Appropriateness of testicular cancer management: a population-based cohort study

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Objective: *Testicular cancer is a highly curable malignancy of young men. Appropriate and timely management is critical to ensure optimal clinical outcomes. A 3-year population-based review of testicular cancer patients in Manitoba, Canada was undertaken to evaluate our management patterns.*

Methods: *Men diagnosed with testicular cancer from 1998 to 2000 were identified from the Provincial Cancer Registry. Chart review was utilized to collect information on demographic characteristics, timelines of diagnostic and staging investigations, completeness of pathology reports, management, and outcomes.*

Results: *Seventy-eight men were identified with 80 testicular cancers: 46 (59%) patients had 48 seminomas and 32 (41%) had non-seminomatous germ cell tumors (NSGCT). One or more pre-operative tumor markers were missing or unavailable in 41 (52%) cases. Median time from scrotal ultrasound to orchiectomy was 7 days, but was greater than 2 weeks in 13 (16%) patients. Pathology reports provided acceptable detail in only 21 (27%) cases. Eighteen subjects (23%) did not complete necessary staging investigations (chest and abdominal imaging, and post-orchiectomy markers) until at least 3 weeks after surgery. Post-orchiectomy management of both seminoma and NSGCT patients was largely within acceptable limits apart from some non-standard chemotherapy choices in advanced stage disease, and significant departures from standard recommendations regarding surveillance. The Kaplan-Meier estimate of overall survival at 5 years is 97% in seminoma and 84% in NSGCT.*

Conclusions: *Although clinical outcomes do not appear to have been compromised, deficiencies are evident in testicular cancer management in Manitoba from 1998 to 2000, indicating the need for well-defined management guidelines and improved education of caregivers.*

Key Words: testicular cancer, seminoma, non-seminomatous germ cell tumor, wait times, outcomes, therapy

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Introduction

Testicular cancer is one of the most common malignancies among young men between 15 to 35 years of age, and accounts for ~1% of all male cancers.[1] Across Canada in 2001, there were 804 new cases and 28 deaths from testicular cancer.[2] Although mortality from the disease has declined as therapy has evolved, incidence has increased over the last several decades at a rate of ~2% per year.[2] In fact, worldwide incidence has more than doubled in the past 40 years and the

condition continues to cause morbidity and potential for treatment-related toxicity.[3] The causes for the gradual increase in incidence remain unclear.[4,5]

More than 95% of testicular cancers are germ cell tumors with cases being evenly distributed between two histologically distinct types: seminomas and non-seminomatous germ cell tumors (NSGCT).[6] Distinguishing between seminoma and NSGCT is important because the natural history, treatment implications, and clinical outcomes are different. Seminomas, for instance, are typically more indolent, less likely to cause distant metastasis, and are exquisitely sensitive to radiotherapy.

All testicular cancers should be treated with the intent of cure. Rates of cure for local disease confined to the testicle approach 100% while the advent of cisplatin-based chemotherapy has brought cure rates for advanced disease close to 80%.[7] Recent studies have focused on improving survival while minimizing morbidity from surgery, radiotherapy, and chemotherapy.

Given the young age of most testicular cancer patients, and the highly curable nature of the disease, most clinicians feel a sense of urgency in investigating and appropriately treating such patients. However, little has been published on the impact of delays in the management of testicular cancer patients, and the few available studies are somewhat contradictory.[8] Nonetheless, the Canadian Surgical Wait Times (SWAT) Initiative recently published consensus recommendations that men with testicular cancer should wait no longer than 7 days from the decision to operate until orchiectomy.[9]

In addition to orchiectomy, testicular cancer patients require a complete staging work-up including pre-operative tumor marker measurements, accurate pathology review of the surgical specimen, and appropriate and timely staging investigations, including post-operative tumor marker monitoring as well as chest and abdominal imaging.

