Dr. Karl Storz millennium lecture on new technology

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One world, one people, one surgery

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I am grateful to President Dr. Peters, the Board of Governors, the Program Committee and the entire membership of the Society of American Gastrointestinal Endoscopic Surgeons (SAGES) for having afforded me the honor of delivering the Dr. Karl Storz Lectureship on New Technology. New technology speaks for itself and needs no one to eulogize it. It is the *raison d'etre* of our progress. Although it gives me great pride and joy to deliver this lecture, I must confess that I cannot fathom what prompted me to select this preposterously pompous title, One World, One People, One surgery. For weeks I have kept wakeful nights trying to come to grips with the glaring and obvious contraindications in this title. India has a dozen major religions and many more languages. Its social strata swings from the absurdly opulent to the depressingly deprived. If it is difficult to visualize one people in one country, how about one world! Living and working where I do, I know better than most how relative is the term "new technology." To several in this room, new technology would mean virtual reality and beyond, but to someone in a village without electricity, new technology could well mean a flashlight!

There is a sensitivity in the developed world that induces an aversion to seeing objectively, face to face, the deprived conditions of life in a large number of their fellow humans in other parts. I assure you that it is not my intention to hurt this sensitivity. I am grateful to SAGES for accepting the subject of my talk. In this acceptance I find an openness and a desire to see how new technology, which is the gospel of truth, faith, and progress in some parts of the world, impinges on and affects life, health, and surgery in other parts. In the current state of world history (or is it geography?), 75% of the world land mass and 85% of its population are in a state euphemistically termed "developing". I admire SAGES for its change of focus to see new technology through the eyes of 85% of the world's people. A few members here may question how that should concern or interest them. As a 2000-year-old technology taught, whatever befalls the least of my children concerns me, for what avails a man if he gains the whole world, yet loses his soul?

What the term "developing" means is that in India, for example, 50% of the people have no electricity at home; 40% have no safe drinking water; and 35% live far below the poverty line. If these are the ground realities in just one country, how could I even remotely conceptualize the phenomenon not only of one world or one people, but also of one surgery? The reason I can do so is because I conceptualize not as an economist, not as a bureaucrat, but as a surgeon. I believe surgery is a humanitarian science, and if it is to be that, then the cutting edge of surgical progress must be made available and affordable to all people in all places. Here I would like to stress the distinction between surgical progress and surgical technology. Although both often go hand in hand, they are not synonymous.

I was forced to learn the difference between surgical progress and new technology very early in my surgical career. When I returned to India in 1963 after working in England, I found that we could not treat children with hydrocephalus in Bombay as I was used to doing in Liverpool, because the Spitz or Pudenz shunts were unavailable and unaffordable. Soon after my return, the same surgical progress was adapted to India by use of the valves in the mother's saphenous vein (Fig. 1) to create an affordable and functional ventriculojugular shunt [9].

I owe my somewhat heterodox and quixotic thought process to my Alma Mater the Ghordandas Sunderdas Medical College, which at its inception 75 years ago, at the height of the British Raj's power in India, created ripples by appointing to its teaching staff *only* native-born Indians, and which has as its motto "You are here not to worship what is known but to question it." I also owe an equal debt to my Chief in the same institution, Professor P. K. Sen, who pioneered open heart surgery in India, performed the first heart transplant in Asia, and who gave me for my Ph.D. thesis the subject, Transmyocardial Acupuncture for Myocardial Revascularization Corelation With the Reptilian Heart. Although our work was published [7, 8], not only did the University of Bombay reject my thesis, it derecognized

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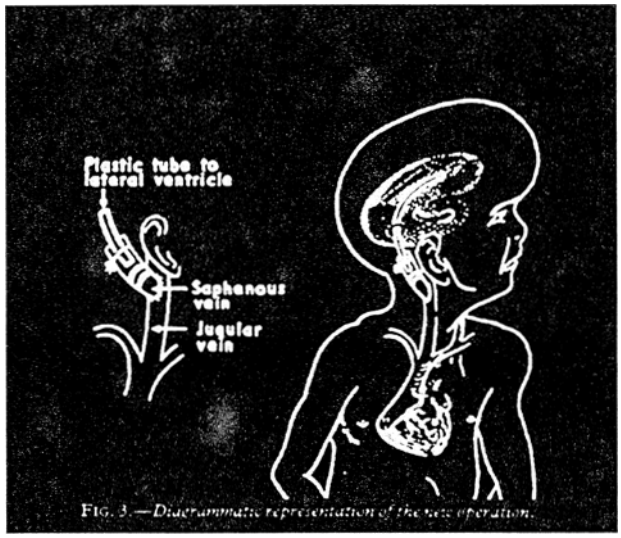


Fig. 1. Diagrammatic representation showing use of saphenous vein for ventriculojugular shunt.

