Addis Ababa University
College of Medicine and Health Science
Department of Surgery

Early Post-Operative Morbidities Following Early Versus Delayed Sigmoidectomy after Sigmoid Volvulus

By: **Dr. Habtamu Atalel / GSR 4**

Advisor: **Dr. Solomon Bekele / General & colorectal surgeon**

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR SPECIALITY CERTIFICATE IN GENERAL SURGERY

December 11, 2024
Addis Ababa, Ethiopia

Name of principal investigator Adress	Dr Habtamu Atalel Admassu (MD, General Surgeon) Mobile: +251910096724 Email- habx6724@gmail.com Addis Ababa, Ethiopia
Name of primary advisor	Dr Solomon Bekele (MD, General & Colorectal surgeon)
Full title of research	Early Post-Operative Morbidities Following Early Versus Delayed Sigmoidectomy after Sigmoid Volvulus
Total duration of research	One year
Study area	Addis Ababa
Total cost of the project	**29,080 ETB**

APPROVAL SHEET ADDIS ABABA UNIVERSITY COLLEGE OF MEDICINE AND HEALTH SCIENCE
DEPARTMENT OF SURGERY

I, the undersigned general surgery resident, declare that I have submitted my original work on a title Early Post-Operative Morbidities Following Early Versus Delayed Sigmoidectomy after Sigmoid Volvulus for the examination.

Submitted by:

Dr. Habtamu Atalel	Signature	Date

This thesis work has been submitted for examination with my approval as an advisor.

Approved by:

Dr. Solomon Bekele	Signature	Date

Statement of the Author

I hereby declare that this thesis is my original work and has not been presented for a degree in any other university and all sources of material used for this thesis have been duly acknowledged.

Name: Habtamu Atalel (MD)

Signature: _____

Date:_____

Acknowledgment

First and foremost all thanks go to the Almighty God for everything he has done for me.

I would like to thank the Department of Surgery for creating this learning evironment. And also to Dr. Solomon Bekele, my advisor, for his unwavering support, comments & critics throughout the whole process.

I would like to thank the advisory committee from Addis Ababa Health Bureau for critically reviewing my research proposal and adding their input.

Finally, I want to thank my family and friends for their support throughout my journey.

Achronyms

- A.A - Addis Ababa
- BPH- Benign prostatic hyperplesia
- DM - Diabetes Mellitus
- EMR - Electronic medical record
- HTN - Hypertension
- IOF - Intraoperative finding
- LBO - Large bowel obstruction
- MF - Mesenteric fibrosis
- M:F- Male to Female ratio
- PEC - Percutaneous endoscopic colopexy
- RS - Redundant sigmoid
- SV - Sigmoid volvulus
- SSSI - superficial surgical site infection
- SPSS- Statistical package for social sciences
- TASH - Tikur Anbessa Specialized Hospital
- ZMH - Zewditu Memorial Hospital

List of tables

Abstract

Background—Sigmoid volvulus (SV) is characterized by the abnormal twisting of the sigmoid colon on its mesentery. It is the number one cause of acute LBO in Ethiopia. The incidence of SV varies among different regions. In Western countries, it accounts for 1-5% of all colonic obstructions, while in Ethiopia, it accounts for 58-69% of the LBO. It has a high recurrence rate of about 30 % to 80% and a significant mortality rate reaching 25–50% in some case series.

According to the current practice guidelines, patients who present with uncomplicated SV are initially managed by endoscopic decompression followed by Sigmoidectomy. Sigmoidectomy carries inherent risks, including surgical site infections, anastomotic leaks, and cardio-respiratory complications. The study aimed to assess the early postoperative outcome of index and elective Sigmoidectomies.

Method: - A retrospective cross-sectional study was conducted by reviewing medical records of patients operated at three University-affiliated tertiary Hospitals in Addis Ababa. Data was collected through a structured questionnaire. The variables were coded and analyzed using SPSS version 26.

Result: -The analysis showed that the majority of our patients were from AA (76.9%) and the majority of them were male (84.3%) with an M: F ratio of 5:1. The median age of the sample patients was 53 years. During their sigmoid volvulus attacks, most of our patients presented more than 24 hours after the onset of symptoms (71.1%). Both elective and index sigmoidectomies had comparable frequencies, 51.2% & 48.8% respectively. And the majority of the cases were done via open Sigmoidectomies (95.9%). The median hospital stay after surgery was 6 days with 64.5% of the patients being discharged before 7th post-operative day. The most common post-operative morbidity was wound infection accounting for 31%. Younger patients (18-40years) had an 84.7% rate of being discharged from the hospital within a week of their surgery while the age groups from 41 to 70 and 71 to 90 had decreased discharge rate from the hospital within the first week of the surgery;(57.3%,69.2% respectively). Elective procedures had a shorter hospital stay with a one-week discharge rate of 77.4% while index procedures had a 50.8% discharge rate. And 30.8% of index sigmoidectomy patients stayed in the hospital for more than two weeks. The presence of diabetes was associated with a significant number of SSSI & wound dehiscence with 25% of diabetic patients

undergoing sigmoidectomy ending up with wound dehiscence & another 25% of the patients with SSSI as compared.

The intraoperative finding of bowel edema was associated with an increased rate of hospital stay and anastomotic leak. Having index sigmoidectomy was associated with increased anastomotic leak rate and pulmonary complications.

