Management of testicular cancer: Practice survey in localized stage

Benoît Mesnard[1], Jean-François Hetet[2], Emmanuel Couteau[3], Arthur Fosse[4], Vincent Bocquillon[5], Alexis Gignoux[6], Michel Baron[7], Nicolas Gaschignard[8], Jérôme Rigaud[1]

[1]Department of Urology and Transplantation Surgery, Nantes University Hospital, Nantes, France; [2]Clinique Jules Verne, Nantes, France; [3]Santé Atlantique, Nantes, France; [4]Hôpital Privé du Confluent, Nantes, France; [5]Polyclinique de l'Europe, Saint Nazaire, France; [6]Clinique Saint-Charles, La Roche-Sur-Yon, France; [7]Clinique Mutualiste, Saint-Nazaire, France; [8]Centre Hospitalier Départemental Vendée, La Roche-Sur-Yon, France

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ABSTRACT

INTRODUCTION: Management of testicular cancer requires a complete evaluation to confirm the localized stage and effective treatment according to guidelines to ensure the best outcome. The primary objective of this study was to evaluate practices at each stage of care in patients with a localized testicular tumor. The secondary objective was to evaluate the oncological prognosis of these patients according to the modalities of care.

METHODS: We conducted a multicenter practice evaluation study with retrospective collection and evaluation of patient records. The study was conducted in two French departments (population pool of 2 million inhabitants) between January 1, 2010, and January 31, 2015, enabling a five-year followup of patients. Patients presenting with stage I testicular tumor according to the American Joint Committee on Cancer classification were included in the analysis.

RESULTS: A total of 226 records were analyzed; 93% of patients underwent bilateral scrotal ultrasound and 93.25% had a chest-abdomen-pelvis computed tomography scan. A total of 29.65% of patients had a preoperative tumor marker assay in accordance with guidelines; 94% of patients had a total orchiectomy, with a median time of 15 days. At the end of the followup period, 17 patients had suffered a recurrence of their disease. Providing adjuvant care in accordance with guidelines reduced the risk of recurrence in patients with a seminomatous tumor.

CONCLUSIONS: Our study showed heterogeneity in compliance with guidelines for evaluation and effective treatment of patients with a localized testicular tumor. Some essential practices, such as assays of tumor markers and fertility preservation for patients over 40 years, were not well carried out. Adjuvant management of localized tumors appears to be an important predictor of recurrence.

INTRODUCTION

Testicular cancer is a rare cancer that mainly affects young adults (15–35 years of age). Testicular cancer represents 1.5% of male tumors and 5% of all urological tumors, with an incidence in Europe estimated at 5.6/100 000 inhabitants.[1] This incidence, however, varies markedly according to world regions, with higher incidence levels in Europe, North America, and Oceania, and lower levels in Africa (0.4/100 000 inhabitants).[2] Although rare, the incidence of these tumors in Western countries has been growing constantly for the past 30 years.[3,4] Despite this increase, mortality related to this cancer has declined worldwide.[1] This decrease in testicular cancer-related mortality can be explained primarily by the introduction of systemic treatments, in particular the use of platinum salts in the 1970s and 80s.[5] The standardization of practices now appears to play a major role in the reduced mortality ascribed to this cancer.

The drafting and dissemination of testicular cancer management guidelines has reduced the mortality associated with this cancer.[6,7] Failure to observe testicular cancer guidelines also leads to an increase in morbidity and a reported drop in quality of life.[8,9] Management of testicular cancer is governed by several guidelines published by learned societies and health authorities: Association Française d'Urologie (AFU), Institut National Du Cancer (INCa), European Association of Urology (EAU), American Urological

KEY MESSAGES

- Heterogeneity in guidelines compliance for evaluation and effective treatment were observed in patients with a localized testicular tumor.
- The assay of tumor markers and fertility preservation for patients over 40 years were poorly carried out.
- Adjuvant management of localized tumors appears to be an important predictor of recurrence.

