
Anesthesia in Resource-Poor Settings: The Médecins Sans Frontières Experience

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Introduction

Médecins Sans Frontières/Doctors Without Borders (MSF) is an independent medical humanitarian organization formed in 1971 by a small group of French doctors and journalists with the aim of providing emergency care to populations in danger. The underlying principle is that this assistance is offered based solely on need, irrespective of race, religion, gender or political affiliation. Surgical programs have been part of this response in some settings since the early 1980s [1]. With MSF now active in more than 70 countries, these surgical activities are undertaken in a wide array of contexts, ranging from conflict zones such as Afghanistan, Democratic Republic of Congo, and Syria, to natural disasters (e.g., the earthquake in Haiti and Typhoon Haiyan in the Philippines) to low-resource but more stable environments such as India and Burundi.

A key conclusion from this experience is that basic surgery should always be considered as an integral part of medical care, even in the most remote and impoverished settings, given its proven

value in reducing mortality, morbidity and disability and improving quality of life [2, 3]. In working to translate this notion into practice, we and others have also learned that—contrary to a common view of surgery as unrealistically expensive and complex for difficult settings—basic surgical care provided at the low-cost district hospital level can be surprisingly cost-effective, and “might compare favorably with selected primary health interventions in terms of cost-effectiveness” [4–6].

What is also clear from our work in emergency/low-resource settings is that surgeons and anaesthetists need to discard preconceived notions of an inevitable link between the technical complexity of surgical and anesthesia techniques and the ability to reduce morbidity and mortality. On the contrary, we have found that keeping our interventions simple, accessible and sustainable within a given context is often the most effective way to best serve the needs of the many. In MSF-Belgium projects, the focus is on providing access to quality surgical and anesthetic management in programs that are well adapted to each context and to the needs of the local population.

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Overview of Surgical and Anesthesia Activities

The countries and contexts where MSF-Belgium had surgical missions at the end of 2013 are shown in Table 9.1. All but two are in either

Table 9.1 Ongoing surgery projects, 2013

Country	Project	Context	Program description
Afghanistan	Kabul	Conflict	Obstetrics, general surgery
	Khost	Conflict	Obstetrics
	Kunduz	Conflict	Obstetrics, general surgery
Burundi	Gitega	Post-conflict	Obstetrics (fistula repair)
	Kabezi	Post-conflict	Obstetrics
DRC	Masisi	Conflict	Obstetrics, general surgery
	Niangara	Conflict	Obstetrics, general surgery
Haiti	Tabarre	Stable	Orthopaedics, general surgery
India	Mon	Stable	Obstetrics, general surgery
Mali	Douentza	Conflict	Obstetrics, general surgery
Mauritania	Bassikounou	Conflict	Obstetrics, general surgery
Pakistan	Timurgara	Conflict	Obstetrics, general surgery
Philippines	Guiuan	Natural disaster	Obstetrics, general surgery
Sierra Leone	Bo	Post-conflict	Obstetrics
South Sudan	Gogrial	Conflict	Obstetrics, general surgery
	Gumuruk	Conflict	General surgery
Somalia	Burao	Conflict	Obstetrics, general surgery
Syria	Jabal-Akkrad	Conflict	Obstetrics, general surgery

Table 9.2 Overview of surgical activities, 2010–2013

Indicator (#)	Total	2013	2012	2011	2010
Patients ^a	59,824	14,199	14,583	19,296	11,746
Cases ^b	77,048	19,395	19,145	22,964	15,544
Procedures ^c	83,004	21,774	20,865	24,101	16,264
Main surgical indicators					
Violent trauma ^d	4,767 (xx %)	1,445 (10.2 %)	1,277 (8.8 %)	1,086 (5.6 %)	959 (8.2 %)
Accidental trauma	10,283 (xx %)	3,808 (26.8 %)	3,075 (21.1 %)	1,927 (12 %)	1,473 (12.5 %)
Obstetrical ^e	25,719 (xx %)	6,337 (44.6 %)	6,785 (46.5 %)	7,644 (47.5 %)	4,953 (42.2 %)
Other pathologies	15,876 (xx %)	2,609 (18.4 %)	3,446 (23.6 %)	5,460 (34.0 %)	4,361 (37.1 %)
Total	56,605	14,199	14,583	16,077	11,746
	CK 56,646				
No. of projects ^f		18	22	21	19

^aNumber of new cases

^bNumber of Operating Room. visits

^cNumber of surgical procedures performed during an intervention. MSF data tools allow reporting up to three procedures. For data analysis, only the first entry is considered because not all projects reported multiple procedures in one surgical intervention

^dViolent trauma cases as cause for intervention (only new cases)

^ePercentage of Caesarean sections uses patient number (new cases) as the denominator

^fNumber of active projects during 2013

emergency settings (conflict or natural disaster) or post-conflict regions.

