Insights into Medicine and Surgery

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By

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ABOUT THE AUTHOR

The author graduated from the University of Illinois College of Medicine in 1953. He learned general medicine and surgery, to deliver babies and to set fractured bones during an internship at the Cook County Hospital in Chicago. After serving as a medical officer in the navy, he trained in surgery, then practiced pediatric surgery at the Cook County and Children's Memorial Hospitals in Chicago.

These essays are selected from his 200 articles and book chapters in the medical literature, textbooks of surgery and books on medical history.

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MEDICINE AND SURGERY FROM ANCIENT TIMES TO THE 20TH CENTURY

Archeologic study of human remains, and the observations of early European explorers provide clues to the medical and surgical practices of our remote human ancestors. In many instances the herbal remedies and wound care of native people, especially in the Americas, was superior to that of the Europeans during the middle ages.

The intrusion of a foreign object was thought to be the cause of disease by many cultures, especially among Indigenous North Americans since the penetration of the skin by a thorn or the bite of an animal produced local pain and swelling as well as systemic symptoms. [1,2] The concept was reinforced when men began hurling missiles at each other, and arrows became imbedded in the body. The appearance of an *Ascaris Lumbricoides* in the stool of a sick child or a two-foot-long guinea worm, *Dracunculus medinensis*, emerging from a blister on the leg would confirm the idea that foreign objects were the cause of human illness. Object intrusion was a better theory of disease than bad air or God's punishment in Western medical tradition.

Our human ancestors learned to remove imbedded foreign bodies by sucking with the mouth. This technique became an almost universal method of treating illness. Shamans sucked on hollow tubes, such as reeds, horns or bird bones, to remove disease. [3,4] The application of hot cups to the skin to produce suction is another method. When combined with scarification or an incision, cupping was an effective way to drain an abscess. The induction of vomiting and purgation are other universal methods to rid the body of a foreign agent causing disease.

Explorers, missionaries and anthropologists observed and recorded the medical practices of North American Natives for nearly five hundred years. At the time of conquest, Native Americans used more than four hundred medicinal plants, including a cure for scurvy, coca leaves to relieve pain and cinchona bark for malaria. [5] Balsam of Peru, turpentine and other agents prevented wound infections. Lithospermum ruderale [Puccoon], used for birth control, contains natural estrogens that interfere with ovulation. [6]

Many Indian remedies found their way into folk medicine and even our pharmacopeia. Physicians still use Podophylin, a native remedy, for venereal warts. Cherokee Indians used the pulverized root of Spigelia marilandica, known as pinkroot, to treat intestinal worms. [7] Down from the common cattail was used to dress burns and as padding for infants' cradleboards. Pads of cattail and mosses were also used as diapers. Many herbs were used for several different complaints at all ages, but specific roots were used on the gums of babies during teething and herbal teas were used to treat infantile diarrhea.

The first Europeans to reach the North American continent remarked on the excellent health of the natives and the seeming absence of birth defects and deformities. They also noted the skill with which the Indigenous people treated wounds and their ability to survive injuries, even gunshots in viscera that would have killed a white man. With no knowledge of asepsis, they kept wounds scrupulously clean with washes, powders and poultices made of boiled herbs, egg whites, Balsam of Peru, resins and honey. Native Americans sutured wounds with sinews, human hair and needles made of fish bone, with wicks of cloth or bark for drainage. They controlled hemorrhage with spider webs, the down from birds and herbs. The Northern Cheyenne in Montana still use the spores of a brown puffball, Bovista Plumbea (a Lycoperdaceae), for bleeding and others applied the spores to umbilical cords of newborn infants to prevent infection. [8] Extracts from Lycoperdaceae produce significant antibiotic activity against a variety of bacteria. [9]

Two examples of surgery witnessed by a European attest to the skill of Native American surgeons. Naiuchi, a Zuni traditional healer, first gave a woman with a breast abscess a decoction of Datura [Jimson weed] that put her to sleep. He then incised the abscess with a sharp bit of flint and broke up the loculations with his finger. The lady slept through the procedure. The other case was a nine-year old girl with a curvature of the spine and a cold abscess that pointed in the left groin. The incision extended from the posterior crest of the ileum downward almost to the inguinal ring. The wound was cleaned with water and packed with pinon gum, squash seeds and mutton fat. She died, apparently with tuberculosis, several months later. [10]

