

# Brain Metastases as Presenting Feature in 'Burned Out' Testicular Germ Cell Tumor

Kate Johnson<sup>1</sup>, Bryan Brunet<sup>2</sup>

1. Radiation Oncology, Cancer Care Manitoba, University of Manitoba, Canada 2. Radiation Oncology, Saskatoon Cancer Center

✉ **Corresponding author:** Kate Johnson, kate.johnson@usask.ca

Disclosures can be found in Additional Information at the end of the article

---

---

## Abstract

Testicular germ cell tumors (TGCTs) are the most common malignancy in males aged 20 to 39, and the incidence is increasing. TGCTs have a tendency to grow rapidly with a high risk of metastatic spread. TGCTs generally present with a palpable testicular mass, yet may present less commonly with symptoms arising from metastatic disease.

A 24-year-old otherwise healthy male presented with progressive headaches. Initial imaging reported a single mass in the right frontal lobe. Complete surgical resection revealed suspicion for metastatic poorly differentiated carcinoma with an inconclusive immunohistochemical profile. Further staging scans revealed pulmonary and pelvic tumor deposits. Tumor markers with alpha-fetoprotein, beta-human chorionic gonadotropin, and lactate dehydrogenase were not elevated. Follow-up cranial magnetic resonance imaging revealed intracranial disease progression and he underwent whole brain radiation therapy. Additional outside pathology consultation for chromosomal analysis revealed features consistent with a TGCT. A scrotal ultrasound revealed a minimally atrophic right testicle. With evidence supporting the potential for response to chemotherapeutic treatment in TGCT, the patient was started on cisplatin and etoposide. Bleomycin was planned for the second cycle of chemotherapy if his pulmonary function improved.

A salient feature of all invasive TGCTs is a gain in material in the short arm of chromosome 12, and is diagnostic if present. Although the initial pathology revealed a non-diagnostic metastatic tumor, further testing revealed amplification of chromosome 12p. The examination of poorly differentiated carcinomas of an unknown primary site using light microscopy and immunohistochemical profiling alone may be inadequate, and should undergo molecular chromosomal analysis.

This case is presented for its unconventional presentation and rarity of occurrence. It brings forward the discussion of both the commonality of TGCT in young male adults, as well as the anomaly of a 'burned out' phenomenon. With unreliable tumor markers, nonspecific symptoms, and pathological findings, 'burned out' TGCTs may account for a challenging diagnosis in a variety of cases, especially with the presenting symptom arising from a less common metastatic site. This case adds to the increasing literature on a rare entity of the 'burned out' TGCT, and upon literature review, presents itself as the first reported case presenting with brain metastasis.

Received 10/01/2015  
Review began 10/27/2015  
Review ended 03/26/2016  
Published 04/01/2016

© Copyright 2016  
Johnson et al. This is an open access  
article distributed under the terms of the  
Creative Commons Attribution License  
CC-BY 3.0., which permits unrestricted  
use, distribution, and reproduction in any  
medium, provided the original author and  
source are credited.

**Categories:** Oncology, Pathology, Urology

**Keywords:** brain metastasis, regressed, 'burned out' phenomenon, testicular tumour, germ cell tumour, chromosome 12p, case report

---

## Introduction

Testicular germ cell tumors (TGCTs) are the most common malignancy diagnosed in males aged 20 to 39, and the incidence is increasing [1-3]. TGCTs have a tendency to grow rapidly with a high risk of metastatic spread. TGCTs generally present with a palpable testicular mass, yet, less commonly may present with symptoms arising from metastatic disease. Specifically, TGCTs have a propensity to metastasize to retroperitoneal lymph nodes, lungs, liver, bones, and less frequently, to the brain [4].

The phenomenon of a primary TGCT outgrowing its blood supply and undergoing auto-infarction has been described as a 'burned out' TGCT. The regressed testicular lesion is not appreciable on physical exam, and spontaneous regression occurs without treatment [5]. Despite the regression of the primary testicular tumor, approximately 50% of 'burned out' primary testicular tumors continue to harbor malignant cells and distant metastatic disease can progress [6-7]. A 'burned out' TGCT can arise, regress, and metastasize within the same testicle. Cases within the literature describe pathological evidence of tumor regression of a testicular mass with a focus of GCT within a clinically unremarkable testicle [4,8]. This can lead to difficulty in making a diagnosis as the metastasis can be mistaken for a primary tumor.

