The impact of introducing diagnostic and therapeutic upper endoscopy in an ambulatory Surgery Center in Rural Eastern Uganda

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Abstract

Background: The availability of upper endoscopy (UE) is limited in many rural low- and middle-income countries (LMIC). Few studies have evaluated use of elective endoscopies to address esophago-gastric diseases in remote Eastern Uganda.

Objective: This research assesses the impact of introducing UE on diagnosing gastrointestinal diseases endemic to the area.

Methods: This is a retrospective, cross sectional, single center study evaluating patients who received elective UE from Kyabirwa Surgical Center in rural Eastern Uganda, between 2020 to 2022. Primary outcome variables were presenting symptoms, endoscopic diagnoses and respective treatments.

Results: 350 endoscopies were performed for 333 patients, (1:1 male-to-female ratio, average age 48). Abnormalities were found on endoscopy in 73% of patients, revealing diagnoses of esophageal cancer (16.4%, N=64), gastritis (16.7%, N=65), hiatal hernia (8.7%, N=34), esophagitis (7.4%, N=29), ulcer (6.2%, N=24), and candidiasis (5.1%, N=20). Most patients presented with epigastric pain alone (40%, N=133) or dysphagia (39%, N=130). 51% of patients with dysphagia had esophageal cancer on endoscopy, of which 28.1% had an interval palliative stent placed.

Conclusions: The introduction of UE into a rural LMICs is possible and can verify baseline prevalence of endemic upper gastrointestinal diseases. Confirmation of diagnosis by endoscopy can direct medical management and interventional therapy.

Keywords: Diagnostic and therapeutic upper endoscopy; ambulatory surgery center; rural Eastern Uganda.

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Introduction

Chronic upper gastrointestinal (GI) symptoms are a universal problem, with only 60% of patients seeking treatment in western societies, and a much lower percentage in low- and middle-income countries (LMICs) where access to care is scarce[1,2]. Unfortunately, LMICs continue to have a large burden of GI disease[3,4]. Besides hiatal hernias, peptic ulcer disease, and *H. Pylori* gastritis, there is also a disproportionate amount of esophageal squamous cell cancer (ESCC) specifically in East Africa[5,6]. However, the true prevalence of upper GI diseases remains unknown, as access to diagnostic endoscopy is limited[4,7,8].

In East Africa, there are significantly fewer diagnostic or therapeutic endoscopies performed compared to Western countries. For example, a study conducted in Ethiopia, Kenya, Malawi, and Zambia states that there is one endoscopist for every 400,000 to 2 million individuals and one functioning gastroscope for every 400,000 to 1.3 million individuals[3]. These statistics account for less than 10% of the same resources found in high income countries. Additionally, most medical procedures in these LMICs are performed in urban hospitals staffed by specialists or sparse private facilities with prohibitively high costs, frequent case cancellations and lengthy procedural wait times. Without ready access to specialist procedur-

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alists, patients in rural communities typically travel long distances to urban centers or forego surgical care[9]. These barriers place undue burden on the most vulnerable patient population with the most unmet surgical needs[10]. As a result, most patients in East Africa with chronic GI symptoms are treated with medical management and lifestyle changes without confirmatory endoscopy[11]. For patients with alarming symptoms of potential cancer, little can be done without access to diagnostic or therapeutic endoscopy, increasing the prevalence of advanced disease[12].

With the successful implementation of upper endoscopy (UE) in a resource-limited, remote area of Uganda, we are able to combine visual diagnoses with histopathology to tailor therapies. This study reports on the epidemiology of endemic GI disorders currently affecting a rural population in Eastern Uganda and the impact of introducing UE on the diagnoses and treatment of patients with upper GI symptoms.

Material and Methods

This is a retrospective, cross sectional, single center study conducted at Kyabirwa Surgical Center (KSC) in rural Eastern Uganda, a 3-hour drive from the capital, Kampala, and 10 km from the nearest district hospital. This out-patient private facility, funded by self-pay and philanthropic support, provides out-patient surgical care to its catchment area of 520,000 people, delivering 65-75% of the community's surgical needs. Patients are referred to KSC by non-governmental organizations, local clinics, and community engagement.

