



ERAS for Low- and Middle-Income Countries

64

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Introduction

Since the early 1990s, there has been a significant shift in disease burden in low- and middle-income countries (LMICs) [1]. For the preceding decades, communicable diseases predominately influenced premature disability and death in LMICs. The availability of universal treatment for human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS), and prevention and improved treatments of other infectious diseases, allowed for increased longevity and a shift in disease burden toward noncommunicable diseases (NCDs.) Noncommunicable diseases, including cardiovascular disease, cancer, and trauma, have since eclipsed communicable diseases in LMICs as contributors to premature disability and death (Fig. 64.1) [2]. This epidemiological shift has elevated the need for surgery and safe anesthesia in LMICs, since many NCDs require surgical care for diagnosis, treatment, or palliation. Unfortunately, surgical care and anesthesia has been neglected in LMICs for decades [3].

The prevalence of communicable disease in LMICs prior to 1991 demanded that a majority of healthcare infrastructure and resources in LMICs be focused on preventing and treating these disease states. During this time frame, many global health specialists—physicians, healthcare systems, and Ministries of Health in LMICs—believed that only emergency surgery was a worthwhile investment and that basic surgery was a luxury [4]. Therefore, little investment in surgical infrastructure occurred in LMICs during this time frame, leaving most LMICs with few trained surgeons, even fewer trained anesthesia providers, and limited operating theater space and equipment. These realities meant that few

patients had access to surgery in LMICs [5], and for those who avoided or survived communicable disease, there was a huge increase in the prevalence of surgical disease and in the resulting premature disability and death. The expanding burden of surgical disease went largely unnoticed by the global health community until 2015 when three pivotal events occurred. The 3rd Edition of *The Disease Control Priorities in Developing Countries* volume on Essential Surgery [6], the Lancet Commission on Global Surgery [7], and the World Health Assembly Resolution on Safe Surgery and Anaesthesia as part of Universal Health Coverage [8] were published in series in mid-2015, shifting the perception of surgery and anesthesia from a “luxury” to “essential.” Since May 2015, many efforts are underway to improve and scale up surgery and safe anesthesia in LMICs.

Many middle-income countries, and most low-income countries, have had to evaluate their surgical systems and invest not only in surgical and anesthesia infrastructure but also the training of additional surgeons, anesthesiologists, and other anesthesia providers. For many countries, these processes are only beginning and will take decades to scale up to providing essential surgery for all in need. The Lancet Commission on Global Surgery estimates that 5 billion humans are in need of essential surgery and safe anesthesia and that more than 143 million surgeries will be needed annually to meet the global burden of surgical disease [7]. The process facing most LMICs is daunting at best and is being facilitated by the National Surgical, Obstetric, and Anesthesia Plans (NSOAP) process [9]. Zambia, Ethiopia, Tanzania, and Rwanda have undertaken this process and are providing examples regionally and across the globe for other LMICs.

Most of the surgical systems in LMICs continue to provide emergency and some basic surgery as the scale up toward the universal provision of basic surgery (Table 64.1) progresses. Currently the surgical care provided however is often poorly executed, anesthesia care is limited, and both result in high complication and mortality rates [10, 11].

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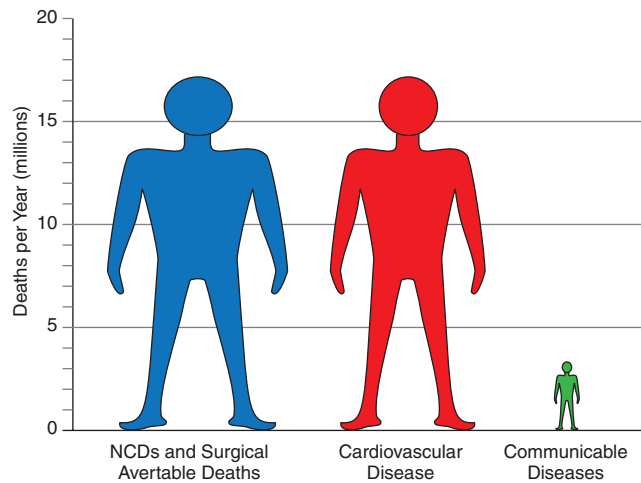


Fig. 64.1 Deaths for communicable disease, cardiovascular disease, and surgical disease

The simultaneous scale up of surgery and safe anesthesia in low-volume countries [12] across the globe (Fig. 64.2) [5] offers a unique opportunity for standardization and protocolized care that may save healthcare dollars and improve complication and perioperative mortality rates. Enhanced recovery after surgery (ERAS) programs have provided a system that focuses on standardized care, with an evidence-based approach to preoperative, intraoperative, and postoperative care, including pain management.