Although recommendations are available to assist physicians in the appropriate diagnosis and follow-up of testicular cancer patients, there is a paucity of data regarding current practice patterns and the degree to which physicians adhere to such guidelines.[10] Therefore, the current population-based study was performed to determine the adequacy and timeliness of diagnostic, staging, treatment, and follow-up strategies used in Manitoba. Patient outcomes for seminoma and NSGCT were also assessed and compared to outcomes reported in the literature.

Methods

CancerCare Manitoba is the provincial cancer agency that provides care to the 1.4 million individuals in the province and maintains the Manitoba Cancer Registry, which collects data and generates statistics related to cancer in this population. While not all cancer patients in the province are referred to the agency for management, cancer is a reportable disease in Manitoba, which allows the provincial cancer registry to capture virtually all cancer diagnoses. The registry contains demographic parameters and vital statistics for each cancer patient.

Upon obtaining full ethics approval from the University of Manitoba Health Research Ethics Board, we used the Manitoba Cancer Registry to identify all men diagnosed with germ cell tumors between January 1, 1998 and December 31, 2000. Patients were excluded from analysis if they had primary extra-gonadal germ cell cancers. For patients seen at CancerCare Manitoba, charts were reviewed and information on baseline patient attributes, diagnostic and staging characteristics, and management patterns were collected retrospectively. For patients who were neither assessed nor managed at CancerCare Manitoba, complete records were obtained where possible from their primary surgeon or community oncologist.

Patient attributes that were collected included: demographic information, presenting symptoms, side of affected testis, and personal history of cryptorchidism. Diagnostic and management characteristics that were recorded included: date of scrotal ultrasound, orchiectomy, and chest and abdominal imaging; histology and TNM stage at diagnosis; timing of pre-operative and post-operative serum tumor marker measurements; choice, dose and duration of radiotherapy and chemotherapy; frequency of physician visits and imaging studies during the first 5 years of follow-up; and response to therapy.[11] Guidelines from the National Comprehensive Cancer Network (version 1.2006) were used as reference standard to assess the adequacy of surveillance strategies.[12]

Pathology reports from orchiectomy were identified and reviewed by an experienced reference pathologist from the genitourinary disease site group at CancerCare Manitoba (DH). Each pathology report was evaluated for its comprehensiveness in documentation. Failure to comment on either the status of lymphovascular invasion or tunica involvement was viewed as a "major deficiency", and lead to an "unacceptable" rating.

Overall survival (OS) was determined from the date of diagnosis to the date of death from any cause;

censoring occurred at the date of last evaluation. Vital statistics were obtained from the cancer registry. If a patient did not satisfy one of these endpoints, the date of last known contact with the healthcare system was used; this information was obtained from the Manitoba Health database. Analysis of 5-year OS was conducted using Kaplan-Meier methodology.[13] SPSS software (version 12.0, SPSS Inc., Chicago, Illinois) was used for all statistical analyses.

Results

From January 1998 to December 2000, 82 men were diagnosed with germ cell tumors in Manitoba. Annual incidences were 22, 35, and 25 cases in 1998, 1999, and 2000 respectively. Of the 82 patients, only 6 were never seen at CancerCare Manitoba. Four patients were excluded from further analyses because of extragonadal site of primary tumor. Two men had bilateral

TABLE 1. **Patient and disease characteristics**

	Seminoma	**Non-seminoma**
Number of patients	46	32
Number of cases	48	32
Affected testis		
Right	24 (50%)	12 (37%)
Left	20 (42%)	20 (63%)
Bilateral	2 (8%)	—
Age at diagnosis		
Median	39	32
Range	20-69	15-69
Stage at diagnosis		
I	34 (74%)	20 (62%)
II	9 (20%)	6 (19%)
III	0 (0%)	5 (16%)
Unknown	3 (6%)	1 (3%)
Predominant histology		
Embryonal carcinoma	—	18 (57%)
Teratoma	—	6 (18%)
Choriocarcinoma	—	2 (6%)
Yolk sac tumor	—	1 (3%)
Mixed germ cell tumor	—	5 (16%)
Site of residence		
Winnipeg (urban)	52 (66%)	
Other communities	26 (34%)	
Location of surgery		
Tertiary hospital	24 (31%)	
Community hospital	42 (54%)	
Rural hospital	9 (11%)	
NR	3 (4%)	
Referred to oncology by		
Urologist	73 (94%)	
General surgeon	1 (1%)	
NR	4 (5%)	
Scrotal ultrasound		
Bilateral	57 (73%)	
Unilateral	2 (2%)	
NR	19 (25%)	

