

ACCEPTED RESEARCH ARTICLE

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## ORIGINAL RESEARCH

# Complicated inguinal hernia in rural southeast Nigeria: A multicentre observational study on epidemiology and treatment outcomes

**Running title** – Complicated inguinal hernia in rural southeast Nigeria

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## ABSTRACT

**Background:** There is enormous pool of unmet need for inguinal hernia (IH) repair in our environment due to numerous factors against elective repair. This has led to a large number of patients presenting emergently with complications. The aim of this study is to document the epidemiology and outcome of surgical management of complicated inguinal hernia (CIH) in a low income rural southeast Nigeria.

**Methods:** This was a multi-centre, retrospective cross-sectional analytical study of patients who received surgical treatment for CIH over eight years period (January 2013- December 2020) at three selected district hospitals in Southeast Nigeria. The trend over time and outcome of surgical treatment were evaluated. The main outcome



measures analyzed were morbidity, mortality and length of hospital stay (LOHS). The various clinical, demographic and perioperative indices that impacted on morbidity and mortality were evaluated.

**Results:** Of the 540 patients evaluated, there were 89 (16.5%) bilateral and 451 (83.5%) unilateral IHs. Majority (78.5%) were inguinoscrotal/inguinolabial hernias. Nearly a third (30.4%) presented after 72 hours of complications. At presentation, all (540, 100.0%) had irreducible groin swellings and abdominal pain, but 68.95 had abdominal swelling. Comorbidities were present in 26.3% of patients. Strangulation, obstruction and incarceration were present in 46.5%, 42.0% and 11.5% respectively. Morbidity was increased in cases of laparotomy and bowel resection ( $p=0.000$ ), emergency repair ( $p<0.001$ ), large hernias ( $p=0.004$ ) and operations performed by lower rank of surgeon ( $p=0.001$ ). Bowel resection rate was 28.5%. Overall, morbidity and mortality rates were 47.4% and 8.1% respectively. Mortality was significantly higher in patients with delayed presentation  $> 24$  hours (OR:13.42; C.I:6.74-29.44;  $p=0.001$ ), strangulated cases (OR:3.34; C.I:2.85-11.16;  $p=0.02$ ), comorbidity (OR:6.72; C.I:10.42-37.55;  $p=0.01$ ) and advanced age (OR:14.38; C.I:13.46-47.72;  $p=0.03$ ).

**Conclusions:** Majority of the patients had voluminous hernias and presented late with attendant high morbidity and mortality. Bowel resection, delayed presentation, advanced age, comorbidity and lower rank of surgeon executing the repair were responsible for high adverse postoperative outcomes.

**Keywords:** emergency admission, inguinal hernia, laparotomy, mortality, wound infection, Nigeria

## INTRODUCTION

Worldwide, the prevalence of strangulated inguinal hernia (SIH) is 0.3-2.9% of all inguinal hernias in adults<sup>[1]</sup>. Overall, IH are the commonest, accounting for about 75% of all abdominal wall hernias and 10-15% of all general surgical procedures globally<sup>[2,3]</sup>. Inguinal hernia is common world-wide, but particularly in Africa<sup>[4,5]</sup>. In the continent, about 175 cases per 100,000 people each year are recorded, but only 25 are actually repaired<sup>[4,5]</sup>. In rural sub-Saharan Africa, more men suffer from hernia than from HIV with an estimated 603 million untreated cases of groin hernias<sup>[6]</sup>. Therefore, there is enormous pool of unmet need for IH repair in Africa and reasons adduced were poverty, ignorance, deplorable road networks and dearth of adequately functioning health facilities and medical personnel<sup>[4,5,7]</sup>. This led to a large number of patients presenting in emergency with longstanding voluminous hernias.<sup>[2,4,5,8]</sup>

In Africa, 30 per 100,000 patients need surgery for strangulated hernia, but only four actually receive an operation<sup>[4]</sup>. In a review of 199 patients with IH in Sokoto, Nigeria, Mba recorded emergency presentation in 23.7% and found that 20% of the complicated cases died with or without surgery<sup>[8]</sup>. In Mulago hospital, Kampala, a worse scenario was observed where 54.5% of 195 patients with IH were strangulated at time of admission and 41.8% developed significant complications postoperatively<sup>[9]</sup>.