Implementing evidence-based guidelines, standardizing perioperative care, developing well-functioning teams, monitoring and measuring patient outcomes, and recovery and measuring compliance to guidelines are likely to reduce complications, length of hospital stay (LOS), and costs. The access to quality data will assist in benchmarking, monitoring, and continuous improvement. The ERAS care pathway provides an ideal platform to achieve this goal.

ERAS in Low- and Middle-Income Countries: Barriers, Challenges, and Opportunities

Embracing standardization and implementing ERAS in LMICs will require significant modification of protocols used in high-income countries (HICs) and careful consideration of the very limited resources for surgery and anesthesia in most LMICs. Designing ERAS for LMICs, and implementing appropriate guidelines, will need to take into account the limited access to healthcare; delays in seeking, reaching, and receiving care; the resource-constrained health systems; the nutritional status of the population; the high

Table 64.1 The 44 basic procedures recommended for all hospitals in LMICs

<i>Dental</i>
Extraction
Drainage of dental abscess
Treatment for caries
<i>Obstetric, gynecological, and family planning</i>
Normal delivery
Cesarean birth
Vacuum extraction or forceps delivery
Ectopic pregnancy
Manual vacuum aspiration and dilation and curettage
Tubal ligation
Vasectomy
Hysterectomy for uterine rupture or intractable postpartum hemorrhage
Visual inspection with acetic acid and cryotherapy for precancerous cervical lesions
Repair obstetric fistula
<i>General surgical</i>
Drainage of superficial abscess
Male circumcision
Repair of perforations (perforated peptic ulcer, typhoid ileal perforation, etc.)
Appendectomy
Bowel obstruction
Colostomy
Gallbladder disease (including emergency surgery for acute cholecystitis)
Hernia (including incarceration)
Hydrocelectomy
Relief of urinary obstruction; catheterization or suprapubic cystostomy (tube into the bladder through the skin)
<i>Injury</i>
Resuscitation with basic life support measures
Suturing laceration
Management of non-displaced fractures
Resuscitation with advanced life support measures, including surgical airway
Tube thoracostomy (chest drain)
Trauma laparotomy
Fracture reduction
Irrigation and debridement of open fractures
Placement of external fixator; use of traction
Escharotomy or fasciotomy (cutting of constricting tissue to relieve pressure from swelling)
Trauma-related amputations
Skin grafting
Burr hole
<i>Congenital</i>
Cleft lip and palate repair
Club foot repair
Shunt for hydrocephalus
Repair of anorectal malformations and Hirschsprung's disease
<i>Visual impairment</i>
Cataract extraction and insertion of intraocular lens
Eyelid surgery for trachoma
<i>Non-trauma orthopedic</i>
Drainage of septic arthritis
Debridement of osteomyelitis