Indigenous "specialists" were also adept at setting fractures and reducing dislocations. Ojibwa traditional healers treated broken bones by first washing the limb with warm water and rubbing the skin with grease and a poultice of wild ginger. Perhaps the heat and massage relaxed the muscles,

so the fracture could be reduced with a "quick jerk." The limb was then immobilized with wooden splints or wet rawhide, which formed a tough, hard cast when dried. Others applied wet clay that hardened to a form-fitting cast. Havasupai fracture doctors also used a mixture of hot ashes and wet sand to relax the muscles before reducing the fracture. [11]

Though Indigenous healers successfully treated colonists, the Europeans, especially the missionaries, dismissed native healing skills because the shamans who healed with herbs and surgery were considered pagans, even satanic. The healing practices of the shamans were founded on ancient traditions that were totally unlike Christianity. Individualistic Native American beliefs were based on dreams, the spirits of animals, departed ancestors and the forces of nature. [12] The shamans' healing often involved chanting, drumming and feats of magic to battle evil forces. A seventeenth-century Jesuit missionary referred to a shaman as a "juggler." [13]

The route to becoming a shaman often started with a dream or a severe illness that involved hallucinations or a near-death experience. They retreated to special places for solitude, fasting and sleep deprivation to induce an altered mental state. Initiates in some tribes used drugs such as Datura that first produce nausea and vomiting, then ecstatic dreams in color that leave a sensation of rebirth. A shaman interpreted the dreams of the initiate to determine the source of his power. [14] For example, tribes in the western Great Plains believed that visions of the bear gave the power to cure serious wounds. [15] The initiate then spent an apprenticeship with an older shaman to learn the rituals for healing and the traditions and taboos that protected the tribe. Europeans dismissed the drumming, chanting, prayer and dancing as pure witchcraft, but rhythmic sensory stimulation induces a powerful psychological impact and even an altered state of consciousness resembling anesthesia. Religious sects continue to use music and other repetitive activity to induce hypnotic states that appear to activate the body's healing systems. [16]

When there was no obvious cause for disease, such as a wound, snake bite or fracture, shamans claimed that a particular sickness was caused by an object "shot" magically into the victim's body by an enemy or some spiritual being. [17] The object might be a pebble, a snake, a worm or even a bit of leather that could be removed with incantations and by sucking the affected part. The shaman would produce an object and if the patient got well, he could claim a cure. This process of blaming object intrusion and treatment with suction may go back to the real thorns and spines that afflicted ancient peoples. Sucking was probably the earliest treatment for

real foreign bodies and is a universal treatment for snake bite. If, as some say, "magic is the father of medicine," then surgery may well be the mother of magic.

During the early part of the twentieth century, George Hunt, a well-educated Native American, became an assistant to Franz Boas, a pioneer anthropologist. In order to expose the "fraudulent practices" of shamans, Hunt went through the initiation ceremonies and learned the shaman's methods. As a part of his initiation, Hunt learned how to suck a bloody ball of eagle down from a patient and claim that he had removed the cause of disease. To his amazement, the patient recovered. Hunt became a skilled healer and cured many patients. [18] We should not be surprised, since patients often spontaneously recover, and doctors understand the power of a placebo.

Some shamans were best at treating mental illness. When a shaman was called to treat a young woman who could neither move nor speak, he first worked his chants, drumming and incantations. Then, with the aid of two assistants, he dunked her underwater in a nearby stream. She soon struggled and walked away—cured. This case reminded me of an intern colleague at the Cook County Hospital who had a patient "paralyzed" from the waist down. He listened to her story and examined her, while she was still on a wheeled cart. When he found that her sensation was normal, he lifted up one end of the cart, so the patient slid down and landed on her feet. She cussed out the intern and walked out of the hospital.

Some shamans were generalists, while others had specific power to cure certain diseases. The prospective patient or his family would give gifts to the shaman before the healing ritual. A Montana Gros Ventre Shaman, Little Man, had received his curing powers from a bear, an old man and a coyote. When a boy named Jimmy became ill with pain in his right side, the family called the shaman, according to the following account:

> "Little Man painted his body the way the bear had told him, sang his healing song four times and passed a bear claw through a smudge fire. He said, 'Tell me wherever it hurts, and I will work on it.' Jimmy said, 'Here on my right side.' The old man said, 'That's a bad place. I don't like to suck there because it might hurt your guts. But I will use this bear claw.' So he asked the boy, showing him the bear claw, 'Do you think you can stand this?' Jimmy said he could, and Little Man said, 'Well, make sure you can stand it.' He told the old lady to hold Jimmy's hands down and me to hold his feet down. The boy wriggled and made faces when the claw went in at the side.

