

**Research Article**
**Open Access**

## Study of Gastrointestinal Causes of Death: A 5-Year Autopsy Based Study

 Sneha R. Adidam<sup>1</sup>, Varindra Rakhar<sup>2</sup> and Chalapathi Rao Adidam Venkata<sup>2\*</sup>
<sup>1</sup>Department of Internal Medicine, Howard University Hospital, Washington DC

<sup>2</sup>Laboratory Services, Eric Williams Medical Sciences Complex (EWMSC), Trinidad and Tobago

**ABSTRACT**

**Introduction:** Gastrointestinal disorders (GI) including hepatobiliary-pancreatic (HBP) diseases are a cause for significant morbidity and mortality. Mortality due to nonmalignant disorders are often diagnosed but are less studied. Limited autopsy-based studies have been conducted on gastrointestinal causes of death despite gastrointestinal and hepato-biliary-pancreatic diseases being one of the important causes for morbidity and mortality. Autopsy is still considered a valuable tool in reliably determining the underlying pathology and cause of death. This study of gastrointestinal causes of death was conducted to evaluate and understand its impact.

**Methods:** This is a 5-year retrospective autopsy-based study for the period August 2016 to July 2021. Data was collected from autopsy request forms, patients' hospital records and autopsy reports, which included age, gender, ethnicity, salient clinical features, key autopsy findings and the cause of death.

**Results:** During the 5-year period, a total of 3435 autopsies were performed, out of which 294 cases were found to have gastrointestinal-hepato-biliary-pancreatic (GIHBP) disorders as the cause of death, contributing to 8.6%. This accounts for the third leading cause of death. The main causes of death were gastrointestinal bleeding (GIB) (26%), perforation of a viscus organ and peritonitis (23%), hepato-biliary-pancreatic disease (17%), ischemic bowel changes (13.6%), neoplastic disease (11.6%) and others. Majority of patients were males and of African ethnicity. Patients aged above 40 years accounted for 83% of the deaths. Abdominal pain was the most common presenting symptom. Three leading autopsy findings include gastrointestinal bleeding, ascites, perforation and peritonitis.

**Conclusion:** GIHBP disorders are the third leading cause of death. GI bleeding, non-traumatic perforation and peritonitis are identified as significant mechanisms of death. Autopsy still plays an important role in reliably determining the cause of death. Prompt diagnosis and appropriate management may decrease mortality. This study augments the limited body of literature and provides insight into gastrointestinal causes of death.

**\*Corresponding author**

Chalapathi Rao Adidam Venkata, Laboratory Services, Eric Williams Medical Sciences Complex (EWMSC), Trinidad and Tobago.

E-Mail: avcraouwi@gmail.com

**Received:** May 07, 2022; **Accepted:** May 12, 2022; **Published:** May 19, 2022

**Keywords:** Gastrointestinal and Hepatobiliary-Pancreatic Disorders, Cirrhosis, Gastrointestinal Bleeding, Colo-Rectal Carcinoma, Perforation, Peritonitis

**Introduction**

Gastrointestinal (GI) disorders including hepatobiliary-pancreatic (HBP) diseases are a cause for significant morbidity and mortality [1,2]. Mortality due to nonmalignant GIHBP disorders are often diagnosed but are less studied. Some of these disorders that could cause death include bleeding, ischemia, peritonitis, perforation of a viscus, mechanical disorders, metabolic disorders and infections [3]. Chronic liver disease, particularly alcohol-related, are increasing over the years even in Asian countries and it is an important cause of mortality. It has been ranked fifth according to statistics in the United Kingdom [4,5]. Globally, while pancreatic cancer is most fatal, acute pancreatitis is a common pancreatic disease associated with significant morbidity and mortality [6]. The burden of pancreatic disorders is expected to increase over time and people of African descent are more likely to be affected [7,8].

