



Invention of toilet paper: something else the Romans didn't do for us, p 41

Who killed Ramesses III?

Zahi Hawass and colleagues shed new light on the harem conspiracy

Introduction

The end of Ramesses III's life has long been debated among Egyptologists. A series of historical documents, of which the most important is the Judicial Papyrus of Turin,^{1, 2} clearly state that in the year 1155 BC, members of his harem made an attempt on his life as part of a palace coup. According to the documents, the coup failed, but it is unclear whether the assas-

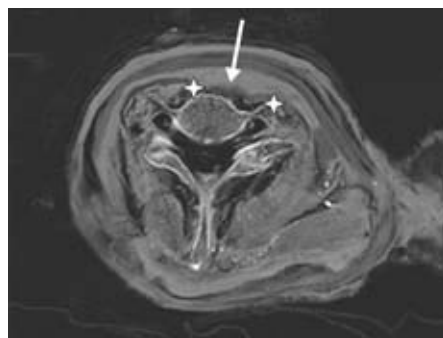


Fig 1 | Axial CT section image of the neck of Ramesses III. Stars=wound margins. Arrow=homogeneous embalming material seeping into wound and bone



Fig 2 | Sagittal CT section image of the neck of Ramesses III. Arrow=foreign object. Stars=wound margins; embalming material has seeped into wound and bone. Triangles=skin above and below the wound

ination was successful. The Judicial Papyrus recounts four separate trials and lists the punishments meted out to those involved in the conspiracy. Chief conspirators included a secondary queen Tiy, and her son Prince Pentawere.¹

The ancient documents refer to Ramesses III as "the Great God," and imply that he had died before or during the trials. However, the texts also imply that the court received direct instructions from the king, who must therefore have survived the original attack.¹ The only line specifically interpreted by Egyptologists as a possible metaphor for an assassination is the "overturning of the royal bark."² Such circumlocution regarding the cause of a king's death has long been considered to be part of the protocol of ancient Egyptian literature.

Owing to the inconclusive nature of this textual evidence, and the lack of any obvious cause of death found in previous forensic studies of the king's mummy,³ scholars have argued a variety of possibilities: the king was injured as part of the plot and later died from his wounds, the plot was foiled entirely, or the attempt was successful.⁴ Moreover, the mummy of Prince Pentawere has not been definitively identified. However, scholars have considered the mummy of unknown man E as a possible candidate, who was found, like Ramesses III, in the royal cache at Deir el Bahari. Unknown man E's contorted expression, unusual mummification process, and goat skin were noted during the unwrapping of the mummy in 1886.⁵ There has also been much speculation about the cause of his death, with poison or burial alive mentioned as possibilities, but no conclusive evidence for either.³

To gather more information about the harem conspiracy and the fates of Ramesses III and the suspected conspirator involved in his assassination, we analysed the mummies of Ramesses III and unknown man E using anthropological, forensic, radiological, and genetic methods.

Results

The CT investigation revealed a serious wound in the throat of Ramesses III's mummy, directly under the larynx (fig 1). The injury was roughly 70 mm wide and extended to the bones (fifth to seventh cervical vertebrae), severing all soft



Fig 4 | Neck region of unknown man E. Arrows=skin folds and wrinkles under right mandible and neck region

tissue areas in the anterior side of the neck (fig 2). The trachea was clearly cut and its proximal and distal ends were retracted and separated by about 30 mm. A small, focal cortical interruption at the anterior surface of vertebral body was visible, at the seventh cervical vertebra (fig 2). Accordingly, all organs in this region (such as the trachea, oesophagus, and large blood vessels) were severed. The extent and depth of the wound indicated that it could have caused the immediate death of Ramesses III.

A flat, irregular foreign object was lodged in the right lower rim of the wound; it was roughly 15 mm in diameter with a high CT density (2200 HU), similar to a semiprecious stone (fig 2). Reconstruction of this foreign object showed a wedjet (or Horus eye) amulet (fig 3). The eye of Horus is a magical amulet that served as a metaphor of royal power, protection, and good health in ancient Egypt.¹⁰

We estimated unknown man E to be about 18-20 years old, based on the incomplete fusion of epiphyseal lines in the long bones, as seen in CT scans. Unknown man E underwent an unusual process of mummification for the 20th dynasty of ancient Egypt (1186-1070 BC),

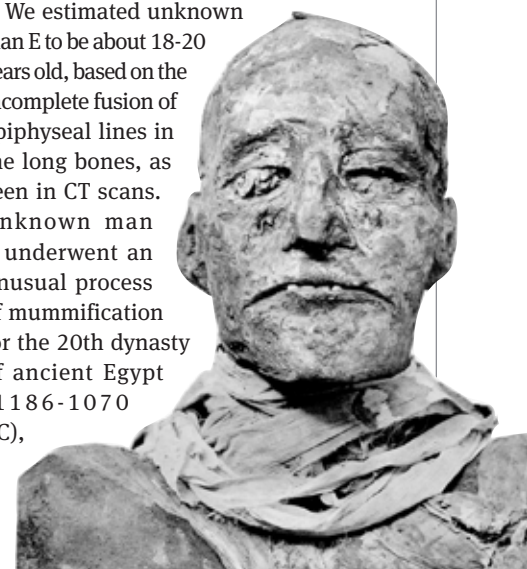


Table 1 | Genetic kinship analysis

Sample	Y chromosomal data															
	DYS 448	DYS 438	DYS 437	YGATA H4	DYS 392	DYS 635	DYS 439	DYS 391	DYS 393	DYS 385a,b	DYS 19	DYS 458	DYS 389I	DYS 390	DYS 389I	DYS 456
Ramesses III	20	10	14	13	17	—	—	8	8	20	19	—	33	21	13	13
Unknown man E	20	10	14	13	17	—	—	8	8	20	19	—	33	21	13	13
Controls*																
Control DNA 007	19	12	15	13	13	24	12	11	13	11,14	15	17	29	24	13	15
Staff 1	19	12	15	12	13	23	12	11	12	11	14	15	29	24	13	16
Staff 2	19	11	14	11	11	25	12	10	12	13	13	19	27	24	11	14
Staff 3	19	12	15	12	13	23	12	11	12	11	14	15	29	24	13	16

DYS=DNA Y chromosome short tandem repeats (repeating DNA sequences of 4-5 base pairs). Data are number of repetitions of each short sequence; overall, they represent a Y chromosomal genetic fingerprint that can be used to test the paternal relation of Ramesses III and unknown man E and moreover predict the Y chromosomal haplogroup.

