Prognosis of Colorectal Cancer in Tikur Anbessa Specialized Hospital, the Only Oncology Center in Ethiopia

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Research article

Keywords: Colorectal cancer, survival, prognostic factor, Cox regression, Tikur Anbessa Specialized Hospital, Addis Ababa

Posted Date: September 6th, 2019

DOI: <https://doi.org/10.21203/rs.2.13961/v1>

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Version of Record: A version of this preprint was published at PLOS ONE on February 2nd, 2021. See the published version at <https://doi.org/10.1371/journal.pone.0246424>.

Abstract

BACKGROUND: Colorectal cancer is the third most commonly diagnosed cancer in males and the second in females worldwide. According to Addis Ababa cancer registry, it is the first in male and fourth in female in Ethiopia. However, there have not been studies on prognostic factors and survival of colorectal cancer. Hence, this study aimed to estimate survival time and identify prognostic factors.

METHODS: In this institution based retrospective study, medical records review of 422 colorectal cancer patients and telephone interview was used as sources of data. Survival time was estimated using Kaplan-Meier estimator. Prognostic factors were identified using the multivariable Cox regression model.

RESULTS: The median survival time was 39 months. The overall five years survival rate was 33%. Patients diagnosed with rectal cancer had 76% (HR: 1.761, 95% CI: 1.173-2.644) increased risk to die compared to colon cancer patients. Node positive patients were 3.146 (95% CI: 1.626-6.078) times likely to die compared to node negative and metastatic cancer were 4.221 (95% CI: 2.788-6.392) times likely to die compared to non-metastatic patients. Risk of death was 36.1% lesser (HR: 0.639 (95% CI: 0.418-0.977)) among those who received adjuvant therapy compared to patients who had only surgical resection.

CONCLUSION: The overall survival rate is low and majority of patients were young adults at presentation. Patient's survival is largely influenced by advanced stage at presentation and delays in administration of adjuvant therapy. Adjuvant therapy was among the good prognostic factors. Implementation of colorectal cancer screening program and early detection with timely and advanced treatment are crucial to increase patients' survival time. **KEY WORDS:** Colorectal cancer, survival, prognostic factor, Cox regression, Tikur Anbessa Specialized Hospital, Addis Ababa.

Background

Cancer is the leading cause of death globally, surpassing mortality rates of tuberculosis, malaria and HIV/AIDS combined, and it is quietly taking center stage. Colorectal cancer is a cancer of large intestine. It also be known as colon cancer or rectal cancer based on the site where the cancer originate but when both present with similar features they are termed as colorectal cancer (CRC).(1–5) Clinical presentation of CRC depends on its size, presence or absence of metastases and tumor location. Although early CRC often has no symptoms.(6) CRC is the third most commonly diagnosed cancer in males and second in females, making the disease the second-most common cause of cancer-related death worldwide and remains one of the biggest killer cancers in the world. Its burden is expected to increase. Despite this increasing burden, in Africa CRC continues to receive a relatively low public health priority due to limited resources and more other prompt diseases.(3, 5, 7, 8)

In Ethiopia, CRC is the third most prevalent cancers among the entire adult population and patients often present with advanced stages of cancer.(9) According to Addis Ababa cancer registry it is the first in male and fourth in female.(10) From 14,500 cancer related deaths among males 11.2% were due to CRC and 4.8% from 26,200 cancer related deaths in women were due to CRC.(11) Currently CRC, it is the most common malignant cancer representing 13% of all malignant tumors in the gastrointestinal tract. More CRC deaths (52%) occur in the less developed regions of the world, reflecting poorer survival in these regions. (3, 12)

The highest five-year survival rates (72%) are in Israel and North Korea, in North America, Europe and Australia/ New Zealand survival varies from 65%–70%, 55% in other developed countries, 39% in developing countries including India and 14% in Africa.(6, 13, 14) Various studies shows that CRC survival is mainly determined by age at diagnosis, tumor site, tumor grade, cancer stage, tumor size and location, lymph node involvement, distant metastasis and treatment modalities.(15–27) Some literatures reported that sex, educational status, family history, pre-operative carcinoembryonic Antigen (CEA) level and lymphovascular invasion as significant prognostic factors.(18, 21, 23, 25)

In Africa, data for CRC survival is scanty. In Ethiopia, to the best of our knowledge, there is no study on prognostic factor and survival of colorectal cancer. For these reasons, this study explored survival and prognostic factors of colorectal cancer patients in Tikur Anbessa Specialized hospital (TASH) of Addis Ababa, Ethiopia.

