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Trends in testicular germ cell tumors among native black African men do not mirror those of African Americans: multi-institutional data from South Africa

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Abstract

Background: Testicular germ cell tumor (TGCT) is most frequently diagnosed in young males and its etiology remains poorly understood. Cases of newly diagnosed TGCT have been rising in the United States and incidence among African Americans (AA) has increased nearly 40%. Incidence of TGCT in native black African (BA) males, conversely, has remained low. We sought to determine the racial identification of patients diagnosed with TGCT in Cape Town, South Africa. We hypothesize that the rise in TGCT among AA males is distinct from that of BA males in South Africa.

Methods: A retrospective review involving two tertiary care centres in the Western Cape was performed. Data were extracted for males > 13 years of age diagnosed with TGCT from January 1, 2000 to June 30, 2015. Racial status was self-declared and included BA, Caucasian, Mixed Ancestry (MA), and Asian. Patients were identified from combined Urology–Oncology clinic logs at both institutions, as well as from pathology records at the National Health Laboratory Service indicating any form of testicular cancer.

Results: 225 patients were identified. 97% of cases involved males identified as MA (130) or Caucasian (88). Only 2% of the study population identified as BA, with complete absence of self-identifying BA males for several years within the queried interval. Among males diagnosed with TGCT, the percentage self-identifying as Caucasian increased over time (R^2 0.92).

Conclusions: Males diagnosed with TGCT in the Western Cape predominantly self-identify as MA or Caucasian. Exceedingly few cases are attributed to BA, and even less to Asian males. The trend in racial distribution suggests that the increasing incidence reported for AAs may be due to interracial gene exchange, environmental factors, or a combination thereof.

Keywords: Testicular carcinoma, Epidemiology, Racial discrepancies in presentation

1 Background

According to the Surveillance, Epidemiology and End Results Programme (SEER) database, an estimated 9600 new cases of testicular germ cell tumor (TGCT) were diagnosed in 2020, accounting for 0.5% of all new cancer cases. TGCT is most frequently diagnosed among males between 20 and 34 years of age in the United States (US),

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and the percentage of associated mortality is also highest in this age group [1]. Established risk factors for developing TGCT include age, being Caucasian, cryptorchidism, carcinoma in-situ (CIS) of the testis, and prior testicular cancer in the contralateral testis [2]. Despite these identified contributors, the etiology of TGCT remains poorly understood and is likely a combination of environmental and genetic factors.

Annual incidence of newly diagnosed TGCT has been rising, on average, 0.8% each year for the last 10 years in the US [1]. From 1992–2011, overall rates of TGCT increased significantly. Incidence was highest among non-Hispanic Caucasian males (6.97 per 100,000 man-years) and lowest among AA males (1.2 per 100,000 man-years). However, although the incidence was lowest in AA males, it increased 36.36% from 1992–1996 to 2007–2011 [3]. Data regarding the incidence of TGCT among native black African (BA) males is less robust, but a low incidence has been documented in southwestern Nigeria [4].

Our study sought to determine the racial distribution among those males diagnosed with TGCT in Cape Town, South Africa. No prior relevant literature for this region exists. We hypothesize that TGCT is predominantly a disease among Caucasian patients, or those with Mixed Ancestry.

2 Methods

Institutional Human Research Ethics Committee approval was obtained. Data was retrospectively reviewed for males > 13 years of age diagnosed with TGCT from January 1, 2000 to June 30, 2015 at either of two tertiary care centres in the Western Cape. Racial status was self-declared and included BA, Caucasian, Mixed Ancestry (MA), and Asian. Patients were identified from the combined Urology-Oncology clinic logs at both institutions, as well as from pathology records indicating any form of testicular cancer at the National Health Laboratory Service. Data was extracted for pathology and cancer staging. Cases were plotted based on racial distribution and linear regression analysis was performed.