In rural African communities with constrained resources, fewer health facilities and dearth of qualified medical personnel, the situation appears more disturbing<sup>[10]</sup>. Moreover, data to document a rising or falling trend in morbidity and mortality of emergency IH scourge among rural dwellers in the continent are scarce<sup>[3,4,5,6,10,11]</sup>. European hernia aid volunteers found that African states had witnessed a marked collapse in the health sector manifested by rapid deterioration of medical infrastructure coupled with medical workers of African extract leaving in droves to other countries<sup>[4,6,12]</sup>. The current trail of brain drain across Africa affects the gross output from repair of common surgical conditions like hernias and in turn, increases the overall disability adjusted life-years (DALY) associated with hernia<sup>[4,12,13]</sup>. The DALY concept provided a strong evidence to universally accept the hernia disease as a public health problem<sup>[12,13]</sup>

In the continent, what was left was a pathetic health system, the rural settlement being the worst affected<sup>[12]</sup>. In the light of the above, surgeons from the Plymouth service group, UK founded 'Operation Hernia' with a primary aim of advancing elective mass hernia repair in rural communities in developing nations<sup>[6]</sup>. In sub-Saharan Africa, they showed that morbidities and mortality were very low despite the large sizes of the hernias<sup>[4,6,12]</sup>. However, both the low coverage of the program and the fact that the repairs were restricted to uncomplicated IH suggest that such observation may not represent the prevailing situation in most rural and semi-urban areas in Africa. In rural southeast Nigeria, data on complicated IH are scarce. The aim of this study is to document the epidemiology, surgical management and outcome of emergency IH repair at district hospitals in our environment.



## MATERIALS AND METHODS

### Design and Setting

This was an observational, retrospective, multicenter retrospective cross-sectional analytical study of epidemiology and treatment outcome of CIH from January, 2013 to December, 2020. The study was done at Bishop Shanahan Specialist Hospital(BSHSH) Nsukka, Enugu State; General hospital Nsukka, Enugu State and Mater Misericordiae specialist hospital(MMSH) Afikpo, Ebonyi State. The three hospitals are located in southeast geopolitical zone of Nigeria. These hospitals were selected because the authors practiced in those centres; also, the selected hospitals have high patients' volumes and are either located in rural or semi-urban areas which is the focus of this research paper.

### Subjects/Procedure

We retrieved the case files of patients with clinical diagnosis of CIH from the records departments of the selected hospitals. Complicated inguinal hernia or emergency presentation of inguinal hernia refers to complications of incarceration, obstruction or strangulation with or without gangrene arising de novo in an otherwise uncomplicated inguinal hernia. Therefore, only case files of patients with any of the above preoperative complications and who later received emergency abdominal operation/repair were included in this study. The files of patients aged 16 years and above were included. Files of patients with either incomplete clinical details or died before operation or had spontaneous reduction (and absconded from surgery) were excluded. Considering the retrospective nature of this study and the large fixed available sample of CIH cases within the study period, consideration of sample size determination was informal. We determined the trend over the eight years period and analyzed the contributions of the various clinicopathologic parameters to the overall clinical feature of CIH. We also analyzed the impact of several demographic, clinical and perioperative parameters on morbidity and mortality of CIH. The postoperative complications were graded using the Clavein-Dindo system<sup>14</sup>. Nylon darn was utilized routinely to repair all the cases. The main outcome measures assessed were morbidity and mortality. Generally, the following variables were investigated: clinicopathologic characteristics, annual incidence, bowel resection rates, postoperative complications rates and severity (Clavien-Dindo system) and determinants of postoperative complications. A variable follow-up period ranging from one to 16 months was noted in the case files. In other to eliminate bias, only in-patient deaths and morbidities recorded in the case files were considered and no assumptions of morbidities and deaths of patients who stopped hospital visits were included in our reports.

### Reporting

Results were reported according to The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines<sup>15,16</sup>.

### Data Analysis

Data analysis was done using Statistical Package for Social Sciences (SPSS) software version 23.0 (IBM, Chicago, IL USA, 2015). For the categorical variables, data were summarized in proportions and frequency tables. For continuous variables, we computed the ranges and mean. During analysis, we computed p-values for categorical variables using Chi-square and Fisher's exact test in accordance with the size of the dataset. Furthermore, we determined the association between some selected clinical variables and morbidity and mortality (Clavien-Dindo classification<sup>14</sup>) using logistic regression analyses. Confidence interval was calculated at 95% level and significance at 5% probability level ( $p < 0.05$ ).

### Ethical Approval

Ethical approval was obtained from "Ethical Research committee" of BSHSH while permissions were obtained from General Hospital and MMSH.



## RESULTS

### Characteristics of the study participants

During the eight years period, 16,968 patients had general surgical procedures. Of these, 3,326(19.6%) and 2,483 (14.6%) were due to abdominal wall hernias and IH respectively. Inguinal hernias, therefore accounted for 74.7% of the entire abdominal wall hernias repaired during this review. Of the IHs, 576 (23.2%) patients presented under emergency set up, but only 540 (21.7%) fulfilled the inclusion criteria. The remaining 36 (6.3%) case files were excluded; 19 (3.3%) had incomplete data, 13 (2.3%) died before operation and four (0.7%) absconded after spontaneous reduction. The 540 patients formed our study population. The flow diagram is shown below (figure 1). There were 495 males and 45 females giving a male to female ratio of 11:1. Sixty-eight (12.6%) were elderly, 339 (62.8%) were young and the rest (133, 24.6%) were middle-aged patients. Their ages ranged from 16-82 years with a mean of 42.46 +/- SD 16.71.