The core activity at these projects is the provision of lifesaving and essential surgery that requires only low technology and is based in district hospitals or in the subset of primary health centers with surgical capacity. Lifesaving surgery is defined as any procedure performed in response to an acute state in which the patient's life, organ,

or limb is at stake and surgery must be done as soon as possible, usually within hours. Essential surgery addresses conditions that may not immediately affect health or life but will considerably impair the quality of life or present a serious future health threat, and that are amenable to a proven surgical treatment.

Table 9.2 gives an overview of the main surgical activities in these and 10 other (no longer

Table 9.3 Types of anesthesia used at surgical projects, 2013

Type of anesthesia	2013		2012		2011		2010	
	#	%	#	%	#	%	#	%
Spinal	7,208	37.2	7,294	38.1	7,797	39.7	5,224	33.6
General	7,945	41.0	7,971	41.6	7,961	40.5	7,033	45.2
Intubated	2,183	11.2	1,933	10.1	2,110	10.7	1,636	10.5
Local/regional	1,417	7.3	1,383	7.2	1,191	6.1	1,139	7.4
Combined/others	642	3.3	564	3.0	585	3.0	512	3.3
Total	19,395	100.0	19,145	100.0	19,644	100.0	15,544	100.0

Table 9.4 Ketamine doses and administration at MSF-Belgium surgical projects

Parameter	Anesthesia		Analgesia	
	IM/rectal	IV	IM	IV
Dose (mg/kg)	8–10	1–2	2–4	0.3–0.8
Onset (min)	5	1–2	5	1–2
Duration (min)	20–30	10–15	–	–
Maintenance (mg/kg)	5	0.5–1	–	–
Frequency (min)	20–30	15–20	–	–

active) surgery projects during the years 2010–2013 [7]. Focusing on the 14,199 patients treated in 2013, the most common indication for surgery was obstetrical (44.6 % of all patients), 79 % of which were Caesarean sections (data not shown). Accidental trauma was second (26.8 %), followed by violent trauma (10.2 %). At the same time, certain projects involved more complex, specialized types of surgery, for example, high-standard orthopedic procedures such as osteosynthesis and obstetric fistula repair.

In terms of anesthesia practice, around 90 % of all surgeries in 2010–2013 used either general or spinal anesthesia, as shown in Table 9.3. General anesthesia in most MSF contexts uses the intravenous agents ketamine and thiopental as well as the inhalation agent halothane. We consider ketamine an excellent choice for field settings due to its ease of use and safety profile and its widespread uptake throughout middle- and low-income countries (Table 9.4). (However, projects that use ketamine must have resuscitation material available, due to the known risk of respiratory arrest.) Drugs used for muscular relaxation and intubation include depolarizing agents (suxamethonium) and non-depolarizing agents (vecuronium, atracurium).

Spinal anesthesia (SA) is indicated for surgery below the umbilicus, i.e., lower limb surgery, surgery of the inguinal area and amputations; for Caesarean sections we use hyperbaric bupivacaine. Neither adrenaline nor opioids are added to our protocols, as we see no clear advantage.

Principles in MSF Field Anesthesia Practice

A key first principle in our surgical missions is that it is feasible, although challenging, to do safe anesthesia with basic tools and infrastructure: after all, millions of episodes of anesthetic administration are performed safely around the world every year in relatively low-technology settings. Clearly this requires anaesthetists with certain critical skills, but a trained anesthesiologist should know how to deal with the types of emergency situations (such as hemorrhagic shock or polytrauma), which happen everywhere. So in this sense there should be no essential difference between anesthetic practices in Western versus resource-poor settings; the difference is in practical implementation stemming from context-specific constraints.

