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Pediatric minimally invasive surgery in Africa: limitations and current situation

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The second largest and most populous continent, with an exploding pediatric population, Africa has an overwhelming burden on its very limited pediatric surgical services. In an international environment of progressively advancing endoscopic and robotic surgical techniques, the authors focus on the current role of endoscopic surgery on the continent and explore the potential reasons for its delayed acceptance and implementation. They proceed to document the spectrum of what is available and, using their "African experience," expand on financially viable models of further rolling out these techniques, including discussion around suitable training models for surgeons and their teams.

Overview and spectrum of laparoscopy within Africa: rudimentary to First World

Africa is the world's second largest and second most populous continent, after Asia. If adjacent islands are included, it covers 6% of the earth's total surface area, 20% of the total land area, and accounts for approximately 14% of the world's human population. There are 46 countries including Madagascar and 53 including all the island groups. Health care problems in these countries are well known and generally related to limited resources. Facilities are often old and overcrowded, septic complications common, and patients present with advanced stage diseases of a different spectrum to developed countries. With limited availability of special investigations, such as computed tomography and magnetic resonance imaging scans, outdated equipment, consumables that are difficult to obtain or in some instances simply not available, management can be a challenge. Of note is the poor ratio of pediatric surgeon to population, with South Africa, most likely one of the best off nations, having a ratio of approximately 1:1.8 million!

The consequent burden of clinical work is obviously enormous, which in its own right has had a profound impact on the role of minimal access surgery in the region, at the same time presenting a unique opportunity for establishing minimal access units. After the advent of modern endoscopic surgery and its rapid assimilation into adult practice, its uptake and advancement into the pediatric population was relatively slow, on account of numerous obstacles, including smaller patient size and consequent working space, with the subsequent requirement of finer, shorter, and more delicate instrumentation and ports. Not only did this increase the technical difficulty of designing and manufacturing the instrumentation but a direct

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consequence was the associated increase in production costs, obviously transferred on to the end user. Fortunately, once these issues had been resolved, although obviously forever a "work in progress," the use of minimal access procedures was rapidly and widely extended into the pediatric surgical population and numerous units published widely on their experience. At the outset, simple diagnostic procedures formed the vast majority of surgeries,[1] after which, once adequate levels of competence had been achieved, more complex ablative and then reconstructive procedures were undertaken. From an African perspective, the "birth" of pediatric laparoscopy was rapidly assimilated in certain countries, examples, including Egypt, South Africa, and Senegal,[2,3] generally originating in academic centers and slowly spreading as it found wider acceptance. However, in the vast majority of African states, the implementation was delayed, if undertaken at all, and subsequent progress was slow, reason being predominantly "perceived" financial constraints, as well as cultural obstacles to its implementation and subsequent role out. Another significant obstacle in the introduction and implementation of minimal access surgery in the African context has been the workload of a typical pediatric surgical unit. The Department of Pediatric Surgery at the Chris Hani Baragwanath Hospital, Soweto, Johannesburg, is a good example of the clinical burden that many of these institutions face, with the unit at the Chris Hani Baragwanath Hospital performing upward of 180 index cases per month, with waiting lists running up to 6 months in advance! Similarly, The Ain Shams University Hospital performs 200-250 cases on a monthly basis, within similar waiting lists. In conjunction with relative shortages of trained staff, this places an enormous onus on staff to "get the work" done, with far less allocated time available for training and learning of new techniques. That said, these units are currently 2 of the leading laparoscopic units within South Africa, demonstrating what can be achieved when the commitment is there and, more importantly, when simple strategies are carefully planned and meticulously implemented. The literature is clear that, certainly in its inception, endoscopic procedures have longer set up times and, in addition, longer operating times, hence further pressurizing already overburdened operation theater schedules and, on account of completing fewer cases, further delaying access of patients to their allocated operating room slot.[4,5] This undoubtedly acts as a deterrent to implement minimal access surgery.

A further point that colleagues have raised has been the lack of drive from a patient perspective, with poor education on their part not pushing for the benefits of a minimal access approach. However, to counter that argument, one of the most significant driving factors for the establishment of a laparoscopic-related living donor renal harvesting program in Johannesburg over the last 5 years was donor request! It is important to remain clear about ones objectives, however, not allowing patient preference to drive the indication for surgery or optimal method thereof.

In addition to the aforementioned text, one of the most significant purported limitations to its widespread implementation has been the capital and ongoing running costs of an endoscopic suite. However, although this is often perceived as a convincing argument, it has been clearly demonstrated on the African continent that a basic set up can be achieved quite reasonably and very effectively. Furthermore, public–private partnerships, in conjunction with the establishment of good trusting relationships with relevant members of the trade, can allow one to live ones dreams too, as we have described later. What individuals and institutions often fail to realize, however, are the advantages of endoscopic techniques. Although the established benefits of less postoperative pain and shorter hospital stays obviously benefit the patient, the impact on hospitals, with respect to emptying beds and wards and alleviating pressure, and on the community, with significantly early return to work having significant economic benefits, are most important.

Looking again at Cape to Cairo, or "North versus South," we have learnt numerous lessons from the implementation and advancement of our respective endoscopic programs, and using rational decision-making trees and technical alternatives, we have grown our units, incorporating major endoscopic procedures into our busy schedules. Core concepts have included clearly defining the indications for surgery, appropriate training on models other than the live human patient, using techniques aimed at reducing cost as opposed to those used at the current "cutting edge" (GIA staplers, retrieval bags, single-use ports), ensuring that a designated person or team looks after the equipment, and most importantly, ensuring that the entire operating room team is appropriately trained not only in all aspects of the technical set up but also on the specifics of the operation being performed.

The current African experience is that in both the northern and southern regions of the continent, many centers are well equipped and trained to perform a wide spectrum of endoscopic procedures, including complex reconstructive operations. In Egypt, 5 such centers exist, with numerous centers providing a more basic service; however, all centers provide for at least basic training of their trainees. The South African experience is not dissimilar, with all the 7 university training centers having established endoscopic units, interested surgical staff, and various training programs aimed at equipping staff members and trainees with the necessary skills to safely operate on their patients, without putting the human subject at risk during the steep initial learning curve. One aspect of minimal access surgery that the South Africans have not embraced has been the role of robotic surgery. There are 2 reasons for this: prohibitive cost and the fact that this technology, like previous aspects of pediatric endoscopy, still requires significant development, with the current incisions and port requirements making its use a poor choice, both cosmetically and from a logistical perspective.

Centers in both North and Southern Africa have recently, significantly, committed to national education forums in endoscopic surgical techniques, including the installation of advanced skills laboratories as well as running regular live-