Methods

A retrospective study was conducted on colorectal cancer patients referred to TASH Radiotherapy center from January 2012 to December 2016. TASH is the only oncology and cancer referral center providing services for majority of cancer cases from all over the country.(28)

The sample size was determined with the following assumptions: 95% confidence interval (CI), power of 90%, a hazard ratio of 1.832 and assuming that hazard ratio is constant in time.

The medical records of 422 colorectal cancer patients was reviewed and telephone follow-up was used to find out the vital status of patients. The follow up time was from the first date of confirmed diagnosis to the date of death, date of lost to follow up or date of last contact. Patients with unknown vital status or alive patients during last contact (phone) were considered as censored. Patients diagnosed with colorectal cancer plus other site cancer were excluded from the study. Data on socio demographic characteristics, genetic factor (family history of CRC), comorbidities (HIV/AIDS, diabetic mellitus and hypertension), and pathological characteristics (primary tumor site, histopathology, tumor grade, Size and location of tumor, Lymph node metastasis, Distant metastasis, lymphovascular invasion, perinural invasion and pre-operative CEA level and treatment modality were extracted from the medical records..

STATISTICAL ANALYSIS

Analysis was performed using SPSS version 25 and Stata version 14. Descriptive analysis were done using frequency, percentages and median. Survival time was estimated using Kaplan-Meier method. Log-rank test was used to compare (overall) survival of two or more groups and identify potential prognostic variables. In the univariate analysis, variables with $p < 0.25$ were entered into the multivariable Cox regression model. Deviation from the proportional hazard assumption of the Cox regression model was examined using plots of scaled schoenfeld residuals, global test and log-log transformation of Kaplan- Maier survival curves of categorical variables. Prognostic factors of colorectal cancer survival were identified using multivariable Cox regression model. P-value of less than 0.05 was considered as statistically significant.

Results

Summary of Baseline Information

A total of 422 colorectal cancer patients treated in Tikur Anbessa Specialized Hospital from January 2012 to December 2016 were considered in this retrospective study. One hundred seventy five (41.5%) of the patients died in the study period while the remaining 247 (58.5%) were censored. Majority of the patients, 262 (62.1%) were male. The overall median age was 46 years with Interquartile range (IQR) of 23 and 185 (43.9%) were in the age group of 40–59 years. For the lifestyle characteristics, the prevalence of comorbidities was 52 (12.3%). Twenty-eight (6.6%) of the patients were hypertensive, 15 (3.6%) were diabetic and 7(1.7%) were HIV positive at presentation. The details are presented in Table 1.

Table 1 here.....

As depicted in Table 2, colon, 217 (51.4%) and rectum 144, (34.1%) were the common cancer sites involved. Majority of the patients, 333 (~79%), have adenocarcinoma NOS, followed by mucinous adenocarcinoma (12.9%) and signet ring adenocarcinoma (4.7%). The majority 198 (46.9%) were well-differentiated adenocarcinoma.

Majority of the patients were diagnosed with primary tumor of pT3 (46.7%). About one-fourth patients presented with pathologically confirmed regional lymph node involvement. In 57.1% of cases the lymph node status is unknown which means we don't know the TNM staging in this group of patients. Nearly half, (49.3%), of the patients had received adjuvant chemotherapy or radiotherapy after surgery.

Table 2 here.....

YEARLY INCIDENCE OF DEATH AND SURVIVAL OF COLORECTAL CANCER PATIETS

From a total of 422 patients, 175 (41.5%) died and 144 (34.1%) were alive by Oct. 2018, when the status was last updated. The vital status of the remaining, 103 (24.4%), was unknown due to refusal to respond to calls and not working telephones. Overall, there were 822.25 person-years observation with 19 month (IQR 28) median time of follow up and this makes the incidence rate of death in colorectal cancer patients 21.28% per 100 person-years observation.