GI cancers, being the second most common, are an important cause of death. Hugar et al mention that limited studies are presented in the literature despite gastrointestinal diseases being an important cause of sudden natural death. Sudden GI death is an unexpected death due to digestive system causes usually found on autopsy [9]. There may be congenital or acquired causes of sudden GI deaths. Some may be more observable than others [10]. GI disorders, although may not be an immediate cause of death, could be a significant contributory condition or may be identified as an incidental finding. Abdominal pain was the most common symptom followed by diarrhea, vomiting, nausea, constipation and bleeding [11]. Although the worldwide trend is of declining autopsy rate, a significant number of autopsies are routinely performed primarily to establish the cause of death at our tertiary health care center and teaching hospital in Trinidad, West Indies [12]. Autopsy is still considered to be a valuable tool in reliably determining the underlying pathology and cause of death. A 5-year autopsy-based study of gastrointestinal causes of death was conducted to evaluate and understand its impact in the practice of medicine.

## Materials and Methods

This is a 5-year retrospective autopsy-based study conducted at a tertiary care center in Trinidad. All deceased patients who have undergone autopsies for the period of study (August 2016 to July 2021) were selected for the study. Complete autopsies were performed at the tertiary hospital on both hospital-based and community deaths. All deceased patients within the age range from birth to 95 years were included in the study. Data was collected from autopsy request forms, patients' hospital records and autopsy reports, which included age, gender, ethnicity, salient clinical features listed in the autopsy request form/patient record, key autopsy findings and the cause of death. Histopathology findings were reviewed in relevant cases. Radiological findings and laboratory data are not included in the study as they were not available in majority of the cases particularly in deaths occurring in the community, "brought in dead" cases to the hospital or death within a few hours of admission. Data collected was recorded on a data collection sheet with no identifiers. All deaths caused directly by GIHBP disorders or initiated the sequence of events that lead to the death were included in this study.

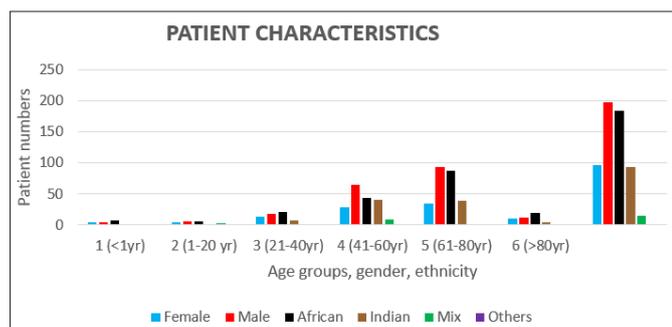
Patients were categorized into six age groups as follows: 1) <1 year, 2) 1-20 years, 3) 21-40 years, 4) 41-60 years, 5) 61-80 years and 6) >80 years. The Causes of Death due to GIHBP disorders were divided into six broad categories as given in (Table 1) The GIHBP disorders associated signs and symptoms were suitably categorized and studied. Those cases where the primary cause of death was due to cardiovascular or non-GIHBP diseases were excluded in the analysis.

All cases registered in the autopsy records for the period of study were included for descriptive statistical analysis performed using the IBM SPSS software, Version 28.0.1.0 (142) and charts were derived from Microsoft Excel; 2019.

## Results

Autopsy services at our center serve a population of about 450,000. A total of 3435 autopsies performed during the period August 2016 to July 2021 were studied. A total of 294 cases were identified to have significant GIHBP pathology contributing to death. During the data analysis, it was noted that overall cardiovascular disease was the leading cause of death accounting to 61% and the second important cause was pulmonary disorders (21%). Third leading cause was GIHBP disorders constituting 8.6%. Hypertension and diabetes mellitus were significant comorbidities in nearly a quarter of patients with GIHBP disorders.

Patient characteristics are provided in Figure 1



**Figure 1:** Shows Distribution According to age Groups, Gender and Ethnicity. Graph on the right Depicts Overall Predominance of Males and African Ethnicity.

## Age

Considering all the causes of GIHBP disorders included in our study, mean age was 59.6 years and mortality was highest in the age group 61-80 years accounting for 42% and the next common age group was 41-60 years accounting for 34%.

## Sex

All-cause GIHBP mortality was 68% in males compared to 32% in females resulting in a male: female (M:F) ratio of 2.1:1.