### Clinical presentation

Approximately half (265, 49.1%) of the patients harbored hernias for more than five years before onset of complications. More so, 42 (7.8%) had lived with hernias for >25 years before developing complications, while only 82 (15.2%) gave a short history (<1 year) of symptoms before onset of complications. The most common barrier against early repair was financial constraint 214 (39.6%) followed by patent medicine dealers/ traditional healers intervention 110 (20.4%); others were fear of surgery 58 (10.7%), delayed referral by private hospitals 54 (10.0%), mixed reasons 82 (15.2%) and long distance of patients' home/ bad road network 22 (4.1%). The annual rates and degree of bowel involvement are shown below (Table 1).

All (540,100.0%) presented with both irreducible groin swelling and abdominal pain. Comorbid illnesses were present in 142 (26.3%) patients, ranging from hypertension, diabetes, urinary obstruction, obesity, chronic respiratory diseases, HIV/AIDS, chronic liver disease, congestive heart failure to chronic kidney disease. Of the 451 unilateral cases, 340 (75.4%) harbored hernia on the right side while 111 (24.6%) had theirs on the left. About 9.1% (49 patients) of the total cases had recurrent hernias and all were unilateral. Nearly a tenth (49,9.1%) harbored additional hernias at extra-inguinal sites. Other clinicopathologic findings are shown below (Table 2)

### Surgical treatment and anaesthetic assessment

One hundred and fifty-four (28.5%) patients had intestinal resection. Of these, 21 (13.6%) had stomas while the remaining 133 (86.4%) had resection and primary anastomosis. All inguinal hernia sites were repaired by nylon darning. The impact of age, comorbidity, degree of delay and degree of bowel involvement on bowel resection and mortality rates are shown below (Table 3). The impact of various clinical and perioperative parameters on morbidity rates are shown below (Table 4). The American Association of Anaesthesiologists (ASA) classification included; ASA I (14, 2.6%), ASA II (23, 4.3%), ASA III (422, 78.1%), ASA IV (77, 14.3%) and ASA V (4, 0.7%). ASA I and II cases were from those that had spontaneous reduction. A high ASA score (III-V) was found to be an independent predictor of bowel resection (OR:2.79;CI:5.62-28.53;p=0.003) and perioperative death (OR:10.32;CI:7.48-62.37;p<0.001).

### Outcome of surgical treatment

The most frequent postoperative complication recorded in this series was wound infection (88, 16.3%), followed by scrotal oedema (59, 10.9%). Recurrence (5.1%) was recorded in 28 patients postoperatively and all required surgical intervention without ICU admission (Clavein IV). All recurrent cases were unilateral. The recurrences were fixed in a future repair without general anaesthesia in 19 cases (Clavein IIIa) and with general anaesthesia in 9 cases (Clavein IIIb). Generally, 23.1% (125) patients suffered postoperative morbidities that did not require surgical intervention (Clavein-Dindo grade I and II). Over a tenth (62, 11.5%) of the patients developed postoperative morbidities that required surgical intervention without ICU admission (Clavein IIIa and IIIb). Twenty-five (4.6%) had postoperative morbidities that required ICU management (Clavein IV) while death was recorded in 44 (8.1%) patients (Clavein V). Mortality was significantly higher in those with delay beyond 24hours



(OR:13.42;CI:6.74-29.44;p=0.001), strangulated IH (OR:3.34;CI:2.85-11.16;p=0.02), age above 44years (OR:14.38;CI:13.46-47.72) and comorbidity (OR:6.72;CI:10.42-37.55;p=0.01).

## DISCUSSION

In this review, we determined that emergency presentation represented 21.7% of all IHS managed in the selected hospitals. This rate was higher than a figure of 16.8% from a recent publication in a municipal hospital in southeast Nigeria [17]. This may be explained by differences in design and setting. Moreover, for a common surgical disease prone to complications, a remote, rural residence is perhaps more liable to delayed presentation and treatment compared to a metropolitan referral hospital. In addition, studies have shown that longstanding, neglected hernias presenting with complications are more prevalent in populations comprising mainly of farmers, artisans, lower class and poorly educated persons [5,8,18,19]. Constance and Everhart working in USA observed that advanced age and rural residence remained independently associated with higher incidence of IH in a multivariate-adjusted analysis [18]. The proportion of strangulated component in this study was high (10.1%) compared to the Western figures [1,13,18]. Previous workers have observed that delayed presentation following onset of complications are phenomenal in sub-Saharan Africa and other LMICs and this may partly explain the higher rates of SIH with or without gangrene in this study and other African series [3,7,10,20-25]. In this report, presentation with longstanding hernias was common and nearly half (49.1%) of the patients lived with their hernias for greater than five years before complications developed. Majority stated that financial constraint was responsible for non-elective presentation, consistent with reports from Tanzania and Ghana [3,26]. The health seeking behavior in our setting and Tanzania is similar, but unfortunately reflects the prevailing situation in many rural Africa and India [3,5,9,19,21,27,28]. In contrast to findings in this review and many African series [3,8-10], an impressive 76.9% of 39 patients with complicated abdominal wall hernia in a UK series had consulted their general practitioners before the hernias developed complications [29]. This difference in health seeking behavior between African and European patients has been highlighted by previous authors who identified poverty and socio-cultural beliefs as the key barriers in the African context [4,5,26,31]. In the light of the above, it appears African patients with IH or its complications are predominantly rural dwellers with deplorable health seeking behaviors.

