Joseph Priestley’s “Factitious Airs” and Medical Therapy Before 1800: A Brief Review*

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Early in her journey through Alabama Territory in 1818, future newspaper editor Anne Newport Royall recorded a conversation among several fellow guests on the evening of January 3 during her stay in Huntsville. Resting in her room, she heard “the sound of mirth and jollity below” in the parlor, and joined the others downstairs “to learn what was going on.” Several men and women were discussing several different topics, including “the gas (all the rage).” A Mrs. Mosely tries mightily to understand. “And what is gas . . . hear nothing but gas, gas, gas, where I go—and I know no more about it than a monkey. I have asked hundreds, and either they, or I, must be fools: Not a soul that I meet can explain it in terms that I can comprehend.” In response, one of the young men present, citing author Frederick Accum as his authority, begins a long explanation of oxygen, hydrogen and nitrogen gases.1,2

That a conversation about gases took place in American frontier settlements such as Huntsville in 1818 is indicative of how widespread public interest in the topic must have been. Anne Royall notes that talk of gases is “all the rage,” but doesn’t explain what she means. Her letters from Alabama and other southern states were written to “Matt,” a young lawyer and friend in Virginia, who may have easily understood the reference. Inhalation of gases by humans is not mentioned, but such experimentation had begun in England in the 1760s as the search began for a therapeutic use.

By 1800 the nitrous oxide or “laughing gas” experiments which began in Bristol in 1799 by Thomas Beddoes and Humphry Davy were so notorious in England that the first in a series of satiric portraits appeared in print, Richard Polwhele’s The Pneumatic Revellers: An Eclogue (published anonymously). In the poem, physician Beddoes, who had secured funding for and organized the Bristol efforts, is made to say that everyone who breathed the gas “cried it was a pleasure exsation [sic] to drink draughts of the mighty pneumatic.” Other poems such as The Skeptic (1800) and Thomas Green Fessenden’s The Modern Philosopher (1806) continued to depict the nitrous oxide inhalation as the ridiculous activities of political radicals.3 What had begun as a serious search by numerous physicians to find medical uses for “pneumatic” gases abruptly ended in public mockery and therapeutic inefficacy.

Despite this reaction in England, gas research migrated quickly to America. James Woodhouse, chemistry professor at the University of Pennsylvania School of Medicine, visited London in 1802 and met with Humphry Davy, who had served as Beddoes’ assistant in Bristol. Upon his return to Philadelphia, Woodhouse began attempts to replicate the nitrous oxide experiments in his chemistry classes. William Barton, one of his students, wrote as his dissertation a rousing defense of the Bristol nitrous oxide work.4

Over the next several decades, demonstrations of the effects of breathing nitrous oxide became common in classrooms and to the general public with appearances by traveling showmen, who included Samuel Colt, later of Colt revolver fame. This pattern continued until the first public demonstration of anesthesia with ether in Boston in October, 1846.5 Material on nitrous oxide, oxygen, hydrogen, and other gases also appeared in numerous medical and chemistry textbooks during the first half of the nineteenth century.6

The search for therapeutic uses of inhalation gases began in the mid-eighteenth century with Joseph Priestley and several of his contemporaries. Such seventeenth century researchers as Van Helmont, Robert Boyle and Stephen Hales had identified vapors different from atmospheric airs. They realized that the vapors could be separated from solids or combined with other substances. Joseph Black’s discovery of “fixed air” or carbon dioxide and Henry Cavendish’s isolation of “inflammable air” or hydrogen gas set the stage for Priestley and others who isolated additional gases and recommended or employed their use in medicine.7

Priestley was a Unitarian minister, political liberal and remarkably prolific author who drifted into chemical experimentation when his research into electricity proved too expensive.8 His early apparatus consisted primarily of common household implements; later, ceramic tubes, dishes, and retorts were made for him by his friend and supporter Josiah Wedgwood.9,10 In the summer of 1773, Priestley became the librarian and intellectual companion to William, Lord Shelburne. For the next seven years, he used his free time and modest equipment to continue the experiments he had begun in 1770 on different kinds of “airs” or gases, including oxygen, carbon dioxide, nitrogen dioxide and nitrous oxide. This work, in an area known as pneumatic chemistry, resulted in a series of publications, including Experiments and Observations on Different Kinds of Air, issued in six volumes between 1774 and 1786.11 As these works were being published, Priestley developed relationships with various intin-
History Activities at the ASA

The following activities pertaining to the History of Anesthesia will take place at this year’s ASA Annual Meeting in San Francisco. The and other information can be found at the following website: <www.anes.uab.edu/aneshist/asa00history.htm>.

Speaker will be Maurice Albin, M.D., M.S. The Wounding, Amputation, and Death of Thomas Jonathan “Stonewall” Jackson: An Anesthetic Insight.

Speaker will be Peter Safar, M.D., On Resuscitation Medicine in the 20th Century. Introduction by Donald V. Caton, M.D.

Investiture of 2000 WLM Laureate of the History of Anesthesia. Tuesday, October 17, 2000, 12:50-1:00 p.m.
Honorees are Norman A. Bergman, M.D., F.R.C.A. (posthumous presentation) and Thomas B. Boulton, M.D., Ch.B., F.R.C.A.

Panel on History: The Unforeseen Consequences of Anesthesia, 1848-2000. Tuesday, October 17, 2000, 2:00-4:00 p.m. Moscone Center, room 132.
Moderators will be Douglas R. Bacon, M.D., M.A., and Maurice Albin, M.D., M.Sc.

5th INTERNATIONAL SYMPOSIUM ON THE HISTORY OF ANAESTHESIA (ISHA)
The 5th International Symposium on the History of Anaesthesia will be held at the University of Santiago de Compostela, Spain
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Letter to the Editor
Dear Dr. Cope,
I’m looking for some biographic data about the American ophthalmologist Joy Jeffries (1833-1915) who, in the middle of the last century, repeatedly travelled to Europe and especially to London. Here he presented his skills using ether for anesthetic purpose and so he became the leading protagonist for its use in Europe. Thus, the broad use of chloroform was stopped on the Continent and ether became the predominant anesthetic.
Unfortunately, little biographic data about Jeffries could be found here in Germany. It would be wonderful if any reader could support me with the desired material.
Many thanks for your efforts.
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The Book Corner

by Peter McDermott, M.D.

The Mysteries Within: A Surgeon Reflects on Medical Myths

Dr. Nuland, winner of the National Book Award for his How We Die, has written a witty and provocative book on the history of human innards. Tracing our historical knowledge of and misconceptions of our internal organs, he has told the story of science emerging from myth—of truth breaking free of ignorance. His cast of stars includes the stomach, heart, spleen, liver, and the reproductive organs. The supporting cast consists of those philosopher-scientists who have sought through the last two and a half millennia to light and costume the organs. This structure of Nuland’s approach to the triumph of Western medicine—“organ”-ic, rather than chronicologic—is a happy conceit. He combines his surgical intra-abdominal experience as well as his musings upon that experience with a survey of the progress of scientific thinking, especially in medical development.

Now, note that I have used several words that are no-nos for historians: triumph, progress, development. Despite his occasional protests that we should be cautious in judging the past by the standards of the present, Nuland commits this error throughout the book. This seems so common in popular histories that, I suppose, it is futile to rail against it. However, in defense of the past, it is not only fallacious reasoning but also just unfair to expect from the past that which was inconceivable to it. When we start giving grades to our predecessors, we stop understanding them. Parenthetically, David Hackett Fischer’s Historians’ Fallacies should be on the reading list of those who respect the past and seek to know its truths and how they were understood.

Nuland’s first Western hero is the fifth-century BCE philosopher-scientist, Empedocles, whom he credits with “seeing” and subordinating grand rational schemes (risks schemes as they are known today) to his sense experience. This is a phenomenological epistemology which would have been incomprehensible to Empedocles, who was so tentative in his theory of the four elements that he felt obliged to add “love” and “strife” to the list. His predecessors, the monists and the Pythagoreans, and their attempt to understand what reality consisted of, how man could know truth, how life and matter differed and compared, how change could be explained—these thorny problems and the serious people dealing with them aren’t covered. One gets the impression that Empedocles emerged from the mists of superstition and magic. T’aint so.