3 Results

Patient characteristics are documented in Table 1. 225 patients were identified. Most self-identified as MA (130), followed by Caucasian (88), BA (5) and Asian (2). The majority of males, overall, were between the ages of 30 and 39.

3.1 Case trends

Cases of TGCT by race were plotted and linear regression was performed (Fig. 1). Asian males were excluded due to extremely low incidence. Over the 15-year interval, the number of TGCT cases attributed to BA remained low. Representation of self-identified Caucasian males increased among the TGCT population over time (R^2 0.92).

Table 1 Patient characteristics by race

	BA (%)	MA (%)	Caucasian (%)	Asian (%)	Total (%)
Total	5	130	88	2	225
Seminoma	1 (20)	64 (49)	36 (41)	1 (50)	102 (45)
NSGCT	4 (80)	66 (51)	52 (59)	1 (50)	123 (55)
Age distribution (years)					
13–19	0	10	10	0	20
20–29	2	44	23	1	70
30–39	2	42	30	1	75
40–49	1	26	22	0	49
50–59	0	6	2	0	8
>60	0	3	0	0	3

The total number of admissions to both hospitals during the study period is also noted according to racial distribution. The overall number of BA admissions increased during the study period.

3.2 Disease characteristics

Most tumors were non-seminomatous germ cell tumors (NSGCT), representing 80%, 59%, and 51% of pathology in the BA, Caucasian, and MA populations, respectively.

Stage distribution at diagnosis among groups is presented in Fig. 2. Staging information was available for 174 patients (77%). Of these, 52% presented with Stage 1, 13% with Stage 2, and 36% with Stage 3 disease. 80% of BAs presented with Stage 3 disease compared to 50% of Asians, 39% of MA, and 26% of Caucasian males.

4 Discussion

Based on the academic centres included in this study, TGCT is rarely diagnosed among BA males in Cape Town, South Africa. Over our 15-year study period, there were only 5 BA males within the entire cohort (ranging from 0 to 2 individuals in any given year). Our results are consistent with the reportedly low incidence among native African males in southwestern Nigeria (26 cases of testicular and para-testicular tumors over the 17 year period of 1989 to 2005, 8 of which were TGCT; average incidence of 1.5 cases per year; 0.55 per 100,000 population) [4]. Our data is also in line with that from the National Cancer Registry, which reports annual incidence rates for cancer cases diagnosed in both public and private pathology laboratories throughout South Africa. The age standardized incidence rate per 100,000 for black males was the same in 2012 as it was in 2000 (0.17) [5, 6].