## Ethnicity

Two main ethnic groups in the country are African and East Indian in almost equal proportion; 36.3% and 37.6% respectively. GIHBP disorders as a cause of death were identified in 65% of patients of African descent.

## Cause of Death

List of Causes of Death due to GIHBP disorders and their distribution in different age groups are depicted in (Tables 1 and 2) Diagnoses were combined to create clinically meaningful categories.

**Table 1: List of Causes of Death Due to GIHBP Disorders: Diagnoses were Combined to Create SIX Clinically Meaningful Categories as Below:**

Cause of Death	Total #	Percentage Distribution
GI Bleed	76	26
Perforation and Peritonitis	69	23.5
Hepatobiliary and Pancreatic Diseases (Non-Neoplastic)	51	17
Ischemic Bowel Changes	40	13.6
Malignancies	34	11.6
Others	24	8

**Table 2: Age Distribution of Common Causes of Death Due to GIHBP Disorders**

Age group (No.)	Common Causes of Death
<1 YR (10)	NEC (Neonatal Enterocolitis) (4) Ischemic Bowel Changes/Perforation (3) Congenital Abnormalities (2)
1-20 YR (10)	Ischemic Bowel Changes (3) Enterocolitis (2) Malignancies (2)
21-40 YR (31)	HBP disease (10) GI Bleed (6) Perforation/Peritonitis (6)
41-60 YR (92)	GI Bleed (22) Perforation/peritonitis (20) HBP disease (20) Ischemic Bowel Changes (10) Malignancies (9)
61-80 YR (128)	GI Bleed (38) Perforation/peritonitis (34) HBP Disease (19) Malignancies (17) Ischemic Bowel Changes (16)
>80 YR (23)	GI Bleed (7) Ischemic Bowel Changes (7) Perforation/peritonitis (5) Malignancies (2)

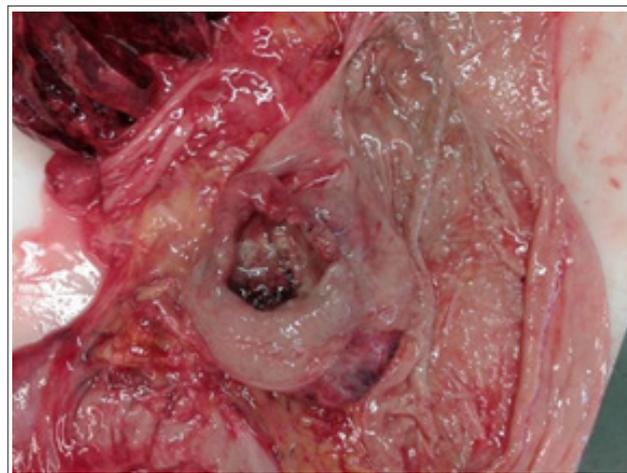
The leading cause of death was gastrointestinal bleeding. Major causes for bleeding identified were due to peptic ulcer disease, diverticular disease, varices and tumors. Non-traumatic perforation and peritonitis contributed to death in a significant number of cases. Important conditions that resulted in perforation/peritonitis were peptic ulcers, ischemic bowel disease, tumors, diverticular disease and acute appendicitis. Underlying causes for ischemic bowel changes and intestinal obstruction as a significant cause of death were mechanical bowel disorders (adhesions, volvulus), vascular disease and different types of hernias (inguinal/umbilical/abdominal). A few cases of necrotizing enterocolitis were recorded in neonates. In the category of hepato-biliary-pancreatic disorders; alcoholic liver disease, cirrhosis, acute pancreatitis and acute cholecystitis were identified to be contributing to mortality. Steatosis, gallstones and hepatic congestion were incidental findings. Common tumors were colorectal carcinoma, esophago-gastric and pancreatic malignancies. Less common entities like gastrointestinal stromal, hepatic and neuroendocrine tumors were also recorded. Other less common causes include postoperative complications of laparotomy, congenital disease such as gastroschisis and trauma to the bowel.

Abdominal pain (31%) was the leading symptom in the study followed by vomiting (26%) and bleeding (21%). Other findings include abdominal distension (8%), constipation (7%) and hernias (7%). Others noted that were less common (<5%) include diarrhea, jaundice and nausea.

