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NEW SURGICAL HORIZONS

Navigating laparoscopic surgery into the next decade in developing countries—a personal perspective

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Abstract
Introduction Over 500 years ago, Vasco de Gama navigated from west to east, from Lisbon in Portugal to Calicut in India, in an epic voyage that lasted over 1 year (Fig. 1). This voyage was perhaps the greatest historic and, certainly, the greatest navigational achievement of the last millennium. For better or for worse, it catalysed a series of events that forever changed not only the history, but also the geography of the world.
Discussion In our plans to navigate endoscopic surgery into the next decade in developing countries, we too should endeavour to change both the history and the geography of surgery. This talk traces a journey over 34 years of effort to spread laparoscopic surgery into developing countries.

Keywords Minimal access surgery · Navigation · Cost-effective · Developing countries

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Essentials for navigation

From the triumphs of navigators like Cheng Ho, Vasco de Gama (Fig. 1), Magellan and Columbus, one can learn that there are some fundamental essentials for navigation.

Vision The first prerequisite for navigation is the vision to see way beyond what the eye can see. This vision was best exemplified in laparoscopy by Kelling, Kalk and Beck. With the eye to telescope, Semm, arguably the first true laparoscopic surgeon exemplified in endoscopy vision, enterprise and tenacity, performed an endoscopic oophorectomy in 1976 (Fig. 2). In 1980, he had produced the first profusely illustrated book and color atlas on laparoscopy and laparoscopic surgery, and in the same year performed the first laparoscopic appendectomy, which was not accepted for publication until 1983 [1].

Enquiring mind A mind that never stops questioning. I was fortunate that the motto of my alma mater is "you are here *not* to worship what is taught, but to *question* it," for asking questions is the fuel for moving forward.

Courage To surmount all obstacles in the face of ridicule, failure and disaster. Erich Muhe, in a small German town, performed the first closed cholecystectomy in 1985 but paid dearly for his courage to break new ground and to oppose the establishment. He was ostracized by his peers and colleagues for his 'surgical blasphemy'. He ultimately paid heavily for his belief in minimal access surgery (MAS). To me he is the face of courage in the advance of MAS.

Preparation Just as the navigators of yore prepared for their voyage by making their ships sea worthy, stocking adequate provisions, and recruiting the best sailors, so too,

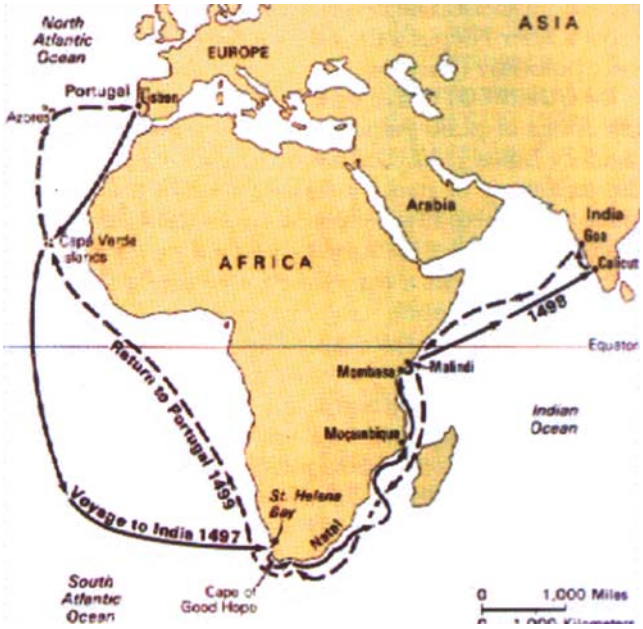

Fig. 1 Vasco de Gama voyage, west to east 1497

as we navigate into the next decade, we must ensure that our preparations are thorough. And of all preparations in surgery, the most basic is education. Laparoscopic surgery is *not* a 'different' surgery but the logical progression of general surgery brought about by improved technology, and the basic tenets of training for all surgery are similar:

- Training
- Technique and technology harnessing
- Temperament

Endoscopic surgery, by its inherent drawbacks and deficiencies, demands the ultimate in surgical skill, manual dexterity and pinpoint eye–hand coordination, and it is understandable, necessary and desirable that the thrust of training for MAS is towards manual surgical mastery. Depending on the facilities available, this training module could be the most basic or the most sophisticated equipment in the developing world—from a home-made box trainer to a more sophisticated trainer to a virtual reality trainer, all indigenously manufactured (Fig. 3).

