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Original Research Article

Prevalence of Malnutrition and its Association with Early Outcomes among Adult Patients Undergoing Abdominal Surgery Admitted at Bugando Medical Centre, Mwanza, Tanzania

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Abstract: ***Introduction:*** Malnutrition is an emerging but neglected problem in hospitalized surgical patients which contributes significantly to the adverse postoperative outcomes. However, in most of our settings; patients scheduled for abdominal surgeries are not routinely assessed for nutritional status rendering difficultness in mitigating the avoidable predicaments. ***Objective:*** To determine the prevalence of malnutrition and its association with the early outcomes among patients undergoing abdominal surgery at Bugando Medical Centre (BMC), Mwanza, Tanzania. ***Methods:*** This was a prospective longitudinal study involving adult patients who underwent abdominal surgeries at BMC from January 2023 to June 2023. Nutritional status assessment was done according to the Nutrition Risk Screening tool (NRS-2002). ***Results:*** The overall prevalence of malnutrition was found to be 51.8%. Complication and mortality rates were 25.4% and 8.3% respectively. The overall length of hospital stay ranged from 5 days to 14 days (median of 9 days). Preoperative malnutrition was found to be statistically significant associated with early postoperative complications (OR=4.1, 95% [2.0-8.2], p-value< 0.001), prolonged Length of hospital stay (LOS) (OR=2.5, 95% [1.4-5.8], p-value = 0.003) and mortality (OR=4.6, 95% [2.5-11.2], p-value < 0.001). Furthermore, preoperative malnutrition significantly predicted surgical site infections (OR=2.2, 95% [1.0-4.8], p-value =0.047) and anastomotic leakage (OR=3.1, 95% [1.1-8.9], p-value =0.035). ***Conclusion:*** Preoperative malnutrition is a significant and independent risk factor for postoperative complications, prolonged hospital stay and mortality following abdominal surgery. This study emphasizes the need for routine assessment of nutritional status using a validated tool preoperatively so as to draft a nutrition care strategy to prevent postoperative malnutrition-related adverse outcomes.

Keywords: Malnutrition, prevalence, abdominal surgery, early outcome, Nutritional risk screening.

BACKGROUND

The World Health Organization defines malnutrition as a deficiency, excess or imbalance in a person's intake of energy and/or nutrients. Malnutrition constitutes a major problem globally and it is associated with delayed recovery, higher rates of morbidity and mortality, prolonged hospital stay, increased healthcare cost with a higher early re-admission [1]. According to Global Nutrition Report; In Tanzania, the prevalence of underweight among adults in 2016 was 9.8% in females and 12.3% in males with a projection of 9% and 11.3% in females and males respectively by the year 2019 [2]. There are several forms of malnutrition, the two main categories being under-nutrition and over nutrition [1, 3].

According to reports, malnutrition affects 20 to 50 percent of hospitalized patients worldwide depending upon the population being researched and the method used to assess nutritional status [4-6]. The prevalence of malnutrition is apparently higher among surgical patients, with the rate ranging from 35 to 60% [7]. Large proportions of these patients are already undernourished on admission or develop it while in the hospital [8]. In surgery, malnutrition has been found to be an independent predictor of morbidity and mortality in

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postoperative patients [9-11]. literatures provide a thorough description of the correlation between preoperative malnutrition and postoperative surgical results [9, 10].

Malnutrition has historically been linked to poor clinical results, delayed recovery, increase in death and infection rates, prolonged hospital stay, higher hospital expenses and higher rehabilitation costs before patients can resume their normal activities [12]. Prior gastrointestinal (GI) surgery, malnutrition can be caused by decreased oral food intake, pre-existing chronic disease, tumor cachexia, impaired absorption due to intestinal obstruction, and previous surgical bowel resection. Moreover, low socioeconomic status as seen in elderly and handicapped patients represents an additional risk factor [13]. Furthermore surgery causes physiological stress in turn causing an increased energy expenditure that often leads to a negative nitrogen balance [12, 14]. The postoperative course depends on the type and magnitude of the operation, other co-existing diseases, complications, the patient's age and nutritional status [9, 12].

Patients undergoing surgery have a higher risk for malnutrition which can further affect the postoperative outcome negatively [9]. Malnutrition in hospitalized patients often goes unrecognized or overlooked by health professionals and screening of these patients is not routinely performed.

