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ORIGINAL ARTICLE

Clinical and epidemiological factors associated with suicide in colorectal cancer

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Abstract

Purpose While increased suicidal tendencies among cancer patients have been well documented, this study aims to examine suicide rates and factors associated with suicide specifically in patients with colorectal cancer (CRC).

Methods Patients diagnosed with CRC between the years of 1988–2010 were selected from the Surveillance, Epidemiology, and End Result (SEER) database. Comparisons with the general population were done using the National Center for Disease Control registry.

Results One thousand three hundred eighty-one suicides among 884,529 patients were identified, with a standardized mortality ratio (SMR) of 1.53 (95% CI, 1.13–1.33) compared to the general population. No statistically significant difference in suicide rate was found with respect to age, marital status, socio-economic status, surgical intervention, histologic subtype, or stage at diagnosis. Within the CRC population, Whites were significantly more likely to commit suicide than non-Whites (OR, 2.28; 95% CI, 1.89–2.75; $P < 0.001$), and males were significantly more likely than females (OR, 5.635; 95% CI, 4.85–6.54; $P < 0.001$). Most suicides occurred in patients with distal lesions in the sigmoid/rectosigmoid junction ($P < 0.001$). SMRs for CRC patients were 4.24 for females (95% CI, 3.69–4.86), 1.35 for males (95% CI, 1.28–1.43), 0.38 for African-Americans (95% CI, 0.28–0.52), 1.77 for Whites (95% CI, 1.68–1.87), and 0.90 for other races (95% CI, 0.72–1.12).

Conclusion Identification of risk factors associated with suicide among patients with CRC is an important step in developing screening strategies and management of psychosocial stressors. These results could be helpful in formulating a comprehensive suicide risk scoring system for screening all cancer patients.

Keywords Colorectal cancer · Colon cancer · Rectal cancer · SEER database · Suicide risk

Introduction

Innumerable medical advances, standardized screening, and improved access to care have resulted in a steady decline in the incidence and mortality of colon and rectal cancer (CRC). CRC, however, remains the third most common cancer and cause of cancer-related death in the USA. While the American Cancer Society (ACS) estimates approximately 135,430 new diagnoses in 2017 alone, only 50,260 CRC-related mortalities are estimated this year, following a linear downtrend of colorectal cancer mortalities consistent with data of the past 20 years [1]. This trend is further reiterated in the most recent National Cancer Institute/Center for Disease Control published statistics for clinicians. Referencing the ACS national registry, the incidence of CRC from 1998 to 2006 fell 3% from 1995 to 1998. Mortality secondary to CRC saw an even more drastic decrease, falling 3.9% during the 2002–2006 period as compared to 1990–2002 [2]. The result of these strides is an expanding population of CRC survivors with previously unmet needs and nuances of care.

As medical management is tailored to this changing population, it becomes imperative to approach CRC patients with a well-rounded plan of care that encompasses the psychosocial issues as well as medical factors affecting these patients. Suicide in cancer patients has garnered significant attention as recent research has begun to illustrate the increased risk

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of suicide and suicidal ideation in this group [3–10]. The University of Washington recently published data indicating an almost twofold greater incidence of suicide in cancer patients, indiscriminate of type, versus the general population. Culling data from 1973 to 2001, the incidence of suicide in cancer patients was 31.4 per 100,000 vs. 16.7 per 100,000 in the general US population [11]. Furthermore, a published study in the *Journal of Surgical Oncology* noted that as many as 12% of 20+ years cancer survivors endorsed recent suicidal ideation and/or attempts [12].

One study showed that of the 0.2% of over three million patients with single malignancy cancer aged 20+ who completed suicide, 36% committed suicide within 1 year of diagnosis, and one third of these patients did so within 1 month of diagnosis [6]. Given this risk, the National Comprehensive Cancer Network developed the Distress Management Guidelines to provide a means for the rapid assessment of patients for emotional distress and depression in the office. This screening tool is required for all NCCN member cancer centers.

Objectives

As laudable strides have been made in examining and diagnosing patients at risk for suicide and component predisposing factors in cancer patients specifically, this study seeks to further delineate this relationship specifically in the colorectal cancer population [13–18]. Our objective relies on use of a population-based cohort, assessing incidence of suicide in patients with colon and rectal malignancies, while expounding upon demographical, clinical, and diagnostic factors associated with suicide in this patient population. We hypothesize that patients diagnosed with colon and rectal malignancies will demonstrate a high incidence of suicide when compared to the general population. Based on findings from previous investigations relating to suicide in general, and in relation to other cancer types, [11, 13, 16] we hypothesized that patients with older age, advanced stage disease, and unmarried status would be at greater risk of suicide compared with other patients with colorectal cancer.

