

Slide of Listerine

Probably a more enduring accolade was the naming of this well-known product after Joseph Lister. Developed in St Louis in 1888, it was promoted for a brand-new condition labeled "halitosis".

Slide of John Halsted

John Halsted was an icon of American surgery and particularly surgical teaching. Although addicted to cocaine and morphine throughout his career, he made enormous contributions to surgical technique. He was the originator of multiple surgical procedures. Halsted was one of the four founding surgeons of Johns Hopkins Hospital. He promoted the idea that the most meticulous, gentle handling of tissues, with a minimum of bleeding and damage led to superior results and lower infection rates and was an early adopter of the Listerian ideas of antisepsis.

Slide of Caroline Hampton

Caroline Hampton, a young woman from South Carolina, was his primary scrub nurse in the operating room. She developed a painful intractable contact dermatitis from the antiseptics used in the surgical field. Halstead, anxious to keep her, asked the Goodyear Rubber Company to fashion protective gloves for her hands. These are the first surgical gloves used in the operating room and gradually spread to the other members of the team who had all been operating barehanded until then. Their use evolved to protecting the patient from the surgeon's hands as opposed to protecting the surgeon from the caustic antiseptics.

Slide of Robert Koch

Robert Koch was a German physician and microbiologist, a contemporary and a rival of Pasteur's. It was Koch who took the next step in establishing the germ theory by identifying specific pathogens and their diseases.

Slide of microbes

This is the first published photograph of bacteria, taken in Koch's lab. He discovered the bacteria responsible for anthrax, Cholera as well as tuberculosis, for which he won the Nobel Prize. The rod-shaped organisms in this photo are the anthrax bacilli. His work firmly established the germ theory of Pasteur and he developed rules to accurately identify disease causing organisms.

Slide of Koch's Postulates

He noted these four conditions had to be met. First the Organism needed to be observed in all cases of the disease. You needed to be able to extract it and transfer it to culture where it could be grown. Then reintroduced into another host, an animal, where it would reproduce the disease and then once again be observed in that host. These were actually a little overly stringent and do not apply to all cases, but they firmly established the link between disease an identifiable bacteria. In the case of wound infections he actually identified that responsible bacteria were both in the wound and on the hands of the surgeons.

We therefore entered a period where we moved from the idea of antisepsis, killing the bacteria in the wound and the surrounding air and surfaces, to the idea of asepsis, that is keeping the germs out of the wound and off the skin. That meant the development of crucial advances:

1. Gloves to prevent the surgeons from introducing bacteria into wounds.
2. Special operating rooms instead of working in the wards with other infected patients nearby.
3. Clean operating gowns and hats.
4. Masks for everyone in the vicinity as they discovered the bacteria in our respiratory secretions.

So now there was a dramatic expansion again of what could be done in an operating room. Major orthopedic and intra-abdominal procedures could be undertaken although the chest was still out of bounds as we could not artificially ventilate patients and the heart was clearly unapproachable.

Two of the three barriers had been overcome. But there remained a mysterious condition that was frequently seen in battlefield injuries. That is, a casualty might receive appropriate care and successful treatment with dressing of a wound and perhaps an amputation but would still die subsequently.

Slide of Stonewall Jackson

This is a depiction of Stonewall Jackson after the battle of Chancellorsville. He was mistakenly wounded by his own troops, shot by members of a North Carolina infantry. He had a very serious wound of his left arm as well as a second shot that hit his right hand. He was taken back to camp and attended to by his physician, Dr. Hunter Holmes McGuire. His description of General Jackson is classic for the findings of hemorrhagic shock that is brought on by blood loss.

First, his uniform was all soaked with blood on arrival and, in fact, the left arm wound was still bleeding. His hands were cold and clammy and his lips pale. Doctor McGuire was able to perform a successful amputation of his left arm and adequately repair the damage to his right hand. Jackson actually recovered to a degree and survived seven days before succumbing to other complications. In this case he probably did not die from the initial blood loss, but Dr, McGuire provided one of the first good descriptions of hemorrhagic shock from the battlefield.

Yet the whole idea of blood loss as a potentially fatal insult historically had not really been grasped. The signs were recognized but it was uncertain whether this might just represent a psychiatric problem after an injury. Bloodletting, as you know, practiced for centuries, remained popular; it would obviously exacerbate the problem.

Slide of Jackson's arm tombstone

I don't know the story behind this because it seemed a little tangential, but I felt I couldn’t NOT show it.

Slide of first blood transfusion

Transfusions had been tried very early. This effort was recorded in 1667. The idea was obviously fraught with religious philosophical as well as technical problems. The first thought was that animals could be used. in France, Jean Baptiste Denis successfully transfused lamb's blood into this young man. The worry, of course, was that some of the essence of the donor might be transferred to the recipient and therefore a lamb was used as it seemed his disposition was benign. The boy survived, probably because very little blood was actually transfused. But all subsequent efforts we're obviously failures and deaths occurred as there would be no blood compatibility between species. The practice was banned by both church and governments.

Slide of 4 ounces

Nothing was attempted for virtually the next 150 years. Postpartum hemorrhage, that is the mother continuing to bleed after delivery of a baby, remained a major problem and a frequent cause of maternal death. In 1818 James Blundell, and obstetrician in London, successfully transfused a small amount of blood from a patient's husband, and she survived. He attempted it 10 more times, but only 5 were successful. The problems were multiple:

Slide of transfusion number one

In this example you can see there obviously be no control over which way the blood was flowing or how much might be passed from one to another.

Slide of transfusion #2

Here they have fashioned a device to help control volume as well as a pump to deliver blood to the recipient. But clearly the overriding problem was the ignorance of blood groups and the resulting incompatibility which would result in fatal immune reactions.

Slide of Karl Landsteiner

It was 80 years later in 1900 when Karl Landsteiner, an Austrian physician, discovered three blood types A, B, and C. He changed "C" to type "O," and his colleagues later added type AB.

Slide of Ludvig Hektoen

Soon thereafter in 1907 Ludvig Hektoen, physician in Chicago, showed that you could cross match blood before attempting a transfusion by exposing a small amount of donor blood to the serum of the recipient which would contain the antibodies.

Slide of blood crossmatching

You can see in this demonstration from Dr. Landsteiner's lab where he has mixed red blood cells of his own and two of his colleagues with his serum and the serum from the two colleagues.

