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Teaching humanitarian surgery: Filling the gap between NGO needs and subspecialized surgery through a novel inter-university certificate.

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Original Article

Abstract:

Background

Access to surgical care is a global health burden. A broad spectrum of surgical competences is required in the humanitarian context whereas current occidental surgical training is oriented towards subspecialties. We proposed to design a course addressing the specificities of surgery in the humanitarian setting and austere environment.

Method

The novelty of the course lies in the implication of academic medical doctors alongside with surgeons working for humanitarian non-governmental organizations (NGO). The medical component of the National Defense participated regarding particular topics of war surgery. The course is aimed at trained surgeons and senior residents interested in participating to humanitarian missions.

Results

The program includes theoretical teaching on surgical knowledge and skills applied to the austere context. The course also covers non-medical aspects of humanitarian action such as international humanitarian law, logistics, disaster management and psychological support. It comprises a large-scale mass casualty exercise and a practical skills lab on surgical techniques, ultrasonography and resuscitation.

Attendance to the four teaching modules, ATLS certification and succeeding final examinations provide an interuniversity certificate.

30 participants originating from 11 different countries joined the course. Various surgical backgrounds, training levels as well as humanitarian experience were represented.

Feedback from the participants was solicited after each teaching module and remarks were applied to the following session. Overall participant evaluations of the first course session are presented.

Conclusion

Teaching humanitarian surgery joining academic and field actors seems to allow filling the gap between high-income country surgical practice and the needs of the humanitarian context.

Accepted Manuscript

Introduction:

Surgical and obstetrical pathology is frequently encountered in the setting of humanitarian medical missions. According to the estimations of the World Health Organization, each year more than 5 million people die as a consequence of injuries and 303 000 women from complications of pregnancy. Injuries are responsible for an estimated 6% of all years lived with disability. About 90% of these injuries and 99% of maternal deaths occur in low- and middle income countries (LMIC). [1], [2] The 3rd edition of the World Bank report on disease control priorities concludes that many of these injury- and obstetric-related deaths, as well as deaths from other causes such as abdominal emergencies and congenital anomalies, could be prevented by improved access to surgical care. Providing essential surgical procedures would save about 1.5 million lives a year, that is 6-7% of all preventable deaths in LMICs. [3], [4] Humanitarian medicine takes place in parts of the world where access to healthcare is particularly scarce. In such contexts, either healthcare structures have been destroyed or medical manpower is missing as a consequence of armed conflicts or natural disasters. Surgeons participating to humanitarian missions are confronted to a resource limited medical practice where sophisticated technical equipment and high-end medical infrastructures are not available. Furthermore, humanitarian surgeons should be able to offer broad spectrum medical services requiring a wide range of competences. Professionalism, adaptability, sound judgment and common sense are essential qualities for field surgical practitioners in these conditions. [5] In contrast, medical and in particular surgical training in high income countries is directed towards a highly specialized practice often relying on sophisticated techniques. Residents are trained in subspecialized surgical

departments to achieve state of the art treatments of diseases based on advanced paraclinical workup and multidisciplinary decision-making. In particular, minimally invasive surgical techniques are used whenever possible. Furthermore, in many European surgical residency programs, trauma surgery and surgical intensive care are poorly taught. Sub-specialization has led to the disappearance of real general surgeons. Recent reports from medical NGO's show that surgical activity during humanitarian missions comprises 22% of minor surgeries, 49% of cesarean sections 35 % of trauma related surgeries and 15% of other interventions.[6] A study comparing US trained chief residents' case logs with those performed during humanitarian missions, shows that only 44% of chief residents' case logs corresponded to the surgeries performed during humanitarian missions. [7] Accordingly, there is clearly a gap between surgical practice in high income countries and requirements for humanitarian surgical practice in environments that mostly can be qualified as austere. The authors addressed this question through the elaboration of a course dedicated to the specificities of surgery in the humanitarian setting with the aim to improve the knowledge and skills of civilian trained surgeons willing to participate to surgical missions in austere environments in the humanitarian setting.

Methods for course elaboration

In 2015, a group of academic surgeons, alongside with surgeons experienced in the field of humanitarian medicine proposed to organize a new course on humanitarian surgery in austere environments. The authors (RR, MT, JFB, TR) started constructing the course by gathering leaders in different surgical subspecialties from three Belgian universities. Some of these were chosen because of their special

interest in medical action in resource-limited environments, some others because of their highly specific knowledge of a specific domain of medical practice (Table 3).

