Seminars in Pediatric Surgery 25 (2016) 23–31

Contents lists available at ScienceDirect

Seminars in Pediatric Surgery

journal homepage: www.elsevier.com/locate/sempedsurg

Injuries and surgical needs of children in conflict and disaster: From Boston to Haiti and beyond

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ARTICLE INFO

Keywords:
Pediatric surgery
Conflict medicine
Disaster

ABSTRACT

Comprehensive care of patients in conflict and disaster requires coordination of medical, social, and public health agencies. Pediatric patients in these settings comprise a particularly vulnerable group subject to disruption of social networks and separation from family, inadequate surgical care due to lack of surgeon, anesthetist, and nursing specialization, and a general lack of advocacy within the global public health agenda. In the recent upswell of attention to the global surgical burden of disease and deficiencies in necessary infrastructure, the needs of pediatric surgical patients remain underappreciated and underemphasized amid calls for improvement in global surgical health. Experience in recent natural and man-made disasters has demonstrated that pediatric patients makeup a significant proportion of those injured, and has perhaps refocused our need to better characterize the surgical needs of children in conflict and disaster. In addition to treat such patients, we recognize the unmet challenges of improving pediatric emergency and surgical infrastructures in the low- and middle-income country settings where conflict and disaster occur most often, and continuing to advocate for vulnerable children worldwide and keep them out of harm's way.

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Background

Conflict and disaster affect growing numbers of civilians worldwide, as military struggles increasingly target civilian populations. Where during World War I only 20% of the injured were civilians, the internecine and politically complex conflicts of the 21st century have seen that number swell to over 80%.[1,2] Similarly, climate change and urban crowding have rendered dense human populations extremely vulnerable to the rising number of natural disasters occurring annually.

Children comprise a particularly vulnerable proportion of the civilians killed and injured for myriad, interconnected reasons. Children are physiologically frailer than adults, tend to be disproportionally afflicted and affected by malnutrition, and are torn by forced migration that has left more than 50 million persons displaced both within their own countries (internally displaced persons—IDPs) and across national borders (refugees).[3] Children are also more susceptible to injury from unexploded ordnance and land mines, and they are particularly vulnerable to some of the more sordid deviances of modern warfare in the form of sexual abuse and enslavement, and forced conscription into child armies. In addition, the provision of surgical care to pediatric patients is often punctuated by inexperienced providers, uncertain anesthesia, and age-inappropriate post-operative care.

In the specific example of landmine injuries, children injured during a natural growth period may need amputations revised and prostheses refitted, straining further poorly formed and funded health care systems.[4] The reluctance or inability to treat pediatric burn victims with early burn excision and grafting leaves a heavy burden of scar contracture and long-term rehabilitation needs, in addition to the psychological burden of disfigurement.[5] The unavailability of skilled nursing and advanced medical care and imaging leaves providers at times no choice but to subject pediatric patients to obligatory exploratory operations with attendant morbidity and mortality in lieu of careful observation that can be used appropriately in a majority of blunt trauma. Numerous other such examples of pediatric care deficits exist.

Precise numbers of children affected by conflict and disaster are hard to generate. By some estimates, over 1 billion children live in

Abbreviations: LMIC, low- and middle-income country; IDP, internally displaced person; NGO, non-governmental organization.

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http://dx.doi.org/10.1053/j.sempedsurg.2015.09.006
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areas of active or recent conflict, with 300 million under the age of 5 years.[6] Overall, 50% of the victims of natural and man-made disasters are children, numbering perhaps 200 million per year.[7,8] Some 200,000 children are estimated to die annually from conflict with another 500,000 disabled annually.[2] Natural disasters are variably classified and produce injury patterns and volumes that vary according to type of disaster. In addition to disaster-specific injuries, natural disasters also markedly disrupt health care systems by causing numerous injuries in a short period of time, and exacerbate pre-existing childhood illnesses (such as respiratory infections, diarrheal illnesses, and measles) as important secondary effects.

The surgical needs of children in conflict and disaster zones perhaps share more in common with usual needs than is initially apparent. To be certain, pediatric surgical expertise is required for the treatment of penetrating torso, neurosurgical injuries and mangled extremities in conflict, or extremity orthopedic injuries suffered in natural disasters. But lessons learned from the many conflicts and natural disasters of the past several decades underscore the importance of restoring normative care as quickly as possible and not neglecting the ongoing needs of patients displaced by conflict.[9] Health care systems in zones of conflict are typically fragile and poorly resourced, but the essential surgical needs of patients in these zones are not so much unique as perhaps grander in scale than normally seen.