testicular cancers (one with synchronous seminomas and another with metachronous seminomas). Therefore, a total of 78 patients with 80 cases (48 seminomas and 32 NSGCT) were available for study. The baseline patient and disease characteristics are summarized in Table 1.

Table 2 outlines the time intervals between diagnostic and staging investigations in detail. For the 54 men with available data, 27 (50%) had orchiectomy within 7 days of a suspicious scrotal ultrasound; the remaining 27 (50%) waited more than 1 week with 13 (24%) waiting more than 14 days (5 waited between 41 and 60 days). Twenty-four (31%) cases had unreported dates of ultrasound or had no ultrasound.

There appeared to be a negative correlation between time to orchiectomy and initial stage. Fifty-two patients had adequate information about both staging and time to orchiectomy. In the 40 undergoing orchiectomy within 14 days, 13 had stage II or III disease. In the 12 undergoing orchiectomy later than 14 days, only stage I disease was identified. This apparent negative correlation was not statistically significant. There were insufficient events to evaluate an association between time to orchiectomy and recurrence or death.

For patients who underwent abdominal imaging after orchiectomy (n = 75), the median time interval was 12 days; 26 (35%) waited more than 14 days. Abdominal CT was the modality of choice in 98% of patients. For men who received chest imaging following orchiectomy (n = 70), 18 (26%) waited more than 14 days. Median wait time was 29 days; chest x-ray was the selected modality in 78%, while the remainder received CTs. Additional imaging was performed if symptoms warranted investigation. For seminomas, head CTs, bones scans, and lymphangiograms were performed on 3, 3, and 15 patients respectively. For NSGCT, head CTs or brain MRIs were done in six cases, and bone scans were carried out in five patients.

Time to oncology referral, defined as date of orchiectomy to date of evaluation at CancerCare Manitoba, was a median of 38 and 44 days for seminoma and NSGCT patients, respectively. Only 23 (29%) men were seen by an oncologist within 4 weeks of surgery, and 6 (8%) were never referred to CancerCare Manitoba.

Preoperative tumor markers (α-fetoprotein (AFP), β-human chorionic gonadotropin (βhCG), and lactate dehydrogenase (LDH)) were recorded in 53 (68%), 49 (63%), and 14 (18%) patients respectively. Postoperatively, these same markers were available in 72 (92%), 69 (88%), and 54 (69%) men, and only a minority (< 30%) had markers repeated in the first 4 weeks after orchiectomy.

In total, 79 orchiectomy or extra-gonadal biopsy specimens were available for pathology review. Only 21 (27%) reports were deemed to contain sufficient histologic description because 48 (61%) had one major deficiency and 10 (12%) contained two major deficiencies. There was no comment on lymphovascular invasion (LVI) in 58 (73%) reports.

Table 3 details the initial management of our testicular cancer patients. Following orchiectomy, management of stage I seminomas consisted of surveillance in 8 cases and adjuvant radiotherapy (XRT) in the remaining 26. Time from orchiectomy to XRT was a median of 108 days (range 42-408 days) with a median wait time from radiation oncology consultation to XRT of 48 days (range 12-165 days). Explanations for delays included waiting to obtain further investigations, medical complications (gluteal abscess in the individual waiting 165 days), and patient indecisiveness. None of these early stage patients have recurred, none have required chemotherapy, and none have died of any cause to date.

