

RESEARCH COMMUNICATION

Patients' Profile, Clinical Presentations and Histopathological Features of Colo-rectal Cancer in Al Hassa Region, Saudi Arabia

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Abstract

Background: Patients' demographics, presenting clinical and histopathological features for colo-rectal cancer (CRC) are important factors for patients' outcome and disease prognosis. This study aimed to describe the pattern of CRC in terms of patients' demographics, main presenting symptoms and histopathological features in Al Hassa region of Saudi Arabia. **Subjects and Methods:** A retrospective hospital records-based study which included reviewing of patients' records diagnosed with CRC at three general hospitals in Al Hassa region, Saudi Arabia. A compilation form was designed to collect information regarding socio-demographics, age at diagnosis; referral sites and the main presentations at CRC diagnosis. sites and the main presentations at CRC diagnosis. Histopathological reports were reviewed to delineate the main cytopathologic features, prominent cytological characteristics, the presence of predisposing pathology, and disease stage. **Results:** Of the 142 cases with CRC, 15.5% and 33.1% were affected before 40 and 50 years of age respectively. Emergency rooms were main referral sites for CRC cases (31.0%). Right colon was affected in 16.9% while left colonic lesions accounted for 62.7%. Intestinal obstruction was the main presentations (41.5%), and 26.1% presented with symptoms indicating distant metastatic lesions. Adenocarcinoma was the predominant pathological lesions (86.6%). Metastatic CRC was diagnosed in 62.7%. Duke's staging showed that 22.5% and 40.1% of lesions were classified into C and D categories respectively. **Conclusion:** Saudi patients with CRC present late with distant metastasis, and advanced disease stage. A sizeable proportion of patients developed the lesions at relatively young age. Screening recommendations should be enacted and revised in response to current change with younger age of affection.

Keywords: Colo-rectal cancer - presentations - histopathology - retrospective study - Saudi Arabia

Asian Pacific J Cancer Prev, 13, 211-216

Introduction

Colorectal cancer (CRC) is now the first and third most common cancer among males and females in Saudi Arabia (KSA). It has a progressive rise in age standardized rate (ASR) over last few decades in KSA. Despite this rise CRC has regional variations with lower incidences in Arab world as compared to Western countries (Al-Shamsi et al., 2003). This gap is narrowing quite rapidly. It is attributed to increase in predisposing factors along with decrease in protective mechanisms (Rozen et al 2005). Variations in these determinants are considered major factors leading to difference in distribution of CRC across the globe and within different regions of the country. An increased number of young patients with advanced CRC are reported in various studies across the world. Changes in type of CRC and subsite distribution are other global phenomena (Ponz de Leon et al., 2004).

Countries with economic transition are also going through transition in epidemiological patterns of CRC. Many studies from Middle East associated lifestyle, specially increased consumption of fruits, as a reason of low CRC prevalence as compared to developed countries (Rozen et al., 2011). A shift in pattern of CRC is expected due to shift in balance between these predisposing and protective factors. The disease pattern helps health care authorities to take public health measures and formulate screening recommendations. More than 50% of colorectal tumours can be detected with the flexible sigmoidoscope. Many innovative CRC screening methods are proposed based on its changing trends (He & Efron, 2011). If the 'subsite shift' is a true phenomenon, this might emphasize abandoning sigmoidoscopy and favoring pancolonoscopy or new modalities as the technique of choice for screening individuals at risk of colorectal cancer (Cancer Incidence Report Saudi Arabia, 2005). A changing pattern of CRC

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is reported in Saudi Arabia (Ibrahim et al., 2008). These studies were conducted in major tertiary care centre of mega Saudi cities (Isbister, 1992; Mansoor et al., 2002; Ibrahim et al., 2008). Al Hsa region in Eastern province is a mix of sub urban and rural population with a mix of traditional Arab and western living style. This study aimed to describe the pattern of CRC in terms of demographic features (patient characteristics, age & gender distribution), main presenting symptom and histopathological features (subsite distribution, cytological characteristics and staging) in Al Hsa region of Saudi Arabia.

