Guidelines for Pediatric Perioperative Care During Short-Term Plastic Reconstructive Surgical Projects in Less Developed Nations

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Many physicians, nurses, and other health care providers are involved in short-term plastic/reconstructive surgical care of children in the less developed world. They provide an enormously important service to children that otherwise might not receive surgical care. Care may involve a variety of procedures ranging from cleft lip repair to complex craniofacial reconstruction. Regardless of the type of care, the overriding goal should always be the safety of the child. Patient safety can be optimized by careful selection of patients, facilities, and procedures, by ensuring the availability of proper equipment and staffing, and by close coordination with host professionals and officials. As with care in the developed world, preparation and planning are crucial to the provision of high-quality care in the developing world.

Volunteers in Plastic Surgery (VIPS) is a committee of the Plastic Surgery Education Foundation (PSEF), which is highly supportive of volunteer surgical programs in developing countries. The PSEF is a part of the American Society of Plastic Surgeons. In 2006, VIPS undertook a project to develop guidelines that would indicate what practices are consistent with quality and safety during short-term reconstructive plastic surgery endeavors in developing countries. That undertaking involved the input of numerous pediatric anesthesiologists and plastic reconstructive surgeons who have particular expertise in short-term surgical care in developing countries (including input from all the authors of this manuscript). The project therefore started as an initiative of VIPS, but soon involved members of the Society for Pediatric Anesthesia (SPA) and in particular the SPA Committee on International Education and Service. Once completed, those guidelines were circulated to many societies and organizations that conduct reconstructive plastic surgery in developing countries. Specifically, they were reviewed and endorsed by the boards of the American Society of Plastic Surgeons, the PSEF, the SPA, the American Cleft Palate-Craniofacial Association, the American Society of Maxillofacial Surgeons, European Society of Plastic, Reconstructive and Aesthetic Surgery, and the American Association for Hand Surgery. Interplast, Operation Smile International, and Smile Train have also endorsed the guidelines. Those guidelines are available in a document titled *Guidelines for the Care of Children in the Less Developed World*, which can be found at the VIPS web site.[a] The guidelines below, although not specifically endorsed by the organizations listed above, started with that same document posted at the VIPS web site and therefore resembles it substantially. However, we have added clarifications, referencing, tabular presentation, and in a few cases new recommendations.

This article is intended to assist in preparation and planning for, and evaluation of, short-term reconstructive plastic surgical projects. It provides a framework for the delivery of high-quality plastic surgical care in remote settings. That framework should help health care providers and program organizers from developed countries determine what manpower and equipment they want to use during these projects. Also, the same framework may help organizations located in less developed nations who would like to host a surgical mission and need to determine whether the surgical support offered to them will be of high quality.

These guidelines were developed specifically with plastic surgical projects in mind, although many of these recommendations apply to other types of surgical projects conducted in remote locations, which hereafter are referred to as surgical missions. Below, we review important aspects of planning and performing surgical missions, including selection of the mission site and facility, and the appropriate selections of patients, procedures, professional staff, and equipment. It is important to recognize that facilities, equipment, and staffing appropriate for low-risk patients and uncomplicated procedures may not be adequate for higher-risk patients and more complex procedures. For example, a mission that involves caring for an infant (a high-risk patient) receiving a craniosynostosis repair (a complex procedure) necessitates a much greater level of professional expertise and facility than a mission that only entails care of healthy children receiving cleft lip repairs. Surgical mission leadership should ensure sufficient professional expertise, equipment, and facilities to manage the level of perioperative care that will be required. In the sections that follow, we have defined "high-risk patients" and "complex procedures," because we believe these definitions are helpful for determining appropriate selection of patients, equipment, facilities, and health care personnel needed to provide quality perioperative care in this unusual setting. However, we recognize that our definitions are not all-inclusive or authoritative and that defining "high-risk" patients and "complex procedures" is not always as clear as in the example above.