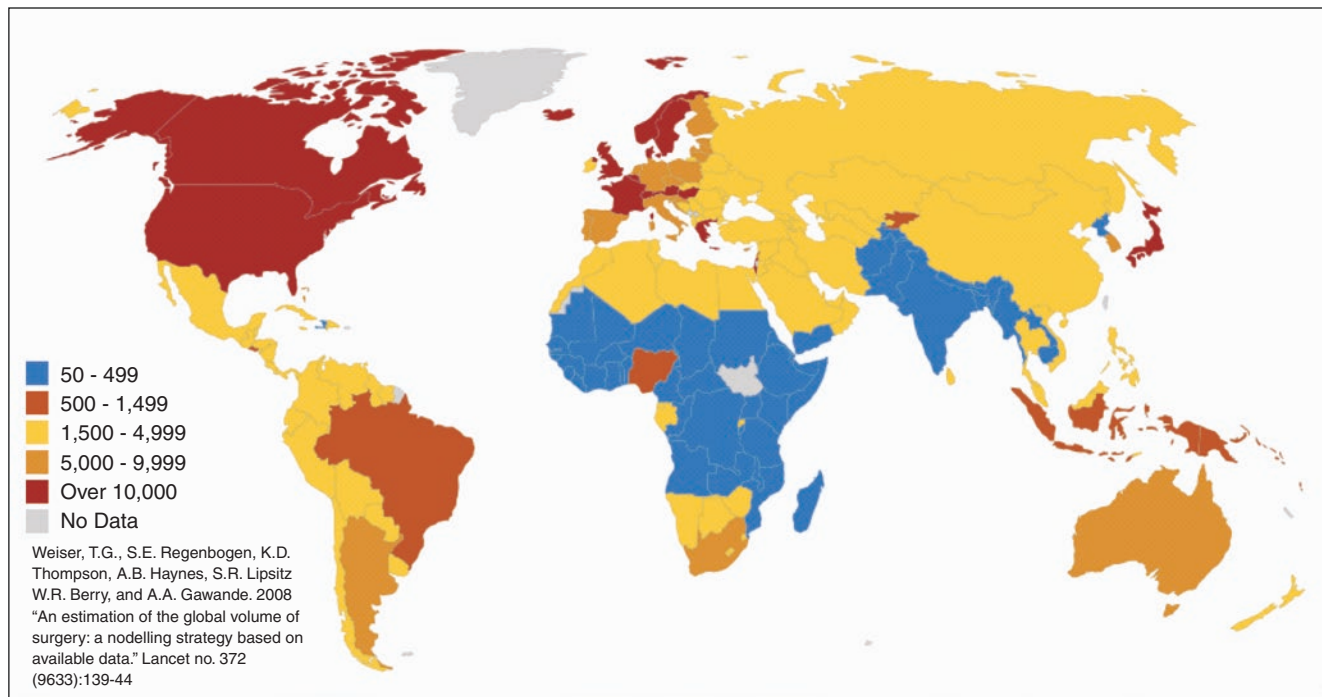


Fig. 64.2 Worldwide surgical volumes. (Reprinted with permission from Weiser et al. [5])

prevalence of HIV; the burden of disease; and the economic status of the country. In addition, guidelines will need to be constructed to include cost-effective and readily available medicines and supplements.

Access to Healthcare

The Global Surgery 2030 agenda [7], and the *Essential Surgery: Disease Control Priorities, third edition* (DCP3) recommendations [1] have opened the door for improving access to basic surgery and safe anesthesia, and the World Health Assembly (WHA) Resolution # 68.15 [8] and NSOAPS [9] have catalyzed scale up to address the large unmet surgical needs in LMICs.

Sustainable change can only be achieved by health systems that are supported by Ministries of Health to include resources for surgical care and safe anesthesia. The access required includes the 44 basic surgeries recommended by DCP3 (Table 64.1) [1], along with additional emergency surgery and the resources to support complete care of the surgical patient, including critical care services within the highest level of hospital care. To achieve not only access, but also good outcomes, the healthcare systems scaling up to surgical care should focus on standardized, evidence-based care that is cost-effective and supported by quality data. For many LMICs, this will include a new focus on preoperative care and patient preparation before surgery.

Preoperative Evaluation and Optimization

Currently there is limited or no availability of dedicated preoperative clinics in LMICs, and most patients are seen the day before surgery by the managing team. In many surgical settings in LMICs, there is also limited laboratory and medical evaluation capacity, including for echocardiograms and advanced imaging such as computed tomography (CT) scans and magnetic resonance imaging (MRI). Therefore, currently there is limited preoperative preparation and a limited ability to optimize patients. It is unlikely in the current surgical environment in LMICs that patients would be delayed for further testing, which may not be available anyway. In addition, many surgeons in LMICs will not focus on patient optimization, in spite of the benefits and cost reductions that are proven and ubiquitously understood in HICs. During planning for NSOAPS and the scale up of surgical care in LMICs, the addition of preoperative evaluation and testing should be considered.