Despite reports of poor surgical outcome in malnourished patients going for surgery, there is a lack of data supporting this in Sub-Saharan African. In Tanzania for example, there are no data regarding the prevalence and effects of preoperative nutritional status on surgical outcomes among patients undergoing abdominal surgery. This study was then conducted in our local setting so as to determine the prevalence of malnutrition among adult surgical patients undergoing abdominal surgery and to assess its association with the outcomes at Bugando medical Centre, a zonal referral hospital along the shores of the lake zone - Tanzania.

MATERIALS AND METHODS

Study design and setting

This was a prospective longitudinal study involving general surgical patients undergoing abdominal surgeries at BMC from January 2023 to June2023. The study was conducted in the emergency department (EMD), surgical wards and surgical outpatient department. Bugando Medical Centre is the tertiary health hospital providing tertiary care and teaching hospital for the Catholic University of Health and Allied Sciences (CUHAS), it has a bed capacity of 1100. It is situated in Mwanza City in northwest Tanzania, and it serves a population of over 8 million people from the regions that surround it. The hospital has a surgical ward which has a capacity of 53 beds, emergency medicine department (EMD) with an adult wing of over 10 beds capacity. It has a surgical outpatient department (SOPD) clinic that is functional in all working days.

Study participants, Study Sample, Data collection and Follow-up

All adult patients who were for and underwent either elective or emergency abdominal surgery at BMC during the study period were included in the study after giving their consents. Those who received preoperative parenteral nutrition and those who were moribund at the time of data collection were excluded from the study. With the use of Kish Leslie formula (1965), the minimum sample size of 302 was calculated to be appropriate in this study [15]. Only 308 patients out of 312 of the study population were enrolled in the study and 4 patients were excluded (1 received preoperative Parenteral nutrition and the other 3 were moribund). As 5 patients were lost during a short follow-up period, the 303 patients successfully made it to the end of the study. Preoperatively, all recruited patients underwent nutritional assessment, nutritional profile was done using Nutrition Risk Screening tool (NRS 2002) which is a simple and well-validated tool which incorporates pre-screening with four entities which are; the amount of malnutrition as defined by weight loss, food intake, BMI, as well as the severity of the disease. Screening follows which includes surrogate measures of nutritional status and data on the severity of the disease (stress metabolism). A score of 0 to 3 can be obtained with an addition of 1 if the patient is over 70 years of age. A total score of≥3 points means that the patient is at risk of malnutrition or already malnourished and therefore a nutritional therapy is indicated. Patients were examined from 24 hours after surgery in the wards to see if they have developed any complication of interest. After discharge, patients were followed for 30 days at Surgical Outpatient Department (SOPD) clinic as scheduled on day 7, 14, 21 and 30.

Data Analysis

A structured questionnaire was used to collect data which was entered into Microsoft excel, cleaned and then exported to STATA version 15.0 software for analysis according to the objectives of the study. Categorical variables were presented as percentages /proportions, whereas continuous variables were described as means (± standard deviation) or median (interquartile range) depending on the distribution of data. The odds ratio was calculated to test for strength of association between predictor (independent) and outcome variables. Significance was defined as a p-value of less than 0.05. Variables with a p value < 0.05 in univariate analysis were subjected multivariate regression model to control for other variables.

Ethical Considerations

The ethical approval to conduct the study was sought from CUHAS/BMC research ethics and review committee (CREC). The permission to conduct the study

was obtained from BMC authorities. All participants were requested to sign a written informed consent before being recruited into the study. Confidentiality was assured and by any means the study did not compromise or negatively interfered with the management of the patients.

RESULTS

Demographics and clinical characteristics of the study participants

The mean age (±SD) of the study was 47±17.5 years, the youngest was 18 years old and the oldest was 85 years old as depicted in figure 1 below. Out of 303 patients, 153(50.5 %) were males and 150(49.5%) were females. Pre-existing medical illnesses were reported in 64(21.1%) patients which mostly included hypertension, cancer and HIV/AIDS.

