SA Journal of Oncology
ISSN: (Online) 2523-0646, (Print) 2518-8704

An interim analysis of the national treatment guideline for paediatric germ cell tumours and sex cord stromal tumours by the South African Association of Paediatric Haematology Oncology

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Background: The South African Association of Paediatric Haematology Oncology (SAAPHO) developed a national treatment guideline for children with benign and malignant extracranial germ cell tumours (MEGCTs) and sex cord stromal tumours (SCSTs), named MEGCT-2016, and prospectively enrolled them into an observational study with standard-risk and high-risk treatment arms.

Aim: To assess the adherence to the national treatment guideline, MEGCT-2016, and to evaluate the progress of patients at three years of enrollment.

Setting: South African Paediatric oncology units (POUs).

Methods: Patients eligible for the MEGCT-2016 study were enrolled at nine POUs. Patients were treated with surgery alone for limited-stage disease or surgery and chemotherapy for advanced disease. Patient, treatment-related, and outcome data were captured in a REDCap™ database. The Kaplan–Meier procedure was used to calculate the 3-year overall survival (OS). Toxicity data and audiology and glomerular filtration rate (GFR) testing practices are described and compared to historical cohorts.

Results: A total of 63 record entries were analysed: 31 patients had MEGCTs, 26 benign EGCTs (19 mature teratomas and 7 immature teratomas) and 6 patients had SCSTs. The 3-year OS was improved in children with limited-stage MEGCTs (100% for Stage 1, Stage 2 and Stage 3 disease) compared to retrospective cohorts. Stage 4 patients had a less favourable 3-year OS (37.5%) compared to historical cohorts. Audiology and GFR assessments were markedly improved. Treatment-related morbidity was almost entirely restricted to advanced-stage patients following intensive chemotherapy.

Conclusion: Prospective national treatment guideline implementation is feasible in South African POUs and has improved practice and outcomes compared to historical cohorts. The interim analysis has allowed modification of the treatment algorithm for patients with Stage 4 disease to improve outcomes in this group.

Contribution: National paediatric cancer disease-specific treatment guidelines improves clinical practice and childhood cancer outcomes and creates a foundation from which to launch paediatric clinical trials in South African POUs.

Keywords: national treatment guideline; paediatric germ cell tumours; paediatric sex cord stromal tumours; interim analysis; improved outcomes.

Introduction

Paediatric cancer is a relatively rare disease compared to adult cancer.[1] Given the small number of paediatric cancer patients,[1] multi-national and international research groups, like the Children's Oncology Group (COG), (United States [US], mid-1990s), the Berlin-Frankfurt-Münster group (Germany, 1975), the United Kingdom (UK) Children's Cancer Study Group (1977) and *Société Internationale d'Oncologie Pédiatrique* [International Society of Paediatric Oncology] (SIOP) (France, 1969) have pioneered work in answering major questions over the last five decades,[2] facilitated by favourable resource and regulatory environments. The situation in Africa is wholly different, with fewer than 1% of clinical trials conducted on the continent, largely restricted to a few middle-income countries like South Africa and Egypt. Although high-quality research exists, it is dogged by the ongoing challenges of political instability, fragmented governance, poverty,

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Dates:
Received: 24 Sept. 2025
Accepted: 30 Mar. 2026
Published: 09 July 2026

How to cite this article:
Hendricks M, Van Zyl A, Du Plessis J, et al. An interim analysis of the national treatment guideline for paediatric germ cell tumours and sex cord stromal tumours by the South African Association of Paediatric Haematology Oncology. S. Afr. j. oncol. 2026; 10(0), a356. https://doi.org/10.4102/sajo.v10i0.356

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a collection of more prominent public health priorities, funding shortages and adverse regulatory and ethical environments.[3] Unsurprisingly, most children (80%) with cancer in high-income countries (HICs) will become long-term survivors, while their counterparts in low-income countries only achieve a 40% 5-year overall survival (OS).[4]

In 1987, the South African Children's Cancer Study Group (SACCSG) was established to document the number of childhood cancer cases in the country. The SACCSG was renamed The South African Association of Paediatric Haematology Oncology (SAAPHO) in 2023. Based on institutional preference, South African paediatric oncology units (POUs) treated children according to successful regimens developed in the US, the UK and Europe. Institutional and national politics influenced the quality of collaboration between academic hospitals. The care for children with cancer in South Africa subsequently improved, although harmonised cancer disease-specific approaches were lacking.

