

ORIGINAL RESEARCH

Surgical emergencies referred from district hospitals to University Teaching Hospital of Kigali and the implications on surgical services in Rwanda: A retrospective study

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Abstract

Background

We investigated referred emergency general surgery (EGS) cases in Rwanda in terms of compliance with Ministry of Health (MOH) surgical package specifications.

Methods

This was a retrospective chart review of all EGS patients referred from district hospitals to the University Teaching Hospital of Kigali, Rwanda, to define the range of referred EGS conditions. Data were collected regarding demographics, clinical course, and reasons for transfer. Descriptive statistics were used to compare the diagnoses and implemented interventions for referred patients with specifications indicated in MOH surgical package documentation. Logistic regression was used to determine patient factors associated with mortality among transferred EGS patients.

Results

Over a 1-year period, there were 563 patients transferred with EGS conditions. The most common diagnoses were bowel obstruction (n=125, 22%), soft tissue infection (n=113, 20%) and trauma (n=104, 18%). Procedures commonly performed included laparotomy (n=21, 24%), bowel resection (n=20, 23%), and debridement (n=9, 11%). According to the MOH recommendations, 455 patients (81%) had conditions that could be managed at district hospitals.

The median symptom duration was 4 days (interquartile range [IQR], 2-7 days). The mortality rate was 12%, and the rates of reoperation and intensive care unit admission were 7% and 4.8%, respectively. The median duration of hospitalization was 7 days (IQR, 3-13 days).

Conclusions

EGS remains a public health challenge in Rwanda. Redefining the surgical packages of each health facility level, improving training and staffing at district hospitals, and addressing infrastructural gaps would facilitate earlier diagnosis and management of patients nearer to their homes.

Keywords: district hospitals, public health, emergency surgery, community-based health insurance, Rwanda

Introduction

Surgical conditions represent up to 30% of the global burden of disease.^[1] Authors from low- and middle-income countries (LMICs) have reported on the surgical

and anaesthetic human resource crisis, gaps in infrastructure, and limited access to specialized surgical care.^{[2]-[4]} Surgical care has been recognized as a fundamental human right and can be improved through decentralization from

tertiary-level to secondary- and primary-level hospitals.[5] To efficiently decentralize services, stakeholders need to understand the burden of disease as well as the strengths and limitations at district hospitals. Investment in district hospitals and the provision of basic essential surgical care can have wide-ranging effects on health systems in LMICs. There is a need for improved access to district-level surgical care with defined transfer mechanisms to higher levels of care when needed.[6]

Emergency general surgery (EGS) remains a public health challenge.[7] In a prospective observational cohort study of 247 hospitals in Africa, urgent or emergency operations accounted for 57% of procedures performed.[8] Urgent or emergency procedures have been reported to account for 70% of general surgery operations in Rwanda.[9] Common EGS conditions include soft tissue infections and acute abdominal conditions.[10] While surgery at district hospitals is performed by both surgeons and general practitioners, patients are more likely to undergo surgery at a district hospital if it has a surgeon employed.[10] The presence of a surgeon also results in more complex operations being performed at a district hospital.[10] Most nonobstetric surgical emergencies are transferred and arrive at tertiary referral hospitals after delays, which increase the risk of morbidity and death.[11]

The Rwandan health system is designed on a pyramidal model wherein—aside from trauma cases—patients first consult a health centre, then a district hospital, before being transferred to a referral hospital. Most (97%) of the Rwandan population has health insurance through a government-sponsored, community-based health insurance programme.[12] Through this health insurance programme, 90% of in-hospital charges are covered. To qualify for community-based health insurance coverage, patients must pass through the healthcare system.