There is need to increase the surgical capacity of hospitals in rural and semi-urban areas to provide regular and efficient emergency and elective surgical services. A recent publication from our environment showed enormous deficits in all the domains of essential surgical and anaesthesia services listed in the Lancet Commission on global health [28]. In faraway Ghana, Ohene Yeboah and Dally expressed concern when they found that each year, less than 1% of estimated 44,917 adult men in Kumasi who required a surgical correction for IH actually got a repair done [27]. As part of intervention to increase IH surgery output in Ghana, Ohene Yeboah has advocated among others, the licensing of non-physician clinicians (NPCs) to perform hernia surgery and elevation of hernia to public health domain and priority similar to malaria, tuberculosis and HIV [26].

The recent introduction of rural surgical posting in the curriculum of West African College of Surgeons (WACS) and National Postgraduate Medical College of Nigeria (NPMCN), faculty of surgery as part of requirement for post-graduate surgery training is salutary [32]. Incidentally, two of the three hospitals involved in this study are designated centres for the rural surgery program in Nigeria. In consideration of the success/gains made so far, we agree with Ajao and Ajoa [32] that the nascent program when properly harnessed has the potential to give an expanded training exposure to the surgical trainees and robust surgical services to patients in the rural areas.

The clinicopathologic characteristics of the hernias observed in this study overlapped with results from similar studies in Tanzania, Ghana, Kenya and Nigeria [3,8,31,33]. The markedly raised proportion of indirect hernia (79.0%) in this series is clinically significant. In one study on elective IH repair in southeast Nigeria [2], indirect hernias accounted for 66.3%, comparable to a value of 65.5% quoted by Mabula and Chayla in Bugando, Tanzania [3] and 61.0% by Ogbuanya and colleagues from a municipal hospital in Nigeria [20]. Elsewhere, it was observed that indirect hernias become strangulated more than direct hernias, primary hernias strangulate more than recurrent and that the right side is most affected [1]. The higher proportion of indirect hernias in this study may be due to the fact that our cohorts comprised only complicated cases while the studies [2,3,20] with lower values recruited either combined elective and emergency cases or only elective cases. The primary hernia and right-side preponderance were equally reflected in this study. The late descent of right testis during embryologic development has been implicated in the right-side dominance of IHS [2,3,8]. Ajao, working in Ibadan, Nigeria shared similar experience and found 68.4% of obstructed groin hernias on the right and 79.1% as indirect IH [34].



Another striking epidemiological finding is the high rate of inguinoscrotal/inguinolabial hernias (494, 78.5%), which suggests that almost all the indirect hernias (497) have progressed to complete or incomplete inguinoscrotal/inguinolabial hernia akin to findings from other African studies<sup>[18,31]</sup>. Hitherto, voluminous inguinoscrotal hernia was very common in Africans, occasionally attaining the size of human head, prompting European workers to use such terms like “African puzzles” or “African Enigma” to describe the rather unusual situation<sup>[6,19,31]</sup>. In an excellent report by the Plymouth hernia service group comparing 106 UK and 135 Ghanaian adult patients with IH, 67% of the Ghanaian hernias extended into the scrotum compared with 6.0% of the UK hernias<sup>[30]</sup>.

Majority of the emergency repairs were carried out via an inguinal route. This is consistent with reports from Ibadan and Abakaliki, both in Nigeria<sup>[17,34]</sup>. The bowel resection rate of 28.5% was high and correlates with the significant delay between onset of hernia complication and hospital presentation (Table 3). In this series, delayed presentation increased the risk of gangrene, necessitating bowel resection with consequent high post-operative morbidity and mortality. Indeed, delay beyond 24hours after onset of complication was an independent predictor of intestinal resection ( $p < 0.001$ ) and mortality ( $p = 0.001$ ). In Kumasi, Ghana, similar delay was reported where 54% of those that presented 48-72hours after complication had bowel resection compared with 10.0% for delay of 0-12hours<sup>[20]</sup>. Indeed, mortality rate of 27.2% was quoted in those that presented 48-72hours later, compared with 0.0% in the early presenters (0-12hours)<sup>[20]</sup>. In this review, hernia strangulation was an important predictor of both bowel resection ( $p < 0.001$ ) and mortality ( $p = 0.021$ ). This may be related to the higher rates of septic complications in SIH as previously reported in USA, Ghana and Nigeria<sup>[1,8,10,17,22]</sup>. Indeed, the danger of this condition is not in the operation, but in the delay<sup>[17,22]</sup>.