National treatment guideline development in South Africa began in 2007, focusing on Wilms tumour and retinoblastoma. The national retinoblastoma working group launched the Retinoblastoma National Treatment Guideline in 2011. Five participating POUs enrolled patients from 2012.[5] Later that year, the SACCSG (now SAAPHO) committed to developing a national treatment guideline for Hodgkin lymphoma (HL). The HL group recently reported improved survival for children enrolled prospectively onto the new HL-2018 National Treatment Guideline with excellent 2-year OS (92.6%) for children with standard and intermediate-risk (IR) disease treated with adriamycin, bleomycin, vincristine and dacarbazine (ABVD) and those with high-risk (HR) disease treated with adriamycin, bleomycin, vincristine and dacarbazine and cyclophosphamide, vincristine, prednisone and dacarbazine (ABVD-COPDac). The OS was significantly better than that of a historical cohort treated with varied regimens (5-year OS 84%). A commendable equivalent 2-year OS of 93% was reported for children living with human immunodeficiency virus (HIV) treated with the new standardised approach while simultaneously receiving anti-retroviral therapy.[6] National treatment guidelines for neuroblastoma and germ cell tumours (GCTs) have followed.

We now report an interim analysis of the MEGCT-2016 national treatment guideline at 42 months of enrolment which focussed on patterns of care and guideline adherence, toxicity reporting and patient outcomes.

Methods

Setting

This was a national study conducted in South Africa across multiple POUs.

Eligibility

All children under the age of 16 years with benign mature teratoma (MT) and immature teratoma (IT) or MEGCT and sex cord stromal tumours (SCSTs) were prospectively enrolled into the MEGCT-2016 study following informed consent by parents or legal guardians, (and, where applicable participants' assent). Patients were required to be chemotherapy naïve, whether or not they had undergone previous surgery. Children with intracranial GCTs were excluded, as well as those female patients who were pregnant, breastfeeding or who were sexually active but refused contraception.

Staging and risk stratification

Staging was conducted pre-operatively with magnetic resonance imaging (MRI) or computer tomography (CT) in conjunction with serum tumour markers and tumour histology. Germ cell tumours were staged according to the COG Staging System,[7] while those with SCST were staged according to the International Federation of Gynaecology and Obstetrics (FIGO) classification.[8]

Patients with stage 1 disease with completely resected tumours were watched expectantly and followed up. Patient with SCST Stage 1C and above received four cycles of $P_{100}E_{500}b$ (cisplatin IV

100 mg/m² in five fractionated doses, etoposide IV 100 mg/m² daily for 5 days, bleomycin IV 15 IU/m² on day 3). Standard risk (SR) patients were defined as those under 11 years of age with any stage disease at any site (ovarian, testicular, extragonadal), while HR patients were described as those 11 years or older with Stage 3 or Stage 4 disease at any site (ovarian, testicular or extragonadal). Standard risk patients with MEGCTs received four cycles of $J_{600}E_{360}b$ (carboplatin IV 600 mg/m² on day 2, etoposide IV 120 mg/m² daily for 3 days, bleomycin IV 15I U/m² on day 3), while HR patients received a hybrid regimen ($J_{600}E_{360}b$ / $P_{100}E_{500}b$) to a total of six cycles.

Data collection

Study data were entered into a REDCap™ database. The first treatment visit data included patient data (age, sex, anthropometry, HIV status), socio-economic data (household income and maternal education), disease data (presenting symptoms), tumour data (site, histology, stage and risk assignment), imaging assessment/s, details of surgery and chemotherapy), tumour markers, haematology and renal blood panels and glomerular filtration rate (GFR) and audiology assessments. The World Health Organization (WHO) Nutritional Landscape Information System (NLIS) Interpretation Guide, 2010,[9] was used to define anthropometric parameters. Socioeconomic status by household status was assigned according to the Provincial Government of the Western Cape's Federal Acquisition Regulation No. 9 of 2017 (PGWC FAR9/2017) or provincial equivalent. Information for all subsequent treatment visits included further chemotherapy data (treatment visits), all (severe) adverse events (SAEs), interim disease evaluations, end-of-treatment evaluations and follow-up visit data.

Guideline evaluation

Guideline implementation was assessed by evaluating adherence to recommended treatment approaches as well as completion of key baseline investigations specified in the guideline, including GFR and audiology assessments.

Toxicity was included as a predefined component of the interim analysis in order to evaluate the safety and feasibility of guideline implementation across participating centres and to identify any early signals that might warrant protocol review or modification.

A guideline violation was defined as a treatment decision or action that deviated from the MEGCT-2016 recommendation without documented justification and which was not supported by an accepted clinical indication. For example, this included (but was not limited to) incorrect risk assignment resulting in the selection of a chemotherapy regimen not recommended by the guideline.