There are other heroes in this story. The Renaissance anatomists, especially Vesalius, triumph over the tyranny of a willful and “arrogant” Galen. Never mind that Galen had his own problems with superstitious medical practices, that he revived the anatomic studies of Aristotle, Erasistratus, and Herophilus; that he would have been the first to object to the perverse uses to which his work was put. William Harvey’s experimental and quasi-inductive work on the circulation and generation are extolled and rightly so; but one must remember that there were no significant consequences, clinical or scientific, that resulted for the next century or so. Nuland sees science coming on to the scene in the sixteenth and seventeenth centuries and empiricism, which he defines as “dependence only on reproducible observation and experience” appearing only recently. This is a profound anachronistic redefinition of empiricism. Sextus Empiricus in the first century CE and the skeptics he represented would not have been amused, though amusing skeptics has never been easy.

The interface between faith and science is probed but no new nuggets uncovered. I think the whole empty argument about religion and science being at war has pretty much been put to rest. Well, maybe not in Kansas.

A last few remarks: this book has a useful index but no bibliography or footnotes. It seems designed for laymen with an interest in the history of medicine but not an extensive background in it. It is overwhelmingly Western in its emphasis: the Chinese and Islamic contributions are slighted and the Sumerians needn’t have bothered. Nuland seems on one hand to fault the past for its penchant for “saving the phenomena,” insisting that experience fit within a theoretical model, and on the other, for accepting explanations of the phenomena that incorporate experience and observations. “For a scientist,” he says, “final is never Final.” Plato, in telling a plausible story of matter and the cosmos in his Timaeus, said as much.
Priestley... Continued from Page 1

erant lecturers who demonstrated his discoveries to public audiences.2

In the first volume of his great work, Priestley suggested various uses for these gases, "airs," or "pneumatics." Most striking for us is the confidence he had in their application in medicine. "I cannot help flattering myself," he wrote, "that, in time, very great medicinal use will be made of the application of these different kinds of air to the animal system. Let ingenious physicians attend to this subject, and endeavor to lay hold of the new handle which is now presented them, before it be seized by rash empiricks..."3

In the first three volumes published between 1774 and 1777, Priestley included "fixed air" case reports from several physicians. A decade earlier, one of Joseph Black's Edinburgh medical students, David Macbride, had suggested the gas released by fermenting malt might aid in the treatment of such "putrefaction" diseases as scurvy. Some two years later, William Brownrigg proclaimed the curative properties of the "fixed air" in mineral or spa waters.7

At about the same time as Priestley's beginning work (the mid-1770s), Sir John Pringle, Thomas Percival, Thomas Henry, and John Mervin Nooth all recommended "fixed air" for various medical conditions. Apparatus designed by Nooth to infuse water with carbon dioxide and thus create carbonated water were very popular; "many thousands" were apparently sold in both England and on the continent. Even Priestley finally admitted Nooth's equipment for producing fixed air was superior to his own. At this time such water—stronger in carbonation than natural mineral water—was considered a remedy for "putrefaction diseases" or infections, bladder stones, and various other conditions such as gout and arthritis that were supposedly aided by mineral waters. A Nooth apparatus was adapted by Peter Squire for the first administration of ether anesthesia in England on December 21, 1846.7,4 Soon after Priestley's call for medicinal uses of gases and their application to medicine, physicians who had success with fixed air as a therapy. Dr. Dobson of Liverpool mixed Salt of Tartar, lemon juice and carbonated water for his patient, Ann Forbes, "who was extremely ill of the small-pox..." and whose condition had resisted standard treatment. After a day of ingesting this potion every hour, "the putrid stench was diminished, and she perfectly recovered in a short time." "Dr. Dobson" was Matthew Dobson, who in the previous year published his own work on fixed air; it reached a third edition by 1787.10

Dr. Haygarth of Chester used the remedy on a young boy who had an ulcerous sore throat, scarlet fever, and a host of other complaints. "Fixed air was at length ordered, after which he perfectly recovered in the space of a week." Wood notes that Thomas Percival and Henry Cavendish had used fixed air in cases of consumption and kidney and bladder stones respectively with good results. Wood admits that he has not always had success using this method for stones: "I must acknowledge that I have often tried this medicine without being able to perform a radical cure...I generally mitigated the painful symptoms...but my patients generally became tired, and rather chose to submit themselves to the hands of the surgeon, than be kept longer in suspense of an early method of cure."11

By the early 1780s, some claims of efficacy could be made for pneumatic medicine based on case reports collected by these physicians. Toward the end of that decade another physician became interested in possible therapeutic uses for the "factitious airs." Over a period of more than 10 years, Thomas Beddoes attempted to formalize the investigation of gases and their application to medical therapy.

Beddoes, who was born in Shropshire in 1760, studied under Joseph Black in Edinburgh beginning in the fall of 1784, and finished his medical degree at Oxford in December 1786. The following summer he made a trip to France and met with chemists Antoine Lavoisier and Louis Bernard Guyton de Morveau. Through these experiences Beddoes became well-acquainted with the knowledge of gases at the time, and the forces of change in chemistry represented by men like Lavoisier. In the autumn of 1787, he returned to Oxford as lecturer in chemistry, and began working with pioneer English balloonist James Sadler, who designed equipment for Beddoes' gas experiments.

Beddoes was also attracted to the revolutionary movement in politics. His proselytizing for the French revolt led the university to deny him the newly created Regius chair in chemistry, and Beddoes left Oxford and set up a medical practice in Bristol. Hotwells, a mineral spring resort at nearby Clifton, provided a stream of sick but wealthy patients through whom he could build his practice and seek participants in the gas experiments.

In the mid-1790s, Beddoes embarked on an ambitious program of publications; he conducted experiments on the use of gases—especially oxygen—in the treatment of consumption; and he led efforts to develop a Pneumatic Medical Institution.12-21 Sadler soon left Bristol, and Beddoes quickly teamed with industrialist James Watt. Watt's daughter Janet had died of consumption, despite being briefly treated by Beddoes. Watt, whose son Gregory also had tuberculosis, joined Beddoes' efforts in "my earnest desire to aid you and your endeavors with the hope that possibly some idea might be started, which may save other parents from the sorrow that has unfortunately fallen to my lot..."22 The two men published five volumes of Considerations on the Medical Uses of Factitious Airs between 1794 and 1796, and Watt built equipment to manufacture the large amounts of gas needed. Beddoes attracted numerous financial supporters from clergy, royalty and physicians throughout England.

By 1798 Beddoes was ready to open his institution in Clifton. Located on Dowry Square in Clifton, the facility was actually two adjacent houses altered to create a lecture room, space for outpatients and 10 inpatients, and a laboratory. Thus provisions were made for education, patient care, and research.

In October, 1798, Beddoes'shired Humphry Davy (at the time only 19 years old) as his research director and activity increased on Dowry Square. A steady stream of patients visited Beddoes as Davy began basic research into the manufacture and use of various gases with equipment manufactured by Watt and later William Clayfield. By October, 1799, Davy decided to experiment with nitrous oxide, a gas thought by some authorities to be noxious and a cause of contagion.23-25 Davy proved otherwise. Not only could nitrous oxide be safely inspired by humans, but under certain conditions its psychological and behavioral effects were spectacular. Soon the
parade of luminaries visiting Dowry Square to breathe the gas included Robert Southey, Samuel Taylor Coleridge, John Rickman, Grosvenor Bedford, Thomas Wedgwood, and Anna Laetitia Barbauld. Novelist Maria Edgeworth, author/publisher Joseph Cottle, and physician and future thesaurus-maker Peter Mark Roget were among the observers of these experiments. These activities soon attracted the attention of Beddoes’ political enemies and the satirists referred to earlier.

In the fall of 1800, an outbreak of typhus swept through Bristol. By then, the gas experiments had ceased, and the Pneumatic Institute became a traditional hospital for a few years before Beddoes' death in 1808.

By then, interest in pneumatic medicine had decreased sharply, although interest in gases would survive in textbooks and public and classroom lectures until the mid-1840s when anesthesia was discovered. By early 1801, Davy had published his great work on nitrous oxide and left for London, where he worked at Count Rumford’s new Royal Institution and achieved even greater scientific fame.

Throughout the 1790s, a number of other physicians had joined Beddoes’ search for medical uses of gases, often at his urging and using Watt’s equipment for gas manufacture. These men included William Withering (carbonic acid gas, oxygen, 1796); Citizen Alyon (oxygencated ointment, 1798); Thomas Garnett (oxygen, 1798); and Christoph Girtanner (carbonic acid gas, 1796). Other physicians directly influenced by Beddoes included Robert Thornton, John Ferriar, John Alterson, and William Saunders. Prominent author, scientist and Fellow of the Royal Society Tiberius Cavallo also published his views on “aerial fluids” and their medical possibilities. James C. Smyth, a Fellow of the Royal College of Physicians, claimed a role for “nitrous vapour” in “preventing and destroying contagion.”