In Rwanda, efforts have been made to decentralize healthcare, including surgical services. There are approximately 50 formally trained surgeons in Rwanda for a population of around 12 million, with most surgeons located in urban centres.[2] The majority of caesarean deliveries are performed at district hospitals by general practitioners.[2] However, few nonobstetric surgical emergencies are managed at the district level.[13] According to the package for health facilities at different levels of service delivery, a wide range of operations can be successfully managed at district hospitals.[14]

University Teaching Hospital of Kigali (*Centre Hospitalier Universitaire de Kigali*, CHUK) is a 565-bed teaching and referral hospital in Kigali. Currently, CHUK serves a catchment area that has 19 district hospitals, accounting for around 50% of the Rwandan population. The main operating theatre complex has 6 theatres shared by different surgical specialties: general surgery, paediatric surgery, orthopaedics, neurosurgery, urology, plastic surgery, maxillofacial surgery, and otorhinolaryngology. The hospital has 2 additional operating theatres reserved for obstetrics and gynaecology.

We assessed the range of diagnoses and outcomes among patients with EGS conditions transferred from district hos-

pitals to CHUK. We then compared the referred cases to the stipulations of the district hospital surgical care package documentation to identify gaps in coverage and propose a revised district-level surgical care package. Finally, we aimed to determine risk factors for death among patients transferred from district hospitals. We hypothesized that, according to the current Ministry of Health (MOH) surgical package, the majority of EGS conditions referred to CHUK could be managed at district hospitals.

Methods

The University of Rwanda College of Medicine and Health Sciences Institutional Review Board approved this retrospective investigation of EGS patients referred to a tertiary referral hospital from district hospitals in Rwanda. The aim was to define the burden and diversity of emergency surgical conditions referred to CHUK and compare these findings with existing MOH surgical package stipulations regarding district hospital-level surgical care.[15] This was accomplished through a retrospective review of the hospital records of all EGS patients referred from district hospitals from January through December 2016. EGS patients were defined as patients (trauma or nontrauma) admitted to the CHUK adult or paediatric emergency departments requiring EGS consultations, excluding isolated orthopaedic or neurosurgical trauma. We collected data on patient demographics, surgical diagnoses, management at CHUK, and outcomes.

Statistical analysis

We report frequencies and percentages to describe categorical variables to characterize patients referred to CHUK with EGS conditions. Our analysis included comparing the range of surgical procedures performed at CHUK with that indicated in MOH surgical package specifications regarding surgical care at district hospitals.[14] We calculated the frequencies and percentages of transferred patients who underwent operations at CHUK that met the MOH criteria for surgery that should be performed at district hospitals.

We used chi-square analysis and multivariate logistic regression to determine factors associated with survival and mortality among patients transferred from district hospitals. Variables with P values <0.1 determined by univariate analysis were entered into the multivariate regression model. P values <0.05 were considered statistically significant.

Results

Over a 1-year period (1 January through 31 December 2016), there were 563 EGS patients transferred from district hospitals to CHUK (Table 1). The most common diagnoses were bowel obstruction ($n=125$, 22%), soft tissue infection ($n=113$, 20%), and trauma ($n=104$, 18%). Most transferred patients ($n=468$, 84%) with EGS conditions underwent operations at CHUK. The most common operations were laparotomy ($n=116$, 25%), bowel resection ($n=67$, 14%) and debridement ($n=51$, 11%). Based on recommendations in the MOH surgical package documentation,

Table 1. Characteristics of patients referred to CHUK in 2016 with emergency general surgery conditions

Characteristic	n (%)
Gender	
Male	377 (67)
Female	186 (33)
Province	
East	178 (31.6)
Kigali City	151 (26.8)
North	117 (20.8)
West	67 (11.9)
South	50 (8.9)
Profession	
Farmer/housewife	218 (38.9)
Student	94 (16.8)
Self-employed	38 (6.8)
Employed by a company or institution	23 (4.1)
Unemployed	71 (12.7)
Other	15 (2.7)
Not documented	102 (18.2)
Referring district hospital	
Muhima	65 (12.5)
Kibagabaga	53 (10.2)
Kirehe	33 (6.3)
Byumba	32 (6.1)
Nyamata	25 (4.8)
Rwinkwavu	24 (4.6)
Gisenyi	23 (4.4)
Masaka	23 (4.4)
Nyagatare	22 (4.3)
Butaro	20 (3.9)
Other	199 (38.3)
Insurance	
Community-based health insurance	452 (80.6)
Private	40 (7.1)
Other	43 (7.7)
Not documented	26 (4.6)
No insurance	40 (7.1)
	<i>Continued</i>