One colleague is type A, one type B and Dr. Landsteiner is type O. Reactions, shown by the "agglutination," that can be observed under the microscope, occur when type a or B red blood cells are exposed to serum from another blood type. You can see Dr Landsteiner's blood engenders no reaction, however, because type O is the "universal donor" with neither A or B antigens on its surface.

The important point is that you could use these challenges to determine blood types of the donor and recipient, and then test the cross match BEFORE transfusion to avoid these potentially fatal immune reactions. Now there are many other antigens we test for to ensure the highest compatibility, but this was the crucial advance.

Once again war propels advances in field as WW I casualties present a dramatic need for blood and the discovery of citrate-glucose solution makes it possible. This additive would both preserve and anticoagulate donated blood, so it could then be stored, transported, and subsequently administered.

Slide of bags of blood.

It wasn't until 1950 that we had what's termed the most important technical advance made in blood banking. That was the development of durable plastic bags, allowing easy storage and transportation and avoiding glass containers.

So now the three barriers of pain, infection, and bleeding had been breached

This set the stage for the great advancements surrounding World War II, including:

Blood banks, with blood being available not only for trauma but also elective surgeries.

The development of penicillin, our first antibiotic.

The development of balanced anesthesia with new agents. Previously, high doses of ether or other single anesthetics were required. They would often linger in all the tissues of the body with slow awakening and recovery from any surgery. Balanced anesthesia would allow much smaller doses of separate agents to be used with less toxicity. Commonly, you would have

One agent for sedation so the patient would be asleep.

A second agent would be for muscle relaxation. This would be derived from curare from the tips of the blow darts of the South American Indians.

A third agent would be used for pain relief, an opioid.

This was also the era when surgical specialization took off. You now had the development of individual disciplines and surgeons who could develop advanced expertise.

Slide of cardiac OR

The development of cardiac surgery was certainly one of these, especially over the last 60 years. This is our cardiac OR at Lynchburg General. The invention of the heart lung machine allowed us to work within the heart, repairing defects in children and adults. Then the development of effective artificial valves permitted the treatment of rheumatic and degenerative diseases of the valves. The advent of coronary artery bypass surgery gave us another option in the treatment

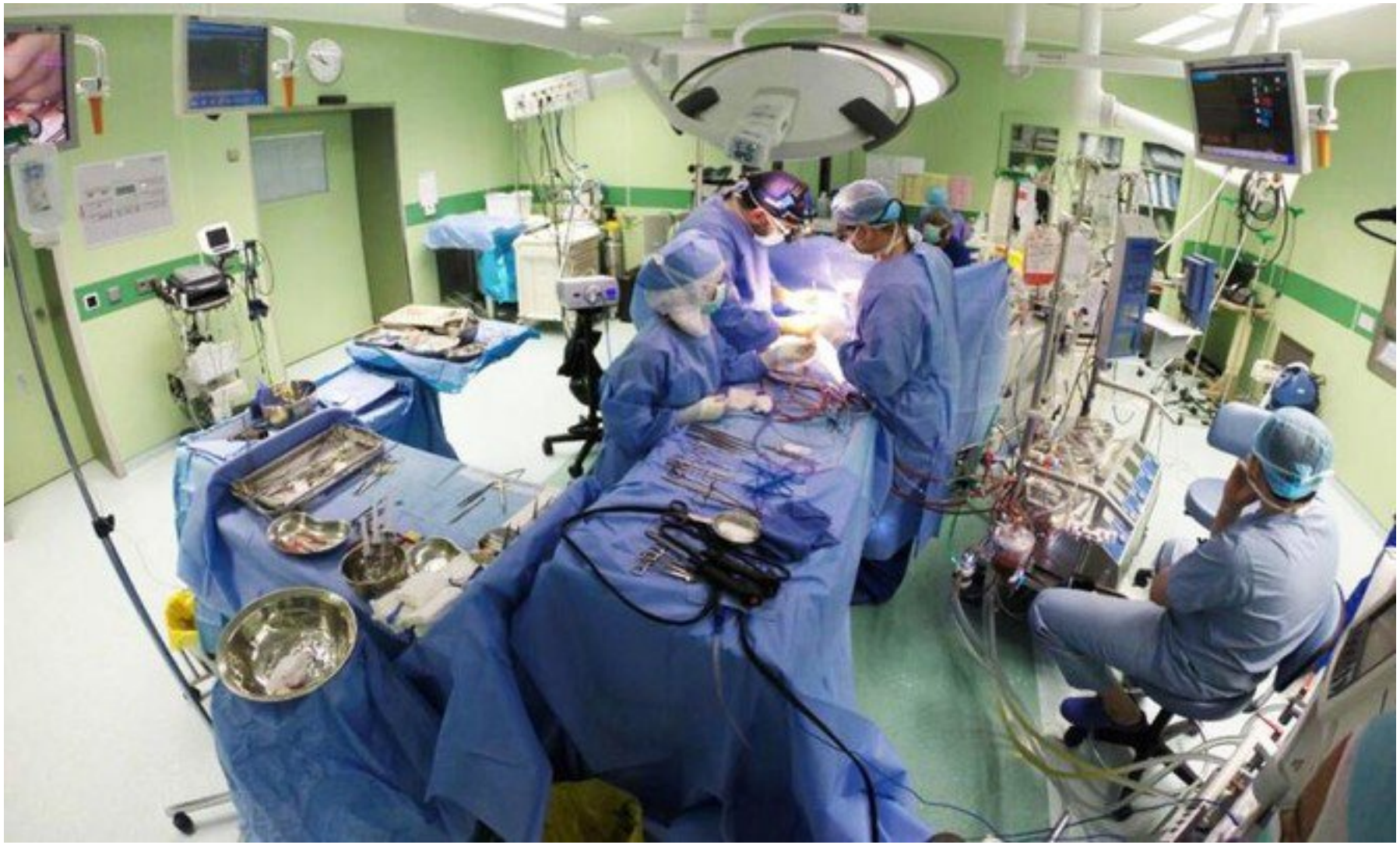
of ubiquitous coronary artery disease. Now heart transplants have advanced to where most know someone, or know of someone who has undergone a transpant.

slide of LBJ

As a result of these transformative changes, surgery evolved from this gruesome and dangerous craft to a full-fledged part of our medical system, dramatically expanding our ability to intervene in the course of disease.

