BMC Surgery

RESEARCH

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Surgical management of pancreatic cancer in Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia: a 5 years retrospective descriptive study

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Abstract

Introduction The incidence of Pancreatic cancer is different in different parts of the world. It is a cancer with the worst prognosis of all malignancies. Pancreatic cancer is predominantly a disease of an older population. There are different environmental (modifiable) and non-modifiable risk factors associated with the development of pancreatic cancer. At present, surgical resection is the only potential cure for pancreatic cancer. However, as only 10–20% of the patients have resectable disease at the time of diagnosis. The morbidities associated with surgeries for pancreatic cancers remain high though the post-operative mortality has shown significant reduction in the past few decades. So far, no study has been conducted to investigate pancreatic cancer in Ethiopia.

Objectives To assess the clinico-pathologic profile, associated factors, surgical management and short-term outcome of patients with pancreatic cancer in Tikur Anbessa Specialized hospital.

Methods A 5 years retrospective hospital-based cross-sectional study was conducted on 52 patients operated with the diagnosis of pancreatic cancer with either curative or palliative intents. The study period was from April 2016 to July 2021. The data collected includes demographic profile, associated risk factors and comorbidities, clinical presentations, biochemical parameters, pathologic features of the tumors as well as type of treatment offered and short term treatment outcome. The data was analyzed using SPSS version 25.

Result The mean and median age of patients was 54.1 and 54.5% respectively. Males constitute about 52% the patients. 21% of the patients have potential risk factors; whereas only 10 (19.2%) of the patients had medical comorbidities. Median duration of symptoms at diagnosis was 12 weeks. Abdominal pain (88.5%) was the most common presenting symptom followed by anorexia (80.8%) and significant weight loss (78.8%), while 71.2% of the patients have jaundice. On clinical evaluation, 69.2% were jaundiced, while 34.6% had a palpable gallbladder. More than two third of patients presented with advanced disease. 76.9% of the tumors are located in the head of pancreas. More than three quarters (77%) of the surgeries performed were palliative. Postoperative morbidity and mortality were 19.2% and 3.8% respectively.

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Conclusion Age at first diagnosis of pancreatic cancer is relatively earlier in our setup. Most patients present with advanced condition, only amenable for palliative measures. The post-operative morbidity and mortality are more or less comparable with similar studies. The need for adjuvant therapy in pancreatic cancer should be emphasized.

Keywords Pancreas, Cancer, Epidemiology, Surgery, Outcome

Introduction

Background

Pancreatic cancer is one of the most lethal human cancers. It ranks fourteenth in terms of new cancers cases in 2020 and it is the seventh leading cause of cancer-related deaths worldwide according to the Global Cancer Incidence, Mortality and Prevalence (GLOBOCAN 2020 [1–3]. In Europe, it ranks 6th in incidence and it is the 4th leading cause of death according to estimate from 40 countries in 2012 [4]. The incidence is different in different parts of the world, being more common in Europe and America (10 cases per 100,000) and it is lowest in South central Asia and most of Africa (as low as 0.9 cases per 100,000) [1]. The incidence in Ethiopia is unknown but estimated to be at around 1.5 cases per 100,000 according to the Global Cancer Observatory 2018 report.

It is a cancer with the worst prognosis of all malignancies with the 5 years overall survival at 5–9% [5, 6]. This is due to the fact that pancreatic cancer is difficult to diagnose early, since there are no specific cost-effective screening tests that can easily and reliably find early-stage pancreatic cancer in people who have no symptoms of the disease. This means it is often not found until later stages when the cancer can no longer be removed with surgery and has spread from the pancreas to other parts of the body [6–8].

Pancreatic cancer is predominantly a disease of an older population and most of the patients are older than 50 years. Indeed, the risk of developing pancreatic cancer increases with age, with the highest peak occurring between 60 and 80 years of age [2, 6, 8–11].

Pancreatic cancer occurs more in men possibly due to more exposure to environmental or occupational risk factors as well as lifestyles such as heavy smoking habit and high alcohol intake in men; however, it is also possible that there may yet be undiscovered genetic factors influencing cancer incidence and mortality in males and females [2, 6, 8–11]. In 40% of the patients, we may identify risk factors although causal relation is usually difficult to make out [12]. Familial pancreatic cancer accounts for 5–10% of new cases [2, 3]. There are different environmental (modifiable) and non-modifiable risk factors associated with the development of pancreatic cancer. These are cigarette smoking, diabetes mellitus, chronic, heavy alcohol consumption, obesity, dietary factors, physical inactivity, environmental exposure, chronic pancreatitis, and non-O blood group [2, 11–13, 14]. Smoking is the most established risk factor and the risk increases with the dose and duration of smoking [3, 11–13, 14]. High alcohol intake is associated with an increased risk of pancreatic cancer [2, 3, 13, 15]. Both type I and type II diabetes are associated with the risk of pancreatic cancer [2, 13, 16].