Professor Sen as a guide for Ph.D. research at the University of Bombay for what it termed initiating such absurd research. Thirty years later, with the advent of lasers, the same procedure now is given due respectability and importance as a "new" method of myocardial revascularization [5], which shows how new technology can breathe new life into old "absurd research."

I head the Department of Minimal Access Surgery at the Hinduja Hospital and Research Centre in Mumbai, which is affiliated with the Mass General Hospital, where working conditions are quite similar. In a perfect example of diversity, for more than 30 years I have had the great joy and pride of working in the Department of Surgery at the J. J. Hospital, a 165-year-old teaching hospital affiliated to the University of Bombay, 5 hours every day, for no remuneration at all. This "honorary" service was common practice in India and performed by thousands of doctors all through their best working years.

Figure 2 shows my ward in the J. J. Hospital, and working for these patients was ample remuneration. So overburdened were resources that a mere x-ray would take weeks to materialize. In 1971, after seeing Dr. N. D. Motashaw, a gynecology colleague, do a diagnostic laparoscopy, I was convinced that laparoscopy could hasten diagnosis and treatment, improve bed use, and reduce expense and patient distress in my unit. At that time, no endoscopy equipment was being manufactured in India. For that matter, in 1971, unlike today, there were very very few manufacturers anywhere dedicated to endoscopy.

It was not the pursuit or acquisition of new technology, but sheer economic necessity, that took me to Tuttlingen, Germany in March 1972. There, for the first time, I met Dr. Karl Storz (Fig. 3), to whose genius, perseverance, perfectionism, and commitment to the evolution of new technology and the welfare of the surgical patient this lecture is dedicated. Figure 4 shows the equipment I acquired from Karl Storz in March 1972. Over the years, thousands of tributes have been paid to Dr. Karl Storz. To my mind, blurred as this 30-year-old picture is, it represents one of the highest tributes that could ever be paid to any manufacturer of surgical technology anywhere. This diagnostic laparoscopy set, which I used in a teaching hospital for 18 years, helped me treat a few thousand welfare patients and train almost 100 surgical residents. This set traveled with me all over India and into neighboring countries for training workshops in large cities and small remote towns. Through these 18 years, this equipment worked as perfectly as the day it was purchased. Surgeons have waxed lyrical over the optics, sophistication, and precision of new technology, but to