Materials and Methods

Setting

Al-Hassa Governorate located in the Eastern Province of Saudi Arabia, 375 Km from Riyadh, populated with about one and half million Saudis. Al-Hassa is comprised of three regions: urban occupied by about 60% of the population, rural; composed of 6 major villages and occupied by 35% of the population and Hegar areas "Bedouin scattered communities" populated by the remaining 5%. Health care services are mainly provided through a network of Primary Health Care centers (n=54) and two general referral secondary level hospitals namely King Fahad (400 beds) and Prince Bin Jalawy (250 beds), serving around 85% of the population. Other health care facilities include ARAMCO and National Guard Health facilities serving the rest of the population of Al Hassa.

Setting and Design

A retrospective hospital records-based study which included review of patients' records diagnosed with CRC at three general hospitals in Al Hassa region KSA, namely: King Fahd, Prince Bin Jalawy and National Guard Hospitals. The three hospitals provide a secondary level of care and serve about 1.5 million population. All available patients' records from January 1st year 2004 to December 31st 2009 were reviewed and included.

Data collection

A compilation form was designed to collect the necessary information regarding the following items: Socio-demographics including: name/patient's ID registry, residence, gender and nationality of patients diagnosed with CRC. Patient's age at diagnosis of CRC, health facilities responsible for referral and the main presentation at diagnosis were also collected. Histopathological reports were reviewed to delineate the main cytopathologic features, sub-site affection, prominent cytological characteristics the lesions, the presence of any predisposing pathology, and disease stage. Sub-site distribution of the included lesions was based on those proposed by Chatter-Cora et al (Chatter-Cora et al 2002).

The International classification of diseases for oncology (3rd edition) (International Classification of Diseases for Oncology; ICD-O-3 2000) was used to classify the reviewed lesions (International Classification of Diseases for Oncology, 3rd Edition (ICD-O-3).

Data processing and analysis

The total records available were 151, but with regard to data completion, 142 records were included for final analysis (records of 7 males and 2 females were discarded due to deficient records and/or absence of histopathology reports). Data were entered and processed using SPSS version 16.0 (SPSS Inc. Chicago, IL). For categorical data, proportions, frequency and percentage were used for expression; Fisher Exact, Chi square and Z test for proportions were employed for comparison. Continuous data were expressed using median, mean and standard deviation. P value < 0.05 was considered significant.

Ethical considerations

Permissions were obtained from King Faisal University as well as from the authorities of the included hospitals after approval of the study protocol and data compilation form. Data confidentiality was maintained all through the study.

Results

The age at diagnosis of the included patients ranged from 16 to 90 years (mean of 54.8±14.5 years). Table

Table 1. Colo-rectal Cancer Patients' Characteristic in Relation to Gender, Al Hassa, Saudi Arabia

Characteristics	P value	Total No. (%) (N=142)	Gender	
			Females (N=73)	Males (N=69)
Hospital included:				
King Fahd		70(49.3)	38(52.0)	32(46.4)
Prince Bin Jalawy		44(31.0)	21(28.8)	23(33.3)
National Guard		28(19.7)	14(19.2)	14(20.3)
Nationality:				
Saudi	0.215 ^a	135(95.1)	71(97.3)	64(92.8)
Expatriates		7(4.9)	2(2.7)	5(7.2)
Age groups:				
	0.745 ^b	54.5±14.5 (54.0)	55±11 (52.0)	54±18 (55.0)
< 40 years	0.007 ^c	22(15.5)	5(6.8)	17(24.6)
40- <50 years	0.243 ^c	25(17.6)	16(21.9)	9(13.1)
50- <60 years	0.244 ^c	45(31.7)	27(37.1)	18(26.1)
≥ 60 years	0.942 ^c	50(35.2)	25(34.2)	25(36.2)
Referral site:				
Emergency	0.684 ^d	44(31.0)	21(28.8)	23(33.3)
Primary health care	0.942 ^c	24(16.9)	13(17.8)	11(16.0)
Outpatient hospital clinics				
	0.894 ^c	19(13.4)	10(13.7)	9(13.1)
Private polyclinics	0.246 ^c	11(7.7)	8(11.0)	3(4.3)
Private hospitals	0.246 ^c	11(7.7)	4(5.4)	7(10.1)
None specified	0.853 ^c	33(23.3)	17(23.3)	16(23.2)
Co-morbidities*:				
	0.978 ^c	36(25.4)	18(24.7)	18(26.1)
Diabetes (type 2)		7(4.9)	4/73	3/69
Diabetic+ hypertensive		7(4.9)	4/73	3/69
Bronchial asthma + diabetes		4(2.8)	2/73	2/69
Coronary heart disease		4(2.8)	1/73	3/69
Obstructive lung disease		1(0.7)	-	1/69
Previous cerebral stroke		2(1.4)	-	2/69
Cholelithiasis		6(4.2)	6/73	-
Ulcerative colitis		3(2.1)	--	3/69
Peptic ulcer disease		2(1.4)	1/73	1/69

^aFisher exact test; ^bt test; ^cZ test for proportion; More than one morbid condition can exist

Table 2. Colo-rectal Sub-site Affected with Age at Diagnosis and Main Clinical Presentation in Relation to Gender of the Included Patients.