The clinical manifestation is determined by tumor site; cancers of the body and tail cause epigastric pain, anorexia and weight loss. Cancers of the head cause jaundice at an earlier stage, which may be associated with pruritus [11]. Given the fact that more than 90% the tumors are located at the head region, the most common symptom of pancreatic cancer is jaundice followed by weight loss [8, 17, 18].

Although its role is mainly limited to monitoring of response to treatment and as a marker of recurrent disease, serum CA 19−9 is the only marker approved by the United States FDA for use in the routine management of pancreatic cancer [3].

At present, surgical resection is the only potential cure for pancreatic cancer, although rates of recurrence are high with inevitably dismal rates of long-term survival [3, 18]. However, only 10–20% of the patients have resectable disease at the time of diagnosis [3, 10, 17–19]. Minimal invasive palliative measures are required and are the mainstay of treatment for most of these patients. However, the role of surgical palliation is immense in resource limited setups of like ours.

Post-operative mortality after pancreato-duodenectomy has dropped from as high as 40% to less than 5% in most high volume centers [11, 20–24]. Peri-operative morbidity and complications, including pancreatic fistula, however, still remain as high as 50% [21, 24].

Although most cases of pancreatic cancers are diagnosed in the developed regions of world accounting for about 55% of the world incidence, both incidence and mortality rates are increasing in less developed countries [8–10]. The incidence rates vary significantly between countries and even between different regions within the same country [3, 10]. Some of these researches have shown that some environmental factors have role in the occurrence of this disease. Most of these environmental factors are very prevalent in our setup.

Numerous reports have been published by western countries on this disease entity but only few works have been done in Africa and to the best of our knowledge, no study has been conducted to investigate pancreatic cancer in Ethiopia [7–10, 25]. The current pancreatic cancer incidence and prevalence data from Africa in general and

our country in particular are presumed to be an underestimate of the disease burden [25]. The need to look at local data also becomes very imperative because of the finding of some study that African-Americans and economic disadvantaged populations have higher incidence of pancreatic cancer [1, 2, 26].

The aim of our research is to assess the prevalence, clinical profile, and frequency of associated factors, surgical treatment and short-term outcomes of patients with pancreatic cancer in Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia. This study serves four main purposes: First, it provides a very first local data on pancreatic cancer. Secondly, it analyzes if our patients are different from those in other studies in terms of incidence, associated factors, clinical profile and short-term treatment outcome. Third, it serves as a basis for future researches on similar area of interest. Lastly, it will enable us to share our experiences to other institutions.

The goal of this current study is to assess the clinicopathologic profile, Associated factors, Management and Short-term outcome of patients with pancreatic cancers and compare our results with other similar studies.

Objectives

General objectives

- To assess the clinico-pathologic profile, Associated factors, Management and Short-term outcome.

Specific objectives

- Assess the epidemiologic characteristics of patients with pancreatic cancer.
- Assess the incidence of associated risk factors.
- Assess the pattern of clinical manifestations and diagnosis.
- Evaluate our experience of surgical management of pancreatic cancer.
- Compare results with other similar studies.

Methodology

The study was conducted in Tikur Anbessa Specialized Hospital, Addis Ababa Ethiopia, which is the largest comprehensive tertiary referral hospital for patients from all corners of the country. This is a hospital-based retrospective cross-sectional study of all patients surgically managed for pancreatic cancer in Tikur Anbessa specialized Hospital between April 2016 and July 2021.

All the necessary approvals for carrying out the research were obtained from the department and Institution ethical review board.

Patients with the diagnosis of pancreatic cancer and operated were identified from the ward HMIS and OR logbook using their medical record number. Manual review of patient records was performed to obtain relevant data points. All adult patients who underwent surgery with the diagnosis of pancreatic cancer were included. Patients with incomplete information and whose intraoperative finding and/or postoperative tissue diagnosis was not pancreatic cancer were excluded.

For the data collection, we used Convenience or availability sampling method. Seventy-five patients were enlisted from the operation theatre logbook, and ward HMIS logbook. Full medical record of these patients was searched for in the record room and using electronic medical record. 5 patients were excluded due to wrong diagnosis 17 patients were excluded because of either lost chart or incomplete data, giving the final sample size of 52 patients.

The data was collected using a structured questionnaire, which contains the socio-demographics, risk factors, clinical profiles, laboratory parameters, diagnostic and treatment modalities, as well as short term treatment outcome. Data were then coded and entered into an IBM compatible computer, using the SPSS version 25 for Windows. Qualitative variables were expressed as number and percentage while quantitative variables were expressed as mean and median.

Operational definitions

Morbidity: Procedure or non-procedure related complication requiring medical/surgical intervention.

Mortality: All deaths within 30 days of surgery or in the same admission, irrespective of cause.

Postoperative pancreatic fistula: According ISGPF, a postoperative PF is defined as drain output of any measurable volume after postoperative day 3 with an amylase level greater than **three times** the upper limit of the normal serum value.

Post-pancreatectomy hemorrhage: Bleeding in the form of fresh blood in the NGT and/or melena necessitating treatment such as transfusion of blood, embolization or relaparotomy.