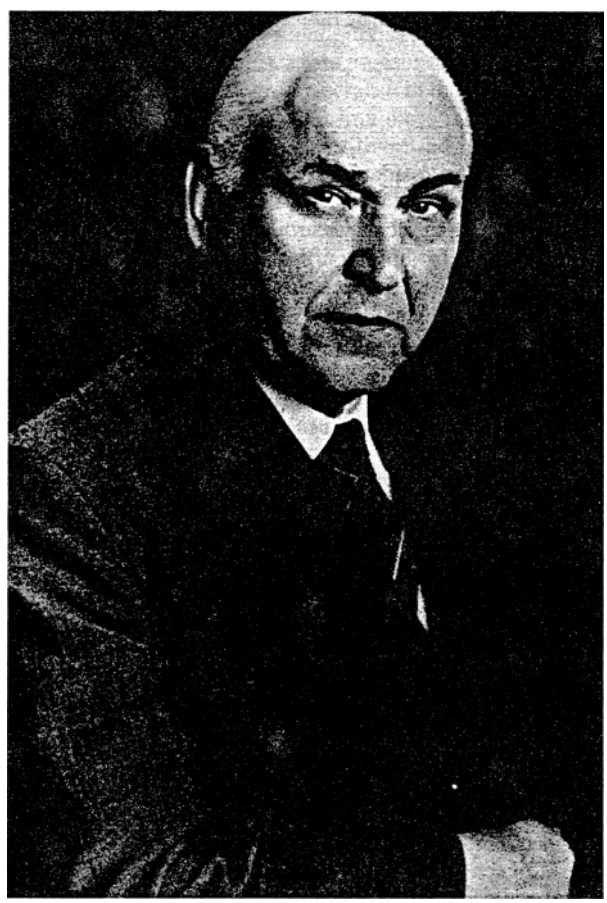


Fig. 2. Ward 19A, J. J. Hospital Bombay, 1971.
Fig. 3. Dr. Karl Storz. He believed in the beauty of his dreams.

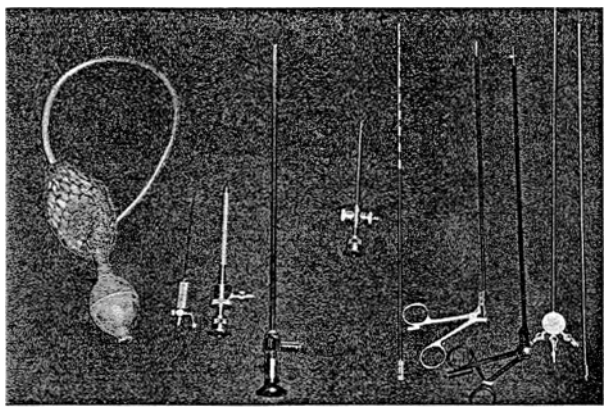


Fig. 4. Diagnostic laparoscopy equipment, 1972.

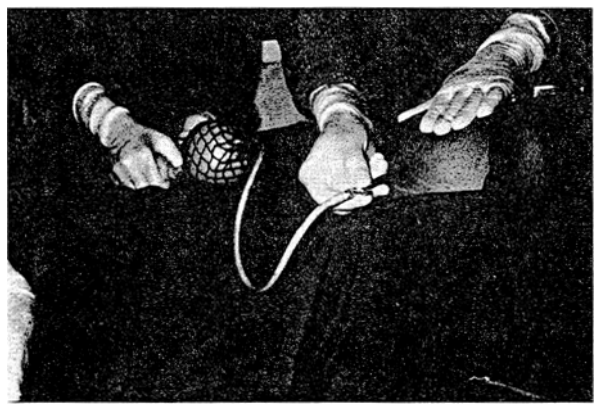


Fig. 5. Pneumoperitoneum created by a sigmoidoscope air pump.

me in a developing country, its durability, its longevity was the real essence of true technology.

I could not afford a nitrous oxide or carbon dioxide insufflator, so I used a sigmoidoscope air pump (which hopefully had not just been used for a sigmoidoscopy!) to create a pneumoperitoneum (Fig. 5). What I started because of economic necessity I continued to use for years by choice, for we did all our diagnostic laparoscopy with the patient under local anesthesia, [10] and the slow gentler increase in the pneumoperitoneum by the small pump was far kinder and more acceptable to the conscious patient. Furthermore, atmospheric air was less irritating, and no more dangerous. This simple air pump, which cost 40 rupees (~$1 U.S.) in India, taught me a new perspective and a great deal about the evaluation of new technology, that what is good for the patient *is* good technology and that simple equipment is very often as effective, at least as safe, and certainly very much cheaper. Now when I see new equipment, new technology, I ask myself, "is this *really* an advance in technology or is it just another new toy? Can something like my sigmoidoscope pump perform the same function?" Of course, outpatient laparoscopic sterilization has amply vindicated, the cost effectiveness and value of new technology in developing countries by aiding us in one of our greatest challenges: population control.

The cost of the diagnostic laparoscopy equipment we used at the J. J. Hospital, when spread over 3,000 patients, works out to 30 rupees per patient (~$$0.75 U.S.) (Table 1). With biopsy-proven positive diagnostic rate of 84% this proved that technology, when appropriately applied, far from being a financial burden, was distinctly cost effective in poor countries.