Five experienced senior surgeons who had been active in humanitarian medical action for renowned non-governmental organizations (NGO) accepted to participate to the construction of the course (ML, JPG, RM, LD, IN). The organizers could rely on the support of a well-established medical NGO to provide guidance and experienced medical and non-medical advice. The medical component of the National Defense was solicited considering their specific knowledge about war medicine and logistical organization in conflict zones.

Two of the organizing surgeons having no humanitarian field experience participated to similar courses on surgery in the austere setting: RR attended the one week “Surgical training for Austere Environments” course at the Royal College of Surgeons of England in London, United Kingdom.[8] MT attended the two-day “MSF International Surgical workshop” in Düsseldorf, Germany. Both attended a large-scale mass casualty simulation exercise held by our partner medical NGO as observers. One of the organizers (RR) spent one week as an observer in an NGO-led Trauma center in Bujumbura, Burundi.

Course elaboration. Organizational meetings were set up with the proposed teachers and experts in the topics to be taught during the Certificate. The course content had to be defined according to the needs in the field, including theoretical teaching and practical sessions. The first comprises not only surgical techniques but also many non-surgical medical topics such as anesthesia, resuscitation, ICU management and infection control. Basic knowledge in non-medical domains such as logistics of humanitarian missions, international humanitarian law, military organization in conflict

zones, ballistics and chemical warfare, as well as psychological support for victims and caregivers were integrated in the program. Alongside the theoretical teaching, the organizers decided to provide hands-on teaching of special surgical skills, pediatric resuscitation, cast immobilization and non-operative orthopedic fracture treatment as well as basic ultrasound practice. A mass-casualty management course on organizational aspects for hospital preparedness for a mass causality incident and on triage techniques was also included. The selected topics were organized in half- or full-day teaching modules. One academic faculty member together with one faculty member with humanitarian field experience carried the organizational responsibility of each module.

Methods for course evaluation. At the end of each three-day course module, participants were asked to complete a satisfaction and feedback form. This document comprised a structured evaluation of their overall satisfaction about the course, the logistical and organizational aspects, the teaching contents, the relevance and the effectiveness (EvaSys survey software / Electric Paper Ltd, London UK). Participants could also freely report about what they appreciated most during the teaching module and make suggestions in order to improve the course. The results of these inquiries were systematically reviewed by the steering committee and taken into consideration to enhance the following course module.

Results

Course contents. The course schedule was set for four three-day teaching sessions which seemed to be the most acceptable format, allowing the participants to assimilate a limited set of topics for each module and not to take long periods off their clinical duties. The course was aimed at certified surgeons with clinical practice or senior surgical residents. The goal was not to give a refresher course on general surgery, but to provide the participants an insight into the challenges of surgery in the austere and humanitarian setting and to give them directions to adapt their knowledge to this kind of situation (Tables 2 and 3)

Session 1. The first teaching session started with an introduction to the course and to humanitarian medical action. General principles of trauma surgery were presented since trauma care is a major part of humanitarian surgical practice. The concepts of damage control surgery and resuscitation adapted to the austere environment were discussed. Specific courses about war surgery included the management of combat-related victims, wound ballistics and organizational aspects of military and humanitarian medical care in conflict zones. A special interest was given to victims presenting injuries due to penetrating trauma, burns and blast. This module also included basic teaching on anesthesiology, resuscitation and surgical intensive care management applied to the low resource setting. A more specialized surgical teaching session on “Head and Neck surgical pathology” comprised basic neurosurgery including indications and technique of craniotomy without previous imaging. Management of penetrating neck injuries and of common surgical ENT problems was presented. This session also comprised a course on maxillofacial

trauma, including dental wiring technique as well as indications and techniques of enucleation. A session on plastic surgery covered general aspects of wound healing and clinical wound management in the austere environment. Theoretical concepts of basic flaps and of skin grafting but also specific aspects of urgent and elective surgical management of burn related injuries were exposed.