Delayed Gastric Emptying: As proposed by the International Study Group for Pancreatic Surgery (**ISGPS**), DGE was classified into three grades based on their clinical impact.

- **Grade A**: Need for intubation of NGT for 4 days or reinsertion of the NGT after postoperative day (POD) 3, or inability to tolerate a solid diet by POD 7.
- **Grade B**: Need for intubation of NGT for 8 days or reinsertion of the NGT after postoperative day (POD) 7, or inability to tolerate a solid diet by POD 14.

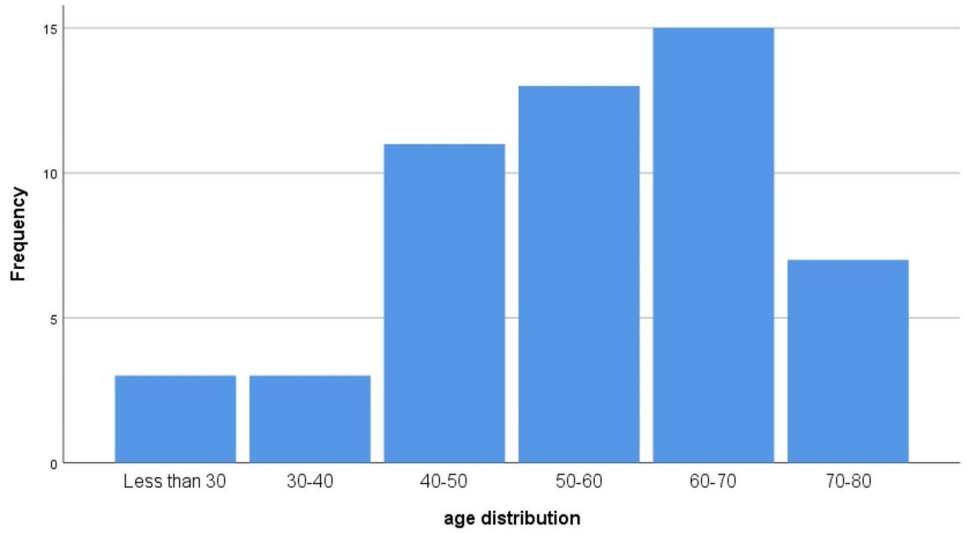

Fig. 1 Age distribution

- **Grade C**: Need for intubation of NGT for 15 days or reinsertion of the NGT after postoperative day (POD) 14, or inability to tolerate a solid diet by POD 21.

Results

Demographic characteristics

Out of nearly 75 patients who were operated for pancreatic cancer 52 patients who fulfilled the inclusion criteria were included in this study.

The median age at diagnosis was 54.5 years with age range from 25 to 80 years. Majority of the patients are in between 50 and 70 years of age. 67.5% of the patients were more than 50 years. Males account for 52% while females account for 48% the patients (see Fig. 1).

Risk factors and comorbidities

Only one patient had a family history of pancreatic cancer. Six patients (11.5%) had diabetes Mellitus at the time of diagnosis. Two of the patients were newly diagnosed cases. Two of them had the diagnosis 2 months prior to presentation which was around same time with symptom onset. The other two patients were known DM patients for years. Three (5.8%) cases were cigarette smokers. Only one patient was found to have history of heavy alcohol consumption.

Only 10 (19.2%) of the patients had medical comorbidities, the commonest being hypertension in 6 patients (11.5%).

Clinical features

The mean and median duration of symptoms at diagnosis was 31.8 and 12 weeks respectively. Patients with tumor location other than the head and neck regions of the pancreas tend to present after longer duration. Table 1 shows the clinical and diagnostic characteristics of pancreatic cancer patients. Figures 1 and 2 show the age and sex distribution of the study population. The majority of patients complained abdominal pain (88.5%), anorexia (80.8%), significant weight loss (78.8%), jaundice (71.2%), and nausea and vomiting (57.7%). On clinical evaluation 69.2% were jaundiced, while 34.6% had a palpable gallbladder. Table 2 below shows the biochemical profiles.

Table 1 Clinical features

Clinical features	Number of cases	Percent (%)
Symptoms		
RUQ/epigastric abdominal pain	46	88.5
Anorexia	42	80.8
Weight loss	41	78.8
Jaundice	37	71.2
Nausea/Vomiting	30	57.7
Pruritus	24	46.2
Abdominal swelling	6	11.5
Others	2	3.8
Signs		
Jaundiced	36	69.2
Palpable gall bladder	18	34.6
Abdominal mass	10	19.2
RUQ/epigastric tenderness	4	7.6
Scratch marks	3	5.8
Others	2	3.8

Pathology and staging

Tumor stage was assessed with preoperative imaging findings and intraoperative findings during surgical exploration. Accordingly, 71.1% of the cases had locally