In advanced seminomas, 5 patients received XRT and 4 were treated with chemotherapy. A variety of chemotherapy regimens were utilized, including 4 cycles of etoposide/cisplatin (EP) in 2 cases, 6 cycles of bleomycin/EP (BEP) in 1 patient, and 4 cycles of carboplatin/EB in another. One individual from the XRT group suffered an out-of-field relapse and subsequently

TABLE 2. **Time to staging investigations**

Waiting time between	**N**
Scrotal ultrasound and orchiectomy	
≤ 7 days	27 (35%)
8 to ≤ 14 days	14 (18%)
15 to ≤ 21 days	6 (7%)
> 21 days	7 (9%)
NR	24 (31%)
Orchiectomy and abdominal imaging	
Preoperative	13 (17%)
≤ 7 days	24 (31%)
8 to ≤ 14 days	12 (15%)
15 to ≤ 21 days	8 (10%)
> 21 days	18 (23%)
NR	3 (4%)
Orchiectomy and chest imaging	
Preoperative	45 (58%)
≤ 7 days	3 (4%)
8 to ≤ 14 days	4 (5%)
15 to ≤ 21 days	0 (0%)
> 21 days	18 (23%)
NR	8 (10%)

TABLE 3. **Initial management**

Seminoma	**N**	**XRT**	**Surveillance**	**Chemotherapy**
Stage I	34	26	8	—
Stage II and III	9	5[a]	—	4
Non-seminoma	**N**	**RPLND**	**Surveillance**	**Chemotherapy**
Stage I	20	—	20[b]	—
Stage II and III	11	2[c]	—	9[d]

[a]One individual suffered an out-of-field relapse and required subsequent management with chemotherapy.
[b]Five patients recurred and required subsequent management with chemotherapy.
[c]One individual progressed and required subsequent management with chemotherapy.
[d]One patient had only a PR and another suffered a relapse, and both required subsequent management with a second-line chemotherapy regimen (ifosfamide/vinorelbine and etoposide/ifosfamide/cisplatin, respectively).

received 3 cycles of BEP with good response. Another patient in the chemotherapy group died of liver metastases. Details of subsequent therapy in this patient were poorly reported. In total, one stage II seminoma patient succumbed to his disease. The estimate of overall 5-year survival for seminomas is ~ 97%, Figure 1.

For 29 of the 31 patients receiving XRT, radiation was administered according to the "dog-leg" distribution, which included the ipsilateral pelvic lymph nodes and the para-aortic lymph nodes to the level of approximately T11. In the two cases with bilateral disease, an inverted "Y" distribution was used. The median dose delivered was 25 Gy in 20 fractions (range 25.5 Gy in 15 fractions to 28 Gy in 20 fractions). Doses for radiotherapy were calculated at the mid-plane of the patient, and delivered using conventional fractionation. The median beam energy was 6 MV (range 6-23 MV photons). Three patients received a para-aortic boost of 10 Gy in 5 fractions for bulky nodal disease. There was reasonable homogeneity among the various radiation oncologists with respect to their individual practice patterns.

In contrast, all 20 stage I NSGCT patients were initially observed after orchiectomy, with 16 carrying on with a surveillance program. In this early stage group, there were 5 (25%) recurrences – 3 had early relapses demonstrated only by tumor marker elevation, 1 had early evidence of advanced disease, and 1 developed advanced disease at a later date. In the group with "marker only" relapses, 1 required 2 cycles of EP and 1 received 3 cycles of BEP with good response. The third patient died of his disease despite 3 cycles of BEP. In the more advanced relapses, 1 experienced recurrence in the bone and epidural space, and died despite 4 cycles of BEP and 6 cycles of TAC (docetaxel, doxorubicin, cyclophosphamide). Another patient relapsed in the lungs, but had CR following 3 cycles of BEP.