Key gross autopsy findings (Figures 2, 3 and 4) included GI bleeding (40%), ascites (27%), perforation of a viscus and peritonitis (24%), peptic ulcers; gastric and duodenal (23%), dusky and hemorrhagic bowel in ischemic bowel and mechanical disorders (18%). A nodular liver was noted in 19% of cases. Pancreatitis and pancreatic hemorrhagic necrosis accounted for 2%. Furthermore, there were tumor masses in the GI tract, liver and pancreas accounting for 15%. Histologic findings confirmed the diagnosis in relevant cases (Figures 5,6). Some of the other nonfatal incidental findings noted were esophagitis, gastritis, erosions, diverticulosis and gallstones.



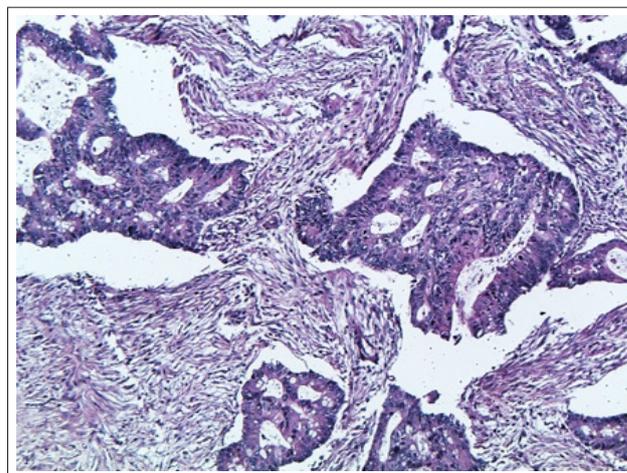
**Figure 2:** Perforated Peptic Ulcers-Stomach



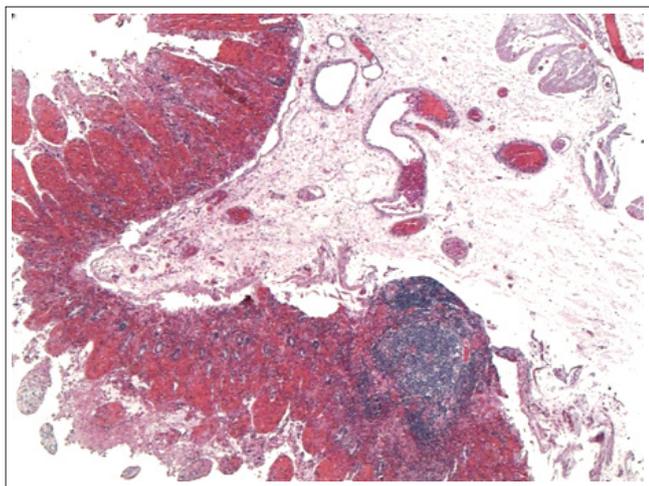
**Figure 3:** Ulcerative Gastric Cancer



**Figure 4:** Peritoneal Carcinomatosis



**Figure 5:** Adenocarcinoma: Malignant Glands Invading Muscularis of Colon



**Figure 6:** Ischemic Hemorrhagic Infarction of the Small bowel: A) Necrosis and Hemorrhage of the Mucosa; B) Congested Blood Vessels and Edema of Submucosa.

### Discussion

In this study, GIHP disorders account for the third leading cause of death (8.6%). The leading cause is cardiovascular disease and the second being pulmonary disorders. Compared to our findings, in the study by Siddique et al, GIHP pathologies account for the second most common cause of death. In contrast to Hugar BS et al mention that out of a total of 291 sudden natural deaths, 62 cases (21.3%) were due to gastrointestinal causes, a similar study from Tunisia reported 2.7%. Unlike our study results of 8.5%, the two studies from South India and Tunisia were limited to sudden deaths.

Similar to other studies, males are more commonly affected than females. Mean age in our study was 59.6 years. However, the overall highest number of deaths were noted between 41-80 years accounting for 76% compared to a study from South India, which reported the lower age group was more often implicated in GI causes of death [13]. People of African descent were more affected in this study although the population is evenly balanced with people of East Indian descent in the country.