Conclusion: Index sigmoidectomies were associated with a higher complication rate than elective sigmoidectomies.

table of content

1. INTRODUCTION

1.1 Background of the study

A major cause of acute large bowel obstruction worldwide, Sigmoid volvulus, is characterized by the abnormal twisting of the sigmoid colon on its mesentery. Sigmoid volvulus is described as far back as the Papyrus Ebers of ancient Egypt. The Egyptians recognized the natural history by which the twisted colon either spontaneously reduced or "rotted." Hippocrates recognized sigmoid volvulus and advocated using a 12-inch long suppository and insufflated air to relieve the obstruction [1,2]. Soranus, an ancient Greek physician, defined the condition as a "severe and dangerous twisting of the intestines." Because of severe pain, volvulus was often referred to as "iliac passion" until the early nineteenth century. It is the number one cause of acute LBO in Ethiopia. The incidence of SV varies among different regions, in western countries it accounts for 1-5% of all colonic obstructions[1,3], while in Ethiopia it accounts for 58-69% of the LBO[4, 5]. SV has a high recurrence rate of about 30 % to 80% [7,8] and a significant mortality rate reaching up to 25–50% in some case series[9]. The classic presentation also varies between developed and developing nations; in developed countries, it usually happens in an institutionalized individual on psychotropic medications[10], whereas, in developing countries, it often occurs in active individuals who consume a large amount of fiber diet after fasting. The male-to-female ratio is 2:1[6], and the median age of presentation is 60 to 80 years old[1,3,4,5,6,7,8]. Other risk factors include chronic constipation, permissive use of laxatives, and weak support of the sigmoid colon either congenitally or acquired due to previous colon mobilization. It is rare in children but can happen in patients with Hirschsprung's or Chagas disease[11].

According to the rapidity of the twisting of the sigmoid, SV can be classified as acute, sub-acute, and fulminating type. The sub-acute form is the most common type with recurrent bouts of volvulus and usually occurs in elderly individuals. The acute form usually occurs in younger people and presents with classic symptoms of LBO. The fulminating type is a progression of untreated or inadequately treated acute volvulus, presenting with peritonitis or shock secondary to bowel perforation.

The anatomical risk factors for SV are long redundant sigmoid with a narrow mesentery that allows twisting of the sigmoid colon around its vascular access. Rotation of the distended colon occurs usually in an anticlockwise pattern leading to vascular impingement. Movement of the dilated bowel is hindered by the abdominal wall and retroperitoneum. Chronic adhesions and inflammation due to previous episodes of torsion and detorsion lead to the shortening of the mesocolon. These factors will lead to entrapment of the twisted sigmoid colon, failure of decompression, and progressive strangulation secondary to closed-loop obstruction.

Plain X-ray is diagnostic in 57–90% of patients, with the classic coffee bean sign detected in about 60% of cases. Computed tomography (CT) scan has a very high accuracy for diagnosis of SV, approaching 100%. Other imaging modalities, such as barium enema, are less commonly used nowadays.

According to the current practice guidelines, patients who present with uncomplicated SV are initially managed by endoscopic decompression either with rigid or flexible sigmoidoscopy, with insertion of a rectal tube for 24–48 hours to maintain reduction and lessen the risk of early recurrence. Following initial conservative management, patients should be assessed for definitive surgery, ideally during the index admission after medical optimization to avoid the high risk of recurrence and increased morbidity and mortality with each attack. Patients who present with peritonitis and sepsis should be managed surgically, usually with Hartman's procedure.

1.2 Statement of the problem

Despite advancements in diagnostic modalities and therapeutic interventions, the management of sigmoid volvulus poses considerable challenges, particularly in cases requiring surgical intervention. Sigmoidectomy, the surgical removal of the sigmoid colon, is often the definitive treatment for recurrent or complicated sigmoid volvulus. However, the postoperative morbidity associated with this procedure warrants comprehensive investigation to optimize patient outcomes and minimize complications.

Sigmoidectomy carries inherent risks, including surgical site infections, anastomotic leaks, bowel obstruction, and cardio-respiratory complications. Furthermore, factors such as patient co-morbidities, surgical technique, and preoperative care may influence the incidence and severity of postoperative morbidity[12]. Understanding these factors is crucial for tailoring surgical approaches, optimizing preoperative management, and enhancing patient outcomes.

Throughout our clinical practice, we have observed multiple occasions where the timing of Sigmoidectomy after initial deflation significantly correlated to patient outcomes including wound infections, anastomotic leak rate, pulmonary complications, and hospital stay.

Multiple researches have been done on the incidence, severity, and risk factors of post-operative complications following sigmoidectomy for sigmoid volvulus but none, as to our search, has been done comparing morbidities following early versus delayed sigmoidectomy.

1.3 Significance of the study

This research paper aims to provide a thorough analysis of postoperative morbidity following early and delayed sigmoidectomies after initial decompression was done for sigmoid volvulus. By examining a cohort of patients who underwent this surgical intervention, we seek to identify risk factors, common complications, and strategies for prevention and management.

Through a comprehensive review of existing literature and retrospective analysis of clinical data, this research aims to elucidate the severity of post-operative complications associated with early and delayed sigmoidectomies after initial decompression. Furthermore, it will explore potential predictors of morbidity, such as patient demographics, pre-existing medical conditions, and operative variables.

Ultimately, the findings of this study will fill the knowledge gap that exists in this area due to the lack of previous researches ,thereby, inform clinical practice guidelines, improve risk stratification, and guide perioperative decision-making to minimize post-operative morbidity and enhance the overall quality of care for patients undergoing sigmoidectomy following sigmoid volvulus.

2. Objective

2.1 General objectives

- The goal of the study is to assess the early post-operative outcome of early and delayed sigmoidectomies, thus, comparing which option has the least morbidity after initial sigmoid volvulus management.

2.2 Specific objective

- To determine early postoperative outcomes after early and delayed sigmoidectomy
- To compare which surgical approach has increased morbidity
- To identify which of the two options of management has a better postoperative outcome

3. LITERATURE REVIEW

Introduction

A case of sigmoid volvulus was reported in ancient Egypt as early as 1550 BC. Research on its prevalence, risk factors, presentation, and management options have been published for decades.

The purpose of this review is to search & analyze previously done research on the topic and identify gaps in the literature regarding the my topic.

The best form of prophylactic management of a decompressed sigmoid volvulus (SV) is controversial, especially in the elderly. ***M.Bruzzi J.H.lefevre & colleague****s*[13]. Assessed these issues in a retrospective study of 65 patients who presented with acute sigmoid volvulus from 2003 to 2013. Emergency decompression was attempted in all patients in whom there was no sign of peritonitis. Planned surgical resection was the procedure of choice in young patients. Percutaneous endoscopic colopexy (PEC) was used in high surgical risk patients.