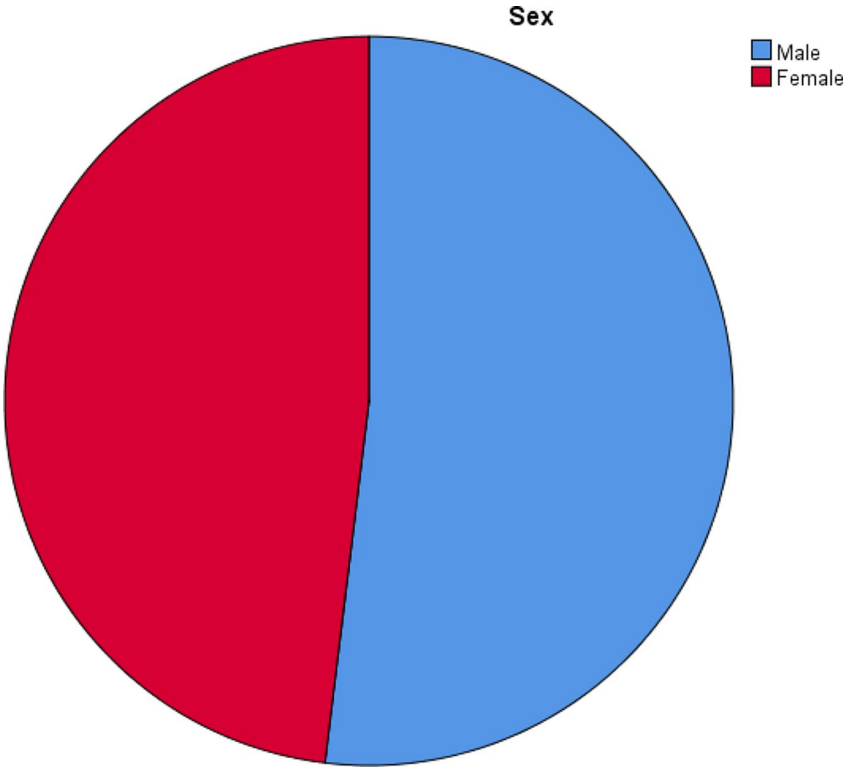

Fig. 2 Sex distribution of the study population

advanced and/or metastatic disease at the time of diagnosis. None of the clinical variables or biochemical parameters could reliably predict the stage of the tumor.

More than three quarters of the tumors are located in the head of the pancreas (76.9%), followed by uncinate process (13.5%). See Table 3 below. Tumor size was assessed by measurement from preoperative imaging (CT and /or ultrasound) as well as from rough estimation made intra-operatively. The mean of size of tumor 5.5 cm. Tumors in the body and tail of the pancreas tend to be larger than those in the head and neck region. Figure 3 clearly shows that most patient are diagnosed at advanced stages.

Treatment and outcome

Given the advanced disease at presentation the vast majority of surgical interventions provided were of palliative (81.8%). Double by-pass was the most frequently performed by-pass procedure (50%) followed by biliary by-pass (23.1%). Gastrojejunostomy alone was done in 2 patients with pancreatic head tumors. Potentially curative procedures performed include distal pancreatectomy +/- Splenectomy in 5 patients (9.6%), Classical Whipple's in 4 patients (7.7%). Central pancreatectomy was done for 1 patient with tumor located in the neck.

In two patients, only biopsy was taken due to the far advancement of the tumor upon exploration. No specific type of procedure is correlated with increased risk of post-op complications.

Ten patients had post-operative complications during the same hospitalization, making the post-operative morbidity 19.2%. Deranged INR value at diagnosis was associated with increased risk of post-op complications ($r=0.54$), which is significant with a P-value of 0.01. Significantly elevated serum ALP also has positive association, although the strength is weak ($r=0.37$) but it wasn't statistically significant. There were two deaths. The mean and median length of postop hospital stay is 8 and 7 days respectively.

Only 6 patients (11.5%) had received adjuvant chemotherapy.

The median duration of post-op follow-up after the surgery was 6 weeks from the index surgery. Only 18.2% of the cases had follow up visit beyond 6 months.

Table 4 below shows the treatment modalities given, post-operative complications and duration of post-op follow-up. Figure 4 shows that most patients didn't have proper documentation of their post-op follow-up.

Discussion

This current study is the first retrospective descriptive study on pancreatic cancer conducted in Ethiopia. With a nearly 1:1 ratio of sex distribution, our study is slightly differs from other studies done in different parts of the world all of which show a male to female ratio of around