Materials/methods

Sources

The Surveillance, Epidemiology, and End Results (SEER) database of the National Cancer Institute was queried to identify patients with colon and rectal malignancies. The SEER database reports data on incidence, prevalence, and survival within registries comprising specific geographic areas representing 30% of the US population, and the population covered by SEER is comparable to the general US population with regard to measures of poverty and education. The study cohort consists of patients from all 18 registries comprising the SEER database [19–21]. Mortality and demographic data from 1988–2010 for patients diagnosed with colon and rectal malignancies was included. Comparison data with the general US population for the same time period were derived from the Centers for Disease Control (CDC) and Prevention's National Center for Injury Prevention and Control using the Web-based Injury Statistics Query and Reporting System (WISQARS). Ethics approvals were not needed for this study as the SEER database is nationally maintained and de-identified.

Patients

The study population was identified using International Classification of Disease Oncology (ICD-O) codes regarding colon and rectal malignancies. The demographic variables of interest included race/ethnicity, income, marital status, age at time of diagnosis and gender. Clinical variables assessed included disease grade/stage at diagnosis, primary site, receipt of surgical therapy, receipt of radiation therapy, and tumor histopathology [3]. Incidence of suicide was calculated as patients Dead of Suicide (DOS) versus Dead of Other Causes (DOC).

Statistical analysis

Models were constructed using backward analysis and removal of impertinent patient demographic variables, resulting in the best-fit model of use. A Fisher's exact test with mid-P method was used to create a confidence interval (CI) of 95% and thus calculate exact probability. Contingency tables and standardized mortality ratios (SMRs) were calculated in typical fashion [22]. Suicide rates (number of suicides/person-years of survival) were compared between our selected patients and the general population. These rates were matched to our demographic variables when applicable and compared across age groups. Multivariable logistic regressing models were further used to calculate odds ratios regarding detailed variables of CRC-associated with increased incidence of suicide. This regression analysis was exploratory in nature. The totality of statistical analysis was completed with SAS Statistical Software (Cary, NC), and figures were prepared with GraphPad Prism 6 (San Diego, CA).

Results

In reviewing the database, 1381 suicides among 884,529 patients were identified (see Table 1). SMRs were calculated in order to quantify the difference in mortality rates of the study population versus the general population. A SMR of 1.53 was

Table 1 Incidence of suicide among patients with colorectal cancer by demographic characteristics

Cancer site	No. of suicides	Person-years	Suicide rate per 100,000 person-years	Standardized mortality ratio	95% CI
Colorectal population	1381	4,747,322	29.00	1.53	1.13–1.33
Sex					
Female	203	2,391,968	0.06	4.24	3.69–4.86
Male	1178	2,355,354	0.34	1.35	1.28–1.43
Age, year					
≤ 39	38	136,243	0.19	2.15	1.54–2.91
40–49	74	374,792	0.14	0.58	0.46–0.72
50–59	20	69,484	0.20	1.25	0.79–1.90
60–69	38	120,796	0.22	1.57	1.13–2.14
70–79	53	140,511	0.26	1.8	1.36–2.33
≥ 80	1158	3,905,497	0.21	0.96	0.90–1.01
Race					
African-American	38	412,983	0.06	0.38	0.28–0.52
White	1263	3,955,442	0.22	1.77	1.68–1.87
Other	77	356,558	0.15	0.9	0.72–1.12
Unknown	3	22,338	0.09	–	–

noted between CRC patients and the general population (95% CI, 1.13–1.33), with 4.24 for females (95% CI, 3.69–4.86), 1.35 for males (95% CI, 1.28–1.43), 0.38 for African-Americans (95% CI, 0.28–0.52), 1.77 for Whites (95% CI, 1.68–1.87), and 0.90 for other races (95% CI, 0.72–1.12). Within the CRC population, Whites were significantly more likely to commit suicide than non-Whites (OR, 2.28; 95% CI, 1.89–2.75; $P < 0.001$), and males were significantly more likely than females (OR, 5.635; 95% CI, 4.85–6.54; $P < 0.001$). Notably, of the patients committing suicide, 1158 (84%) were over 80 years old. With regard to demographic factors, there was no statistically significant difference in suicide rate with respect to age, marital status, or median household income compared to the general population. Clinical factors such as surgical intervention, histologic subtype, or stage at diagnosis did not have a statistically significant relationship to suicide. However, patients with distal lesions, of either the rectosigmoid junction or rectum, were 52% more likely to commit suicide ($P < 0.0001$) than those with proximal cancers (95% CI, 1.32–1.76).