There were 65 patients (45 males) with a median age of 71.5 (24–99) years. Non-surgical reduction was performed in 62 with a success rate of 95% (59/62). Recurrence after initial decompression was 67% at a median follow-up of 5 (1–14) years. A prophylactic surgical resection was performed with primary anastomosis in 33 patients. There were no deaths and the major morbidity rate was 6%. At a mean follow-up of 62 months, only 1 (3%) patient had had a recurrence (at 130 months). PEC was performed in six patients of median age 90 (84–99) years and with a median American Society of Anaesthesiologists score of 4. Complications included local site infection (n = 2), pain (n = 1), and abdominal wall bleeding (n = 1). After a median follow-up of 2 (1–4) years, three patients died from medical causes and one recurrence occurred 13 months after removal of the PEC tube. Their conclusion was prophylactic resection after initial decompression of SV results in a low rate of recurrence. Planned sigmoid resection is safe and effective. In frail elderly patients, PEC is satisfactory.

Ali Nuhu & his colleagues[14] at the King Royal Victoria Hospital studied the epidemiology, incidence, clinical features & outcome of the management of SV in West

Africa from 2000 to 2005. A total of 48 patients, 45 (93.8%) males and 3 (6.3%) females, with a male: female ratio of 14.3:1, an age range of 19 to 78 years, and a mean age of 45.8 +/- 17.6 years underwent treatment for acute sigmoid volvulus. Twenty-one (43.8%) of the patients were aged 40 to 49 years. Two (4.2%) had rectal tube detorsion followed by elective sigmoidectomy and primary anastomosis on the same admission, while 24 (50%) had emergency laparotomy, at which bowel decompression, one-stage resection, and primary anastomosis without on-table lavage were done. The rest of the patients, 22 (45.8%), had gangrenous sigmoid colons at laparotomy and consequently underwent resection and Hartman's procedure. Fourteen (29.1%) patients developed wound infection; and 5 (10.4%) had prolonged ileus, which was managed conservatively. There was no anastomotic leak. The mean hospital stay was 11.1 days. There were 5 deaths, giving a mortality rate of 10.4%. There conclusion was Sigmoid colectomy and primary anastomosis can be carried out safely in those with viable colon without on-table colonic lavage.

Durkaya Oren S. Atamanalp & colleagues [15] did a retrospective study on the management of 827 SV cases. The mean age was 57.9 years (range, 10 weeks to 98 years), and 688 patients (83.2 percent) were male. The non-operative reduction was applied in (69.5%) of 575 patients(barium enema in 13, rigid sigmoidoscopy in 351, and flexible sigmoidoscopy in 211, with rectal tube placement in all patients). The results were as follows: success of 78.1 percent, mortality of 0.9 percent, complication of 3 percent, and early recurrence of 3.3 percent. Surgical treatment was performed on 393 patients (detorsion in 46, mesosigmoidopexy in 56, exteriorization in 4, resection with Hartman's procedure in 146, resection with Mikulicz procedure in 14, resection with primary anastomosis in 51, tube cecostomy and colonic cleansing with resection in 75, and laparotomy in 1). The results were as follows: mortality of 15.8 percent, complication of 37.2 percent, early recurrence of 0.8 percent, and late recurrence of 6.7 percent.

They concluded that non-operative reduction is the initial treatment of sigmoid colon volvulus, and flexible sigmoidoscopy with rectal tube placement can be used successfully. Patients in whom bowel gangrene or peritonitis is present or non-operative treatment is unsuccessful need emergency surgery. In surgical treatment, resection and primary anastomosis is the first choice, and it can be performed with acceptable mortality and morbidity rates if the patient is stable and tension-free anastomosis is possible. Non-

definitive procedures have high recurrence rates; thus, definitive surgical techniques must be preferred.

Abera Mulugeta & colleagues[16] did a retrospective cross-sectional review on the pattern & outcome of the management of SV at a district hospital in Ethiopia. A total of 131 patients were managed for acute sigmoid volvulus. 108 (82.4%) were men with a male-to-female ratio of 4.7:1. The hospital prevalence of acute sigmoid volvulus was 27.9%. The majority (42%) of the patients were in the 6th decade of life. Abdominal pain, abdominal distension & inability to pass feces & flatus were the predominant presenting complaints while abdominal distension was the dominant physical finding in all of the patients. Ninety-seven patients (74%) had viable bowel obstruction of which 29 patients had successful rectal tube deflation. The remaining 68 patients were managed operatively by either primary resection & anastomosis (62 patients) or de-rotation alone (6 patients). Thirty-four patients had gangrenous bowel obstruction and were managed by either primary resection and anastomosis (16 patients) or Hartman's colostomy (18 patients). Six patients died of which 5 had primary resection and anastomosis (2 for viable and 3 for gangrenous bowel obstruction). The predominant postoperative complication was wound infection in 11(10.7%) patients.
Factors associated with unfavorable outcomes were female sex, primary resection & end to end anastomosis, and presentation of illness more than 24 h.
As a conclusion they said, the most common management was primary resection and anastomosis. The overall mortality rate was 4.5% and the mortality rate related to primary resection and end-to-end anastomosis was 6.4%. The mortality rate was higher in those patients who had resection and anastomosis for gangrenous bowel compared to those who had viable bowel (19% vs 3%). Generally, factors associated with poor outcomes were duration of illness, primary resection and anastomosis, and being female.