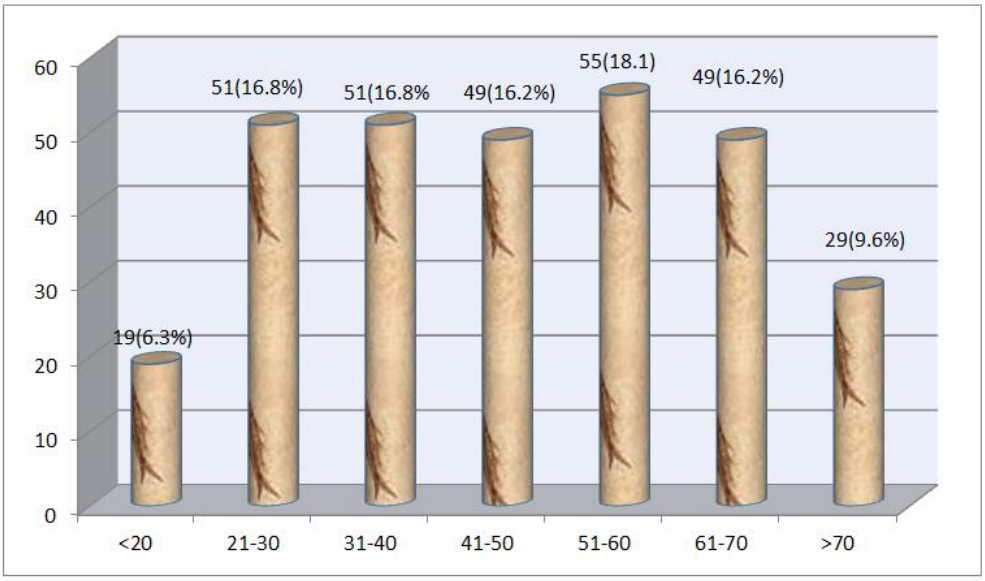

Figure 1: Age distribution among patients undergoing abdominal surgeries at BMC

Indications for major abdominal surgeries

In this study, hernia was the most common indication for abdominal surgery accounting for 52(17.2%) patients as shown in Figure 2 below. Table 1 shows operative characteristics of patients who underwent abdominal surgery.

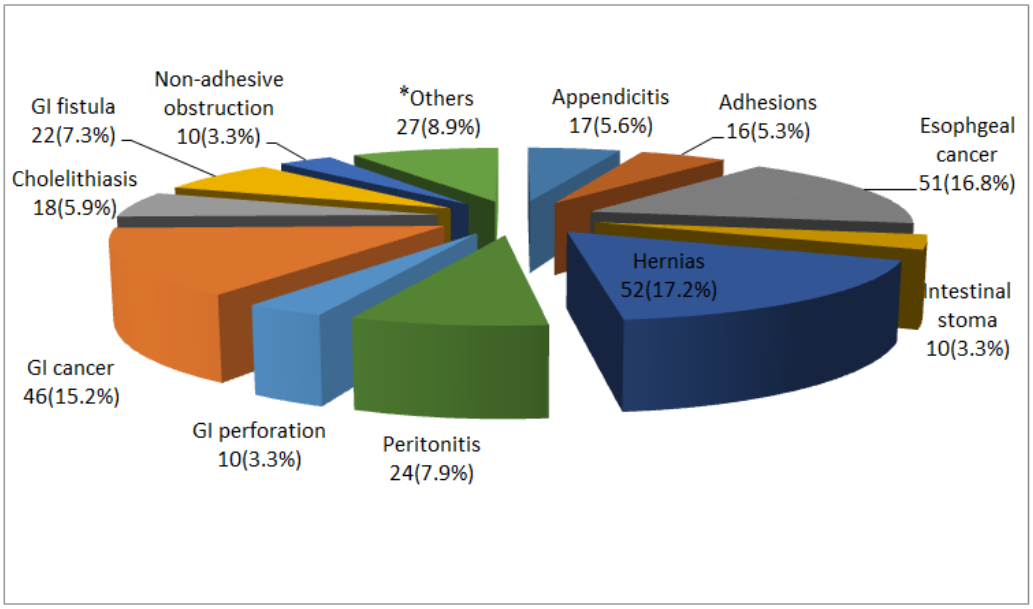

Figure 2: Indications for major abdominal surgery among patients at BMC (N=303)

*Others: Pyloric stenosis, Hepatic cyst, Splenic/ liver injury, Rectal prolapse and Achalasia cardia