In September 1989, I wrote to Storz, Tuttlingen, Germany, for laparoscopic surgery equipment, and in March 1990 I again was in Tuttlingen, this time to meet Ms. Sybill Storz. With this equipment (Fig. 6), I began performing laparoscopic surgery, which, to the best of my knowledge, was the first in a developing country. In a very short time I was convinced of its numerous benefits to the patient. With frenzied and missionary zeal, I held workshops in teaching hospitals and small towns, in India and neighboring countries, in an effort to spread the gospel of endoscopic surgery. These "see one, do one, teach one" workshops (Fig. 7) were

Table 1. Cost-effective diagnostic laparoscopy

Equipment cost in 1972	
Repairs, replacement	94,000 rupees
Equipment cost per patient	30.3 rupees (~$0.75 U.S.)
Used 1972–1990 for 3,100 welfare patients	
Equipment helped to train more than 90 residents	

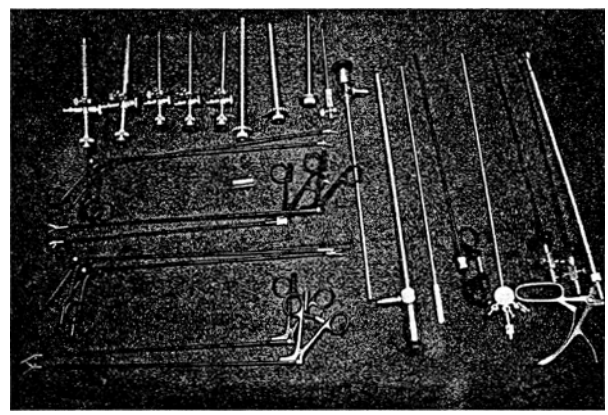


Fig. 6. Laparoscopic surgery equipment, 1990.

a very poor medium for teaching laparoscopic surgery, but there was no charge for attending these workshops, and they aroused immense interest and awareness in the surgical community (Fig. 8). From each workshop, a few surgeons came for more systematic training.

What started as a small dot on the map of a big country had taken on the proportion of a measles epidemic within 4 years. Currently, more than 1,200 members of the Indian Association of Gastrointestinal Endo Surgeons are doing safe and economic laparoscopic surgery all over the country. Although laparoscopic surgery unfortunately still is beyond the financial reach of many patients, it is gratifying that the same surgery is performed 6 to 12 times more economically in small towns and rural areas than in large cities.

Those of us who pursued this new challenge in surgery were not without our strident critics from all parts of the

Fig. 7. Early laparoscopic surgery workshop.
Fig. 8. Live transmission from operating room.

world [1–4]. We were castigated for our warped perception of health care, our distorted values, and our disregard for reality, and for promoting the enemy of the good. Even our ethics were questioned. When analyzed with cold calculation, there is truth and logic in these criticisms, which in effect, however, unfortunately boil down to just one question: What right have a poor people who lack drinking water, sanitation, and primary health care to aspire to high-technology surgery or even to deserve it? To the economist, statistician, and hard-thinking realist, this question may make sense. To me, what makes sense is that in the entire history of surgery, from the dawn of mankind right up to the present, there have been only three patient-friendly revolutions, those brought about by asepsis, anesthesia, and minimal access surgery. I cannot passively accept that in one country or in one world there must forever and ever be perpetuated a class system with a second tier of humans fit only for second-rate surgery. The poorest of the poor have as much right as anyone to less pain after surgery, reduced medication, less morbidity, shorter hospitalization, and early return to home, family, and work. Minimal access surgery and the expensive technology it requires is advocated, not as homage or tribute to new technology, but in appreciation of the manifold benefits this new technology gives our patients and our people.

The preamble to the World Health Organization (WHO) charter states: "The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human without distinction of race, religion, political belief, economic, or social condition." These are brave words, but they ring so hollow to those who work in developing countries. In all these developing countries, two parallel systems of medicine are found:

1. Large hospitals in cities that cater to 15% of the population and receive a disproportionate 80% of health funding
2. Primary health care centers in rural areas, that serve 85% of the population and are starved of funds.

Both of these systems work in sad isolation. No longer can doctors in the cities work in arrogant oblivion to the totality of health care in the developing world. Both of these systems must interdigitate into one unit, with the larger institutions realizing their responsibility and duty to overall health care. Many surgeons in many countries are working toward the fusion of these two systems. As an example, the Association of Surgeons of India, which corresponds to the American College of Surgeons, is developing an outreach program of the Surgeons Volunteer Corps in an attempt to bridge the gap between these two systems of health care.