Statistical methods and analysis

Patients were grouped into three disease cohorts: SCST, extracranial germ cell tumour (EGCT) which included MT and IT and MEGCTs for rational analysis. IBM SSPS™ Statistical Software 28.0.1.1 (Version 14), Armonk, New York, US was used for consolidation, uniform recording and descriptive statistics, survival analyses and output graphics. The Kaplan–Meier procedure was used to estimate OS curves and survival at 3 years with associated 95% confidence intervals. A p-value < 5% was used as a cut-off to define statistical significance.

Ethical considerations

Ethical approval was obtained from the University of Cape Town's Human Research Ethics Committee (HREC 002/2018) with reciprocal approval from all participating universities.

Results

Assessment of database and enrolments

Eleven of the 13 POUs (Figure 1) in South Africa were ethically approved to participate in the MEGCT-2016 national treatment guideline study. Nine actively recruited patients.

Between 01 January 2020 and 30 June 2023, there were 72 database entries into the REDCap™ database, of which 68 were complete at the time of this analysis. Three patients were excluded from the analysis leaving 65, which were analysed. The patient attrition rate was 8.3% over 42 months. To determine if there was homology between patients enrolled on the MEGCT-2016 database and those registered with the SAAPHO Tumour Registry (SAAPHO-TR), the number and type of MEGCT diagnoses registered with the SAAPHO-TR from January 2020 to June 2023 were compared. Seventy-two patients were reported to the registry, of which 65 were enrolled on the MEGCT database.

Patients enrolled on malignant extracranial germ cell tumour-2016

Malignant extracranial germ cell tumours

A total of 31 patients with MEGCTs were enrolled in the study: 19 patients with SR and 12 patients with HR disease. Two fully resected Stage 1 patients required no chemotherapy and were observed. Of the remaining 29 patients, 13 patients received chemotherapy, 12 patients received $J_{600}E_{360}b$ (per the guideline's recommendation) and one patient received $P_{100}E_{500}b$. Twelve HR patients were enrolled; 11 patients were appropriately staged and risk-stratified. One patient aged 10.5 years, with a Stage 4 dysgerminoma, was assigned HR status and treated as such.

Standard risk patients (n = 19)

The median age for the entire group was 23 months, and the mean was 42.8 months (1 month–154 months). There were three Stage 1 patients (15.8%), eight Stage 2 patients (42.1%),