Session 2. International humanitarian law was presented and interactively discussed with the participants regarding specificities and rights to provide medical treatment in foreign countries in the setting of humanitarian action. Impartiality of humanitarian organizations and restriction of their action in an internationally accepted legal frame were the major topics. A course on pharmacy logistics allowed the participants to get an insight into the organizational needs to provide adequate medical supplies to remote places and their implications for medical practice in the field. Infection prevention and control applied to the austere environment were highlighted. An interactive session about stress management encountered by the medical and paramedical staff allowed the participants to consider stress situations they might have to face during surgical missions. A whole teaching day was dedicated to abdominal surgical pathology and abdominal trauma management in austere environments. Specificities of the common surgical problems due to tropical infectious diseases were exposed. Hernia repair in resource-limited environment was discussed in regard to surgical indications and techniques. Theoretical and practical teaching on clinical nutrition applied to the field conditions was also included in this teaching module. The course on vascular surgery addressed the general principles of vascular surgery, basic vascular exposures, temporary shunting and definitive arterial repair for vascular trauma. Concerning thoracic surgery, exploratory thoracotomy and

sternotomy as well as operative management of cardiac and pulmonary injuries and of empyema were exposed.

Urologic pathology and treatment of kidney and bladder stones, urinary retention and prostate hypertrophy but also urinary tract trauma were taught and largely discussed during a specific course.

Session 3. The third teaching module was dedicated to three major topics: Obstetrics and gynecology, pediatric surgery and orthopedics. One entire teaching day was dedicated to each one of these subjects since these are some of the most often encountered fields in humanitarian practice. [6], [7], [9] Most general surgeons are only scarcely confronted to these fields in their daily practice and thus feel even less comfortable dealing with this pathology in the austere and isolated setting of humanitarian missions.

The obstetrics and gynecology course covered normal and pathologic labor including obstructed labor and management of postpartum hemorrhage. Basic use of obstetrical ultrasound for pregnancy surveillance was explained. Recognition and treatment of complications such as (pre-) eclampsia, placental abruption and uterine rupture were taught since these are more frequent in fragilized populations because of the lack of systematic screening and the delayed medical advice for pregnant women. Surgical techniques for Cesarean section, post-delivery bleeding control and hysterectomy were taught giving practical tips and tricks for the austere environment. The second day of this teaching module was dedicated to pediatrics, comprising a course on basic pediatric anesthesia as well as neonatal and pediatric medical resuscitation. These courses were taught by a specialist pediatric anesthesiologist and by a specialist intensive care pediatrician. The course on surgical pathology in

children was taught by one of the co-authors (JPG) who is a retired pediatric surgeon very active in humanitarian surgery. The pathology was addressed not only by age group, but essentially according to the treatment possibilities in austere environments and the necessity to refrain from surgical intervention in complex cases that require tertiary treatment facilities. Orthopedic trauma management was widely exposed covering upper and lower limbs but also general management of spine trauma. A particular course on bone infection and management of septic bone nonunion in austere environments was taught.

Session 4. During the fourth and last teaching session, two days were dedicated to practical skills teaching and one to the final exam in order to obtain the Course Certificate.

A mass-casualty management teaching module was organized on a special outdoor facility of Médecins Sans Frontières-Operational Center Brussels (MSF-OCB) in Brussels, Belgium: It comprised a two-hour theoretical teaching on preparedness for mass casualty incidents and on the practical management of such events in the context of humanitarian missions. A tabletop exercise on hospital organization for mass-casualty incidents in austere environments, conjointly organized with the National Defense, allowed the participants to get an insight on the necessities in such situations. A full-scale mass-casualty exercise was carried out after the theoretical teaching. For this purpose, the students were divided into groups and had to organize the logistic and medical aspects of the situation. A group debriefing was held afterwards under the supervision of a mass-casualty expert from the partner medical NGO. The second day was dedicated to practical surgical teaching and specific hands-on workshops. In the cadaver lab, the students were divided into groups, each of the groups being allocated to one cadaver. Teachers had to rotate

from one group to another in order to demonstrate and give hands-on teaching about specific techniques already covered during the theoretical courses.

Specific surgical techniques were taught on hand surgery for trauma; orthopedics; limb fasciotomy and amputation; basic flaps and skin grafting; burr holes and craniotomy; sternotomy and exploratory thoracotomy inclusive clamshell thoracotomy and exposition maneuvers during crash laparotomy for trauma.