Table 1: Operative characteristics of patients who underwent abdominal surgeries

Characteristics	Frequency (n=303)	Percent (%)
Nature of Surgery		
Emergency	82	27.1
Elective	221	72.9
Number of Surgeries		
Incident Surgery	187	61.7
More than one surgery	116	38.3
Surgical procedure		
Open	263	86.8
Laparoscopic	40	13.2
Duration of Surgery		
< 120 minutes	208	68.5
≥ 120 minutes	95	31.4
Wound class		
Clean/clean contaminated	250	82.5
Contaminated and dirty	53	17.5

Pre- operative nutritional status of patients who underwent abdominal surgeries

Out of 303 patients who underwent abdominal surgeries, 157(51.8%) were found to have malnutrition as shown in figure 3 below. In this study, the prevalence of malnutrition for those at the 6th decade of life and above was found to be 51.1%, majority being males by 54.1%.

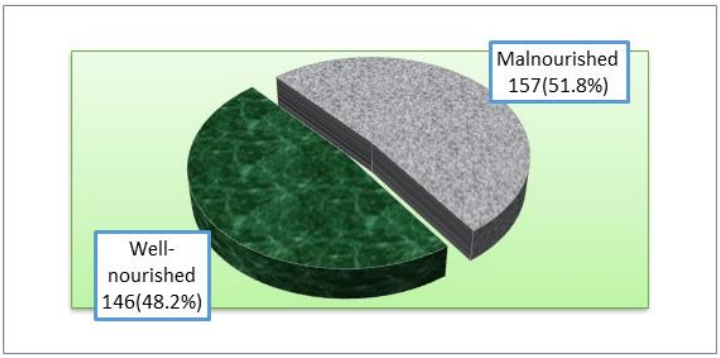

Figure 3: Pre- operative nutritional status of patients undergoing abdominal surgery

Early outcomes among patients undergoing underwent abdominal surgeries

Out of 303 patients enrolled in this study, 77 developed 105 complications giving complication rate of 25.4% in all complications. Surgical site infection was the most common post-operative complication accounting for 46.7% of cases (Figure 4). The median length of hospital stay was 9 days with a range of 5-14 days. A total of 70 (23.1%) patients had a longer hospital stay of more than 14 days. Twenty-five patients died giving a mortality rate of 8.3%.

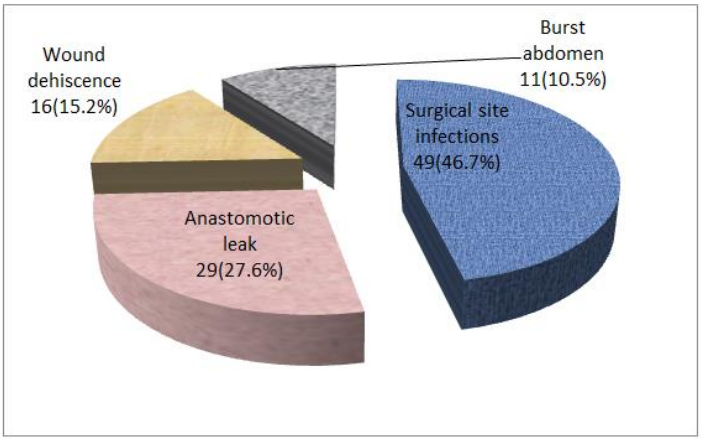

Figure 4: Distribution of postoperative complications following abdominal surgery (N=105)

Association of preoperative malnutrition and early outcomes following abdominal surgery

Preoperative malnutrition was found to be statistically significantly associated with early postoperative complications (OR=4.1, 95% [2.0-8.2], p-value< 0.001), prolonged LOS (OR=2.5, 95% [1.4-5.8], p-value = 0.003) and mortality (OR=4.6, 95% [2.5-11.2], p-value < 0.001). Furthermore, preoperative malnutrition significantly predicted surgical site infections (OR=2.2, 95% [1.0-4.8], p-value =0.047) and anastomotic leakage (OR=3.1, 95% [1.1-8.9], p-value =0.035).

