

## **SURGEONS AND THE OPERATING THEATER: PAST, PRESENT AND FUTURE**

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Operating theaters have always been looked upon with a feeling of awe, wonder and dramatic expectations reminiscent of real theaters. Perhaps the only difference is that in surgical operating theaters, there are no rehearsals!<sup>1</sup> Each performance has to be the best. The personality of surgeons has always reflected this desire to perform the art of surgery in front of an appreciative audience. Surgeons are supposed to have “the eye of an eagle, the heart of a lion, the hands of a lady, and the flare of an accomplished actor,” as was stated about nineteenth-century surgeon, Fergusson.<sup>2</sup> In ancient times, operating theaters were the seats of excitement and tragedy, horror and terror; filled with the cries of patients and the gasps of witnessing audiences, and the struggle between the unwilling patient and willing volunteers fighting to hold them down. The courage of the surgeon and the speed of his actions were the only prerequisites. An attendant stood by, recording the time with a stopwatch in hand,<sup>3</sup> blood was collected in a box of sawdust and flaps were left unsutured.<sup>4</sup> Liston (1794-1847) and Fergusson (1808-1877) were credited with being able to amputate a thigh, including wound closure and dressing, in three and a half minutes. Best, an eighteenth-century surgeon, could remove a leg in under thirty seconds. Often the surgeon would acknowledge the compliments of the audience with a formal bow. All that remained to make the theater scenes complete would have been the fall of the customary theatrical curtains. Success was of vital importance, as failure, especially with royal patients, might have cost the surgeon his life. Although today the terror and horror of operating theaters might have diminished, thanks to scientific discoveries, the drama of performance still persists.

### **The Designs**

In ancient times, operations were performed on an “as

is and where is” basis. Surgeons would go to the patient with their toolbox and perform the surgical procedures, whether in the patient’s house, the camps, the streets or on the battlefields. The procedures were limited to emergency or life-threatening situations only. Abscesses were incised, sinuses and fistulae were probed, strictures were dilated, superficial lumps were excised and amputations were performed on patients. In the golden period of Islamic medicine (ninth, tenth and eleventh century Hijrah), medicine, like art, literature and science, was at its peak. Abdul Qassim Al-Zahrawi (tenth century Hijrah) was the Arabic surgeon par excellence of this era.<sup>5,6</sup> He was the first to actually perform surgery with his own hands rather than just supervise the messy jobs of the barber surgeons of his time. He also wrote an encyclopedia of medicine called “Kitab Al Tasrif Liman Ajiza and Al-Talif.” The thirteenth of the 30 volumes of this encyclopedia deals with surgery and surgical instruments.<sup>7</sup> This surgical treatise describes the details of wound care and wound suturing, bone setting and cauterization procedures. He is credited with performing the first successful thyroidectomy on record,<sup>8,9</sup> although Al-Tasrif mentions the condition as “tumor which occurs on the outside of the throat and is called elephant of the throat,” most likely referring to goiter.<sup>7</sup> He is also credited with many other operative innovations, such as guillotine for tonsillectomy, tracheotomy, lithotomy, amputation, foreign body extractions, and also the use of the tourniquet.

In spite of the detailed descriptions of surgical achievements, there is no description in Arabic literature of there being an organized operating theater. Like the obstetrical practices of that time, surgical procedures were performed on patients wherever they were, with such precautions as were then understood, such as proper washing of hands, instruments, use of boiling water and hot probes for cautery.

Although separate rooms for operations were proposed by Tenon in 1788, Dupuytren was performing operations on patients in their ward bed as late as 1815. Delpech (1817) returned to operating in the ward when adequate operating facilities were not made available. Even in 1926, Crile (Sr.) was reported to have performed “steal” operations in patients’ beds for exophthalmic goiter.<sup>3</sup> It

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was not until the sixteenth century that the concept of bringing patients to an arena where the surgeon would operate emerged. Ironically, this change in practice was due to another morbid development—the emergence of amphitheaters for anatomical dissection and demonstration on dead bodies, the result of the keen interest of physicians and laymen. In the seventeenth and eighteenth centuries, surgeons adopted these amphitheaters as an arena for performing and demonstrating operations, and giving lectures simultaneously. The most famous anatomy amphitheater was at Padua, Italy. Surgical procedures on live patients were performed and demonstrated to an enthusiastic surrounding audience, with no regard for contamination, sepsis or eventual pain.

It took a long time for the sanctity of the operating theater to be established, thanks to the pioneering works of Lord Lister and other scientists of the seventeenth to nineteenth centuries. Appalled by the horror and tragedy enacted in the surgical amphitheaters before the antiseptic revolution, Stephen Smith, a New York surgeon, in 1878 advised abolition of operating amphitheaters as dangerous to the patient and useless for the purpose of instruction.<sup>3</sup> Genuine fear of contamination and asepsis altered the whole design of operating theaters. Still retaining the form of amphitheaters, the main operating room was separated from other nonsterile areas. Glass partitions separated the operating room from the visitors' gallery, allowing demonstrations without contamination. Movements of patients and personnel, air flow in the operating room, as well as other essential rituals were defined and controlled so as to keep the environment free from contamination. By 1898, surgical amphitheaters disappeared and either became small appendages of surgical wards, or were rebuilt to incorporate separation of the performers from the observers. Advances in microbiology and asepsis shook the very foundation of the surgeon's role. The major advances were the four A's: anesthesia (1846); antiseptics (1867); asepsis (1886); and antibiotics (1929).<sup>4</sup>

The next essential change in operating theater design came with the concept of economizing resources. Centralization of supplies, and the use of monitoring stations and accessory facilities were found to be economical and so operating theater complexes were created to incorporate all these requirements. The rapid development of endosurgery is poised to herald a new concept in operating theater design.