Our finding of the most common cause of death was GI bleeding (26%), in contrast to the study by Siddique et al, in which gastrointestinal ischemia/ necrosis/infarct/infection (37%) was the leading cause of death. However, the leading cause of death as GI bleeding was comparable to other studies in the literature [14]. Perforation of bowel was a common mechanism of death according to Abderrahim et al. In our analysis, the second most common cause was perforation of a hollow viscus and peritonitis. Hepato-pancreatic causes of death were significant as in other studies. Graudal N et al mention in the autopsy-based study that 4.5% were diagnosed with cirrhosis [15]. Cirrhosis ranks as the 14th cause of death worldwide [16]. Non-neoplastic pancreatic disease is also on the rise, it is more common in the west and is associated with alcohol and stone disease. It is observed more often in males of African descent [6,8]. Alcoholic liver disease/ cirrhosis and acute pancreatitis were important causes in our study involving males of African descent. The incidence of GIHP malignancies were comparable to other studies that ranged from 14 to 29%. Colorectal carcinoma was the most frequent malignancy in our study. Ischemic bowel changes due to various underlying conditions, such as strangulated/incarcerated hernias, volvulus

and vascular disease are highlighted, with a possible suggestion that some could have been avoided by early intervention.

Abdominal pain is the most frequent symptom as in other studies [1,6]. The presentation correlated well with the clinical condition and cause of death. Hypertension and diabetes mellitus were present as comorbidities in a significant number of cases. GI bleeding, ascites, perforation/peritonitis, ischemic bowel changes, mass lesions in the gut, liver and pancreas are typically identified as key autopsy findings. It was noted in a report by Cina et al that almost 15% of patients with peptic ulcer disease have a disease course complicated by gastrointestinal hemorrhage, of which, about 6% ended up with a perforated ulcer [17]. Some of the common incidental nonfatal findings include gallstones, polyps and gastritis, which were also noted in other studies [3].

It is our observation that sudden death is an uncommon event with respect to GIHP causes of death unlike cardiovascular and pulmonary disorders. Furthermore, we recognize that GIHP disorders present with signs and symptoms, which may even be neglected or delayed before seeking medical attention as mentioned by Hugar et al [13]. Therefore, seeking timely medical services, prompt, accurate diagnosis and treatment could result in reduction of GIHP causes of death.

Strengths and limitations of the Study: High autopsy rate at our medical center allows for reliable evaluation of causes of death. Radiological data was not available for analysis. Data includes only the autopsy-based cause of death information and not all deaths in the hospital and community were included in the study as autopsies were not done on every death.

Future Perspectives: It may be beneficial to widen the scope of the study by including deaths due to GIHP disorders that have been certified based on a definitive clinical diagnosis. This may help to further delineate the extent of morbidity and mortality due to GIHP disorders.

### Conclusion

In this study, GIHP disorders are an important third leading cause of death. Autopsy is still a valuable tool in reliably determining the cause of death particularly in cases where medical attention was not sought or in sudden deaths. Given that gastrointestinal causes of death are just behind cardiopulmonary causes, it is prudent for physicians to be aware of these clinical presentations and possible underlying pathologies. Males of african descent above 40 years of age were at highest risk of gastrointestinal fatalities. GI bleeding, non-traumatic perforation and peritonitis was identified as the leading causes of death. Abdominal pain is the most common presenting symptom and common autopsy findings were gastrointestinal hemorrhage, ascites and perforated viscus/peritonitis. Timely and appropriate management of such patients with a high index of suspicion may decrease morbidity and mortality. Furthermore, it is our humble attempt to augment the existing limited body of literature for clinicians and pathologists to refer to in order to reduce gastrointestinal causes of death.

**Statement of Ethics:** Hospital Ethics Committee has granted approval for the study.

**Conflicts of Interest:** There are NO conflicts of interest to declare for this study/work.

**Financial Disclosure:** This research received no specific grant

from any funding agency in the public, commercial, or not-for-profit sectors.

