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Specialization in acute care surgery in low-income and middle-income countries

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ABSTRACT

Traumatic injuries represent the highest portion of surgical conditions worldwide, and the groups most vulnerable to these injuries are disproportionately in low-income and middle-income countries (LMICs). It is in this context that we recognize and propose an urgent opportunity for developing and strengthening the field of acute care surgery (ACS) in LMICs. In this article, we will briefly review the history and advantages of ACS as a specialty and recognize the unique opportunity and benefit it may have in LMICs.

There is a significant burden and unmet need for surgical care in the world's poorest regions. Approximately a third of deaths worldwide are lost from conditions needing emergency and essential surgical procedures.[1] Traumatic injuries represent the highest portion of these surgical conditions worldwide,[2 3] and the groups most vulnerable to these injuries are disproportionately in low-income and middle- income countries (LMICs) where 90% of deaths from traumatic injuries occur.[4] Most of these injuries affect the young and economically productive age groups (5 to 45 years old), and for every death, there are a dozen disabilities.[5]

In addition to the global disease burden from trauma, emergency general surgery conditions constitute a large burden of disease in LMICs. Acute surgical conditions are responsible for 1.2 million preventable deaths each year in LMICs.[6] Out of these cases, more than 145 000 preventable deaths are from appendicitis, biliary disease, hernias and bowel obstructions. Based on the US and German experiences, experts estimate that up to 90% reduction in mortality could be accomplished in LMICs through increased access to surgical care.[7] The WHO estimates that the global disability-adjusted life years lost from injuries, maternal, neonatal, and three general surgical emergencies (peptic ulcer disease, appendicitis, and other digestive diseases) are considerably higher in LMICs than in high-income countries (HICs).[8] In contrast to the remarkable burden of trauma and emergency surgical conditions in LMICs, elective procedures compose 80% of surgical volume in HICs.[9 10]

Many challenges contribute to the limited access to surgical services in LMICs. Although training programs in LMICs produce a wide range of providers including surgeons and mid-level providers to manage surgical care, substantial scale-up in surgical workforce is needed to provide appropriate, quality surgical care for the growing global demand. Indeed, the high burden of emergency and trauma surgery cases in LMICs often means that surgeons cover trauma and emergency operations as well as elective operations. Moreover, lack of affordable and reliable transport for patients referred between facilities and inefficient allocation of operating rooms (ORs) present challenges specific to acute surgical cases needing appropriate level of care in a timely manner.

Given the need for more robust emergency surgery and trauma care in LMICs, optimizing the management of these acutely ill surgical patients would require cultivating a specific skillset in providers as well as a surgical system at the hospital and regional levels that is aligned to providing this care. It is in this context that we recognize and propose an urgent opportunity for developing and strengthening the field of acute care surgery (ACS) in LMICs.

HISTORICAL CONTEXT FOR ACS

Although emergency general surgery and trauma patients have always been an integral part of surgical care, the field of ACS as a surgical specialty is a relatively new concept.

With increasing surgical subspecialization in the USA, there has been a parallel growing need for coverage of trauma and emergency general surgical cases in academic and community hospitals.[11] Trauma and critical care surgeons responded to this demand for emergency surgical care, as they had been trained for a specialized skillset with significant overlap with emergency general surgery cases. Some emergency surgical cases may be relatively straightforward (ie, appendectomy and cholecystectomy), but others may present with more severe disease requiring intensive care (ie, intestinal ischemia and bowel perforation). In addition, trauma surgeons were well-poised to provide rapid assessment and management around-the-clock, as they were already working in-house at level 1 trauma centers. ACS thus combines these distinct but complementary fields of trauma, critical care, and emergency general surgery[12 13] into a single specialty, ultimately allowing for more effective reorganizing and restructuring of management of acutely ill surgical patients.

The ACS specialty was first developed in 2005 through the American Association for the Surgery of Trauma (AAST) to address this trend of increasing surgical subspecialization and diminishing general surgical workforce in the USA.[14] Since then, ACS models have been developed in Canada,[15] Taiwan,[16] and Australia[17] as well.

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THE ACS MODEL

The ACS model incorporates features at the referral system level, hospital systems level, and individual surgeon specialists. The ACS model incorporates both trauma, critical care, and emergency general surgery.