Table 2: Association between preoperative malnutrition and early outcomes following abdominal surgery

Predictor variables	Outcome variables		Univariate analysis		Multivariate analysis	
	N (%)	N (%)	OR(95% CI)	P-Value	OR(95%CI)	P- Value
	Overall Complications (N=77)					
NRS score	No	**Yes**				
<3	129(88.4)	17(11.6)				
≥3	97(61.8)	60(38.2)	4.6(2.6-8.5)	**<0.001**	4.1(2.0-8.2)	**<0.001**
	Surgical site infections(N=49)					
NRS Score	No	Yes				
<3	132(90.4)	14(9.6)				
≥3	122(77.7)	35(22.3)	2.7(1.4-5.3)	**0.003**	2.2(1.0-4.8)	**0.047**
	Anastomotic leakage(N=29)					
NRS score	No	Yes				
<3	141(96.6)	5(3.4)				
≥3	133(84.7)	24(15.3)	5.1(1.9-13.7)	**0.001**	3.1(1.1-8.9)	**0.035**
	Burst abdomen (N=11)					
NRS Score	No	Yes				
<3	144(98.6)	2(1.4)				
≥3	148(94.3)	9(5.7)	4.4(0.9-20.6)	**0.062**		
	Wound dehiscence (N=16)					
NRS Score	No	Yes				
<3	143(98)	3(2.0)				
≥3	144(91.7)	13(8.3)	4.3(1.0-15.4)	**0.025**	3.3(0.8-13.5)	**0.097**
	Length of hospital stay					
NRS score	<14 days	≥14 days				
< 3	125(85.6)	21(14.4)				
≥3	108(68.8)	49(31.21)	2.7(1.5-4.8))	**0.001**	2.5(1.4-5.8)	**0.003**
	Mortality (N=25)					
NRS score	Alive	Dead				
<3	144(98.6)	2(1.4)				
≥3	134(85.4)	23(14.6)	4.6(2.6-8.5)	**0.011**	4.6(2.5-11.2)	**<0.001**

DISCUSSION

Malnutrition has been reported to be prevalent in surgical patients with a global prevalence of up to 60% has been reported in literature [7]. Patients who undergo abdominal surgery are at increased risk of malnutrition due to long period of starvation before and after surgery, the stress of surgery itself and post-surgery increase in metabolic rate [15-19]. In this study, the prevalence of malnutrition among patients undergoing major abdominal surgery was 51.8% like the 51.0% that was reported in China [20]. It is slightly high as compared to the 40% in Canada [21], 48.1% in Brazil [22] and 20% in Denmark [23]. On the other hand, the prevalence of malnutrition in this study was lower than 65.3% that was reported in Tirana by Shpata *et al.*, [10] among patients who underwent gastrointestinal surgery. The difference in prevalence in these studies could be explained by differences in diagnostic criteria and/or screening method (tool) used to define malnutrition and also differences in patients' characteristics.

Advanced age has been shown to be associated with malnutrition in previous studies [25, 26]. Aside from their diseases, aged population tend to present with other factors that interfere in the nutritional status such as reduced functional reserves, co-morbidities, decreased production of gastrointestinal secretions, damaged or lack of teeth, social isolation, and psychological derangements [25]. In this study, the prevalence of malnutrition in elderly patients aged 60 years and above was found to be 51.1% with Similar reports in other studies [11, 27]. This study also observed similar trend of malnutrition in males after abdominal surgeries [25, 28]. The cause for this preponderance is not clear, though it might be attributed by the differences in exposure to risk factors on either gender.

Studies have clearly demonstrated malnutrition as a significant risk factor for postoperative complications in patients undergoing major abdominal surgeries [16-19]. Schiesser *et al.,* [29] with the use of Nutrition Risk Screening 2002 score found a significance association between malnutrition and postoperative complications for patients who underwent gastrointestinal surgeries. In this study, the overall complication rate was 25.4% which is comparable to what was reported by others [25, 34] but high compared to what was reported by Mosquera *et al.,* [27] in their study, having the complication rate of 15% amongst the 490 patients who underwent elective procedures. On the other hand, Maurício *et al*., [24] evaluated patients who underwent elective surgeries for colorectal cancer and found a high complication rate of 33.3%. The difference in the study population explains the observed disparity to this study, as it has included both benign, infectious and malignant indications for abdominal surgery. Furthermore, these two studies identified higher complication rate in malnourished patients as observed in our study as the malnourished patients were 4.1 times more likely to develop complications than well-nourished ones.