### The Facilities

Gone are the days when gas cylinders, suction apparatus and cautery machines were wheeled around all over the operating theater from room to room. Most of these are now centralized and are incorporated in the overall design. All one sees are the tubes connected to the

ceilings or the walls. The operating tables themselves are specially designed to facilitate convenient access to operating fields. On-the-spot availability of diagnostic radiology equipment, microsurgery apparatus, stored blood or blood-saving devices for autotransfusion are all becoming standard fixtures. Laser technology, ultrasound and monitoring equipment for keyhole surgery are being incorporated. Equally important are patient monitoring machines for hemodynamics, anesthesia, cardiorespiratory function and even for cerebral functions where necessary. This is not to mention the equipment required for specialty surgical procedures such as replacements and transplantations.

### The Rituals

The history of the operating theater is full of mystique as far as rituals are concerned. In the past, surgeons did not wear gowns, masks or gloves. Coats were not removed and sleeves were rarely rolled up. Hands and clothes were cleaned only after the operation to remove the messy blood.<sup>4</sup> The theatrical appearance of surgeons, with their flowing robes, has been replaced by a spaceman-like creature covered by gown, cap, mask and gloves. Rituals such as scrubbing hands to the tune of a ticking stopwatch, shaving operating areas meticulously and changing knives after every layer of incision have all been in vogue at one time or another.<sup>10</sup> Some rituals seem to have had scientific arguments in favor of them, while others seemed more rooted in superstition.

The credit for the introduction of surgical gloves is generally given to the American surgeon William Halsted. Paradoxically, his reason for the use of gloves was not asepsis, but to protect the hands of his scrub nurse from reaction to mercuric chloride solution. It was a coincidental observation that the incidence of asepsis decreased. Halsted then popularized the use of gloves and married his scrub nurse. It is again paradoxical that later, many surgeons removed the gloves for delicate maneuvers such as closed mitral valvotomies with uncovered sharp fingernails. Wearing a face mask is another theater ritual, probably the least important, since many modern surgeons do not wear them and yet report no increase in wound infections.<sup>5</sup>

Cushing at the Hopkin's insisted upon total silence to minimize droplet infections of wounds.<sup>4</sup> Silence, however, is now being replaced by music. Playing music in the operating room, either of the surgeon's choice or that of the patient before he slumbers into the oblivion of anesthesia, is another well-tried fad. Music played in and around the operating theater may be soothing for patients as well as staff, and can far outweigh any inconvenience by providing a diversion and releasing the anxiety of patients, breaking the monotony of the atmosphere and creating a

closer bond among the surgical team by decreasing the level of tension fatigue. A scientific study has also concluded that soothing music can be helpful in clinical situations where reduction of the basal metabolic rate and relaxation are required. Exposure to soothing music relaxes patients and contributes to smoother anesthetic induction and/or the use of smaller amounts of sedation and anesthetic agents.<sup>11</sup> A study in the US showed that surgeons' speed and accuracy at mental arithmetic improved by listening to music of their own choice.<sup>12</sup> This shows the importance which must be given to the work environment, along with the precision of the work itself.

### The Future

What is in store for the future? We have come a long way during this century. With the emergence of highly specialized surgery, such as transplant operations, there has been a transient rebirth of the operating amphitheater to allow the drama to be witnessed by observers. Surgical celebrities from the world over come to view bold and innovative procedures.<sup>3</sup>

We are likely to have operating theaters in the next century very much like the amphitheaters of the past, but loaded with modern technology. Conventional gaseous anesthesia may be replaced by electronically controlled neurolept anesthesia. The laser and the ultrasonic knife may replace traditional scalpels, although it is hard to believe that the standard surgical knife will become obsolete.

Audiovisual technology will play a prominent role. A whole wall will act as a wide screen in the operating room, in place of a television monitor. It will prove to be convenient to operating endosurgeons as well as to keen onlookers. Close-circuit televisions will help to teach and train. Tele-consultations during operations, between the operating surgeon and any advising authority sitting on the other side of the world should be possible with satellites and appropriate equipment in operating rooms. Someday, computer-controlled robots may take over those procedures

which are standard and repetitive, such as shaving, cleaning, towelling, positioning, even opening and closing, and probably zipping the cavities.

Where will this all end? "That there must be a final limit to development in our profession, there can be no doubt; that we have nearly, if not quite, reached these final limits, there can be little question," John Erich Erichson wrote in 1873.<sup>4</sup> It would be foolish to have similar thoughts today. We can only imagine what the operating amphitheaters of the next century will be like. Perhaps with miniaturization of access and equipment, the surgeon of the next century may walk, drive, or even fly with his paraphernalia and operate wherever the patient is, under the safety of bloodless surgery and an antibiotic umbrella. Popularization of day surgery and outpatient procedures, advances in endosurgery and gene therapy, may make standard operating theaters redundant and obsolete.

One thing, however, will never change. The surgeon will continue to be the key performer in any type of operating amphitheater of the future.

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