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[a]See http://www.plasticsurgery.org/Foundation/Volunteer_and_Giving_Opportunities/Volunteers_in_Plastic_Surgery_(VIPS).html. Accessed August 15, 2010.

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Our recommendations are based largely on expert opinion. Authors of this document have extensive experience serving as physicians on surgical missions with a diversity of organizations and we therefore believe that there is no bias toward the methods of one organization over another. All authors of this document are physicians, and therefore this represents a physician perspective, not a nursing, patient, or society perspective. The consensus-building process was rigorous and involved numerous face-to-face meetings, writing and rewriting of this document. Whenever an author believed that a statement in this document was not acceptable, alternative language was crafted so that all authors could accept the tenets of the guidelines. We do not intend for these recommendations to represent a standard that must be followed by everyone performing reconstructive plastic surgical missions in developing countries, nor do we intend for this document to be a primer on how to run such a surgical project. Needs may vary greatly depending on the surgical mission location, the patient population, and on circumstances that arise during the mission. Therefore, medical professionals and organizations must adapt accordingly, taking into consideration their specific needs and the resources available to the organization. Surgical mission work done as part of disaster relief is a different entity than what we address here; the recommendations below were created with nondisaster situations in mind. These guidelines do not address many aspects of surgical missions such as cost, host relations, travel, logistics, and staff safety. These items, although important, are not the focus of this effort, and to some degree have been addressed elsewhere.[1]

SITE VISIT

A site visit should be performed before any surgical mission to a new site, and should be performed by either an anesthesiologist or surgeon who has experience working in developing countries with the organization involved. Sometimes an invitation to provide service is extended because of a need for training local personnel in the organization of periodic missions, or in the particular surgical and nursing skills of a surgical subspecialty. In other instances, the goal is clearly to provide surgical services where otherwise none are available. The participants from the visiting organization and from the host site should have a clear understanding as to whether the principal goals of the surgical mission are training, education, or provision of service, and the site visit is an excellent opportunity to gain that understanding. A clear understanding of these goals will help to determine what clinical and educational resources need to be mobilized and the host's expectations for involvement of their own health care providers. Additionally, communication with the sponsoring group(s) should be sought to determine their expectations for operating room (OR) visits, for photography and videography, and social events during the surgical mission. Sponsors may need to alter expectations to allow safe practice and adequate patient privacy, and these discussions are better handled at a site visit before sponsors have made extensive arrangements. Such clarity will therefore increase the chance of reaching or exceeding the local community's expectations for the surgical mission.

In addition to determining the host country's goals for the surgical mission, the individual conducting the site visit should address each of the following specific questions:

1. Need: Is there a need for the service to be provided? Who requested the services, and what was the basis for their request?
2. Coordination: Are other organizations providing the same service at or near the same time?
3. Facility: Does the facility have the space, services, staff, and equipment necessary for preoperative patient screening and to provide safe perioperative care given the type of surgeries planned? Will adequate numbers of skilled translators be available?
4. Logistical support: Is there food, housing, and transportation available for the team as well as for the patients and families?
5. Professional support: Are members of the local professional community committed to assist in the care of the patients and provide follow-up care should it be necessary after the team departs?
6. Political support: Is the local government supportive of the work that is planned?
7. Team safety: Is the location safe to visit?

Answers to the above questions should be obtained before arrival of the surgical mission team so that care can be provided safely and efficiently. We recognize that the answers to the above questions may not always accurately reflect the reality that the mission team faces when they arrive to perform surgery. However, addressing these questions at the site visit, and expecting specific answers, may help avert unpleasant surprises. Site visits before return trips, with surgical missions taking place in known locations and with known hosts, are considerably less important than for new surgical locations, but may be useful if changes in facility or host country personnel are expected. When planning return trips, consultation should take place with individuals from the previous mission, or their reports should be examined, to determine what successes or difficulties they may have had. We have developed an extensive data form specifically designed for collection of important site visit information and this form is available as an appendix to the guidelines located on the VIPS web site noted above.