*Data from control DNA (provided with chemicals for DNA analysis; refers to an unknown European sample) and male staff members also supplied for comparison.

because there was no evidence of removal of the inner organs or brain.¹¹ The skin has a reddish colour and the body was covered by a goat skin. Use of goat or sheep skins in dynastic burials was rare because these materials were regarded ritually impure.¹²⁻¹³ The red coloration of the mummy's skin could have been caused by a mixture of natron, crushed resin, and lime, which had been detected under a layer of bandages during the unwrapping in 1886.⁵

Unusual compressed skin folds and wrinkles were seen directly under the right mandible and at the right and left neck regions (fig 4). CT scans confirmed residue in the brain and inner organs, and the absence of embalming material inside body cavities (fig 5). The scans also revealed taphonomical changes in the mummy, as shown by gas formation in the abdominal cavity, urinary bladder, hip, and lower neck (fig 5). The thorax also seemed to be strongly inflated with air, together with widened intercostal spaces and a lateral shifting of the scapulae (fig 6, bmj.com). This effect could be due to postmortem processes of degradation in the mummy, but other reasons for the thorax widening should be considered. In modern cases, diseases such as emphysema or death by suffocation can lead to overinflation of the lungs.¹⁴

Genetic kinship analyses revealed identical haplotypes in both mummies (table 1); using the Whit Athey's haplogroup predictor, we determined the Y chromosomal haplogroup E1b1a. The testing of polymorphic autosomal microsatellite loci provided similar results in at least one allele of each marker (table 2, bmj.com). Although the mummy of Ramesses III's wife Tiy was not available for testing, the identical Y chromosomal DNA and autosomal half allele sharing of the two male mummies strongly suggest a father-son relationship.

Discussion

This study gives clues to the authenticity of the historically described harem conspiracy sur-

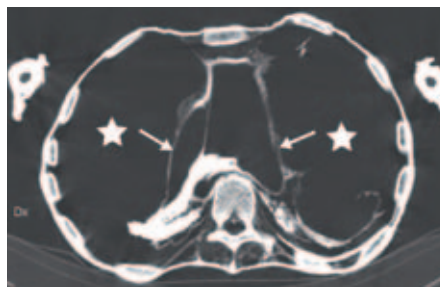


Fig 5 | Axial CT image of the lower thoracic region of unknown man E. Thorax is filled with air (stars) and appears to be inflated. Residue in the diaphragm and organs (arrows) are present at the dorsal site

rounding Ramesses III, and finally reveals its tragic outcome. Our CT analysis provides evidence that conspirators killed Ramesses III by cutting his throat. The large and deep cut wound in his neck must have been caused by a sharp knife or other blade. Damage to the throat after death appears to be unlikely, because the collar around the mummy's neck was intact and undamaged at the unwrapping in 1886, where a thick layer of bitumen was removed with a hammer from the mummy.¹⁵ It is a possibility that the throat was cut during the mummification process. Embalmers often restored damages during mummification, by inserting wooden sticks or replacing missing body parts;¹⁶ however, a treatment in which the throat was cut by the embalmers has not been described in any other Egyptian mummy.

Further evidence of an assassination comes from the presence of a Horus eye amulet in the wound. The presence of the amulet deep in the soft tissue of the wound together with the homogeneous material that penetrated the wound up to the bone substantiate the supposition that the wound was already present at the time of embalming. Most probably, the ancient Egyptian embalmers tried to restore the wound during mummification by inserting the amulet (generally used for healing purposes) and by covering the neck with a collar of thick linen layers (fig 7, bmj.com).

Our analysis showed that Ramesses III and unknown man E shared the same paternal lineage and had identical alleles at autosomal markers, strongly suggesting that they were father and son. However, based on the genetic testing, any differentiation among the several sons of Ramesses III was not possible. Historically, Pentawere was the only son who revolted against his father in contrast to all his brothers. According to the Judicial Papyrus of Turin, Pentawere was involved in the harem conspiracy, was found guilty at trial, and then took his own life.

The unusual mummification process of unknown man E, including the ritually impure use of a goat skin to cover the body, could be interpreted as evidence for a punishment in the form of a non-royal burial procedure. Together with the genetically proved family relationship with Ramesses III, we therefore believe that unknown man E is a good candidate for Pentawere. Unknown man E's cause of death has to remain a matter of speculation. His inflated thorax and the skinfolds around his neck may point to violent actions that led to death, such as strangulation. However, the lack of further evidence for strangulation (such as fractures in the laryngeal skeleton)¹⁷ and the gas formation in the body caused by decomposition processes do not allow any clear conclusions regarding the cause of death of unknown man E.

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Toilet hygiene in the classical era

Philippe Charlier and colleagues describe what the Greeks and Romans used instead of toilet paper

The first mention of toilet paper in the Western world comes from the 16th century, with a short description by the French novelist (and physician) François Rabelais arguing its ineffectiveness.¹ China, however, had toilet paper in the 2nd century BC,² and the Japanese used *chugi* (20-25 cm wooden sticks) during the Nara period (8th century AD) for both external and internal cleaning of the anal canal. Other cultures do not use toilet paper, partly because paper is often not easily available. Anal cleaning can be carried out in various ways according to local customs and climate, including with water (using a bidet, for example), leaves, grass, stones, corn cobs, animal furs, sticks, snow, seashells, and, lastly, hands.

During the Greco-Roman period, a sponge fixed to a stick (*tersorium*) was used to clean the buttocks after defecation; the sponge was then replaced in a bucket filled with salt water or vinegar water.³ Another technique was to use oval or circular fragments of ceramic known as “pessoi” (meaning pebbles),⁴ a term also used to denote an ancient board game. Aristophanes referred to the use of pessoi for sanitary purposes in *Peace* (5th century BC):

It therefore seems likely that Trygaeus is referring to the Greek proverb: “Three stones are enough to wipe one’s arse”

Arms dealer (displaying a cuirass): And what, alack, shall I do with this rounded cuirass, a beautiful fit, worth ten minas?

Trygaeus: Well, that one will not make a loss for you, anyway. Give me that at cost price. It will be very convenient to crap in . . .

Arms dealer: Stop this impudent mockery of my goods!

Trygaeus (placing the cuirass on the ground like a chamber pot, and squatting on it): Like this, if you put three stones beside it. Is it not clever?⁵

This conversation is clearly scatological (as often in Aristophanes), and the lines before and after this quote refer to wiping the buttocks. It therefore seems likely that Trygaeus is referring to the Greek proverb: “Three stones are enough to wipe one’s arse,” although some have suggested the stones were for balancing the cuirass.

Many pessoi have been found within the faecal filling of Greek and Roman latrines all around the Mediterranean world (fig 1).⁶ Pessoi

found during the American excavation on the Athens agora, for example, are described as 3-10.5 cm in diameter and 0.6-2.2 cm thick and having been re-cut from old broken ceramics to give smooth angles that would minimise anal trauma.⁴ Use of a pessos can still be seen on a Greek kylix (wine cup) conserved in the Museum of Fine Arts in Boston (above). The cup, dating from 6th century BC, was found in Orvieto, Italy, and shows a man, semi-squatting with his clothing raised. The man is maintaining his balance with a cane in his right hand and is clearly wiping his buttocks using a pessos with his left hand.