There are two fully equipped operating rooms, a six-bed monitored post anesthesia unit, and ultrasound and x-ray capabilities. Two qualified surgeons, one anesthetist, nurses, assistants and administrative personnel are on staff, and perform out-patient community visits to patients regularly. Equipment is owned by KSC, and maintained by nurses and assistants on site.

Endoscopy was introduced to the medical practitioners of this community with a one-week in person training session led by a senior practicing gastroenterologist. During this course, six regional Ugandan surgeons gained an understanding of the equipment and technique, and performed endoscopies on patients under the guidance of the instructor. All endoscopies and advanced procedures, including stent placement, thereafter were performed by one surgeon and remotely proctored over Zoom guidance with a fiberoptic, 40 Mbp bandwidth, high-speed internet cable that connected directly to the local area network. A Logitech video camera and transmission platform aided in remote visualization. A live-streaming voice and split screen video feed of the endoscopists hands and the scope view without lag time was established, resulting in a real-time ability to discuss findings and endoscopic handling[13]. Once comfortable with diagnostic endoscopy, the KSC staff received further in-person stent training by a Ugandan endoscopist.

Initial endoscopic diagnoses were mostly made based on observations by the surgeon, often with expert input via zoom, followed by histological clarification when a biopsy was taken. Most biopsies were sent to a third-party pathology lab either in Kampala, Uganda or to its branches in Tanzania or South Africa with at least a 7-day turnaround time. If the slides were inconclusive requiring a second opinion, the specimen was processed at KSC and read via remotely controlled microscopy by a pathologist in NY. Logistical constraints limited telepathology for only those patients with the most time-sensitive endoscopic diagnoses, such as malignancy.

After obtaining Institutional Review Board approval by the Mbarara University of Science and Technology and the Ugandan National Council for Science and Technology (MUST-2022-636 and UNCST-HS2489ES), endoscopy reports from all esophagogastroduodenoscopies performed between February 2020 and June 2022 were collected from an electronic medical record database using procedure codes. Patient demographics, chief complaint, pathology, intraoperative/postoperative adverse events (hemorrhage, perforation, immediate return to facility or death) and subsequent interventions were gathered. Patients who received stent placement were additionally retrospectively contacted, with permission, to assess symptomology after stenting. Data collection and analysis was performed by surgeons and gastroenterologists at MSH and KSC. All variables were categorical and described using percentages and proportions.

Results

In total, 350 UE reports from 333 patients were evaluat-

ed, accounting for 18% of surgical procedures performed during this time. The male: female ratio was 1:1, with a mean age of 48.5 years. There were no intraoperative or post-operative adverse events (hemorrhage, perforation, immediate return to facility or death).

Indications for Endoscopy and Endoscopic Biopsy

The most common presenting symptoms were epigastric pain, dysphagia, odynophagia, and dyspepsia. Epigastric pain alone was the presenting symptom for 133 (40%) of patients. Dysphagia was a chief complaint in 130 (39%) of patients, with 31 (24%) also having alarming symptoms, defined as weight loss, hematemesis, or melena. The remaining patients (N=70, 21%) presented with multiple symptoms, while 2 patients had previously dagnosed cancer (Table 1).