Association (AUA), National Comprehensive Cancer Network (NCCN), and European Society for Medical Oncology (ESMO).

In 70% of cases, testicular cancer is discovered at the localized stage without extra-testicular extension.[10] Its management, mainly performed by urologists, requires a complete evaluation to confirm the localized stage and an effective treatment according to guidelines to allow excellent survival.

The objective of our study was to carry out a practice evaluation study as part of the management of patients with a localized testicular tumor. The primary objective of this work was to describe practices at each stage of management and to correlate them with guidelines. The secondary objective was to evaluate the long-term oncological prognosis of these patients according to the management modalities.

METHODS

We conducted an evaluation study of professional practices. This was a multicenter, epidemiological study, with retrospective collection and evaluation of patient records.

Population and data collection

The study was conducted in two French departments (population basin of 2 million inhabitants) with records of patients treated by orchiectomy for localized testicular cancer between January 1, 2010, and January 31, 2015, to allow a minimum followup of five years for all patients. It was carried out in nine public and private healthcare centers that cared for more than 90% of patients in these two departments. The inclusion criteria were as follows: patients with a new diagnosis of primary malignant tumor of the testis between January 1, 2010, and January 31, 2015, in the French departments of Loire-Atlantique and Vendée. The exclusion criteria were as follows: anatomopathology in favor of a secondary lesion of the testis or a hematological pathology of testicular localization, extension assessment finding a disease with lymph node (N+) or metastatic (M+) extension.[11] Data collection included: preoperative characteristics of the patient, preoperative imaging and blood tests, surgical data, anatomopathological results, and adjuvant management, along with patient followup.

Statistical analysis and ethics declaration

The reference guidelines were the guidelines in force at the time: AFU 2010,[12] EAU 2010,[13] and ESMO 2010.[14] Tumor extension was determined according to the TNM 2009 classification, and the classification of the American Joint Committee on Cancer (AJCC) 2009.[11] Continuous variables were expressed as mean ± standard deviation (SD) or median (interquartile range [IQR]) according to their normal distribution. Discrete variables were expressed by their number and percentage. The date of last followup was defined by the last referenced medical interview. Survival was analyzed according to the Kaplan-Meier method from the followup of patients with a seminomatous (SGCT) or non-seminomatous (NSGCT) germ cell tumor and compared by the log-rank test (Prism 9.1.1).

This study was declared to the National Commission for Information Technology and Civil Liberties (CNIL) and was subject to amendments to ensure compliance (CNIL reference: 2221375v0). This study was also reported to the Health Data Hub.

RESULTS

Two hundred and twenty-six patients were treated for a localized primary testicular tumor between January 1, 2010, and January 31, 2015. One hundred twenty-eight patients (56.64%) were treated in a public healthcare center and 98 (43.46%) were treated in a private healthcare center. Forty-one surgeons performed all the procedures. Each surgeon performed a median of three operations (1–5).

Patient characteristics

The mean age of the patients was 36 years. The mean age was significantly different depending on the type of tumor presented by the patient (SGCT: 40.14 years/ NSGCT: 29.81 years, $p<0.001$). In our series, just over

17% of patients had gonadal dysgenesis. The characteristics of patients managed in private and public healthcare centers were identical. The primary method of discovery was the self-examination of a testicular mass in the face of acute scrotal pain. All the data are summarized in Table 1.

Preoperative extension assessment

Tumor markers — alpha-fetoprotein (AFP), total human chorionic gonadotropin (HCG), and lactate dehydrogenase (LDG) — were assayed as recommended in 29.65% of cases. Total HCG was only prescribed in 30.97% of cases. Therefore, if we tolerate that the assay of beta-HCG instead of total HCG was acceptable, then the biological assessment was compliant in 82.74% of cases.

A scrotum ultrasound was performed on 211 patients (93.36%). Only one patient received a scrotum magnetic resonance imaging (MRI) (questionable diagnosis in the context of an infertility assessment).