Every individual and group involved in surgical mission work must recognize that the impression they leave behind has a profound effect on how future mission groups are viewed, and on whether their organization, or others, are welcomed in the future. Thus, a site visit is not only important to the success of an individual surgical mission but also to the collective success of all organizations providing this type of health care and education.

FACILITIES/SITES

All facilities should have the infrastructure, equipment, and ancillary support necessary to manage the complexity of surgical patients and surgical cases planned. In situations where the organization chooses a facility that cannot provide these items, then the organization will need to supply them. Basic equipment requirements are noted in this section because some organizations rely heavily on host

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country equipment available at the facility. A more detailed list of recommended equipment is provided separately in the equipment section below.

Basic facility requirements include:

1. Electrical power and water supply that is adequate for the procedures planned and is dependable. Electrical power should be continuous, and contingency plans for electrical outage should be made.
2. A dependable oxygen supply for all care areas including sufficient backup should the primary source fail.
3. Anesthesia machines that are not antiquated and are familiar to all members of the anesthesia team, are known to function, and have recently calibrated vaporizers known to function in conjunction with those machines (see equipment section below regarding recommendations for volatile anesthetics). Note that use of the copper kettle and Vernitrol should be considered unacceptable even if in working order and practitioners know how to use them.
4. Functioning monitors for each patient undergoing anesthesia. Monitors should be capable of providing continuous evaluation of electrocardiogram, arterial blood pressure, arterial oxygen saturation, end-tidal CO_2, and temperature. Pulse oximetry should be used, at least initially, for all children in the recovery area. Electrocardiogram, noninvasive arterial blood pressure, and pulse oximetry should be immediately available in all care areas.
5. Working suction that is present at each OR table and in the recovery area. Suction should also be immediately available in all other care areas.
6. Immediate availability of laboratory and radiology services, including the ability to obtain hemoglobin, electrolytes, and chest radiograph.
7. A blood bank that has the capability to provide either cross-matched, type-specific, or O negative fresh whole blood or packed red blood cells that have been tested for hepatitis B and C and for human immunodeficiency virus. The banked blood should be available at any hour of the day that significant bleeding could occur.
8. A means to sterilize or disinfect equipment that must be reused. Information on sterilization by use of soaking solutions has been provided by Fisher et al.

Additionally, organizations caring for patients that will require or could require critical care should have the space, personnel, and equipment to create a critical care unit if that resource does not exist at the facility or nearby.

PATIENTS

All surgical procedures requiring anesthesia are accompanied by recognized surgical and anesthetic risks that are patient dependent. The provision of safe and quality care depends on reducing both surgical and anesthetic risks, which in many cases are intertwined. As in developed countries, the parents of children who are operated on during surgical missions should be informed of the potential adverse outcomes and should be made aware of what surgical results can be expected.

During the 1990s, the risk of major morbidity and mortality was much greater during pediatric surgical missions than during pediatric surgery in developed countries.[2] More recent data, to our knowledge, have not been published. This section focuses on patient factors that are either known or believed to increase risk. Some patient factors noted below are strong risk predictors and should be reason for exclusion, whereas others might not be exclusionary but should warrant special precautions. Below, we define a "high-risk patient" in order to make recommendations regarding what personnel and equipment may reduce risk and to help manage complications when they arise. Several widely recognized important patient risk factors include the following:

