RESEARCH COMMUNICATION

Pattern of Cancer in Adolescent and Young Adults - A Ten Year Study in India

R Kalyani*, Subhashish Das, ML Harendra Kumar

Abstract

Background: Cancers in adolescent and young adults are different from those in older adults and are more likely to relate to genetic predisposition and exposure to risk factors early in life. They also have the greatest impact on those individuals who have most of their potential years of life ahead of them. Objective: To determine the incidence and pattern of cancers in adolescent and young adults. Methodology: A ten year retrospective study from January 1997 to December 2006 was performed at the Department of Pathology. All malignancies diagnosed between the ages of 15-44 years were retrieved from our records and socioepidemiological data regarding each case were collected from the hospital record section. The cases were analyzed for incidence, site of involvement, age /sex distribution and year wise distribution by descriptive analysis. Results:In this study, cancer in adolescent and young adults accounted for 26.6% of all the cancers diagnosed. Maximum cases were seen between 35-39 years age group in both genders. The male: female ratio was 1:2. Year wise there was steady rise in number of cases from 1997 to 2006 in both genders. The top five common sites in males were cancer of mouth, stomach, testis, bone & penis and in females were mouth, cervix uterus, breast, thyroid & stomach. Conclusion: In the present study, cancer of mouth predominated in both genders, followed by stomach in males and cervix uterus and breast in females, reflecting potential lifestyle and environmental factors.

Keywords: Adolescent and young adults - cancer pattern

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Introduction

The patterns of cancer in adolescents and young adults (AYA) are unique and differ from those in children and older adults (Californian study, 2006). The cancers involved are more likely related to genetic predisposition, specific health behavior / lifestyle among young people exposing themselves to causative agents (Canadian study., 2003, Xiaocheng et al., 2005). When diagnosed, AYA suffer from adverse psychosocial effects (Vickie Williams, 2005). The incidence of those affected is increasing rapidly although this has not been much focus of attention in cancer control and prevention (Xiaocheng et al., 2005).

Materials and Methods

A ten years retrospective study from January 1997 to December 2006 was undertaken at department of Pathology. All the histopathology and fine needle aspiration cytology (FNAC) cases reported between age group of 15-44 as malignant cases were included in this study. Multiple specimens of a patient, especially where FNAC was done followed by histopathology were considered as one case. Only those FNAC cases which were not followed by histopathological study were counted separately. All hematological malignancies were excluded. The relevant history and clinical findings of each case were retrieved from records. Cases lacking relevant clinical information were excluded. The diagnoses of each case were critically revised, confirmed and the cumulative data was then categorized and coded according to ICD 10 WHO ISCD 1994 as in Table 1 (Nandakumar et al., 2004). The metastatic cancers of unknown primary were grouped separately. The cases were analyzed for age, sex, year wise, top ten common cancers and histologically as epithelial and non-epithelial cancers by descriptive analysis using SPSS Software 15. The findings were compared with other similar studies. Ethical clearance was obtained for conducting this study.

Table 1. Cases Reported at Dept. of Pathology (Jan 1997 to Dec. 2006)

Total No. of Cases Reported in 10 Years	19615	
Histopathology	15307	
FNAC	4308	
Total malignancies reported	2744	(13.98%)
Total malignancies in AYA	730	(26.6%)
Males	242	(33.1%)
Females	488	(66.8%)
Male : Female	1 : 2	

Malignancies :
With known primary site ; Males (200) + Females (441) = 641
With unknown primary site : Males (42) + Females (47) = 89

*Department of Pathology, Sri Devaraj Urs Medical College, Kolar, Karnataka, India * For correspondence : drkalyanir@rediffmail.com*

Table 2. Site Distribution of Various Cancers (ICD - 10 - WHO ISCD 1994)