> When Little Man jerked it out, a cherry seed and some 'rotten gut' came with it. Right after that he was well." [19]

A bear claw is an unusual surgical instrument but would be sharp enough to make an incision through the abdominal wall. Was this magic, or did Little Man drain an appendiceal abscess? Older children with undiagnosed appendicitis often develop localized abscesses in the right lower part of their abdomen. In some cases, the abscess spontaneously resolves, and others are cured by simple drainage of the pus. Foreign bodies such as cherry pits, or a calcified fecalith which resembles a cherry pit, often cause appendicitis. This case may be an example of pure hokum, but it is just as likely that Little Man hypnotized the boy with his bear song and drained an abdominal abscess.

Indigenous people in America learned to fashion instruments from available materials. A hollow reed attached to an animal bladder was used to irrigate wounds or to give enemas, and bird beaks were used as forceps to extract foreign bodies. The following is an example of how a traditional healer combined magic with surgery to remove an imbedded arrowhead:

"Rattles Stones Like a Bell, a Mandan Plains shaman during the mid-eighteenth century, received his doctoring powers from the crane. Another shaman, Cherry Necklace, had tried to remove an arrowhead stuck in the bone of a wounded warrior, but the man was in so much pain that he wouldn't go to sleep. The first shaman then consulted Rattles Like a Bell, who had two dried crane heads with the lower jaws attached and a stuffed crane. The shaman tied one of the dry heads around the patient's neck and painted his face red. He sang his medicine song, which put the wounded man to sleep. While he was singing, the crane came alive and walked around the wounded man. As the man was going to sleep, he heard the crane calling 'Konix' and the traditional healer answering 'Konix' from the other side of the room. When he was asleep, the crane walked up to him and stuck his bill in the wound, using his bill as pinchers. After pulling several times, he succeeded in extracting the arrowhead. Matter and blood came out of the wound. The 'doctor' then led his patient to the river to bathe, while the people in the village watched." [20]

This story rings true. The hypnotic singing put the willing patient in a trance, allowing removal of the arrow point. Both the Sandhill and the whooping cranes are magnificent birds that were once common throughout the west. Their long, strong bills could certainly be used as a forceps. Bathing the man in the river was a good way to irrigate the wound.

We know nothing about the incidence of birth defects in Native Americans or how deformed infants were treated. Some observers claimed that the Native Americans abandoned deformed infants, but there is considerable evidence that Native families were very careful of their children. In some tribes, due to their nomadic lifestyle, sick or aged relatives were left to die. A deformed child who could not keep up might also have been left behind. [21] The Sioux, by contrast, felt that a child was a great gift to be cherished. [22] The Cheyenne Elders, only two or three generations from the Indigenous massacres of the 1800s, remember that children were loved and protected. Mothers covered their infants with their own bodies to shield them from the soldiers' guns, and the rare child with a cleft lip or club foot grew to adulthood. A Navaho tale of the Stricken Twins, one blind and the other lame illustrates compassion. The blind twin carried his lame brother, who acted as his brother's eyes. [23]

Indigenous North Americans did not perform major amputations or trephinations, but skulls with holes indicating deliberate surgical trephination have been found in the Andes. The Incas used a slingshot that threw an inch and a half diameter stone and a club with a bronze head to bash the skulls of neighboring tribes. Inca skulls at the San Diego Museum demonstrated a variety of depressed skull fractures possibly due to hurled stones or war clubs. Other skulls suggest that the Incas used a drill to make small round holes. The absence of osteomyelitis in the skulls of survivors indicate the use of antisepsis to prevent infection. [24]

An Inca surgeon would have known that a depressed skull fracture causes coma with weakness or paralysis on the opposite side of the body. The next step would be an attempt to elevate the fracture with a lever. When this didn't work, the surgeon made a hole in the skull next to the fracture so he could introduce an instrument beneath the broken, depressed bone. This is exactly the procedure done today. It would not take a great step of imagination to believe that our ancient surgeon then opened the skull to release a blood clot. The finding of trephined children's skulls suggests that the operation was used to treat convulsions. In any event, the Inca surgeon appeared to treat his patients rationally. The oldest specimens of trephinated skulls date from as long ago as 3000 B C.E. a time when the stone-headed ax was a favored weapon. Romanian shepherds opened the skulls of sheep suffering from the staggers to remove the larva of Multiceps Multiceps, a parasite, is further evidence of trephination to relieve disease. [25]

The Inca surgeon cut through the scalp with a sharp stone knife, possibly using extracts of coca leaves as a topical anesthetic. He could have

controlled bleeding with pressure or with plants containing tannic acid. The surgeon chiseled away the outer and inner tables of the skull while avoiding injury to the dura mater. An alternative technique was to drill holes with a stone drill, twirled between the hands, and then to connect the holes by chiseling the bone. Among the Incas, the survival rate after trephination was approximately seventy-five percent since fifty-five percent of trephinated skulls show complete and sixteen percent demonstrate incomplete healing. [26] There are also skulls with multiple healed openings, indicating operations at different times with survival.