Alongside these topics, a workshop on regional anesthesia, basic ultrasound techniques including focused assessment by sonography for trauma (FAST) and ultrasound-guided fracture reduction, neonatal and pediatric resuscitation as well as cast immobilization.

Participant evaluation and certification. The evaluation of the participants was divided in two parts. A written test for which each teacher had been requested to propose two multiple-choice questions concerning his course, these questions having been reviewed and approved by the organizers. On the same day the candidates passed an interview led by two teachers, one of them being a humanitarian surgeon, the other one an academic surgeon. It consisted in leading a discussion and making treatment proposals starting from a clinical case.

In order to obtain the certification, participants had to provide a valid ATLS-provider certificate.

Participants. 31 participants originating from 11 different countries and three observers joined the course. Most were general surgeons, but subspecialties like orthopedic, vascular, plastic, urologic and pediatric surgery were represented amongst them. Humanitarian surgical experience of the participants was unequal

since less than half of them had taken part in surgical activity in austere environments or humanitarian missions, the other ones never having been involved in this kind of practice. 6 of the participants were final year surgical residents. The observers were two surgeons with humanitarian experience of whom one also participated to the practical teaching and one final year medical student.

Participant satisfaction. The overall participant satisfaction was good and the overall assessment of the course reached an average of 3,48 on a scale of 4 (SD 0,68). Teaching contents and effectiveness were also much appreciated since these items reached respectively 3,62 / 4 (SD 0,59) and 3,29 / 4 (SD 0,72). The results on teaching relevance were satisfactory with an average score of 2,95 / 4 (SD 0,68) (Figure 1).

To the question about what participants enjoyed the most during the course, the answers were mostly about the implication of teachers with practical field experience and about the practical advice on dealing with situations in austere and resource-limited environments. The diversity of the presented topics and especially of those with direct field application was much enjoyed. Teachers having presented an interactive and participative teaching style were acclaimed by the participants in the evaluation. Suggestions for future course enhancement were to base the teaching mostly on practical clinical situations and to show more real-life clinical cases. Although the idea of sharing the teaching between expert academic teachers and surgeons issued from the humanitarian NGO's was appreciated, specific comments were made on some of the academic teachers whose topics seemed to be too far away from the field reality. Students suggested that a better balance between both types of teachers should be found and that the pool of field-experienced teachers

could be more international. Another suggestion was that the teaching materials, especially a written text or the course slides, should be made available to the students before the teaching sessions, allowing them to be better prepared, to participate more interactively and also annotate the support according to the developments made during the interactive discussions.

Discussion.

Discussing with experienced humanitarian surgeons, it appeared to us, Europe-trained surgeons, that the encountered pathology and the requirements for a surgeon in the field are very different of our daily practice in high income countries. The novelty in the concept of the “humanitarian surgery in austere environments” course is the collaboration of specialized academic teachers alongside with surgeons and other professionals mainly active in the humanitarian setting. The field experience in low resource settings of many subspecialized university-issued surgeons was mostly inexistent. From the beginning of the course elaboration, it appeared to us that putting together our experience and sharing our knowledge seemed beneficial in order to produce an up to date and yet realistic core program that could respond to the educational needs for surgeons interested in participating to humanitarian missions. Highly specialized surgical techniques, nowadays commonly used in high income countries, had to be discussed in order to be adapted to the practical situations encountered in the low-resource setting. On the other hand, specific questions and situations encountered in the field were brought to light by the humanitarian collaborators and integrated in the course program. This combination of knowledge is important and gives the course its main attractivity regarding the target

audience. Senior residents and surgeons with no humanitarian experience could get a realistic insight into the challenges of humanitarian surgery and leads to adapt their knowledge and skills to this kind of practice. Participants with field experience were able to refresh their theoretical knowledge and to learn about new techniques and concepts in order to respond to the clinical challenges they encounter during their practice.

The teaching of non-surgical, but also non-medical topics to a surgical audience appeared to us as unavoidable. In contrary of the high-income setting, surgeons active in the austere environments often carry responsibilities beyond surgical practice. Basic knowledge of the general aspects of a humanitarian mission needs to be known in order to produce efficient work together with non-medical and local collaborators.