Remote staging was mainly carried out by a chest-abdomen-pelvis computed tomography (CT) scan (94.25% of cases). The combination of abdomen-pelvis MRI and chest X-ray was performed for only one patient with renal impairment.

Twelve patients (5.3%) did not undergo staging by pre- or postoperative imaging (six minor patients with suspected mature teratoma, six patients non-compliant at time of management). There was no association between patients who had not undergone staging by pre- or postoperative imaging and those who had not undergone a tumor marker assay.

An ^{18}FDG positron emission tomography (PET) scan was performed as part of initial staging in 11.95% of cases (research protocol and diagnostic questions concerning lung or retroperitoneal lesions).

Finally, 24.77% of patients had a complete assessment according to strict guidelines: tumor markers (AFP, total HCG [not beta], LDH), scrotum ultrasound, chest-abdomen-pelvis CT. If we tolerate the prescription of beta-HCG instead of total HCG, 73.89% of patients had a complete assessment according to guidelines. All data are shown in Table 2.

Preoperative and surgical care

Traceable information on the possibility of performing sperm cryopreservation was noted in the medical record in more than 75% of cases. Information and performance of sperm cryopreservation were significantly associated with patient age patient. (Information on sperm cryopreservation: 88.2% before 35 years vs. 50% after 40 years, p<0.001; sperm cryopreservation: 70.1% before age 40 vs. 14.1% after age 40, p<0.001.) A testicular prosthesis was implanted at the time of total orchiectomy in 118 cases (54.88%).

Table 1. Patient characteristics (n=226)

	n (%) or mean ± SD or median (IQR)
Age at diagnosis (years)	36.25±12.63
Age at diagnosis (years) according to seminomatous and non-seminomatous tumor status	Seminomatous tumors: 40.14±10.82
Non-seminomatous tumors	29.81±12.91
Weight (kg)	74±21.43
Height (m)	1.77±0.08
BMI (kg/m^2)	25.03±4.50
ASA score 1 2 3 4 Not evaluated	 84 (75%) 24 (21.43%) 3 (2.70%) 1 (0.89%) 114
History of dysgenesis	39 (17.26%)
If yes, type	Cryptorchidism: 15 (38.46%) Varicocele: 6 (15.38%) Infertility: 4 (10.26%) Spermatic cord torsion: 3 (7.69%) Testicular atrophy: 3 (7.69%) Hydrocele: 1 (2.56%) 21-hydroxylase block: 1 (2.56%) Vater syndrome: 1 (2.56%) Other: 5 (12.82%)
Personal history of neoplasia	6 (2.65%)
If yes, type	Contralateral testicular tumor: 2 Prostate adenocarcinoma: 2 Papillary renal cell carcinoma: 1 Penile squamous cell carcinoma: 1
Family history of germ cell tumor (1st or 2nd degree)	4 (1.77%)
Clinical call point	Self-examination: 164 (72.57%) Painful acute bursitis: 29 (12.83%) Chronic pain: 9 (3.98%) Infertility assessment: 9 (3.98%) Hetero-palpation: 6 (2.66%) Gynaecomastia: 4 (1.77%) Incidental discovery upon imaging (for trauma): 4 (1.77%) Early puberty assessment: 1 (0.44%) Signs of local skin invasion: 0 Abdominal pain: 0
Laterality	Left: 117 (51.77%) Right: 109 (48.23%)

IQR: interquartile range; SD: standard deviation.