ICD Code	Site of Malignancy	Males		Females		Total	
		Cases	%	Cases	%	Cases	%
C06	Mouth	50	20.66	127	26.02	177	24.24
C07/08	Salivary Gland	7	2.89	3	0.61	10	1.36
C15	Esophagus	6	2.47	13	2.66	19	2.60
C16	Stomach	33	13.63	22	4.50	55	7.53
C17	Small Intestine	1	0.41	-	-	1	0.13
C18	Colon	9	3.71	2	0.40	11	1.50
C19/20	Rectum	3	1.23	8	1.63	11	1.50
C22	Liver + Hepatobiliary ducts	6	2.47	1	0.20	7	0.95
C26	Other GI	-	-	1	0.20	1	0.13
C32	Larynx	6	2.47	1	0.20	7	0.95
C34	Lung	4	1.65	3	0.61	7	0.95
C 38	Pleura, Mediastinum, Heart	-	-	1	0.20	1	0.13
C40/41	Bone	13	5.37	20	4.09	33	4.52
C43	Melanoma	4	1.65	2	0.40	6	0.82
C44	Other Skin Cancer	2	0.82	6	1.22	8	1.09
C50	Breast	2	-	62	12.70	64	8.76
C51	Vulva	-	-	1	0.20	1	0.13
C52	Vagina	-	-	5	1.02	5	0.68
C53	Cervix Uterus	-	-	90	18.44	90	12.32
C54	Corpus Uterus	-	-	2	0.40	2	0.27
C56	Ovary	-	-	13	2.66	13	1.78
C57	Other FGO	-	-	1	0.20	1	0.13
C60	Penis	10	4.13	-	-	10	1.36
C61	Prostate	1	0.41	-	-	1	0.13
C62	Testis	14	5.78	-	-	14	1.91
C64	Kidney	1	0.41	-	-	1	0.13
C67	Bladder	4	1.65	5	1.02	9	1.23
C73	Thyroid	7	2.89	49	10.04	56	7.67
C81	Hodgkin's lymphoma	8	3.30	6	1.22	14	1.91
C82	Non-Hodgkin lymphoma	9	3.71	5	1.02	14	1.91
C80	Unknown Primary / Metastatis	42	17.35	47	9.63	89	12.19
	Total	242	100	488	100	730	100

Results

Tables 1 and 2 shows that among 19,615 cases of histopathology and FNAC reported a total of 2744 (13.98%) were malignant of which 730 cases (26.6%) were cancers of AYA. Males accounted for 242 cases (33.1%) and females 488 cases (66.8%) with M:F ratio being 1:2. Of 730 cancer cases, 89 cases were metastatic cancers of unknown primary site.

Table 3 reveals that between 15-44 years maximum cases were seen between 35-39 years age group. In both gender maximum cases were between 35-39 years age

Table 3. Cancer in various Age Groups in relations to Sex

Sl.No.	Age Group	Males	Females	M : F
1	15-19	9	10	1:1.1
2	20-24	20	31	1:1.5
3	25-29	32	40	1:1.25
4	30-34	24	73	1:3.04
5	35-39	80	147	1:1.85
6	40-44	77	86	1:2.41
	Total	242	488	1:2

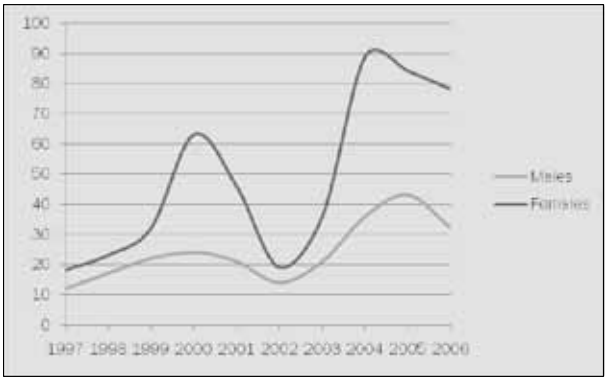

Figure 1. Distribution of Cancer by Year and Sex

Table 4. Top Ten Cancers in Males, Females and Combined in present study

Sl.No.	Males		Females		Combined	
	Site	%	Site	%	Site	%
1	Mouth	20.66	Mouth	26.02	Mouth	24.24
2	Stomach	13.63	Cervix Uterus	18.44	Cervix Uterus	12.32
3	Testis	5.78	Breast	12.70	Breast	8.76
4	Bone	5.37	Thyroid	10.04	Thyroid	7.67
5	Penis	4.13	Stomach	4.50	Stomach	7.53
6	Colon	3.71	Bone	4.09	Bone	4.52
7	NHL	3.71	Esophagus	2.66	Esophagus	2.60
8	Hodgkin's lym.	3.30	Ovary	2.66	Testis	1.91
9	Thyroid	2.89	Rectum	1.63	NHL	1.91
10	Salivary gland	2.89	Hodgkin's lym	1.22	Hodgkin's lym	1.91