Our ancient forbears had by trial and error discovered ways to prevent infection and relieve pain, and there were "specialists" who cured disease with their hands. At the time of conquest, the medicine and surgery of Native Americans was in many ways superior to that of Europeans. Unfortunately, the ridicule of the conquerors and missionaries together with devastating new diseases such as smallpox undermined the natives' faith in their traditional healing practices.

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EGYPTIAN PAPYRI

The earliest written record of wound care and medicine, written on papyrus that grows along the Nile River, dates from as early as 3000-2500 B.C.E. The papyrus was printed in pictorial signs or hieroglyphs. Doctor-priests used incantations, prayers and amulets to cure disease. [1] There were also conventional practitioners who used a wide range of drugs prepared from plants, animals and metal compounds. Thus, it is likely that Egyptian practice grew from the same combination of the supernatural and empiric medicine found in other ancient cultures.

An American, Mr. Edwin Smith, found the papyrus at Luxor, Egypt in 1862; James Henry Breasted of the Oriental Institute at the University of Chicago translated the hieroglyphs. Volume II of the translation consists of facsimiles of the original document on one page with a "clean" version on the facing page. Volume I contains the English translation with voluminous commentaries and interpretations. The general introduction provides the best references. [2]

The author of the papyrus systematically recorded a rational approach to forty-eight individual cases, suggesting that he was a surgeon. He described, for the first time, the meninges and the convolutions of the brain, the articulation of the mandible, the ribs, vertebrae, and blood vessels. He knew that the brain controlled the motions of the body, the importance of the pulse, and the role of the heart in blood circulation.

The section on head wounds starts with a simple skin laceration penetrating to the skull and ends with a compound, comminuted skull fracture that exposed the brain. The treatment of fractures of the nose, maxilla, zygoma and a dislocation of the mandible are rational and exhibit a good knowledge of anatomy. The author described wounds of the lip, chin and throat, crushed cervical vertebra, clavicular fractures, injuries to the shoulder and humerus, fractured ribs and a sprain of the spinal vertebra. The discussion of each case starts with the diagnosis and proceeds logically through examination and treatment.

In some cases, such as the open fracture of the skull, the surgeon predicted a fatal outcome and said, "an ailment not to be treated." He did recommend

keeping the patient upright to avoid pressure on the brain. All of the cases except for a tumor and an abscess of the breast appeared to be injuries due to falls or battle. The wounds were classified as soft tissue only, penetration to bone, perforation through bone, compound fracture and a "smash" that caused a compound comminuted fracture, including penetration to the brain.

The author used a form of adhesive tape to approximate simple flesh wounds, and in the case of a gaping wound of the eyebrow, he said, "Thou shouldst draw together for him his gash with stitching." On the first day, he applied fresh meat, perhaps to control hemorrhage; on the following days, a mixture of honey and grease was applied with lint.

Honey is bacteriostatic, and the author also used a decoction of willow leaves containing salicin that may have had a mildly antiseptic effect. For infected wounds, he used a solution containing salts of copper and sodium, similar to the normal saline soaks used today. The author immobilized fractures with medicated compresses, linen bandages and padded wooden splints.

In Case Twelve, we can see his rational approach to a patient with a broken nose, as well as the stilted language of the translation:

> "If thou examined a man having a break in the chamber of his nose, and thou findest his nose bent, while his face is disfigured and the swelling which is over it is protruding, thou shouldst say concerning him; One having a break in the chamber of his nose. An ailment which I will treat. Thou shouldst force it to fall in, so that it is lying in its place, and clean out for him, the interior of both his nostrils with two swabs of linen until every worm of blood which coagulates in the inside of his two nostrils comes forth. Now afterward thou shouldst place two plugs of linen saturated with grease and put into his two nostrils. Thou shouldst place for him two stiff rolls of linen, bound on. Thou shouldst treat him afterwards with grease, honey and lint every day until he recovers."