1. Age: Multiple studies have identified age as a significant risk factor for pediatric perioperative cardiac arrest or death. One study found that neonates (0–31 days old) and infants older than 1 month (1–12 months of age) had an incidence of perioperative cardiac arrest during noncardiac surgery that was approximately 14 times and 1.5 times the incidence of cardiac arrest in children 1 to 10 years of age, respectively.[3] Additionally, former premature infants who are <60 weeks' postconceptual age have been shown to be at increased risk for postanesthetic apnea.[4] Generally, infants who were born at full term (>37 weeks' gestational age) and are <3 months old, and those known to have been born at <37 weeks' gestational age and who are <6 months old, are not appropriate patients for surgical missions.
2. Coexisting disease: Children with systemic disease such as heart disease, lung disease, neuromuscular disease, and metabolic or syndromic abnormalities have been repeatedly shown to be at increased risk of perioperative cardiac arrest and death. Studies using the American Society of Anesthesiologists (ASA) Physical Status Classification System suggest that risk increases for children in ASA class III or higher.[5] Children known, or strongly suspected to have an uncorrected congenital heart defect, or a corrected complex congenital heart lesion, should be considered inappropriate for surgery during noncardiac surgical missions. Children who are known, or suspected to have sickle cell anemia or hemophilia cannot be properly prepared for surgery in the mission setting, are at high risk of perioperative complications, and therefore should not be surgical candidates.
3. Intercurrent illness: Children who are ill, especially those with upper respiratory tract infections, are at increased risk for perioperative respiratory complications. The magnitude of the risk varies depending on factors such as procedure, airway management, and age.[6] As is the case in developed nations, children with known lower respiratory tract infections, active exacerbations of reactive airway disease, febrile illness, and those children who are not fully recovered from serious infections, such as bacterial sepsis, malaria, and rickettsial disease, are clearly not appropriate candidates for elective procedures.

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4. Poor nutrition: Although studies performed in developed countries typically do not examine nutrition as a risk factor, it is widely recognized that nutritional status is a marker for chronic disease in children. Failure to achieve milestones for height, weight, and head circumference appropriate to the setting should be considered a marker of increased risk, especially in young children. There may be country-specific growth curves for the country where the mission will occur, but most countries have now accepted the recently published World Health Organization (WHO) growth curves that are available at the WHO web site.[b] Those WHO growth curves were created by the WHO Multicenter Reference Study, which collected thousands of data points from children of varying ethnic and cultural backgrounds, and are believed to provide a single international standard of physiological growth during the first 5 years of life. However, growth charts are of limited value to surgical mission teams because they typically lack patient history and have no data on changes in weight/height/head circumference over time. Physical signs of malnutrition may therefore be more useful in this setting than comparing a patient's weight, height, and head circumference to accepted norms. The presence of anemia may also be a marker of poor nutrition and hence be associated with increased risk. A hemoglobin value of 10 g/dL has traditionally been used as the lowest acceptable limit during plastic surgical missions. That is especially true for palatal operations that may result in bleeding, and may be less relevant for operations for which the chance of bleeding is essentially nonexistent. There are no data to support the use of hemoglobin of 10 g/dL as a cutoff value; however, we believe that the lower oxygen-carrying capacity and the higher likelihood of malnutrition warrant its use as a risk indicator.
5. Airway abnormalities: Congenital and acquired anomalies increase risk, and those specific to the airway are of particular concern. Patients with significant congenital anomalies or complex syndromes are generally not appropriate candidates for cleft palate repair during surgical missions because they are at increased risk of postoperative airway compromise and are best managed with planned intensive care unit care postoperatively.
6. Timing: It is important to recognize that virtually every study of risk has demonstrated that emergency procedures and procedures performed during off hours carry increased risk. The pediatric perioperative cardiac arrest registry determined that cardiac arrest that occurred during an emergency surgery was nearly 3 times as likely to result in death compared with cardiac arrest during nonemergent surgery.[7] The desire to perform as many procedures as possible in a short mission should be weighed against the increased risk associated with fatigue and the reduced availability of equipment, ancillary support, and personnel typically associated with operating during evening and nighttime hours.