Patients could now go into the operating room not with existential fear and desperation but rather with hope. They might even be happy enough to show off their scar with some pride.


Cigarettes

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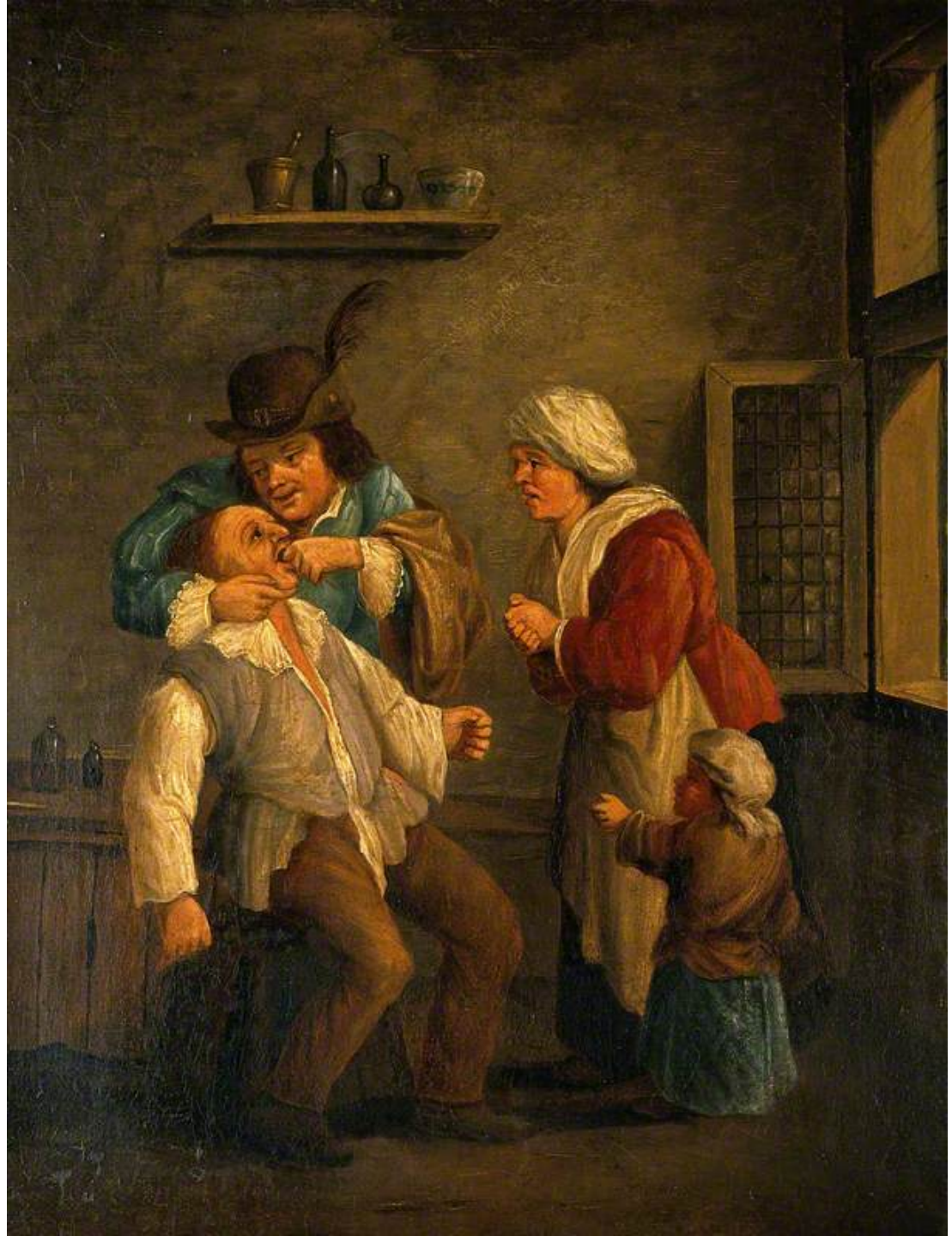
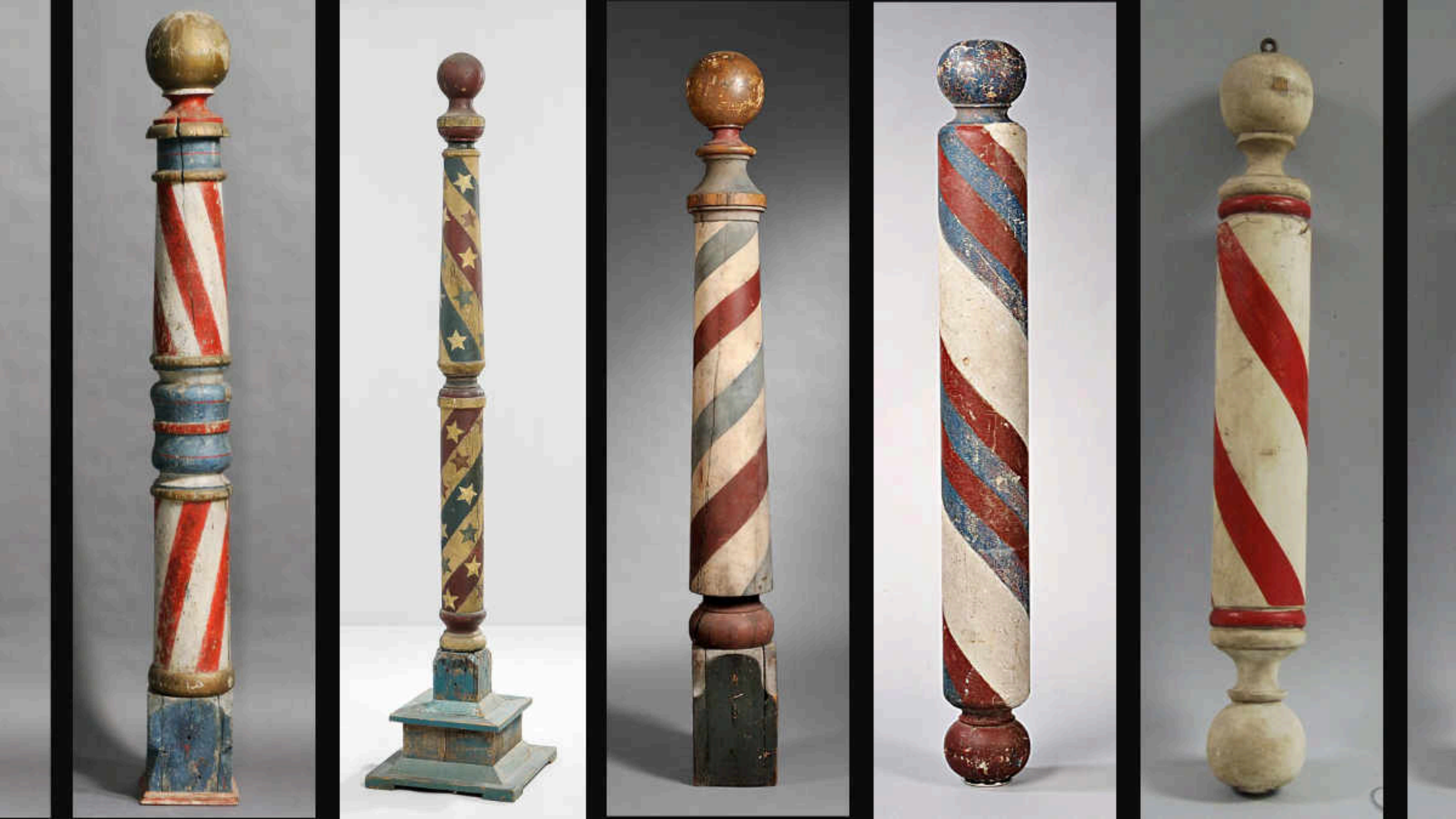