J.O Larkin & colleagues[17] assessed the benefit of early resection for recurrent SV in a retrospective review of 27 patients who had acute SV from 1996 to 2006 in Ireland. Eleven patients were managed with colonoscopic decompression alone. The overall mortality rate for non-operative management was 36.4% (4 of 11 patients). Fifteen patients had operative management (five semi-elective following decompression, 10 emergency). There was no mortality in the semi-elective cohort and one in the emergency surgery group. The overall mortality for surgery was 6% (1 of 15). Five of

the seven patients managed with colonoscopic decompression alone who survived were subsequently re-admitted with sigmoid volvulus (a 71.4% recurrence rate). The six deaths in our overall series each occurred in patients with established gangrene of the bowel. With early surgical intervention before the onset of gangrene, however, good outcomes may be achieved, even in patients unsuitable for elective surgery. Eight of the 15 operatively managed patients were considered to be ASA (American Society of Anaesthesiologists) grade 4. There was no postoperative mortality in this group. They concluded that given the high rate of recurrence of sigmoid volvulus after initial successful non-operative management and the attendant risks of mortality from gangrenous bowel developing with a subsequent volvulus, they contended that all patients should be considered for definitive surgery after initial colonoscopic decompression, irrespective of the ASA score.

Despite these and many other researches done on incidence, epidemiology, clinical features, and management options in SV, there is no data on any database we searched whether early(semi-elective) or delayed(elective) sigmoidectomy for SV carries less morbidity and mortality. Consequently these research will provide data and information that can help minimize the information gap there is on timing of sigmoidectomy for SV.

4. Material & methods

4.1 Study Design, Setting, and Period

This research was aimed at comparing the early post-operative morbidities following early and delayed sigmoidectomies after decompression of sigmoid volvulus.
A Hospital-based multi-center, two-year, retrospective, cross-sectional study was conducted from June 15, 2024, to September 15, 2024, GC on cases operated from November 1, 2022, to November 1, 2024, GC, and assessed early post-operative morbidities following early and delayed sigmoidectomy among patients coming to three specialized teaching Hospitals in Addis Ababa, Ethiopia. Of the various Hospitals in the city, the majority of them give surgical service to SV. Among those, three of the oldest, well-known, and most versed Hospitals were purposefully chosen for the study. Namely, Tikur Anbesa Specialized Hospital(TASH), Zewditu Memorial Hospital(ZMH), and Menillik Comprehensive Hospital.

4.2 Participants, Sample Size and Sampling

The source population was all patients being treated for SV in the mentioned Hospitals during the study period.
Study population- Those who had sigmoidectomy done for SV in these Hospitals during the study period
Sample size- All patients that are operated for SV during the study period at the Hospitals.

There were two groups of participants, those who had early sigmoid resection done (on index admission after tube deflation) and those who had delayed sigmoid resection done (after 6 weeks of rectal tube deflation)

4.3 Data collection

Data was collected by **medical chart & EMR review method.** Where the early post operative (within one month of the operation) outcome of patients was objectively assessed from both groups.

Data collection was done through checklist including a special patient Proforma that includes age, gender, demographic characteristics, deflation history, comorbidities, presentation, time of the surgery, type of the surgery, operative finding, outcomes, post operative complications encountered,and other relevant items related to disease.

The structured check-list was documented from each patient card and surgery registration books. The check lists was prepared in English language.

4.4 Data analysis

Data was summarized, categorized, and coded into numeric values in Excel before being loaded into **SPSS-26** statistical program. Tables were used to provide descriptive statistics, sums, means, and percentages so they could be easily interpreted. Chi-square analysis was performed to investigate the correlation between dependent and independent variables. A *P*-value of <0.05 was considered statistically significant.

4.5. Variables

Dependent variables

- Length of Hospital stay
- Wound infection
- Anastomotic leak
- Pulmonary complication

Independent variables

- Age
- Gender
- Address
- Co-morbidities
- Duration of illness
- Previous deflation history
- Type of surgery
- Timing of surgery
- Type of incision
- Intra-op finding

5. Inclusion & exclusion criteria

- **Inclusion criteria -** all patient charts found and charts that are completed during the study period
- **Exclusion criteria -** lost charts or incomplete charts

6. Operational definitions

- **Sigmoidectomy-** surgical resection of the sigmoid colon
- **Early (semi-elective) sigmoidectomy-** sigmoid resection done on index admission(within 10 days) after decompression of acute sigmoid volvulus
- **Delayed (elective) sigmoidectomy –** sigmoid resection done after six weeks of the initial sigmoid volvulus decompression

7. Ethical considerations

The study was conducted after ethical approval was granted by the research committee of the Department of Surgery of Addis Ababa University and Addis Ababa Health Bureau. The data collected from medical records was only accessed by the principal investigator and was held anonymous and confidential.

8. Results

The analysis showed that Majority of our patients were from AA (76.9%) and majority of the them were male (84.3%) with a M:F ration of 5:1. and The median age of the sample patients was 53 years. Majoriy of the patients didn't have any comorbidity(75%), and the most common comorbidity was HTN accounting for 17.4%.

During their sigmoid volvulus attackes, most of our patients presented more than 24hrs after the onset of symptoms (71.1%) and the median frequency of deflation before the surgery was 2 with 79.3% being deflated less than three times.

Both elective and index sigmoidectomies had comparable frequency, 51.2% & 48.8% respectively. And majority of the cases were done via open sigmoidectomies (95.9%). and most of incisions made were lower midline accounting for 76.8% followed by left lower transverse(25.6%) & Laparoscopic sigmoidectomy was 2.5%.

In 50% of the surgeries, only redundant sigmoid was reported as the IOF. Bowel edema was reported in 8.3% of cases.