Based on the above considerations, for the purpose of this document, patients are considered high risk when they have 1 or more of the following characteristics:

1. Age younger than 1 year.
2. ASA physical status ≥III (i.e., a severe systemic illness limiting day to day activity).
3. Poor nutrition: Children who have physical signs of malnutrition, or have height, weight, or head circumference that is below the third percentile for age on the WHO growth curves.
4. Hemoglobin <10 g (a higher value may need to be selected when working at high altitude where ambient oxygen is less and normal hemoglobin values are higher).
5. Significant airway anomalies: A difficult mask airway and/or intubation is anticipated from the physical examination. Additionally, a difficult airway should be anticipated in a patient who has had a cleft palate repair and is returning to the OR for reexploration because of hemorrhage.
6. A need for emergent surgery, such as a need to reexplore because of hemorrhage after a cleft palate repair.

PROCEDURES

Perioperative patient risk increases not only with certain patient characteristics, but also when performing more complex procedures.[3,5,7] Some plastic surgical procedures should be considered too high risk for surgical missions, whereas others may be reasonable for that setting but should require special precautions.

Complex surgical procedures include pharyngeal flaps, sphincteroplasty, use of a tongue flap to close a palatal fistula, pollicization of the thumb, extensive skin grafting when excessive bleeding is likely, microsurgery, or microtia repair requiring rib grafting. Plastic reconstructive procedures that enter the cranial vault, such as craniosynostosis repair, or require entry of the abdominal or thoracic cavity, such as some flap procedures, are also considered complex operations. Additionally, any surgery that must be done emergently constitutes a complex surgical procedure. Team members of surgical missions that plan to perform complex surgical procedures, or realistically may have to perform emergent procedures, should take into consideration the extra manpower, equipment, physical space, and ancillary support that go along with performing such procedures. For example, many of these complex procedures will require the presence of a pediatric critical care unit that is staffed by skilled and experienced health care professionals familiar with recovering patients after these operations.

Surgical mission teams should consider patient risk factors in combination with complexity of the surgical procedure. For example, a procedure that is associated with a risk of significant blood loss, such as cleft palate repair, would be relatively contraindicated in a patient with hemoglobin <10 g/dL. Another example of surgical and patient factors combining to creat substantial risk would be

[b]See http://www.who.int/childgrowth/standards/en/. Accessed August 15, 2010.

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undertaking a cleft palate repair or creating a pharyngeal flap in a syndromic patient; the risk of postoperative airway complications would be high.

A formal time-out process should be considered before initiation of the procedure. The WHO has proposed a checklist and has posted a version on the Internet.[c] The checklist identifies the patient, the procedure, procedure site, need for antibiotic prophylaxis, and all concerns of the entire patient care team.

STAFFING

Selection of professional staff appropriate for the patients, procedures, and setting is critical to patient safety and quality of care during surgical missions. Teams should be staffed not only with qualified individuals but also with the proper numbers and ratios of professional staff to support the type of surgery and the number of tables planned. As with facilities, there are basic requirements for professional staff that apply regardless of the complexity of procedure or patient. For example, all professional staff should have an active license to provide patient care in the discipline in which they are working while on the surgical mission. Organizations should always verify months in advance that licenses of mission team members are sufficient to practice in the country where the mission is planned; many countries will not allow visiting medical practitioners to practice without first acquiring a temporary medical license, which requires providing documentation of education, training, and other credentials. Medical professionals that are typically involved in surgical missions are listed below, along with suggestions for practice experience and credentials they should have.