Table 2 Biochemical parameters

Parameter	Value
Serum total bilirubin(*n* = 49)	
Normal	12 (24.5%)
Less than 5 mg/dl	4 (8.2%)
5-10 mg/dl	5 (10.2%)
10–20 mg/dl	13 (26.5%)
Greater than 20 mg/dl	15 (30.6%)
AST (*n* = 52)	
Normal	12 (23.1%)
Slightly elevated	2 (3.8%)
Significantly elevated	38(73.1%)
ALT (*n* = 52)	
Normal	12 (23.1%)
Slightly elevated	7 (13.5%)
Significantly elevated	33 (63.5%)
ALP (*n* = 50)	
Normal	11 (22%)
Slightly elevated	3 (6%)
Significantly elevated	36 (72%)
CA 19 – 9 (*n* = 15----29%)	
Normal (< 37U/ml)	8 (53.3%)
37-130U/ml	1 (6.7%)
>130 mg/dl	6 (40%)
Albumin (*n* = 47)	
Less than 2.5 mg/dl	7 (14.9%)
2.5-3.0 mg/dl	10 (21.3%)
3.0-3.5 mg/dl	8 (19.1%)
Equal or greater than 3.5 m/dl	21 (44.7%)
INR (*n* = 45)	
Normal (Less 1.5)	31 (68.9%)
1–2	10 (22.2%)
>2	4 (8.9%)

Table 3 Tumor characteristics

Parameter	Value
Tumor stage	
Stage 1	5 (9.6%)
Stage 2	10 (19.2%)
Stage 3	23 (44.2%)
Stage 4	14 (26.9%)
Tumor location within the pancreas	
Head	40 (76.9%)
Uncinate process	7 (13.5%)
Neck	5 (9.6%)
Body	5 (9.6%)
Tail	5 (9.6%)

1.5: 1 [2, 6, 8, 25, 27]. The male predominance is mostly attributed to the more occupational exposure and lifestyle (e.g. smoking) risk factors, which might be less pronounced in our population. It might also be due to yet undiscovered genetic factor which influences incidence.

The mean and median age of our patients was 54.5 and 54.1 years respectively. These findings are comparable with studies from other African countries and the Middle East [9, 25, 28]. However, this figure is significantly lower than in United States (mean=71 years) [2] and reports from west and north African countries [6, 8, 11, 27]. The younger age of presentation is not unique to pancreatic cancer in sub-Saharan Africa or Ethiopia for that matter. Studies evaluating gastric, esophageal and colorectal cancers also suggest a younger age at onset [29–31].

A case-control study conducted in Italy over 18 years between 1991 and 2008 has shown that 13.6% of pancreatic cancers were attributable to tobacco smoking, 13.0% were attributable to heavy alcohol drinking, 9.7% were attributable to diabetes, 11.9% were attributable to a low adherence to Mediterranean diet, and 0.6% were attributable to a family history of pancreatic cancer [32].

Our results showed that 3 patients (5.8%) were cigarette smokers and 1 patient was alcoholic. This could represent a risk factor for developing a pancreatic cancer since several published reports showed that smoking is the most established risk factor with smokers having about a twofold increased risk compared to nonsmokers [2]. Smoking is considered to be responsible for 20–35% of pancreatic cancer cases [12]. The lower proportion of smokers in our study may be as a result of the generally low smoking habit in our population. A study done in Kuwait to assess the incidence, clinical profile, and frequency of associated factors on 251 patients have identified that 38.2% of the cases were chronic smokers [6].

Numerous epidemiological studies have reported a positive association between diabetes mellitus (DM) and the risk of pancreatic cancer. In the present study, patients with DM constituted 19.2%, which is in keeping with reports from Nigeria [8, 11]. However, studies from Algeria and Kuwait have shown higher figures, 25% and 61.4% respectively [6, 27]. It is estimated that about 5–10% of individuals with pancreatic cancers report a family history of pancreatic cancer [2]. In this current study one patient reported a positive family history of pancreatic cancer. In Kuwait 19.9% of the patients were found to have a positive family history of pancreatic cancer, which is thought to be due to arranged marriage between same families and shared environmental risk factors (e.g. smoking). Table 5 compares the demography of patients and the frequency of associated factors with similar other studies.

In the present study, the median duration of symptoms was 12 weeks. The majority of patients complained from abdominal pain (88.5%), anorexia (80.8%) loss of weight (78.8%), jaundice (71.2%), and nausea and vomiting (57.7%). This is in agreement with several studies that reported that pancreatic cancer does not manifest as early symptoms and initial symptoms are often nonspecific, such as abdominal discomfort, abdominal pain, weight loss, anorexia, and nausea. Pain or jaundice are frequently presenting symptoms with pain usually preceding jaundice [6–9, 11, 25].