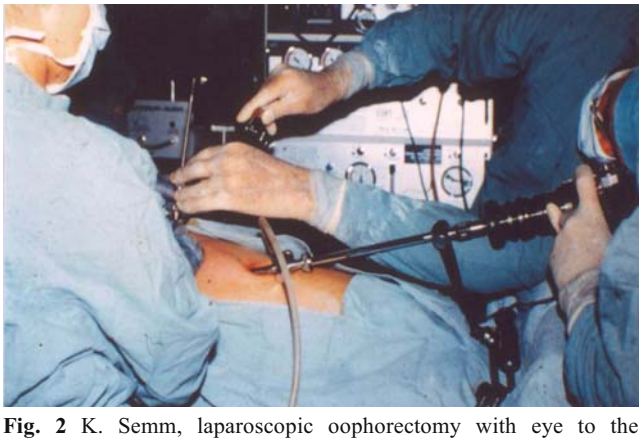

Fig. 2 K. Semm, laparoscopic oophorectomy with eye to the telescope or camera 1976

However sophisticated and futuristic our simulator exercises and studies are to improve and excel in manual dexterity, they will teach only a fraction of what attributes a surgeon needs to navigate endoscopic surgery into the next decade. It is my ardent prayer for future surgeons to maintain the traditional Billroth 'teacher–trainee' relationship whose benefits and teaching go beyond measurable and definable surgery to a higher level of patient care, decision making, empathy and ethics, none of which can be learnt from books, simulators or the Internet. It is from his teacher that the young surgeon will also learn to beware of the sinister Achilles' heel of endoscopic surgery, best defined by the Greek word 'hubris'—overweening self-confidence, pride and arrogance.

Technology into the next decade

There can be no doubt that the driving force that will navigate endoscopic surgery into the next decade will be the technological explosion we are seeing unfold before us:

1. Telemedicine
   - Regular training for far-flung centres—especially helpful in developing countries with vast areas
   - Preceptorship through video-based surgery
   - Guidance in times of crisis, complications for surgeons in distress in small rural centres
2. Energy sources
   - Noncontact cutting, coagulation–reinvention of lasers
   - Precision guidance to reduce lateral damage to microns
   - Smart energy, i.e. tissue differentiation energy able to distinguish between 'targeted' and 'nontargeted' tissue
   - Miniaturisation of extracorporeal shock wave lithotripsy may find applications in tissue dissection
3. Tissue approximation
   - Synthetic biocompatible glues and biodegradable approximating devices will develop
4. Instrumentation
   - Manipulations in hand instruments—3 or 4 degrees of movement
   - Instruments that function through flexible endoscopes
   - Tactile feedback in hand instruments

Fig. 3 Three trainer modules, 1989–2006 progressive sophistication from plastic box to dry trainer to virtual reality

5. Robotics

Surgery is not just a technological or a manual proposition but also a human application. In the developing world, to make logical use of the triumph of technology, it must be offset by what is termed the five A's of practicality. Any technology to be of practical benefit *must* be *affordable*, *acceptable*, *accessible*, *available* and *appropriate*. Everything comes at a price—there are no free lunches. We are so enamoured by our technology that we fail to see its downside. We have "taller buildings but shorter tempers, wider freeways but narrower viewpoints, fancier houses but broken homes, more conveniences but less time, added years to life but not life to years," where the surgeon may end up being coldly clinical but perhaps not warm, kind and humane.

Mindset adaptability The capacity to adapt one's mind to various parallel possibilities of technique. In the late 1970s and early 1980s, several surgeons were doing a vast volume of upper gastrointestinal endoscopy. When endoscopic common bile duct calculi retrieval by endoscopic retrograde cholangiopancreatography was described and in its infancy, most surgeons ignored the procedure, complacent in open choledochotomy. The surgeon of that time (myself included) was totally deficient in mindset adaptation. Similarly, complacent as we are in the advances of laparoscopic surgery, we need to keep an open mindset and mentally be ready to adapt to the emerging role of intra-luminal surgery that could be an important force navigating MAS into the next decade [2, 3]. An endoscopic Barrett excision may well be the first step to far more advanced intra-luminal surgery [4].

Honest factual appraisal Not to wilt under peer pressure, believe blindly what is stridently proclaimed by surgeons or manufacturers but to have honest evaluation of the situation. Laparoscopic hernia repair is often described with fundamentalist zeal as the 'gold standard' of hernia repair.

Laparoscopic hernia repair is, I am convinced, a good method of hernia repair in expert hands. Laparoscopic cholecystectomy had a market penetration of over 93% within 3 years. In contrast, in the *developed* world, market penetration of laparoscopic hernia repair varies from 4 to 15% after 14 years [5–7], far less in the developing world. An appreciable percentage of patients with strangulated hernia in East Africa do not reach surgical aid [8], and a large percentage of patients with hernia all over the developing world cannot afford a mesh repair. In view of its dismal market penetration and the economic status of the vast majority, how can laparoscopic hernia repair be termed the 'gold standard'? Overkill is self-destructive; honest appraisal, on the other hand, may promote healthy growth of laparoscopic hernia repair.