Table 1. Continued

Characteristic	n (%)
Past medical history	
Diabetes	15 (2.7)
Hypertension	11 (1.9)
HIV	11 (1.9)
Other	57 (10.1)
None	469 (83.3)
Past surgical history	
Prior surgery	48 (8.5)
None	478 (84.9)
Not documented	37 (6.6)
Diagnosis	
Bowel obstruction, not otherwise specified	125 (22.1)
Skin and soft tissue infection	113 (20.0)
Trauma	104 (18.4)
Peritonitis, not otherwise specified	77 (13.6)
Appendicitis	32 (5.7)
Peptic ulcer disease perforation	30 (5.3)
Bowel perforation	23 (4.1)
Volvulus	20 (3.5)
Other	71 (7.3)
Traditional healer consultation	
Yes	101 (17.9)
No	411 (72.9)
Not documented	52 (9.2)
Health centre consultation	
Yes	295 (52.4)
No	109 (19.4)
Not documented	159 (28.2)
District hospital intervention	
Intravenous crystalloid infusion	469 (83.5)
Antibiotics	382 (70)
Nasogastric tube decompression	201 (35.8)
Surgery	10 (1.8)
	<i>Continued</i>

Table 1. Continued

Characteristic	n (%)
Mode of transportation	
Ambulance	488 (92.2)
Private vehicle	28 (5.3)
Public vehicle	13 (2.5)
Operation at CHUK	
Yes	468 (83.6)
No	93 (16.4)
Type of operation	
Laparotomy, not otherwise specified	116 (24.5)
Bowel resection	67 (14.2)
Debridement	51 (10.8)
Appendectomy	36 (7.6)
Splenectomy	35 (7.4)
Incision and drainage	35 (7.4)
Amputation	32 (6.8)
Omental patch	29 (6.1)
Herniorrhaphy	25 (5.3)
Stoma	16 (3.4)
Other	26 (5.5)
Intensive care unit admission	
Yes	27 (4.8)
No	527 (93.3)
Reoperation	
Yes	42 (7.4)
No	512 (90.6)
Outcome	
Survival	491 (88)
Death	65 (12)

CHUK, Centre Hospitalier Universitaire de Kigali (University Teaching Hospital of Kigali)

455 patients (81%) transferred to CHUK could have been surgically managed at district hospitals (Table 2). Conversely, 108 patients (19%) had surgical conditions that were beyond the scope of district hospital providers. Twenty-seven patients (5%) required intensive care unit (ICU) admission, which could not have been provided at district hospitals.

Transfers were predominantly from Eastern Province (n=178, 32%), Kigali City (n=151, 27%), and Northern Province (n=117, 21%), with 62% coming from 10 different hospitals. Three hundred patients (57.8%) were referred from

high-volume referral district hospitals (those that refer more than 20 patients each year). Sixty-three patients (12.1%) were referred from district hospitals with surgeons employed. The median patient age was 28 years (interquartile range [IQR], 13-45 years), and most patients (n=377, 67%) were male. Most patients (n=495, 95%) had some form of health insurance, with 452 (81%) covered by government-sponsored, community-based health insurance. Forty patients (7%) had no health insurance. Most patients had no comorbidities (n=469, 83%) and no prior surgical history (n=478, 85%).

The median duration of symptoms was 4 days (IQR, 2-7 days). About half of the patients (n=295, 52%) sought care at a health centre before being referred to a district hospital. District hospital management included intravenous crystalloid infusions (n=469, 84%), antibiotics (n=382, 70%), and nasogastric tube decompression (201, 36%). Ten patients (2%) underwent operations at district hospitals; however, detailed information was unavailable regarding the operations performed at district hospitals. Most patients (n=488, 92%) were transferred from the respective district hospitals to CHUK via ambulance.

Forty-two patients (7%) required reoperations. Sixty-five patients (12%) died. The median hospitalization duration at CHUK was 7 days (IQR, 4-13 days).