Surgical site infection is considered the most common complication following major abdominal surgeries affecting about 25%–40% of patients [25, 28]. Similar to other studies [29, 30], this study found that surgical site infection was the most common complication following abdominal surgery accounting for 46.7% of cases. The association of malnutrition with surgical site infections has been widely studied, and a clear relationship has been shown in various surgical procedures [29]. There is a growing body of literature linking malnutrition with various complications including wound healing problems, persistent wound discharges and susceptibility to infections [30, 34]. The mechanism by which malnutrition may result in increased rates of complications involves impairment of the immune system to fight infections due to reduced number of lymphocytes, and impairment of wound healing due to reduced collagen synthesis [34]. During this study, malnutrition was found to significant increase the rate of surgical site infection following a major abdominal surgery. Patients with malnutrition had a higher incidence rate for surgical site infection than patients with a normal nutritional status.

One of the most frequent and dreaded side effects following major abdominal surgery is anastomotic leaking [31]. Anastomosis breakdown can lead to deadly consequences including peritonitis, abscess formation and sepsis which raises the rate of morbidity and mortality. Numerous studies have revealed that anastomotic leaks can be independently predicted in patients with malnutrition [31-35]. Due to the impaired collagen synthesis or fibroblast proliferation, malnutrition has a detrimental effect on anastomotic healing [32]. Kang *et al.*, retrospective study comprising of 72,055 individuals who had elective anterior resection revealed a significant correlation between preoperative malnutrition and anastomotic leak [33]. Zhu *et al.,* [34] performed a study in which hemoglobin and albumin were primarily used to assess preoperative nutritional status and discovered that anemia or hypoalbuminemia was significantly correlated with anastomotic leak. In such a similar vein, Telem's *et al.,* [35] patients with preoperative albumin levels of below 3.5 mg/dL were 2.8 times more likely to get anastomotic leak post colorectal resections. Concomitantly in this study, patients who were malnourished before surgery were 3.1 times more likely to develop anastomotic leak than well-nourished patients.

Wound dehiscence and burst abdomen continue to be major complications of abdominal surgery and hence accompanied by high morbidity and mortality [36]. Wound dehiscence is the partial or complete separation of previously approximated wound margins caused by a failure of adequate wound healing [37]. In this study, wound dehiscence and burst abdomen ranked third and fourth at 15.2% and 10.5% respectively. However, our study found no association between preoperative malnutrition and development of wound dehiscence/burst abdomen following abdominal surgery. Lack of association between preoperative malnutrition and wound dehiscence/burst abdomen can probably be explained by its frequency of occurrence among the study participants, as they were too few to establish any statistical difference. It has also been reported in several studies that preoperative malnutrition is independently associated with a longer length of hospital stay following surgery [12]. This observation is reflected in our study, as compared to patients without malnutrition; those who underwent surgery had a 2.5 times greater chance of prolonged hospital stay which is consistent with earlier studies that showed a significant association between preoperative malnutrition and longer hospital stay following major surgery [38].

Previous studies have shown that preoperative malnutrition was associated with an increased mortality rate of in-hospital patients after major abdominal surgery [38]. Studies have shown that surgical patients with malnutrition have a 1.6-1.9 relative risk of death when compared to well-nourished inpatients [30, 38]. In the current study, the overall mortality rate was 8.3%, which is higher than that reported by others [30, 34]. This study demonstrated that preoperative malnutrition is an independent risk factor for mortality and resulted in a more than 4.6-fold increase in mortality among adult patients with malnutrition post abdominal surgery.

CONCLUSION

Malnutrition is highly prevalent among adult patients undergoing abdominal surgeries and it is a significant and independent risk factor for the adverse postoperative outcomes such as wound dehiscence, burst

abdomen and surgical site infection. This culminates to an extended length of hospital stay with mortality being not an exception. The study further put emphases on the need for a routine assessment of nutritional status prior most abdominal surgeries, as it can simply be achieved by the use of the existing tools such as NRS-2002 and the alike in either emergency or elective setting. This will then attract individualized approaches and measures to assure nutritional stability prior, during and after abdominal surgeries that will enhance recovery and positive outcomes among patients.

Author's Contributions

Jacqueline Kilasi, Seth Jotham and Vihar Kotecha conceptualized the original research. Jacqueline Kilasi and Seth Jotham collected and processed the data as reviewed by Vihar Kotecha and Philipo Chalya. Jacqueline Kilasi and Seth Jotham wrote the original manuscript and all authors approved for its final submission.

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Conflicts of interest: None

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