Table 5. Top Five Cancer Sites in Different age Groups

	15-19	20-24	25-29	30-34	35-39	40-44	45+
Males	Hodgkin's lym	Bone	Stomach	Testis	Mouth	Mouth	Mouth
	Salivary gland	Mouth	Testis	Hodgkin's lym	Stomach	Stomach	Stomach
	Testis	Thyroid	Mouth	penis	Testis	NHL	Esophagus
	Penis	Colon	Bone	Mouth	penis	Colon	Prostate
	Lung	Liver	Colon	Bone	Bone	Salivary Gland	Bladder
Females	Thyroid	Thyroid	Thyroid	Breast	Mouth	Mouth	Mouth
	Bone	Mouth	Cervix	Thyroid	Cervix	Cervix	Cervix
	Hodgkin's lym	Bone	Mouth	Mouth	Breast	Breast	Breast
	Rectum	Stomach	Bone	Cervix	Thyroid	Esophagus	Stomach
		Breast	Stomach	Stomach	Bone	Stomach	Esophagus

group. In general there is a steady rise in number of cases between 15-19 year age group to 35-39 years age group. In all age groups there is preponderance of females. The year wise distribution showed there was a relatively steady rise in number of cases from 1997 to 2006 in both genders (Figure 1).

Table 4 shows common top ten cancers in males, females and in combined. Cancer of mouth predominates in both genders. In males it was followed by stomach cancer whereas in females the next common was cancer of uterine cervix, breast, thyroid and then stomach. Table 5 shows further classification of cancers into epithelial and non-epithelial with age groups in which there was early onset of epithelial tumors in both genders which predominated from 20-24 years age group.

Discussion

The unique trends and patterns of cancers in AYA define risk factors (Canadian study, 2003). The evolving hormonal milieu, maturing development, transitions in anatomy, increase demand in work place, family responsibility and acquiring new lifestyle and habits in a particular region before the old do and also the short period of exposure between the beginning of life and cancer diagnosis giving rise to unique cancer pattern in AYA (Canadian study, 2003; Xiaocheng et al., 2005; Conrad et al., 2006). When diagnosed, AYA suffer from adverse psychosocial effects as most of their potential years of life ahead of them has to be spent with effects of cancer, its treatment or tragically shortened lives with major repercussions on their families and society in general (Canadian study, 2003; Vickie, 2005). Our hospital caters to the local population of Kolar district and also parts of neighboring districts i.e., the borders of Andra Pradesh and Tamil Nadu which has influenced the food habits and lifestyle of the people. The food is very spicy. Rice and ragi are the staple food. There is increase use of tobacco and alcohol in both genders with onset of this habit at very young age especially in low socioeconomic group. Majority of our patients belong to low socioeconomic group with rural background.

The incidence of AYA cancer reported is 8.7% (Canadian study, 2003). Each year 500 males and 350 females are diagnosed in California. The incidence increase in males by 0.75% per year and in females 0.5% per year in Bangladesh (Talukder et al., 2007). Cancer of AYA is 2.7 times more common than cancer of less than 15 years and less common than cancer in older age groups (Archie et al., 2006). The incidence is increasing faster than the increase in either children or older adults and not been much focus of attention in cancer control and prevention (Xiaocheng et al., 2005). Considering racial distribution in cancers of AYA, highest cancer rate is reported in non-Hispanic whites, whereas Asian, American, Indians and Alaska natives has lowest rate (Californian study, Archie et al., 2006). In our study the incidence is 26.6% of total cancers with a steady rise in

Table 6. Top Ten Cancer sites in Various Studies Compared to Present Study

Sl.	Canada 2002 [2]	California 2005 [3]	US 2006 [12]	Present Study
1	Breast	Breast	NHL	Mouth
2	Testis	Thyroid	Hodgkin's lym	Cervix
3	Melanoma	Melanoma	Skin Cancer	Breast
4	Cervix	NHL	MGS	Thyroid
5	NHL	Hodgkin's lym.	Endocrine	Stomach
6	Thyroid	Leukemia	FGS	Bone
7	Colorectal	Colorectal	CNS	Esophagus
8	Lung	Brain	Leukemia	Testis
9	Brain	Nervous Sys.	Breast	NHL
10	Hodgkin's lym	Testis	GIT	Hodgkin's lym

number of cases over 10 years.

Mean age of cancer in AYA reported is 34.5+6.3 years (Talukder et al., 2007). Non Hodgkin's lymphoma increase and sarcoma decrease with age (Californian study, 2006). The risk factors responsible in this age group are infection, adolescent growth spurts, hormones, growth and development factors associated with genetic predispositions (London, 2006). This is the age of cross over from predominance of non-epithelial cancers in childhood to predominance of epithelial cancers in older adults (Xiaocheng et al., 2005). In this study maximum cases were seen between 35-39 years age group in both gender.