1. Surgeons
   a. Those providing surgical care should be familiar with the planned procedure(s) such that they demonstrate competence in these procedures.
   b. Surgeons should be certified in their home country, or eligible for certification, by the board that governs practice of the surgical specialty relevant to the planned procedures.
2. Anesthesiologists
   a. At least 1 anesthesiologist should be included as a part of all surgical teams.
   b. Anesthesiologists should be experienced in the care of children such that they care for children undergoing the same or similar procedures as a significant part of their regular practice.
   c. Anesthesiologists should be certified in their home country, or eligible for certification, by the board that governs anesthesiology practice.
3. Certified registered nurse anesthetists (CRNAs) and anesthesiologist assistants (AAs)
   a. CRNAs and AAs can be an integral part of the anesthesia care team and may provide direct anesthesia care under the supervision of an anesthesiologist with the qualifications listed above. Surgical mission teams should verify in advance that host countries do not object to participation of nonanesthesiologist anesthesia providers.
   b. As with anesthesiologists, CRNAs and AAs should be appropriately certified and experienced in the care of children undergoing the same or similar procedures.
4. Anesthesiology resident(s)
   a. Anesthesiology residents can be an integral part of the anesthesia care team and may provide direct anesthesia care under the supervision of an anesthesiologist with the qualifications listed above.
   b. Anesthesiology residents should have a license to practice medicine, should be in their final year of residency training, and be in good standing with their training program and with their national credentialing organization.
   c. Anesthesiology residents should be supervised in the same manner they are supervised during training in developed countries; no more than 2 anesthesiology residents supervised by an anesthesiologist.
5. Pediatrician(s)
   a. Each team should include a pediatrician, family physician, or other physician experienced in perioperative evaluation and care of children undergoing the same or similar procedures.
   b. Physicians should be certified in their home country, or eligible for certification, by the board that governs practice relevant to the type of perioperative care they plan to render during the mission.
6. Nurses
   a. OR, recovery area, and ward nurses should be experienced in the pediatric patient care role in which they are working while on the surgical mission. Teams that use in-country postoperative ward nurses who have no prior affiliation with the surgical mission team should do everything possible to ensure that those nurses are familiar with pain medications and postoperative concerns and routines for the types of patients they will encounter. If the surgical mission team does not intend to keep their own supervisory nurse in the hospital during night shifts, then they should at least provide a full orientation to the night duty nurses caring for their patients, and should provide a list of contact telephone numbers and clear indications for when they should be called.

As noted above, surgical mission teams should be composed of individuals with proper credentials and experience, and it is equally important that teams have reasonable numbers and ratios of qualified practitioners for the number of OR tables they intend to support. Recommendations for staffing numbers and ratios are listed in Table 1. An anesthesiologist with special training and/or experience in pediatric anesthesia should be included as part of any mission team that performs complex pediatric procedures or provides care to high-risk pediatric patients. Missions involving pediatric patients or procedures that have more

[c]See http://www.who.int/patientsafety/safesurgery/ss_checklist/en/index.html. Accessed August 15, 2010.

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Table 1. Recommended Numbers and Ratios of Qualified Staff for Reconstructive Plastic Surgical Missions

Provider type	Recommended ratios
Surgeons	1 surgeon for each OR table
Anesthesia providers	1 anesthesia provider for each OR table
	1 anesthesiologist to supervise a maximum of 3 CRNAs or AAs (or combination thereof), or 2 anesthesiology residents[a]
	1 free "circulator" anesthesiologist available to assist every 4 operating tables[b]
Primary care physician	1 primary care physician for each mission, with type of physician dependent on patient population served
	1 intensive care specialist for missions involving high-risk patients or complex procedures
Nurses	1 scrub nurse for each OR table
	1 circulating nurse for every 2 OR tables
	1 PACU nurse for every 2 OR tables, with a minimum of 2 PACU nurses
	At least 1 postoperative ward nurse for every 15 ward patients[c]

OR = operating room; CRNA = certified registered nurse anesthetist; AA = anesthesiologist assistant; PACU = postanesthesia care unit.

[a] When supervising 1 anesthesiology resident, the same anesthesiologist should supervise no more than 2 CRNAs or AAs.

[b] These 4 tables include those that a circulator is supervising and those where the circulator is assisting other anesthesiologists that are administering anesthesia. If there is no designated PACU physician, then the circulator should cover the PACU and should cover no more than 3 OR tables.