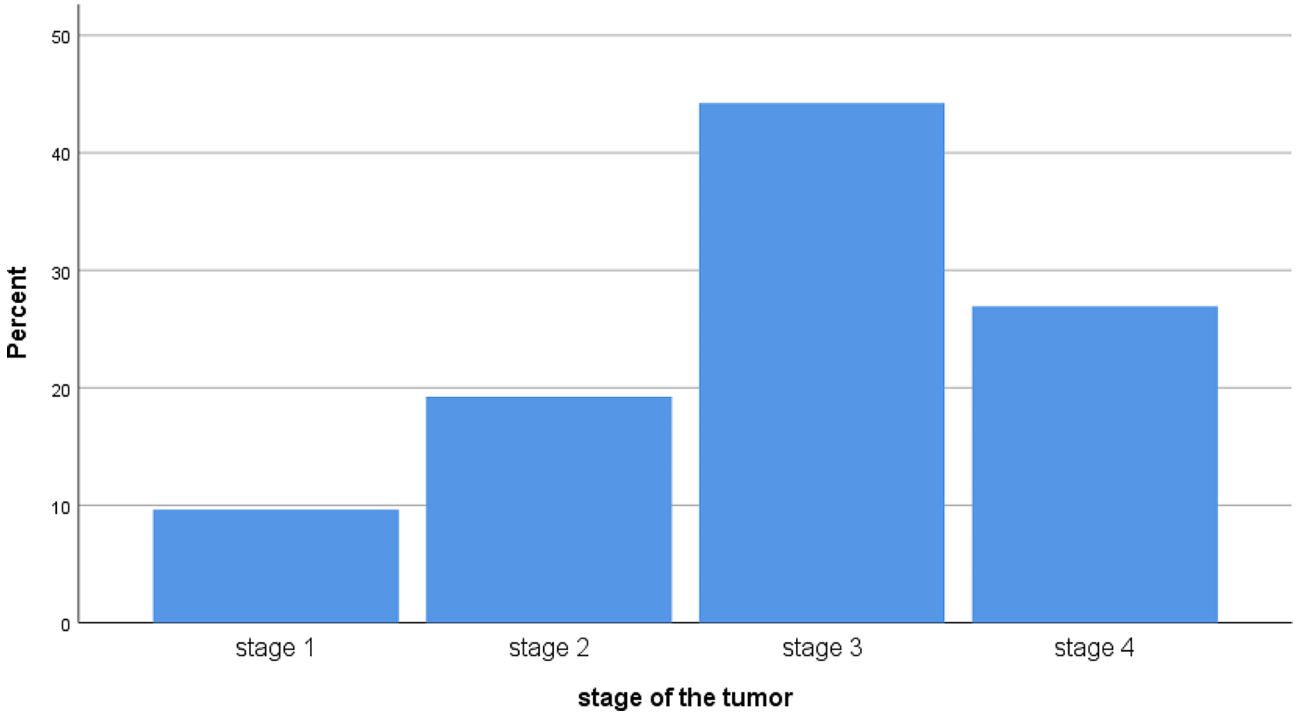

Fig. 3 Stage of the tumor at diagnosis

Table 4 Treatment and outcome

Type of operation	Value
Double By-Pass	26 (50%)
Biliary By-Pass	12 (23.1%)
Distal Pancreatectomy+/-Splenectomy	5 (9.6%)
Classical Whipple's	4 (7.7%)
Gastrojejunostomy	2 (3.8%)
Biopsy	2 (3.8%)
Central Pancreatectomy	1 (1.9%)
Total	**52 (100%)**
Post-Operative complications (*n* = 10)	
Delayed gastric emptying	3
Bile leak	2
Surgical site infection	2
Pancreatic fistula	1
Chylous fistula	1
Multiple electrolyte disturbance	1
Death (*n* = 2)	
Massive Upper GI Bleeding	1
Cardiogenic shock	1
Follow up (*n* = 33)	
Less than 1 month	8 (24.2%)
1–3 months	15 (45.5%)
3–6 months	4 (12.1%)
Longer than 6 months	6 (18.2%)
No recorded follow up	**19 (36.5%)**

Some studies have found that elevated transaminases and reduced serum protein indicate that patients had very advanced disease with a much-reduced life expectancy. Our research didn't show such a relation though it requires further study.

Regarding tumor location within the pancreas, our study has shown that the majority of the cancers are located in the head (76.9%). This is in line with other researches [6, 8, 11, 25, 27, 33].

The vast majority of pancreatic cancers are diagnosed at advanced stage, which is also the case in our setup where more than 71% the patients presented with stage 3 (44.2%) and 4(26.9%) disease. Alegbelye et al. [8], reported that most of the patients have advanced disease at time of presentation that only 3% of them were resectable. In a study by Onyekewere et al. [11], all of the patients were stage 3 and 4. In a report by Sellam et al. [27], more than 85% of the patients had advanced disease. Most of these studies, however, showed that the proportion of patients with stage 4 is higher than the stage 3 disease. The predominace of stage 3 disease in our study may be due to the fact that most stage 4 disease patients may not have been admitted and operated. The global trend shows that 80–90% of patients have unresectable tumors at the moment of diagnosis [2, 34] This is because of the location of pancreas; early symptoms of pancreatic cancer are so vague and are usually ignored by most patients, poor health-seeking behavior of our patients. Another reason for late presentation is due to aggressive growth behavior of the disease that leads to early dissemination of the tumor as well as lack of screening method for detection of early disease. Obviously, a high index of suspicion on the part of health workers is essential to early detection of pancreatic cancer.