The median hospital stay after surgery was 6 days with 64.5% of the patients being discharged before 7^{th} post-operative day. The most common postoperative morbidity was wound infection accounting for 31% followed by the anastomotic leak (9.9%) and pulmonary complications (8.3%)

The commonest wound infection was SSSI 17.4%, followed by wound dehiscence(7.4%) and post operative intra abdominal collection (6.6%)

Table 1. Demographic and clinical condition of the Sample patients

	Category	N	Percent %
Gender	Male	102	84.3
	female	18	15.7
	Total	121	100
Age	18-40	26	21.5
	41-70	82	67.8
	71-90	13	10.7
	Total	121	100
Region	Adis Ababa	93	76.9
	Oromia	6	5
	Amhara	22	18.2
	Total	121	100
Comorbidity	Diabetes	4	3.3
	Hypertension	21	17.4
	DM + HTN	2	1.7
	Cardiac	1	0.8
	BPH	2	1.7
	None	97	75.2
	Total	121	100
Duration of illness	<24hrs	35	28.9
	>24hrs	86	71.1
	Total	121	100
Deflation frequency	<3	96	79.3
	4-6	22	18.2
	7-10	2	1.7
	Total	121	100

Abbreviations- DM+HTN- diabetic plus hypertension, BPH- benign prostatic hyperplasia

Table 2. The frequency in the surgical aspect of the cases

Variable	Category	N	Percentage
Time of surgery	Elective	62	51.2
	index	59	48.8
	Total	121	100
Type of surgery	Open	116	95.9
	laparoscopic	3	2.5
	Lap- assisted	2	1.7
	Total	121	100
Type of incision	Lower midline	82	67.8
	Left transverse	31	25.6
	Left paramedian	3	2.5
	Total	121	100
IOF	Redundant sigmoid + MF	50	41.3
	Redundant sigmoid + Bowel Edema	10	8.3
	Redundant sigmoid	61	50.4
	Total	121	100

Abbreviation; MF- mesenteric fibrosis

Table 3. Frequency of the post-operative outcomes

Variable	Category	N	Percentage %
Duration of hospital stay	<7 days	78	64.5
	8-15days	36	29.8
	16-30 days	6	5
	30-60 days	1	0.8
	Total	121	100
Wound infection	SSSI	21	17.4
	Dehiscence	9	7.4
	Post OP collection	8	6.6
	None	83	68.6
	Total	121	100
Anastomotic leak	Yes	12	9.9
	No	109	90.1
	Total	121	100
Pulmonary complications	Yes	10	8.3
	No	111	91.7
	Total	121	100

8.1. Hospital stays

In analyzing the effect of the different independent variables on the duration of hospital stay, we used Chi-square crosstabulation and considered $P<0.05$ to be significant. Total number of patients were 121. we found that only age, time of surgery, and intra-operative finding had significant effects on the duration of hospital stay after Sigmoidectomy. The rest of the variables had no significant association with the duration of hospital stay.

Younger patients (18-40years) had an 84.7% rate of being discharged from the hospital within a week of their surgery while age groups from 41 to 70 years and 71 to 90 years had decreased discharge rate from the hospital within the first week of the surgery; (57.3%, 69.2%, respectively). Suggesting that the younger the patient, the shorter the hospital stay (p-0.05).

On Analysing the time of the surgery, we found that elective procedures had a shorter hospital stay with a one-week discharge rate of 77.4% while index procedures had a 50.8% discharge rate. And 38.9% of index Sigmoidectomy patients stayed in the hospital for two weeks while only 20.9 of elective Sigmoidectomy patients stayed for that long. (p-0.015)

Analysis of intraoperative findings showed that the finding of bowel edema significantly increased the hospital stays with only 30% of patients discharged on the first week of the surgery compared to 70.4% when only redundant sigmoid was found and 64% when mesenteric fibrosis was found along with redundant sigmoid. Furthermore, 30% of patients with intraoperative bowel edema stayed in the hospital for more than two weeks, on the other hand only 3.2% of patients with the intraoperative finding of redundant sigmoid and, only 2% of those with associated mesenteric fibrosis stayed for that long. (p-0.006)

Table 4. The Chi-square association of duration of hospital stay with age, time of surgery, and intraoperative findings.

Variable	Categories	Duration of hospital stay Label	N	Percent	χ^2	P-Value
Age	18-40 yrs	<7 days	22	84.6		
		7-15days	3	11.5		
		15-30days	0	0		
		30-60days	1	3.8		
		Total	26	100		
	41-70 yrs	<7 days	47	57.3	12.613	0.050
		7-15days	29	35.3		
		15-30days	6	7.3		

		30-60days	0	0		
		Total	82	100		
	70-90 yrs	<7 days	9	69.2		
		7-15days	4	30.7		
		15-30days	0	0		
		30-60days	0	0		
		Total	13	100		
	Elective	<7 days	48	77.4		
		7-15days	13	20.9		
Time of		15-30days	1	1.6		
surgery		30-60days	0	0	10.530	0.015
		Total	62	100		
	Index	<7 days	30	50.8		
		7-15days	23	38.9		
		15-30days	5	8.4		
		30-60days	1	1.6		
		Total	59	100		
	RS	<7 days	43	70.4		
		7-15days	15	24.5		
		15-30days	2	3.2		
		30-60days	1	1.6		
		Total	61	100		
	RS+ MF	<7 days	32	64		
		7-15days	17	34		
Intraoperati		15-30days	1	2	18.250	0.006
ve finding		30-60days	0	0		
		Total	50	100		
	RS + Edema	<7 days	3	30		
		7-15days	4	40		
		15-30days	3	30		
		30-60days	0	0		
		Total	10	100		

Abbreviations - RS- redundant sigmoid, RS+MF- redundant sigmoid with mesenteric fibrosis, RS+Edema- redundant sigmoid with bowel edema

8.2. Wound infection

A chi-square analysis was performed to determine the association of the independent variables with the rate of postoperative wound infection. A total of 121 patients were used in the analysis & we found that only comorbidities and time of surgery had statistically significant effect on wound infections (P <0.005). The other independent variables had no statistically significant correlation with the wound infection rate in this study.

As we can see from Table 5, 25% of diabetic patients undergoing sigmoidectomy had wound dehiscence & another 25% of the patients had SSSI.