Table 1. Diagnoses Based on Presenting Symptom

					Diagnoses (not mutually exclusie)												
Presenting Problem	N	N%	# Biopsies	% Biopsies	Gastric Ca	Eso Ca	Candidiasis	Esophagitis	Gastritis	Ulcer	Duodenitis	Hiatal hernia	Eso varices	Achalasia	Normal	Other**	
epigastric pain (alone)	133	40%	28	25%	1	0	6	14	29	11	5	17	0	0	68	7	
dysphagia (alone)	58	17%	35	31%	2	30	4	2	8	2	0	5	0	2	7	2	
dysphagia + alarm symptom	27	8%	22	19%	0	22	2	2	2	0	0	2	0	1	0	1	
odynophasia w/wo epigastric pain/dysphagia	24	7%	6	5%	0	3	2	3	5	0	0	2	0	1	6	4	
epigastric pain + dyspepsia	23	7%	4	4%	0	0	4	2	9	1	1	4	0	0	7	0	
epigastric pain + dysphagia	17	5%	9	8%	0	5	0	1	3	2	2	1	0	0	6	1	
epigastric pain + alarm symptom	15	5%	1	1%	1	0	0	1	2	4	0	0	2	1	4	2	
dyspepsia (alone)	8	2%	5	4%	0	0	1	1	5	2	0	1	0	0	2	0	
alarm symptom (alone)	7	2%	0	0%	0	0	0	2	0	1	0	0	3	0	1	0	
epigastric pain + dysphagia + alarm symptom	4	1%	3	3%	1	2	0	0	0	0	0	0	0	0	0	1	
previously known cancer	2	1%	0	0%	0	2	0	0	0	0	0	1	0	0	0	0	
other*	15	5%	1	1%	0	0	1	1	2	1	1	1	0	0	3	8	
Total	333	100%	114	100%	5	64	20	29	65	24	9	34	5	5	104	26	390
Percentage					1%	16%	5%	7%	17%	6%	2%	9%	1%	1%	27%	7%	100%

The diagnoses in Table 1 were not mutually exclusive (see description in table). Some patients with epigastric pain may have had 2 concurrent diagnoses. Abbreviations: Ca for cancer. Eso for esophagus. Alarm symptoms are defined as weight loss, hematemesis, or melena.

* Other presenting problem: foreign body (6), emesis (4), hiccups (1), Gastric Outlet Obstruction (1), varices (1), nausea (1), other (1)

** Other endoscopic diagnoses: organo-axial volvulus who went onto receive a barium swallow for further characterization (4), foreign object (4), duodenal mass/ obstruction (3), laryngeal tumor (2), enlarged adenoid (2), duodenal helminth (1), GOO (1), gastric varices (1), bleeding duo papilla (1), PEG placement (1), Schatzki's ring (1), Mallory Weiss tear (1), incomplete scope (1), missing repots (3)

Of all patients who underwent endoscopy, 114 (34%) had a biopsy. Biopsies were obtained at the discretion of the endoscopist, with the majority taken to confirm the visual diagnosis of malignancy (N=63, 55%), gastritis (N=30, 26%), or to further characterize an ulcer (N=11, 10%) since biopsies can be costly for rural Ugandans. All except one biopsy of an endoscopically malignant lesion were read as cancer. Most biopsies taken around ulcers or for suspected gastritis were not malignant.

Post-Endoscopy Diagnosis

UE resulted in the diagnosis of gastritis (N=65, 16.7%), esophageal cancer (N=64, 16.4%), hiatal hernia (N= 34, 8.7%), esophagitis (N=29, 7.4%), ulcer (N=24, 6.2%), candidiasis (N=20, 5.1%), and duodenitis (N=9, 2.0%). Most endoscopic diagnoses were made solely on visual observation which defined the diagnosis according to the perceptible characteristics of the mucosa in real-time. As such, treatments were prescribed for most patients with benign-appearing endoscopic findings without tissue diagnosis. However, 26% of those with endoscopic gastritis and 38% of ulcer diagnoses were recommended to have a *H pylori* stool antigen test prior to triple antibiotic therapy. Many were treated for *H. pylori* without a confirmed diagnosis, and while this may increase the antimicrobial resistance in an endemic community, many patients are not able to return to the facility or afford the tests.