The graph in figure A shows the overall survival curve of colorectal cancer patients in TASH. From the graph patients' survival decreases as the observation time increases. One, three and five years overall survival rate were 80%, 55%, and 33% respectively. The median overall survival time was 39 months.

Figure A here.....

The graph in Figure B shows survival of colorectal cancer patients by distant metastasis at presentation. The Kaplan Maier survival curve shows that non-metastatic (MO) patients had better survival compared to metastatic patients (M1) ($p = 0.0001$).

Figure B here.....

Table 3 shows results of the Log-rank test of socio-demographic characteristics and presence of comorbidities in CRC patients. No statistically significant differences was observed among the survival groups ($P>0.05$). Although, having comorbidities lower patients survival rate.

Table 3 here.....

The median survival time, survival rate and log-rank test for pathological and clinical variables was assessed univariately.

As shown in Table 4, pathological and clinical factors like primary tumor site, histopathology, tumor grade, size and location of tumor, lymph node metastasis, distant metastasis and treatment modality were significantly associated with patients' survival time ($p<0.05$). Colon and colorectal cancer patients had better survival compared to that of the other commonest cancer site rectum. Patients with poorly differentiated tumor grade were at increased risk of death compared to those with well and moderately differentiated tumor grades. The median survival time was higher (60 months) among those node-negative patients compared to those diagnosed with node-positive (24 months). Similarly, metastatic cancer patients had lower 5 year survival rate (2%). According to treatment modality, patients who received adjuvant chemotherapy and adjuvant radiotherapy after surgery and who received adjuvant chemotherapy or adjuvant radiotherapy after surgery had higher median survival time (73 months) and (46 months) respectively. Lower median survival

time (6 months) was observed among those who did not receive any cancer treatment during the follow-up time in TASH. This is due to the fact that patients with advanced disease are not fit for chemotherapy or radiotherapy and refusal to initiate treatment. Enough data was not obtained for variables like pre-operative CEA level, lymphovascular and perinural invasion. Hence, not data exploration was performed for these variables.

Table 4 here.....

RESULT OF MULTIVARIABLE COX REGRESSION MODEL

To identify prognostic factors, variables with p -value ≤ 0.25 at the univariate analysis (Tables 3 & 4) were taken to the multiple Cox PH regression model. Hence, age at diagnosis ($p = 0.159$), comorbidity ($p = 0.100$), primary tumor site ($p < 0.01$), histopathology of CRC ($p = 0.011$), Tumor grade ($p < 0.001$), size and location of tumor ($p < 0.001$), lymph node metastasis ($p < 0.001$), distant metastasis ($p < 0.001$), treatment modality ($p < 0.001$) and sex (due to its importance in oncology study) were entered to the final multiple Cox regression model. The proportional hazard assumption was tested using scaled-schoenfeld residuals and the global test for the model ($p = 0.0584$). We failed to reject the null hypothesis that the hazards are proportional. The scaled schoenfeld residuals were also plotted for each variables and the slope were closed to zero for variables in the model and Kaplan Meier curves were parallel for each categories of variables versus time. These implies that the proportional hazard assumption was not violated for this data. Results of the final multivariable cox regression analysis are presented in Table 5. Primary tumor site ($P < 0.05$), lymph node involvement ($P < 0.01$), distant metastasis ($P < 0.001$) and treatment modalities ($p < 0.01$) were significantly associated with survival rate.

Patients diagnosed with rectal cancer had 76% (HR 1.761, 95% CI: 1.173–2.644) increased risk to die compared to colon cancer. Node positive patients were 3.146 (95% CI: 1.629–6.078) times likely to die compared to node negative patients. The risk of death for metastatic cancer were 4.221 (95% CI: 2.788–6.392) times to the non-metastatic patients. For treatment modality, risk of death was 36.1% lesser (HR: 0.639 (95% CI: 0.418–0.977)) and 47.9% lesser (HR: 0.521 (95% CI: 0.279–0.973)) in those patients who received adjuvant chemotherapy or adjuvant radiotherapy and who received adjuvant chemotherapy and adjuvant radiotherapy, respectively compared to patients who had only surgical resection.