Table 2. Preoperative assessment (n=226)

	n (%) or mean ± SD or median (IQR)
Local imaging assessment	
Scrotal ultrasound	211 (93.36%)
Scrotal MRI	1 (0.44%)
If yes, indication	Questionable diagnosis in the context of an infertility assessment
Remote extension assessment	
Chest-abdomen-pelvis CT scan	213 (94.25%)
Abdomen-pelvis MRI	2 (0.88%)
If yes, indication	Kidney failure: 1 Doubts concerning secondary liver lesion: 1
Chest X-ray	1 (0.44%)
If yes, indication	Kidney failure: 1
Bone scintigraphy	0
TEP-18FDG	27 (11.95%)
If yes, indication	Scientific research protocol: 12 (44.44%) Doubts concerning pulmonary lesion: 8 (29.63%) Doubts concerning retroperitoneal lesion: 6 (22.22%) Locally advanced tumor without lesions visible by imaging: 1 (3.70%)
Tumor markers	
No assay of tumor markers	12 (5.31%)
Biological assessment performed according to strict guidelines (AFP, total HCG, LDH)	67 (29.65%)
Biological assessment performed (AFP, total HCG and/or beta HCG, LDH)	187 (82.74%)
Complete assessment performed according to strict guidelines: (scrotal ultrasound + chest-abdomen-pelvis CT scan + markers (AFP, total HCG + LDH))	56 (24.77%)

AFP: alpha-fetoprotein; CT: computed tomography; HCG: human chorionic gonadotropin; IQR: interquartile range; LDH: lactate dehydrogenase; MRI: magnetic resonance imaging; SD: standard deviation.

Partial orchiectomy was performed in 13 cases (5.75%), mainly in cases of suspected mature teratoma or the presence of a limited tumor. Of these 13 patients, two underwent totalization of the orchiectomy during the procedure following the extemporaneous examination of the part (discovery of seminoma). After extemporaneous examination, six patients had mature teratoma, six patients had SGCT, and one patient had fibrothecoma. Patients treated by partial orchiectomy for suspected mature teratoma were exclusively minors (Table 3).

Table 3. Preoperative and surgical management (n=226)

	n (%) or mean ± SD or median (IQR)
Sperm preservation	
Sperm cryopreservation information traced in the patient record	176 (77.88%)
Sperm cryopreservation	117 (51.78%)
Testicular biopsy	
Biopsy of the affected testicle	7 (3.09%)
If yes, indication	Clinical and ultrasound discrepancy (lesion not visible by ultrasound): 4 (57.14%) Incidental discovery during testicular exploration: 1 (14.29%) Suspected Leydigoma: 1 (14.29%) Suspected lymphoma: 1 (14.29%)
Biopsy of the contralateral testicle:	2 (0.89%)
If yes, indication	Contralateral nodule
Surgical management	
Delay in consultation with the urologist (days)	15 (9–27)
Surgical approach	Inguinal approach: 226 (100%)
Type of surgery	Total orchiectomy: 213 (94.25%) Partial orchiectomy: 13 (5.75%)
If partial orchiectomy, indication	Suspected mature teratoma: 5 (38.46%) Limited tumor: 5 (38.46%) Suspected benign tumor: 2 (15.38%) Suspected leydigoma: 1 (7.69%)
If partial orchiectomy, number of totalizations	2 (15.38%) (seminomatous tumor with healthy contralateral testicle)
Simultaneous placement of a testicular prosthesis (n=215 total orchiectomies)	118 (54.88%)

IQR: interquartile range; SD: standard deviation.

Anatomopathology data

The most observed tumor types were SGCT (62.95%) and NSGCT (32.59%).

The mean tumor size was 40 mm. In cases of SGCT, tumor size was indicated in 96.45% of cases and inva-

sion of the rete testis in 92.91% of cases; 54 SGCTs had an invasion of the rete testis and 78 were larger than 40 mm. A total of 95 (67.38%) SGCTs were considered high-risk. In cases of NSGCT, the presence of emboli was reported in 100% of cases, allowing these high-risk tumors to be classified in 30.14% of cases

All data are available in Table 4.

Adjuvant management

The preferred adjuvant management depended on the histological type and the risk of tumor recurrence.