Discharge Planning

Early discharge of postoperative patients might not be as easily achieved in LMICs as in high-income countries. In LMICs patients have limited access to transport and healthcare facilities. Patients who develop postoperative complications at home are likely to return late. Hence surgeons

might be hesitant to discharge patients earlier. The benefits of early discharge to both the patient and the healthcare system may not be realized, and patient care could be compromised if discharge occurs without adequate support systems in place.

Prior to solutions for perioperative management—including preoperative evaluation and optimization and discharge planning being reached—ERAS goals and processes will need to be modified for LMIC settings. Areas of importance and early consideration in the planning process for ERAS in LMICs include standardization of perioperative optimization goals, perioperative discharge planning, and realistic follow-up plans for patients who live long distances from the operative facility. Surgical conditions that currently have long waiting lists for surgical intervention may offer a window of opportunity to optimize patients, but will require restructuring of current practices. Similarly, in the postoperative period, creative solutions for follow-up should be considered. Possible solutions include follow-up clinics in remote areas, phone follow-up (when patient families have phones), alarm symptom checklists, and after-hours call options. Clear preoperative discharge planning to identify and address any barriers to discharge is essential. When family phones are available, a single on-call telephone number that gives patients and their families immediate access to the managing team is helpful, as are daily calls to the patient following discharge. In addition, the use of mobile health platforms, and home visits by community healthcare workers, may assist in discharge and follow-up success. However, locally developed and relevant solutions will need to be considered, since much of what is proposed here may not yet exist in most LMICs.

Cost Implications

The most important cost amelioration opportunity for LMICs is that potential health system and patient savings are possible when standardized approaches are utilized and length of hospital stay is shortened. Significant resources are required to implement and maintain the ERAS program. Costs include salaries for the ERAS nurse coordinator, data capturer, administrator, the implementation program, database management, education, research and training, regular team meetings, nutritional support, and computer hardware and software. LMICs face the additional challenges of inadequate infrastructure that includes equipment, drugs, pathology, radiology, managerial support, transport, ambulance service, safe water, electricity, and adequate and reliable Internet connection.

Innovative solutions will be needed. All stakeholders should be engaged as there is significant potential for mutual benefit. Seed funding could be an option to implement the

program. Partnerships with governments and private companies could provide seed funding.

The data from HIC show that once ERAS is implemented, a cost saving of 10–20% can be achieved. Local cost-benefit analysis will need to be conducted in LMICs to guide the implementation of ERAS. If similar savings can be achieved, it could be used to offset the start-up costs and expand the program.

Nutrition

Malnutrition and obesity are significant public health problems in LMICs; 62% of the world's obese population reside in LMICs. This has occurred alongside a large burden of underweight populations in many LMICs.

Obesity adds to the complexity of surgery and perioperative care. It is also associated with increased comorbidities, higher complication rates, and longer length of stay. Malnourished patients have significantly higher morbidity and mortality, a longer length of stay, and increased hospital costs [13–15]. Improving the patient's nutritional status prior to surgery is associated with improved outcomes.

The benefits of the ERAS program may not be fully realized if patients are not nutritionally assessed and optimized preoperatively. This could be difficult to achieve in LMICs, where resources are limited, nutritional optimization is not prioritized, and funding for supplements is difficult to source.

Routine nutritional assessment and support, a key element of the ERAS program, is not traditional practice in LMICs. To address this, dieticians will need to play a larger role in assessing, monitoring, and supporting patients. The current shortage of dieticians in the LMICs will need to be addressed [16]. In addition, all ERAS team members will need training and education on the importance of preoperative nutritional assessment and optimization. Funding will also be required for appropriate nutritional support, monitoring, and measurement.

Human Immunodeficiency Virus

Because the brunt of the HIV epidemic globally is borne by LMICs, the impact of HIV/AIDS must be considered throughout the perioperative period. Perioperative HIV status testing is neither routine in HICs nor in LMICs; therefore the signs of HIV infection—including weight loss, micronutrient deficiencies, malabsorption, and altered immunity and metabolism—must be considered for every patient in LMICs. There is conflicting and limited evidence of the impact of HIV status on postoperative patient outcomes following surgery, but this must be considered as scale up to surgical care is planned [17, 18].