Imaging can be helpful in making the diagnosis, with scrotal ultrasonography revealing evidence of a regressed tumor. Possible findings consist of a hypochoic area, atrophic testicle, or microcalcifications [7-8]. Macroscopic evidence of a fibrotic scar in the parenchyma and microscopic findings of intratubular germ

## How to cite this article

Johnson K, Brunet B (April 01, 2016) Brain Metastases as Presenting Feature in 'Burned Out' Testicular Germ Cell Tumor. *Cureus* 8(4): e551. DOI 10.7759/cureus.551

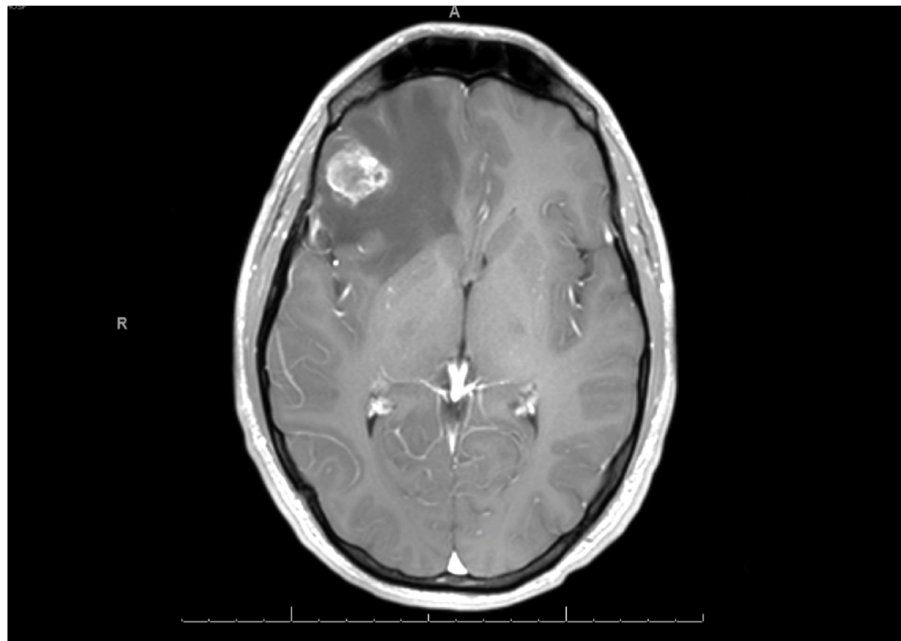
cells or seminomatous foci may be seen on pathological evaluation [9-11].

Of significance, extra-gonadal germ cell tumors (EGCT) are a known entity that also present with biochemistry and histological findings of a germ cell tumor in the absence of primary testicular or ovarian tumor. However, EGCT are differentiated from 'burned out' TGCT by their characteristic midline location, from the pineal gland to the coccyx. Furthermore, in EGCT no radiologic nor pathologic evidence of a primary malignancy is present in the primary reproductive organs [12].

Chemotherapeutic strategies implemented in the 1970s for the treatment of advanced stage TGCTs represents a paradigm shift to a curable disease [13-15]. Here we discuss a rare case that highlights the challenges of diagnosing a 'burned out' TGCT.

## Case Presentation

A 24-year-old previously healthy male presented with progressive nausea, vomiting, visual changes, and memory impairment. His only significant finding on history was a strong family history of factor V Leiden mutation. The physical exam was grossly unremarkable. The initial magnetic resonance imaging (MRI) reported a single mass in the right frontal lobe (Figure 1).

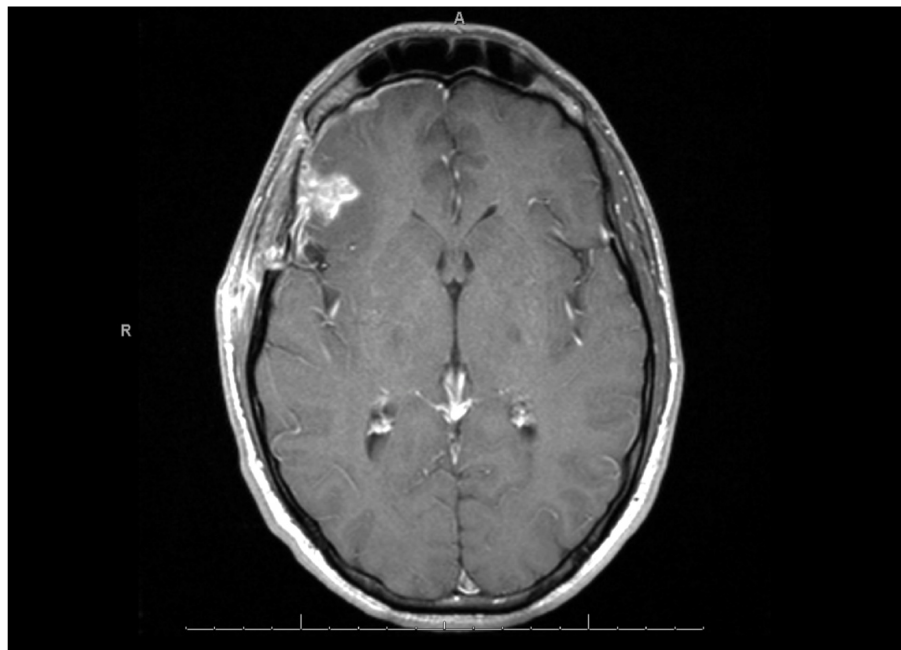


**FIGURE 1: Initial Brain MRI**

Single intra-axial heterogeneously enhancing mass in the inferior aspect of the right frontal lobe.