Two physicians who published their own extensive accounts at this time were Richard Pearson, at the General Hospital in Birmingham between 1792 and 1801; and Daniel Hill, of Guy’s Hospital in London. Pearson’s pamphlet, published in 1795, reviews the development of pneumatic medicine to that point, citing the work of Beddoes and noting that “Apparatus for obtaining the different kinds of airs have been introduced into the Hospital and Dispensary here ... (meaning Birmingham) ... and in process of time, when the preparation and uses of these elastic fluids come to be understood, we may expect that these apparatuses will be found in the laboratories of most of the apothecaries.” In a fascinating coda, Pearson discusses his work with ether vapor. Ether was the agent used by Crawford Long and William Morton in the 1840s to achieve anesthesia. Pearson failed to discover its anesthetic effects, but he did observe that patients breathing it often “... find it so grateful to their feelings, that they are disposed to have recourse to it too often, and cannot readily be prevailed upon to lay it aside when it is no longer necessary.”

Daniel Hill describes 19 cases from his own practice in which he applied oxygen or “vital air.” The cases ranged from a two-month-old baby girl to several men and women in their twenties and thirties. About half the cases were children. The case of Thomas Mazey is particularly fascinating. This eleven and a half-year-old boy was less than three feet, three inches tall and weighed not quite 49 pounds. Hill notes his “caddaverous countenance, apparent torpor of mind ...” in July, 1796, prior to his prescription of “... a dailey [sic] alternative course of diluted nitrous air only, for six weeks. In the space of ten days, he was evidently stronger ...” By the middle of September “... he had grown one inch and half higher, and was one pound four ounces heavier.” Within a year, Thomas had gained over 11 pounds and grown almost eight inches in height. Here perhaps is an excellent example of the placebo effect and coincidence at work in so many of cases reported in the pneumatic medicine literature. Physicians who used this particular therapy were as quick as any others to ascribe any improvements to their interventions.

Despite such apparent successes, research efforts on the gases were even denounced from the pulpit in America. On November 7, 1798, the Pittsfield, Massachusetts, newspaper, the Berkshire Gazette, published anonymously a portion of a sermon that declared, “It is not the fashion to kneel before crucifixes, but to worship, adore human reason, falsely so called; and the rage for relics, is now spreading itself on ... making experiments on air ...” The extract was contained in a sermon preached by Azel Backus in Hartford, Connecticut in May of that year.

What then can we conclude about pneumatic medicine?

- Pneumatic medicine as a therapy for consumption and other ills was a failure.
- Beddoes and Davy recognized the pain-relieving properties of nitrous oxide but failed to explore these properties.
- Pneumatic medicine provided extensive research into gases and proved that humans could safely inhale some of them.
- Nitrous oxide research in Bristol investigated all three areas of modern medical research: 1) basic laboratory research; 2) animal research: rabbits, mice, guinea pigs, fish, lizards, insects, birds; 3) human research on both healthy and sick volunteers and sick.
- Beddoes’ Pneumatic Institute embraced the three pillars of the modern...
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medical center: clinical care, education, research.

- Beddoes' efforts during the 1790s coordinated and stimulated the research conducted by a number of physicians scattered throughout England—the multi-center trial.

- The nitrous oxide work of Beddoes and Davy influenced research on that gas in America.

- Those involved in the study of pneumatic medicine developed complicated equipment for large-scale production of gases and developed breathing equipment for use in humans.

- The accounts in Beddoes' Notices and Davy's Researches of nitrous oxide inhalation are among the earliest accounts of drug-induced "mythical" experiences.

- The work of Beddoes and others with oxygen foreshadowed by more than a century the modern practice of respiratory therapy.4,5,50

- Pneumatic medicine investigators were prodigious in their efforts to publish—another modern characteristic!

- With the exception of the work of Henry Hill Hickman who investigated carbon dioxide inhalation in dogs in the 1820s,5 pneumatic medicine provided the only serious research into gas inhalation until the late nineteenth century.

"Pneumatic chemistry in its application to medicine, is an art in infancy, weak, almost useless, but apparently possessed of capabilities of improvement," Davy wrote.22 His mentor Beddoes was even more self-critical and hopeful. "It could not therefore escape me that the pursuit might, in its own nature, be highly rational, and yet that those who first engaged in it, might never strike into the right path. It was plain that we might even prepare a happier era for mankind, and yet that those who first engaged in it, might as the best ever written on these subjects so important to the birth of the anesthesia.

Readers interested in further discussion of topics addressed in this paper should obtain a copy of Dr. Norman A. Bergman's 'The Genesis of Surgical Anesthesia.' His discussions of pneumatic medicine in the eighteenth and nineteenth centuries are superb; the details which he reveals and the conclusions which he makes stand as the best ever written on these subjects so important to the birth of the anesthesia.

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Deyan Shang and the Development of Modern Chinese Anesthesia

by Guyan Wang, M.D., 1999 Rod Calverley Fellow and Patrick Sim, M.L.S., Librarian Wood Library-Museum of Anesthesiology

Introduction

Pain relief for surgery in China is believed to have first occurred ca. 220 by surgeon Hua To who applied Indian hemp, among other concoctions, to desensitize his patients during operation. Yet, medicine and surgery in China never developed to its full potential while western medicine made remarkable strides in the ensuing centuries. Social stratification in traditional China seemed to have stifled such progress. The status of the physician in Chinese society was often relegated to the category of astrologers.1 Such tradition discouraged talent, and thus explains the lack of medical progress in a vast nation like China until the advent of the modern era.

The history of modern Chinese anesthesia is relatively sketchy. It was introduced about a year after Morton’s successful demonstration in western America. 2 The focus of this paper is on Western medical education in China in the early 20th century through its China Medical Board. The Rockefeller Foundation helped establish Western medical education in China in the early 20th century through its China Medical Board. This connection was somewhat accountable for the training of the most influential first-generation Chinese anesthesiologists since 1949, personified by Jone Wu, Deyan Shang and Yung Shieh, all of whom studied anesthesia in Midwestern America.3 The focus of this paper is on the career of Dr. Deyan Shang, whose influence on modern Chinese anesthesia was immense, and whose medical career paralleled the development of anesthesia in China since the founding of the People’s Republic of China.

Deyan Shang’s Road to Medicine and Anesthesia

Deyan Shang was born in 1918 to a poor family in northeastern China, son of a minor government bureaucrat. Life was hard for the Shang family and young Deyan’s education was interrupted by frequent family relocations. He managed to complete his elementary and secondary education in 1937, which included three years of French language instruction. He entered Lanchou University Medical School in 1938, graduating in 1942. His proficiency in the French language, and his interest in other western languages, enabled him to read medical literature of the West.

After three years as a surgeon at Lanchou General Hospital, he was invited to develop anesthesia service at the medical school in 1945. For further training he was sent to America in 1947, arriving in Chicago for an anesthesia residency to be taken at the University of Illinois. His career goal remained in surgery, despite the fact that anesthesia would become an inseparable part of his medical career. Indeed, surgery was the main vehicle he would use to propel his anesthesia program when he returned to Lanchou. Throughout his career, he would hold dual medical appointments in surgery and anesthesiology, and would contribute chapters on anesthesia, resuscitation and other related expertise in surgical textbooks. His anesthesia-related papers were also published in surgical journals.

Deyan Shang and the Development of Anesthesiology in China

Upon his return to China, Dr. Shang was appointed chairman of the department of anesthesiology at the Lanchou Central Hospital, the first such appointment in modern China, with simultaneous appointments as vice chairman of surgery and director of surgical education. To develop and promote anesthesiology, he required medical students and surgical residents to study anesthesia. As his teaching institution later became a general hospital for veterans in northern China, he was able to travel extensively to develop anesthesia in northern and northwestern China in affiliated veterans’ hospitals.

Integrated Anesthesia Service: Clinical Care, Teaching & Research

In 1954, a new research center for the study of surgery for the wounded was established in Dr. Shang’s native province in northeast China during the Korean War. He was appointed chairman of the department of anesthesia at this new research center, where clinical responsibility, teaching and research were centralized. On clinical care, Dr. Shang led his team of multi-disciplinary experts in the treatment of end-stage wounded patients. He was proud to note that none of the mortality at this center was anesthesia related. On teaching, Dr. Shang instituted an anesthesia rotation system for military surgeons. He also conducted research at the Center where abundant cases of wounded patients were presented. He culled foreign medical journals for research topics, and wrote book chapters on anesthesia for the wounded.