Proposed First Steps for Low- and Middle-Income Countries

In spite of the many challenges and barriers to considering ERAS for LMICs, there are many benefits to even highly modified ERAS processes that may benefit surgical patients and systems in resource-constrained systems [19]. Included in early implementation of ERAS principles are cost-savings related to standardized approaches to patient care, fewer complications, and a reduction in hospital stays. Equally important is the potential for decreasing life-threatening complications including deep vein thrombosis and perhaps decreasing intraoperative and perioperative death rates.

A discussion on ERAS must begin at a very basic level in LMICs, including all stakeholders: Ministries of Health, hospital systems, physicians, and nurses. This scope of buy-in is essential because most of what is required for a successful ERAS program may not yet exist in the most resource-constrained systems. To get started, key stakeholders must acknowledge that standardization will benefit the scale up to surgery and safe anesthesia, and all must agree on the basic elements of surgical care that ERAS has been proven to impact. We proposed that the ERAS framework be applied to all basic and emergency surgery in LMICs, rather than be limited to the specialty surgery for which ERAS was designed in HICs. We also propose that these considerations should be grouped as perioperative, intraoperative, and postoperative. As well, we hope that LMIC readers will appreciate that our initial recommendations are the basic building blocks of modern surgical care and that, ideally, as resources allow and surgical volume increases, ERAS processes will evolve to look more like ERAS systems in HICs, for the greatest benefit to patients.

Preoperative Considerations

As mentioned previously, in many LMICs preoperative evaluation is limited or not available. Evaluation, patient selection, and patient optimization, however, are essential to the surgical scale and honestly to surgical programs worldwide. Where little or no preoperative evaluation before the day of surgery exists, this must be step one. Resources must be allocated for preoperative screening, and considerations must be agreed upon for patient optimization and scheduling. For these goals to be reached, human resources, laboratory support, and other testing must be available. While a dedicated space, a preoperative clinic, is optimal, creative solutions such as visiting preoperative nurses or a mobile clinic may prove useful. The basic components of preoperative care are

outlined in Fig. 64.3. Laboratory testing and basic testing to include electrocardiogram (ECG) evaluation may not be universally available, but is an important step forward in preoperative evaluation.

Intraoperative Management

As LMICs scale up to provide basic surgery in most hospitals, the standardization and modernization of surgical care and anesthesia are important. The ERAS approach has benefit for every surgery in LMICs, since the basic tenets of ERAS focus on physiologic normalcy. This approach includes a modern nil per os (NPO) approach before surgery: clear liquids up to 2 hours before surgery and in some cases providing a carbohydrate drink in advance of surgery. Intraoperative planning for the least invasive approach to any surgical procedure is optimal, and closing the surgical wound without drains whenever possible has been shown to decrease complications. From an anesthesia perspective, providing a standard anesthetic with multimodal pain management and keeping the patient normovolemic is ideal. Preventing hypothermia and controlling blood pressure, while avoiding long periods of hypotension, is also a goal for all surgery (Fig. 64.4).