Table 5 here.....

Discussion

This study provided estimates of survival time and identified prognostic factors of colorectal cancer patients in the only oncology referral center in Ethiopia over the period 2012–2016. Our findings revealed that the median age at diagnosis was 46 and 52.8% of them are diagnosed age less than 50, which shows majority of them are young adults and middle aged adults whereas the median age at diagnosis was 70 in Germany. Data from Oman showed that the median age was 56 years and majority of the patients, 61.1%, were older than 50 years. Similarly, in Jordan the median age was 62 for males and 58 for females. More than half of the patients were above age 60 years, which differs from our study result. The contributing factors are age structure of Ethiopia. It might also relate to the unhealthy nutritional habit in Ethiopia (high intake of fats and red meats) and lack of birth registration may contribute as most patients from rural area might not know their exact age. (22, 24, 26)

Around 34% of the patients were metastatic cancer at presentation. This is similar to a report from Oman (36.8) and Kenya (29.1%) but in contrast with reports from Germany (28.1%), in Ghana (24.9%), in Malaysia (24.3%), in Jordan (17.2%) and in Iran (6.8%) of patients were metastatic. (15, 18, 21, 22, 24, 26, 29) The late presentation might be due to patients' low awareness of colorectal cancer sign and symptoms, lack of screening program, lengthy and poor referral system in Ethiopia. This might have contributed to the observed low survival of patients treated in Tikur Anbesa Specialized hospital in Addis Ababa, Ethiopia.

In our current study, the five year overall survival (OS) rate was 33%, much lower than OS rate in developed countries. Highest five-year survival rate (72%) are in Israel and North Korea. Survival varies from 65% to 70% in North America, Europe and Australia, 63% in Germany and 55% in other developed countries. (13, 14, 26) This could be primarily due to increase in colorectal cancer screening, removal of precancerous adenomas, timely and advanced treatment in developed countries. In developing Asian countries, the five-year survival rate of CRC patients ranged from 33% to 56.9% in Iran, 58.2% in Jordan, 43% & 48.7% in Malaysia, 42% in Oman, 39% in India, 38.6% in Thailand which are above the survival rate of patients in Ethiopia. (14, 15, 18, 22–25, 27, 29) The reason for this difference could be lack of screening programs to detect the cancer at an early stage, poorly developed infrastructure of cancer health cares in Ethiopia. Treatments are also very limited and inaccessible especially for patients living far from TASH, the only oncology and cancer referral center in the country. The five years overall survival rates of colorectal cancer patients in a teaching hospital in Ghana ($n = 221$) was 16% which is below the overall survival rate in this study. (21) Variation in methodology, population characteristics and observed number of events may have contributed to these differences in findings.

In our study, age at diagnosis is not a significant prognostic factor affecting survival. This is consistent with studies conducted in Malaysia and Ghana (15, 21). However, it was inconsistent with studies conducted in India, Iran, Jordan and Thailand. (17, 18, 20, 22, 25) This might be due to the fact that majority of the study participant were young compared to patients in those studies. Comorbidity is not also a significant prognostic factor affecting patient's survival. This finding is also in line with reports from Ghana, Iran and Malaysia. (15, 21, 23)

In multivariable Cox regression model, Primary tumor site ($P < 0.05$), lymph node involvement ($P < 0.01$), distant metastasis ($P < 0.001$) and treatment modalities ($p < 0.01$) were significant prognostic factors for colorectal cancer patients survival. Patients diagnosed with rectal cancer had 76% (HR =

1.761) increased hazard to death compared to colon cancer patients. This is in agreement with reports from Iran where rectal cancer had high risk of death and determines prognosis significantly.(18)

In this study, the hazard of death was significantly higher for those patients who were diagnosed with positive lymph node with (HR = 3.146) compared to node negative. This finding is in line with reports from Ghana, Malaysia, Thailand and Iran.(15, 18, 21, 25) The other finding of this study is the risk of death was four fold higher (HR = 4.221) for those who presented with metastatic cancer compared to non-metastatic cancer patients. This finding is comparable to those reports found in Ghana, Thailand, Jordan, Malaysia and Iran.(15, 18, 21, 22, 25) Node involvement and metastatic cancer at presentation were the major prognostic factors for colorectal cancer patients.