Sub-site affection and presentation.	Age in years		P value*	Total	Gender:	
	Mean ± SD	Med			Females (N=73)	Males (N=69)
Sub-site affected:						
Cecum and terminal ileum	54±12	56	0.77	8(6)	5(7)	3(4)
Right colon	57±18	59	0.93	9(6)	4(6)	5(7)
Hepatic flexure	50±15	58	0.39	7(5)	2(3)	5(7)
Transverse colon	67±4	66	--	2(1)	--	2(3)
Splenic flexure	70±14	71	0.7	4(3)	2(3)	2(3)
Left colon	50±15	50	0.1	33(23)	22(30)	11(16)
Sigmoid	50±14	50	0.6	26(18)	15(21)	11(16)
Recto-sigmoid	58±12	56	0.1	26(18)	9(12)	17(25)
Rectum	60±15	57	0.9	25(18)	12(17)	13(19)
Ano-rectal	56±10	55	--	2(1)	2(3)	-
Main clinical presentations**:						
Intestinal obstruction ± Abd. pains	Mass ± Mass	Ascitis ± Jaundice	Hepatomegaly			
--	--	0.04	59(41.5)	37(50.7)	22(31.9)	
Bleeding per rectum	Tenismus	± Mass				
--	--	0.67	10(7.0)	4(5.5)	6(8.7)	
Lung lesions with pleural effusion						
--	--	0.15	16(11.3)	5(6.8)	11(15.9)	
Pelvic mass + weight loss						
--	--	0.63	6(4.2)	2(2.7)	4(5.8)	
Sepsis, Abscesses, Skin sinus, vaginal fistula						
--	--	0.67	15(10.6)	9(12.3)	6(8.7)	
Dehydration with prolonged vomiting						
--	--	0.92	11(7.7)	6(8.2)	5(7.2)	
Convulsions with lateralizing signs						
--	--	0.57	4(2.8)	1(1.4)	3(4.3)	
Enlarged inguinal lymph nodes						
--	--	0.96	3(2.1)	2(2.7)	1(1.4)	
Unspecified						
--	--	0.96	3(2.1)	1(1.4)	2(2.9)	
--	--	0.55	9(6.3)	6(8.2)	3(4.3)	

*Z test for proportions; **Not mutually exclusive

1 shows that out of 142 patients' records included, males constituted 48.6%. Males were slightly younger compared to females. Saudis represented the majority of cases; all of the included patients were residents of Al Hassa. According to age groups classification, males were significantly affected at young age as 24.6% were < 40 years of age (P=0.007). Females showed a higher but non-significant predominance within the age group of 40-<50 years (21.9% vs. 13.1% among males). Also, the table shows that 33.1% of CRC developed before 50 years of age. Emergency rooms were main referral sites for CRC cases (31.0%), followed by Primary Health Care centers (16.9%) and outpatient clinics (13.4%) while private sector was responsible for referral of 15.4%. Recorded co-morbid disease conditions accounted for 25.4% of cases without significant difference in relation to gender.

Table 2 depicts sub-site affection of CRC in relation to gender. Right colo-rectal lesions (cecum, ascending and hepatic flexure) represented 16.9% of the encountered lesions while left colon affected (splenic flexure, descending, sigmoid, recto-sigmoid) accounted for 62.7%. Left colon, sigmoid and rectosigmoid accounted

Table 3. Encountered Predisposing Pathological Lesions, Histopathological Features and Sites for Metastasis of Colo-rectal Cancers in Relation to Gender and Age.