The fundamental principles we apply to field anesthesia are:

- *Primum non nocere*—patient safety comes first. To achieve this,
- Simpler is often safer. We therefore keep protocols, equipment, etc. as basic as possible, which helps us implement
- The best practices for the majority of patients (“the best for most”). To achieve this,
- Flexibility is key to effectiveness.

On a practical level, MSF surgical/anesthesia activities follow these basic principles:

- Privacy and respect for the patient.
- Consent of the patient, or, if she/he is unable to consent, his or her representative must do so.
- Surgery is intrinsically linked to anesthesia, and vice versa.
- Surgical and anesthesia providers have a formal qualification or MSF validation.
- Surgery and anesthesia arsenals (techniques, equipment, and drugs) are safe, simple, and effective, allowing in most cases a low dependence on sophisticated technology.
- Tight collaboration between the surgical and anesthetic providers is assured.
- Before the start of new projects, a number of defined prerequisites must be in place.
- Surgery and anesthesia care encompass preoperative, intraoperative (perioperative), and postoperative care.
- Quality control is assured by following MSF policies, guidelines and protocols; and by appropriate record-keeping of patient files, including anesthesia/surgical information and other relevant clinical data.
- Emergency preparedness is essential, ensuring the maintenance of skills; the permanent availability of minimum materials, well-functioning sterilization facilities, and regular review; and updating of a Multiple Casualty Plan.

Key Challenges and How MSF Adapts

Adapting to the Local Cultural Context

Although perhaps not evident at first glance, cultural issues are essential to the way we work as field anesthesiologists. Informed consent provides a good example. Consent is important not only as an administrative procedure but, much more—especially in settings where many people cannot read—as a way of explaining to the patient (or family) what will happen during the surgery, what outcome(s) to expect and what difficulties and complications might arise. In many settings

where we work, only males can provide consent, so for female patients we need approval from the husband or father. Sometimes the issues around obtaining consent delays surgery, and the medical team might sometimes consider going ahead in exceptional cases if there is urgent medical need but the family could not be briefed on the severity of the patient's condition. However, especially in contexts with high security constraints, it may be better not to proceed under these circumstances, because the reaction if a patient dies may be incomprehension, blame or even violence.

A situation we faced in one project after a natural disaster illustrates this problem. A 9-year-old girl arrived at a neighboring hospital (run by another international organization) that was treating pediatric patients. They called our surgeon to consult, and he determined that the child had acute abdominal pathology and urgently needed surgery. But when the anesthesiologist arrived and asked for the child's parents, he learned that they had gone to the market to buy milk for the child. The surgeon was in a quandary about whether to proceed, but after some discussion he accepted the need to wait. The medical team could not anticipate how the parents might react if they returned to find their child in the operating theatre; if the child died, they might think that the operation killed her. Since we were in a very violent neighborhood, it was conceivable that someone might have a weapon, or come back later to kill the surgical team. Fortunately the parents returned quickly and gave consent, and the surgery proceeded smoothly. But the story illustrates a risk that affects our decision-making.

Beyond informed consent, cultural norms related to modesty also affect our work. If an anesthesiologist wants to perform spinal anesthesia but the (female) patient arrives completely covered and refuses to even show her back, the medical team needs to be flexible, innovative and yet cautious. In our projects we work on the premise that everyone has the right to make decisions about their own body regardless of whether they are knowledgeable about medical issues or share our beliefs.

Table 9.5 Gender distribution of surgical patients, 2010–2013

Gender	2013		2012		2011		2010	
	#	%	#	%	#	%	#	%
Female	8,698	61.3	9,072	62.2	10,498	65.3	7,323	62.3
Male	5,501	38.7	5,511	37.8	5,579	34.7	4,423	37.7
Total	14,199	100.0	14,583	100.0	16,077	100.0	11,746	100.0