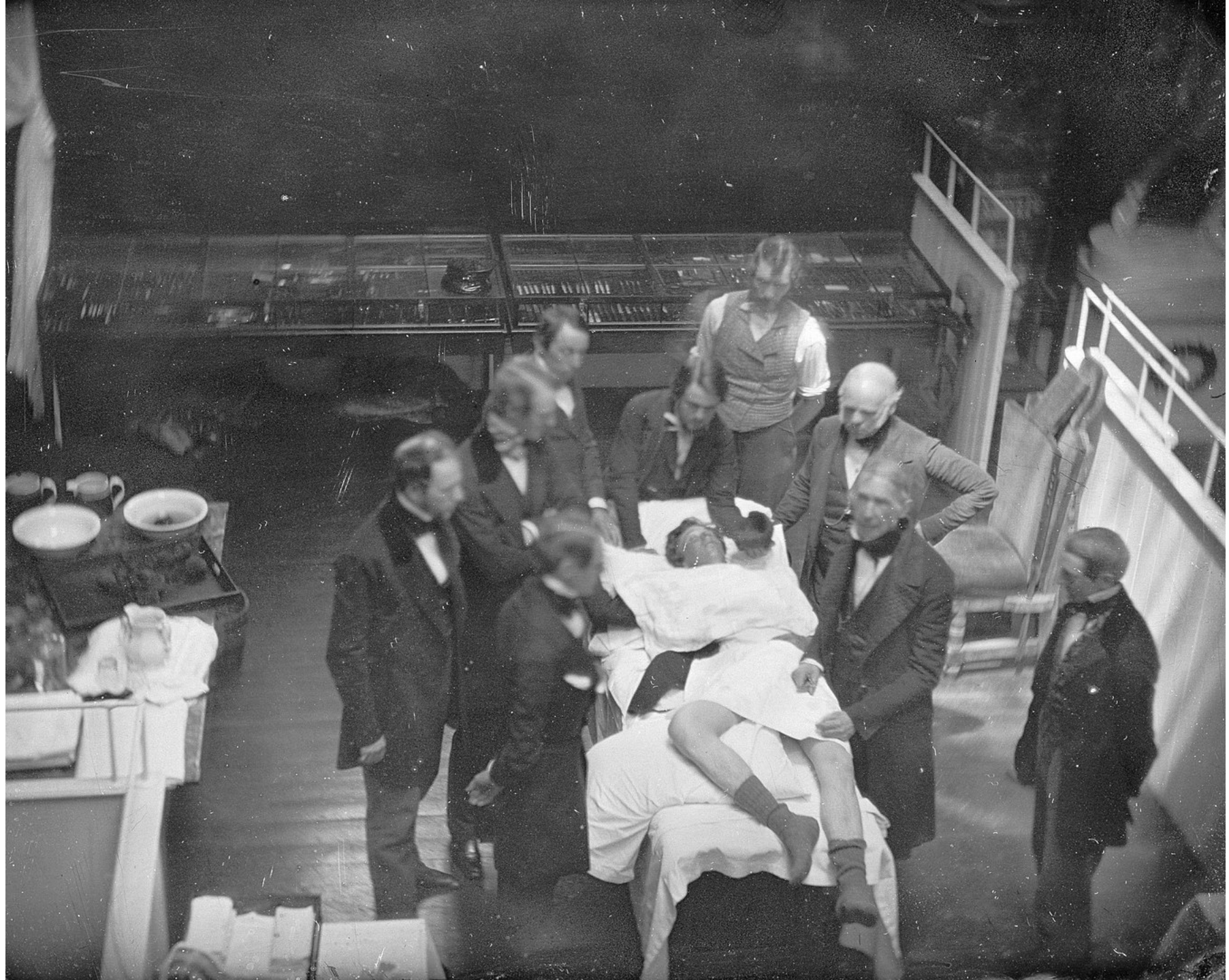


THREE BARRIERS

Pain

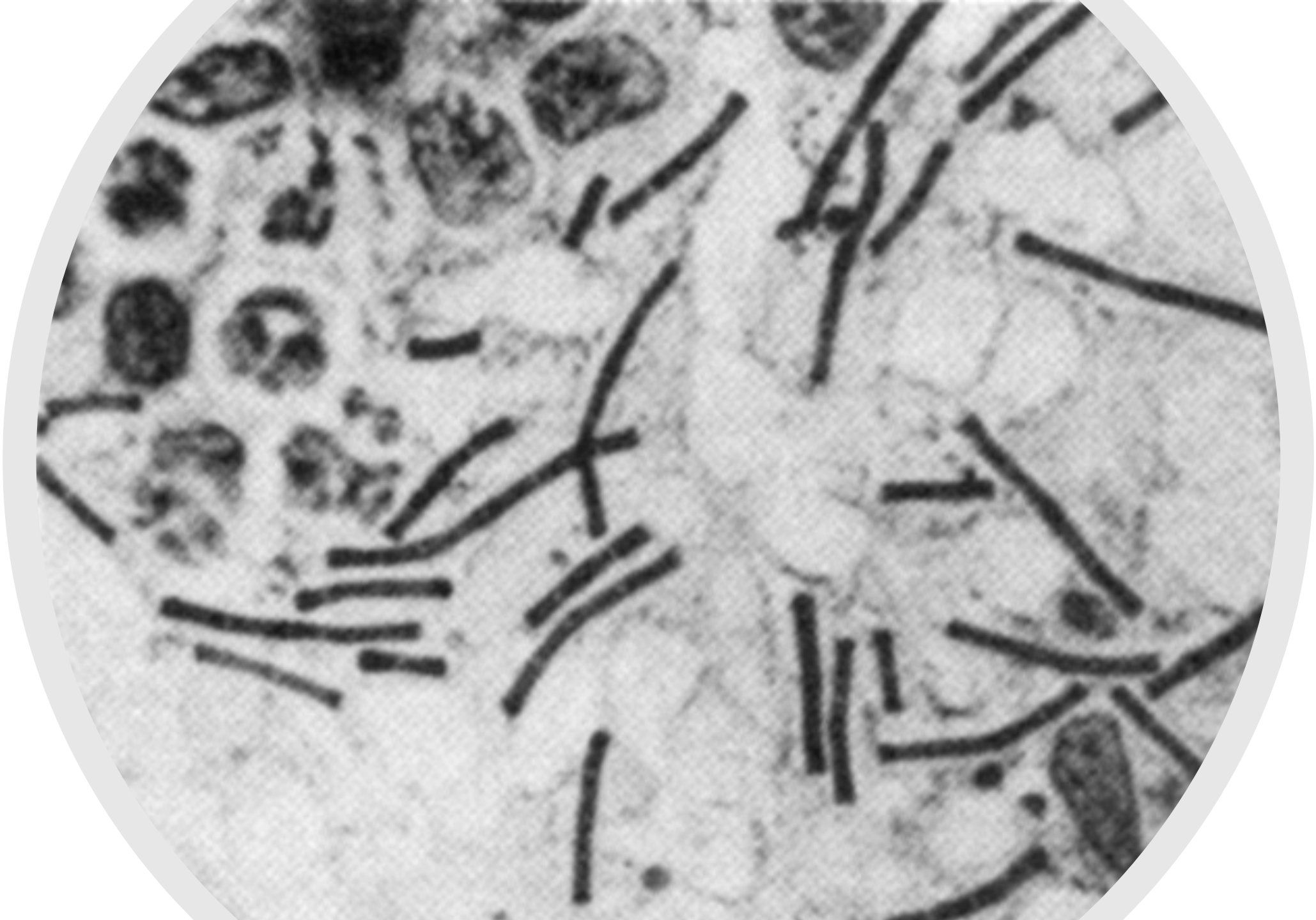
Infection

Blood loss



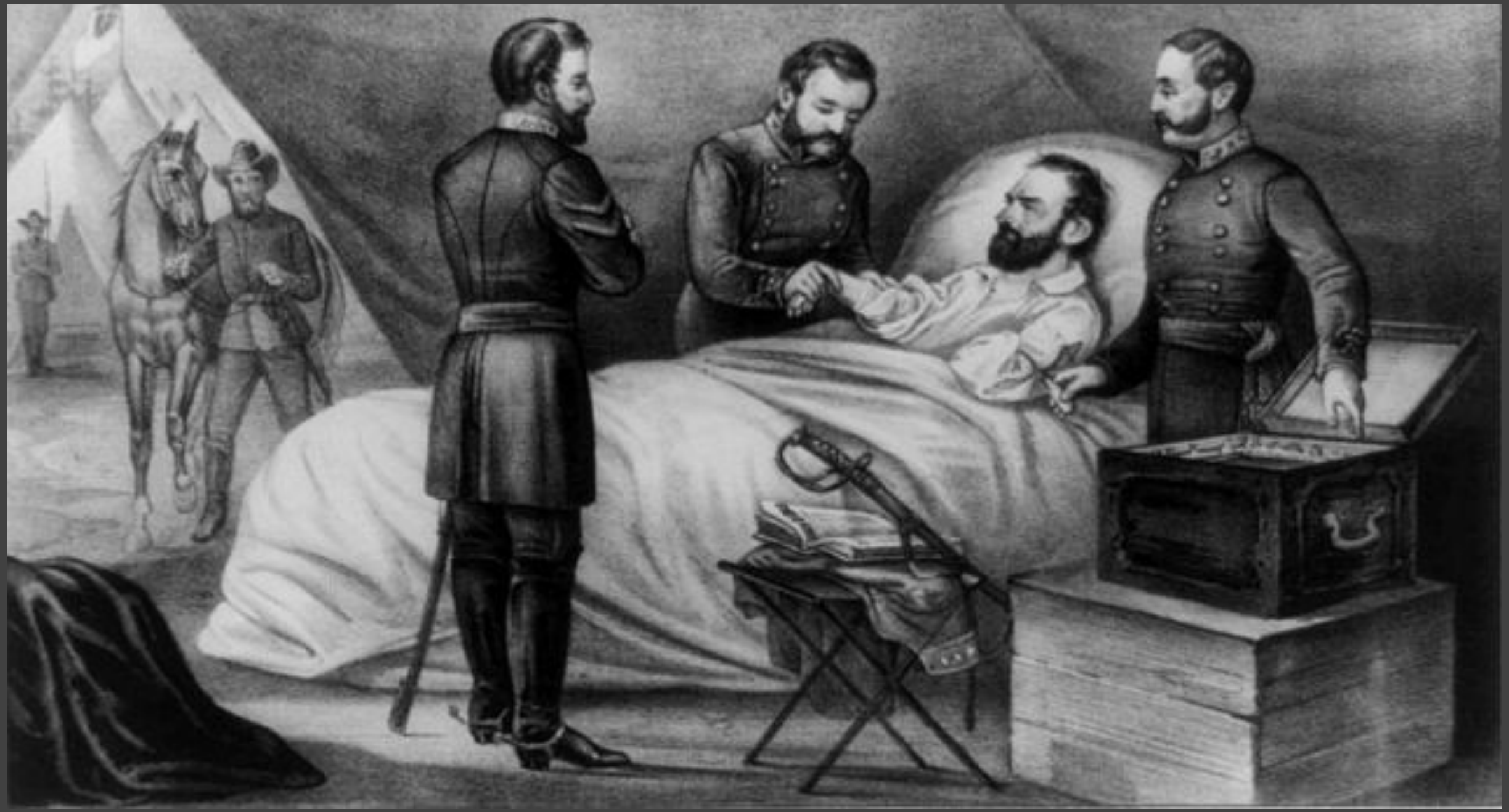
Replica of Morton Inhaler


VANILLA MINT
LISTERINE
MENTHE-VANILLE
Original
LISTERINE
d'origine
ADVANCED
LISTERINE
PLUS
WHITE
BLANCHES
Cool Citrus
LISTERINE



Koch's postulates

1	The microorganism must be found in all cases of the disease.
2	It must be isolated from the host and grown in pure culture.
3	It must reproduce the original disease when injected into a susceptible host.
4	It must be found in the experimental host so infected.




ARM OF
STONEWALL JACKSON
MAY 3, 1863.

First blood transfusion

In 1667 in Paris for the first time a successful blood transfusion was carried out to a man from a lamb. Subsequent transfusions ended with the death of both