The overall mortality rate of 8.1% found in this report is comparable with rates of 10.4% in Nigeria<sup>[14]</sup> and 9.7% in Tanzania<sup>[3]</sup>. Majority (86.4%, 38 deaths) of the deaths occurred in those with high ASA scores ( $p < 0.001$ ), comorbidities ( $p = 0.001$ ), advanced age ( $p = 0.03$ ) and bowel resection ( $p < 0.001$ ) consistent with findings from Nigeria<sup>[8,17]</sup>, Tanzania<sup>[3]</sup>, India<sup>[21]</sup>, Ghana<sup>[22,27]</sup>, Kenya<sup>[33]</sup> and Malawi<sup>[24]</sup>. Overall, we observed that the Clavein grades of the patients in our study (Clavein I-IIIa= 31.3%; IIIb= 3.3%; IV= 4.6% and V = 8.1%) were uniformly higher than values quoted in a Swedish series<sup>[35]</sup> (Clavein I-IIIa= 14.0%; Clavein IIIb= 2.0%; IV= 3.0% and V=1.0%). The explanation for this may partly be due to the fact that the ventral hernia repairs in Sweden<sup>[35]</sup> excluded emergency/ complicated hernias thereby reducing the incidence of adverse postoperative events like morbidities and mortalities. In the postoperative period, 72.7% (32 deaths) of the total deaths (Clavein-Dindo grade V) had either wound infection (26 cases) or intrabdominal abscess (6 cases). Indeed, 60.0% of all patients with intra-abdominal abscess were grade V Clavein-Dindo. Therefore, a cautious attitude and aggressive monitoring are warranted in patients with severe wound infection or intra-abdominal abscess after emergency operation for complicated inguinal hernia. Though 6.8% of patients with scrotal oedema were Clavein grade V, the vast majority (88.1%) of those with this postoperative complication received grades I and II Clavein-Dindo and did not require any surgical, radiological or endoscopic intervention before spontaneous resolution. Similarly, 72.2% of cases with postoperative ileus were classified under grade I and II and no deaths (grade V) were noted in those with secondary hydrocele and postoperative recurrence. In consideration of the foregoing, these observations may suggest that following emergency operation for complicated inguinal hernia, some postoperative morbidities like scrotal oedema, paralytic ileus, secondary hydrocele and recurrence are associated with lower risk of mortality. There was statistically significant difference in the rates of morbidities between operations performed by board certified surgeons and other doctors ( $p = 0.001$ ). This finding may be predicated on the gap in surgical skills between the certified surgeon and the lower rank of surgeons. In Sokoto, Nigeria, Mba shared similar experience and found that wound infection rate was higher in cases performed by junior doctors despite the fact that they repaired predominantly elective cases<sup>[8]</sup>. He concluded that these findings were due to non-observance of aseptic principles and inadequate surgical skills of the junior doctors<sup>[8]</sup>.

## Limitation

This study was a retrospective study and data from it may be deficient in some aspects of the reports.

## Conclusion

The burden of complicated IH is enormous in rural southeast Nigeria. Majority of the patients had significant delay before presentation and subsequently received bowel resections with attendant high postoperative morbidity



and mortality. In addition, emergency repair, advanced age, lower rank of surgeon, general anaesthesia, complete inguinoscrotal hernia and comorbidity were associated with high adverse postoperative outcomes.

## Recommendation

There is urgent need to intensity advocacy for expanded surgical services in our rural communities. The case for elective repair of these hernias at auspicious time must be made and the need for consideration of inguinal hernia a functional component of public health system is salutary. Also, IH should be considered for urgent coverage by National Health Insurance Scheme (NHIS).