If new technology is to take firm root in developing countries and play a meaningful role in health care, it *must* be made economical. The following factors can help.

Table 2. Reusable instruments (March 1990–February 1993, 1,084 cases)

Verress, 5 trocars, 2 reducers, and set of 18 hand instruments		274,390 rupees
Sterilization, repairs, replacements, clips, etc.		555,000 rupees
Total cost		829,000 rupees
Cost for 1,000 patients	–	829,390 rupees (~$20,000 U.S.)
Cost for 1 patient	–	830 rupees (~$20 U.S.)

Reusables

There is just no place for disposable equipment. The cost of our hand equipment including sterilization, repairs, and the likes when spread out over our first 1,000 patients, was a somewhat affordable 860 rupees (~$20 U.S.) per patient (Table 2). Reusable supplies go far beyond economy to express a commitment to conserve the earth's resources and ecology. It is reported that in some parts of the world an average-size hospital generates, each day, enough disposable throwaways to fill one average-size swimming pool. Perhaps we can take a message from a statement in Gibbon's book, *Decline and Fall of the Roman Empire:* "The Roman Empire crumbled under the weight of its own prosperity." It would appear that expenditure alone cannot ensure safe patient care. Leape reported [6] that the incidence of iatrogenic injuries, if related to the airline industry, would be the equivalent of three major jetliner crashes every 2 days!

Simple equipment

Economic necessity demands that the surgeon in the developing world innovate with his equipment to fit his budget.

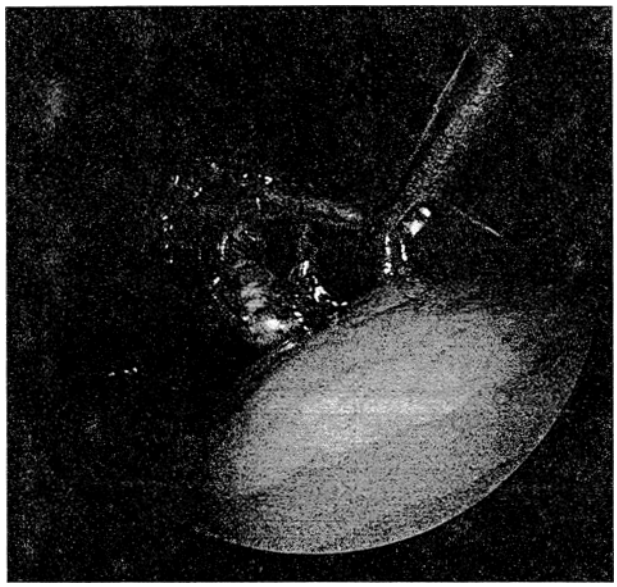
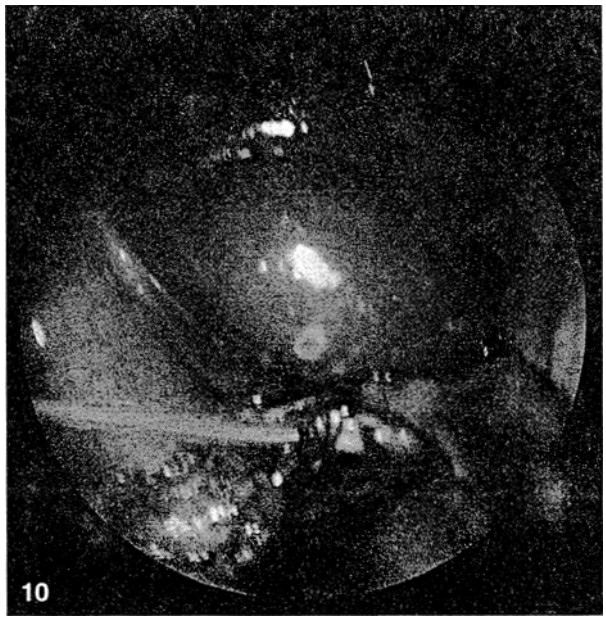


Fig. 9. Hook dissector.