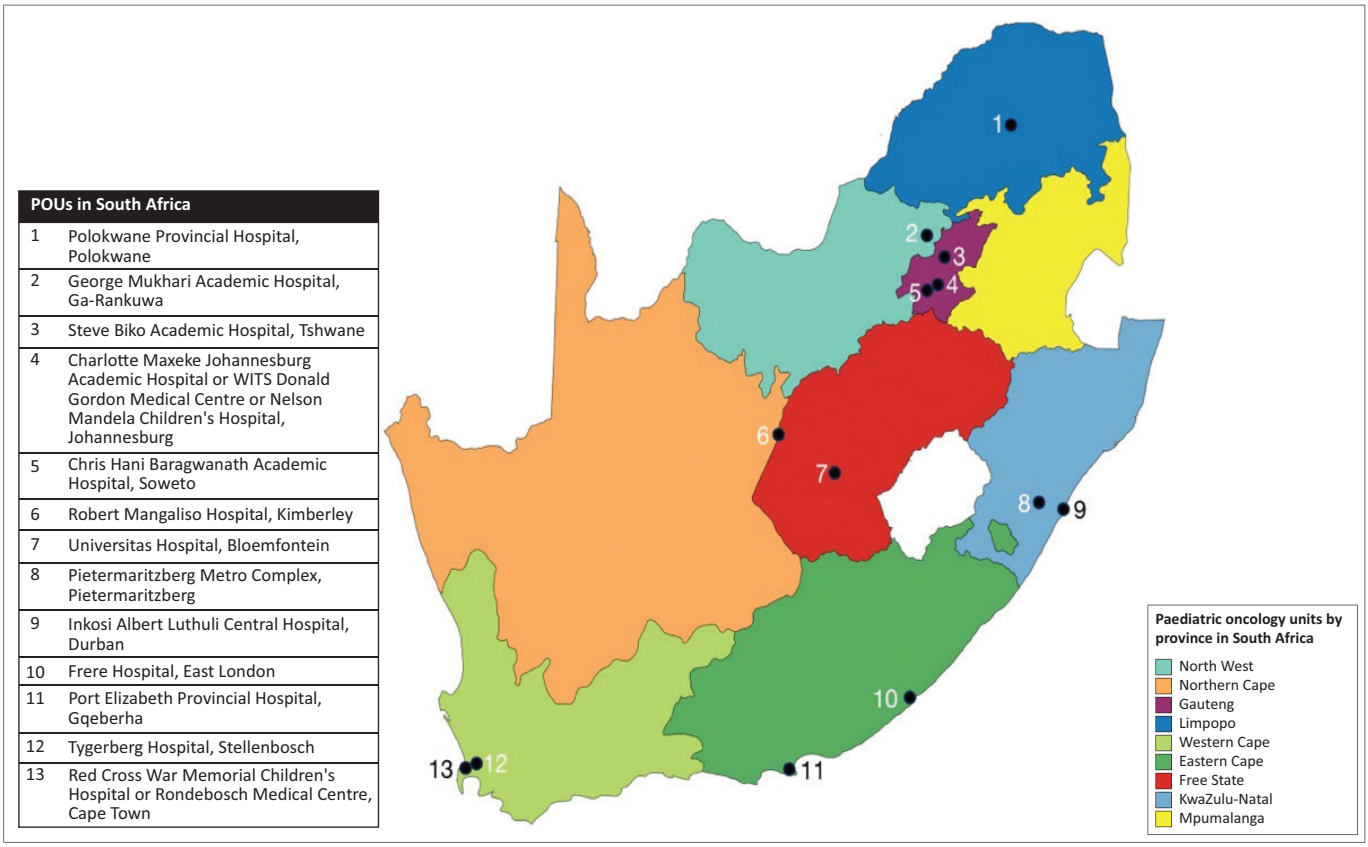


FIGURE 1: Paediatric oncology units in South Africa.

five Stage 3 patients (26.3%) and three Stage 4 patients (15.8%). Metastatic disease included two patients with lung metastases (one with a malignant effusion) and one patient with multiple sites (lung, kidney, bone and brain). All male patients had testicular yolk sac tumours (YSTs). Eight (53.3%) female patients had YSTs, five (33.3%) had mixed MEGCT and two (13.3%) had dysgerminomas. In the female patients, nine primary tumour sites were ovarian (60%), and six were extragonadal (40%).

High-risk patients (n = 12)

The median age for the group was 153 months, and the mean was 151.8 months (age range, 123 months–171 months). All patients were female. There were five Stage 3 patients (41.7%) and seven Stage 4 patients (58.3%). Metastatic sites included four patients with lung metastases, two with lung and liver lesions, and one with multiple sites (lungs, kidney and liver). There were five dysgerminomas (41.7%), three YSTs (25%), three mixed malignant germ cell tumours (MMGCTs) (25%) and one choriocarcinoma (8.3%). Most primary sites (n = 9; 75%) were ovarian, two were retroperitoneal (16.7%), and one metastatic patient had an undetermined primary site (8.3%).

Nutritional and socio-economic status

Neither being underweight-for-age (p = 0.637) nor stunted (p = 0.388) impacted the OS. Similarly, socio-economic status (SES) did not significantly impact OS (p = 0.247).

Adherence and outcome

Overall, 62 patients of the 65 patients (95.3%) were treated according to the guidelines. Two patients were lost to follow-up, and one patient suffered an accidental death from drowning and asphyxiation. Table 1 shows improvement in OS for limited-Stage patients (100%), especially Stage 3 patients, but less favourable outcomes for Stage 4 patients (37.5%). Only Stage 4 patients with single-site (lung) metastases and normal anthropometry were salvaged. The 3-year OS for the group was 84.4% (p = 0.005) (Figure 2).

Extracranial germ cell tumours, mature and immature

A total of 62 patients with mature (n = 19) and immature extracranial (n = 7) GCT were enrolled. The group comprised five male (19.2%) (0.5 month–121 months; median 5 months) and 21 female (80.8%) (0 month–158 months; median 38 months) patients. All male patients had extragonadal tumours (two mediastinal, one head and neck, one retroperitoneal and one sacrococcygeal). Among the female patients, there were 11 (52.4%) ovarian tumours and 10 (47.6%) extragonadal tumours (four retroperitoneal, two head and neck, two sacrococcygeal and two mediastinal). All patients with MTs bar one (n = 18) were Stage 1, and one patient had Stage 3 disease. Five of the patients with ITs had Stage 1, and two had Stage 3 disease, meeting the criteria for a watch-and-wait approach (diagnostic alpha-fetoprotein [AFP] < 1000 ng/mL and no YST elements).