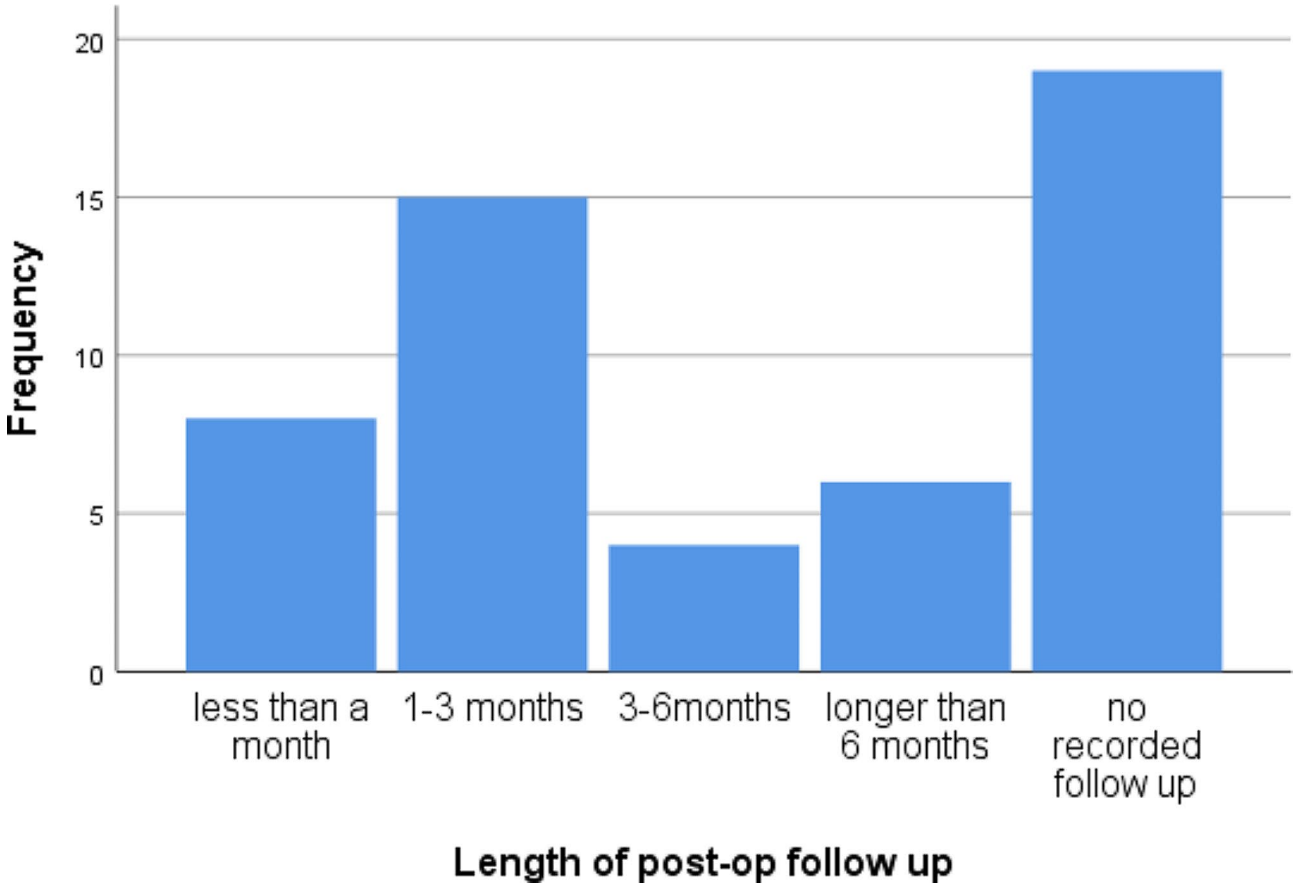

Fig. 4 Post-op follow-up

Table 5 Comparison between different studies: patient characteristics and frequency of associated factors

Author	Years	Country	Sample size (*n*)	Mean/median age	M: F	Smoking %	Diabetes %	Family history	Alcohol %
Our study	**5**	**Ethiopia**	**52**	**54/54.5**	**52:48**	**5.8**	**19.2%**	**1 (3.8%)**	**1 (1.9%)**
Alegbeleye et al.	15	Nigeria	126	/60.2	1.52:1	28%	20	-	22%
Alatise et al.	13	Nigeria	96	/55	2:1	7.3%	11.5%	0	10.4%
Onyekwere et al.	4	Nigeria	27	64.1	15:12	-	22%	-	-
Al-Majed et al.	10	Kuwait	276	60.6	1.5:1	**38.2%**	**61.4%**	**19.9%**	-
Bechtold et al.	8	Zambia	27	55.7	1.5:1	-	-	-	-
Sellam et al.	22	Algeria	264	62.6	1.46:1	-	29%	-	-
Sellam et al.	8	Algeria	160	66.2	1.65:1	32.5%	29%	-	20.6%
Global (Rawla et al.)	2018			**71**	1.5:1	25–30%	40–60%	5–10%	-

The fact that none of the clinical or biochemical parameters could reliably predict tumor stage might be due to the small sample size; otherwise, clinical characteristics like abdominal mass and significant weight loss and significantly elevated CA19-9 levels are associated with advanced stage.