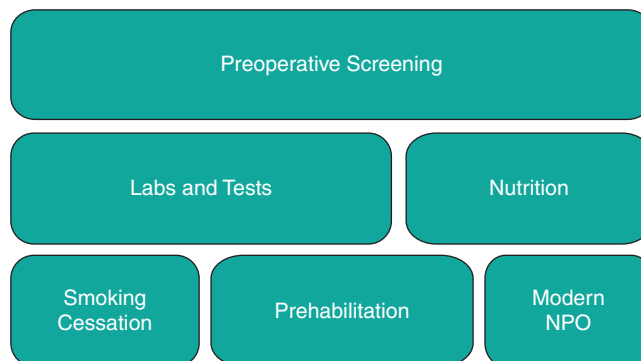


Fig. 64.3 Preoperative evaluation

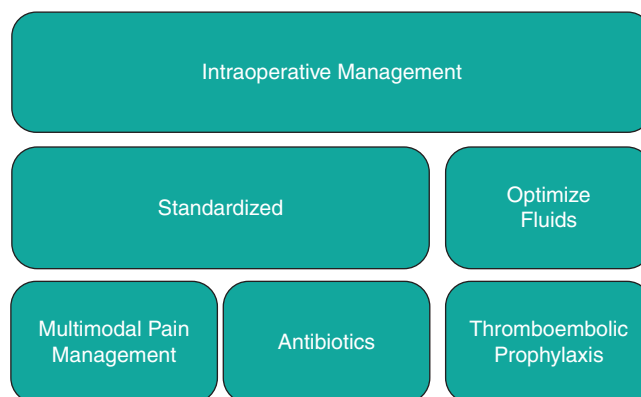


Fig. 64.4 Intraoperative management

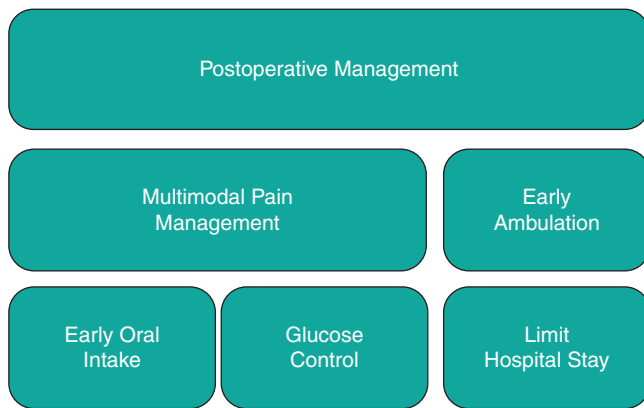


Fig. 64.5 Postoperative management

Postoperative Management

Similar to the basic preoperative and intraoperative management goals described previously, the postoperative management approach focuses on a standardized, evidence-based approach that will improve outcomes and decrease costs in LMICs. The basic postoperative approach for all surgical interventions includes multimodal pain management, early ambulation and oral intake, glucose control, and early planning for discharge (Fig. 64.5).

Data Collection and Management

The role of data within the ERAS protocols is essential. But in many middle-income countries and most low-income countries, the collection of data and the management to follow is a tremendous challenge. Firstly, electronic medical records are often unavailable, and computer systems are not routinely used within the hospital systems. Secondly, and of equal importance, is the workforce. In most LMICs the surgical workforce is significantly understaffed. This is well-documented within the Lancet Commission [7] and is a focus for scaling up the basic surgery in all hospitals. The existing workforce—nurses and physicians, as well as medical assistants and clinical officers—are consumed with caring for patients. With this in mind, data collection for ERAS in these settings will also require modification and, in many cases, simplification.

Surgical indicators, such as infection rates [20, 21] and perioperative mortality rates [22, 23], may offer initial and easy-to-collect benchmarks for the impact of ERAS.

Monitoring and Evaluation

Currently, most LMICs that are engaged in scaling up to basic surgical services and safe anesthesia will find it

difficult to manage additional tasks, including monitoring outcomes and evaluating the proposed standardized approaches. In LMICs with limited access to computers, the Internet, and personnel, capturing and entering data may prove a significant challenge. Finding solutions to this prior to implementation will ensure downstream benefit for the ERAS program.

The ERAS(R) Interactive Audit System for monitoring and evaluation system is an integral part of the implementation program, as it allows the teams to continuously monitor their compliance to the guidelines, measure their outcomes, and effect change.