Variables	Age		P value*	Total	Gender:	
	Mean ± SD	Med			Females (N=73)	Males (N=69)
Predisposing lesions:						
Polyps	42±6.1	45	0.888	21(15)	10(14)	11(16)
Villous adenoma	67±3.5	66		6(4)	4/10	2 / 1 1
Tubular adenoma	54±6.8	55		3(2)	2/10	1/11
Tubulovillous adenoma	58±9.9	58		5(4)	2/10	3/11
Ulcerative colitis	66±8.7	60		4(3)	2/10	2/11
Histopathological features:						
- Adenocarcinoma	56±14.1	55.5	0.9	123(86.6)	64(87.7)	59(85.5)
Moderately differentiated	54±14.1	52	0.8	97/123	51/64	46/59
Poorly differentiated	51±12.1	54	0.7	12/123	5/64	7/59
Well differentiated	64±16.0	60	0.9	11/123	5/64	6/59
With mucoid changes	52±10.3	48.5	--	3/123	3/64	--
- Mucinous carcinoma	33±20.7	20	0.9	5(4)	2(3)	3(4.3)
- Signet cell carcinoma	61±13.3	67	0.9	5(4)	2(3)	3(4.3)
- Squameous cell carcinoma	69±8.9	69	0.7	4(3)	2(3)	2(3)
- Colloid carcinoma	--	59.5	--	2(1)	2(3)	--
- Non Hodgkin lymphoma	65±7.4	63	1.0	3(2)	1(1)	2(3)
Metastasis:						
	59±5.8	59	1.0	89(63)	46(63)	43(62)
- Liver	--	-	0.9	11(12)	5/46	6/43
- Lungs	--	-	0.9	7(8)	3/46	4/43
- Peritoneum	--	-	1.0	36(40)	19/46	17/43
- Brain	--	-	1.0	3(3)	2/46	1/43
- Pelvis	--	-	0.9	24(27)	13/46	11/43
- Inguinal lymph nodes	--	-	1.0	3(3)	1/46	2/43
- Multiple sites	--	-	1.0	5(6)	3/46	2/43
Duke's classification:						
A	--	-	0.9	17(12)	9(12)	8(12)
B	--	-	1.0	36(25)	18(25)	18(26)
C	--	-	1.0	32(23)	17(23)	15(22)
D	--	-	0.9	57(40)	29(40)	28(41)
TNM classifications:						
Grade I	--	-	0.7	15(11)	9(12)	6(9)
Grade II	--	-	0.9	43(30)	23(32)	20(29)
Grade III	--	-	0.8	33(23)	16(22)	17(25)
Grade IV	--	-	0.8	51(36)	25(34)	26(38)

* Z test for proportions

for 59.9% of CRC cases. Sub-site distribution displayed no significant difference in relation to gender. Left colon and sigmoid lesions occurred at relatively younger age

Table 4. Colo-rectal Cancer in Relation to Age Distribution of the Included Subjects From the Three Health Facilities

Characteristics	P value	Age at diagnosis of colo-rectal cancer: No. (%)	
		≥40 years (N=120)	<40 years (N=22)
Gender:			
Male	0.003 ^a	52(42.6)	17(77.3)
Female		68(57.4)	5(22.7)
Nationality:			
Saudis	--	113(92.6)	22(100.0)
Expatriates		7(7.4)	--
Sub-site affected:			
Right colon	0.967 ^b	13(10.8)	3(13.6)
Transverse colon/ flexures	0.694 ^b	11(9.2)	2(9.1)
Left colon	0.208 ^b	26(21.7)	8(36.4)
Sigmoid	0.750 ^b	21(17.5)	5(22.7)
Recto-sigmoid	0.110 ^b	47(39.2)	4(18.2)
Ano-rectal	--	2(1.7)	--
Histopathological features:			
Adenocarcinoma	0.419 ^b	99(82.5)	20(90.9)
Moderately differentiated	0.682 ^b	80/99	16/20
Poorly differentiated	0.298 ^b	8/99	4/20
Well differentiated	--	10/99	--
With mucoid changes	--	1/99	--
Mucinous carcinoma	0.147 ^b	1(0.8)	2(9.1)
Signet cell carcinoma	--	3(2.5)	--
Others	--	17(14.2)	--
Metastasis at diagnosis:			
Local	0.151 ^b	31(25.8)	2(9.1)
Distant	0.112 ^b	36(30.0)	11(50.0)
None	0.960 ^b	53(44.2)	9(40.9)
TNM classification:			
Grade I	--	15(12.6)	--
Grade II	0.934	37(30.8)	6(27.3)
Grade III	0.831	28(23.3)	5(22.7)
Grade IV	0.209	40(33.3)	11(50.0)