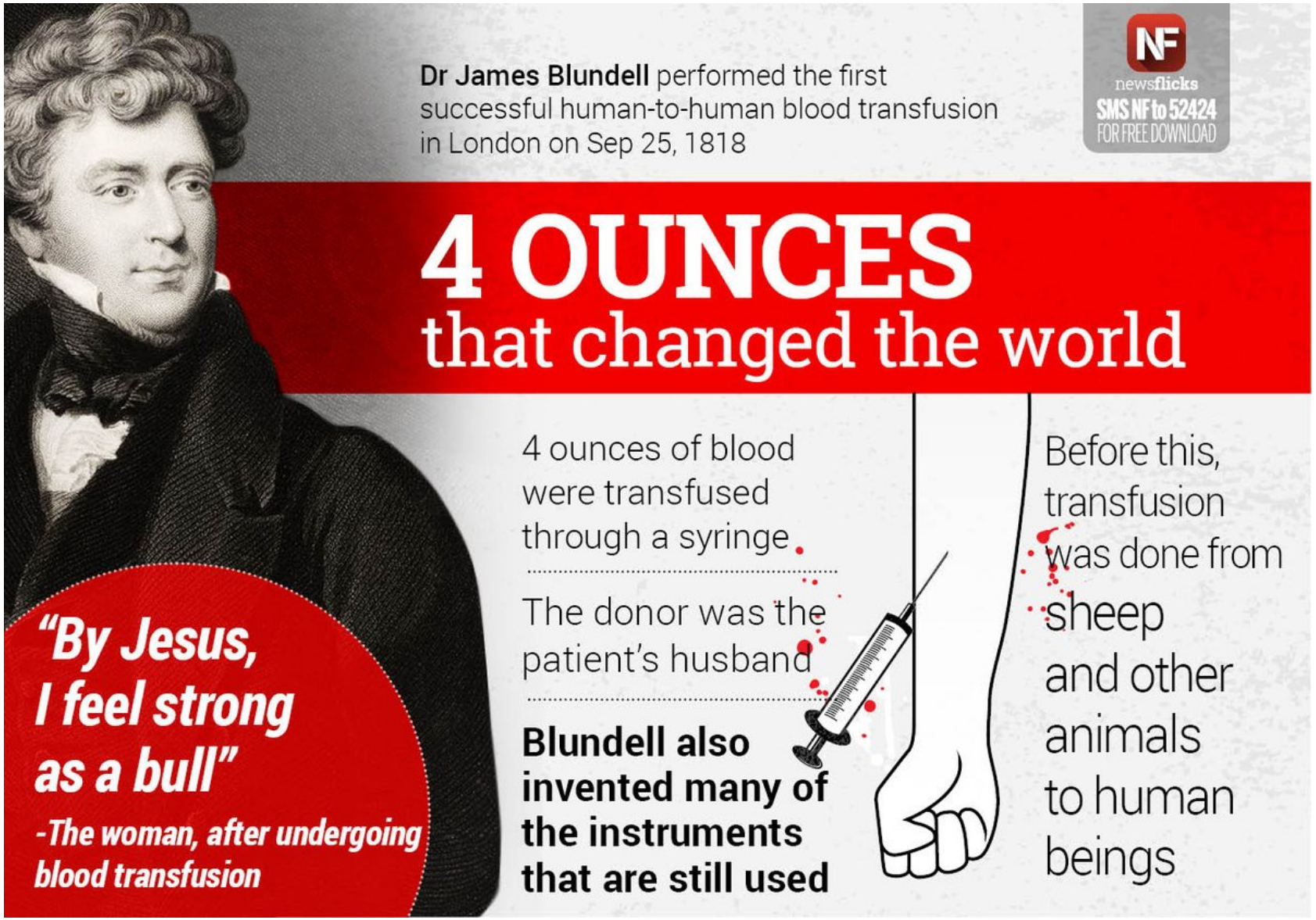
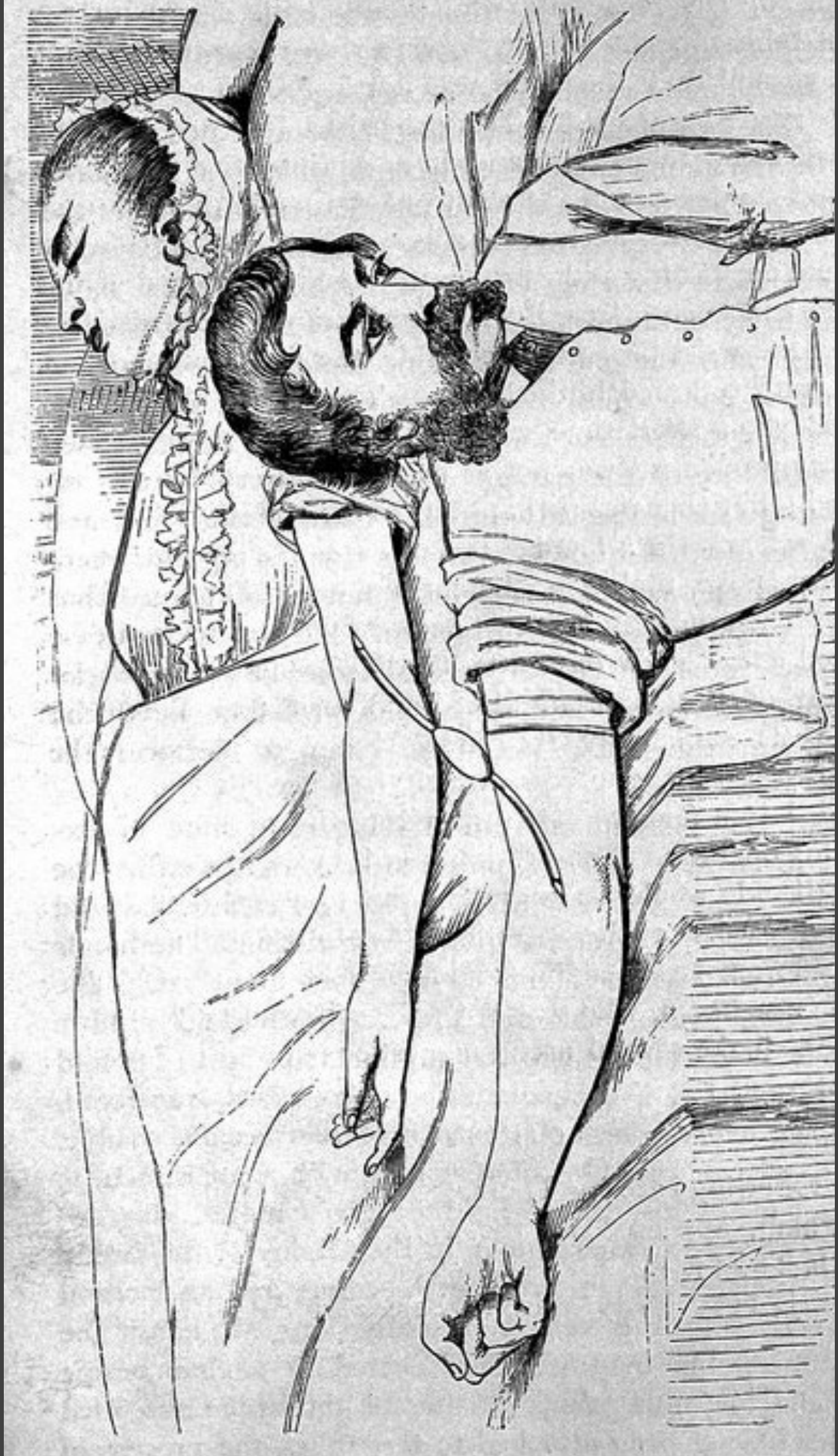