Esophageal cancer patients were on average 58 years old, with a male:female ratio of 2:1. Of the 64 patients with esophageal cancer, 73.4% (N= 47) were squamous cell, 6.3% (N=4) were adenocarcinoma, 3.1% (N=2) were diagnosed elsewhere without specification, and 17.2% (N=11) were not subtyped by our records. Of note, of which 100% of those diagnosed with esophageal cancer had an initial complaint of dysphagia. However, only 60.9% of patients with dysphagia had esophageal cancer. Three quarters of patients had a high-grade obstruction where the endoscope could not be passed beyond the tumor. The length of the cancer was not routinely reported, though two patients had esophageal cancer that crossed the gastroesophageal junction into the stomach.

Treatment of Esophageal Cancer

Of the 64 patients with confirmed esophageal cancer, 18 patients (28.1%) had a palliative stent placed a median of 17 days from the index endoscopy (range 0 – 224 days, average 35). This lag time was due to the time it takes to gather pathology and schedule stenting. The remaining patients were either lost to follow up, financially and/or logistically objected, or were too apprehensive to undergo this palliative procedure. All cancer patients were referred to the Uganda Cancer Institute for chemoradiation and a staging workup.

For patients who were stented, 55% of patients died of esophageal cancer an average of 114 days after stent placement. As reported by relatives, at time of death, 80% of the stented patients tolerated liquid and solid food. Of those still alive and accounted for, 80% denied any dysphagia an average of 88 days post stent placement. One patient was re-stented for tumor growth and another rescoped for presumed stent migration, which was in fact, properly positioned. There were no perforations or additional procedural complications.

Treatment of Benign Disease

Common benign conditions discovered on UE included gastritis, hiatal hernias, ulcers, esophagitis, and candidiasis. Among these, patients with gastritis (89%), esophagitis (83%), and ulcer (96%) were managed with an antacid or triple therapy, plus lifestyle changes (avoidance of spicy foods/coffee, head elevation, smoking cessation, and intentional weight loss). Of the 20 patients with candidiasis, 18 (90%) were prescribed an antifungal agent. Patients with benign conditions were educated via in-person discussions with the KSC team on the importance of medication compliance and techniques to prevent symptom recurrence or progression. Since access to medication and therefore, adherence, can be difficult in rural Uganda, patients with benign conditions were educated via in-person discussions with the KSC team on the importance of medication compliance and techniques to prevent symptom recurrence or progression. For patients with normal findings on endoscopy, 27% received subsequent imaging to rule out biliary or pancreatic pathology. Patients with niche findings like laryngeal/pharyngeal tumors or enlarged adenoids were referred to subspecialists such as ENT (Table 2).

Table 2. Management Based on Endoscopic Diagnoses

Diagnoses (not mutually exclusive)	N	%N	Post Procedural Management (not mutually exclusive)										
			PPI/antacid	lifestyle modifcaiton	analgesic	antibiotic	antifungal	triple therapy	palliative stent	US/CT	subspecialty referral	close outpatient follow up	other***
normal endoscopy + persistent symptoms	104	27%	34	14	8	4	0	3	0	28	7	17	0
gastritis	65	17%	52	11	1	4	4	6	0	4	0	11	0
esophageal cancer	64	16%	2	2	15	9	2	0	18	0	0	29	0
hiatal hernia	34	9%	23	14	3	0	1	0	0	1	0	5	2
esophagitis	29	7%	23	2	1	1	4	1	0	2	0	2	0
ulcer	24	6%	18	5	0	0	1	5	0	0	0	5	0
candidiasis	20	5%	1	1	1	0	18	1	0	0	0	2	0
duodenitis	9	2%	4	1	0	0	0	1	0	2	0	3	0
esophageal varices	5	1%	1	0	0	1	0	0	0	0	0	0	3
achalasia	5	1%	0	0	0	0	0	0	0	0	0	5	0
gastric cancer	5	1%	1	0	0	0	0	0	2	0	0	3	0
other**	26	7%	6	2	4	2	2	1	0	4	4	7	0
Total	390	100%											