There were 6 stage II and 5 stage III NSGCTs. Of the stage II patients, 2 underwent retroperitoneal lymph node dissection (RPLND) and 4 others received BEP chemotherapy (range 3 to 6 cycles). One RPLND patient suffered relapse in the lungs and was subsequently treated with 4 cycles of EP that ultimately resulted in CR. Of the stage III patients, all were treated with BEP chemotherapy (range 4 to 6 cycles). One stage III patient however developed only PR following BEP and was therefore treated with 6 cycles of IV (ifosfamide/vinorelbine). Another relapsed and required VIP (etoposide, ifosfamide, cisplatin). These latter two patients died at 2 and 4 years, respectively. No patients proceeded to high

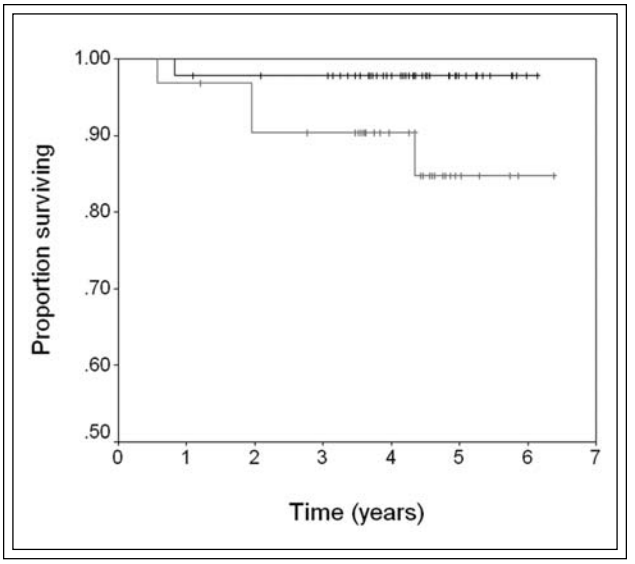

Figure 1. Overall survival of men diagnosed with testicular cancer in Manitoba in 1998-2000. The black line represents men with seminoma, the red those with non-seminomatous germ cell tumors.

TABLE 4. **Surveillance patterns**

		Patients with adequate:	
	Clinic visits	**Chest x-ray and CT**	**Tumor markers**
Seminoma			
n= 8	5 (62%)	3 (38%)	--
Non-semimona			
n = 16	11 (69%)	10 (63%)	9 (56%)

dose chemotherapy and autologous stem cell transplantation. In summary, there were 4 NSGCT deaths and the estimate of overall 5-year survival for NSGCT is ~ 84%, Figure 1.

Surveillance patterns for testicular cancer patients in Manitoba revealed significant departures from standard recommendations, as summarized in Table 4. For seminomas, adequate surveillance was liberally defined as ≥ 3 clinic visits and 3 marker measurements per year and ≥ 3 chest x-rays and 3 abdominal CT scans during the first 2 years of follow-up. For NSGCT, adequate surveillance in our study meant ≥ 4 clinic visits and 4 marker measurements in year 1, ≥ 2 clinic visits in year 2, and ≥ 2 chest x-rays and 2 abdominal CT scans during each of the first 2 years of follow-up. In total, 8 seminoma and 16 non-seminoma patients underwent surveillance. Only 5 (62%) and 3 (38%) seminoma patients had adequate numbers of physician visits and imaging studies, respectively, during years 1 and 2 of follow-up. For NSGCT, 11 (69%) and 10 (63%) had sufficient follow-up visits and imaging, respectively. Only 9 (56%) had appropriate tumor marker measurements.

Discussion

Conventional wisdom holds that effective management of testicular cancer requires accurate identification of the primary tumor and timely detection of local and distant metastases so that prompt treatment can be offered. In this population-based cohort study of testicular cancer patients in Manitoba, we observed wide variations in the diagnosis, staging, therapy, and follow-up of the 78 affected men. In this context, timeliness of orchiectomy and of imaging studies, tumor marker measurements, and pathology reporting appeared particularly deficient and inconsistent with generally accepted patterns of care among oncologists.