Hypertension was found in 17.4% of the patients and from these patients 14.2% developed SSSI, surprisingly, the post-operative intraabdominal collection rate was higher for hypertensive patients with 4.7% of these patients developing it compared to other comorbidities. (P-0.010)

Analysis of the effect of the time of surgery on wound infections found that the rate of Superficial surgical site infection, wound dehiscence, and post-operative collection were all higher for the index Sigmoidectomy patients with 22% of patients developing SSSI, 10.1% developed wound dehiscence and 11.8% having intraabdominal collection. While 12.9% of elective sigmoidectomy patients developed SSSI; 4.8% developed wound dehiscence and 1.6% developed intraabdominal collection. (p-0.018)

Table 5. The effect of comorbidity and time of surgery with wound infections

Variable	Category	Wound infection Labels	N	%	χ^2	P-Value
		No	1	50		
		SSSI	1	50		
	BPH	Dehiscence	0	0		
		Post op collection	0	0		

Comorbidity	Cardiac	Total	2	100	30.44	0.010
		No	1	100		
		SSSI	0	0		
		Dehiscence	0	0		
		Post op collection	0	0		
	DM	Total	1	100		
		No	2	50		
		SSSI	1	25		
		Dehiscence	1	25		
		Post op collection	0	0		
	HTN	Total	4	100		
		No	16	76.1		
		SSSI	3	14.2		
		Dehiscence	1	4.7		
		Post op collection	1	4.7		
	HTN + DM	Total	21	100		
		No	0	0		
		SSSI	0	0		
		Dehiscence	2	100		
		Post op collection	0	0		
	NONE	Total	2	100		
		No	63	69.2		
		SSSI	16	17.5		
		Dehiscence	5	2.4		
		Post op collection	7	7.6		
Time of surgery	elective	Total	91	100	10.104	0.018
		No	50	80.6		
		SSSI	8	12.9		
		Dehiscence	3	4.8		
		Post op collection	1	1.6		
	Index	Total	62	100		
		No	33	55.9		
		SSSI	13	22		
		Dehiscence	6	10.1		
		Post op collection	7	11.8		

IOF	Redundant sigmoid	Total	59	100
		No	46	75.4
		SSSI	7	11.4
		Dehiscence	5	8.1
		Post op collection	3	4.9
		Total	61	100
	Redundant sigmoid + MF	No	34	68
		SSSI	12	24
		Dehiscence	3	6
		Post op collection	1	2
		Total	50	100
	Redundant sigmoid + Edema	No	3	30
		SSSI	2	20
		Dehiscence	1	10
		Post op collection	4	40
		Total	10	100

8.3. Anastomotic leak rate

Chi-square analysis was performed to determine the association of the different variables with the rate of anastomotic leak. A total of 121 patients were used in the analysis, and we found that only the time of the surgery and Intraoperative findings had a statistically significant effect on the rate of anastomotic leak. (P<0.005)

The presence of bowel edema at the time of Sigmoidectomies was associated with a 60% leak rate, while finding only redundant sigmoid and redundant sigmoid with mesenteric fibrosis had a 6.5% and 4% leak rate, respectively. (P-0.00)

Having index Sigmoidectomy had a 20% higher chance of having an anastomotic leak as compared to elective Sigmoidectomies. (P-0.00)

Table 6 Effect of time of surgery and IOF on anastomotic leak rate

Variable	Category	Anastomotic leak Labels	N	%	χ^2	P-Value
IOF	Redundant sigmoid	Yes	4	6.5	30.807	0.00
		No	57	93.4		
		Total	61	100		
	Redundant Sigmoid + Mesenteric fibrosis	Yes	2	4		
		No	48	96		
		Total	50	100		
	Redundant sigmoid + edema	Yes	6	60		
		No	4	40		
		Total	10	100		
Time of surgery	Elective	Yes	0	0	13.998	0.00
		No	62	100		
		Total	62	100		
	Index	Yes	12	20		
		No	47	79.6		
		Total	59	100		

8.4. Pulmonary complications

Analysis of pulmonary complications found that only the time of surgery had a statistically significant effect on pulmonary complication rate. Those who had index Sigmoidectomy developed pulmonary complications in 15.2% significantly higher than those in the elective group with a 1.62% rate of pulmonary complications. ,(P-0.006), see table 7

Table 7 the relationship between the time of surgery and pulmonary complications

Variable		Pulmonary complications				
	Category	labels	N	%	χ^2	P value
Time of surgery	Elective	Yes	1	1.62		
		No	61	98.3		
		Total	62	100		
	Index	Yes	9	15.2	7.420	0.006
		No	50	84.7		
		Total	59	100		

9. Discussion

This research aimed to find out whether index Sigmoidectomies had a higher rate of post-operative morbidities as compared to elective Sigmoidectomies.

This retrospective research found that the demographical parameters of our sample patients were similar to previous studies done in this country. The prevalence of comorbidities along with SV was 24.8% in our study which is a bit lower than the previous studies (25-65%). The peculiar thing we found was that the commonest comorbidity was hypertension (17.4%) and 79.1% were deflated less than three times before their surgery.

The findings that most of the patients presented after 24 hours of the onset of their symptoms and the most common procedure done being open Sigmoidectomy; were in line with previous studies. One surprising finding was that the frequency of index operations was comparable with the elective one (48.8 % vs 51.2%).

The incision most preferred by our surgeons was lower midline (67.8%), in line with previous studies in our country but significantly higher than the Western studies. There was a significant rise in the rate of left lower transverse incisions (25.6%) as compared to previous studies in this country. Laparoscopic procedures were significantly lower in our country (2.5%) as compared to Western countries (46%).

Intraoperative findings were also assumed to affect the postoperative outcomes, and in these studies, 50% of the intraoperative findings were just redundant sigmoid, without any mention of the status of the mesentery or bowel. Bowel edema was mentioned in 8.3% of the reports. On further analysis of these data, we found that 100% of the intraoperative findings of bowel edema were reported on index procedures. (p-0.003)

The majority of patients were discharged on the first week of their surgery (64.9%), shorter than previous studies(12 days) and 29.8% stayed in the hospital for a further two weeks. On further analysis, there was no association between the type of surgery and duration of hospital stay (p-0.824)

Post operative complications were higher in our setup (49.9%) as compared to western countries (20%). the commonest one was wound infection (31.4%) similar to other studies in the country but with higher figures than the western setup.

The anastomotic leak rate and pulmonary complications were relatively similar to previous studies.

Further analysing the post operative morbidities with regard to the patient characteristics, comorbidities, presentation and surgical variables we found the following correlations .