[c] A lower ratio should be considered when numerous palate surgery patients are on the postoperative ward.

than a minimal likelihood to require postoperative intensive care should include a pediatric intensivist and nurses experienced in pediatric critical care. Consideration should also be given to including a pediatric respiratory therapist if the need for mechanical ventilation is expected. A biomedical engineer may be a valuable addition to a mission team because they ensure compatibility of the electrical and oxygen supplies with the equipment the mission team plans to use. Also, biomedical engineers often help with OR setup, can trouble shoot faulty equipment, and in doing so solve problems that may hinder starting or proceeding with surgical cases. Furthermore, when planning procedures for velopalatine insufficiency, consideration should be given to whether speech therapy is available locally.

EQUIPMENT AND SUPPLIES

Teams performing surgery in less developed countries should expect to provide all of the equipment and supplies needed to perform the intended procedures. Care should be exercised when using supplies (medications in particular) purchased in the host country, especially if labels are not in the host country's language or drugs are unfamiliar. In general, the supplies and equipment needed in a developing world hospital are not different than those needed in a modern hospital. Medications and disposables that are single use when practicing in more developed countries should also be single use on surgical missions. In Table 2, we have compiled a list of equipment and supplies that are recommended for the care of pediatric patients during a surgical mission. Table 2 is not intended to be an all-inclusive list, and each team should give careful thought to what equipment and supplies they may need.

POSTSURGICAL MISSION CARE

Trip planning should anticipate the need for postoperative patient follow-up to address surgical complications and to track all perioperative complications. This postoperative team would be best constituted by a surgeon and at least 1 other medical professional that understands postoperative management. In-country personnel with appropriate skills for postoperative care should be identified and trained to report all postoperative outcomes of interest to the sponsoring agency's medical supervisors.

QUALITY IMPROVEMENT

It is strongly recommended that every organization develops a means of collecting quality improvement data. Data that should be monitored might include the following:

1. Critical events, such as cardiac arrest, respiratory failure, death, unanticipated escalation in level of care (postoperative ventilatory support, intensive care unit–equivalent care), unanticipated need for transfusion, return to the OR to manage complications, any life threating emergency, etc.
2. Anesthesia quality markers such as unanticipated difficult intubation, laryngospasm requiring reintubation, postanesthesia care unit reintubation, bronchospasm, cancellation after induction of anesthesia, etc.
3. Specific surgical complications such as wound infection, dehiscence, etc.

Internal tracking of outcomes can indicate an organization's strengths and weaknesses, so that they might direct attention to areas needing improvement. A multiorganizational registry of major morbidity and mortality during surgical missions is under development by the SPA Committee on International Education and Service. The plan for this registry is for organizations to voluntarily participate and anonymously submit their data on patients who required unexpected critical care and those who experienced cardiac arrest or death. It is expected that this registry will provide a platform for a greater understanding of risk factors associated with rare critical events, and that such data will be amassed more rapidly by pooling data from the collective experience of all participating organizations. Organizations interested in joining the collective registry should contact the corresponding author.

SERIOUS ADVERSE OUTCOMES

Organizations should have a written plan for management of serious adverse outcomes such as a patient death, serious injury, or a life-threatening complication. The plan should be available to all their surgical mission teams and should deal with event documentation, internal review of causation and responses, and with information sharing with the patient's family, the host country sponsors, and the entire team. It should reflect the importance of considering cultural issues,

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Table 2. Equipment and Supplies Recommended for a Surgical Mission