ERAS Guidelines in Low- and Middle-Income Countries

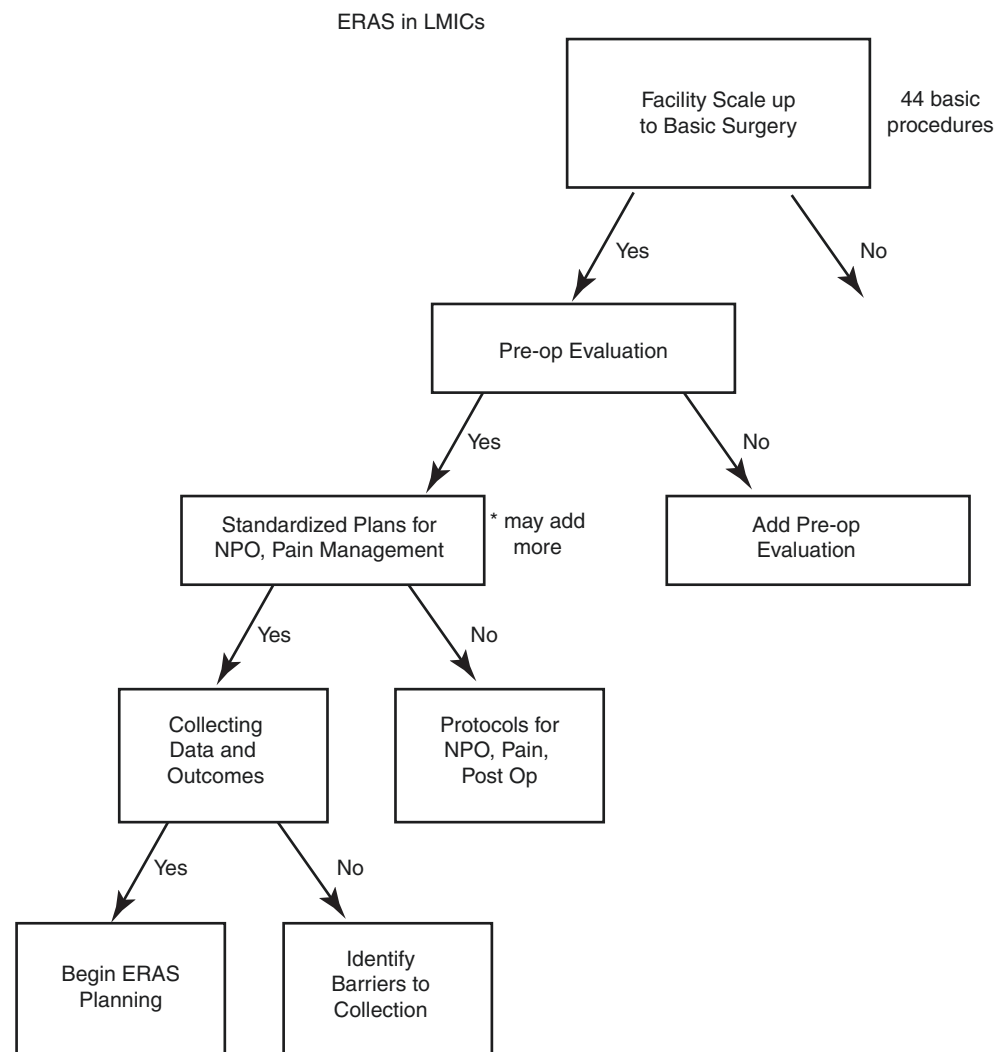
Many of the recommendations for a universal ERAS approach in LMICs will require a paradigm shift in patient preparation, intraoperative management, and discharge planning in LMICs. For this reason, and to assist in utilizing ERAS during scale up to greater access to surgery and safe anesthesia, we highly recommend the creation of guidelines for ERAS in LMICs to assist in the process. The creation of such guidelines will require input from surgical and anesthesia providers working in LMICs and from the local hospital systems and Ministries of Health. Once these guidelines are drafted, it is highly desirable that the recommended processes be tested in situ and then eventually included in NSOAP planning.

An initial evaluation of ERAS interest and the resources required to begin ERAS processes is highly recommended and could be considered in concert with an NSOAP evaluation. Figure 64.6 demonstrates the proposed steps for such an evaluation in LMICs.

Conclusion

Enhanced recovery after surgery has improved surgical care and outcomes and decreased costs in HICs. These benefits are greatly needed as scale up to universal access to surgical care and safe anesthesia continues in LMICs. Existing ERAS protocols offer much needed standardization and structure to systems scaling up for the provision of basic surgery, but must be modified for the realities of healthcare in LMICs. Implementation of the ERAS Care System in LMICs could provide a platform to facilitate implementation of the Global Surgery 2030 goals, improve patient outcomes and service efficiency, and reduce hospital bed days.

Fig. 64.6 Initial evaluation for ERAS planning in LMICs



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