Diagnoses among patients admitted to the ICU included trauma (n=8), peritonitis (n=7), bowel obstruction (n=4), perforated peptic ulcer (n=3), bowel perforation (n=2), soft tissue infection (n=1), and other (n=2). Operations performed for ICU patients included laparotomy (n=11), bowel resection (n=8), omental patching (n=3), splenectomy (n=2), and debridement (n=2).

Nonoperative management was provided to 93 patients (16%). The diagnoses of patients who received nonoperative management included bowel obstruction, soft tissue infection, and intestinal volvulus.

There were 73 patients who underwent surgery but for whom data regarding the type of procedure performed were missing.

The following factors were associated with patient death according to the univariate analysis: referral from Northern Province, nasogastric tube placement at the referring district hospital, a diagnosis of volvulus or bowel perforation, stoma creation, and ICU admission (Table 3). Multivariate analysis revealed the following factors to be associated with patient death: referral from Northern Province (odds ratio [OR], 2.72; 95% confidence interval [CI], 1.39 to 5.33), bowel perforation (OR, 6.57; 95% CI, 1.93 to 22.32), volvulus (OR, 6.79; 95% CI, 2.15 to 21.47), stoma (OR, 3.88; 95% CI, 1.03 to 14.56), and ICU admission (OR, 9.73; 95% CI, 3.94 to 24.00) (Table 4).

Discussion

The management of emergency surgical conditions requires interplay among core components of the healthcare system, including workforce, equipment and surgical consumables, infrastructure, health information systems, and leadership. Deficits in any of these core components will compromise

Table 2. Emergency general surgery procedures for district hospital management according to the Rwanda Ministry of Health service package, 2011^[1,4]

Rwanda Ministry of Health surgical package recommendations		Patients referred to CHUK (n)	
Diagnosis	Type of intervention	Underwent operation	Admitted to ICU
Acute abdomen except sigmoid volvulus	Laparotomy: choice between operation or referral depends on the practitioner's experience	182	13
Inguinal hernia^a	Hernia repair: Bassini technique most used		
Strangulated hernia^a	Hernia repair	25 ^a	0 ^a
Umbilical hernia^a	Hernia repair		
Abdominal trauma	Laparotomy and possible repair of injured organ (spleen, liver, bowel)	65	8
Urine retention^b	Insertion of suprapubic catheter		----- ^b
Thoracic effusion, pneumothorax^c	Chest tube for drainage		----- ^c
Perforated duodenal or gastric ulcer	Simple repair of a perforated duodenal or gastric ulcer = excision of ulcer and closing suture: the level of treatment depends on the skills of the practitioner and on the benign or malignant nature of the ulcer	30	3
Intestinal perforation	Suture of an intestinal perforation: intervention can also be done in a district hospital with a surgical experienced family physician	23	2
Appendicitis	Appendectomy	36	0
Colonic disorders	Colostomy	16	0
Anal fissure^d	Anal fissure repair		0 ^d
Haemorrhoids^e	Haemorrhoidectomy		0 ^e
Paraphimosis^f	Dorsal slit of the foreskin		0 ^f
Breast abscess^g	Incision and drainage		0 ^g
Neck abscess^h	Incision and drainage		0 ^h
Undescended testis and torsionⁱ	Exploration, orchidopexy		0 ⁱ
Intestinal cancer^j	Intestinal resection and anastomosis		----- ^j
Traumatic amputation	Haemostasis and amputation	4 traumatic, 28 soft tissue infections	0
Lacerations	Debridement	28 soft tissue, 18 traumatic	1

CHUK, *Centre Hospitalier Universitaire de Kigali* (University Teaching Hospital of Kigali); ICU, intensive care unit

^a"Hernia" included inguinal, strangulated, and umbilical hernias for study data collection purposes. Data were not collected for patients requiring ^bsuprapubic catheterization or ^cchest tube insertion. During the study period, there were no emergency general surgery patients transferred for the following diagnoses: ^danal fissure, ^ehaemorrhoids, ^fparaphimosis, ^gbreast abscess, ^hneck abscess. ⁱUndescended testes and torsion were managed by a separate urology service. ^jIntestinal cancer was not reported as a separate diagnosis for data collection.