There are sparse data to support the conventional wisdom of urgency in the management of testicular cancer. A recent review by the Canadian Surgical Wait Times (SWAT) Initiative could identify only five retrospective cohort studies that addressed the impact on outcomes of delays to surgery.[8] In each case, the subjects of the studies were treated prior to 1990. One study of 154 subjects found a statistically significant increase in the development of metastatic disease and a reduction in overall survival in men with surgery delayed beyond 30 days of symptom commencement,[14] while a second study noted a statistically significant association between more advanced stage of disease and greater delay to orchiectomy.[15] In contrast, two other studies failed to demonstrate an association between time to orchiectomy and clinically important outcomes (recurrence, overall survival),[16,17] while another actually demonstrated a decreased relapse free survival in patients undergoing a more timely orchiectomy.[18]

Despite this contradictory evidence, a study from the United Kingdom found that the median time from diagnosis to orchiectomy in 40 patients was only 4 days.[19] Likewise, a recent survey of Canadian urologists found that 50% would operate in less than 7 days of deciding that surgery was necessary, with almost 83% operating in less than 2 weeks,[20] underscoring the fact that most urologists feel that urgent surgery is necessary. The recommendation of the Canadian Surgical Wait Time Initiative, although based largely on expert opinion, is that orchiectomy should occur in less than 7 days from the date of the decision to operate.[9] Despite this recommendation, a significant proportion of our subjects did not undergo an orchiectomy in a reasonable time frame. Most disturbingly, four underwent orchiectomy 6 or more weeks after an ultrasound documenting probable testicular cancer. Parenthetically, we chose to look at the time from ultrasound to orchiectomy as our measure of surgical delay since in our jurisdiction most men with suspected testicular cancer undergo a scrotal ultrasound, and an abnormal ultrasound should certainly prompt a decision to proceed to surgery. Additionally, time from onset of symptoms is highly subjective, and we lacked information about time from referral to a urologist or time from initial urological consultation.

Abdominal and chest imaging are essential to staging because the retroperitoneal lymph nodes and the lungs are the most common sites of metastasis and disease recurrence.[21,22] Our study confirmed that the majority of our patients did undergo imaging as part of their work-up, but 23% and 33% of patients waited more than 2 weeks from time of surgery before completing chest and abdominal imaging, respectively. Of note, there was an extremely wide spectrum of wait times with some patients waiting in excess of 6 months between interventions. Currently, there are no published recommendations to standardize the timeliness of investigations in testicular cancer, but again long wait times would appear to contradict the conventional medical wisdom that early detection and prompt management are usually best. Furthermore, a wait period beyond 2 weeks for imaging alone is particularly difficult to justify when compared to published studies on breast, lung, and colorectal cancers that have documented a median wait time of only 2 to 5 weeks from diagnosis to therapy.[23-25]

Considering that many germ cell tumors produce AFP, βhCG, or LDH, tumor marker monitoring is as important as radiological investigations in the routine staging work-up.[26,27] Specifically, tumor markers are useful because failure of AFP, βhCG to decline as expected post-operatively predicts residual disease while de novo rise of markers indicates recurrent disease. In Manitoba, we note that very few men appeared to undergo complete and timely measurements of all three tumor markers. LDH monitoring was particularly poor with only 18% and 69% of patients undergoing measurements pre- and post-operatively, respectively. Moreover, a significant number waited more than 4 weeks post-orchiectomy for repeat marker measurements. These observations are concerning as tumor marker elevation can precede radiological and clinical signs of disease as an early indicator of progression or recurrence.[28] This point is highlighted by three NSGCT patients in the current study who exhibited early "marker only" relapses, which would have been undetected if markers were not measured. Although our chart review may have underestimated the thoroughness of tumor marker measurements by only capturing instances that were documented in the patients' charts, we view the failure to maintain accurate records of tests and procedures to be equally prohibitive to providing optimal care.

Upon diagnosis, testicular cancer patients should be promptly referred to a comprehensive cancer centre for management as most require chemotherapy, radiotherapy, or close follow-up, all of which are both labor and resource intensive. However, only 29% of Manitobans were referred to and seen by an oncologist at CancerCare Manitoba within 4 weeks of surgery. This observation contrasts that of other centers which have reported good adherence to a "2-week rule" from time of referral to assessment by an oncologist for some cancers.[29,30] Manitoba's sparsely populated land mass, harsh winter climate, and high proportion of rural residents are possible explanations for this difference as such factors often prevent convenient and expedient access to physician services and facilities.