Although they are not directly participating to humanitarian action most of the time, we felt that implicating the medical and non-medical components of the National Defense would be interesting regarding their special knowledge on war medicine and logistics. An insight into modern warfare and the threats related to it but also into the military medical organization seemed to be very interesting regarding the frequent deployment of humanitarian surgeons in conflict zones. A high level of expertise in war surgery but also concerning chemical warfare, ballistics and mass casualty event management in war zones was provided by the military.

Finally, the strong collaboration with a large and well-structured NGO was of utmost importance. All non-medical aspects of the teaching program could be covered by highly experienced professionals of this organization. From the beginning of the course elaboration, the NGO collaborators could correctly orientate the course

contents towards the needs they encounter in the field and thus render the program highly attractive and specific. Confrontation with real-life situations from the field were most appreciated by the participants and were the starting point of many discussions during the interactive teaching sessions.

Spreading the course announcement through its network, the NGO allowed us to recruit not only experienced teachers, but also surgeons active in the humanitarian setting who wished to participate to the course in order to improve their knowledge and skills. Some surgeons originating from LMIC's were sent to the course by the NGO.

The course being held at the headquarters of the NGO, participants could easily get in contact with humanitarian workers and also informally gather information about the practicalities of humanitarian medical action. Two of the course participants with no previous humanitarian experience went on their first mission with this NGO during the 3 months following the course.

The HSAE course has been considered by some as a trauma course where participants would be taught how to deal with war injuries. This had certainly been favored by the context of recent terrorist attacks across Europe

The goal of the HSAE course although is much different and broader than to provide a general trauma surgery course. The most important and specific aspect is to prepare surgeons to face surgical pathology in a culturally different and resource-limited setting where the endpoints of therapy often differ from those they are used to in their usual high-income country medical and social environment.

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Table 1.**Humanitarian Surgery in austere environments inter-university course, session 2017-2018****Faculty profile: Professionnal origin and subspecialties**

<u>Academic:</u>	<u>NGO</u>	<u>Defence</u>
Acute Care Surgery	Legal office	Army Field logistics
Anesthesiology	Mass casualty expert	NBC specialist
Anesthesiology: Burns specialist	Medical Head	Specialist in ballistics
Cardiovascular and thoracic surgery	Pharmacy logistics	
Digestive surgery	Surgical referent	
ENT Surgery		
Eye surgery		
ICU nutritionist		
Infectious diseases		
Maxillo-facial Surgery		
Neurosurgery and spine surgery		
Orthopedics / Hand surgery		
Pediatric ICU		
Pediatric surgery		
Plastic and reconstructive surgery		
Plastic surgery		
Psychologist		
Urology		
Vascular surgery		

Table 2.

Humanitarian Surgery in austere environments inter-university course, session 2017-2018
Lectures

General Introduction to humanitarian medicine International humanitarian law Humanitarian NGO logistic organization in conflict zones Infection control and hygiene in austere medical environments Pharmaceutics and logistics in humanitarian missions Stress management and post-traumatic stress disorder Resuscitation and anesthesia (incl. Crush syndrome and burn management) Perioperative nutrition and practical application in the field Wound ballistics and management of gunshot and blast injuries Military organisation of combat casualty care Chemical warfare agents and management of chemical injuries Principles of damage control surgery Abdominal Surgery: Trauma and non trauma (incl. tropical diseases) Thoracic surgery and trauma Vascular surgery (trauma incl. amputation) Head and Neck pathology (ENT, maxillofacial, ophthalmology) Neurosurgery: CNS and spine trauma Plastic and reconstructive surgery (Wound management, grafts, flaps) Urology (basic techniques, prostate hypertrophy and urologic trauma) Obstetrics and gynecology (incl neonatology) Pediatric surgery Orthopedics: operative and non-operative fracture management (incl. Hand surgery)

Table 3.

Humanitarian Surgery in austere environments inter-university course, session 2017-2018
Practical exercises

Mass casualty exercise:

Theoretical course on disaster management

Real-size mass casualty exercise adapted to austere conditions

Tabletop exercise on mass casualty incident management

Skills lab:

Surgical technique practice in the cadaver lab

Workshops:

Casts

Basic clinical Ultrasound: FAST, US in head trauma, US-guided fracture reduction

Basic pediatric and neonatal resuscitation

Regional anesthesia workshop

Vascular access workshop

Figure 1:

Humanitarian Surgery in austere environments inter-university course, session 2017-2018
Participant satisfaction