The Papyrus Ebers, dating from about the same time as the Edwin Smith papyrus, is a collection of remedies for internal ailments, diseases of the eye and skin problems. The treatment for rectal prolapse included myrrh, frankincense, coriander, oil, and salt all boiled together and then applied to the "hinder part." Mostly, however, the magician-doctors relied on charms such as appeals to Horus to heal sick children. On the other hand, for a burned child, the appeal to Horus is combined with a salve made of gum and ram's hair. [4]

The early Egyptian surgeons used bronze instruments, a great leap forward over stone tools. The temple at Kom Ombo, an ancient settlement on the east bank of the Nile twenty miles north of Aswan, is dedicated to Horus, a healing God. One wall of the temple has carvings illustrating forceps, scalpels, hooks, saws and a speculum.

There are also illustrations of birth defects such as umbilical and inguinal hernia, club feet and dwarfs in statues and tomb reliefs. The royal proctologist (known as the herder of the anus) cared for the royal rectum. The ancient Egyptians probably did not perform elective surgery, but they took care of wounds with antisepsis to prevent infection. They were also the first to use stitches to close wounds. [5]

A carving from the tomb of Ankn-ma-hor at Saqquara in Egypt, dated approximately 2400 B.C., illustrates circumcision on teenage boys, the world's oldest depiction of a surgical operation. [6] Was this a religious rite of passage or was the operation performed for medical reasons? One medical indication for circumcision is an infected, swollen, painful foreskin that can't be retracted. Urination may be difficult. When warm soaks to the penis don't work, a small slit in the dorsum of the foreskin allows it to be retracted. It would only be a minor step to excise a part of the foreskin to prevent future problems.

Another explanation for circumcision follows from the mutilation of captured warriors in ancient Egypt. [7] At first an extremity was amputated, but if the prisoner survived, he was unfit for labor. The alternative, total castration by removal of the penis and testicles, carried too high a mortality rate. As a result, orchiectomy and later only circumcision marked these slaves. Eventually the Egyptians circumcised all slaves, including the Jews. By the time of the Jewish exodus from Egypt, circumcision had been adopted as a Jewish ritual. At some point in time, the operation was done in eight-day old infants instead of older boys. [8] Moses Maimonides, the great twelfth-century Jewish physician, scholar and theologian, discussed circumcision in his commentary on the Mishneh Torah, saying, "The foreskin is regarded as an abomination, for which the Gentiles are condemned in Scripture, as it is said, 'For all the nations are uncircumcised' [Jer. 9:25]. The patriarch Abraham was not called perfect until he had circumcised himself, as it is said, 'Walk before Me; and be perfect. And I will make My covenant between Me and you' [Gen. 17:1-2]. Whoever neglects the covenant of our ancestor Abraham and retains the foreskin or artificially obliterates the marks of circumcision, even if he has acquired much knowledge of the Torah and practices good deeds, will have no

portion in the world to come." [9] In his Guide for the Perplexed, Maimonides says circumcision is necessary to decrease sexual lust. [10]

Christians and Muslims adopted circumcision, and both male circumcision as well as excision of the clitoris in girls came to be practiced throughout much of the world, even in aboriginal Australia. [11] In Ottoman Turkey, circumcision of the Sultan's sons was an occasion for great festivities lasting 15 days. [12] There are detailed descriptions as well as lovely painted miniatures depicting the circumcisions of the sons of Mehmet in 1582 and the four sons of Ahmed III in 1720. The royal surgeons circumcised thousands of boys from poor families before operating on the princes. The ceremonies took place in a special courtyard of the great Topkapi Palace in Istanbul overlooking the Bosporus. Fountains with running water at the windows of the courtyard provided a sense of tranquility and dulled the boys' cries. Led by the royal eunuch, two men marched each boy to the courtyard. The foreskin was cut with curved scissors between ligatures and the wound was dressed with ashes or egg yolks boiled in rose water. The Sultan provided sport, music, fireworks, and gave gifts to the poor boys. Even today, in Istanbul, one can see young boys, dressed in robes and crowns, going with their families to the circumcision ceremony.

Through the years, "congenital phimosis" and the "adherent prepuce" became diseases requiring surgical treatment. By the nineteenth century the operation was performed to treat bedwetting, masturbation, urinary infection, neurosis and even epilepsy. Today, circumcision remains the most common pediatric operation, demanded by parents and performed for the prevention of cancer and AIDS. Circumcision stands as an enduring symbol of the historic relationship between religion and medicine. It was probably the first "elective" operation, and from its beginnings, only specialists whether priests, blacksmiths or surgeons performed the operation.