Some scholars suggest that ostraka, small pieces of broken ceramic inscribed with names that the Greeks used to vote to ostracise their enemies, could also have been used as pessoi, literally putting faecal matter on the name of hated individuals. (Examples of ostraka with the names of Socrates, Themistocles, and Pericles have been found in Athens and Piraeus).

The two pessoi in figure 1 belong to a private collection. Their precise archaeological origin (discovered in the filling of latrines close to deposits of excrement) and their morphology (rounded and with the edges recut) clearly indicate their use for anal cleaning. Solidified and partially mineralised excrement can still be seen on the non-cleaned and lateral surfaces, which has been confirmed by microscopy (fig 2, bmj.com).

The abrasive characteristics of ceramic suggest that long term use of pessoi could have resulted in local irritation, skin or mucosal damage, or complications of external haemorrhoids. Maybe this crude and satiric description



by Horace in his 8th epode (1st century BC)—“an ass at the centre of dry and old buttocks mimicking that of a defecating cow”—refers to complications arising from such anal irritation.⁸

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Fig 1 | Examples of terracotta pessoi (probably from amphora) found in Roman latrines dating from the 2nd century AD. The one on the left comes from Utica (Sicily), has a diameter of 4.7 cm and a thickness of 1.7 cm, and has been re-cut as an octagon.⁷ The pessos on the right was found in Gortyn (Crete) and has a diameter of 6 cm and a thickness of 1.3 cm

THE AMBROSÍOS PAINTER (KYLIX), MUSEUM OF FINE ARTS, BOSTON (GIFT OF EDWARD PERRY WARREN)



John Collins Warren as a young man

John Collins Warren's medical career

- 1778: Born 1 August 1778, in Boston, Massachusetts
- 1797: Graduated from Harvard College
- 1799-1802: Continued medical studies in London, Edinburgh, and Paris
- 1802: Entered surgical practice in Boston
- 1806: Adjunct professor in anatomy and surgery at Harvard College
- 1810: Lobbied for Harvard Medical School to move from the "college town" of Cambridge over the river to Boston, which had a much larger population of potential patients
- 1815: Promoted to full professor, on the death of his father. Also gave lectures on physiology and midwifery
- 1816-19: First dean of Harvard Medical School
- 1812: A founder (and an editor) of the *New England Medical Journal*
- 1819: Honorary medical degree bestowed on him by Harvard University, his only medical qualification
- 1821: A founder of the Massachusetts General Hospital, serving as its first surgeon
- 1837: Second visit to London
- 1845: On 20 January, performed operation under unsuccessful nitrous oxide anaesthesia (administered by Horace Wells)
- 1846: On 16 October, performed the first operation under successful ether anaesthesia (administered by William Morton)
- 1847: Presented his collection of anatomical and pathological specimens to Harvard University, forming the basis of the Warren Anatomical Museum
- 1851: Third visit to London
- 1856: Died 4 May, in Boston, Massachusetts

John Collins Warren (1778-1856): An American surgeon in London

David K C Cooper finds that the writings of American surgeon John Collins Warren provide an insight into medical practice in early 19th century London

John Collins Warren was born in Boston, Massachusetts, in 1778, into a family noted for its many eminent medical practitioners (web appendix).¹ These included Warren's uncle, a doctor killed in the early stages of the War of American Independence, and father, one of the founders of Harvard Medical School. Although professionally successful and respected (box), Warren was a reserved and disciplined man, and few in Boston had much affection for him.

Warren began to study medicine under his father. In 1799, with no hospital or official medical school in Boston at that time, Warren chose to continue his studies in Europe, beginning in London. In the US, surgery remained fairly basic, but because of the recent studies of John Hunter, surgery in London was becoming an established branch of scientific medicine.

Impressions of London

Of London, Warren wrote to his father: "You have no idea sir, what a shocking place this is in winter. No cold weather, for the grass is perfectly green; but a constant drizzling, that keeps the town dirty as a kennel . . . The air is thickened with smoke and vapors, so that it is scarcely respirable; and as for the sun, no one can tell you when he was seen. The days are five hours long; or, more strictly speaking, there are five hours of twilight: . . . I have, within this week, been obliged to stop almost every day, at some part of it, so totally dark was it."² There were, however, "plenty of amusements here: in truth, there is amusement at every step through the streets of London. I constantly meet something new and interesting in this wonderful place."²

Surgical training in London

Warren spent his most important formative period in surgery at Guy's Hospital, of which he considered himself an alumnus. Warren wrote: "There are two kinds of students in the hospitals . . . the one called 'dressers', and the other 'walkers'. The first have the advantage of practicing on all the simple surgical cases, and dressing all wounds themselves [that is, receive a hands-on experience]: the others

merely see what is done [that is, act as mere observers]. Of course, the former have vastly the greatest opportunities: but the expense is likewise double; as the walker pays £25, the dresser £50. Though I do not like to pay so much money for one object, I believe I shall enter as a dresser; for, as I intend to become a surgeon, I think the acquiring [of] a facility and steadiness in manual operation of the utmost importance."²

He was clearly a serious student: "It will be necessary . . . to give up every idea of amusement and company; for a student who is tolerably disposed to be industrious will find every moment of his time fully occupied."² Indeed, dining out at the weekend and an occasional visit to a London theatre were the only breaks Warren allowed himself.

Warren was appointed as dresser to William Cooper (circa 1724-1800), who Warren described as one of the best of men and most eminent surgeons in London. Warren was "immediately put in charge of about forty patients, comprising as interesting a collection of surgical accidents and diseases as could be desired. A large number of these patients required daily dressing, which I practiced for a year faithfully. During my week [on call], I slept in the hospital . . . I am pitched into a surgeon. Obligated to do things of which I never saw a case, nor had an idea of, and I think I do very well."²

On his living conditions, Warren wrote: "My residence, while at Guy's Hospital, was in St. Thomas Street, close to the hospital. I lived at a cork-cutter's, and had two small rooms on the third story . . . I lived in the usual manner of medical students; that is, entirely by myself. Food being provided by the landlady, I took it in my room. We breakfasted at nine, dined at three, and drank tea irregularly."² (Presumably, he returned to work after dining.)