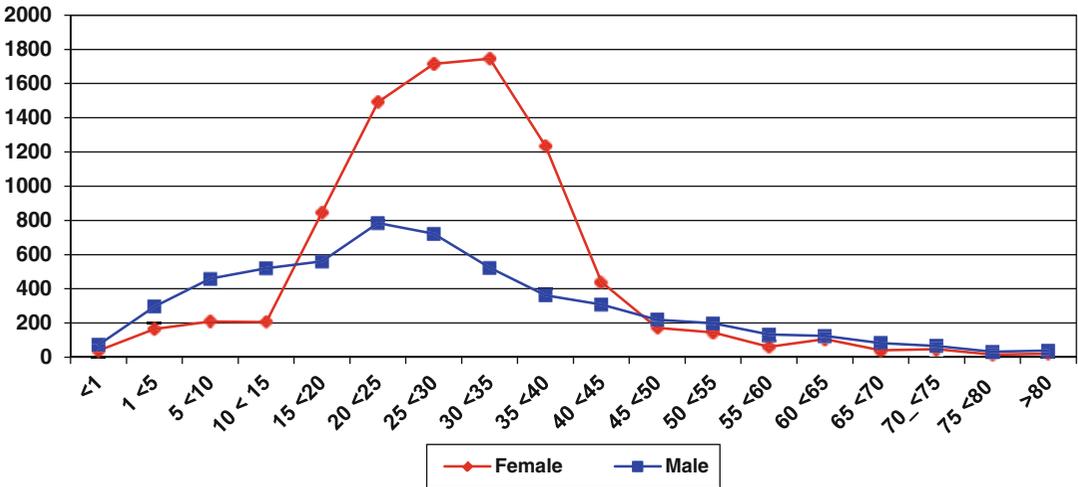


Fig. 9.1 Age distribution by gender at MSF-Belgium surgical projects, 2013

Adapting to the Patients’ Profiles and Pathologies

Working in war-affected and underdeveloped countries with largely broken health systems means treating patients with very different profiles and pathologies than those in a typical Western hospital [8].

Although most of our surgical missions receive trauma patients, the majority of whom are male, overall more than 60 % of our surgical patients in 2010–2013 were women, as shown in Table 9.5. They were also overwhelmingly young (see 2013 data in Fig. 9.1), with a mean age of 28 years old for women and 27 for men. Another characteristic of the patients who reach our facilities is that they typically have an acute pathology, such as appendicitis, obstetric emergency, or strangulated hernia, since people with diseases like cancer or heart failure usually die in these settings due to lack of care. The decision to seek care is often difficult for our patients, because

they may need money for the journey, or a means of transport. We therefore receive many patients who delayed leaving home when they became ill, or spent several days traveling to the hospital. Many have been treated by a traditional healer before coming to our hospital. Over the few days of these delays, an easily treatable pathology such as appendicitis can become life-threatening acute peritonitis.

The most common pathologies in our surgical patients are obstructed labor, acute abdomen and fractures (trauma), although this varies widely among projects. For obstetrical patients, a typical scenario is obstructed labor leading to a ruptured uterus, so the patient arrives in shock with the baby in her belly. We also see many cases of postpartum hemorrhage, as well as eclampsia and preeclampsia. Our general surgery projects frequently receive patients with visceral abdominal pathologies, such as peritonitis, often stemming from obstructed hernia. The number of trauma cases is highly dependent on the setting: for example, a

project at a distant hospital in rural Congo may see fewer trauma cases because patients die before they reach the hospital. Most projects receive many patients with limb injuries, who tend to survive the initial trauma, as well as patients with blunt trauma of the liver or pancreas.

A common challenge these trauma cases present for anesthesiologists is the need to deal with hemorrhagic shock even when blood supplies are extremely limited. Under these circumstances it is sometimes necessary to use autologous hemotransfusion, a procedure that—while not well-known in Western countries—has saved many lives in MSF settings. Teams experienced with this procedure often perform autologous hemotransfusion from hemothorax and ectopic pregnancy. At the same time, the use of tourniquets, quick-clot gauzes, and intraosseus access with drill is common. Ketamine anesthesia has proven to be a good solution for this kind of pathology [9].