Pancreatic protocol Multi-detector CT scan is the gold standard diagnostic and staging method. The stage of the tumor has been found to be an important predictor of resectability and death in patients with pancreatic tumor and curative resection is the single most important factor determining outcome in patients with pancreatic adenocarcinoma [33, 35]. While complete surgical resection may lead to long-term survival in approximately 25% of patients, only 15–20% are actually resectable [36]. In this current study 19.2% of our patients have undergone potentially curative resections. This figure may increase in the future with more experience and resection of some of the borderline resectable tumors. *Alegbeleye et al.*. and *Alatise et al.*, both from Nigeria, had reported resection rate of around 3% [8, 9]. *Wagner et al.* from Switzerland had reported up to 57.7% rate of resection, out of which

(78.8%) were curative (R0) [33]. Of the patients who underwent resection 68.7% were stage 3 tumors. This might partly be due to better expertise and multidisciplinary approach. The most commonly performed by-pass procedure is double by-pass, accounting for 65% of by-pass procedures. This is agreement with many other studies [8, 9, 33].

The overall incidence of post-operative complications is 19.2%, which is higher than reports from Nigeria [8, 9]; but lower than study by *Wagner et al.*., although this study has greater proportion of more extensive and complicated resections. A study done in US by *Mayo et al.*. showed a significantly higher rate of complications (52%), the most common being infectious complications. Delayed gastric emptying is the most frequent complication in our series (3 patients). *Wagner et al.* showed that 24% of his study subjects had delayed gastric emptying [15]. *Romano et al.*. had reported that Delayed Gastric Emptying is the commonest complication and responsible of increased length of hospital stay and readmission rate. The overall perioperative complication rate was 12.1% [20]. The perioperative mortality rate in our study is 3.8%. *Wagner et al.* reported a mortality rate of 2.8 [33].

Even with complete surgical resection, most patients will die of recurrent disease because of the multifocality of the disease and micrometastasis [37]. Several studies had shown that outcome of patients are improved when placed on adjuvant chemotherapy, radiotherapy or combination of both [35, 37, 38]. The number of patients who took adjuvant chemotherapy (1.2%) is very low compared to other studies. *Alegbelyeet al.*, *Alatise et al.*, *and Wagner et al.* reported the rate of adjuvant therapy to be 22%, 17.6% and 11.2% respectively. *Mayo et al.* from Baltimore USA reported that 51% of the study subjects have received adjuvant therapy [21].

Conclusion

Age at first diagnosis of pancreatic cancer is relatively earlier in our setup. Frequency of associated risk factors is also smaller, which might be because lack proper screening. Most patients present with advanced disease amenable only to palliative measures. The earlier the diagnosis is made, the better are chances for the patient's survival. Therefore, early diagnosis remains the key to treatment with abdominal ultrasonography and CT scan being most readily available in this environment. The need for adjuvant therapy in pancreatic cancer cannot be over emphasized. A multidisciplinary approach is of paramount importance.

Limitations of the study

We acknowledge the limitations of our current study given the fact that it is a single center study, with small sample size. Besides, conclusion regarding the associated factors as risk factors couldn't be reached given the retrospective and descriptive nature of the study. Analytical tests could not be done due to the small sample size. Thus, we recommend that more researches should be done that incorporate a larger sample size, analytical tests and a longer follow-up period.

Strength of the study

As a very first study in Ethiopia on the subject matter, this research contributes to the limited local data. It also identifies our gaps in areas of diagnosis, treatment and research and we believe that it will raise awareness among health care providers.

Abbreviations

CA 19 – 9	Cancer Antigen 19 – 9
CEA	Carcinoembryonic Antigen
Ca	Cancer
FDA	Food and Drug Administration
GOO	Gastric Outlet Obstruction
HMIS	Health Management Information System
HPB	Hepato-Pancreato-Biliary
ISGPF	International Study Group for Pancreatic Fistula
ISGPS	International Study Group for Pancreatic Surgery
IRB	Institutional Review Board
MRN	Medical Record Number
NGT	Nasogastric Tube
POD	Post-operative days
PD	Pancreato-duodenectomy
PPPD	Pylorus Preserving Pancreato-duodenectomy
PI	Principal Investigator
SPSS	Statistical Package Of Social Sciences
UCLA	University of California, Los Angeles

Acknowledgements

Not applicable.

Author contributions

T.A. is the principal investigator and prepared the main manuscript. Z.A. is the advisor. All authors reviewed the manuscript.

Funding

The necessary fund for the conduct of this study was obtained from Addis Ababa University.

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Ethical clearance to conduct this study was obtained from the institutional review board of College of Health Sciences, Addis Ababa University. Given the retrospective design of the study with all data gathered from patient's medical record obtaining informed consent from all study subjects is neither practicable nor necessary.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Received: 28 August 2023 / Accepted: 12 February 2024
Published online: 06 August 2024

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