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## REFERENCES

1. Góngora-Gómez EM. [Strangulated inguinal hernia]. Spanish. *Cir Cir*. 2012;80(4):357-367. [\[PubMed\]](#)
2. Ogbuanya AUO, Emedike SCO. Elective repair of uncomplicated inguinal hernia in South Eastern Nigeria. *Asian J Med Sci*. 2015;7(2):90-95. doi:10.3126/ajms.v7i2.13349 [\[View Article\]](#)
3. Mabula JB, Chalya PL. Surgical management of inguinal hernias at Bugando Medical Centre in northwestern Tanzania: our experiences in a resource-limited setting. *BMC Res Notes*. 2012;5:585. doi:10.1186/1756-0500-5-585 [\[View Article\]](#) [\[PubMed\]](#)
4. Warwick A, Oppong C, Boatong DB, Kingsnorth A. Inguinal hernia repair is safe in Africa. *East Cent Afr J Surg*. 2013;18(2):14-17.
5. Ohene-Yeboah M, Abantanga FA. Inguinal hernia disease in Africa: a common but neglected surgical condition. *West Afr J Med*. 2011;30(2):77-83. [\[PubMed\]](#)
6. Croitoru C, Stanek A. Far away from NHS – hernia surgery in Nigeria and Kenya. *Ulster Med J*. 2018;87(1):11-16. [\[View Article\]](#) [\[PubMed\]](#)
7. Ogbuanya AU, Eni U, Enemu VC. Recurrent inguinal hernia: epidemiology and outcomes of surgical repair in a resource-limited setting. *East Afr Med J*. 2021;98(1):3401-3412.
8. Mbah N. Morbidity and mortality associated with inguinal hernia in northwestern Nigeria. *West Afr J Med*. 2007;26(4):288-292. doi:10.4314/wajm.v26i4.28329 [\[View Article\]](#) [\[PubMed\]](#)
9. Odula PO, Kakande I. Groin hernia in Mulago Hospital, Kampala. *East Cent Afr J Surg*. 2004;9:74-77.
10. Ogbuanya AU, Amah D. Delay in presentation and challenges of treatment of complicated abdominal wall hernias in rural southeast Nigeria. *Niger J Surg Sci*. 2018;28(2):26-33. doi:10.4103/njss.njss\_4\_20 [\[View Article\]](#)
11. Ozgediz D, Jamison D, Cherian M, McQueen K. The burden of surgical conditions and access to surgical care in low- and middle-income countries. *Bull World Health Organ*. 2008;86(8):646-647. doi:0.2471/BLT.07.050435 [\[View Article\]](#) [\[PubMed\]](#)
12. Alimoglu O, Ankarali S, Eren T, Leblebici M, Burcu B, Shamaileh T. Hernia surgery in Uganda: an experience of Doctors Worldwide. *Anadolu Klinigi*. 2016;21(1):48-53.
13. Beard JH, Oresanya LB, Ohene-Yeboah M, Dicker RA, Harris HW. Characterizing the global burden of surgical disease: a method to estimate inguinal hernia epidemiology in Ghana. *World J Surg*. 2013;37(3):498-503. doi:10.1007/s00268-012-1864-x [\[View Article\]](#) [\[PubMed\]](#)
14. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg*. 2004;240(2):205-213. <https://doi.org/10.1097/01.sla.0000133083.54934.ae> PMID:15273542 [\[View Article\]](#) [\[PubMed\]](#)
15. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *PLoS Med*. 2007;4(10):e296. doi:10.1371/journal.pmed.0040296 [\[View Article\]](#) [\[PubMed\]](#)