The finding of this study demonstrates that risk of death was significantly lesser (HR = 0.639 & 0.521) among those who received adjuvant chemotherapy or/and adjuvant radiotherapy compared to those who only received surgical resection. This is similar to reports from Ghana, Thailand, Iran and Malaysia that adjuvant therapy was a good prognostic factor. (15, 18, 21, 25)

The study was conducted in the only oncology referral center in the country that provides services for majority of cancer cases from all over the country. Hence, our findings may reflect the situation in the whole of Ethiopia. The limitations of this study are possible significant prognostic factors such as family history, lymphovascular invasion; perinural invasion and pre-operative CEA level were not assessed due to the scantiness of the data. The other limitation is that only seven CRC patients died in the institution with a report of detailed causes of death. The death of the remaining 168 patients and causes of deaths were ascertained by telephone interview not from death report which may lead to over detection of death as a result of cause ascertainment bias.

Conclusions

This study clearly estimates low overall five-year survival rate for patients diagnosed with colorectal cancer in Tikur Anbessa Specialized Hospital compared to similar studies conducted in various countries. Majority of our patients were young adults and diagnosed with advanced cancer stage. Patient's survival is largely influenced by advanced stage at presentation and delayed in administration of adjuvant therapy. Primary tumor site, lymph node involvement, distant metastasis and treatment modalities were important prognostic factors for colorectal cancer. Rectal cancer, node-positive, and metastatic cancer at presentation in colorectal cancer patients decreased the survival rate. Whereas, adjuvant therapy increased survival rate. Timely administration of adjuvant chemotherapy through improving access to chemotherapy and radiotherapy will improve outcome.

Furthermore, implementation of colorectal cancer screening program and early detection with timely and advanced treatment are important to increase the survival time.

Abbreviations

CEA: carcinoembryonic Antigen; CI: confidence interval; df: degree of freedom; HIV/AIDS: human immuno virus/ acquired immuno deficiency syndrome; HR: hazard ratio; IQR: inter-quartile range; NOS: not otherwise specified; TNM, tumor nodes metastasis; x2: chi square

Declarations

Ethical approval and consent to participate

Ethical approval for the proposed study was obtained from GAMBY Medical and Business Sciences College institutional research ethics review committee (GCA.A 20/2010). Verbal informed consent was obtained for patients eligible for the phone interview.

Consent for publication

Not applicable

Availability of data and material

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

Competing interests

No conflict of interest to disclose

Funding support

No funding support

Author contributions

EKE: Conceptualization, data curation, analysis, methodology, manuscript drafting, review and editing. MA: Interpretation and critical revision of the manuscript. BTA: Conceptualization, supervision, interpretation and critical revision of the manuscript. All authors have read and approved the manuscript.

Acknowledgements

The authors would like to thank the TASH radiotherapy center for granting permission to extract the data for this study and Mr. Solomon Asmare, for his support throughout this study and workers at the card room.

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Tables

Table 1: Socio-demographic characteristics of colorectal cancer patients (n=422) in Tikur Anbesa Specialized Hospital (TASH), Addis Ababa, Ethiopia, 2012-2016

Variables	n (%)
Age (Median, IQR) 46 (23)	
≤ 29	50 (11.8)
30-39	79 (18.7)
40-49	94 (22.3)
50-59	91 (21.6)
60-69	77 (18.2)
≥70	31 (7.3)
Sex	
Male	262 (62.1)
Female	160 (37.9)
Place of residence	
Addis Ababa	187 (44.3)
Out of Addis Ababa	235 (55.7)
Educational status	
Unable to read and write	16 (3.8)
Able to read and write	2 (0.5)
Elementary (1-8)	20 (4.7)
High school (9-12)	19 (4.5)
College and above	22 (5.2)
Unspecified	343 (81.3)
Family history	
Yes	1 (0.2)
No	132 (31.3)
Unspecified	289 (68.5)
Comorbidities	
Yes	52 (12.3)
No	370 (87.7)
HIV/AIDS	
Yes	7 (1.7)
No	415 (98.3)
Diabetic mellitus	
Yes	15 (3.6)
No	406 (96.2)
Unspecified	1 (0.2)
Hypertension	
Yes	28 (6.6)
No	394 (93.4)