Despite this profile being heavily skewed towards acute pathologies, 95 % of our surgical patients in 2013 were considered to have a stable physical status prior to surgical intervention, since they received scores of ASA1 or ASA2 on the American Society of Anesthesiologists (ASA) scale. This scoring system subjectively categorizes patients into six subgroups based on preoperative physical fitness. It makes no adjustment for age, sex, weight, or pregnancy, nor does it reflect the nature of the planned surgery, the skill of the anesthetist or surgeon, the degree of preoperative preparation, or facilities for postoperative care, and thus may not provide the information best suited for our populations. At the same time, poor general health of our patients is another factor surgeons and anesthetists must often consider. For example, many patients in low-resource settings have chronic anemia, with levels of hemoglobin that are astonishingly low by Western standards and that potentially complicate any surgical intervention: we have seen cases of women arriving at our facilities with hemoglobin levels of 5 g/dl, well below the 12 g/dl which defines anemia in adult women, and even below MSF's threshold for proceeding to transfusion, i.e., 7 g/dl.

Clarity About Our Role and the Patient Population We Serve

Anesthetists working in Western countries usually rely heavily on technology for evaluating and monitoring patients, and typically want the same machinery to be available at our missions. However, this is often not feasible or wise, as the examples below illustrate. In practice, decisions on whether and what technology to transfer to the field, and what protocols to follow, go to the heart of understanding our role and how to best serve the most underserved patients—and have led MSF to the principles, mentioned earlier, of prioritizing simplicity and working towards sustainability [10].

For example, should we use an electrocardiograph in our surgeries? While the answer is obvious for Western settings, consider a rural hospital in a remote region of a low-resource country where we work with and train local staff. First, the nurse anesthetist must learn what an electrocardiogram is and in what situations we use it. Then she/he must learn about the different arrhythmias, how to distinguish them, and the drugs needed for each one—and, to be worth this considerable effort, all these drugs should be available locally. At the same time, intensive care facilities are scarce in these settings. Maintaining and repairing electrocardiograph equipment presents yet another set of problems. For these reasons, we have found it safer and more feasible in practice to rely on simpler monitoring protocols, which MSF developed based on the minimal standards for different levels of health care facilities as established by the World Health Organization (WHO) (2003). MSF standards call for the availability of equipment that is simple, safe, and easy to understand and maintain—at a minimum, oxygen (mainly with oxygen concentrators) and basic monitoring equipment (stethoscope, sphygmomanometer, pulse oximetry) must be on hand at all MSF missions with surgical activity. In addition, sites must have adult and pediatric resuscitation bags, suction device (which may be as simple as a foot sucker), laryngoscope set and

intubation material, Magill forceps, anesthesia masks of different sizes, pressure infusion bag, and a standard list of drugs and consumables.

Another aspect of this basic-versus-high technology issue to consider is its potential impact on the patient population we serve. For example, our obstetrical surgery projects mainly prioritize Cesarean sections and other obstetrical emergencies. Expatriate medical personnel arriving at these projects sometimes suggest installing incubators for premature babies. But there are usually very few such facilities in the region—so having these incubators would transform our projects into the most advanced maternal centers far and wide, which in turn could end up drawing the country's elite as patients, rather than the local populations we came to serve and who otherwise have little access to care.

A related issue that influences our way of working, including the choice of equipment and protocols, is sustainability, given that MSF missions typically last from periods ranging from several months (e.g., after a natural disaster) to 4–5 years, and occasionally longer. For example, we could bring sophisticated anesthesia drugs used in the USA and elsewhere into our missions. But if we base protocols on these drugs, what happens when we leave? First, it will be difficult or impossible for the host country, institution or patients to access and afford these medicines. Second, there will be few staff trained in their use beyond those who worked with MSF. So instead we focus on medications that are commonly used in the region, that local staff know how to use, and that are affordable. When a project closes, we endeavor to leave behind a functional unit that can continue providing at least some basic care. Whether this is possible depends on many local factors, including security, availability of drugs and consumables, and the skill level and training of local staff (see following section). It also depends greatly on the circumstances of our departure, and is often impossible if we are forced to leave unexpectedly due to a host government withdrawing permission for us to work, or to increased security risks.

Managing Human Resources for Field Anesthesia

Anesthesia providers in MSF medical structures are drawn from a range of personnel that includes anesthesiologists, nurse anesthetists, other types of physicians or nurses, and anesthesia technicians. At the field level, the choice of anesthetist depends upon the human resources (HR) available, the type of project, whether or how much training is conducted, and the quality and quantity of surgical interventions. HR constraints, in turn, are shaped by both the quality and background of the anesthesia provider (anesthesiologist vs. nurse anesthetist; expatriate vs. national staff).