Duration of hospital stay after sigmoidectomy was statistically affected only by the age of the patient, time of surgery, and intraoperative findings. We found that younger patients less than 40 years of age had a higher (84.8%) earlier discharge rate within the first week of the surgery as compared to older patients. (p-0.050)
We found that elective procedures had a shorter hospital stay with a one-week discharge rate of 77.4% while index procedures had a 50.8% discharge rate. And 30.8% of index sigmoidectomy patients stayed in the hospital for two weeks while only 20.9% of elective sigmoidectomy patients stayed for that long. (p-0.015)Suggesting that index procedures carry a longer hospital stay profile than elective procedures. Probably due to the higher rate of morbidities they carry as we shall see later.
We also found that the presence of bowel edema intraoperatively increased the duration of hospital stay with only 30% discharged in the first week of surgery as compared to 70.4% when only redundant sigmoid was found. Up to 30% of patients with intraoperative bowel edema stayed for more than two weeks in the hospital. (p-0.006) Suggesting that this group of patients had encountered a higher rate of postoperative morbidity as a reason to stay in the hospital.

Wound infection is one of the most common complication after sigmoid resection for redundant sigmoid world wide. In our analysis it accounts for 31.4% of the sigmoidectomies. Its rate was influenced by comorbidities and time of surgery.
The presence of diabetes was associated with a significant number of SSSI & wound dehiscence with 25% of diabetic patients undergoing sigmoidectomy ending up with wound dehiscence & another 25% of the patients with SSSI as compared to those who didn't have diabetes with dehiscence rate of 2.7% and SSSI of 17.5%.
Hypertension was found in 17.4% of the patients and from these patients 14.2%. Surprisingly the rate of post-operative intraabdominal collection was higher for patients with hypertension(4.7%) as compared to those who had diabetes(0%). (p-0.010), but

these are contrasted with the finding that the highest number of post-operative collections occurred in those without any comorbidity(7.4%).
These data suggest that the presence of comorbidities should alert the surgeon to the increased possibility of wound complications.

The effect of the time of surgery on wound infection was also analyzed and as can be seen from Table 5, the rate of Superficial surgical site infection, wound dehiscence, and post-operative collection were all higher for the index sigmoidectomy patients with 9% increased chance of developing SSSI, 5.3% higher chance of developing wound dehiscence and 10.2% higher chance of having an intraabdominal collection. (p-0.018)

Anastomotic leak is one of the most feared complication of sigmoidectomies. In our analysis only time of surgery and intraooperative findings had statistically significant effect on it.
Having index sigmoidectomy had a 20% higher chance of having anastomotic leak as compared to elective sigmoidectomies. (p-0.00), high likely due to the higher rate of bowel edema encountered during index procedures as reported previously(100%)
The presence of bowel edema at the time of sigmoidectomies was associated with a 60% leak rate. With a 53.5% higher chance of leaking compared to the finding of redundant sigmoid only. (P-0.00)

Pulmonary complications after sigmoid resection are less common than the other morbidities in our study. We found that only time of surgery had significant effect on rate of pulmonary complications as compared to other variables.
Having index sigmoidectomy had a 13.5% higher chance of developing pulmonary complications,(P-0.006), likely due to the longer hospital stay of these patients; 30% of index sigmoidectomy cases stayed in the hospital for more than two weeks. Also, the increased wound complications after index surgeries as seen previously could explain the increased rate of pulmonary complications.

Over all, there were few limitations in the study, small number of cases, being the main one. The fact that it was only a two year retrospective study and only three hospital were

used in a single city have contibuted to these problem. Futher studies need to be done with large number of case to further solidify the findings of these study.

10. Summary

Sigmoid volvulus, is characterized by the abnormal twisting of the sigmoid colon on its mesentery. It is the number one cause of acute LBO in Ethiopia. The incidence of SV varies among different regions, in western countries it accounts for 1-5% of all colonic obstructions, while in Ethiopia it accounts for 58-69% of the LBO.

According to the current practice guidelines, patients who present with uncomplicated SV are initially managed by endoscopic decompression followed by sigmoidectomy. Sigmoidectomy carries inherent risks, including surgical site infections, anastomotic leaks, bowel obstruction, and cardiovascular complications.

These study was aimed to compare the post operative outcome of patients undergoing index and elective sigmoidectomies. We did a retrospective crossectional analysis of patients who underwent sigmoidectomy for redundant sigmoid in three referal hospital in Addis Ababa. We analysed 121 patients by reviewing their charts and EMRs, data was enterd and edited on Excel and coded and analysed via IMB SPSS version 26.

We found that majory of our patients were from Addis Ababa(76.9%) and majority of the them were male (84.3%) with a M:F ration of 5:1. and The median age of the sample patients was 53 years. Majoriy of the patients didn't have any comorbidity(75%), and the most common comorbidity was HTN accounting for 17.4%.

Both elective and index sigmoidectomies had comparable frequencies, 51.2% & 48.8% respectively. And the majority of the cases were done via open sigmoidectomies (95.9%) The median hospital stay after surgery was 6 days with 64.5% of the patients being discharged before 7th post-operative day. The most common postoperative morbidity was wound infection accounting for 31% followed by anastomotic leak (9.9%) and pulmonary complications (8.3%)

Intraoperative findings were also assumed to affect the post-operative outcomes and in our analysis, we found that 100% of the intraoperative findings of edema was reported on index procedures. Post-operative complications were higher in our setup(49.9%) as compared to western countries (20%). The commonest one was wound infection (31.4%).

Younger patients less than 40 years of age had a higher (84.8%) earlier discharge rate within the first week of the surgery as compared to older patients.

We found that elective procedures had a shorter hospital stay with a one week discharge rate of 77.4% while index procedures had 50.8% discharge rate.
Intraoperative Bowel edema significantly increased the duration of hospital stay with only 30% discharged in the first week of surgery as compared to 70.4% when only redundant sigmoid was found.
The presence of diabetes and having index sigmoidectomy both had increased all aspects of wound complications. It was also found that index surgeries and the presence of bowel edema had significantly increased anastomotic leak rate. Having index sigmoidectomy also increased the pulmonary complication rate.