Another ancient form of ritual surgery, self-mutilation by amputation of a finger, is depicted in rock art. [13] The practice, which may have originated as a form of punishment or a way to protect children from evil, appears to have been most common in Australia and North America. When a Crow Indian died, his near relatives sacrificed a finger and when the tribe experienced high mortality from sickness or war, men hacked off all but their thumbs and enough fingers to shoot a bow or gun. They performed the amputations through the first or second joints, either by running a sharp knife around the joint or striking with a tomahawk. [14]

Castration was used as punishment and a way to mark enemy captives. The lack of a beard and a feminine voice made it easy to recognize slaves. It evolved into a way for rulers to have docile guards for the king's women. Since castration drove out sexual desire, princes and nobles used eunuchs to guard the harem. The word eunuch means guard or bed keeper in Greek. The avoidance of sexual sin and temptation also led to self-castration; St. Origen and St. Francis were self-imposed eunuchs.

The sultans and caliphs considered that removal of both the penis and testicles produced the safest eunuchs to watch over their harems. Since this operation carried a higher mortality rate, those whose testes and penis were removed were more valuable. The great eunuch factories of North Africa, often operated by Coptic monks, gathered thousands of boys every year and sold the survivors in markets all over Asia Minor. The helpless boy was tied down on a board and restrained with a collar around his neck. The operator then seized the penis and testicles and with one swoop of a razor-sharp knife slashed away the boy's manhood. A tube was placed in the urethra and the wound was packed to control hemorrhage. [15] Eunuchs often held prominent positions in courts, and in China young boys underwent the operation voluntarily. [16] Castration was also used to preserve a boy's singing voice. When Rome became a music center with the establishment of opera, eunuchs were in great demand and well-intentioned parents even allowed their children to be castrated to sing in church services.

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BLADDER STONES FROM ANCIENT INDIA TO THE WORLD

The *Sushruta Samhita* from dating to between 1200 and 600 B.C.E. accurately describes in considerable detail many diseases and surgical procedures. The manuscript is especially noted for the first description of lithotomy, the removal of bladder stones. [1]

Sushruta, a surgeon, learned anatomy by dissecting the corpses of infants. Hindu holy scriptures dictate that any dead human being must be burned rather than buried, but infants younger than two years and firstborn male children were exceptions to this rule. [2]

Sushruta differentiated arteries and veins centuries before William Harvey. [3] He also described common congenital malformations as well as congenital syphilis, tuberculosis, fractured bones and leprosy. Children with gross malformations were considered a source of shame and abandoned in the wilderness but he sutured cleft lips and possibly performed sigmoid colostomies to relieve the colon obstruction caused by Hirschsprung's disease. [4] Sushruta also described Caesarean section and rhinoplasty.

His description of perineal lithotomy for the removal of urinary bladder stones may be the first operation on a body cavity. The word lithotomy, coined from Greek 'lithos' (stone) and 'tomos' (cut), suggests the operation originated in Greece. However, the Sushruta Samhita described vesicolithotomy several centuries prior to Hippocrates.

Here his classic description of perineal lithotomy to remove bladder stones in children:

> "A person of strong physique and un-agitated mind [the attendant] should be made first to sit on a level board or table as high as the knee-joint. The patient should then be made to lie on his back on the table placing the upper part of his body on the attendant's lap, with his waist resting on an elevated cloth cushion. Then the elbows and knee-joints of the patient should be contracted and bound up with fastenings or with linen. After that the umbilical region of the abdomen of the patient should be well rubbed with oil or clarified butter and the left side of the umbilical region should be pressed down with the closed fist so that the stone comes within reach of the

> operator. The surgeon should then introduce into the rectum, the second and third fingers of his left hand, duly anointed and with the nails well pared. Then the fingers should be carried upward towards the rope of the perineum (i.e. in the middle line) so as to bring the stone between the rectum and the penis, when it should be so firmly and strongly pressed as to look like an elevated tumor, taking care that the bladder remains strongly contracted but at the same time even.
>
> An operation should not be proceeded with, nor an attempt made to extract the stone in a case, where, the stone on being handled, the patient would be found to drop down motionless with his head bent down and his eyes fixed in a vacant stare like that of a dead man, as an extraction in such a case is sure to be followed by death. The operation should only be continued in the absence of such an occurrence.
>
> An incision should then be made on the left side of the raphe of the perineum at the distance of a barleycorn and of sufficient width to allow the free egress of the stone. Several authorities recommend the opening to be on the right side of the raphe of the perineum for the convenience of extracting the stone from its cavity so that it may not break into pieces nor leave any broken particles behind, however small, as they would in such a case be sure to grow larger again. Hence, the entire stone should be extracted with the help of forceps, the points of which are not too sharp.
>
> After extraction of the stone, the patient should be made to sit in a cauldron full of warm water and fomented, thereby. In doing so, the possibility of an accumulation of blood in the bladder will be prevented; however, if blood be accumulated therein, a decoction of ksheera trees should be injected into the bladder with the help of a urethral catheter. [5]