Table 4. Anatomopathology data (n=226)

	n (%) or mean ± SD or median (IQR)	
Tumor type	Seminomatous tumor: 141 (62.95%) Mixed non-seminomatous tumor: 51 (22.77%) Pure embryonal carcinoma: 12 (5.36%) Teratoma: 10 (4.46%) Leydig cell tumr: 6 (2.68%) Sertoli cell tumor: 1 (0.45%) Spermatocytic seminoma: 1 (0.45%) Fibrothecoma: 1 (0.45%) Burned-out tumor: 1 (0.45%) N/A: 2	
If mixed non-seminomatous tumor, subtype represented	Embryonal carcinoma: 43 (84.31%) Teratoma: 29 (56.86%) Seminoma: 25 (49.02%) Endodermal sinus tumor: 21 (41.18%) Choriocarcinoma: 17 (33.33%) Syncytiotrophoblast cells: 3 (5.88%) Endodermal sinus tumor: 2 (3.92%) Epidermoid carcinoma: 1 (1.96%)	
n=226	n (%) or mean ± SD or median (IQR)	
	Seminomatous tumors (n=141)	Non-seminomatous tumors (n=73)
Tumor size (mm)	42.54±20.43 Not evaluated: 5 (3.55%)	37.44±23.05 Not evaluated: 2 (2.74%)
Multifocal nature	Unifocal: 132 (93.62%) Multifocal: 9 (6.38%)	Unifocal: 70 (95.89%) Multifocal: 3 (4.11%)
Invasion of rete testis	54 (41.22%) Not evaluated: 10 (7.09%)	17 (28.33%) Not evaluated: 13 (17.81%)
Invasion of the epididymis	12 (8.63%) Not evaluated: 2 (1.42%)	4 (5.88%) Not evaluated: 5 (6.85%)
Lymphovascular invasion	30 (21.28%) Not evaluated: 0	22 (30.14%) Not evaluated: 0
Intratubular germ cell neoplasia	70 (64.82%) Not evaluated: 33 (23.40%)	32 (65.31%) Not evaluated: 24 (32.88%)
T (TNM)	T1: 112 (79.43%) T2: 26 (18.44%) T3: 3 (2.13%) T4: 0	T1: 49 (67.13%) T2: 22 (30.137%) T3: 0 T4: 2 (2.74%)

IQR: interquartile range; N/A: not available SD: standard deviation.

High-risk SGCTs were defined as a size >40 mm and/or an invasion of the rete testis. In cases of low-risk SGCTs, monitoring was the preferred option (71.74%). For high-risk SGCTs, chemotherapy with one cycle of AUC-7 carboplatin was the predominantly selected option (55.91%). Adjuvant management was not influenced by the number of poor prognostic factors (chemotherapy: 55% if one risk factor, 57.5% if two risk factors, p=0.811).

High-risk NSGCTs were defined by the presence of vascular emboli. In cases of low-risk NSGCTs, surveillance was predominantly performed (92%), and in cases of high-risk NSGCTs, 77.27% of patients received chemotherapy with bleomycin-etoposide-cisplatin (BEP).

In cases of adjuvant chemotherapy, 98.39% of patients had undergone chemotherapy (BEP or carboplatin AUC-7) in accordance with the histological type (SGCT or NSGCT) according to the guidelines in force. Only one patient had undergone chemotherapy with BEP for the management of SGCT.

In cases of raised preoperative tumor markers, 58.33% of patients had a postoperative tumor marker assay (assessment of tumor markers two weeks to three months after surgery). Twelve patients (5.43%) had markers that remained elevated postoperatively (stage Is). Of these 12 patients, five had pure embryonal carcinoma and eight patients had mixed NSGCT. Adjuvant chemotherapy was performed in nine cases with either one cycle of BEP (one case), two cycles of BEP (five cases), or three cycles of BEP (three cases). Simple monitoring without treatment was performed in three cases. One of the patients managed by simple monitoring and two patients treated with two BEP cycles suffered from recurrence. The other patients managed by simple monitoring received close followup, with above-normal AFP levels but no CT scan image of recurrence throughout the followup.

All data are available in Table 5.