TABLE 1: Comparison of overall survival.

MEGCT stage	25-yr retrospective (*n*)	OS (5-yr) retrospective (%)*	MEGCT-2016 (*n*)	OS (3-yr) MEGCT-2016 (%)**
1	59	96.0	2	100
2	37	94.3	8	100
3	75	75.5	8	100
4	46	60.1	8	37.5
Total	**218**	**80.3**	**26**	**84.4**

Note: Survival between the 25-year national retrospective malignant extracranial germ cell tumour review and the interim analysis of malignant extracranial germ cell tumour-2016 at 42 months.

MEGCT, malignant extracranial germ cell tumour; OS, overall survival; yr, year.

*, $p < 0.001$; **, $p = 0.005$.

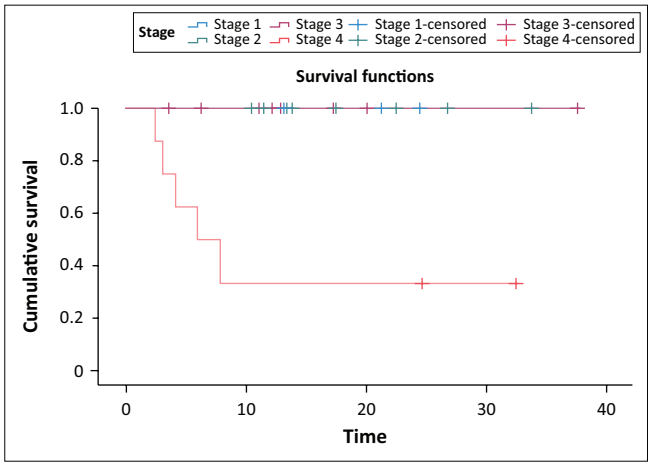


FIGURE 2: Three-year overall survival for patients enrolled onto malignant extracranial germ cell tumour-2016.

All South African children with mature and immature EGCTs are alive and disease-free except one child who demised after treatment from aspiration many months after definitive surgery for an extensive left-sided hemi-facial tumour. Two children, one from Zimbabwe (MT) and another from Swaziland (IT), returned home following definitive surgery and were lost to follow-up.

Sex cord stromal tumours

Six patients with SCSTs were enrolled. All were female with primary ovarian juvenile granulosa cell tumours (age range, 8 months–154 months; median age 95 months). Three patients had complete resections and were observed. The remaining three with FIGO stage 1c disease and above (one Stage 3 and one Stage 4 with lung metastases) received four courses of PEb. All children are alive and disease-free.

All patients

Treatment-related morbidity and mortality

All participants were HIV-negative. There were 19 treatment-related events in 14 patients. Most episodes occurred in children with MEGCTs (17 episodes in 12 children) and were chemotherapy-related. Fifteen episodes (78.9%) were infection-related, of which six were culture-positive with Gram-negative organisms or fungi. Only two children with culture-positive bloodstream infections (BSIs) had a central venous access device (CVAD). Two severely malnourished children, both with Stage 4 HR MEGCTs, had five infective episodes: three culture-positive BSIs and two radiological pneumonia episodes. Tuberculosis tests were negative. Two infection-related deaths (septic shock from nosocomially acquired *Leuconostoc pseudomesenteroides* and *Enterococcus faecium*/*Candida Krusei* septicaemia) occurred in two Stage 4 patients (one SR and one HR) who were not remitted at the end of therapy and who commenced second-line chemotherapy. The second patient was heavily pre-treated, having received first-line therapy and four courses of TIP (paclitaxel, ifosfamide and cisplatin).

Two drug-related episodes, both etoposide allergies, occurred. One patient with medical insurance was able to access etoposide phosphate as a substitute agent and received the full guideline-recommended dose. The other patient underwent an etoposide desensitisation programme run by the hospital allergy service and successfully completed the recommended doses.

Surgically-related treatment morbidity in children with EGCT was limited to two episodes. The first episode occurred after the excision of a large head and neck primary tumour that required a post-operative tracheostomy for long-term ventilatory support and a percutaneous endoscopic gastrostomy (PEG) insertion and revision, during which the tube dislodged. Unfortunately, once the PEG was removed after long-term dietetic support, she suffered a large aspiration following the recommencement of oral feeding and demised. The second child was treated for a nosocomial infection and moderate anaemia.