Fuwai Cardiovascular Research Institute & the First Animal and Biomedical Engineering Laboratories in China

Dr. Shang’s research focus intensified in 1956 with the founding of the Central Military Cardiovascular Hospital in suburban Beijing, where he was appointed anesthesia research director. This facility later became a civilian institute, and was renamed the Chinese Academy of Medical Sciences at the Fuwai Hospital Cardiovascular Research Institute. He established the first laboratories for animal and biomedical engineering research. His team investigated the physiology of hypothermia for cardiovascular surgery, devised extra-corporeal circulation apparatus to assist invasive cardiovascular surgery, and designed manufacturing apparatus for mass production of nitrous oxide. Such accomplishments engendered further research in the physiology of hemodynamics, and the pharmacology of anesthesia. Pulmonary physiology and resuscitative medicine were also studied. Dr. Shang’s research was halted in 1966 at the beginning of the Cultural Revolution, not resuming until a decade later.

Professionalization of Chinese Anesthesia

Dr. Shang’s vision for the professionalization of anesthesiology was insightful, reminiscent of the early pioneers of American anesthesia led by Ralph Waters. He traveled abroad extensively for communication and exchange of ideas to advance Chinese anesthesia. He tirelessly established liaison with other medical disciplines to gain respect for anesthesia in medicine. Through his incessant petition to his professional brethren in medicine, anesthesia was formally recognized as a branch of clinical medicine. He rallied all of his colleagues to organize the Chinese Society of Anesthesiologists in 1979. Simultaneously, he pushed for the publication of a professional journal for Chinese anesthesiology assuming significant editorial roles in March 1981. Dr. Shang died in 1985 of a prolonged illness. His professional life ran parallel to the development of modern Chinese anesthesia.

References

Anesthesia 2000 in Ho Chi Minh City

by Ray J. Defalque, M.D.

I spent the month of April working as an anesthesiologist at the CTO (Center Trauma Orthopedics) in Ho Chi Minh City (HCMC). April, at the end of the dry season, has temperatures in the upper 90s and humidity over 90%. HCMC (formerly Saigon) is not the capital of Viet Nam but it is its largest city, a huge bustling metropolis of six to seven million people and two million motorbikes (ho da in Vietnamese). Traffic accidents, nicknamed “hon da syndromes” by Saigon’s surgeons, are a main source of CTO admissions.

The CTO is a 450-bed orthopedic hospital founded in 1985 at the site of a former Chinese clinic. It is a four-story white structure built around a courtyard filled with tropical trees. On each floor a circular gallery with a view on the courtyard gives access to a multitude of four bed wards. The patients’ bed care and their meals are provided by their relatives who buy their food from nearby street vendors.

The CTO serves the orthopedic needs of the metropolis and the adjacent Mekong delta; its renowned spine department attracts patients from a large part of South Viet Nam. The Center has a large emergency department with three ORs for trauma requiring immediate surgery, such as large wounds, bleedings, or open fractures. Closed fractures are reduced, casted and sent home or immobilized and admitted for later surgery. Severe spine, chest, or pelvic casualties are sent to SICU after initial treatment in the ER.

The surgical suite on the first floor has seven ORs, a large holding area and a big PACU, several small rooms for instruments, supplies, etc., and two lounges and dressing rooms.

Anyone entering the suite must trade his or her street shoes for rubber sandals, which, unfortunately, are too small for Western feet. Socks are rarely worn in South Viet Nam. Of the seven ORs, two are assigned to spine surgery, two to leg procedures and the other three to upper limb, pediatric, and cancer surgeries, respectively. Each OR has a small, individual air conditioning unit; the rest of the suite has only fans and is extremely hot. Every room has a French surgical table, X-ray viewers, wall suction, tourniquets and a modern diathermy unit. A fracture table, two X-ray machines (one with C-arm), and an arthroscopy unit can be brought into any room when needed.

Each OR handled four or five cases each day during my stay. Saturday was a full working day reserved for patients willing to pay an extra fee to by-pass the waiting list. Medical care is no longer free in Viet Nam although the surgical fees are modest and many patients receive financial support from various agencies (unions, party, etc.) or even from public subscriptions.

The CTO has a small laboratory for routine tests but depends on a larger nearby hospital for complex laboratory tests and its blood supply. Casualties with multiple traumas occasionally cause problems, as they require the exchange of various specialists between the CTO and the other hospital.

The surgery I saw at CTO resembled that done in any U.S. orthopedic department. We had many patients with osteomyelitis, tuberculosis of bones and joints, and sequel of war injuries. I also saw several lovely children and adolescents with limb sarcomas or congenital deformities, horrible sequel of Agent Orange. Defolia­tion, which touched ten percent of the country, remains an emotional issue in Viet Nam. The center also treated a large number of patients with broken or collapsed vertebrae due to trauma, osteomyelitis, and Pott’s disease and patients with scoliosis, herniated disks, and extensive cervical or lumbar spinal stenosis.

Our day started at 0700 with a lecture I gave to the department of anesthesia. The chief of anesthesia or one of his assistants translated it. At 0730 I occasionally attended the surgical conference, a formal and intimidating affair held in an ice-cold room with projectors, laser pointers and hand mikes. All the surgeons, the hospital director, and retired professors attended. About ten interesting casualties admitted over the past twenty-four hours were presented at lightning speed and heatedly debated in rapid-fire Vietnamese. Since there was no translation, I generally joined the anesthetists in the canteen for a traditional Vietnamese breakfast of “pho bo”, a large bowl of spicy soup of rice noodles and beef.

Surgery started at 0800 and ended around 1400. On Friday it stopped by 1300 to allow the nurses a thorough cleaning of the ORs, including the walls and ceilings. The OR turnover time rarely exceeded five minutes. The patient was anesthetized and made ready for surgery within a few minutes and surgery followed at the same fast pace. A total hip or knee arthroplasty took about one hour, a hip hemi-arthroplasty or a femoral shaft nailing 30 to 45 minutes.

Once the operation had started, the surgeons who had been loudly bantering outside of the OR became strangely silent and totally engrossed in their procedure. Technical difficulties, bleeding, nursing or anesthetic mishaps never brought criticism, tantrums, or vocal outbursts, all serious breaches of Vietnamese etiquette. The surgeons’ skill and speed were impressive. I saw several extensive brachial plexus injuries repaired in two to three hours, without loupes, headlights or constant readjustments of the OR lights. At the end of an interesting case the surgeons sat on the floor to discuss the procedure, drawing on the surgical drapes and providing a translation for their “round eye” visitor. “Round eye” is a Vietnamese nickname for Westerner. Compliments to a surgeon on his surgical speed and skill only brought a puzzled look or a shy grin and the success of the operation was attributed to luck. Self-deprecation is an important feature of the Vietnamese social code.

The chief of anesthesia at CTO during my visit was young, “boarded” in anesthesia and internal medicine and with a special interest in pulmonary complications of trauma. He had studied in France and was fluent in French and English. He also could communicate in their language with the numerous Cambodian refugees we treated at CTO. He had designed and built the OR and SICU electrical system, central O₂ supply and the plumbing. He led a team of nine anesthesiologists (three women) and twelve CRNAs (three men). The anesthesiologists were in their mid- or late thirties and eight to ten years out of training. Three had taken advanced training in France and were familiar with the latest anesthetic techniques and concepts. Because of various generous leaves of absence, only four to five anesthesiologists were present each day to cover the OR, ER, SICU and to make the preoperative visits. Each anesthesiologist supervised two or three CRNAs and was on call.
every fourth or fifth day for 24 to 36 hours with the next day off.

Three ORs (spine, lower extremity) had modern U.S. anesthetic machines (Narkomed, Ohmeda) with soda lime, ventilator and monitoring unit. The other anesthetic machines in the OR and ER suites included two U.S. Army Heidbrinks and five small Japanese units. All had a flow meter for O2 and O3, an O3 flush value, a Floutek vaporizer, and a Jackson-Rees system with an efficient positive pressure valve. There was neither N2O nor scavenger and only halothane in a high O2 flow was used during my visit.

All lower limb operations were done under spinal anesthesia. This was performed at L-4-5 in sitting position with a disposable 25 G Quincke needle. Fifteen to 17.5 mg of an isotropic spinal solution of 0.5% bupivacaine (Astra, Australia) was injected. In every SAB I observed, the CSF was obtained within a few seconds at the first attempt, a T6 level was reached, and the vital signs invariably remained stable. Three anesthesiologists occasionally combined a spinal with a continuous epidural block for oncological surgery. A few children received a single shot bupivacaine caudal after induction and intubation.