Abbreviations: US for ultrasound. CT for computed tomography.
** other endoscopic diagnoses: organo-axial volvulus (4), foreign object (4), duodenal mass/obstruction (2), laryngeal tumor (2), enlarged adenoid (2), helminth (1), Gastric Outlet Obstruction (1), gastric varices (1), bleeding duodenal papilla (1), pancreatic mass (1), PEG placement (1), Schatzki's ring (1), Mallory Weiss tear (1), incomplete scope (1), missing reports(3)
***other treatments: additional medications: propranolol (3), fundoplication (2)

Discussion

This study examines the impact of implementing an independent outpatient surgery center with improved access to UE for the diagnosis and treatment of benign and malignant GI diseases endemic to Eastern Uganda. Prior to establishment of KSC, patients in this region had limited access to endoscopy, and most upper GI complaints were symptomatically managed without confirmatory diagnosis[14,15]. The unique availability of UE at KSC has not only better characterized the upper GI diseases endemic to this region, but also allowed for more precise individualized disease management through proficient skill development.

In this study, epigastric pain was the most common presenting complaint, with half of these patients having normal endoscopies, and only one patient (0.7%) newly diagnosed with cancer. Although the largest percentage of patients who presented for endoscopy had a normal examination (27%), this was comparable to high income, developed countries, emphasizing its utility and lack of overuse in this vulnerable community[16]. In fact, the use of endoscopy in those patients ruled out esophagogastric and duodenal pathologies, which helped clinicians seek further investigations via ultrasound or CT for pancreaticobiliary disease. Gastritis was the most common condition diagnosed histologically and visually on endoscopy, similar to findings described in other parts of east Africa, as *H.pylori* is ubiquitous to this region[17,18]. In two similarly endoscopically naïve, rural populations referred to regional hospitals for workup, gastritis was found in 28% and 40.2% of patients compared to our 17%[19,20]. Though gastritis was still our most common clinical diagnosis, this difference may be a result of selection bias, as KSC was a new institution with a possible lower referral base for more symptomatic patients than more established centers.

Contrary to epigastric pain, dysphagia as a presenting complaint was highly associated with a cancer diagnosis. This emphasizes the prevalence of advanced disease in remote areas and the lack of access to care[21]. Previous studies recommend that patients over 40 years old with dyspepsia undergo UE to rule out gastroesophageal cancers[22,23]. However, in this study, dysphagia is the most ominous presenting symptom, where nearly half of all patients presenting with dysphagia were diagnosed with advanced esophageal cancer, and all patients with ESCC presented with dysphagia and had obstructing tumors. According to Doe et al, while dyspepsia is common in rural Uganda, it can be empirically treated in the community, versus dysphagia, which should be symptomatically endoscopically prioritized, as it is associated with significant morbidity in this population[20]. Thus, the impor-

tance of UEs for patients with dysphagia in rural Uganda should be emphasized.

KSC addresses some of the nuanced complexities of introducing advanced medical procedures in rural, low resource communities. Training local healthcare providers in endoscopic techniques and advanced procedures, accessible and affordable access via adequate subsidization, and patient acceptance, are just some of the universal challenges that we are trying to alleviate with the establishment of this facility, while working towards a self-sustaining ambulatory surgical care facility.

Scarce studies have evaluated the effect of intense week-long "surgical training camps," to bring endoscopic skills to more remote regional hospitals, however none have evaluated its efficacy in standalone ambulatory surgery centers with access to remote, real-time guidance thereafter[24]. Though well received and informative, these week-long training camps however, rarely allow the endoscopist to achieve competence, as the evidence-based threshold of 200 procedures to do so is difficult to attain in such a short time-period[24]. Additionally, minimum operative case volumes for training do not exist in rural Africa, and competence is highly dependent on regional variations of endemic conditions and case distributions between urban and rural centers[25]. Parker et al reiterate need amongst rural African surgeons for more experience in less commonly performed procedures, including endoscopy, and argue for a minimum of 40 upper endoscopies throughout surgical training to acquire basic skills that can eventually be transferred into community settings[25]. This may be especially difficult to achieve if the surgeons themselves do not have access to specialized training programs locally, and is a barrier that needs to be addressed.