ACS referral systems

The purpose of referral systems is to link patients to highly specialised facilities with expertise in their specific conditions. Through a referral network, patients are transferred to specialized facilities for management by experienced providers. This organization allows patients with more complex disease to be expeditiously treated by specialized surgeons. Previous literature in regional trauma referral systems have shown that there is a significant decrease in injury-related mortality in HIC.[18–21] Development of trauma systems in LMICs, too, may yield similar results.[22]

In contrast, with the relatively recent development of ACS, there is still limited data on regional ACS referral systems. A Canadian regional referral system for ACS was developed in response to a shortage of surgeons available to take emergency call.[5] In this model, wait times for the OR were lengthened due to the time for transfer, but there was no difference in length of stay, complications, readmissions, or mortality. A regional ACS service developed in the USA showed that despite high severity of illness, mortality and length of hospital stay steadily decreased during the period of ACS implementation.[23] What is certain is that even with a limited ability to refer patients regardless of country setting, a very productive network for surgical care can be established.[24]

ACS model within the hospital system

Within the hospital, there is a system of organization for ACS teams. Hospitals with a developed ACS system have dedicated staff and dedicated ORs to ensure rapid assessment and management of ACS patients.

Creation of a dedicated ACS team allows for a restructuring of emergency case management within a hospital. During the initial presentation of the patient, the ACS model facilitates more expeditious treatment by reducing the time to surgical assessment and planning.[25] Studies from North America, Australia, and Asia examining the most common ACS cases demonstrated a statistically significant decrease in time to surgical consultation and time to the OR for appendectomies[26 27 28] and cholecystectomies[29]. This increased efficiency additionally helps reduce overcrowding in the emergency department.[13] Thus, the availability of a senior ACS surgeon leads to shorter stays in the emergency department, reduced time to review and management decisions, and expedited times to the OR.[30]

In addition to a dedicated staff, ACS systems also have a dedicated OR for ACS cases. The importance of a dedicated OR for ACS cases cannot be understated: it allows for emergency operations throughout the day, rather than waiting for elective cases to be completed. This arrangement allows for a daytime OR team to manage these potentially complex, critically ill patients in a timely manner. The ACS model has been found to be less disruptive to elective operations, as senior ACS surgeons are on-site during regular office hours and cleared of elective commitments while on call.[13 14] In addition, the dedicated OR ensures that emergency operations do not disrupt the elective OR schedule.

Once the operation is completed, increased availability of an experienced ACS surgeon may also result in reduced complication rates and length of hospital stay.[22] A study from the English National Health Service Hospital Trusts has further shown that increased availability of radiology services may improve outcomes for high-risk emergency general surgery patients.[31] A formalized ACS model thus involves strengthening perioperative, multidisciplinary care for the acutely ill surgical patient.

Finally, ACS models have been shown to decrease costs and increase revenue for hospital systems. DiRusso and colleagues[32] have demonstrated cost savings of more than $4000 per patient after a trauma quality improvement intervention, with net savings of more than 10:1 against investments. Another study compared operative productivity before and after the implementation of ACS and revealed a 66% increase in operative volume with an ACS division in place. Additionally, an increase in evaluation and management work and relative value unit (wRVU) production, as well as a rise in procedural wRVU production, was seen for both ACS and non-trauma surgeons.[33] Although operative volume and work RVUs increase with establishment of ACS teams, the dollar per RVU declines due to a higher proportion of uncompensated care.[34]

ACS providers

Acute care surgeons are specialists with a unique skillset that encompasses trauma, critical care and emergency general surgery. Key components of an ACS model include but are not limited to: around-the-clock availability, acuity of cases similar to that of trauma, and a broad range of surgical presentations.[21] ACS provides a framework for general surgeons to work together, combining different techniques and strategies from different surgical subspecialties. Recognition of the ACS surgeon as a specialist may be a catalyst for changing attitudes and allocating resources for ACS.[22]

In addition to the benefits for the hospital and patient, there are benefits for the individual surgeon in the ACS model. Examples of these advantages at the individual level include: freeing up elective surgeons, greater job satisfaction, more balanced lifestyles, more resident education, and higher technical independence. Indeed, surgeon satisfaction is improved with an ACS model, compared with those who operate under more traditional call schedules.[35] Both ACS and non-ACS surgeons reported improved job satisfaction with implementation of an ACS service.[36] For the patient, these surgeon factors may be associated with improved quality of patient care and expedited patient care, while for the hospital, there can be increased revenue, increased evidence-based standards, and more favorable hospital reputation.[21]

The growing appeal of ACS is also illustrated in the increasing number of trainees applying for fellowship in ACS, compared with previous reports showing declining interest in trauma surgery.[37] The first trauma fellowship began in 1980, but specialized fellowship training in ACS in the USA did not exist until 2008.[38] Trauma societies exist in Colombia, Cuba, Chile, Ecuador, Guatemala, Mexico, Panama, Paraguay, Uruguay, and Venezuela. However, none offer an ACS fellowship.[39] Again, there are examples of trauma or critical care fellowships in other LMICs (ie, Colleges of Medicine in South Africa and Aga Khan University in Pakistan), but no ACS fellowships.