Except in small children, upper extremity surgery was done under brachial plexus anesthesia: axillary blocks for procedures distal to the elbow, interscalene blocks for surgery proximal to it. For both blocks, 30 ml lidocaine 2% with 1:200,000 epinephrine was injected, followed by 10 ml bupivacaine 0.5%. This sequence, I was told, avoided diluting the lidocaine. Children received smaller volumes. The blocks in adults were done in the holding area after IV administration of fentanyl and midazolam. In very small children the block was induced in the OR after IV injection of 0.5 mg/kg ketamine. An ordinary 22 G needle with an extension, a plexufix, or in very thin patients, a 25G butterfly unit was used. Paresthesia was not sought and my nerve stimulator was judged cumbersome and time consuming. Except for a rare incomplete axillary block, which required IV adjuncts or halothane by mask, all the blocks I witnessed were adequate and provided three to four hours of anesthesia. The thin, muscular, and stoic Vietnamese patients are ideal subjects for regional anesthesia.

Patients with an unstable cervical spine arrived to the OR with heavy weights tied to a head halo. The neck was kept in traction until the spine had been surgically immobilized through a posterior approach. A standard method was used to anesthetize those difficult patients: after IV induction with 0.5 mg/kg propofol and 0.05 mg/kg pipercuronium, a nasal endotracheal tube was inserted under direct laryngoscopy with the help of a Magill forceps. If intubation had been impossible, a LMA would have been inserted and the patient allowed to wake up but this never occurred during my stay. The CTO had no special larynoscopes or FO equipment and blind nasal techniques were unknown. In transthoracic spinal operations the retracted lung was kept immobile with intermittent doses of 0.01 mg/kg pipercuronium and no DLT was needed. Generally, neostigmine reversal was unnecessary. An 18 G forearm angiocath was the only IV access even in major spinal procedures where blood loss was anticipated and the extremities were inaccessible to the anesthetist. When the blood loss neared 500 ml, the Ringer's lactate was replaced by Gelafundin, an inexpensive German derivative of gelatine (MW 5,000) or the more expensive HaeSteril 6%, a saline solution of polystarch (MW 200,000). Whole blood was transfused when the hemorrhage reached 1,000 ml. The largest blood loss I witnessed was 2,000 ml in a six-hour extensive thoraco-lumbar decompression. The patient received 1,000 ml of autologous whole blood. I never saw any significant bleeding in non-spinal surgery.

Although pentothal and etomidate were available, only propofol (0.5 mg/kg) was used for induction. It was also given in repeated small increments with O3 by mask for short, minor procedures. IV fentanyl and midazolam were extensively administered before general or regional anesthesia. Fentanyl was handled like any other drug without special accounting. Only pipercuronium and, rarely, vecuronium were used, mainly for adult intubations. Most children and a rare adult received suxamethonium for intubation. I never saw it cause fasciculation. Halothane, given in a high O2 flow, was the only inhalation agent at CTO. All patients received IV ampicillin at the onset of surgery. A few anesthetic drugs were produced in Viet Nam but most were gifts from Germany, Australia, or Malaysia. More drugs will soon be available as the government now allocates more resources for medical care.

Our patients received a large oral dose of diazepam or midazolam on the ward before they were brought by wheel chair or stretcher to the holding area where a SRNA inserted an 18 G anglocath. The waiting patients were alert but amazingly silent and tranquil. A parent accompanied the small children. To speed up the OR turn-over time, many patients after surgery were taken still anesthetized and intubated to the Recovery Room where monitors and restraints were applied and O3 given through a T-tube. I was amazed at how quiet, stoic, and uncomplaining our postoperative patients were, as if indifferent to their pain. Very few requested analgesics. Patients after thoracotomy, extensive spinal or pelvic surgery, or those with continuous epidural analgesia or morphine IV pumps were ultimately transferred to SICU. I never saw nausea or vomiting, emergence delirium, hallucinations after ketamine, shivering after halothane, hypothermia, or postural post-spinal headaches. We had three complications during my visit: two mild toxic reactions to the local anesthetic and a high spinal block with respiratory and cardiovascular impairments. All were quickly and efficiently treated. Surgeons operated on their HIV patients dressed in a heavy space-like suit, which must have been most uncomfortable in the warm ORs. HIV is on the rise in Viet Nam, and the government is vigorously battling prostitution and drug addiction.

After the morning lecture, I spent the rest of the day in the ORs, helping the anesthesiologists and, when we were short of anesthesiologists, supervising one or two ORs or giving anesthesia myself. Everyone's trust and courtesy made the job easy and enjoyable.

I found the CTO staff, like most people in HCMC, to be informal and easy going, but with a delightful, old fashioned courtliness. The Vietnamese are eager to interact with foreigners and although they are immensely proud of their country and their way of life, they easily adapt foreign ideas and techniques to their own. Anesthesia at CTO showed a strong French influence with distinct American features. The surgeons felt their procedures combined the best of the French, American, and Japanese doctrines.

The Vietnamese character of smiling courtesy, simplicity and sense of humor and the dislike of open criticism, arrogance, and especially of any manifestations of impatience and anger made for extremely smooth and pleasant relations in the OR. I was immediately adopted by the CTO family and soon allowed to share their views, hopes, problems, and even the rich local gossip. We parted with some sadness but with the promise to meet again soon. I hope I can keep that promise and soon return to HCMC and its great people.
50 Years of Paediatric Anaesthesia

by Dr. Kester Brown
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The first paediatric anaesthetic that I saw was an infant having reduction of intussusception under drawover trilene and ether following an ethyl chloride induction at my father's hospital in Kenya in 1950. That was the standard anaesthetic in the hospital given by a locally trained medical assistant. There was no thiopentone. There was not even any electricity at that time. About the same time, Margaret McClelland had introduced d-tubocurarine into paediatric anaesthesia in Melbourne, having gained experience with it while working in England during the war. She helped Harry Adams at CIG develop special equipment for children. The Adams-McClelland valve was a type of T-piece arrangement with a valve in it so that it could be used as a T-piece with a closed bag, open bag or the bag in the inspiratory limb.

My interest in anaesthesia developed when I was a medical student and my first administrations were when we gave ethyl chloride and ether for guillotine tonsillectomy—a standard technique at that time. Next, I administered divinyl ether (Vines-thene) to a boy with a fractured leg on the Grenfell Mission boat, Maraval, in Nain, a settlement in northern Labrador. I had two weeks training as an intern in London, Ontario, before heading to Yellowknife, NWT, where I became virtually the busiest administrator of anaesthesia in the North West Territories!!

My career has spanned a most exciting period of paediatric anaesthesia—the development of prolonged intubation and ventilation, the development intensive care units—initially in recovery rooms, the introduction of PEEP which resulted in the expansion of neonatology to the care of younger and younger premature infants and deep hypothermia for infant cardiac surgery. My first year of anaesthesia in Vancouver (1963-65) was the turning point when cyclopropane and ether declined in popularity due to their flammability and halothane and later methoxyflurane gained in popularity. I spent two periods of two months in 1963 and 1964 at the old Vancouver Children's Hospital in East 59th Street, where I followed every patient for at least 16 hours to determine the incidence of postoperative vomiting. Forty-three per cent vomited after tonsillectomy and 51% after dental procedures, the lowest incidence being with the recently introduced agent, methoxyflurane. A different consultant came each week and some encouraged me to apply a different technique for every patient so I learnt to use every combination of agents that were available.

Cyclopropane, whilst being a wonderfully rapid inducer of anaesthesia and which, through its sympathetic stimulant effects, maintained blood pressure well while it was being given, could cause severe laryngeal spasm during emergence. After a week with three severe cyclospasms, I learnt that patients usually take a breath before the heart stops, that it is best to keep applying constant positive pressure oxygen until the cords relax, and that Ralph Waters had taught one of my teachers, Herb Randall, that one should introduce nitrous oxide while the cyclopropane is blown off as a mechanism to reduce the chance of spasm following cyclopropane anaesthesia. I was privileged to be taught by people who had learnt from pioneers like Ralph Waters, Wesley Bourne and Digby Lee. Eric Webb, who wrote a paper comparing and anaesthesia published in the Canadian Journal in 1967, taught me the most valuable lessons about intubation, particularly the importance of passing the tube from the corner of the mouth so that you can see it actually going through between the vocal cords. A wild man, but a great teacher, he also stimulated my interest in history of anaesthesia.

During my time in Vancouver (1963-65) I undertook studies on post-operative vomiting, the effect of succinylcholine on serum potassium, maximum heart rate during exercise in relation to age and the effects of phenothiazine (Dilantin) and succinylcholine on single atrial cell action potentials. I spent the later half of 1965 at HSC in Toronto where my interest in Paediatric anaesthesia was increased by Al Conn and other well-known members of the department including Code Smith, who fired my interest in pharmacology, and Al Johnston who helped me prepare my first published paper. During my time there I conducted another study on post-operative vomiting which showed that promethazine and another, never marketed phenothiazine reduced the number of patients vomiting by more than half compared to controls and the number of vomiting episodes to one third.