Ability to change course No voyage is without its detours and deviations, and navigation demands the ability to change course as the situation demands. As we advance endoscopy in the developing world, we will inevitably come across ravines, crevasses and roadblocks and must have the mental and technical ability to change course to circumvent these problems. As the Spanish poet Antonio Machado wrote: "Traveller, there is no path, a path is made by walking." And one can only repeat the litany of all navigators: "We cannot direct the wind...but we can adjust our sails."

Clear-cut objective Above all, this ensures that one arrives at the correct destination. In my 50 years in surgery, I have never come across a simpler, more precise and more perfect definition of the aims of surgery than stated by Charles Mayo: "There are only two aims of surgery—to heal the sick and to advance the science." Being sick is not just the privilege of the rich but also the burden of the poor and the destitute.

The developing world This is the geography of the world as we live in today (Fig. 4). Five centuries ago, Vasco de Gama, by his navigation, changed not only the history but also the geography of the world. We endoscopic surgeons, if we have the will, also have the power to change both the history and the geography of surgery. The developing world holds over 75% of the world's population, and also, alas, over 75% of the world's poor. If we have an honest belief in our conviction that surgery is not just a technological triumph but equally so a humanitarian pursuit, it is mandatory that we navigate the advance of surgery, which, today, is embodied in endoscopic surgery and in MAS to ensure that this surgical advance can reach all people in all places. The preamble of the World Health Organization charter reads: "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." Those who live in the developing world are well aware how empty and hollow these words are when 60% of the population have no access to the electric light, 55% have no access to safe drinking water and where the population-to-doctor ratio and population-to-hospital-bed ratio is a fraction of the west [9] (Table 1).

Fig. 4 World map. The developing world covers over 75% of our land surface and has over 75% of the world population

While all over the developing world there is a vibrant economic resurgence, unfortunately, the gap between the very rich and the very poor has not narrowed. A conspicuous aberration in the picture of health care in all developing countries is the stark contrast between opulence and luxury on one side and poverty and deprivation on the other. This is a tertiary care hospital comparable to the best anywhere (Fig. 5), while this, just a few kilometres away, was my ward in the Public Teaching Hospital in 1972 where the infrastructure is stretched beyond reasonable efficiency (Fig. 6).

To date, there have been only three patient-friendly surgical revolutions:

- **First revolution: asepsis (1866)**
- **Second revolution: anaesthesia (1884)**
- **Third revolution: endoscopic surgery and laparoscopic surgery**

It was with the aim of bringing the benefit of laparoscopy to the poor in a teaching hospital in a developing country that diagnostic laparoscopy was commenced, under local anaesthesia, in 1972 and was found to greatly hasten diagnosis, simplify treatment and improve patient turnover and bed utilisation. As a mechanical insufflator was beyond our limited finance, a sigmoidoscope pump was used for insufflation [10] (Fig. 7). To the surprise of several centres, the procedure was found amazingly cost effective [11] (Table 2).

Table 1 Health care parameters (WHO global health care data 2005)

Country	Doctor/ population	Nurse/ population	Bed/population
Germany	3.37 per 1,000 (2003)	9.72 per 1,000 (2003)	8.93 per 100 (2002)
France	3.37 per 1,000 (2004)	7.24 per 1,000 (2004)	7.80 per 1,000 (2002)
United States	2.56 per 1,000 (2000)	9.37 per 1,000 (2000)	4.2 per 1,000 (1998)
India	0.6 per 1,000 (2005)	0.8 per 1,000 (2004)	0.69 per 1,000 (1998)
Nigeria	0.27 per 1,000 (2000)	NA	NA
Cambodia	0.16 per 1,000 (2000)	0.61 per 1,000 (2000)	0.5 per 1,000 (2001)

Fig. 5 Hinduja Hospital, Mumbai

With a background of over 3,000 diagnostic laparoscopies, laparoscopic cholecystectomy was started, once again, in a teaching hospital in early 1990 [12]. Out of sheer economic necessity, several cost-effective measures emerged all over the developing world—an infant feeding tube (cost 0.5 euro), soft, safe, sterile and ideal for laparoscopic cholangiography; an ovum forceps for lithotripsy and stone extraction, just one strand of chromic catgut (cost 0.8 euro) for a laparoscopic appendectomy [13]. Mosquito net is freely available in the developing world. A small piece (cost 0.2 euro) has been found ideal for Lichtenstein hernia mesh repair [14]. The list could be infinite.

To navigate MAS into the heart of the developing world, we need to rise above our circumstances. Surgeons in the developing world are in the best position to define our problems as also our priorities. It is for us to find our own solutions born out of necessity and ingenuity, and if our solutions are simple and cheap, as befits our economy, let us view these solutions with pride, and never, never with embarrassment just because they lack glitter and sophistication [15, 16]. There needs to be cohesion and cooperation in the efforts of laparoscopic surgeons all over the developing world so that their experiences, innovations, failures, triumphs, thoughts and research can be shared amongst a group that has identical ambitions, goals, problems and constraints. This could be in the form of books, journals, associations, research and regional conferences.