William Cooper left patients largely in the care of his assistants, which suited Warren, who was keen to gain as much experience as possible. Twice a week, Cooper "walked round with his dresser in a very quiet way, making amusing and instructive remarks. He had no great respect for America, considering her as having separated from the British Empire before maturity . . . He was a very pleasant

man, however, and occasionally asked me to dine with him.”²

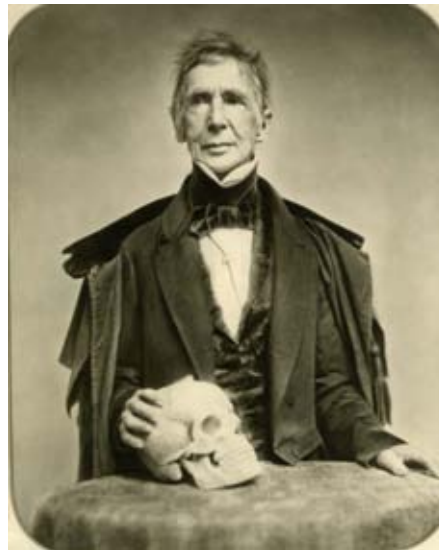
Within a few months, William Cooper retired and was succeeded by his nephew, Astley Cooper (1768-1841), who Warren described as “one of the handsomest men I ever saw . . . a young man of the greatest natural abilities, and almost adored at the hospitals. The obligations I am under to Mr. Cooper are infinite. He has always treated me with the most particular attention, and suffered no opportunity of instructing me to pass by. I wish it were possible to return, in the smallest degree, the favors with which he has loaded me.”²

Warren wrote to his father: “There are operations almost every day . . . the stone, hydrocele, cataract, and amputations innumerable; but Mr. Cline’s operations (at St. Thomas’s) for aneurism and hernia are grand. It is a pleasure to see him take up or turn his knife. The lectures have gratified me very much; they have such immense advantages from these (anatomical) preparations. Not a part but is elegantly prepared; some injected with quicksilver, some with wax, dried and wet. Every morbid appearance is here preserved . . . You well know how much clearer an idea is conveyed by these specimens than can be done by a dead, flaccid body. If I had time, I should make many [specimens] myself; but I despair of doing a quarter of what I wish, here. Dissection is carried on in style: twelve or fifteen bodies in a room; the young men at work on them in different ways . . . The people called resurrection-men [that is, body snatchers] supply us abundantly . . . The surgeons here, considering themselves at the head of their profession, dare to differ from everybody else, if they think they have truth with them.”²

In late 1800, after more than a year at Guy’s Hospital, Warren left London for Edinburgh and, six months later, continued his studies in Paris. He returned to Boston in 1802, where he joined his father in practice.

Surgical practice in Boston

In 1837, Warren published *Surgical Observations on Tumors*, an illustrated volume of over 600 pages. The *British and Foreign Medical Review* remarked in the book’s review that “the author proves himself to be a worthy disciple of the school in which he received his early instruction [Guy’s Hospital]; and which, connected as it is with the names and celebrity of Cooper, Bright, and others of hardly less eminence, he seems proud to acknowledge as his alma mater. And surely that school need be no less proud to claim him as a pupil.”³



Warren, circa 1850

“It was very interesting to me to go over the ground I trod more than fifty years ago, and to compare the feelings of the period with those of the present”

London, 1837

Arriving in Liverpool, accompanied by his wife and a daughter, Warren soon moved on to London. “As we came within the ten miles, and witnessed the bustling of carriages, the continuous line of houses, and saw the black smoke rising at a distance—although I had been formerly a resident, I was in some measure oppressed by the idea of entering this world with my family.”²

One of the first things Warren did was call on Astley Cooper, now knighted, who had written: “My old friend Dr. Warren carries in his excellent head all the knowledge of the Old and New World. I shall be delighted to see him.”² Warren presented Cooper with a copy of his book on tumours. Warren noted that, at this late stage of Cooper’s career, “having acquired an ample fortune, he has no occasion to submit to the laborious and responsible duties of the profession; but he is ready at stated hours to give advice to those who apply, both at his own house and in the town. He rises early, and employs two or three hours in anatomical and surgical investigations before breakfast; afterwards he receives patients at his house till two; then visits till six or seven—the common hour of dinner . . . He does not regularly attend any hospital; though, as consulting surgeon of Guy’s he is ready to visit when he can be useful; and his attendance is hailed with pleasure by the surgeons, as a gratifying occurrence.”²

One evening, Warren dined with a group of physicians whose conversation related to the standing of the medical profession in the UK, which was considered not as high as law. “Mr. Key [probably Charles Aston Key (1793-1849) of Guy’s Hospital⁴] complained of their being unable to attain the highest honors. Lawyers have precedence.”¹

Warren and anaesthesia

In his later career in Boston, Warren participated as surgeon in two pioneering efforts of anaesthesia at Massachusetts General Hospital, both initiated by dentists (box).⁵ The first effort, using nitrous oxide, was unsuccessful. But on 16 October 1846, Warren performed an operation for a neck tumour under successful ether anaesthesia. Warren became an enthusiastic advocate of this major innovation.

London, 1851

In September, Warren revisited Guy’s Hospital with a student. They examined the museum, dissecting room, library (which he noted to contain some of his books, but none of those on ether), and the room where he used to sleep. They also found, in what was described as the “accident ward,” the sister or nurse—the only surviving person who was at the hospital when he was a dresser.

Describing the experience in his diary, Warren also wrote: “Finally, I visited what I never did when there—the chapel of the hospital, and the splendid monument of Guy, who founded it . . . It was very interesting to me to go over the ground I trod more than fifty years ago, and to compare the feelings of the period with those of the present; but, though no doubt the balance would be in favor of the first, it was very fascinating, from the uncertainty of success, and the predominant feeling that my life would be short.”²

John Collins Warren—a “Guy’s man”—died in Boston, aged 77.

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Placebos in 19th century medicine

Jacqueline E Raicek and colleagues mine the *BMJ*'s online archive to chart the diverse uses of the placebo effect

Objective To provide the first quantitative data on the use of the term “placebo” in the 19th century.

Design Computer search of *BMJ*'s archival database from January 1840 (the first issue) through December 1899 for uses of the words “placebo(s).” Grounded theory was used to categorise the implications of uses of the term.

Results 71 citations contained the term “placebo(s).” Of these, 22 (31%) used the term to mean “no effect” or as a general pejorative term, 18 (25%) portrayed placebo treatment as permitting the unfolding of the natural history (the normal waxing and waning of illness), 14 (20%) described placebo as important to satisfy patients, 7 (10%) described it as fulfilling a physician's performance role, 3 (4%) described its use to buy time, 3 (4%) described its use for financial gain, 2 (3%) used it in a manner similar to a placebo control, and only one implied that placebo could have a clinical effect. Only one citation mentioned telling the patient about his placebo treatment.

Conclusion Nineteenth century physicians had diverse a priori assumptions about placebos. These findings remind us that contemporary medicine needs to use rigorous science to separate fact from its own beliefs concerning the “provision of care.” As in previous generations, ethical issues concerning placebos continue to challenge medicine.