Until the 1960s, children were intubated with red rubber tubes, which were re-autoclaved many times. We did not have PVC tubes nor special paediatric ventilators. By 1963, when PVC tubes had become available, prolonged intubation was introduced in Adelaide by Tom Allen and Ian Steven, in Melbourne by John Stocks and Ian McDonald, and in Toronto, although the first paper presented was by Bernard Brandstater, an Australian working in Beirut, at the European Congress in 1962. This led to the evolution of Intensive Care areas in recovery rooms to full blown Intensive Care Units.

Some cases of subglottic stenosis occurred following prolonged intubation and the question that arose was whether toxic chemicals were leaking out of the new PVC tubes. Implantation toxicity tests suggested that this was not the case and subsequently John Stocks highlighted the importance of using the correct tube size which allowed a slight leak with positive pressure as the way to avoid it. In the first 60 cases in Melbourne, there were three cases of subglottic stenosis, but when attention was paid to tube size there were no cases in the next 300. Two major areas of interest at that time were fixation of tubes so that they did not fall out accidentally and humidification to prevent the complication of a blocked tube which could be fatal if not recognised. Several methods of humidification were used—some produced so much that the patients nearly drowned, some basically had the gas going over hot water in the tank as in the Donnelly Wilson used in Australia, and the respiratory technicians in Toronto devised an ingenious device called the Winiliz Nebuliser. Droplet size was important—if they were too big they would not reach the distal airways.

My first publication on postoperative ventilation of paediatric cardiac surgical patients, written while I was in Toronto in 1965, covered many aspects of this topic. It seems that this was first publication on this topic. The other question that arose during a panel discussion at the first paediatric anaesthetic conference held in Toronto and organized by Al Conn in November, 1964, was "how long could one leave a tube in situ?" Digby Lee, Jackson Rees and Bob Cope were discussing whether one might leave it for a week. Then one of the most momentous comments I have ever heard at an anaesthetic meeting occurred when Tess Brophy from Brisbane announced that somebody in Australia had left one in for 34 days. Subsequently, in Melbourne, we had one in for seven months before we realised that it was better to do a tracheotomy in patients who might require a tube for this length of time.

The next problem that arose was *Pseudomonas* infection which, at that time, could not be easily treated with antibiotics and caused a significant amount of morbidity and even mortality.

Tube fixation led to some ingenious ideas such as the Jackson Rees tube with the inspiratory and expiratory limbs which were...
attached around the head, the Tunstall tube holder or the system of using a string, and careful strapping which evolved to a fine art using ergonomic principles.

Epiglottitis was a great challenge. It was a matter of considerable debate when I was training in Canada as to how these patients should be anaesthetised and handled. In Toronto, a rigid bronchoscope was passed and the patient then anaesthetised before a tracheotomy was performed. I could never understand why this brutal approach was employed—maybe a surgical fee was involved. In Melbourne I was taught by John Stocks to breathe these patients down on oxygen and halothane, applying CPAP to the circuit and then intubating. There were occasional patients whose epiglottis was so swollen when one looked in that there was no obvious opening—it looked like a cherry. The worst case that I was involved with had a pan-glottitis; with swelling, not only of the epiglottis, but the posterior part of the larynx as well. Emergency tracheotomy was necessary because we could not find the way in with the tube. It was Donald Grubb in Edinburgh who first taught me when I visited his hospital in 1974 that often a tube was only necessary for a little as six hours once antibiotic treatment had been started.

Post-operative ventilation required leaving tubes in for longer periods. The ventilators in common use at that time were Birds, Bennet PR2, and in Toronto, the large Engstrom ventilator was used which had some interesting features. It was volume controlled with a piston pump with a can squeezing a bag in a bottle. When running correctly the bag was completely emptied before the peak pressure in the “bottle” was reached, thus allowing a period for redistribution of gas from well filled to less well filled areas in the lung. The Loosco ventilator was produced in the Netherlands specifically for neonates. Much emphasis was placed on the physiology and the effects of the pattern of ventilation on mean intrathoracic pressure and the influence on venous return.

With prolonged ventilation came the need for disconnect alarms which was the next important development.

Concurrent with these developments for the maintenance of adequate ventilation came greater emphasis on the administration of intravenous fluids and calories followed by the advent of parenteral nutrition. We take IV administration for granted, but when I was a medical student in 1959, prolonged intravenous therapy was managed by the hospital biochemist who came each day to assess the requirements for the next 24 hours.

In 1970, Gregory introduced PEEP for hyaline membrane disease. It was a curious thing that this was not introduced earlier, but the concern about reducing venous return inhibited the idea of applying positive pressure to keep the airways open and the lungs inflated. At that time babies who could not maintain a PO2 above 60 mmHg when breathing 100 per cent oxygen usually died. The first consequence we had of applying PEEP was a continuing mortality, but now due to oxygen toxicity of the lungs. When we were told this we realised that keeping the airways patent allowed easy access of reduced concentrations of oxygen to supply the patient’s needs. We now take for granted that premature babies who may weigh only 500 grams, or even less, can survive, but in those days, if hyaline membrane disease existed, the chances of survival in very pre-term babies was very, very small. It is of great interest to know that one of the greatest paediatric anaesthetists was less than 1 kg at birth and he has survived for over 70 years.

All these developments led to a very significant improvement in surgical survival of conditions such as oesophageal atresia. More recently adjuncts such as ECMO and oscillators have been used, along with nitric oxide and inotropic support to try to improve the results in conditions such as diaphragmatic hernia. Thirty years ago, if a diaphragmatic hernia survived six hours and could be operated on, it was likely that they would survive, particularly if the lung on the affected side was greater than one-third of normal size. It was like a trial of life. While the boundaries have been pushed back, there is still a significant number of failures which incur a considerable cost. I wonder whether the trial of life did not have some advantages.

It is interesting to analyse the “Liverpool Technique” of ventilation practised by Jackson Rees and his colleagues. It was not hyperventilation because PCO2 did not decrease significantly—it was high-frequency oscillation with some PEEP applied. They were away ahead of their time!

1970 saw another great breakthrough with the introduction of deep hypothermia and circulatory arrest to allow infant corrective cardiac surgery to be performed. Prior to that, babies with large VSDs had their pulmonary artery banded. People listen with surprise when I tell them that I guided the surgeons where significant blood loss might be expected. We had two patients who arrested due to blood loss during liver surgery, one under hypothermia who recovered normally, and one who was normothermic who recovered with brain damage.

The next interesting development was the revival of hypotensive anaesthesia using sodium nitroprusside, following a lecture at the Australian Society of Anaesthetists meeting by Ron Katz in 1971 on the use of sodium nitroprusside for induced hypotension and the management of phaeochromocytoma. The introduction of hypotensive anaesthesia with sodium nitroprusside in scoliosis surgery led to a change from taking three hours to insert Harrington Rods with a 3 or 4 unit blood loss, to taking 1 to 1½ hours with minimal blood loss. Hypotensive anaesthesia, particularly when used in conjunction with hypothermia, proved to be a useful technique when very difficult cases were being done where significant blood loss might be expected. We also developed the use of short-term hypotension to solve the problem of uncontrolled bleeding. The bleeding point, which could not usually be found because of the rate of blood loss, could be compressed and then the patient’s blood volume re-estab-
lished before the pressure was gradually taken down by a slow infusion of sodium nitroprusside until such time as the bleeding was sufficiently reduced for the surgeon to be able to locate the bleeding point.

Sodium nitroprusside, and then phenoxybenzamine, a long acting alpha-blocker, were then applied to cardiac surgery. I believe we may have been the first to use this technique. It facilitated cooling with surface cooling in the deep hypothermia cases and also facilitated rewarming and adequate filling of the circulation before the pump was switched off. It also made it easier to evenly cool the body so that a commonly seen after-drop in temperature as equilibration took place, was avoided. I had one patient, a baby with total anomalous pulmonary venous drainage, who came off the pump with a systolic blood pressure of 40 mmHg and it remained so for six hours afterwards. We thought recovery was unlikely until suddenly the blood pressure came up again at that time. In retrospect, I think this is the only case of probable nitroprusside toxicity that I have ever seen.