Majority of the study shows female preponderance with incidence in males of 30-42% and females 57-62% because of more female cancers of female genital organs, breast and thyroid (Canadian study, 2003; Xiaocheng et al., 2005; Californian study, 2006; Talukder et al., 2007). Male : female ratio reported is 0.75 : 1.0 / 1.2 (Canadian study, 2003; Talukder, 2007). Male : Female ratio is reported to decrease linearly from 10-14 years age group to 40-44 years age group (Archie et al., 2006). The transition of male predominance in childhood to female predominance in middle years of life occurs during late adolescent and early adulthood with maximum cases in males between 15-29 years (Archie et al., 2006). Our study showed female preponderance (in all age groups) with male : female ratio of 1:2, incidence in males was 33.1% and in females was 66.8%.

Table 6 shows site distribution of top ten cancers in various studies and the frequency of non-epithelial cancers compared to present study in which top five cancers are epithelial type (Canadian study, 2003; Xiaocheng et al., 2005; Californian study, 2006). The pattern of cancer in other studies is that of affluent society type whereas the pattern in our study was of low socioeconomic group type.

Histologically epithelial cancers predominate in males after 40 years and in females after 25 years (Xiaocheng et al., 2005). The predominance of epithelial or non-epithelial cancers gives clue to etiology (Xiaocheng et al., 2005). Non-epithelial cancers risk factors are viral, infection, radiation, genetic and environmental chemical carcinogens where as those of epithelial are lifestyle factors as tobacco use, alcohol consumption and dietary factors which begin in early age / adolescence and the effect emerge in adulthood (Xiaocheng et al., 2005; Archie et al., 2006). However family history of cancer and genetic predisposition may shorten latency period and increase likelihood of early onset of epithelial cancers as environmental carcinogens per se have not had enough time to induce acquired mutations that lead to overt cancer in AYA (Xiaocheng et al., 2005; Archie et al., 2006). The occurrence of second malignant neoplasm increases the incidence of cancers in AYA (Archie et al., 2006). Our study showed early onset of epithelial cancers in both gender which began in 20-24 years of age indicating the effect of lifestyle factors and also probably the onset of these habits at a very early age. The striking feature in this study is oral cancer which predominates in both gender followed by upper gastrointestinal cancers.

A study reported that primary cancer of esophagus in AYA present at advanced stage with increased rate of incomplete resection / recurrence and poor disease free survival which is because of delayed diagnosis (Patil et al., 1992). Rates of colon and rectal cancers are increasing in young adults; however prevention and screening programmes target only older people.

A western study reported that incidence of cancer cervix will be leveled off when white women reach their 30's because of better detection and treatment for insitu lesions whereas in black women the rate continued to rise with advancing age because of continued increased exposure to HPV (Xiaocheng et al., 2005). In this study, in females following cancer of oral cavity are cancers of uterine cervix, breast and thyroid. Cancers of breast in AYA usually has strong genetic predisposition (Xiaocheng et al., 2005). The mean age was 34.1 in young females and 51.4 in females above 40 years of age with 83.5% incidence of infiltrating duct carcinoma in AYA and that in older females 86.1% (Malik et al., 2003). In our study breast cancer stood top between 30-34 years. The increase in thyroid cancer among females begins at 15-19 years and is associated with puberty, pregnancy and menstrual cycles which stimulate thyroid gland for increase cell replication (Xiaocheng et al., 2005). Incidence of clinical thyroid cancer is higher among females than among males as prevalence of thyroid cancers at autopsy does not vary by gender (Xiaocheng et al., 2005). In our study thyroid cancers were common in females occupying top place between 15-29 years.

Over all survival in AYA cancer is 50% which may be because of delay in seeking medical attention, less awareness amongst professionals to recognize worrying

signs and symptoms. AYA cancers are usually mistaken initially for infectious diseases and treated for the same for long time before the final diagnosis of cancer. Hence greater delay in diagnosis of Cancer in AYA is more because of professional delay than patient symptom delay (Conrad et al., 2006). Males have a worse prognosis than females (Archie et al., 2006). Death due to cancer in AYA in males predominates in less than 30 years and more than 45 years of age where as in females it is between 30-44 years (Archie et al., 2006). African, American, American Indians and Alaska natives have worst prognosis than white non-hispanics and Asians (Archie et al., 2006). Poor outcome in cancer of AYA is because of mix of tumour types seen in this age group, having different biology of cancer, high risk prognostic cytogenetic features, more resistant form of cancer, low clinical trail participation and treatment not yet fully adopted to the tumor biology and is not tailored for cancers of AYA (Vickie, 2005; Conrad et al., 2006). In our study no follow-up of cases was done to comment on prognosis.

In conclusion, this epidemiological study helps to know the incidence of cancer in AYA in this region and to some extent the associated probable risk factors. This is only a hospital records based study. However this study provide leads for further etiological research, identify cancers that have greatest impact in these age groups and helps to take-up cancer preventive measures and screening programmes in early detection of cancer.

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