^aFisher Exact, ^bZ test for proportions

compared (median of 50.0 years) to right colonic tumors. Splenic flexure and transverse colon lesions occurred at relatively older age compared to other sub-site lesions (median of 66.0 and 71.0 years respectively). Intestinal obstruction with abdominal mass were the main presenting clinical presentations (41.5%) and it was higher among

females (P=0.035), 26.1% of the included CRC cases presented with symptoms indicating distant lesions (brain, lung, perineum, iliac fossae abscesses, sinus and fistula formation) and they were more among males (30.3%) compared to females (21.9%) but without statistical significant difference (P=0.342), bleeding per-rectum with or without abdominal or pelvic mass were also common presentation (11.3%) among the included CRC cases.

Table 3 demonstrates the encountered predisposing pathological lesions, histopathological features, the frequency and distribution of metastatic lesions, and Duke's classification. Predisposing pathological lesions were encountered in 14.8% of CRC in the form of polyposis, villous tubular and tubulovillous adenoma (15.9% in males vs. 13.7% among females), ulcerative colitis was diagnosed in three males (2.1%). Adenocarcinoma was the predominant pathological lesions encountered representing 86.6% of the encountered lesions. Well differentiated adenocarcinoma occurred at older age compared to other adenocarcinomas categories while adenocarcinoma with mucoid changes occurred at relatively younger age and exclusive to females. Mucinous carcinoma occurred at very young age (median of 20.0 years) compared to any other lesions encountered. Signet cell carcinoma and squameous cell carcinoma occurred among higher age groups (median of 67.0 and 69.0 years respectively).

Metastatic CRC was diagnosed in 62.7% of cases, mostly involved peritoneum, pelvis, liver, and lungs. There was no significant difference in relation to the patient's gender. Duke's staging showed that 22.5% and 40.1% of lesions were classified in C and D categories respectively. Those classified in A or B categories were accounted for 37.4% with no significant difference in relation to patient's gender.

Table 4 depicts CRC lesions in relation to age of the included patients. Those with CRC < 40 years were predominantly males, exclusively Saudis with more left colon and sigmoid sub-site affections compared to those who developed the CRC lesions at ≥ 40 years. Poorly differentiated adenocarcinomas were the predominant histopathological lesions encountered among those < 40 years (20.0% vs. 8.1% of cases ≥ 40 years). Distant metastases were also more frequent among the young age group (50.0% compared to 30.0%).

Table 5. Colo-rectal Cancer in Relation to Age Distribution of the Included Subjects From the Three Health Facilities.

Histopathology	Sub-sites: No. (%)								
	Rectum	Recto-sigmoid	Sigmoid	Left colon	Splenic flexure	Transverse Colon	Hepatic flexure	Right colon	Cecum
Adenocarcinoma	19/25	14/26	15/26	26/33	2/4	2/2	6/7	8/9	5/8
Adenocarcinoma	2/26	2/26	4/26	1/33	-	-	1/7	-	1/8
Adenocarcinoma	2/25	4/26	3/26	1/33	1/4	-	-	-	-
Adenocarcinoma	1/25	1/26	-	1/33	-	-	-	-	-
Mucinous carcinoma	-	1/26	1/26	2/33	-	-	-	-	-
Squameous cell carcinoma	-	2/26	2/26	-	-	-	-	-	-
Non-Hodgkin's lymphoma	-	-	-	-	-	-	-	1/9	2/8
Signet cell carcinoma	-	1/26	1/26	2/33	1/4	-	-	-	-
Colloid carcinoma	1/25	1/26	-	-	-	-	-	-	-
Total	25(17.6)	26(18.3)	26(18.3)	33(23.2)	4(2.8)	2(1.4)	7(4.9)	9(6.3)	8(5.6)

Table 5 displays the encountered histopathological lesions in relation to sub-site. Poorly differentiated adenocarcinoma showed some predilection to sigmoid, lesions at both right and transverse colon were predominantly moderately differentiated adenocarcinoma, and non-Hodgkin's lymphomas affected the cecum and terminal ileum. Signet cell carcinomas were exclusively affecting the left colon, colloid carcinoma affecting rectosigmoid and rectal sub-sites.