16. Vandenberghe JP, von Elm E, Altman DG, et al; STROBE Initiative. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. *PLoS Med.* 2007;4(10):e297. doi:10.1371/journal.pmed.0040297 [\[View Article\]](#) [\[PubMed\]](#)
17. Ogbuanya AU, Esther AU, Onyeyirichi O, Sylvester O, Adewale BE, Friday AF. Emergency Presentation of Groin Hernia: Severity and Outcomes of Treatment in a Nigerian Tertiary Hospital. *West Afr J Med.* 2020;37(5):468-474. [\[PubMed\]](#)
18. Ruhl CE, Everhart JE. Risk factors for inguinal hernia among adults in the US population. *Am J Epidemiol.* 2007;165(10):1154-1161. doi:10.1093/aje/kwm011 [\[View Article\]](#) [\[PubMed\]](#)
19. Seck M, Cisse M, Sall M, Gueye M, Toure A, Thiam O. Open tension free repair of inguinal hernias: the Lichtenstein technique: advantages and limits in an African context: a retrospective study of 109 cases. *Internet J Surg.* 2017;34(1):e52788.
20. Ogbuanya A, Olisa F, Oguonu A, Ugwu N. Feasibility and safety of prosthetic implants for inguinal hernia repair in a Nigerian tertiary hospital. *Med J Zambia.* 2020;47(3):188-196. doi:10.55320/mjz.47.3.80 [\[View Article\]](#)
21. Rao SS, Singh P, Gupta D, Narang R. Clinico-epidemiologic profile of inguinal hernia in rural medical College in central India. *J Mahatma Gandhi Inst Med Sci.* 2016;21(2):116-121. doi:10.4103/0971-9903.189543 [\[View Article\]](#)
22. Ohene-Yeboah M. Strangulated external hernias in Kumasi. *West Afr J Med.* 2003;22(4):310-313. doi:10.4314/wajm.v22i4.28053 [\[View Article\]](#) [\[PubMed\]](#)
23. Ogbuanya AUO, Ugwu NB. Emergency laparotomy at district hospitals in a developing nation: a review of indications and outcomes of treatment. *J Emerg Pract Trauma.* 2021;7(2):111-117. doi:10.34172/jept.2021.06 [\[View Article\]](#)
24. Gajewski J, Conroy R, Bijlmakers L, et al. Quality of surgery in Malawi: comparison of patient-reported outcomes after hernia surgery between district and central hospitals. *World J Surg.* 2018;42(6):1610-1616. doi:10.1007/s00268-017-4385-9 [\[View Article\]](#) [\[PubMed\]](#)
25. Patel HD, Groen RS, Kamara TB, et al. An estimate of hernia prevalence in Sierra Leone from a nationwide community survey. *Hernia.* 2014;18(2):297-303. doi:10.1007/s10029-013-1179-3 [\[View Article\]](#) [\[PubMed\]](#)
26. Ohene-Yeboah M. Challenges of inguinal hernia surgery in Ghana. *Postgrad Med J Ghana.* 2016;5(1):15-19. doi:10.60014/pmjpg.v5i1.92 [\[View Article\]](#)
27. Ohene-Yeboah M, Dally CK. Strangulated inguinal hernia in adult males in Kumasi. *Ghana Med J.* 2014;48(2):101-105. doi:10.4314/gmj.v48i2.8 [\[View Article\]](#) [\[PubMed\]](#)
28. Ogbuanya AU, Anyanwu SNC, Ajah A, et al. Surgical capacity in rural southeast Nigeria: barriers and new opportunities. *Ann Glob Health.* 2021;87(1):118. doi:10.5334/aogh.3367 [\[View Article\]](#) [\[PubMed\]](#)
29. Davies M, Davies C, Morris-Stiff G, Shute K. Emergency presentation of abdominal hernias: outcome and reasons for delay in treatment – a prospective study. *Ann R Coll Surg Engl.* 2007;89(1):47-50. doi:10.1308/003588407X160855 [\[View Article\]](#) [\[PubMed\]](#)
30. Sanders DL, Porter CS, Mitchell KCD, Kingsnorth AN. A prospective cohort study comparing the African and European hernia. *Hernia.* 2008;12(5):527-529. doi:10.1007/s10029-008-0369-x [\[View Article\]](#) [\[PubMed\]](#)
31. Ayandipo OO, Afuwape OO, Irabor DO, Abdurrazzaq AI. Adult abdominal wall hernia in Ibadan. *Ann Ibad. Ann Ib Postgrad Med.* 2015;13(2):94-99. [\[View Article\]](#) [\[PubMed\]](#)
32. Ajao OG, Alao A. Surgical residency training in developing countries: West African College of Surgeons as a case study. *J Natl Med Assoc.* 2016;108(3):173-179. doi:10.1016/j.jnma.2016.06.001 [\[View Article\]](#) [\[PubMed\]](#)
33. Wasike R, Abdalla A. Inguinal hernia repair at the Aga Khan Hospital, Nairobi: practice and preference discordance. *Ann Afr Surg.* 2008;2(1):23-28. doi:10.4314/aas.v2i1.46244 [\[View Article\]](#)
34. Ajao OG. Obstructed groin hernia in a tropical African population. *J Natl Med Assoc.* 1979;71(11):1093-1094. [\[View Article\]](#) [\[PubMed\]](#)
35. Lindmark M, Strigård K, Löwenmark T, Dahlstrand U, Gunnarsson U. Risk Factors for surgical complications in ventral hernia repair. *World J Surg.* 2018;42(11):3528-3536. doi:10.1007/s00268-018-4642-6 [\[View Article\]](#) [\[PubMed\]](#)



**Table 1: Annual rates of emergency presentation.**

Year	Strangulation+/-Gangrene	Obstruction	Incarceration	Total (%)
2013	36	43	12	91 (16.9)
2014	36	34	10	80 (14.8)
2015	38	32	10	80 (14.8)
2016	33	29	7	69 (12.8)
2017	28	34	6	68 (12.6)
2018	26	18	7	51 (9.4)
2019	27	19	5	51 (9.4)
2020	27	18	3	48 (8.9)
<b>Total(%)</b>	<b>251(46.5)</b>	<b>227 (42.0%)</b>	<b>62 (11.5)</b>	<b>540 (100)</b>