**Acknowledgements:** We acknowledge Ms. Kady Paltoo and Ms. Maggie Ramnath for the support in data collection.

**Authors Contribution:** Author Contributions CRAV has conceptualized, designed and conducted the study. SRA has done literature review, drafted the manuscript and did critical editing. VR assisted and supported in data collection and subsequent analysis. CRAV and SRA have also supervised this manuscript preparation, writing, editing and proofreading.

## References

1. Peery AF, Crockett SD, Barritt AS, Dellon ES, Eluri S, et al (2015) Burden of Gastrointestinal, Liver, and Pancreatic Diseases in the United States. *Gastroenterology* 149: 1731-1741.
2. John Saltzman R, Peery AF (2018) Burden and Costs of Gastrointestinal Disease in the U.S. reviewing *Gastroenterology* Oct 10.
3. Siddique AS (2021) Importance of Autopsy from a Gastrointestinal Pathology Perspective A Ten-year Review of 891 Autopsies. *Arch Gastroenterol Res* 2: 31-34.
4. UK national statistics, <http://www.statistics.gov.uk/>.
5. Garg V, Garg H, Khan A, Trehanpati NKA, Sharma BC, et al. (2012) Granulocyte colony-stimulating factor mobilizes CD34+ cells and improves survival of patients with acute-on-chronic liver failure. *Gastroenterology* 142: 505-512.
6. Xiao AY, Tan ML, Wu LM, Asrani VM, Windsor JA, et al. (2016) Global incidence and mortality of pancreatic diseases: a systematic review, meta-analysis, and meta-regression of population-based cohort studies. *Lancet Gastroenterol Hepatol* 1: 45-55.
7. Everhart JE, Ruhl CE (2009) Burden of digestive diseases in the United States Part III: Liver, biliary tract, and pancreas. *Gastroenterology* 136: 1134-1144.
8. Yadav D, Lowenfels AB (2013) The epidemiology of pancreatitis and pancreatic cancer. *Gastroenterology* 144: 1252-1261.
9. Sarra Ben Abderrahim, Meriem Gharbaoui, Olfa Békir, Moncef Hamdoun, Mohamed Allouche (2022) Sudden death related to the gastrointestinal system in Tunisia: A 13-year autopsy study. *J Forensic Sci* 67: 596-604.
10. Menezes RG, Ahmed S, Pasha SB, Syed Ather Hussain, Huda Fatima, et al. (2018) Gastrointestinal causes of sudden unexpected death: A review. *Med Sci Law* 58: 5-15.
11. Mark Russo W, Jeffrey Wei T, Michelle Thiny T, Lisa Gangarosa M, Alphonso Brown, et al. (2004) Digestive and Liver Diseases Statistics. *Gastroenterology* 126: 1448-1453.
12. Hoyert DL (2011) The changing profile of autopsied deaths in the United States. *NCHS Data Brief* 1-8.
13. Hugar BS, Harish S, Girishchandra YP, Jayanth SH (2014) Study of sudden gastrointestinal deaths: an autopsy study. *Med Sci Law* 54: 63-67.
14. El-Tawil, Ahmed Mahmoud (2012) Trends on gastrointestinal bleeding and mortality: where are we standing?. *World journal of gastroenterology* 18: 1154-1158.
15. Graudal N, Leth P, Marbjerg L, Galloe AM (1991) Characteristics of cirrhosis undiagnosed during life: a comparative analysis of 73 undiagnosed cases and 149 diagnosed cases of cirrhosis, detected in 4929 consecutive autopsies. *J Intern Med* 230:165-171.
16. Mathers C, Lopez A, Murray C. (2006) The burden of disease and mortality by condition: data, methods, and results for 2001. In: Lopez A, Mathers C, Ezzati M, et al, editors. *Global burden of disease and risk factors*. Washington (DC): Oxford University Press and the World Bank 45-93.
17. Cina SJ, Mims WW 3rd, Nichols CA, Conradi SE. (1994) From emergency room to morgue: deaths due to undiagnosed perforated peptic ulcers. Report of four cases with review of the literature. *Am J Forensic Med Pathol* 15: 21-27.

**Copyright:** ©2022 Chalapathi Rao Adidam Venkata, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.