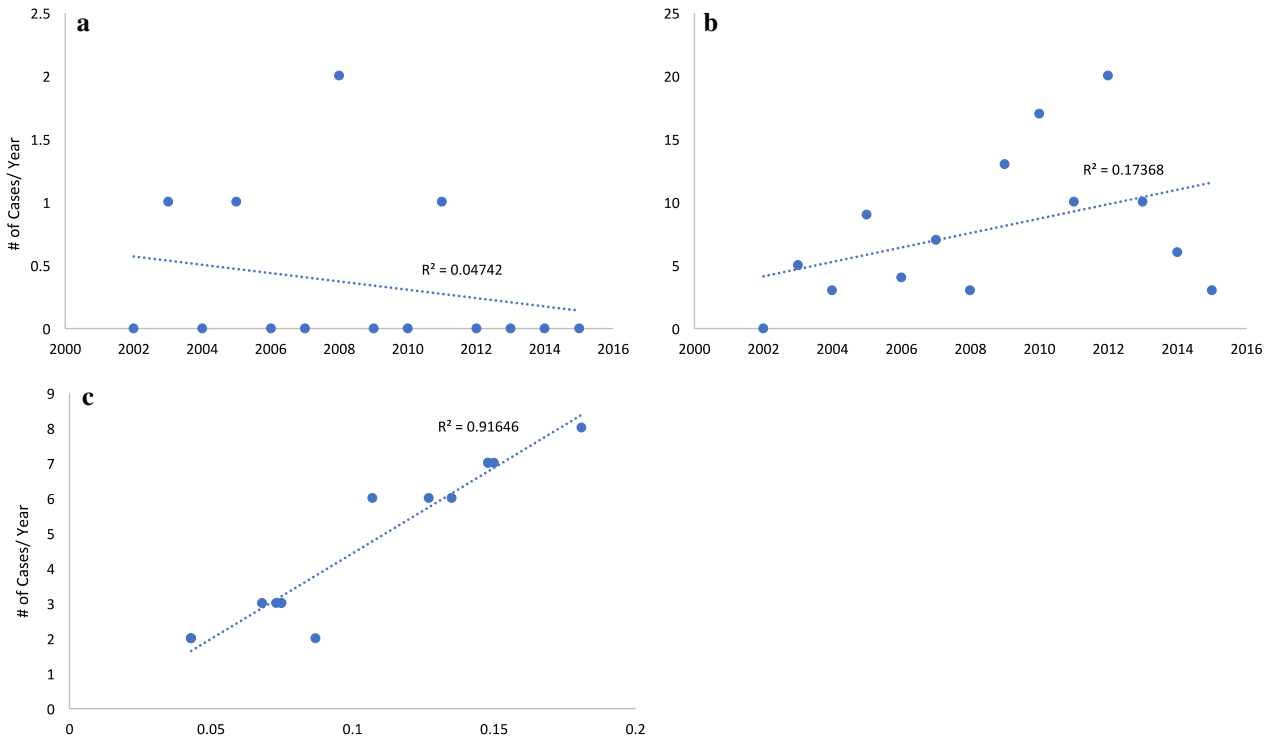

Fig. 1 Trends in annual TGCT cases by race (2000–2015). **a** BA **b** MA **c** Caucasian

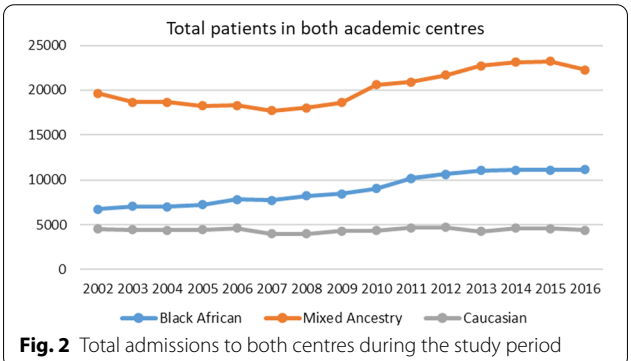

Fig. 2 Total admissions to both centres during the study period

The relatively rare and stably low incidence of TGCT among BA males appears to contrast the trend of increasing incidence among AA males [3]. In our study, it was noted that the overall number of BA patients admitted to both centres during the study period increased, yet the number of BA patients with TGCT remained relatively low (Fig. 2). The number of Caucasian admissions remained stable, but there was an increase in the number of Caucasian patients presenting with TGCT. This data is difficult to interpret, however, as it is not necessarily representative of the whole country.

Although the disease is more commonly encountered among non-Hispanic Caucasian males relative to AA in the US, the incidence increased nearly 40% over 15 years in the latter population [3]. In fact, the incidence of testicular cancer has increased in most populations worldwide based on data comparisons from the early 1970s to the late 2000s, with the highest values observed in Europe and North America, and the lowest in Asia and Africa [7]. Reasons for the rise are largely unclear, but it may represent a combination of environmental and genetic factors. A Danish study found that risk of developing testis cancer was lower for first-generation citizens compared to those of longer lineage [8]. However, the risk discrepancy faded by second-generation birth. These findings support a theory of environmental influence. In addition to a rising incidence, AA males diagnosed with testicular cancer have significantly worse 5- and 10-year overall survival. Studies conflict as to whether the survival difference disappears when adjusting for stage at presentation [9–11].