Audiology and glomerular filtration rate assessments

Thirteen of the 15 patients (86.7%) receiving cisplatin-based chemotherapy had a formal audiology assessment at some point in their treatment. Three of the 13 (23.1%) had baseline assessments prior to the commencement of chemotherapy, six of whom had an assessment at their second treatment visit. The remainder were done at various points in treatment, at the end of therapy or during follow-up. Glomerular filtration rate assessments were performed in all 15 patients who received cisplatin-based chemotherapy: 12 using the eSwartz formula and three by radio-isotope technique.

Discussion

This interim analysis reveals several positive improvements in practice and outcomes for children treated on MEGCT-2016. This was particularly evident for patients with limited-stage disease compared to historical cohorts, with Stage 3 patients making the most noticeable gains.[10] This was encouraging given that HR Stage 3 patients treated with the JEb/PEb (carboplatin, etoposide, bleomycin alternating with cisplatin, etoposide, bleomycin) hybrid appeared to be doing as well as SR Stage 3 patients treated with JEb. The OS for the whole group was marginally better

(84.4% vs. 80.3%). However, we note this with caution, considering that the prospective patient cohort is still small and we acknowledge the inherent problems of selection bias when using retrospective cohorts as comparators and the short follow-up period in the prospective cohort.

Similarly, patients with EGCTs had excellent outcomes (MT 89%, IT 100%) compared to historical datasets (5-year OS All EGCT 85.4%, MT 80.8% IT 92.8%).[11] The number of Stage 3 patients was too small to draw any inferences, but it was encouraging that all were alive by the end of the reporting period. Part of the improvement in both the MEGCTs and ECGTs could be attributed to the fact that the guideline offered specific diagnostic criteria to differentiate these two groups more clearly. This facilitated more accurate diagnosis and limited inappropriate treatment with undue treatment-related morbidity.

Patients with SCSTs with a previously reported 82.1% 5-year OS[12] were all alive and disease-free at interim assessment. Again, the guideline provided specific advice on chemotherapy, staging and risk assignment, which was not standardised prior to 2020.

There were no recorded relapses at the end of the interim assessment period but this is likely to change with time.

Audiology and GFR testing, irrespective of the methods employed, had improved substantially compared to historical practice, where the monitoring and assessment of hearing in children receiving cisplatin-based chemotherapy was previously inadequate.[10] Again, the guidelines and database offered specific guidance on these evaluations. Although audiology testing was still imperfect because of varying access to audiology services across public sector hospitals, the practice was undoubtedly improved.

Follow-up had also been more rigorous, although the follow-up period was short. It remains to be seen if this will be sustained beyond the constructs of a national study. Only four patients in the combined prospective cohort were lost to follow-up compared to 20% SCSTs, 25% MTs and 15% ITs in the retrospective cohort.[11,12] In Saudi Arabia, a 30-year retrospective report comprising 50 patients with benign and malignant EGCTs reported no loss to follow-up.[13] Similarly, a 15-year retrospective report from Thailand reported no patients lost among 44 patients with EGCTs.[14] Two studies from Iran reported rates of 5%[15] and 9%,[16] both in mixed cohorts of children with benign and malignant tumours. Differences in settings, the composition of patient cohorts and follow-up periods make direct comparisons difficult, but there is an impression that the rates of attrition seem to be much higher in our cohort than in other non-African mixed-income settings.

Opportunities for change

The less favourable outcome for Stage 4 patients (3-year OS 37.5%) compared to the historical cohort (5-year OS 60.1%)[10] was concerning. Only Stage 4 patients with single-site lung metastases were salvaged; these were in the minority. In addition, severe malnutrition and culture-positive BSIs raised the risk of death in this group of patients, with the frequency of culture-positive Gram-negative infections a notable feature. It has been shown that poverty and food insecurity, which results in severe malnutrition, impacts immunity negatively, increasing the risk of infection and treatment-related events.[17] Studies from South America and Central America and also from South Africa have shown an association between increased hunger indices, treatment abandonment and relapse, increased treatment-related morbidity and poorer event-free survival (EFS) and OS in childhood cancer survivors.[18,19,20]

In an analysis of combined data from the US and UK in children with MEGCTs, the Malignant Germ Cell International Consortium reported a predicted 4-year EFS of 40% in Stage 4 HR patients with extragonadal tumours and a 3-year EFS of 50% in boys using the International Germ Cell Consensus Classification criteria as a comparator. Stage 4 HR patients with testicular and ovarian primaries had a better predicted EFS at 83% and 67%, respectively.[21] This same trend was detected in our historical cohort of MEGCTs in that Stage 4 patients with testicular (n = 7) primaries had a 4-year EFS of 71.4%, while those with ovarian (n = 18) and extragonadal (n = 21) tumours had a 4-year EFS of 55.9% and 49%, respectively[10] (p = 0.64).