Patient survival

The median followup time was 5.1 years (min–max 0–11.2 years). During this followup, four patients (1.8%) died. The death of only one patient was linked to metastatic progression of his testicular disease. This was a 48-year-old patient treated for a Sertoli cell tumor who died after rapid metastatic progression of his disease. Of the other three patients who died, two had a retroperitoneal recurrence with remission after salvage chemotherapy (high-risk NSGCT). These two patients died as a result of a second neoplasm (adenocarcinoma of the esophagus and cholangiocarcinoma). The

Table 5. Adjuvant management (n=226)

	n (%) or mean ± SD or median (IQR)
Postoperative tumor markers (Assessment of tumor markers 2 weeks to 3 months after surgery)	
Complete postoperative assessment performed (AFP, total HCG or bHCG, LDH)	80 (35.40%)
Complete postoperative assessment performed according to guidelines (AFP, total HCG, LDH)	33 (14.60%)
Tumor marker assays if preoperative markers positive	70 (58.33%)
AJCC staging	
AJCC stage	Ia: 161 (72.85%) Ib: 48 (21.72%) Is: 12 (5.43%) N/A: 5
Adjuvant management	
Seminomatous tumors (n=141)	
Adjuvant management	Monitoring: 76 (54.29%) Chemotherapy: 62 (44.60%) Radiotherapy: 2 (1.43%) N/A: 1
Adjuvant management of low-risk seminomatous tumors	Monitoring: 33 (71.74%) Chemotherapy: 10 (21.739%) Radiotherapy: 2 (4.38%) N/A: 1
Adjuvant management of high-risk seminomatous tumors	Monitoring: 43 (45.75%) Chemotherapy: 52 (55.91%) Radiotherapy: 0
Non-seminomatous tumors (n=73)	
Adjuvant management	Monitoring: 51 (70.83%) Chemotherapy: 21 (29.17%) Retroperitoneal lymphadenectomy: 0 N/A: 1
Adjuvant management of low-risk non-seminomatous tumors	Monitoring: 46 (92%) Chemotherapy: 4 (8%) N/A: 1
Adjuvant management of high-risk non-seminomatous tumors	Monitoring: 5 (21.73%) Chemotherapy: 17 (77.27%)

High-risk seminomatous tumor defined by a size >40 mm and/or invasion of the rete testis. High-risk non-seminomatous tumor defined by the presence of vascular emboli. AFP: alpha-fetoprotein; CT: computed tomography; HCG: human chorionic gonadotropin; IQR: interquartile range; LDH: lactate dehydrogenase; MRI: magnetic resonance imaging; N/A: not available; SD: standard deviation.

last patient did not suffer a recurrence but died of an opportunistic infection (immunocompromised patient and bipulmonary transplant).

Disease progression was observed in 17 patients (7.5%): seven had SGCT, nine had NSGCT, and one had a non-germinal Sertoli cell tumor (the only patient who died of testicular cancer). The recurrence-free survival of all patients with SGCT was significantly higher than that of all patients with NSGCT, regardless of the adjuvant management (p=0.039) (Figure 1A). Similarly, recurrence-free survival was significantly different according to the AJCC stage (p=0.035), in particular with a recurrence-free survival of 72.7% at five years for the stage Is (Figure 2). None of the patients treated with partial orchiectomy experienced a recurrence.

In the subgroup of seven patients who progressed with SGCT, the median time to recurrence was 281 days (min–max 173–547 days). All these patients had received adjuvant care by simple monitoring without chemotherapy, considering that five of them had a high-risk tumor. All patients experienced localized retroperitoneal recurrence and one patient had associated mediastinal extension. All patients were treated with BEP-type chemotherapy. A single patient required residual mass surgery with retroperitoneal dissection, followed by second-line chemotherapy with taxol-ifosfamide-cisplatin (TIP) before achieving remission.