Introduction

Currently, placebos are integral to the methodology of scientific research. Additionally, placebo treatments are generally thought to affect health outcomes, especially those based on subjective self appraisal.¹ Furthermore, administering placebos deceptively, outside of the concealed context of clinical trials with informed consent, is considered unethical.² Historians have noted that such contemporary notions of placebo gained acceptance only after the second world

war with the development and adoption of the randomised controlled trial.³⁻⁴ It is thought that in earlier periods placebos were deceptively and routinely used in clinical practice and considered an innocuous “pious fraud” to placate “ignorant . . . disappointed . . . and incurable cases.”⁵ Patients reporting improvements from placebo were experiencing “imaginary” symptoms.³ This understanding of placebo history is based on non-systematic archival evidence and qualitative descriptions. We sought to provide quantitative historical data on placebo use in the 19th century.

Methods

We included all *BMJ* articles, reports, and letters between the dates of January 1840, the first year of the journal's publication, and December 1899. We chose the *BMJ* for the availability of its online historical database, its prominence, and the likelihood that it represented the medical profession's practices and attitudes. We searched the *BMJ* database with the terms “placebo” “placebos” and “placebo effect.” We used methods from grounded theory to categorise citations according to theme.⁶ (See supplementary material on bmj.com for list of full methods, all citations found, and types of article)

Results

We found 71 citations for “placebo.” All queries for “placebos” yielded the same 71 articles, and we found no articles that mentioned “placebo effect.” Forty seven of the citations (66%) were in specific sections of the *BMJ* (such as “Correspondence” (10%), “Original communications” (10%), and “Reports of societies” (4%), with the remaining 42% distributed among 23 other categories). Twenty four of the citations (34%) were in non-specified sections.

Using grounded theory, we distinguished nine categories for the use of “placebo” in the 71 articles (although there were 75 individual mentions of “placebo” in all): no effect or pejorative (31%), natural history (25%), satisfy patient (20%), medical performance (10%), buy time (4%), financial gain (4%), placebo control (3%), has clinical effect (1%), and unclear (1%) (see table). These categories are further explained and connected with illustrative examples below.

No effect or pejorative—The commonest use of “placebo” was in a derogatory manner to denote therapy that was ineffective or harmless or valuable only for imaginary therapies. A typical comment was placebos are an “innocent deception

on our hypochondriacal and fanciful patients.”⁷ The idea of an ineffective placebo was also emphasised in pejorative descriptions of unorthodox practitioners. “It is not an uncommon occurrence for a sick person to go to the nearest apothecary, and get one of the assistants to prescribe some placebo for the more trivial complaints.”⁸ Homeopathic medicine gives “globules as placebos.”⁹ We decided to combine “no effect” and “pejorative” because it was often difficult to decide whether any distinction we might perceive was the intent of the authors.

Natural history—In this category placebo treatment was equated with the opportunity for allowing patients to use their own ability to get well, often within the context of getting good sleep, eating a healthy diet, and proper care. For example, physicians wrote that giving placebos provided an opportunity “to place the patient in circumstances as favorable as possible to the sanative operations of nature.”¹⁰ Another physician reports on a visit to Persia, where a traditional healer, or hakim, “leaves his patient very much to nature, prescribing merely placebos.”¹¹

Satisfy patient—We put an article into this category when there was some indication that the desire for a treatment came from the patient. For example, a fever was treated with “a saline mixture, with nitric aether, (more as a placebo than because he really seemed in want of medicine).”¹² A bandage was applied to a man's arm “as a placebo to satisfy the patient.”¹³ Included in this category are cases where the physician dispenses a placebo to calm the patient. A physician described other physicians treating patients with diarrhoea from the “fear only” of cholera, “who upon discovering this, gave mere placebos to their patients, who flocked to them in shoals during the panic.”¹⁴

Performance—In these citations physicians described their use of placebo as fulfilling the requirements of their professional role. There was no contextual implication of patient request; the behaviour seemed self generated. When “the patient suffered from disease in which the organs were so profoundly altered that it was little use attempting to prescribe anything more than a series of placebos.”¹⁵ Another physician reports “while examining her she passed a watery evacuation involuntarily on her bed. I had to do something, so I resorted to the blister over the vagus, and left a lavender water placebo to be given.”¹⁶

Buy time—Three citations described situations where placebo was given to patients for extended periods of time or to extend the time

Primary categories of use of the term “placebo” in 71 citations in *BMJ* 1840–99

Category	No (%) of citations
No effect or pejorative	22 (31%)
Natural history	18 (25%)
Satisfy patient	14 (20%)
Performance	7 (10%)
Buy time	3 (4%)
Financial gain	3 (4%)
Placebo control	2 (3%)
Has an effect	1 (1%)
Unclear	1 (1%)



“PORTRAIT OF DR WASHINGTON EPPS, MY DOCTOR” BY LAWRENCE ALMA-TADEMA, BAL/GETTY IMAGES

Buying time

for the physician to make a diagnosis. One physician describes how he used a placebo for three years while he experimented to make lax tympanic membranes tense.¹⁷ In order to determine a patient’s “type of appendicitis,” another doctor advocated “a carminative placebo” and making a second visit four hours later.¹⁸

Financial gain—Three articles clearly suggested that placebos concerned financial incentives. One physician described how “some medical men” with “starving families” would “give globules as placebo.”¹⁹ While the author expressed compassion for his peers, he stressed drawing a “broad line between medicine and homeopathy” and reminded his peers to not barter “principle for pelf [wealth].” Another article described the opportunity of some physicians to “swell up the bill” and prescribe an “aqua col. or placebo prescription.”²⁰

Placebo control—Two articles used placebo as a research tool, probably to ensure blind assessment. Both took place in the late 19th century when orthodox medicine began to have interest in blind assessment.⁴ In one experiment, concerning amblyopia (n=20), performed in 1886, a physician gave “half the cases strychnine” and “in the other half a placebo, with apparently

equally good results.”²¹ Another experiment, performed in 1889, tested whether mercuric iodide had value for scarlet fever. The physician “treated three series of eight cases each simultaneously, with iron, mercuric chloride, and a placebo, and, on the whole, the latter series did best.”²²

Has an effect or unclear—Only one citation was categorised as having an effect on clinical outcomes. It was mentioned that in cases of sleep anxiety, “a placebo administered with the assurance that it is a powerful hypnotic” was “often successful.”²³ The implication of placebo in one citation could not be ascertained.²⁴

Ethical considerations

Ethical issues (such as administering ineffective medicine, quackery, earning extra money) were an overlapping underlying theme in many of the articles. Our impression is that placebos were largely administered deceptively, and patients were never told of the “pious fraud.” Only one case reported disclosure. A placebo disguised as morphine was given to a patient with morphine addiction. Three months later, during the follow-up visit, the physician reported having “a good laugh [with the patient] over the pious fraud of the water hypodermic injection.”²⁵

Discussion

Limitations

Our sample is limited to a single journal, the *BMJ*. We selected it because it is one of the oldest continuous medical journals in the world with an electronically searchable database, and because of its affiliation with the British Medical Association (BMA). We could have expanded our numbers by using the databases of other journals, but we decided that limiting our search to a single journal would provide a valuable proof of principle that quantitative methods could illuminate the history of placebos. Verification in other electronically accessible journals is warranted.