Discussion

CRC has a tendency to increase with advancing age along with fairly rare incidence below 40 years of age, especially in western world (Ponz de Leon et al., 2004). This increasing trend with age is seen in this study as well. However, a significant number of young males (<40 years) has been diagnosed with CRC. CRC at young age is usually associated with predisposing factors e.g. ulcerative colitis (UC), which is not the case here as only three male patients had predisposing comorbidity of UC and very few have predisposing pathological conditions. Early detection of CRC is also a manifestation of either a good screening program or a serious main presenting complaint e.g. bleeding per rectum. Unfortunately there is a lack of proper screening program in Saudi Arabia. Therefore it seems reasonable that a change in dietary pattern with genetic predisposition is causing a sub site colonic involvement leading to serious main presenting complaint in young males.

Left side of colon is the predominant site of CRC in both genders. However, the sub-site stratification is different between males and females. Proximal left colon is more common site in young and females, while rectosigmoid is the main site for males. A tertiary care center reported the same trend of young age at the time of presentation and gender differences in sub site distribution (Guraya & Murshid, 2004).

The higher ASR among more urban regions of Saudi Arabia is reported in Saudi Cancer Registry (Cancer Incidence Report Saudi Arabia, 2005), favoring this rise more to environment rather than aging process. There are some but non-significant gender differences in presentation and cancer staging. Adenocarcinoma is most common variety as reported by other studies. Isbister compared the CRC between Saudi and New Zealand patients and reported more aggressive pattern in Saudi Arabia (Isbister, 1992). More advanced cancer stages, among both genders, are reported in this study. Despite the data is gathered from secondary centers, majority of patients presented with advance Duke's stage. Mansoor et al. (2002) reported from urban center of Jeddah, 28.9 and 5.6% of Duke's C and D respectively, which is much less than our study. This emphasizes the need to enhance early detection by proper screening. Rozen et al. (2011) also reported this changing pattern in Arabs with more and aggressive left sided CRC.

All these changing trends of increase in incidence, detection at young age, advance stage at the time of presentation and variation in sub site distribution are

resulting from myriad of factors. Ibrahim et al. (2008) postulated correlation of changing trends in incidence and mortality of CRC with high and low rates areas, globally. The incidence is increasing much faster in areas where rate was formerly low, as in case of KSA. Al Jabreen has reported in his study in 2007 at one tertiary hospital in Riyadh that only 22% of CRC lesions were localized, 36% were presented with distant metastasis and 45% were presented with large bowel obstruction. The previously mentioned findings along with ours are far higher than those reported from the Western countries where only 18% had distant metastasis and only 8% with obstruction (Reis et al., 2000), but comparable to the situation of CRC in other ethnic population in U.S (Stefanidi et al., 2006).

Another important finding was that 15.5% and 33.1% of CRC were diagnosed in patients < 40 and < 50 years of age respectively, a figure which is far higher than those reported from Western populations (Reis et al., 2000; Stefanidi et al., 2006). Nevertheless, this finding is comparable to other studies carried out in Saudi Arabia, suggested the possibility for the presence of a familial risk factors for the development of CRC among Saudis for which more controlled and validated studies are warranted (Mansoor et al., 2002; Al Jabreen, 2007). The current recommendation for CRC screening at the age of 50 would be of very questionable reliability as a high proportion of those patients will not be diagnosed by the time of the proposed screening (Mansoor et al., 2002; Ibrahim et al., 2008).

Apart from the advanced and aggressive (poorly differentiated adenocarcinoma), more distant metastasis at presentation) nature of CRC lesions at younger age (<40 years), our study did not demonstrate significant differences in relation to other variables included. Al Jaberi and his coauthors reported that 68% of Jordanian CRC patients were younger than 40 years and had advanced lesions (Duke's C or D) compared to 40.0% of those > 40 years (Al Jaberi et al., 1997).

Another important finding of this study is the role of primary care in the early detection of CRC; several barriers in the developing as well as in the developed countries have operated against the proper implementation and yield of CRC screening including resources, lack of proper health education, fears among others (Provenzale & Gray, 2004). CRC screening in Saudi Arabia could be facilitated by information systems that readily identify patients who are due (with higher risk) for screening and track test results. Physicians, especially those at the primary level, may also increase screening by educating patients about cancer along with the rationale and options for screening for early lesions.

Acknowledgements

This is a hospital records-based study with an inherent limitation in paucity of items to be included especially along the domain of socio-demographics, time to diagnosis, reason for diagnostic delays, first clinical symptoms and signs, other relevant investigations and family history for cases with CRC.

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