THE ACS MODEL IN LMICS

Some LMICs have developed trauma systems, but to date, there is limited data on ACS systems that incorporate both trauma and emergency general surgery patients. Further investigation may likely reveal that ACS is a vibrant but unrecognized surgical specialty in LMICs. The high burden of emergency and trauma

surgery cases in LMICs may have already shaped surgical systems to adapt an ACS-like model. More focused review of various types of ACS models in LMICs is needed, and lessons from these experiences shared for increased implementation efforts. Further development of ACS models incorporating both trauma and emergency general surgery would also help encourage more explicit training in this unique and valuable skillset.

ACS referral systems in LMICs

Provision of acute surgical care is complex interplay of agencies, including prehospital, hospital, and interfacility services. This level of organization requires input from the ministry or national leadership. Capacity for ACS referral systems in LMICs will be limited based on the availability of in-country ambulance services. As prehospital systems mature, effective resource distribution and referral designations will be invaluable to addressing the influx of salvageable patients. For trauma patients, hospital and trauma center requirements, such as those proposed by the American College of Surgeons' Committee on Trauma, may help guide better organizing of referral system,[40] but still need contextually appropriate content. Due to resource limitations, regional referral for emergency general surgery patients would likely prioritize patients with complex surgical conditions for referral at the national or provincial level. More routine emergency general surgical patients could be managed at the local or district setting based on local capacity.

ACS model within the hospital system in LMICs

Based on experiences in HICs, ACS would be best developed in hospitals with a high volume of patients, especially referral patients with emergency conditions. The hospital should also have more than one surgical provider, such that responsibilities may be divided between a team dedicated to managing all emergency surgical procedures and another team for the remaining cases. The details of this arrangement, in terms of time schedule, pay structure, and resource availability, would be specific to and driven by each institution.

Hospital systems would need to be organized, allocating a dedicated OR for emergency operations. The question of opportunity cost often arises in response to this proposal for a designated ACS OR. Analysis of referral hospitals has demonstrated that surgical services are usually the most effective and cost-effective component of the facility.[7] The same staff at such facilities provide the services for most general surgical, obstetric, and trauma emergencies, and minor adjustments in the same structure, equipment, and supplies can serve all three components at very low cost. In South Africa, the Pietersburg Hospital in Limpopo Province showed that the OR cancellation rate was 44.5% with the primary reason for OR cancellation due to emergency cases.[41] Although there are costs involved with reserving OR space for emergency operations, these costs are minimal compared with the costs of cancelled operations. In South Africa, Pietersburg Hospital would have saved ZAR 2.7 million over a 1-year period of time if there had been a dedicated emergency OR.

ACS providers in LMICs

ACS senior surgeons would need to be available round-the-clock to provide expeditious assessment. Training programs would need to be developed and focused on specialized training in trauma, critical care and emergency general surgery. In HIC settings, training in ACS has traditionally been at the level of the surgeon. However, in LMICs, ACS training could be expanded to include other levels of healthcare providers including general practitioners and clinical officers. Key features of an ACS provider would involve dedicated training in acute care management and surgical intervention. In addition, ACS providers would need to be dedicated towards emergency care and free from elective responsibilities.

Developing ACS would increase access, improve care, promote sustainable infrastructure investments, and reorganize patterns of service delivery and resource allocation for greater efficiency. Although ultimately the ACS is developed on a national or regional level, this would require a large degree of infrastructure and investment up-front that may not be feasible in LMICs. Instead, a more practical approach would involve a gradual introduction of the ACS model, beginning with implementation at the hospital and provider level. At the hospital and provider level, this would involve creation of a dedicated ACS team of providers with an OR dedicated for emergency operations. These various components of reorganizing surgical care around a dedicated ACS service would require buy-in at both the provider and the hospital levels. Centers with a high volume of emergency surgical conditions (greater than 50% of surgical cases presenting as emergencies) would be have the greatest benefit. To optimize care, we need more robust data collection, information sharing, implementation of standards of care, systems design, education, and advocacy.

CONCLUSION

The ACS model has been shown to improve outcomes in HICs. Given the large burden of trauma and emergency general surgery in LMICs, development of the ACS model in these regions has potential to improve outcomes significantly. Recognizing the acute care surgeon as a specialist is critical to highlighting the importance of this unique skillset and allocating the resources and infrastructure for developing acute surgical care.

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