Expatriate anesthetists, especially those who are new to the field, are likely to face several challenges, starting with the fact that she/he may not be trained to work under adverse conditions or in very basic settings, or to use basic drugs such as ketamine [7].

The types and status of anesthesia equipment at surgical projects varies widely, but the standard equipment is usually very basic and high-standard biomedical devices are rare. Operating Theaters may lack monitors and/or defibrillator equipment, and anesthesia machines with ventilators are also uncommon (Ambu-type self-inflating bags offer one solution). Oxygen cylinders are not often available; in this case oxygen concentrators are a useful alternative. There must be a pulse oximeter that measures the saturation and pulse, as called for by the WHO-recommended standards and followed by MSF [9]. We do not use central venous catheters or central venous access due to the difficulty of assuring good-quality care of these devices in the field and to the need to avoid serious complications, especially infection, related to incorrect use.

This means that anesthesiologists at MSF projects usually have to rely mostly on clinical parameters, using their eyes, ears, and knowledge to make diagnoses without access to an arsenal of tools or tests, and to follow patients during surgery without advanced monitoring devices. She/he will probably need to take a blood pressure

measurement with a cuff every 5 min during surgery, because typically no automatic machine is available. Without all the customary technology, the anesthesia provider's clinical skills are critical. Moreover, she/he is alone and fully in charge, and may even have to multitask—for example, functioning as a circulating nurse who hands supplies to the surgeon.

Such skills are not easy to find: surgeons and anesthesiologists are scarce, and those who function well in resource-limited settings are even rarer. For this reason, training is an important core activity of MSF-Belgium surgical missions. Different training schemes target different type of specialists, taking into consideration their skills and knowledge, as well as the skills and knowledge needed for implementing MSF's medical strategies and protocols.

Another important HR task is to train local staff. The need to do this may not be obvious, since some international organizations work by bringing in all essential personnel from outside—an approach that usually produces good outcomes from the project's beginning [11, 12]. However, it also means that the hospital usually closes at the end of the mission, since there is insufficient local capacity to continue its work. At MSF-Belgium we try to avoid this approach and instead to incorporate local staff development into our activities. A few years ago this often meant a “task shifting” model, especially in countries where there were simply not enough educated, highly trained people to meet the need for anesthesia services [13].

In practice, task shifting meant turning over anesthesia to someone without much education and who would work independently. This was MSF's approach in Somalia (e.g., in Guri'el, where we trained auxiliary nurses in safe anesthesia, which in this setting meant only ketamine and perhaps spinal anesthesia but not intubation [14]).

Where possible, we now look to “task sharing”—for example, by going into hospitals to coach and work alongside national staff for an extended period of time [15]. Sometimes we work with local staff who are certified nurse anesthetists but have not been trained to a high standard, sending doctors to work with them and improve their

knowledge and skills. In other settings, we encounter staff with no training at all in anesthesia. So for example, at some projects in the Democratic Republic of Congo (e.g., Masisi), we worked alongside local staff for several years, teaching them the very basics at first and progressing all the way to intubation; now they are working independently.

Occasionally we do training in more advanced technologies for specific projects. One example is a peripherally inserted central catheter (PICC). These can only be used in selected projects, since in most settings they could do more harm than good. But we introduced them at two projects designated as trauma centers: Kunduz, in northern Afghanistan, which has an intensive care unit and where we trained local physicians on using PICC lines; and Tabarre, in Port-au-Prince, Haiti, where we trained nursing staff, who already have good training and strong skills.

Interacting with Local Staff

Expatriates usually account for only a small proportion of staff at our surgical projects, with national staff typically comprising up to 95 % of personnel. Our experience is that workplace interaction between these two groups often brings some predictable challenges, given the likelihood of a language gap and sometimes the very minimal skill level of local health workers. In some countries where we work, nurses study for only 6 months, and may not know how to perform basic arithmetic calculations or to correctly provide nursing care. Consequently, when an expatriate doctor asks a nurse to do something, the potential for misunderstanding and error is enormous. For example, in one of our projects, an anesthesiologist asked the nurse to give a patient “10 morphines” for postoperative pain. The order was then translated by a (non-medically specialized) translator; not long afterwards the patient went into respiratory depression. It emerged later that the nurse had understood the doctor's order to mean 10 ampules of morphine rather than 10 mg (i.e., one ampule), as the doctor had intended. So the patient got 10 times the intended dosage.