Another significant development was the introduction of the operating microscope, enabling microlaryngeal surgery to be introduced (about 1971) and then the advent of laser which facilitated operating on papilloma of the larynx and other airway abnormalities. The shared airway has been a continuing interest of mine. In 1955, I introduced chlorpromazine to suppress the stress responses to surgery and virtually founded psychoanaesthesia in the process. GammaOH supplemented by methoxyflurane and local anaesthetic gave ideal operating conditions for airway work and bronchoscopy. However, the down side was that these patients slept for some time afterwards. It was later demonstrated that physostigmine had some reversal effect. Inhaled foreign bodies are most common between 18 months and 3 years, more in boys and up to 25% are not diagnosed within a week of inhalation. Narrowed airways can now be studied with tracheobronchography and stenoses can be widened by laryngotraechoepery and other challenging operations.

In 1964, Gordon Bush wrote a paper on the possible causes of cardiac arrest following suxamethonium in burns. At that time the only paper on suxamethonium and potassium was a study done in dogs by Stephenson in Oxford which showed little difference. I undertook a few measurements at the Childrens Hospital in Vancouver and subsequently received my first research grant of $50.00 from the British Columbian Medical Research Foundation to study the effects of suxamethonium on potassium in normal adults. No significant increase occurred. My researches on suxamethonium and potassium continued for over 20 years. I demonstrated a relationship to the size of the burn and the dose of suxamethonium to the rise in serum potassium which occurs in burns and also to show that this does not occur until 7-10 days after the burn injury, which concurs with Vibe Mogensen’s work. Before that, patients are acutely sensitive to suxamethonium and doses as small as 0.1-0.2 mg/kg may be sufficient for intubation. In addition, rejection of a paper showing that EMG was more depressed in burn patients than normal following small doses of suxamethonium led to one of two studies on the dose response of suxamethonium in children to have been published. It showed that we usually use a significant overdose.

1970 was a busy year—an epidemic of anti-depressant overdose following the introduction of these drugs onto our National Health Benefit list occurred in Australia. We had 50 cases in one year and about 30 per cent of cases had serious complications of arrhythmias, convulsions and/or coma. The incidence was greatly reduced when we managed to persuade the government to insist that these drugs should be safety packaged. This followed a study where we tested how long children of 2-5 years took to access various forms of packaging and demonstrated that foil was the most effective deterrent. Our experiments also confirmed that a bolus of sodium bicarbonate provided the most effective treatment of antidepressant-induced dysrhythmias and that adrenaline was safe and effective in the treatment when hypotension occurred.

Another area that has grown in popularity in recent years in paediatric anaesthesia is the use of regional and nerve blocks. Our department has made significant contributions in this field. We began using caudals about 1968 as a result of our trainees rotating to the Womens Hospital where Kevin McCaul taught them the technique, although Curwen in Durban reported 99 cases in neonates in 1950. We have done anatomical studies for anaesthetists and developed new techniques for some of the nerve blocks as a result. In 1975, I realized that no studies had been done of blood levels of local anaesthetics in children. I encouraged a young anaesthetist in our department at the time to participate in a joint project on this subject with the Pharmacy College—it was Rob Eyres who co-authored the first papers on the subject.

In recent years there has been a growing interest in regional anaesthesia in children. There have been so many great advances during the last 30 or 40 years. I have highlighted some of those which I was closely associated with in areas which most people probably take for granted, just like they take the telephone, the motor car and television for granted today. I hope this presentation helps some of you realize where we have come from and that it wasn’t always as it is today. We had to rely much more on our basic clinical skills.

One of my greatest interests has been teaching. I still find that teaching basic skills such as ventilation and intubation, explaining the ergonomic principles, is most useful. Video demonstration is an alternative way of doing this if one cannot do it in the operating theatre.

Paediatric anaesthesia has provided me with a very interesting and challenging career and many wonderful friends all over the world. We should appreciate those who led the way in our specialty—people like Phillip Ayre who devised the T piece and others, many of whom I have referred to in this paper.
From the Literature

by A.J. Wright, M.L.S.,
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Note: In general, I have not examined articles that do not include a notation for the number of references, illustrations, etc. I do examine most books and book chapters. Books can be listed in this column more than once as new reviews appear. Older articles are included as I work through a large backlog of materials. Some listings are not directly related to anesthesia, pain or critical care but concern individuals important in the history of the specialty (e.g., Harvey Cushing). Non-English articles are so indicated. Columns for the past several years are available in the 'Anesthesia History Files' at <http://wwwwvanx.ub.edu/anesthist/anesthist.htm> as "Recent Articles on Anesthesia History."

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Go for the Throat

by Samuel L. Ostrin, M.D.
Elmhurst, Illinois

Dateline: Mount Vernon, Virginia. December 14th, 1799.

The ordeal began as a simple sore throat on Friday the 13th. The issue was resolved in 36 hours. Having withstood phlebotomies, purgatives and poltices, emetics and blistering, the patient remained moribund. The torrent of air rasping across festering sores was the price for a few extra seconds of life. Elisha C. Dick, the junior of three astute physicians in attendance, pondered the septic and suffocating 67-year-old. He ventured a daring approach. Surgically opening the windpipe to bypass the obstruction might give the old soldier a fighting chance. Dick was voted down. This was after all a democracy. By morning, the Father of our American Democracy was dead. Diphtheria had bagged another victim, George Washington. Ironically, “diphtheria” stems from “dipthera”, the leather goat skin upon which Zeus wrote the destiny of man. The operation Dr. Dick suggested, tracheotomy, known to the ancient Greeks, wasn’t a therapeutic option until 19th-century France. The 2,000 year ebb and flow of tracheotomy and diphtheria was a history of siamese twins—inexorably fused until surgery did them part.

Tracheotomy stumbled at the starting gate. Hippocrates opposed separation of cartilage and withheld his seal of approval. Tracheotomy was jinxed for six centuries. In the 2nd century A.D., Antyllus side-stepped Hippocrates’ admonition in a patient suffocating on an aspired foreign body. Avoiding the cartilage, he opened the space between the tracheal rings. This novel insight had eluded his brightest contemporaries, Galen and Aretaeus, and went unappreciated for 500 years. Paulus Aegineta (7th Century) noted the remarkable similarity of Antyllus’ method to suicide victims who cut their throats (i.e., crosswise, NOT up and down), yet were treatable.

As with any new foundling, names were numerous and agreement scarce. Antyllus preferred “pharyngotomy”. Paulus Aegineta liked “laryngotomy”, after Aurelius from the 5th century. In 1620, Nicolas Habicot used “bronchotomy”. Thomas Feyens’ 1649 De Tracheotomia opted for the unpopular, current term. After 150 years of cut-throat competition, the anatomically correct “tracheotomy” won the title match by the early 1800s.

Diphtheria had the opposite problem. Sore throat was an easy diagnosis... but what kind? Diphtheria’s characteristic, but not unique, tendencies to pick on kids and form greyish membranes weren’t stressed until the late 14th century. The symptom complex of sore throat, grouped as “quincy” or “angina”, was a confusion of diphtheria, scarlet fever, strep throat, thrush and myriad other conditions.

In Paris of the 1570s, Guillaume de Baillou took a different slant, that of an epidemiologist. Looking at specific characteristics to separate diseases, he came up with the first accurate description of whooping cough, distinguished measles from smallpox, and coined the term “rheumatism”. In 1578, during an outbreak of “membranous croup” he remarked: “I knew a young man who was attacked during the night by croup which threatened to suffocate him. He opened his throat with a sword. He lost much blood, but recovered. I have asked myself, if in this disease, when everything has failed, would it not be opportune to make an opening in the larynx. Certainly the operation is not without danger; but if it is carried out by a skilled operator who knew how to avoid the recurrent nerves, it would not be dangerous and would certainly give a chance for recovery.” In 1610, Marco Aurelio Severino, did exactly that. During the epidemic in Naples, Severino opened his patients’ windpipes and inserted metal cannulas. Many survived. The medical community was unimpressed.

Spain of 1610, watched in horror as angina maligna extracted its appalling toll. The year 1613 became “l’ano de los garrotillos”, the year of the garrote, after the then-current means of legal execution—strangulation. In the late 1600s, diphtheria immigrated to the New World colonies.