Surgeons used this technique to remove bladder stones until well into the 19th century. How did knowledge of the operation reach the rest of the world from India? The first possibilities are the overland or sea routes that connected India with the west from pre-historic times. [6] Another avenue could have been the Greek mercenaries who accompanied Darius, a Persian Monarch, in 538 BC who invaded the Indus valley. [7] Greek surgeons successfully treated Alexander the Great for life threatening wounds, including a one caused by a steel tipped arrow that penetrated the general's chest. [8] These skilled surgeons would have sought out Indian surgeons and learned of Sushrutta's vesicolithotomy.

Soon after Alexander the Great founded Alexandria in 322 BC, it became the cultural and scientific center of Greece, where Euclid and Archimedes worked. After the death of Alexander, Ptolemy, his general, founded a research institute and a medical school. [9] Ammonius Lithotomos coined

the term lithotomy in 276 BC. His writings were most probably destroyed when Julius Caesar burned the Alexandrian library in 48 BC but Cornelius Celsus (25 BC - 50 AD) cited Ammonius in his encyclopedia, 'De Medicina.' [10] Ammonius invented an instrument to break large stones for easier removal and was a skilled lithotomist. His description of lithotomy for bladder stones is identical with Sushruta's.

During the first centuries of the Christian era, Greek science and medicine were transferred from Constantinople to Persia and Arabia. Indian surgeons also influenced the Arabian surgeons. [11]

Albucasis (936-1013 AD), an Islamic surgeon who practiced in Cordoba Spain, authored a chapter on bladder stones in children that appears to have been taken from the Sushruta Samhita. [12,13,14].

This ancient medical literature was lost during the dark ages, when itinerant, poorly trained lithotomists operated on patients with bladders stones. The Church forbade skilled physicians, who were often clerics, from performing surgery.

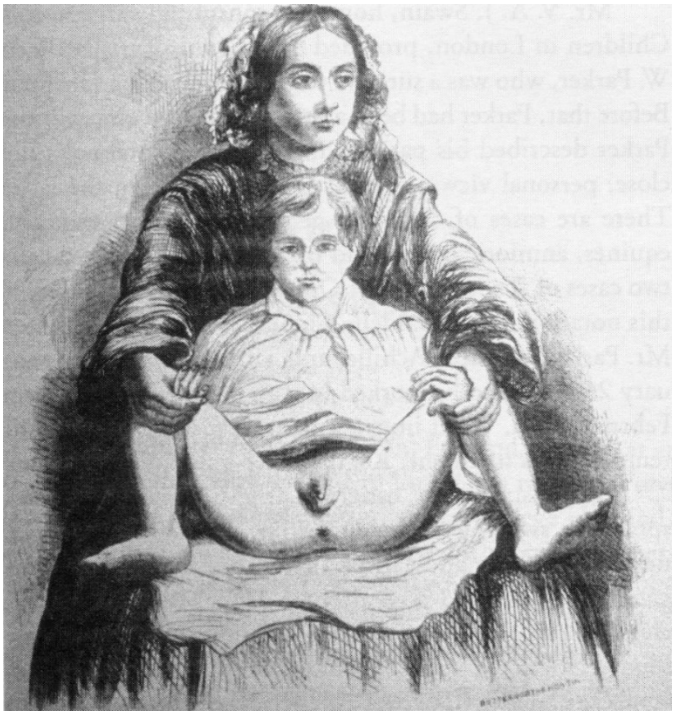
John Baptiste Morgagni, (1682-1771), at Padua, one of the first physicians to dissect the human body to detect the cause of disease described bladder inflammation found at the autopsy of a 14-year-old boy who had died, in great pain, 21 hours after an unskilled lithotomist had removed two small bladder stones. [15] He quoted both Hippocrates and Celsus and was skeptical of lithotomy. Morgagni suggested treatment with medicated water, prepared from the shells of oysters and experimented with injections of an effervescent mixture of alkali and acid into the bladders of dogs. He also observed teenage girls who had inserted needles or bodkins into their bladder through the urethra. Stones formed on these objects and eventually led urosepsis and death.