**Table 2: Preoperative clinicopathologic characteristics**

Parameter	Frequency (number of patients)	Percent (%)	p-value
*Clinical presentation			
Abdominal pain	540	100.0	P< 0.001
Irreducible groin swelling	540	100.0	
Vomiting	398	73.3	
Progressive abdominal swelling	372	68.9	
Delayed Presentation(hours)			0.001
0-24	51	9.5	
25-48	121	22.5	
49-72	204	37.8	
>72	164	30.3	
Type of Hernia			
Primary	580	92.2	
‡Recurrent	49	7.8	
Nature of Hernia			
Indirect	497	79.0	
Direct	120	19.1	
Pantaloon	12	1.9	
Bilaterality			
Bilateral	89	16.5	
Unilateral	451	83.5	

\*some patients presented with 2 or more features;

‡ No cases of recurrent hernias on both sides (all recurrent hernias are unilateral)



**Table 3: Effect of Preoperative clinical indices on bowel resection and mortality**

Clinical variables	Frequency	Bowel resection (%)	Mortality (%)
Complications:			
Incarceration	62	0 (0.0)	0 (0.0)
Obstruction	227	0 (0.0)	3 (1.3)
Strangulation	251	154 (61.4)	41 (16.3)
Total	540	154 (28.5)	44 (8.1)
$\chi^2$		248.06	42.11*
p-value		P < 0.001	0.02
Odd Ratio		46.21	3.34
95% Confidence Interval		8.11-22.32	2.85-11.16
Delay (hours)			
0-24	51	2 (3.9)	0 (0.0)
25-48	121	17 (14.0)	3 (2.5)
49-72	204	60 (29.4)	11 (5.4)
>72	164	75 (45.7)	30 (18.3)
Total	540	154 (28.5)	44 (8.1)
$\chi^2$		51.48	34.34*
p-value		P < 0.001	0.001
Odd Ratio		31.44	13.42
95% Confidence Interval		17.33-54.63	6.74-29.44
Age (years)			
16-44	339	63 (18.6)	4 (1.2)
45-65	133	52 (39.1)	16 (12.0)
>65	68	39 (57.4)	24 (35.3)
$\chi^2$		51.45	91.62
p-value		P < 0.001	0.03
Odd Ratio		6.31	14.38
95% Confidence Interval		16.47-68.94	13.46-47-72
Comorbidity			
Present	142	46 (32.4)	18 (12.7)
Absent	398	108 (27.1)	26 (6.5)
$\chi^2$		6.2	53.6
p-value		0.08	0.01
Odd Ratio		2.42	6.72
95% Confidence Interval		0.75-5.62	10.42-37.55

\*Fisher's exact test used;



**Table 4: Impact of perioperative factors on postoperative morbidities**

Perioperative factor	Frequency	Patients with morbidities	Morbidity (%)	P value	Odd Ratio (95% Confidence Interval)
<b>Extent of surgical repair</b>					
Simple repair	137	32	22.2	P< 0.001	4.32(15.44-64.94)
Repair+bowel resection	154	115	74.7		
Laparotomy + Repair	249	109	43.8		
<b>Status before repair</b>					
Complicated(Emergency)	492	249	50.6	P< 0.001	14.53(7.55-31.52)
Spontaneous	48	7	14.6		
<b>Rank of Doctor</b>					
Lower rank of surgeon	129	92	71.3	P< 0.001	5.7(12.16-66.45)
Board-certified surgeon	411	164	39.9		
<b>Anaesthetic method</b>					
General	399	198	49.6	0.01	19.32(6.37-27.81)
Spinal	129	57	44.1		
Local	12	1	8.3		
<b>Extent of Hernia‡</b>					
Complete inguinoscrotal	315	183	58.1	0.004	10.43(8.31-51.39)
Incomplete inguinoscrotal	133	59	44.4		
Bubunocele	92	14	15.2		

‡No cases of complications on both sides; \*Fisher's exact test used;

**Table 5: Characteristics of Clavein-Dindo<sup>14</sup> classification of postoperative complications.**

Complications	Total	Grade I	Grade II	Grade IIIa	Grade IIIb	Grade IVa	Grade IVb	Grade V	p-value
Variables	N(%)	N (%)	N (%)	N(%)	N (%)	N (%)	N (%)	N (%)	
Wound Infection	88(16.3)	2	25	16	5	10	4	26	0.04
Scrotal oedema	59(10.9)	13	39	0	0	2	1	4	0.03
Heamatoma	42(7.8)	9	16	6	2	2	3	4	0.046
Ileus	18(3.3)	10	3	0	0	1	1	3	P<0.001
Intra-abdominal Abscess	10(1.9)	0	1	0	2	1	0	6	0.002
Visceral Injury	6(1.1)	4	1	0	0	0	0	1	0.01
Secondary Hydrocele	5(0.9)	1	1	3	0	0	0	0	0.002
Recurrence	28(5.2)	0	0	19	9	0	0	0	P<0.001
Total	256(47.4)	39	86	44	18	16	9	44	

1: Flow Diagram of inclusion/exclusion criteria.