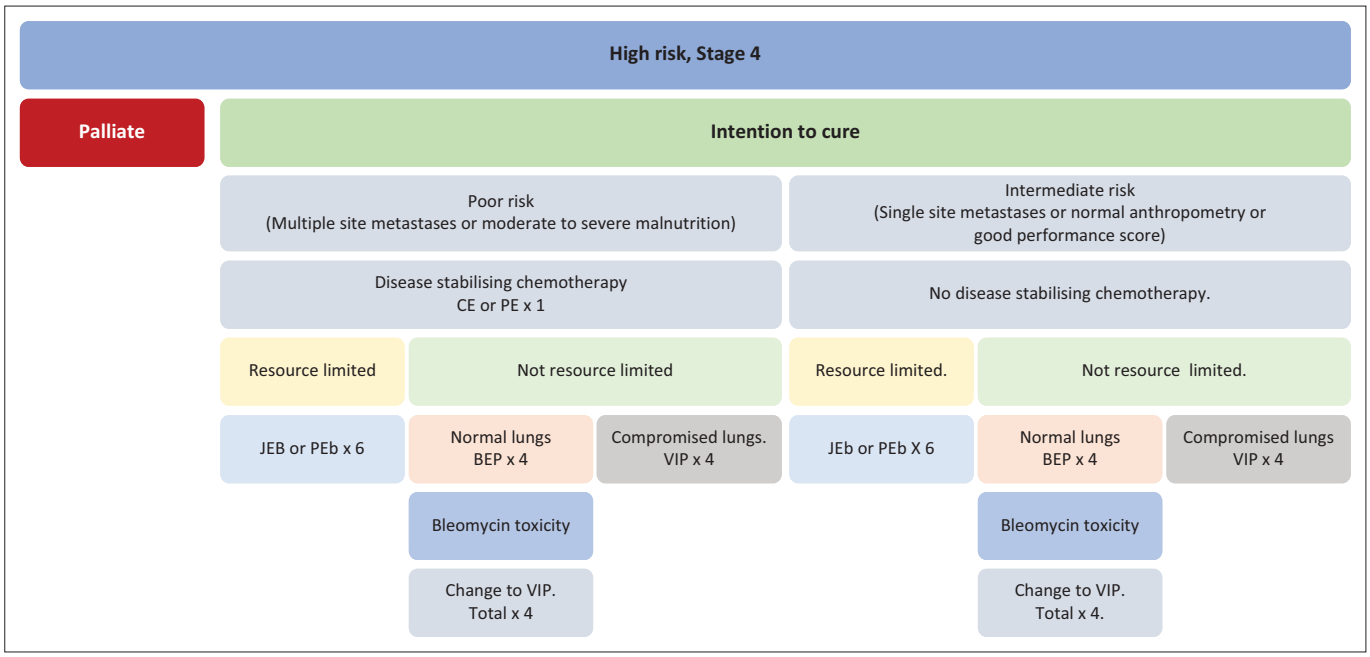
In the prospective cohort, the small number of evaluable Stage 4 patients (n = 8) made distinctions by tumour site impossible to demonstrate. All the patients who died in our cohort had ovarian primaries, and the patients who were alive with disease at the end of first-line chemotherapy (ovarian and extragonadal) all had refractory disease.

Challenges for low-income and middle-income settings

Recording high-quality data is time-consuming, and significant restrictions on time and capacity are undoubtedly our greatest challenge. The database requires constant oversight for quality assurance, support to improve user experience, in-person interaction when data is omitted or unclear, and intermittent short report online meetings for data update reporting, troubleshooting and re-aligning practice. The only sustainable long-term solution is for research activities to be managed by fully funded research staff in an independent unit who are available to all researchers nationally across universities. This will relieve clinicians of the administrative and data management activities critical for producing high-quality research.

Implications for practice

The interim analysis has provided an opportunity for the inclusion of a new algorithm (Figure 3) for patients with Stage 4 disease in the hope that it will improve outcomes. Patients will be categorised into poor risk (PR) or IR groups: PR patients will be defined as those with poor performance scores, multiple site metastatic disease, serious medical co-morbidities and/or those who are moderately to severely



CE, carboplatin, etoposide; PE, cisplatin, etoposide; JEB, cisplatin, etoposide, bleomycin; PEb, cisplatin, etoposide, bleomycin; BEP, cisplatin, etoposide, bleomycin; VIP, etoposide, ifosfamide, bleomycin.