Fig. 6 Ward 19A, J.J. Hospital, Mumbai (1972)

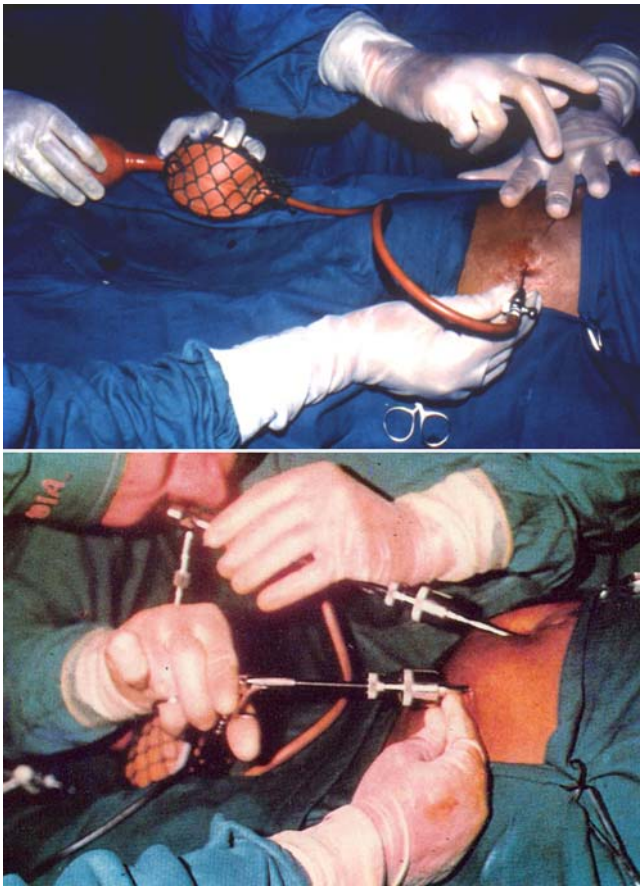

Fig. 7 Sigmoidoscope pump for insufflation. Target laparoscopic biopsy under local anaesthesia

We will always need fellows and residents to work, learn and be inspired by our five-star-accredited training centres. But there is just as much a need for teachers to go and work in small towns to teach and spread basic MAS all over this vast area, working, teaching and learning in the milieu of a rural surgeon (Fig. 8). The developed world has a large role to play in the spread of MAS to poor countries—not merely by way of equipment and technology, but also by demonstrating solidarity, concern and empathy towards

Table 2 Convincing data that laparoscopy is cost-effective in developing countries

	Rupees
Equipment cost	37,000 (1972)
Repairs, replacement	57,000
Total	94,000
Used from 1972 to 1990 for 3,200 cases	
Equipment cost per case Rs. 30.30	(Rs. 60 ≈ 1.0 euro)

Fig. 8 In developing countries, it is important to go and teach in the difficult working conditions of small communities. Surgeons from neighbouring areas come for these intensive courses

developing countries as shown by Philippe Mouret in Vietnam or Jacques Perissat in Africa (Fig. 9).

As we kneel at the altar of high technology, let us not discard the wisdom of the past, which has brought us to our present height. As Ivan Pavlov wrote in 1904:

"What can I wish for the youth who devote themselves to medicine?"

"Firstly, *gradualness*—Never begin the subsequent without mastering the preceding"—strong foundation in basics.

"Secondly, *modesty*—Do not allow haughtiness to take you in possession"—beware of Hubris.

"Thirdly, *passion*—Be passionate in your work and your searchings." Let us try navigate endoscopic surgery into the next decade with passion: Passion to improve the safety of our patients, passion to advance our surgery and our technology to the highest level and, also, passion to spread that advance to all our people in all places.

We should have no false delusions—navigating MAS into the developing world will be a Herculean, almost impossible, task. If the world of surgery even attempts to overcome the obstacles in our path, just by attempting to spread surgical advance to all people in all places, *the attempt to succeed* will be the greatest triumph in the history of surgery for it will show that surgery is more than technological achievement and advance; it still remains a humanitarian science [17].

Fig. 9 Jacques Perissat gives of his time, his knowledge and of himself in spreading MAS in West Africa

Laparoscopic or MAS or minimally invasive surgery, by whatever term, is a giant leap in patient-friendly surgery. This advance could well be the stepping stone to even less invasive, more patient-friendly treatment. There can be no better way to end a talk on MAS than to repeat the words of the first president of the German Surgical Society, Bernhard von Langenbeck, spoken at the First Congress of the Society in 1872: "...that it is less important to find new operations than to find means to avoid surgery...." [18].

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