In the subgroup of nine patients who progressed with NSGCT, the median time to recurrence was 210 days (min–max 52–777 days). Of these patients, eight had a high-risk tumor. In eight cases, adjuvant care was simple monitoring without chemotherapy and in one case, three cycles of BEP chemotherapy (Patient Is). All patients experienced localized retroperitoneal recurrence and one patient had associated pulmonary extension. All patients were treated with BEP-type chemotherapy and achieved remission.

Among patients with SGCT and NSGCT, the recurrence rate was non-significantly higher with monitoring vs. adjuvant chemotherapy (11.3% vs. 7.1%, p=0.326); however, this association was more pronounced in the SGCT group, with a significantly higher recurrence rate in the case of monitoring vs. adjuvant chemotherapy (12.2% vs. 3.1%, p=0.037). No patients with SGCT managed with adjuvant chemotherapy experienced recurrence in the first five years. Management with adjuvant chemotherapy in patients with NSGCT decreased the risk of recurrence, although without reaching the significance threshold (Figure 1B). The number of patients with NSGCT was too small to allow subgroup analysis based on risk and strategy.

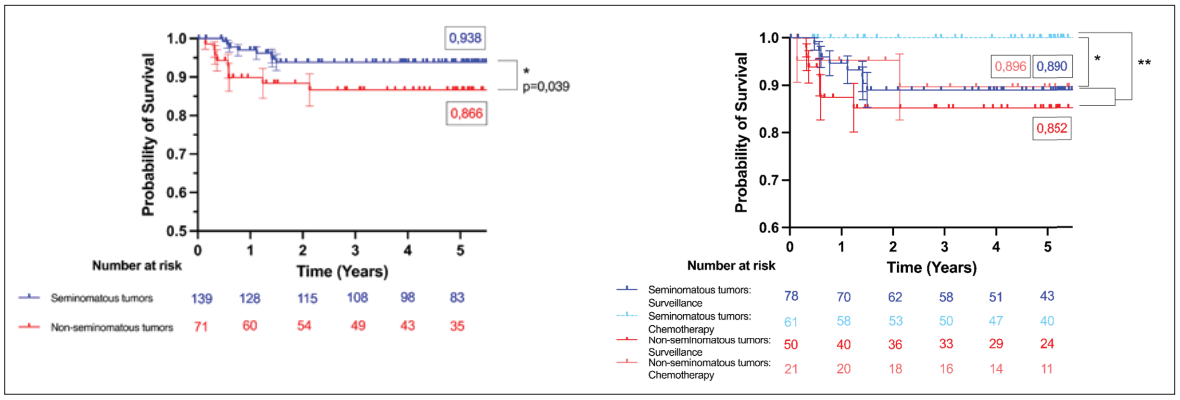

Figure 1. Disease-free survival according to histology (A) according to histology and adjuvant therapy; and (B) comparison according to log-rank test. *p<0.05. **p<0.01. Not available: 17.

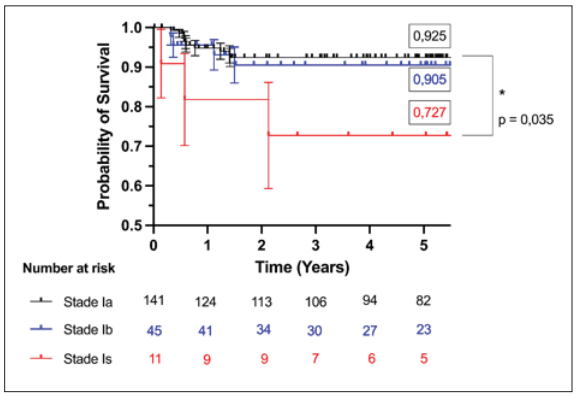

Figure 2. Disease-free survival in seminomatous germ cell tumor (SGCT) or non-seminomatous germ cell tumor (NSGCT) according to American Joint Committee on Cancer (AJCC) classification. Comparison according to log-rank test. *p<0.05. Not available: 17.