Table 2: Pathological and clinical characteristics of colorectal cancer patients (n=422) in TASH, Addis Ababa, Ethiopia, 2012-2016

Variables	n (%)
Primary tumor site	
Colon	217 (51.4)
Rectum	144 (34.1)
Colorectal	31 (7.3)
Recto sigmoid	30 (7.1)
Histopathology	
Adenocarcinoma NOS	333 (78.9)
Mucinous adenocarcinoma	53 (12.6)
Signet ring cell adenocarcinoma	20 (4.7)
Tubulovillous adenocarcinoma	7 (1.7)
Other	5 (1.2)
Unspecified	4 (0.9)
Tumor grade	
Well differentiated	198 (46.9)
Moderately differentiated	84 (19.9)
Poorly differentiated	30 (7.1)
Undifferentiated	4 (0.9)
Unspecified	106 (25.1)
Size and location of tumor	
TX	12 (2.8)
T1	7 (1.7)
T2	62 (14.7)
T3	197 (46.7)
T4	113 (26.8)
Unspecified	31 (7.3)
Lymph node metastasis	
Node negative	79 (18.7)
Node positive	102 (24.2)
Node unknown	241 (57.1)
Distant metastasis	
MX	37 (8.8)
MO	230 (54.5)
M1	143 (33.9)
Unspecified	12 (2.8)
Lymph vascular invasion	
Yes	6 (1.4)
No	38 (9.0)
Unspecified	378 (89.6)
Perineural invasion	
Yes	2(0.5)
No	2 (0.5)
Unspecified	418 (99.1)
Pre-operative CEA level	
Not elevated (≤ 5 ng/ml)	16 (3.8)
Elevated (> 5 ng/ml)	14 (3.3)
Unspecified	392 (92.9)
Treatment modalities	
Surgery only	98 (23.2)
Chemotherapy OR radiotherapy only	25 (5.9)
Surgery + chemotherapy OR radiotherapy	208 (49.3)
Surgery + chemotherapy + radiotherapy	49 (11.6)
Chemotherapy + radiotherapy	6 (1.4)
None	36 (8.5)

Table 3: Median survival, survival rate and log rank test for univariate analysis of socio-demographic characteristics and comorbidities

Variable	n	Median survival in month	Five year survival rate (%)	Log-rank test (df) value	P
Age				7.96(5)	0.159
≤29	50	23	29		
30-39	79	39	45		
40-49	94	43	35		
50-59	91	40	32		
60-69	77	60	50		
≥70	31	25	7		
Sex				5.82(1)	0.468
Male	262	39	33		
Female	160	46	34		
Place of residence				0.26(1)	0.871
Addis Ababa	187	39	36		
Out of Addis Ababa	235	40	29		
Comorbidities				2.70(1)	0.100
Yes	52	21	23		
No	370	41	35		
HIV/AIDS				2.09(1)	0.148
Yes	7	13	29		
No	415	40	33		
Diabetic mellitus				0.74(2)	0.964
Yes	15	60	26		
No	406	40	35		
Hypertension				0.50(1)	0.477
Yes	28	60	60		
No	394	39	31		

Table 4: Median survival, survival rate and log rank test for univariate analysis of pathological and clinical characteristics