11. Conclusion

This study was aimed to compare post operative morbidities of index sigmoidectomy with elective one. Thes paper is the frist of its kind regarding these assumption and the finding of our study showed significantly higher rate of post operative complications and longer hospital stay for patients undergoind index sigmoid resection as compared to elective ones.

This study will guide the clinical decision-making regarding patients with redundant sigmoid and possibly contribute to minimizing post-operative morbidity in these patients.

12. Recommendations

Based on the findings of these studies the following recommendations are forwarded;

- We need to carefully choose patients for sigmoid resection and there is no data to support index resection over elective ones.
- We plan to do an index sigmoid reaction we need to take into account other variables, like age, comorbidity, and the possibility of bowel edema.
- We need to optimize patients with comorbidities before any type of sigmoidectomy.
- If we encounter intraoperative bowel edema, we need to strongly consider colostomy as an option rather than doing anastomosis.
- Since most of the older patients had longer hospital stays, we need to follow the ERAS protocol thoroughly to decrease morbidity and hospital stays in these patients.
- If possible always choose elective surgery over index ones since all the data suggest that index procedures have significantly higher morbidity profiles.

Annex.1. checklist

Checklist of variables

variables			
Demography	**Age**		
	Gender	**Male**	
		Female	
	Address		
Disease-related	**Duration of illness**	> 24hr	
		< 24hr	
	Co-morbidities		
	Previous deflation		
Operation related	**Timing**	**index**	
		elective	
	Intra op finding		
	Operation type	**Open**	
		Laparoscopic	
Postoperative Outcome	**Hospital stay(days)**		
	Wound infection		
	Anastomotic leak		
	Pulmonary complications		

Reference

1. Mangiante, E. C., Croce, M. A., Fabian, T. C., Moore 3rd, O. F., & Britt, L. G. (1989). Sigmoid volvulus. A four-decade experience. The American Surgeon, 55(1), 41-44.
2. Chadwick, J., & Mann, W. N. (1950). The medical works of Hippocrates. Oxford Blackwell Scientific Publications.
3. Wuepper, K. D., Otteman, M. G., & Stahlgren, L. H. (1966). An appraisal of the operative and nonoperative treatment of sigmoid volvulus. Surgery, Gynecology & Obstetrics, 122(1), 84-88.
4. Soressa, U., Mamo, A., Hiko, D., & Fentahun, N. (2016). Prevalence causes and management outcome of intestinal obstruction in Adama Hospital, Ethiopia. BMC surgery, 16, 1-8.
5. Fekadu, G., Tolera, A., Beyene Bayissa, B., Merga, B. T., Edessa, D., & Lamessa, A. (2022). Epidemiology and causes of intestinal obstruction in Ethiopia: a systematic review. SAGE Open Medicine, 10, 20503121221083207.
6. Ton, M. N., Ruzal-Shapiro, C., Stolar, C., & Kazlow, P. G. (2004). Recurrent sigmoid volvulus in a sixteen-year-old boy: case report and review of the literature. Journal of pediatric surgery, 39(9), 1434-1436.
7. Korkut, E., Peksoz, R., Disci, E., & Atamanalp, S. S. (2023). Factors affecting recurrence in sigmoid volvulus. Pakistan Journal of Medical Sciences, 39(1), 150.
8. Chung, Y. F. A., Eu, K. W., Nyam, D. C. N. K., Leong, A. F. P. K., Ho, Y. H., & Seow-Choen, F. (1999). Minimizing recurrence after sigmoid volvulus. Journal of British Surgery, 86(2), 231-233.
9. Cirocchi, R., Farinella, E., La Mura, F., Morelli, U., Trastulli, S., Milani, D., ... & Sciannameo, F. (2010). The sigmoid volvulus: surgical timing and mortality for different clinical types. World Journal of Emergency Surgery, 5, 1-5.
10. Khoury, G. A., Pickard, R., & Knight, M. (1977). Volvulus of the sigmoid colon. Journal of British Surgery, 64(8), 587-589.

11. Salas, S., Angel, C. A., Salas, N., Murillo, C., & Swischuk, L. (2000). Sigmoid volvulus in children and adolescents. Journal of the American College of Surgeons, 190(6), 717-723.
12. Lee, K., Oh, H. K., Cho, J. R., Kim, M., Kim, D. W., Kang, S. B., ... & Seoul Colorectal Research Group. (2020). Surgical management of sigmoid volvulus: a multicenter observational study. Annals of coloproctology, 36(6), 403.
13. Bruzzi, M., Lefèvre, J. H., Desaint, B., Nion-Larmurier, I., Bennis, M., Chafai, N., ... & Parc, Y. (2015). Management of acute sigmoid volvulus: short-and long-term results. Colorectal Disease, 17(10), 922-928.
14. Nuhu, A., & Jah, A. (2010). Acute sigmoid volvulus in a West African popolation. Annals of African Medicine, 9(2).
15. Ören, D., Atamanalp, S. S., Aydinli, B., Yildirgan, I. M., Basoglu, M., Polat, Y. K., & Önbas, Ö. (2007). An algorithm for the management of sigmoid colon volvulus and the safety of primary resection: experience with 827 cases. Diseases of the Colon & Rectum, 50(4), 489-497.
16. Mulugeta, G. A., & Awlachew, S. (2019). Retrospective study on pattern and outcome of management of sigmoid volvulus at district hospital in Ethiopia. BMC surgery, 19, 1-5.
17. Larkin, J. O., Thekiso, T. B., Waldron, R., Barry, K., & Eustace, P. W. (2009). Recurrent sigmoid volvulus–early resection may obviate later emergency surgery and reduce morbidity and mortality. The Annals of the Royal College of Surgeons of England, 91(3), 205-209.
18. Antonescu, I., Carli, F., Mayo, N. E., & Feldman, L. S. (2014). Validation of the SF-36 as a measure of postoperative recovery after colorectal surgery. Surgical endoscopy, 28, 3168-3178.