What are the challenges?

Physiology

When considering the care of pediatric patients in conflict and disasters zones, one must understand the physiologic and physical particulars that separate pediatric patients from adult patients, as well as the specific injury patterns suffered by such patients. In addition, care for such patients is often rendered especially difficult by the types of pre-existing medical conditions particular to low- and middle-income country (LMIC) settings that are common sequelae of disrupted health care systems. Operating in conflict and disaster zones is additionally challenging, as the physical environment in which care is rendered may be unstable (literally or from a security standpoint). Both expatriate and national medical providers are often thrust into situations far from their habitual environment, exacerbating the stress inherent to emergency surgery.

Children vary from adults anatomically and physiologically in at least four ways: anatomic, physiologic, immunologic, and developmental.[10] With a skeleton that is quite pliable and a dense torso/trunk makeup, pediatric patients are perhaps more susceptible to solid organ multi-trauma than adults. They have a small circulating blood volume, placing them at early risk for hemorrhagic shock, and their thin skin and relative lack of subcutaneous tissue exacerbate risks of fluid and temperature loss. A higher basal metabolic rate and variable, age-related baseline vital signs provide challenges in monitoring for the inexperienced nursing and medical provider. Immature immunologic and developmental status can also complicate recovery.

Injuries

While at its best trauma care is standardized and meant to provide a "one-size-fits-all" general approach, several discrete challenges distinguish pediatric care. The initial triage of the injured pediatric patient must take into consideration the subtle early derangements of vital signs that may portend collapse. At the same time, some patients who as adults may be triaged as moribund and beyond salvation may in a pediatric setting merit aggressive intervention, taking advantage of the remarkable resilience and neuro-plasticity of young patients.

Orthopedic injuries in pediatric patients—common in natural disasters such as earthquakes—merit special attention. Fractures may be overlooked due to provider inexperience or poor-quality roentgenography, and subtle fractures of the growth plate may be improperly immobilized.[4] Post-operative care in children is critical for long-term recovery of function, and may be limited again by provider inexperience and the lack of appropriate rehabilitation and prosthetic facilities. In some reports, only 20% of children with serious extremity injuries have access to appropriate prosthetics in LMIC settings.[1]

Chest and abdominal injuries in children may be treated similarly as those in adults, but most hospitals in the settings commonly afflicted by conflict and disaster lack the basic, size-appropriate materiel essential for such care, e.g., thoracic drainage catheters, urinary catheters, and endotracheal tubes. The lack of specialized equipment needed to maintain core body temperature and to minimize excessive blood loss in the injured pediatric patient provide additional challenges.[11,12]

Burns—which may comprise more than 1/3rd of all case volumes in emergency humanitarian settings[13]—pose a particular, resource-intense challenge that affects many phases of emergency care. Initial burn debridement often requires blood transfusion, operating room equipment, and post-operative critical care frequently unavailable in emergency settings. Pediatric patients frequently require multiple return trips to the operating room for dressing changes under general anesthesia that in adults might be done under sedation or oral analgesics alone, and long-term sequelae of burn contractures and psychological after-effects are hard to treat in such contexts.

Operating in conflict

The provision of care to any patient in conflict zones may be difficult at best, and filled with outright peril at worst. Medical professionals and volunteers are no longer immune in conflict areas, and are increasingly subjected to targeted violence aimed at disrupting health care delivery to civilians and combatants, interfering with humanitarian expatriate aid, or just simple banditry.[14] Some non-governmental organizations (NGO) operate with the help of their own security services, others rely on local government protection, while still others rely on intelligence and communication with local warring parties to protect their health care workers. The past decade has witnessed an increased incidence of worker kidnapings, assaults, and murders.[15] The ongoing conflict in Syria has seen targeted government attacks on hospitals, ambulances, and health care workers.[16] Although such action is in direct contravention to international humanitarian law (such as the 1949 Fourth Geneva Convention and the 1977 Additional Protocols to the Geneva Convention) it remains a reality of modern-day emergency care in unstable settings, and unfortunately draws valuable resources away from direct patient care while at the same time potentially decreasing the pool of available health care volunteers and professionals.

While security concerns are no different in the provision of care to children, two particular traits of pediatric care may be germane to this setting. As mentioned previously, children are particularly prone to the external stresses imposed by war, deprivation, hunger, and separation from family. This important psychosocial aspect of care may be hard to account for in the most unstable settings, but must be addressed. Another concern relates to the presence of child soldiers among the victims and perpetrators of conflict injuries. Particularly for health care workers working for the first time in conflicts where child soldiers are present, seeing

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