DISCUSSION

The management of localized testicular cancers meets a twofold requirement — that of oncological safety and the need to protect patients as much as possible from excessive morbidity related to management.[15] Our retrospective, multicenter practice evaluation study is, to our knowledge, one of the first to specifically evaluate the management of localized testicular tumors.

A complete perioperative assessment according to strict guidelines (tumor markers [AFP, total HCG, LDH], scrotal ultrasound, chest-abdomen-pelvis CT scan) was performed in 24.77% of cases. By tolerating the assay of beta-HCG instead of total HCG, this rate was 73.89%. Adjuvant management generally followed guidelines, with most of the surveillance in low-risk tumors (71.74% for SGCTs and 92% for NSGCTs) and chemotherapy in high-risk tumors (55.91% for SGCTs and 77.27% for NSGCTs). Treatment with adjuvant chemotherapy, in accordance with guidelines, was associated with a significant decrease in recurrence in the SGCT subgroup. This association was not observed in the NSGCT subgroup; however, the number of patients not managed according to guidelines in the NSGCT group was too small to demonstrate a possible significant difference in the recurrence-free survival of patients.

Few studies have evaluated practices in testicular cancer, particularly in localized tumors. Howard et al, in 1995, (retrospective analysis of records, Scottish national study, n=391) evaluated the management of NSGCT at all stages.[16] They concluded that 50% of patients had suboptimal care and that this rate was inversely proportional to the number of patients treated in each of the centers. In a 2014 declarative study of the practices of French urological surgeons (n=289), Rigaud et al found that 75% of practitioners performed less than five orchiectomies per year.[17] They also showed that preoperative tumor marker assays were carried out according to guidelines in only 16% of cases. These data are consistent with the results of our series, which found that 37% of patients had tumor marker assays as per guidelines. Sixty-five percent of practitioners claimed to have performed an imaging evaluation in agreement with guidelines, which was lower than our data. Moreover, a minority of practitioners were aware of the poor prognostic factors associated with SGCT and NSGCT. In a 2016 American study, Wymer et al evaluated the management of germ cell tumors in three centers over a 10-year period (retrospective analysis of records, n=593).[6] They found that 30% of patients had received care that differed from the guidelines of the National Comprehensive Cancer Network (NCCN). Most of these patients had either had inappropriate imaging or had been over-treated. Nestler et al, in a 2018 German declarative study, found that there was an over-performance of testicular biopsy contralateral to the tumor and that the practitioners adhering most

closely to guidelines were those starting their practice.[18] Finally, in a 2008 American registry-based study, Oswald et al concluded that a majority of patients received treatment in accordance with guidelines.[19]

Strengths and limitations

The main strength of our study was that it analyzed patient records, hence enabling real-life evaluation of practices. This method of collection is not subject to the reporting bias observed in declarative studies conducted with practitioners. Moreover, our study proposed an exhaustive evaluation of practices with the inclusion of all patients treated in two French departments, whether in public or private healthcare centers (population pool of 2 million inhabitants).

Our study also had several limitations. Data collection was subject to proper medical record-keeping and hence there was potential bias in data collection. Similarly, with the date of the last followup being based on the last medical consultation, there was a risk of non-collection of recurrences after five years. Furthermore, the generalization of these results to other regions and countries should be considered with caution. Practice guidelines are mostly harmonized between countries, but there are differences in some aspects, as well as in the accessibility of care. Finally, although our study included a significant number of patients, the resulting population was not large enough to assess patient survival by stratifying the analysis on histological type, risk factors, and adjuvant management.

CONCLUSIONS

Our practice study with a retrospective review of records described the management of patients with localized testicular cancer, along with the long-term oncological prognosis of these patients. We showed a heterogeneity in compliance with guidelines. Adjuvant management of localized tumors seems to be an important predictor of recurrence.

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CORRESPONDENCE: Dr. Benoît Mesnard, Department of Urology and Transplantation Surgery, Nantes University, Nantes, France; Ebenoit.mesnard@chu-nantes.fr