Discussion

In reviewing the findings, various population characteristics became distinctly associated with statistically significant risk of suicide in CRC patients. White males were more likely than non-White males to commit suicide with an OR of 2.28 and a CI of 1.89. This trend was also noted in their female counterparts. The results suggest that African-American race could be a protective factor for suicide, with an SMR of 0.38, in keeping with results from prior studies of suicide rates in patients with other types of malignancies [13, 23]. White males were the most likely population demographic to commit suicide, matching findings from the general population. However, females appear to be an at-risk population as well. With an SMR of 4.24, the female demographic was approximately four times more likely to commit suicide than a female without the diagnosis of colorectal cancer. This finding is supported by one study of suicide risk in patients with melanoma, where the SMR for females was 2.78 [23]. While the majority of suicides were in patients over the age of 80, this was not a statistically significant finding, contradicting previous studies that found older age to be a significant risk factor for suicide in cancer patients as well as the general population [11, 13, 16]. Socio-economic status (i.e., household income) and marital status were not shown to correlate with incidence of suicide in the CRC SEER population.

With regard to specific clinical variables of colorectal cancer itself, several noteworthy findings were noted. Histologic subtype and stage were not shown to be statistically significant factors in suicide rate. In addition, the stage of the lesion at time of diagnosis and the subsequent care (operative versus non-operative) were not shown to be associated with increased risk of suicide. Similar findings were noted in studies on suicide risk in patients with melanoma and thyroid cancer [23, 24]. Rather, the only notable significance was the location of the lesion, with distal lesions associated with increased suicide. This could potentially be related to differing symptoms between distal and proximal lesions, which in turn affect quality of life [25, 26]. This is surprising given that prior studies indicate stage of disease as the largest factor

decreasing quality of life in cancer patients [26]. As such, this provokes the question of patient education and how solid patients' understanding of this disease process is. If the incidence of suicide was not discernibly greater with increased stage/severity, then could it be possible that the diagnosis of colorectal cancer alone serves as a risk factor? Furthermore, this highlights the concern that this patient population may not be receiving proper education regarding aspects such as the disease process, treatments (both surgical and non-surgical), associated risks, and prognoses of the various histological subtypes and stages of CRC. Finally, given the recent improvement in surgical and adjuvant treatment for CRC and decreasing overall mortality, these patient deaths could be viewed as potentially preventable, as the cancer may not have proved fatal.

The presence of psychiatric disease and abusive histories is a well-described and strong risk factor for suicide [27]. One of the limitations of our study is that we were not able to evaluate these important comorbidities as they were not included in the database. Thus, we were unable to evaluate the role of potentially confounding characteristics that could influence the incidence of suicide in CRC patients. There is no evidence, however, that patients with colorectal cancer have a greater incidence of psychiatric comorbidities than the general population, and there are a vastly larger number of patients who commit suicide in the general population compared to patients with CRC. Additionally, we were unable to account for difference in health insurance status, pre-existing colorectal disease, or other comorbid conditions. Due to the large control sample from the CDC-WISQARS database, we feel any small degree of inherent bias concerning these risk factors and pre-existing comorbidities can be assumed to be negligible.

Conclusion

Our data suggests that suicide is an important, possibly preventable comorbidity in patients with CRC. Race and gender appear to influence suicide rates in patients with colorectal cancer. Females with colorectal cancer demonstrated approximately four times the suicide rate of the gender-matched population. Also, the research indicates that suicide incidence is a factor in this diagnosis without preference for stage or subtype, further implying the need for widespread screening in this at- risk population. The NCCN has recognized the need to give particular attention to the psychological experience of carrying a cancer diagnosis, particularly in the light of the positive impact that early identification and appropriate referral for psychosocial intervention can have on outcome [28]. The increased suicide risk in patients with CRC does not seem to be associated with poor prognosis or likelihood of mortality, highlighting the importance of a patients' full understanding of their diagnosis. The surgeon's office may often serve as the initial and/or only opportunity to fully explain diagnoses to patients, identify patients at risk, and implement appropriate interventions. Physicians need to be aware of the importance of this education and their role in aiding these patients. In addition to increased and improved communication between patient and physician, the results of the current study, coupled with further studies and analyses, could be used to formulate a comprehensive suicide risk scoring system for screening cancer patients. This scoring model could subsequently be incorporated into the existing NCCN Distress Management Guidelines already in place.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

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