This unnecessary complication served as a reminder that our protocols should be designed with the lack of trained staff in mind, by returning to principles of operational simplicity and sustainability. Our protocols now call for giving as much medication as possible by mouth, and in the fewest possible doses.

It is also crucial for expatriates to remember that local staff are salaried workers with families and communities nearby, and often cannot match the intensive work schedule of outsiders present in the country for a short-term mission focused on doing humanitarian work.

Helping Patients Manage Pain

Pain management is especially challenging in MSF surgical projects for several reasons, starting with limitations on the types of medications available. Another factor is that patients may have a cultural expectation that pain is part of life, which can mean that they do not complain about or even mention their pain. In our settings, we train the local staff that pain is also a vital sign. Therefore, patients should be systematically asked during ward rounds about the pain they are feeling, based on the use of scales. We mainly use the Face Rating Scale, where a range of different faces (from a big smile to a crying face) is showed to the patients.

Pain can be treated most effectively if it has been properly evaluated, although we recognize that the patient is the only person who can truly know his/her pain intensity. The use of an evaluation scale is mandatory in our projects, with results recorded as for other vital signs. Protocols for pain management are based on the following practices:

- The sooner treatment is initiated, the better.
- It is advisable to give medication before the pain becomes intense.
- Prescriptions should be systematic and taken regularly at fixed times.
- Oral dosing should be used as much as possible.
- Preference must go to multimodal analgesia.

In the MSF context, the analgesics available are WHO level 1, 2, and 3 drugs, includ-

ing paracetamol, diclofenac, ibuprofen (Level 1), codeine, tramadol (Level 2), and morphine (Level 3). Morphine is the opioid of choice and is preferable to fentanyl (short duration) or pethidine/demerol (weak effect). However, it is difficult to use in the field because few of our staff members are trained to recognize morphine's complications. So we usually advise using and following WHO recommendations, which distinguish three level of pain management beginning with paracetamol and using morphine only at a last resort. Since the dosage requirement of individuals varies, the use of pain scores and clinical examination is mandatory.

Pragmatic Outcomes and Future Directions

In typical MSF field contexts, where the population's basic health needs are usually not being met, the issue of quality is often neglected. This neglect stems largely from the common misperceptions that placing priority on the expansion of coverage inevitably means less focus on quality, and that improving quality requires adoption of more expensive measures, leading to ever-escalating costs. In our experience, reality is much less black-and-white. Ensuring quality at our missions begins with the availability of clear institutional policies, relevant guidelines and strict protocols, all of which (as discussed throughout this chapter) should be well-adapted to the specific context. It also extends to providing the best possible work conditions for the surgical-anesthesia teams and requiring that they follow institutional practices to assure compliance and consistency in patient care.

In terms of monitoring quality, we use intraoperative mortality as a proxy for the delivery of safe anesthesia care. In 2013 MSF-Belgium reported 44 deaths related to its surgical interventions (cases = 19,395), an overall ratio of 0,2 %—an outcome which demonstrates that it *is* possible to provide quality surgical-anesthesia care in field contexts. However, assessing certain other aspects of surgical care is more challenging, since the difficulty of following up with patients once they

leave the hospital impedes the measurement of post-discharge outcomes. This issue is a well-recognized challenge in the field of global surgery; hopefully in the future, we and others will identify feasible ways to evaluate longer-term surgical outcomes and quality.

On a broader level, while it is widely recognized that there is an acute need for surgeons to deliver specialized services in low-income countries, the even greater need for anesthesia providers is often not highlighted [16]. In some humanitarian organizations, this gap is filled by expatriate anesthesia providers (specialized medical doctors and nurses), who make invaluable contributions to their programs and patients. However, it is also a reality that the growing gap between the so-called Western anesthesia practices and the requirements and limitations of field anesthesia make it increasingly difficult to find broadly trained anesthesia specialists with the capacity to be sufficiently adaptable and flexible, and to rely mostly on clinical skills rather than biomedical devices. A big challenge for the field of anesthesiology (and humanitarian organizations) over the coming years is therefore to improve the local anesthesia capacity in low-income countries and to train developed country specialists in the practice of field anesthesia.

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