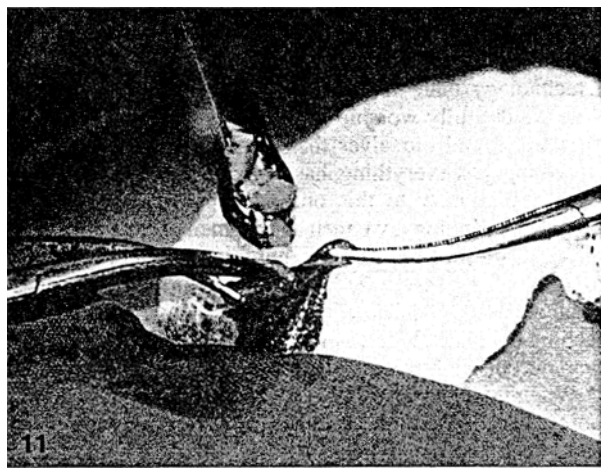


Fig. 10. Infant feeding tube as a cholangiography catheter.
Fig. 11. Ovum forceps as a stone crusher/evacuator.

A simple hook dissector (Fig. 9) (the prototype of which was fabricated by a motor car mechanic) safely skeletonizes tubular structures. A soft, sterile, smooth infant feeding tube, which costs 20 rupees (~$0.50 U.S.) makes an ideal cholangiography catheter (Fig. 10). An ovum forceps, no longer in use in the obstetrics and gynecology division and given to us, makes an ideal lithotriptor and stone evacuator [11] (Fig. 11). We make our own endoloops in-house, and one strand of catgut is all that is required for a laparoscopic appendectomy. As Table 3 shows, we do not miss the luxury of staplers.

Instrument care

No better incentive exists to ensure immaculate instrument care than the knowledge that there is just no money for replacements. Every piece of equipment merits the gentle care and devotion given to a newborn baby. Given this care, quality equipment lasts indefinitely. It is considered neither undignified nor a waste of time for the head of the department to give a hand in instrument care.

Complication-free surgery

Every complication, minor or major, adds greatly to the cost of surgery. However perfect a hepaticojejunostomy, it can never compensate for the physical, mental, emotional, financial disaster of a common bile duct injury.

Local manufacture of equipment

Producing equipment domestically greatly reduces cost.

To be of practical benefit, and let us never forget that surgery is a practical institution, new technology must conform to our criteria of five A's: affordable, available, accessible, acceptable, and appropriate. If a surgeon in rural India must send carbon dioxide cylinders 350 km over bad roads for refilling, I would maintain that using atmospheric air for creating a pneumoperitoneum would be appropriate and acceptable because it is affordable, available and accessible. In January 2000 at the Indian Science Congress, India's elite scientists presented showpieces of new Indian technology: satellites, missiles, radio telescopes, and supercomputers. Not surprisingly, the new technology that received a great deal of attention and appreciation was a simple lever that stops a bucket of water from falling back

Table 3. Laparoscopic appendectomy cost and time factors

	Catgut	Staplers
Cost	60 rupees (~$1.5 U.S.)	12,000 rupees (~$300 U.S.)
Time	9 min	5 min

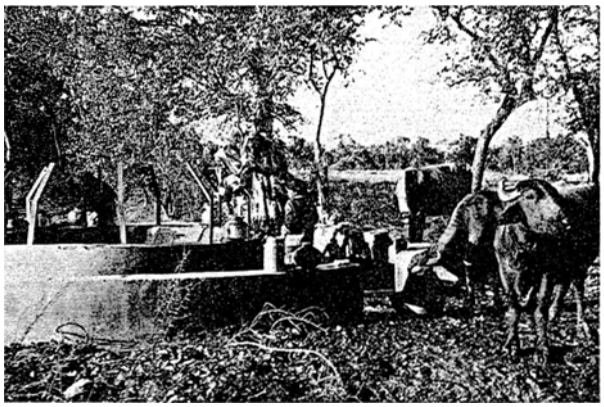


Fig. 12. Appropriate new technology.