Type of equipment or supplies	Specific equipment/supplies
Anesthesia delivery system and patient monitoring device	• Modern and functional anesthesia machine with a calibrated vaporizer specifically made to administer a volatile anesthetic familiar to all anesthesia care providers[a,b] • Patient monitor[b] capable of continuous multilead ECG, automated blood pressure, invasive pressure monitoring,[c] pulse oximetry, temperature, and end-tidal CO_2
Airway management equipment[b]	• Facemasks in full assortment of sizes • Anesthesia circuits (Mapleson or circle system) • Laryngoscope with full assortment of blades • ETTs in full assortment of sizes • Self-inflating bag valve mask • Suction machine, tubing, and catheters
Standard anesthetic/analgesic medications	• Volatile anesthetic such as sevoflurane, halothane, or isoflurane[a] • Anesthesia induction drug such as propofol or sodium pentothal • Neuromuscular blockers such as succinylcholine, and vecuronium or rocuronium • Reversal drug for nondepolarizing muscle relaxants, such as neostigmine plus glycopyrrolate or atropine • Local anesthetics such as 0.25% and 0.5% bupivacaine or 0.2% and 0.5% ropivacaine, either premixed with epinephrine or with epinephrine 1 mg/mL available for mixture • Analgesics such as acetaminophen, ketorolac, and ibuprofen[d] • Prophylactic antibiotics
Routine and emergency vascular access supplies	• IV catheters in all sizes and all materials needed to establish IV access • Tape or occlusive dressings • Isotonic IV solutions • Central venous line kit(s) • Arterial line kit(s)[c] • Blood giving IV sets
Emergency equipment	• Cricothyrotomy kit • Intraosseous needle • Defibrillator • Portable oxygen supply • LMAs with full assortment of sizes • Stat laboratory (point-of-care testing devices such as i-STAT [i-STAT Corp., Princeton, NJ] may suffice)[c] • Fiberoptic bronchoscope[c] • Mechanical ventilator capable of ventilating pediatric patients[c] • Flashlights and batteries
Emergency medications	• Medications called for in ACLS/PALS algorithms such as epinephrine, vasopressin, atropine, sodium bicarbonate, calcium gluconate, magnesium sulfate, amiodarone, lidocaine, and dopamine • Pressors including phenylephrine and ephedrine • Cardiac antidysrhythmic/rhythm-control drugs including lidocaine, esmolol, adenosine, verapamil, digoxin, and amiodarone • Naloxone when narcotic usage is planned • Furosemide to treat pulmonary edema • Dantrolene to treat malignant hyperthermia • Medication to treat anaphylaxis such as epinephrine, dexamethasone, diphenhydramine, and other antihistamines • Broad-spectrum antibiotics such as ceftriaxone and gentamicin • HIV postexposure prophylaxis kit and a point-of-care rapid test of HIV antibody

ECG = electrocardiogram; ETT = endotracheal tube; LMA = laryngeal mask airway; ACLS = advanced cardiac life support; PALS = pediatric advanced life support; HIV = human immunodeficiency virus.

[a] Sevoflurane or halothane are necessary for inhaled inductions, although sevoflurane is preferred. Other volatile anesthetics such as isoflurane may be the sole volatile agent when only IV inductions are used.

[b] Each operating room table should have 1 separate unit available (without sharing). The postanesthesia care unit (PACU) should have 1 monitor for every 2 recovery beds, and should have at least 1 suction device for every 4 recovery beds. A monitor that can provide end-tidal CO_2 and continuous ECG data should be readily available to the PACU and ward but should not be required for standard postoperative care.

[c] Monitoring capability/equipment/medication recommended only for surgical missions with high-risk patients or complex procedures.

[d] Narcotic analgesics may be available on site, and should not be taken from home without proper governmental authorization.

including the political climate of the local facility and the importance of managing the situation in an open, honest, and timely manner. Suggestions for management of these difficult situations have been made by Fisher et al.[1]

CONCLUSIONS

The recommendations contained within this document are guidelines, not comprehensive requirements, and are not intended to represent a "how-to" manual for this type of surgical practice. These guidelines are an attempt to provide accepted criteria to which both teams and hosts may refer when undertaking short-term surgical care for children in a cooperative arrangement. Generally speaking, visiting health care providers involved in elective procedures during surgical missions should attempt to achieve a level of care that is as close as possible to their level at

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home. Safety should always be the primary concern of all who participate in this immensely rewarding work, and it is hoped that these guidelines will serve the common goal of achieving the safest care possible for every child.

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