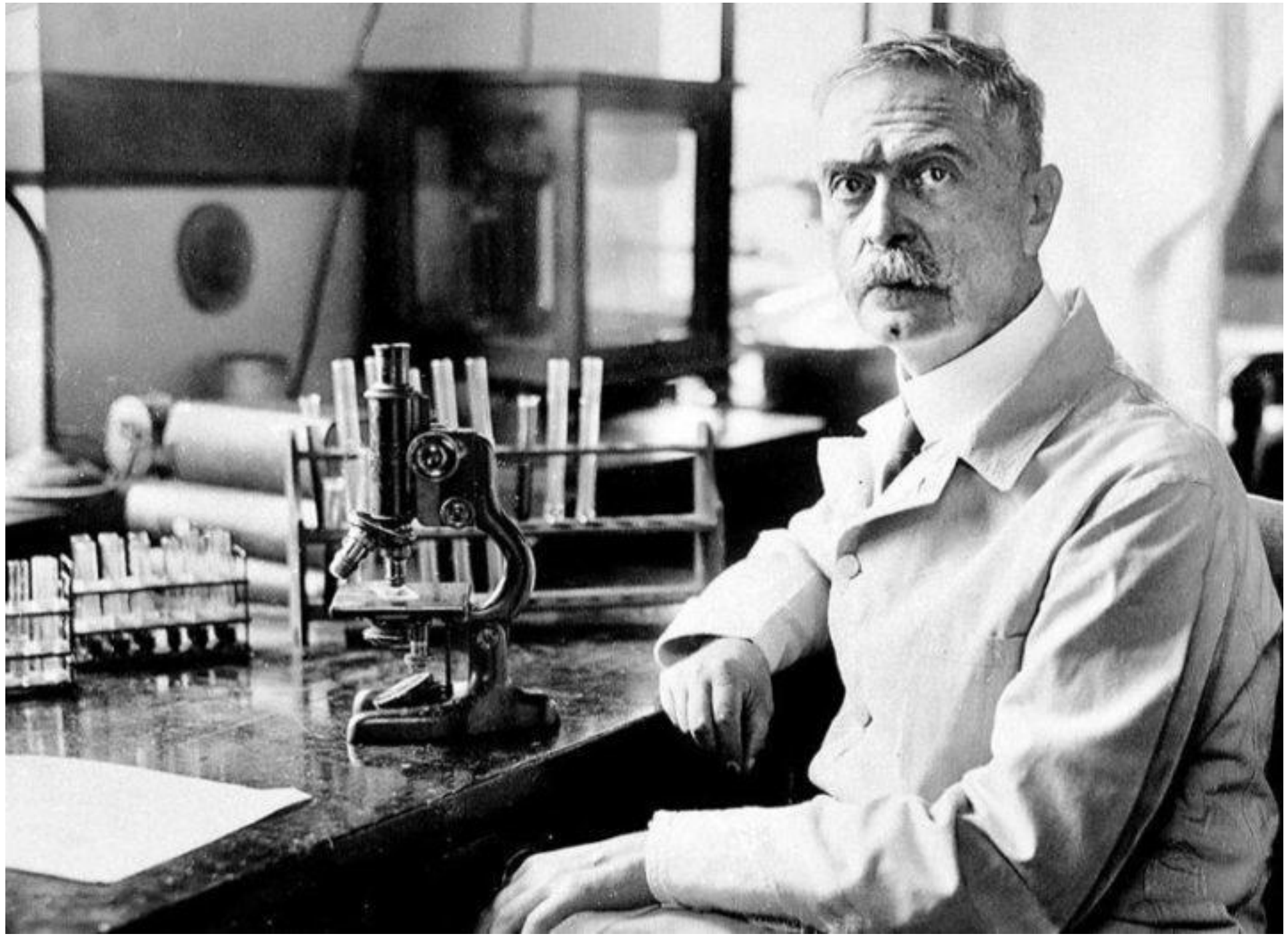