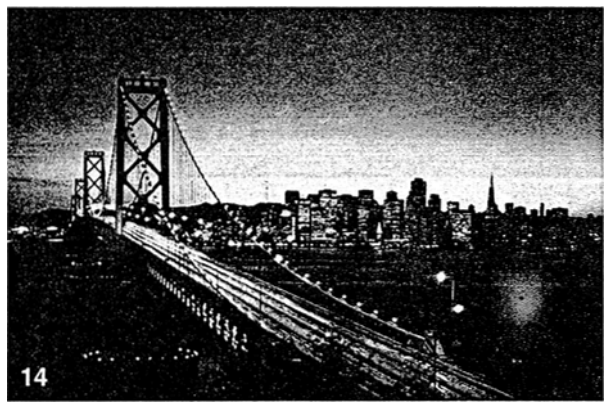


Fig. 13. The Doctor Sir Luke Fields (1891). Tate Gallery, London.
Fig. 14. Bridge to equitable health care.

into the well as it is being winched up. To millions of women who daily draw their water from a well, this new technology was worth much more than all the satellites, missiles, and telescopes not only because it was affordable and available, but also because it directly and significantly improved their quality of life (Fig. 12).

A century is but a dot in the history of mankind, yet in this one last century, there possibly has been more progress in technology than in all the preceding aeons. However, while we dutifully worship at the high alter of technology, we must remind ourselves that there are no free lunches. Everything, just everything, has a price. From the beginning of the last century to this one, is it possible that in our pursuit of technology, we men and women of medicine have lost a great deal of our softness, humility, humanity and true caring and compassion for our patient? Norman Cousins in his book *Anatomy of an Illness* writes: "Patients are today reaching out to the doctor not just for medical help. They are reaching out for kindness, assurance, hope."

When my father, a family physician working in the very poorest part of Bombay, decided to retire at the age of 84 years, he asked me if there was anything I would like to have from his office. I asked for his 1916 edition of *Gray's Anatomy* and for the print of the doctor shown in Fig. 13, which had hung in his office for decades. I found that he had made a notation for me on both of his gifts. On *Gray's Anatomy* he had written, "Respect the human form," and on the print he had inscribed, "If you would enter the temple of medicine, never do so with the soul of a moneychanger." Even now, several doctors are ready and willing to donate a few hours every day throughout the best years of their lives in an effort to level the discrepancies in the dispensation of surgical care. The surgeon in the developing world is realizing that the real challenge facing world surgery is not the inventing or harnessing of new technology, which sometimes merely succeeds in making the simple exquisitely complicated. The real challenge is to spread surgical relief and progress to those who are currently beyond its reach, so that the Preamble to the WHO charter does not remain forever empty rhetoric but can be translated to a dream come true. I ask this question to all: Would organizations such as SAGES, International Federation of Societies of Endoscopic Societies (IFSES), and European Association for Endscopic Surgery (E.A.E.S.) be interested at all in meeting this challenge? If they have the will, I am sure they will find the means. Just in meeting, if not in overcoming, the challenge, we will savor great success, because the true measure of success is not so much the position one has reached as it is the obstacles overcome in pursuit of success. By facing this challenge, we could together reach the most significant triumph of world surgery. Please believe me, it would be a two-way exchange, in which you could be pleasantly surprised to find yourself learning from your colleagues in our one world to achieve the same result with far less expense.

The picture of a bridge shown in Fig. 14 can be seen in any endoscopy journal. To me, this picture is not representative of new technology, but the fulfillment of a dream in which the human spirit, the gospel of love, and empathy for the less privileged *will combine with new technology* to carry 85% of the people in our one world across the bridge from darkness to better and more equitable health care. As Eleanor Roosevelt said, "The future belongs to those who believe in the beauty of their dreams." If we did not believe in the beauty of our dreams, none of us would be surgeons.

There is always a very real danger that we may take ourselves and our technology far too seriously. An anecdote recorded in the annals of the 200-year-old Bombay Asiatic Society always helps me cut myself down to size. It would appear that Mark Twain, while visiting Bombay in the early 1900s, was involved in an erudite discussion on Darwin's theory of evolution. When he could stomach this learned discussion no longer, Mark Twain stood up and said, "La-

dies and gentlemen, there is no way man could have descended from the monkey. I have it on good evidence that God created the monkey later because He was disappointed with man."

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