Variable	n	Median survival in month	Five year survival rate (%)	Log-rank test (df)	P value
Primary tumor site				17.00(3)	0.001
Colon	217	60	53		
Rectum	144	25	16		
Colorectal	31	57	21		
Recto sigmoid	30	41	27		
Histopathology				14.93(5)	0.011
Adenocarcinoma NOS	333	42	36		
Mucinous adenocarcinoma	53	24	15		
Signet ring cell adenocarcinoma	20	23	-		
Tubulovillous adenocarcinoma	7	5	-		
Tumor grade				52.63(4)	0.0001
Well differentiated	198	60	57		
Moderately differentiated	84	41	31		
Poorly differentiated	30	15	41		
Undifferentiated	4	40	-		
Unspecified	106	18	6		
Size and location of tumor				55.46(5)	0.0001
TX	12	12	-		
T1	7	52	-		
T2	62	60	68		
T3	197	46	38		
T4	113	21	22		
Unspecified	31	15	-		
Lymph node metastasis				34.584(2)	0.0001
Node negative	79	60	77		
Node positive	102	24	14		
Node unknown	241	32	28		
Distant metastasis				142.60(3)	0.0001
MX	37	30	17		
M0	230	60	55		
M1	143	14	2		
Treatment modalities				66.09(5)	0.0001
Surgery only	98	39	25		
Surgery OR radiotherapy only	25	14	-		
Surgery + chemotherapy OR radiotherapy	208	46	43		
Surgery + chemotherapy + radiotherapy	49	73	38		
Chemotherapy + radiotherapy	6	12	-		
None	36	6	14		

Table 5: Multivariable survival analysis of prognostic factors in colorectal cancer patients

Prognostic variables	Estimate	Standard error	p-value	HR	CI (95%)
Age			0.263		
≤29				1	
30-39	-0.266	0.329	0.419	0.767	0.403-1.460
40-49	-0.170	0.327	0.582	0.836	0.442-1.582
50-59	-0.067	0.300	0.822	0.935	0.520-1.682
60-69	0.046	0.325	0.908	1.038	0.550-1.958
≥70	-0.740	0.376	0.052	0.484	0.233-1.006
Sex					
Male	0.291	0.175	0.097	1.338	0.949-1.887
Female				1	
Comorbidities					
Yes	0.146	0.239	0.543	1.157	0.724-1.848
No				1	
Primary tumor site			0.036		
Colon				1	
Rectum	0.566	0.207	0.006	1.761	1.173-2.644
Colorectal	-0.023	0.355	0.948	0.977	0.488-1.959
Recto sigmoid	0.446	0.339	0.188	1.562	0.804-3.035
Histopathology			0.249		
Adenocarcinoma NOS				1	
Mucinous adenocarcinoma	0.373	0.245	0.128	1.452	0.899-2.346
Signet ring cell adenocarcinoma	0.487	0.388	0.210	1.628	0.760-3.485
Tubulovillous adenocarcinoma	0.147	0.522	0.778	1.159	0.417-3.223
Tumor grade			1.180		
Well differentiated				1	
Moderately differentiated	0.311	0.221	0.159	1.364	0.885-2.102
Poorly differentiated	0.579	0.325	0.066	1.817	0.060-3.439
Undifferentiated	1.220	1.055	0.247	3.389	0.429-26.786
Size and location of tumor			0.051		
T1	0.112	0.628	8.859	1.118	0.326-3.832
T2	-0.336	0.323	0.297	0.714	0.380-1.344
T3	-0.195	0.199	0.326	0.823	0.557-1.216
T4				1	
Lymph node metastasis			0.003		
Node negative				1	
Node positive	1.146	0.336	0.001	3.146	1.629-6.078
Distant metastasis			0.000		
M0				1	
M1	1.440	0.212	0.000	4.221	2.788-6.392
Treatment modalities			0.007		
Surgery only				1	
Surgery OR radiotherapy only	-0.051	0.334	0.879	0.950	0.494-1.828
Surgery + chemotherapy OR radiotherapy	-0.447	0.217	0.039	0.639	0.418-0.977
Surgery + chemotherapy + radiotherapy	-0.653	0.319	0.041	0.521	0.279-0.973
Chemotherapy + radiotherapy	0.142	0.572	0.803	1.153	0.376-3.537
None	0.575	0.350	0.100	1.778	0.895-3.531

Figures

Figure 1
Kaplan Maier overall survival curve of colorectal cancer patients in TASH, Addis Ababa, Ethiopia, 2012-2016

Figure 2
Kaplan Maier survival curve of colorectal cancer patients with metastatic vs non-metastatic in TASH 2012 – 2016