Table 3. Factors associated with patient survival

Variable	Died n (%)	Survived n (%)	P value
Gender			
Male	40 (11)	333 (89)	0.289
Female	25 (14)	156 (86)	
Referral province			
East	17 (10)	158 (90)	0.331
Kigali	13 (9)	137 (91)	0.180
North	27 (23)	89 (77)	<0.001
South	3 (6)	46 (94)	0.205
West	5 (8)	60 (92)	0.288
District hospital category			
High volume referral (≥20 referrals per year)	36 (10)	320 (90)	0.128
Low volume referral (<20 referrals per year)	29 (14)	172 (86)	
Insurance			
Community-based health insurance	50 (11)	394 (89)	0.780
Other insurance	4 (9)	39 (91)	
Not documented	4 (15)	22 (85)	
No insurance	6 (15)	34 (85)	
Traditional healer consultation	16 (16)	83 (84)	0.125
Health centre consultation	39 (13)	250 (87)	0.164
District hospital intervention			
Antibiotics	44 (12)	331 (88)	0.946
Nasogastric tube decompression	30 (15)	168 (85)	0.057
Intravenous fluids	57 (12)	404 (88)	0.263
Surgery	3 (30)	7 (70)	0.068
Ambulance transport to hospital	58 (12)	423 (88)	0.472

Continued

Table 3. Continued

Variable	Died n (%)	Survived n (%)	P value
Past medical history			
Diabetes	1 (7)	14 (93)	0.223
Hypertension	4 (37)	7 (64)	
HIV	1 (9)	10 (91)	
Other	8 (19)	35 (81)	
None	48 (10)	414 (90)	
Past surgical history	8 (17)	40 (83)	0.450
Diagnosis			
Bowel obstruction	9 (7)	116 (93)	0.851
Trauma	8 (8)	93 (92)	0.755
Soft tissue infections	12 (11)	98 (89)	0.443
Peritonitis	12 (16)	65 (84)	0.200
Peptic ulcer perforation	5 (17)	25 (83)	0.212
Appendicitis	2 (6)	30 (94)	0.174
Bowel perforation	6 (5)	116 (95)	0.048
Volvulus	8 (40)	12 (60)	0.008
Other	3 (8)	37 (93)	0.836
Operation			
Incision and drainage	1 (3)	34 (97)	0.579
Amputation	3 (9)	29 (91)	0.551
Appendectomy	2 (6)	29 (91)	0.161
Bowel resection	8 (12)	59 (88)	0.308
Herniorrhaphy	0	25 (100)	----
Debridement	8 (17)	39 (83)	0.130
Omental patch	5 (17)	24 (83)	0.150
Laparotomy, not otherwise specified	17 (15)	98 (85)	0.162
Splenectomy	2 (6)	31 (94)	0.929
Stoma	5 (31)	11 (69)	0.024
Other	0	26 (100)	----
None	2 (40)	3 (60)	0.038
Intensive care unit admission	12 (44)	15 (56)	<0.001
Reoperation	2 (5)	36 (95)	0.175

Table 4. Multivariate analysis of factors associated with patient survival

Factor	Adjusted OR	95% CI	P value
Referral from Northern Province	2.72	1.39 to 5.33	0.003
NGT decompression at DH	1.04	0.53 to 2.07	0.892
Diagnosis: bowel perforation	6.57	1.93 to 22.32	0.003
Diagnosis: volvulus	6.79	2.15 to 21.47	0.001
Operation: stoma	3.88	1.03 to 14.56	0.044
No operation	6.78	0.94 to 48.71	0.057
ICU admission	9.73	3.94 to 24.00	<0.001

CI, confidence interval; DH, district hospital; ICU, intensive care unit; NGT, nasogastric tube; OR, odds ratio

EGS management at district hospitals. This leads to more transfers of patients to tertiary hospitals, which increases costs and delays patient care.