William Cheseldon (1688-1752), the leading English surgeon in the first half of the eighteenth century, brought perineal lithotomy to the peak of perfection. He apprenticed to a surgeon when he was 15 years of age and passed the examinations to become a barber surgeon after his 7-year apprenticeship. He taught anatomy at St. Thomas Hospital and published "*Anatomy of the Human Body*" in 1713. [16] Unlike earlier surgeons, Cheseldon used a urethral sound as a guide. He routinely did the operation in a little over one minute and once in 53 seconds. Only 3 of 125 children under 10 years of age died. [17] This extraordinary survival rate, prior to anesthesia and antisepsis, attests to his dexterity. Cheseldon's success is

attributed to his perineal incision lateral to midline that avoided the urethra as described by Sushruta.

John Cooper Forster who published "*The Surgical Diseases of Children*" in 1860 used a sound in the urethra to guide a lateral perineal incision into the neck of the bladder and a forceps to remove the stone. The wound healed in eight to ten days. [18] His illustration of a child held in the lithotomy position is essentially the same as that used by Sushruta, except, that with anesthesia, a nurse, rather than two strong men held the patient.

With the advent of antisepsis, a supra-pubic cystotomy became the operation of choice for the removal of stones. Bladder stones are now rare but are seen in arid countries and in children with neurogenic bladders and after reconstruction for congenital deformities. [19]



Lithotomy position from "The Surgical Diseases of Children" by John Cooper Forster

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HIPPOCRATES:
CUTTING FOR STONE AND ABORTION

The medical texts attributed to the Greek physician, Hippocrates, was for centuries the primary source of medical knowledge in the western world. Greek physicians described the symptoms, signs and rational treatment for many diseases. The parts dealing with fractured bones, wounds and visible deformities are classics. They established hospitals far from plague ridden cities where patients rested, bathed and had clean water and pure air and with keen observation they accumulated a practical knowledge of disease, that they attributed to natural, rather than supernatural causes.

Why, then, did Hippocrates, a skilled physician advise his students to refrain from performing abortion and not to operate for bladder stones?

The Hippocratic oath, dating from the fourth or fifth centuries B.C. requires young physicians to swear by the healing Gods to adhere to high ethical standards. The oath includes admonitions against abortion and operating for bladder stones.

> *"I will not give a woman a pessary to induce abortions but I will keep pure and holy both in my life and art. I will not use the knife, not even verily, on sufferers from stone, but will give place to such as are craftsmen."*

Does the phrase to "keep pure and holy" suggest a moral or religious objection to abortion? Did Hippocrates object to using a pessary or to insert dangerous drugs into the vagina, or as with cutting for stone, was he leaving abortion to others who had more skill? Who were these craftsmen?

The answer may be found in a dialogue between Socrates and Theaetetus. Socrates, in his introductory dialogue with Theaetetus, said, "How absurd of you, never to have heard that I am the son of a midwife, a fine buxom woman called Phaenarete!" Socrates explains that midwives are women past the age of childbearing. Then he says, "Moreover with drugs and incantations midwives can either bring on the pangs of travail or alleviate them at their will, make a difficult labor easy and at an early stage **cause a miscarriage if they so decide**." [1] This statement by Socrates is good evidence that midwives were the "craftsmen" who performed abortions.

Ancient Greeks had no moral or religious objections to infanticide or abortion. They exposed "puny or malformed infants" to die. [2] An example is in the tragedy of *Oedipus Rex* when King Laius and Queen Jocasta abandoned their newborn baby to die with the tendons of his feet pierced and fettered because the king had dreamed his son would one day kill him. [3]

Hippocrates was well aware of the symptoms of bladder stones in children: "*Calculous children rub their privy parts and tear at them, as supposing the obstruction of urine is situated there.'* Despite his excellent clinical description, he treated bladder stones with diluted wine and forbade his students to "cut for stone." [4] This is perplexing since the *Corpus Hippocraticum* describes operations for empyema, fractures, rectal prolapse, and recurrent dislocation of the shoulder. [5] His reluctance to operate on bladder stones may have been due to a lack of knowledge of internal anatomy because the ancient Greeks did not allow human dissection. It is likely that Hippocrates' advised his students to leave these procedures to surgeons trained in the Indian method of perineal vesicolithotomy.

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