Dr James Blundell performed the first successful human-to-human blood transfusion in London on Sep 25, 1818
newsflicks
SMS NF to 52424
FOR FREE DOWNLOAD
4 OUNCES
that changed the world
"By Jesus, I feel strong as a bull"
-The woman, after undergoing blood transfusion
4 ounces of blood were transfused through a syringe
The donor was the patient's husband
Blundell also invented many of the instruments that are still used
Before this, transfusion was done from sheep and other animals to human beings

FIG. 1.





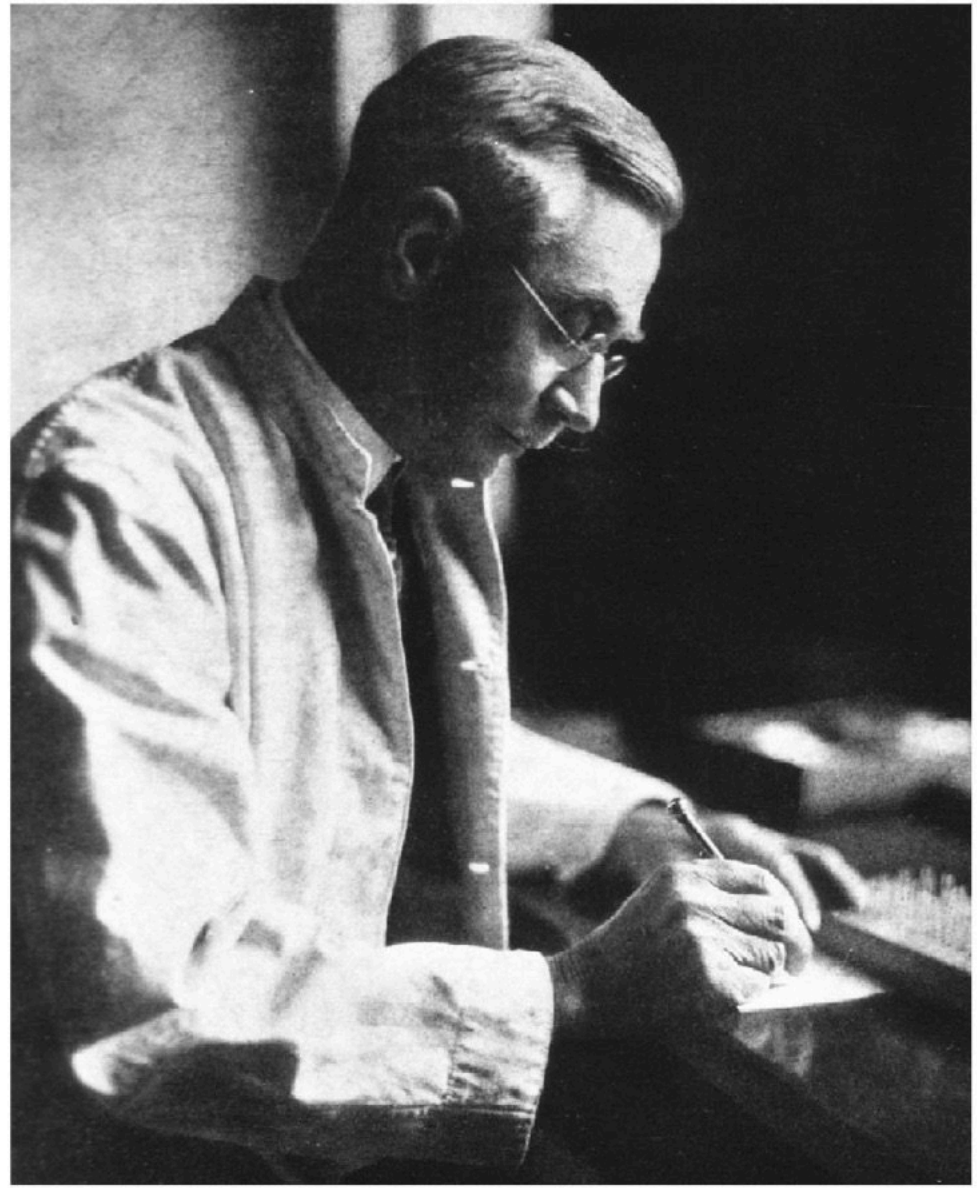
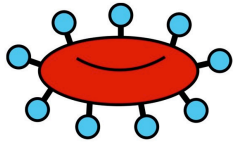


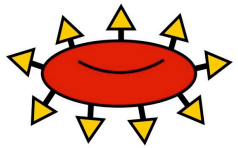
Figure 1. *Ludvig Hektoen, MD (1863–1951), 1921. Image courtesy of the History of Medicine, National Library of Medicine.*

Blood Type

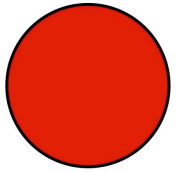
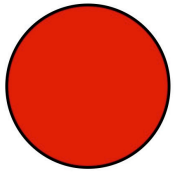
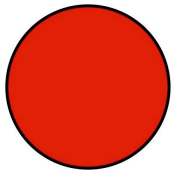
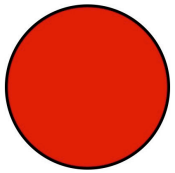
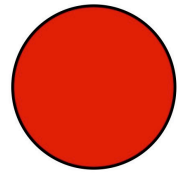
Dr. Pletsching
Type A



Dr. Sturli
Type B



Dr. Landsteiner
Type O

Dr. Pletsching Antibodies against B	**Dr. Sturli** Antibodies against A	**Dr. Landsteiner** Antibodies against A and B
No Reaction 	Reaction 	Reaction 
Reaction 	No Reaction 	Reaction 
No Reaction 	No Reaction 	No Reaction 

Serum