Conclusions

A priori beliefs concerning dummy treatments have been rampant throughout history. In the 19th century, physicians considered placebos to have no impact on clinical outcomes. The idea of what Stuart Wolf first called, in 1950, “the placebo effect” did not exist.^{26 27} Recently, there has been interest in the effects of placebo treatment and the ritual that surrounds all active or inactive medical interventions. Given the recent interest in placebo studies,¹ there is hope that rigorous scientific research will correct our own contemporary a priori beliefs concerning placebos and the “provision of care.” Discovering exactly what effect the ritual of medicine has is important for a full understanding of clinical practice and healthcare policy. An expanded understanding of the underlying neuroscience of placebo effects should also help to make vague beliefs more precise.²⁸ Furthermore the absence of an ethical discussion on placebo use in the 19th century and our own hidden use of placebos in clinical practice²⁹ should remind us that an ethical examination of placebo remains a critical challenge for medicine.

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Surgical thimbles

William H Isbister discusses the usefulness of the humble thimble and its derivatives in a variety of surgical situations

As a child, Christmas meant good food, especially nuts and chocolate, lots of presents, and party games. We often played “hunt the thimble,” and sometimes the thimble was hidden behind my father’s pile of brown paper wrapped, unopened *BMJs*.

By 1975 I was married with three children. Our Christmases still involved fine food and presents but my wife had become a thimble collector and instead of hunting the thimble I was “gifting the thimble.” Over the next years, as I travelled to meetings and conferences, I had the opportunity to seek thimbles out from all over the world, and over time I too became interested in them. I have devoted my retirement to the hobby of thimble collecting and thought that, as a surgeon, close to Christmas, it might be interesting to review the use of the humble thimble in surgical practice.

Searching for thimbles

I searched the *BMJ* archive for the word “thimble” and searched on Google for “surgical thimble.” I excluded thimbles mentioned as foreign bodies in the oesophagus or trachea and non-surgical uses of thimbles. Of 113 articles identified in the *BMJ* archive, 11 detailed the use of surgical thimbles or thimble shaped instruments.

The many uses of thimbles

Although surgeons used thimbles for sewing in the past,¹ with the advent of needle holders this is no longer the case. Thimbles or thimble derivatives, however, are used in other surgical situations.

Cardiac surgery

In the 1950s, a cardiac surgeon, William Glenn,² described the use of a tailor’s thimble to dilate or split the mitral valve during open heart surgery.

In patients with severe mitral valve stenosis needing surgery, the cusps of the valve are sometimes tightly stuck together. They can be separated by

pushing a finger through the valve to break down the adhesions or by sharp dissection, although this may result in valvular insufficiency postoperatively. Glenn described how a thimble, worn on the first finger of the operator’s hand, can facilitate and standardise this process. To prevent the thimble becoming stuck in or below the valve, tapes were looped around the thimble under the surgeon’s glove (fig 1). If it was difficult to extract the thimble or finger, an assistant pulled on the tapes. In his first series, Glenn reported 250 patients in whom this system had been used with good results.

Ear, nose, and throat surgery

Finger protectors (fig 2) can prevent accidental biting injury during intraoral procedures. They might also have been used by staff trying to secure an oral airway during a fit in patients with epilepsy.

In 1906, Cresswell Baber developed metal thimbles for the left forefinger and thumb to facilitate making cotton wool mops for use in ear, nose, and throat surgery (fig 3).³ The thimbles were flattened and had several shallow and one deeper groove on the opposing surfaces, where the metal was dull rather than polished. According to Baber, “with a little practice mops of any size can be rapidly made.” The thimbles fitted on to a metal stand and could be boiled before use to reduce the risk of infection. The handles were for lifting them off the stand.

The Millard surgical hook retractor is used in fine work such as rhinoplasty. The thimble may be worn on the thumb (fig 4) or other finger. Small hooks have been attached to a tailor’s type open thimble (fig 5) to create a retractor; several versions are available.

General surgery

In 1842 Velpeau lectured on his method of ligating varicose veins.⁴ The trunk of the vein was raised with the fingers and a pin passed below



the ends of the fingernails and underneath the vein. The finger was protected from the pin by a thimble. A ligature was wound around the pin and drawn tight. This process was repeated for every dilated vein, so from eight to 15 pins may have been needed between the ankle and the knee. The ligatures and pins were not removed until the vein had become necrotic (around 12 days). If the eschar had not detached by this time it was removed. Velpeau claimed to have used this method in private and public practice and that only one patient died after the procedure.

In 1921 De C Wheeler, vice president of the Royal College of Surgeons, Ireland, reported that a thimble was “of great assistance in making a suprapubic opening for drainage in cases of septic peritonitis.”⁵ He said that “Before the primary wound is closed, the finger guarded with the thimble is introduced into the abdomen and seeks the interval between the recti muscles just above the pubes. With the thimble as a guide a stab wound is rapidly made, dividing all the tissues down to the peritoneum. The latter is pushed forward and is opened by a nick of a sharp pointed knife between the bars carrying the round knob. A drainage tube (Keith’s glass tube for preference) is fitted to the top of the thimble and is guided with great ease to the bottom of Douglas’s pouch [fig 6].” He adds: “If the unguarded finger is used as a guide, the peritoneum stretches itself over the rubber glove

Fig 1 | System used to dilate the heart valves during open heart surgery²

Fig 2 | Finger protector

Fig 3 | Metal thimbles for the left forefinger and thumb to facilitate making cotton wool mops³

Fig 4 | Millard surgical hook retractor

Fig 5 | Different types of retractor based on the tailor’s type open thimble

Fig 6 | Device for introducing a pelvic drain^{5, 6}

Fig 7 | Thimble for protecting against finger injury

Fig 8 | Thimble and wire saw for use in obstructed labour with a dead fetus

and it is troublesome to separate one from the other.” Surgeons must avoid cutting too boldly on an unguarded finger in the presence of septic peritonitis.

A similar technique has been used for draining axillary abscesses after mastectomy. In 1938 the same technique was described using an ordinary sewing thimble.⁷

Surgeons operating in deep cavities sometimes use the index finger of the non-dominant hand to guide the tip of a needle into the correct position. During this process the guiding finger may be injured. Accidental finger stick injuries can occur during normal suturing, as can scalpel cuts during dissection. Because of the risk of HIV infection and hepatitis, surgeons usually wear two pairs of gloves and some also wear a thimble on the index finger under the glove. A more complex type of thimble, which is worn outside of the glove and held in place with a malleable handle, has recently



been described (fig 7). Thimbles modified with a “pushing rod” can be used to facilitate knot tying in deep cavities with not enough room to tie a normal knot. The first throw of the knot is tied outside the cavity and then slid down one of the suture ends until tight using a pusher. The next throw is similarly tied and then pushed down to tighten. Many other simple pushing devices are also in use, so the thimble pusher is not very popular.