Tracheotomy found a friend in Padua: Hieronymus Fabricius ab Aquapendente, surgeon and anatomist of the first order, successor to the chair of Vesalius and teacher of William Harvey. Fabricius wrote the definitive work on tracheotomy. His introduction to “How One Must Pierce the Trachea in Quinsy” elevated the task to an exercise in nobility. “Of all the operations that the doctor performs on man for his cure, I have always held that for the principal one, which gives prompt relief to those who are at the point of death; that which makes the doctor entirely comparable to Aesculapius (the Greek god of medicine). Now one of this type is the opening of the trachea, whereby the patients almost suffocated from the inability to breathe are instantly relieved, and are again able to draw air into the lungs and heart, so necessary to life, and so seem to regain the life which they almost lost.” After reciting the admonitions of the ancients he quickly stipulates: “The surgeons of our time, frightened by all these authorities, do not dare to undertake this operation, and I, myself, in imitation of them, had never done it.” He adds the caveat. “If the operation should be executed happily, and with all the safety that one could wish, nevertheless, if some time later the patient should die, being suffocated because the trachea becomes obstructed, the blame would be cast on the incision and not on the true cause of death.”

Fabricius’ description and advice holds true today. He adds: “it is necessary to introduce a small cannula, the size of the opening, and having two wings to prevent its being pulled out, or being drawn into the interior by breathing; and it must be short so as not to touch the inner wall of the trachea; otherwise it will excite coughing.” His pupil Julius Casserius modified the cannula from a straight to a curved tube and tied it in place with cords encircling the neck. Casserius’ illustrations are the classic companions to Fabricius’ description, but like his mentor he shunned the operation.

The first record of successful tracheotomy preceded Fabricius’ prompting. Sometime before 1546, the Italian Antonio Musa Brasavola saved a patient suffocating from angina with absciss formation. After Severino’s 1610 dramatic but unappreciated demonstration, the next record come from Paris. In 1620, Nicholas Habicot published his series of four trauma victims salvaged by “bronchotomy” (a boy who swallowed gold coins to avoid being robbed, another boy with multiple stab wounds, a young female gunshot victim, and an officer who had cut his throat).

The 18th century literature was peppered with single case reports of success. Significant for the diphtheria connection

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was the 1766 report on a child by Caron at St. Germain en Laye. These were the sparks. The flame of acceptance remained unkindled. The terminology trap proved no problem for the German, Lorenz Heister (1683-1758). In his Of Bronchotomy, Laryngotomy, or Tracheotomy, he picked up the gauntlet. "I am not altogether ignorant that many Physicians are averse to this Operation, either esteeming it dangerous, deadly, or inhumane. But those Gentlemen are greatly mistaken: for the small Wound made in the Trachea by this Operation, is so far from killing, that even much larger, which are not made with this intention, are not to be judged mortal, as we intimated in treating Wounds in this Part. So that we cannot help thinking with Casserius, that those are both ignorant and timorous, who rashly neglect this safe, easy, and often salutary Operation."

Sore throats remained a hot topic in 17th and 18th century circles. England’s John Fothergill and John Huxham, the Americans Samuel Bard and Cotton Mather, and the Dutchman Nicholas Tulp added classics to the expanding body of literature. There was one problem. They still couldn’t tell diphtheria from the other culprits. The early 1800s witnessed an inexplicable remission of the disease. France, the only country not spared, provided the setting for the pivotal event in the diphtheria-tracheotomy connection.

Pierre Fidele Bretonneau was chief physician of the Hospice Generale in Tours. During the 1818 epidemic, he realized that (membranous) croup, malignant angina and angina suffocativa were the same disease. He coined the term ‘diphterite’ after the ‘leather-like’ membranous exudate, which he later revised to ‘diphtheria’. Diphtheria was understandably troubled. He had lost three sons to the disease. His beloved 5-year-old daughter Elisabeth exhibited symptoms similar to her unfortunate brother. She had been ill for four days and was clearly different from scarlet fever and the other pretenders. Seven years later he performed his first successful tracheotomy.

In June, 1825, the Count de Puysegur with parting accolades to the French Connection (Habicot, Feyens, Baillou, Caron, Bretonneau, Trousseau), diphtheria and tracheotomy separated paths. Isolation and angina suffocativa were the same disease. The Count ventured the 25 miles to Tours, pleading with Bretonneau to save his daughter. Bretonneau’s operation was a keeper. Bretonneau and his pupil, Armand Trousseau, championed its expeditious use and the claim of diphtheria as a distinct entity. The literature exploded with names, dates and numbers of tracheotomies for a variety of conditions with varying, but ever improving rates of success.

With parting accolades to the French Connection (Habicot, Feyens, Baillou, Caron, Bretonneau, Trousseau), diphtheria and tracheotomy separated paths. Isolation of the responsible organism by Edwin Klebs in 1883 silenced lingering criticism of Bretonneau’s theory. In rapid order, Roux and Yersins identified the bacteria’s specific exotoxin, and Behring and Kitasato developed an antitoxin and immunization serum. The scourge of diphtheria was reduced to the “D” in childhood’s DPT immunizations.

Emergency physicians, anesthesiologists and trauma surgeons live by the rule of A-B-C: Airway-Breathing-Circulation. Crucial as breath, heart beat and pulse may seem, they remain subordinate to an open airway. The echoes of history command us to action. “If you can’t tube ’em... GO FOR THE THROAT!”

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Anesthesia History:
A Bridge Across the Atlantic
Joint Meeting of
Two Historical Societies for Anesthesia

by Patrick Sim, Librarian
Wood Library-Museum of Anesthesiology

A joint meeting of the History of Anesthesia Society (HAS) in the U.K., and the Anesthesia History Association (AHA) in America, was held as a satellite event of the 12th World Congress of Anesthesiology in Montreal, on June 10, 2000. The McGill University Faculty Club hosted this joint event which attracted more than 30 anesthesia historians worldwide. Scheduled at the tail end of the World Congress of Anesthesiology, it was encouraging to feel the enthusiasm of the audience for the history of anesthesia. Eight papers were presented.

This meeting was the result of a tripartite cooperative effort. Dr. David Shephard of Prince Edward Island represented Canada, the host country, Dr. Jean Horton of Cambridge, President of the HAS, represented the United Kingdom, and Dr. Douglas Bacon, Secretary-Treasurer of AHA, represented the United States. Dr. Neil Adams, Secretary of the HAS, was in charge of this meeting.

The subjects of the papers presented at this meeting were international, featuring history of anesthesia in three continents: from Great Britain, France and Spain in Europe; from Nepal and China in Asia, and from the United States in America. A paper on the courageous ordeal of Lady D'Arblay, also known as Fanny Burney, in a mastectomy for cancer, was read by Dr. D.D.C. Howat. Lady D'Arblay endured for more than 20 minutes without anesthesia during the surgery in 1812, some three decades before the introduction of anesthesia. One of her surgeons was Napoleon's physician, Dominique-Jean Larrey. Dr. Howat's presentation was followed by Professor Maria Theresa Cousin, who discussed the development of neurophysiology in France, highlighting the works of Vulpian and Claude Bernard. Dr. John Severinghaus introduced Joseph Priestley both as a scientist and a philosopher during the era of the Enlightenment in Europe. He also offered an extensive display of the literature on Priestley, which constituted an excellent bibliography of his subject.

The next group of papers was closely

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associated with the authors who presented them. Dr. Ian Mclellan shared his stories of pioneer anaesthetists from Leicester, who had paved the way to the practice of anesthesia in that part of U.K. today. Dr. Jean Horton's story was even more personal. She described the administration of anesthetics at the casualty clearing stations during the Battle of Somme in 1916 from the personal experience recorded by her mother, who was a nurse tending to the wounded at that battle.

The final group of papers was related to the development of anesthesia in the Third World. Dr. Jose Carlos Diz of Santiago, Spain, recounted the work of Norman Bethune on blood transfusion during the Spanish Civil War. Canadian physician Bethune was a hero in the communist revolution in China. Patrick Sim
presented the development of anesthesia in China after the establishment of the People's Republic in the person of Dr. Deyan Shang. Finally, Dr. Bisharad Shrestha of Kathmandu, Nepal, gave a thoughtful presentation of the development of anesthesia in Nepal. It was interesting to note that this "celestial" nation was heavily influenced by Great Britain and India in its anesthetic tradition, despite the fact that China was its northeastern neighbor. Dr. Shrestha's theory was that the land-locked nation had an insurmountable geographical barrier along its border with China, so that Chinese influence in Nepal was minimal.

The McGill Faculty Club was situated in a locale permeated with intellectual pursuit. After the day-long session of history papers, the congregation trotted uphill to a sanctuary of the history of medicine established by a Canadian medical icon, Sir William Osler. The Osler Library was supposed to be closed on Saturday afternoon, but the acting chief of the library, Ms. Pamela Miller, kept it open especially for her international guests to enjoy this great historical collection for medicine. Special books and manuscripts associated with anesthesia were highlighted on display for the international visitors.
Literature... Continued from Page 15


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