As seen at KSC, endoscopic stent placement is just one of the many needed interventions that can be successfully implemented in resource limited settings once basic infrastructure and skill is established. Compared to high-income countries, Uganda lacks screening endoscopy guidelines and treatment options for early esophageal cancer, including chemoradiation, cryotherapy and the skills needed to perform endoscopic mucosal resection or endoscopic submucosal dissection is either inaccessible or unavailable[26,27]. As a result, the majority of ESCC patients in our population present with advanced tumors where palliative stenting is the only management option. Parker et al and White et al showed that with endoscopic equipment and an experienced operator, self-expanding metal stents can effectively and safely palliate dysphagia via a single outpatient procedure without fluoroscopy or the more extensive medical infrastructure required for chemoradiation[12,28]. KSC has shown similar promise, as 28% of patients with ESCC safely had a palliative stent placed, after which their quality of life dramatically improved; they progressed from dysphagia with difficulty in salivary secretion management to being able to swallow solid food. While it took KSC an average of 17 days for stent placement after initial endoscopy, we suggest stenting at the time of initial diagnostic endoscopy when a classic friable esophageal obstructing lesion is seen. In our region, confirmatory pathology results may take two weeks, during which time a patient's nutritional status and quality of life can diminish or they become lost to follow-up. Likewise, travel for an additional procedure can be logistically, emotionally, and financially cumbersome. In fact, high cost was the biggest barrier to care preventing patients from going to a private center[3].

Community awareness and acceptance of outpatient surgical centers are additionally fundamental to successful implementation and utilization. Duron et al emphasized that cost, fear of diagnosis, and lack of health literacy were some of the main barriers to healthcare in Western Kenya, leading to a delay in diagnosis and disease progression, specifically of those with esophageal cancer[21]. Because of private subsidization, KSC can cater to patients that may otherwise be unable to afford intervention. Additionally, we perform direct community engagement through home visits for post-operative checks and to raise awareness of the facilities existence, capabilities, and promise. Philanthropic support, outreach and continued education past the acute perioperative period are crucial to long term success and improved patient care.

By introducing endoscopy with remote guidance in a procedurally naive rural community, we were able to properly advise patients on appropriate treatments. Awareness, acceptance, and attendance of a successful outpatient surgical center promotes early diagnosis and symptomatic relief, and affirms the need for endoscopic skills in this region. Mwachiro et al further emphasizes that advanced procedures such as endoscopic retrograde cholagiopancreatography in rural LMICs are feasible and safe[29]. Similar to KSC, they showed that with a core team of en-

doscopists and hands on training from experts, surgical trainees had favorable outcomes comparable to those in resource-rich health settings[29].

This study has several limitations including the bias by the endoscopist on the visual diagnosis of disease. Additionally, the novelty of KSC as a stand-alone, ambulatory surgery center may result in selection bias of only those most symptomatic or health literate. Lastly, the nature of the study makes it difficult to establish long-term trends regarding the different interventions and their effects.

Conclusion

Symptoms of bothersome gastrointestinal disorders can be nonspecific and often discordant with objective findings. Benign conditions such as gastritis can be debilitating while malignancies may remain indolent until they are too advanced for curative treatment[16].

The ability to bring diagnostic and interventional endoscopy to a remote area has been beneficial and educational to both the physician and patient, especially in an area where there is a high incidence of aggressive malignancy. When specific pathology was present, KSC was able to tailor treatments/workups to precise illnesses. With properly trained personnel, acceptance by the local population, and successful implementation, the introduction of diagnostic and therapeutic endoscopies with the aid of remote guidance into remote locations in need can be globally impactful.

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Conflict of interest

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All authors have participated sufficiently in the work to take full responsibility for appropriate portions of the content.

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