Obstetrics

In 1875 Gordon described an “obstetric thimble” for rupturing the amniotic membranes.⁸ The thimble, which fits on the index finger, had a sharp point that curved over the free edge of the nail and which facilitated the rupture of the membranes.

In obstructed labour with a dead fetus, it may be necessary to decapitate the fetus to facilitate vaginal delivery. A special thimble has been devised that allows the fetal neck to be encircled with a wire saw (Blond Haidler saw). The saw has ball ends and the thimble has a small opening in one side with a hole at its end (fig 8). The saw ball is inserted into this opening and the thimble is worn by the obstetrician. The thimble bearing finger is introduced into the vagina and passed around the fetal neck. The saw handles are attached after removal of the thimble.

In 1903 a cocoa butter and cocaine thimble was used to rapidly dilate the cervical os during the first stage of labour.⁹

Ophthalmology

Ophthalmologists have used a thimble with an extension to facilitate the eversion of the upper eye lid (fig 9). This technique was not widely used and these thimbles are rare.

Orthopaedic surgery

In the 1930s Nordenbos used fibular bone to stabilise femoral neck fractures in much the same way as Küntscher nails were used later.¹⁰ A thimble was placed over the end to prevent the graft from shattering as it was hammered into the drilled out track between the greater trochanter and the femoral head.

Thimble splints have been used to immobilise fractures that are confined to the distal phalanx.¹¹ A plaster of Paris thimble enclosing the whole digit provides adequate immobilisation. Aluminium thimbles have also been used for this purpose (fig 10).

Plastic surgery

Breast plastic surgery often involves extensive finger dissection to separate breast tissue from surrounding structures, and a thimble has been devised to facilitate this process.

Urology

Thimbles have been used to fix the

testes in the scrotum after surgery for undescended testis. Usually a loop suture is placed in tissue adjoining the testis and brought out through the scrotal skin. To prevent the tied suture from cutting through the scrotal skin, the suture is tied over something more substantial. Special buttons, pieces of rolled gauze, and even thimbles have been used.

Dental applications

In 1971, a pair of thimbles was patented that facilitated the use of dental floss (fig 11). The thimbles clamped the floss to the fingers by friction, thus avoiding the need to wrap the floss around the fingertips. Floss was held in a container and fed between the finger and thimble and out through an aperture in the top of the thimble.

Concluding remarks

Thimbles have been part of my life at Christmas for many years, but surprisingly I have never used a thimble in a surgical procedure myself. The *BMJ* archive is testimony to the many uses of thimbles in surgery over the years, and this article attempts to illustrate many of them.

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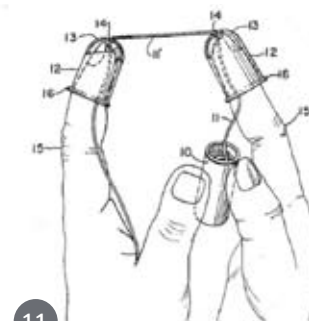
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Fig 9 | Thimble with an extension to facilitate the eversion of the upper eye lid



10

Fig 10 | Thimble splint



11

Fig 11 | Pair of thimbles for facilitating the use of dental floss

Barbara Hepworth's hospital drawings

Richard Cork shows that artistic inspiration can come from the most unlikely places

Nobody could have guessed that Barbara Hepworth's contact with a surgeon would suddenly produce, after the second world war, an outstanding series of drawings inspired by hospital operations.¹ She was, after all, renowned for her controversial achievements as an abstract sculptor. So why did she start work on these powerful images of surgeons, while tirelessly visiting operating theatres in Exeter and London as her fascination with the subject deepened?

Hepworth's involvement with surgery began in 1944, when her young daughter Sarah had osteomyelitis. After Sarah was bandaged "in plaster of Paris from head to toe," Hepworth's anxiety became intense. But even then she was fascinated enough to notice that "the moulding of plaster jackets . . . was very near to my own profession." As Sarah's illness became protracted, Hepworth and her husband, Ben Nicholson, found the medical bills ever more daunting. Yet she received heartwarming sympathy and support from the surgeon Norman Capener. Unlike so many British art lovers of that period, he relished modern art at its most adventurous. Capener was an amateur painter and was particularly fascinated by the mutually rewarding relation between avant-garde art and music. He told Nicholson that Hepworth's sculpture had "a very striking similarity to Bach's more abstract work." Capener began purchasing her art, and he also backed up their friendship by waiving his surgeon's fee.

Seeing surgeons in action

In the summer of 1947, Capener sensed that Hepworth's central involvement with the structure of the human body might mean that she would find stimulus in observing an operation. He had transferred the ailing Sarah from a modest Cornish hospital, near Hepworth's home in St Ives, to the far larger Princess Elizabeth Orthopaedic Hospital in Exeter. Capener seized his moment when he stayed in St Ives to recover from jaundice. Visiting Hepworth, he asked her if she would like to attend an operation in Exeter and "see directly the work of surgeons in action."

At first, Hepworth reacted with horror and denounced his suggestion as "a grim idea." Sarah's illness still haunted her, and she turned down Capener's proposal. But then, after making

clear that observing "any element of catastrophe would be impossible for me," Hepworth decided to push aside her misgivings, take up Capener's offer, and scrutinise an operation in Exeter.

The experience was so compelling that Hepworth went on to observe further operations at the National Orthopaedic Hospital in London and the London Clinic. Having produced her first hospital drawing in November 1947, Hepworth devoted a prodigious amount of her energy and imagination to make nearly 80 drawings over the next couple of years. By that time, the National Health Service had been created, and her strong support for this crucial postwar initiative must have added to the extraordinary intensity of her hospital images.

Over two decades earlier, the young Hepworth had made her first contribution to art in a medical context, while still a student at the Royal College of Art in London. As an entry for a scholarship to study in Rome, she made a proposal for a "panel sculpture" above the main entrance of a hospital. The traditional style she adopted bore no relation to her subsequent work as a highly audacious artist, who shared Henry Moore's determination to revitalise British sculpture. Hepworth became one of few women to achieve a prominent position as a modernist during the interwar period. And now, in the late 1940s, her involvement with surgical operations proved that drawing could have a major role in her mature output.

Hepworth visited hospitals armed with a pen, pencil, and sterilised pad. They enabled her to make swift sketches and notes while scrutinising the surgeons as they went through the various stages of intricate bone operations. All her initial misgivings disappeared, and she grew captivated by the spectacle unfolding in front of her. "From the moment when I entered the operating theatre," she remembered, "I became completely absorbed by two things." The first thing was "the extraordinary beauty of purpose and coordination between human beings all dedicated to the saving of life, and the way that unity of idea and purpose dictated a perfection of concentration, movement, and gesture." Secondly, she was awed "by the way this special grace (grace of mind and body) induced a spontaneous space composition, an articulated and animated kind of abstract sculpture very close to what I had been seeking in my own work."