FIGURE 3: New treatment algorithm for Stage 4 high-risk patients.

malnourished, while IR patients will be defined as having single-site metastases (lung only), those with a normal nutritional status, and those with no severe co-morbidities. Physicians would have the option to use less intensive disease-modifying chemotherapy as an upfront strategy to stabilise disease and improve their patients' overall clinical condition prior to intensive treatment. In resource-limited settings defined as those with poor paediatric intensive care access, no access to granulocyte colony stimulating factors and/or no access to aggressive nutritional support, like total parenteral nutrition, the current hybrid (cisplatin, etoposide, bleomycin [JEb or PEb]) would be offered. Alternatively, in settings where supportive care is optimal, clinicians would have the option to offer more intensive cisplatin, etoposide and bleomycin (BEP) or etoposide, ifosfamide and cisplatin (VIP) upfront, the latter in patients with respiratory embarrassment at presentation, or as change-over therapy for those patients on BEP who develop signs of bleomycin toxicity.

Conclusion

The national treatment guideline for GCT has shown positive early improvements in standardised practice and outcomes for early-stage patients. It is an example of the benefits of national cooperative consensus-led work. The interim analysis has given us the opportunity to make modifications in care for advanced-stage patients based on the extent of disease, nutritional status and resource limitations.

Closing remarks

Malignant extracranial germ cell tumour-2016 will continue to enrol patients until the end of 2026 to determine 5-year OS and EFS and assess whether any significant prognostic factors impact patient outcomes in a larger cohort.

Acknowledgements

This article is based on research originally conducted as part of Marc Hendricks's doctoral thesis titled 'Malignant extracranial germ cell tumours, teratomas and sex cord stromal tumours in children: Moving towards a standardised national South African treatment approach', submitted to the Faculty of Health Sciences, University of Cape Town in 2024. The thesis is currently unpublished and not publicly available. The thesis was supervised by Mariana Kruger and Kirsten A. Donald. The thesis was reworked, revised and adapted into a journal article for publication. The author confirms that the content has not been previously published or disseminated and complies with ethical standards for original publication.

This article is based on data from a larger study. Four related articles have been published:

- Hendricks M, Cois A, Geel J, et al. Favourable outcomes in children with sex cord stromal tumors: A first report by the South African Children's Cancer Study Group 1990–2015. J Pediatr Hematol Oncol. 2021; 43(5):e619–e624. https://doi.org/10.1097/MPH.0000000000002076
- Hendricks M, Cois A, Geel J, et al. Malignant extracranial germ cell tumours: A first national report by the South African Children's Cancer Study Group. Pediatr Blood Cancer. 2022;69(5):e20543. https://doi.org/10.1002/pbc.29543
- Hendricks M, Cois A, Geel J, et al. Extracranial germ cell tumours: Mature and immature (1990–2015). First report by the South African Association of Paediatric Haematology Oncology (SAAPHO). Pediatr Blood Cancer. 2024;71(1):e30723. https://doi.org/10.1002/pbc.30723

- Hendricks M, Cois A, Geel J, et al. Socioeconomic status significantly impacts childhood cancer survival in South Africa. Pediatr Blood Cancer. 2023;70(12):e30669. https://doi.org/10.1002/pbc.30669

The present article addresses a distinct research question, focusing on an interim analysis by the SAAPHO.

Competing interests

The authors has reported that they have received funding from University of Cape Town that may be affected by the research reported in the enclosed publication. They have disclosed those interests fully and have in place an approved plan for managing any potential conflicts arising from that involvement.

CRediT authorship contribution

Marc Hendricks: Conceptualisation, Data curation, Formal analysis, Investigation, Methodology, Resources, Writing – review & editing. Anel van Zyl: Writing – review & editing. Jan du Plessis: Writing – review & editing. Jennifer Geel: Writing – review & editing. Gita Naidu: Writing – review & editing. Bongiwe Radebe: Writing – review & editing. Bulelwa Masoka: Writing – review & editing. Karla Thomas: Writing – review & editing. Rema Mathew: Writing – review & editing. Kirsten Donald: Conceptualisation, Writing – review & editing. Mariana Kruger: Conceptualisation, Writing – review & editing. All authors reviewed the article, contributed to the discussion of results, approved the final version for submission and publication, and take responsibility for the integrity of its findings.

Funding information

This work is funded by the National Research Foundation (CSRU180429324830), the Harry Crossley Foundation at the University of Cape Town, the Professor Bongani Mayosi Netcare Clinical Scholarship and World Child Cancer.

Data availability

The data that support the findings of this study are not openly available because of ethical considerations and are available from the corresponding author, Marc Hendricks, upon reasonable request; and only with the express consent of the SAAPHO.

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