Accurate pathology review of the surgical specimen following orchiectomy is an essential step in guiding further management and estimating risk of recurrence. Characteristics such as tumor size in seminoma, histologic cell type in NSGCT, and degree of rete testis and lymphovascular invasion (LVI) are crucial elements to a complete pathologic evaluation. Warde et al supported this notion in a meta-analysis of 638 early stage seminoma patients, and identified size of primary tumor (> 4 cm, hazard ratio 2.0) and presence of rete testis invasion (hazard ratio 1.7) to be the most important prognostic factors for relapse.[31] Likewise, for early stage NSGCT, the presence of LVI poses a recurrence risk of ~45% versus ~15% in patients without LVI.[32] Interestingly, our review of pathology reports in Manitoba found 73% to be of unacceptable quality; the most common omission was failure to comment on the status of LVI. The causes and processes underlying such deficiencies remain unclear, but warrant further evaluation in the interest of optimizing care.

The experience in Manitoba confirms that XRT is both effective and safe in the management of early stage seminoma. Using the classic "dog-leg" distribution, the radiation field covered the pelvic lymph nodes in 100% of our radiotherapy patients. No patients in this study received up-front supra-diaphragmatic radiation to the mediastinum. Although there is some evidence to suggest that it is reasonable to only treat the para-aortic lymph nodes when there is no history of prior inguinal or scrotal surgery, the risk of recurrence is slightly greater (1.7%) in one series with no significant reduction in radiation-related toxicity.[33] The long-term side effects from XRT can include infertility, erectile dysfunction, GI problems (radiation enteritis, peptic ulcer disease, gastroesophageal reflux), and increase in secondary malignancies.[34-36] Specific toxicity data were not reliably available from this retrospective study, but no treatment-related deaths or second malignancies were noted.

In the current study, all stage I seminomas were managed appropriately with either surveillance or radiotherapy (XRT), but wait times were very long with 8 (31%) individuals spending more than 4 months between diagnosis and XRT. For advanced

disease, seminomas were treated with either XRT or chemotherapy while NSGCT were managed with either surgery or chemotherapy, in accordance with recommendations.[37,38] Of note however, one seminoma patient and two NSGCT patients received six cycles of BEP chemotherapy, which is two cycles beyond what is routinely deemed necessary, thereby exposing these patients to increased potential for toxicity;[37,38] additionally, some of the chemotherapy regimens employed did not conform with usual recommendations.

Using the National Comprehensive Cancer Network guidelines as the gold standard, our review also indicates that there is wide variability in surveillance strategies. Despite implementing a very liberal definition for adequate surveillance, a significant proportion of our patients still had insufficient clinic visits, imaging, and tumor marker monitoring during the first 2 years of follow-up.

Our estimates of overall survival at 5 years were 97% and 84% for seminomas and NSGCT, respectively, which are similar to outcomes reported in the literature.[39,40] Other centers have shown a post-XRT 20 year local control rate and cause specific survival of 95% and 96%, respectively for early stage seminoma.[34] The comparable survival however should be interpreted with caution as the current study is limited by a small sample size of 78 patients, which may have prevented differences in outcomes from being detected. Furthermore, the disparate practice patterns observed in our study may very well have detrimental effects on other outcome measures, such as morbidity from unnecessary interventions and increased health care costs, which were beyond the scope of the current study. The retrospective nature of our series also meant that it was susceptible to the usual biases common to chart reviews, including the risk of reviewer bias and the potential for confounding variables.

Conclusion

Deficiencies are apparent in the management of testicular cancer patients diagnosed in Manitoba between 1998 and 2000. Considering that testicular cancer is a highly curable malignancy of young men, we hope that our study findings will prompt other clinicians to review similar parameters in their jurisdictions for purposes of quality assurance. Moreover, our results indicate that there is a need for well-defined management guidelines and improved education of caregivers. To this end, we are considering the development of a multi-disciplinary rapid access unit to ensure that testicular cancer patients receive the best possible quality of care. □

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