In terms of stage at presentation (Fig. 3), there is a bimodal peak, whereby patients tend to present with very low or very high stage disease. Patients in the BA group appear to present at a higher stage of disease. Due to the low participant numbers, however, it is difficult to draw any statistically significant conclusions from this data. This does appear to be similar to the results of a study

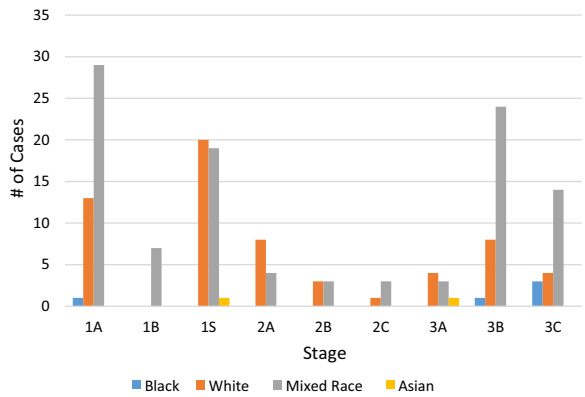

Fig. 3 Stage distribution at diagnosis

in Tanzania by Chalya et al., where 25% presented with Stage 3 disease and 39.3% presented at Stage 4 [12].

This difference in TGCT between AA and BA males may also be due to how males racially self-identify. MA and BA admissions for males and females for all reasons comprised 59.6% and 26.4% of total admissions over the 15-year study period, respectively. It is possible that many of these patients in SA who self-identify as MA would be classified as AA in the US and, therefore, we may overestimate TGCT diagnosis in AA, when a percentage of these males may be MA.

This study is not without limitations, including the retrospective design and potential for incomplete records, as well as the small sample size. Our data collection was limited to the largest two state-run hospitals in the Western Cape, thus failing to account for more affluent patients seen completely within the private sector. However, because BAs in SA are typically of lower income, our analysis is less likely to underreport the incidence in this demographic [13, 14]. The self-reported income status of all patients presenting to the two academic centres in Cape Town confirms that in our study population, patients fall into the lower income bracket of the country. The incidence was calculated based on the population at risk presenting to the two hospitals during the study period. This calculation therefore does not necessarily represent the incidence for the country.

5 Conclusion

Unlike the trend of rising incidence in AA males in the US, there appears to be a stable low incidence for BA males in SA. The discrepancies may be due to interracial gene exchange, environmental factors, improving healthcare access for AA males, or a combination thereof. Further research will better clarify genetic and other causative factors and possibly optimize development of screening and treatment protocols.

Abbreviations

AA: African Americans; BA: Black African; CIS: Carcinoma in-situ; MA: Mixed ancestry; NSGCT: Non-seminomatous germ cell tumors; SA: South Africa; SEER: Surveillance, epidemiology and end results programme; TGCT: Testicular germ cell tumor; US: United States.

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Author contributions

FC and RT contributed to study design. FC, CL and BK contributed to data collection. FC, AP, EM, RT, JL, AvdM and BK contributed to data analysis. FC, AP, EM, BK and CL contributed to manuscript writing of the manuscript. RT, JL and AvdM contributed to final editing of the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

Raw data is available upon request from the corresponding author. The data has not been uploaded onto a database as Ethics approval for this was not obtained prior to data collection. The authors have no problem sharing the raw data with the journal if this is required.

Declarations

Ethics approval and consent to participate

Health Research Ethics Committee approval was obtained prior to data collection from both Tygerberg Hospital (N15/04/033) and Groote Schuur Hospital (572/2015) Health Research Ethics Committees. Consent to participate not applicable as it is a retrospective study.

Consent for publication

Not applicable as there is no identifying data (no images/personal or clinical details) in the manuscript. Approval for a waiver of individual patient consent was obtained from the HREC of both Groote Schuur Hospital and Tygerberg Hospital prior to data collection.

Competing interests

The authors declare that they have no competing interests.

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