Fig 1 | *Prelude II*

All these drawings show Hepworth's willingness to simplify the surgeons and patients alike. Their bodies are purged of all unnecessary detail and reduced to essential forms. But this search for minimal reduction does not mean that Hepworth lost sight of communicating the fundamental meaning inherent in the medical scenes she had studied at first hand. In her exhibition at The Hepworth Wakefield, Wakefield, the expertise and dedication of the surgeons is clearly evident.

Long and distinguished tradition

Hepworth takes her place in a long and distinguished tradition of great artists who became enthralled by the skill and commitment of medical practitioners. In my book, *The Healing Presence of Art*, I single out doctors' portraits by painters as eminent as Francisco de Goya, Vincent Van Gogh, Henri de Toulouse-Lautrec, and Frida Kahlo.² In 1820, Goya painted a moving *Self Portrait with Doctor Arrieta*.³ Here the stricken, 73 year old Goya is supported by a physician who clasps him while offering a lifesaving glass of medicine. A similar respect distinguishes Van Gogh's *Portrait of Trabuc*, the head attendant



“A particularly beautiful example of the difference between physical and spiritual animation can be observed in a delicate operation on the human hand by a great surgeon”

The longer we look at Hepworth's images, the more we realise just how appropriate the phrase “hospital theatre” really is. All the participants seem to be caught up in a life-or-death drama, and we gaze at them as avidly as an audience watching a mesmeric play being performed on a stage. But Hepworth also makes us aware of what Stanley Spencer described as the “stillness in the theatre.” After serving at Beaufort War Hospital in Bristol, a former lunatic asylum taken over by the army for war casualties, Spencer announced in 1916 that he wanted to paint “a fresco of an operation” catching the “classical” quality of the scene. He never achieved his aim, and yet Hepworth's finest drawings have the aura of ancient frescoes discovered on the walls of a temple dedicated to healing.

She was particularly fascinated by the ear fenestration operations carried out by the prominent London Clinic surgeon ER Garnett Passe, accompanied by his assistant Dr John Seymour and the theatre sister Margaret Moir. The surgeon uses a hammer to gain access to the inner ear, and Hepworth must have been especially intrigued by this connection with the sculptor's

at the Saint-Remy mental home where the distraught artist was cared for in 1889-90. Trabuc looks stern, and yet Van Gogh explained that “he is a man who has seen an enormous amount of suffering and death, and there is a sort of contemplative calm in his face.”

Only one year later, in Paris, Toulouse-Lautrec became obsessed by the virtuoso operations carried out in the Hopital Saint-Louis by the celebrated Dr Jules-Emile Pean. “If I were not a painter, I would like to be a doctor.” Toulouse-Lautrec often declared. And he made many incisive portraits of Pean who, like Norman Capener, harboured dreams of becoming a painter. Then, in 1951, Frida Kahlo painted an iconic portrait of herself in a wheelchair with Dr Juan Farill, an outstanding Mexican surgeon who operated on her severely damaged spinal column.⁵ She called him “cutie,” but his face has a god-like character in Kahlo's reverential painting.

Although Barbara Hepworth had a similar affection for Capener as Kahlo did for Farill, in most of her hospital drawings, the surgeons are masked and difficult to identify. Fascinated by every stage of the surgical process, she used a mixture of pastel, gesso, pencil, and oil paint to define the moment of preparation in a masterly drawing called *Prevision*. Here, the eyes of

the surgeon have a piercing probity as he gazes down at the prone, vulnerable body we cannot see. But the focus of the drawing rests on his two immense hands, one of which is precisely adjusting the sleeve of his garment. The elongated fingers and thumbs are at once strong and delicate. Hepworth almost seems to carve them in space.

Nervous energy

Sometimes, she even used a razor blade to scratch the surface of the drawings, thereby giving them an even greater sense of etched urgency. The scratching also conveys the nervous energy experienced by the surgeon, as he braces himself for taking on the full, burdensome responsibility involved in wielding the knife. In a drawing called *Prelude II* (fig 1), which includes as many as seven figures, Hepworth might be the masked woman who stands on the far left of the scene, her clasped hands possibly hiding a sketchpad. She could easily be praying, and the other figures gather round the patient's bed, like priests enacting a religious ritual. The surgeon at the centre stares at his own upraised hand, as if appraising its readiness for the task ahead. And another masked participant holds a large oval light, directing it carefully down towards the crucial place where its brightness will be needed.



Fig 2 | *Tibia Graft*



Fig 3 | *Concentration of Hands II*

hammer, which she deployed to chisel into stone. Moir, who later became Hepworth's secretary, described how Hepworth "came to the London Clinic on several occasions in the space of two or three weeks, each time a fenestration operation was being performed . . . She did brief sketches during these visits, at all stages of the operation." The only surviving sketchbook with Hepworth's hospital drawings relates to the "fenestration of the ear" operations that she witnessed between April and May 1948. The sketches are labelled with colour references to help Hepworth embark on her elaborate drawings back in the studio, and she also jotted down notes like "magnifying glasses" to help her identify the crucial optical devices employed during surgery.

Basic tenderness

No such notes are permitted to interfere with the eloquent effect of the figures in Hepworth's large, finished compositions. Drawings as powerful as *Tibia Graft* (fig 2), or *Concentration of Hands II* (fig 3), take us right to the centre of the hushed

and attentive atmosphere in the operating theatre. She brought a seasoned carver's knowledge to the task of conveying surgical finesse, and Hepworth was awed by the activities she observed. "A particularly beautiful example of the difference between physical and spiritual animation can be observed in a delicate operation on the human hand by a great surgeon," she explained. "The anatomy of the unconscious hand exposed and manipulated by the conscious hand with the scalpel, expresses vividly the creative inspiration of superb coordination in contrast to the unconscious mechanism. The basic tenderness of the large and small form, or mother and child, proclaims a rhythm of composition which is in contrast to the slapping and pushing of tired mother and frustrated child through faults in our way of living and unresolved social conditions."

Hepworth's revealing account, with its emphasis on the relationship between a mother and child, suggests that she was guided throughout the hospital drawings by the strength of her love for her own daughter Sarah. The key words are

"basic tenderness." For Hepworth was able to invest the finest of these images with a heartfelt belief in the profound significance of compassionate and delicate surgeons, as they devote themselves to the challenge of life saving in the luminous hospital chamber.

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An exhibition of Hepworth's hospital drawings continues at The Hepworth Wakefield, Wakefield, until 3 February 2013, before travelling to the Pallant House Gallery, Chichester (16 February to 2 June 2013), and the Mascalls Gallery, Kent (14 June to 24 August 2013).

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