Numerous factors are associated with interhospital transfers for EGS. Previous studies have shown that reasons for transfer include requirements for a higher level of care, specialized services, or a general surgeon.^[16] In Rwanda, district hospital providers' perceptions about the need to transfer patients for emergency surgical interventions are influenced by the lack of competent surgical or anaesthesia providers at their facilities.^[17] In our study, the majority of patients transferred from district hospitals to the tertiary hospital did not need specialized ICU management or complex operative interventions, which suggests that—with appropriate resources—these patients could have been successfully managed at district hospitals.

Increasing the number of trained providers, equipping district hospitals with basic resources to deliver essential surgical care, and assuring sustainability are likely to have wide-ranging effects on the health systems of LMICs.^[6] A study conducted in South Africa showed that 30% of operative procedures performed at a referral hospital could have been managed at the district level.^[15] An earlier study carried out in Rwanda revealed shortages in various resources at district hospitals throughout the country.^[2] However, despite these shortages, more than 80 000 surgical procedures are completed annually in Rwanda.^[2] Increasing surgical capacity at the district hospital level will require ensuring an adequate supply chain for material resources and training of surgical providers.

Our study showed that patients referred to CHUK were predominantly male and that the majority came from Eastern Province, Kigali City, and Northern Province, consistent with the Rwandan population distribution.^[13] The district hospitals in Muhima, Kibagabaga, Kirehe, and Byumba most commonly referred patients to CHUK. A surgeon is

employed in each of 8 Rwandan district hospitals. Of the district hospitals with employed surgeons, the hospitals in Butaro and Rwamagana referred the most patients. These referral patterns could be explained by differences in provider skill sets, disease presentations (including delays in presentation), patient knowledge, or environmental factors. In a high-income setting, interhospital transfer was shown to be more likely to initiate from small, government-run, and rural facilities.^[18]

Patients with a wide range of emergency surgical conditions are referred to CHUK from district hospitals. Bowel obstruction, soft tissue infection, and trauma were the leading diagnostic categories in our study. This was consistent with other studies conducted in sub-Saharan Africa that explored emergency surgical conditions and unmet surgical need.^{[11],[19]} We found the stipulations regarding the service package for district-level surgery^[14] to be somewhat ambiguous: laparotomy is designated as a district hospital procedure but only if the general practitioner is able to treat bowel, liver, or spleen injuries. These guidelines for general practitioners do not clearly define the requirements for performing laparotomies. Based on other reported series, we suggest redefining the procedures to be performed at district hospitals and appropriately training providers (general practitioners, anaesthetists, and nurses) on the management of these conditions. EGS training should focus on the most common procedures and conditions, such as laparotomy for bowel obstruction and bowel perforations, debridement of soft tissue infections, and the management of trauma patients. This would facilitate improved EGS capacity and outcomes.^[20]

In a rural district in South Africa, the main limitation to trauma management capacity was a shortage of human resources.^[21] Intervention options include either strengthening the district-level healthcare worker capacity or bypassing the district and transferring patients directly to referral centres.^[21]

Interfacility transfers of patients with emergency surgical conditions are common. Interhospital transfers delay surgical intervention and increase hospitalization durations.^[6] A study on septic patients found patient transfers to be associated with delayed antibiotic provision and resuscitation therapy.^[22] Transferred patients are often ill and require complex and prolonged hospital care.^[23]

We had some limitations to consider while interpreting our study results. We only described people who managed to reach CHUK and cases for which a surgical team was involved. There were likely other patients who were not transferred to CHUK or died prior to referral or surgical consultation. One reason for not seeking surgical care in LMICs is a person dying before healthcare can be arranged.^[24] Visiting surgical teams and outreach programmes in district hospitals may influence the quality and quantity of care. Additionally, variability in material and human resources may influence the ability of district hospitals to provide surgical care throughout the year.

Conclusions

EGS remains a public health challenge in Rwanda. Redefining the surgical packages of each health facility level, improving training and staffing at district hospitals, and addressing infrastructural gaps would facilitate earlier diagnosis and management of patients nearer to their homes.

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