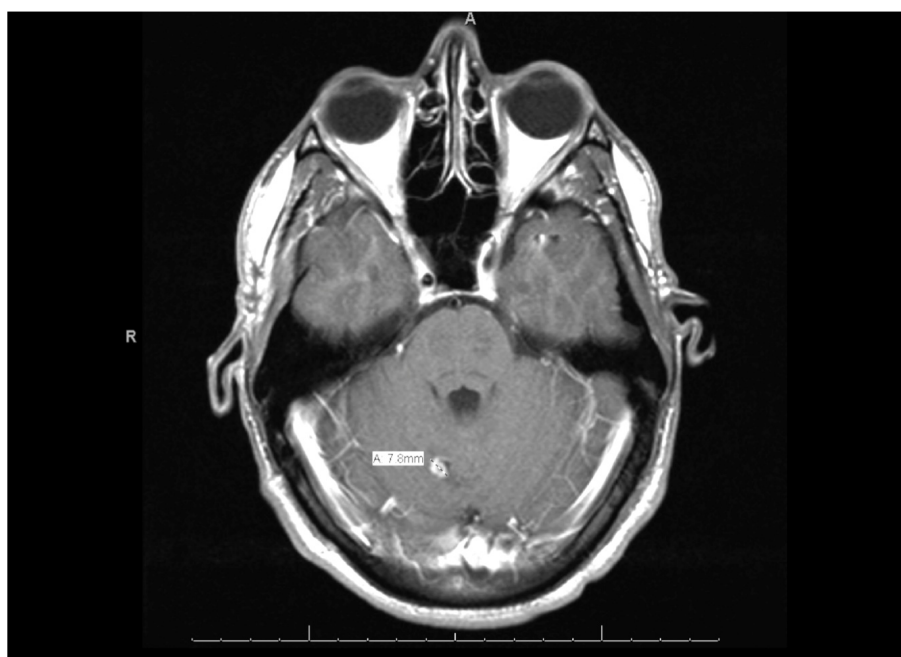
With high suspicion for primary brain tumor, total resection of the intracranial lesion was performed and revealed a metastatic, poorly differentiated carcinoma with an inconclusive immunohistochemical profile.

Staging investigations with computed tomography (CT) and positron emission tomographic (PET) scans revealed pulmonary and pelvic tumor deposits. A scrotal ultrasound revealed a minimally atrophic right testicle with no further abnormalities detected. A follow-up cranial MRI revealed enhancement in the surgical bed and new metastatic foci (Figures 2, 3).



**FIGURE 2: MRI One Month Post-Resection**

Increased enhancement in the surgical bed.

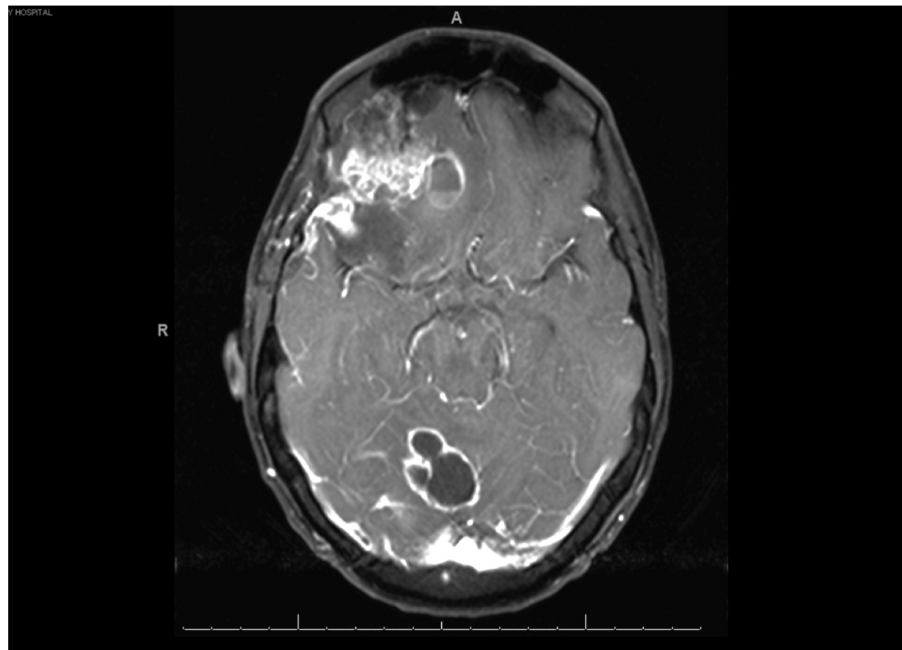


**FIGURE 3: MRI One Month Post-Resection**

New definite enhancing foci compatible with metastatic foci.

Pathological and imaging findings were consistent with metastatic carcinoma with progressive brain lesions from an unestablished primary focus. At this time the brain lesions were increasingly symptomatic. Further treatment options with chemotherapy and whole brain radiation therapy (WBRT) were discussed with the patient. The patient refused palliative intent chemotherapeutic intervention for unknown primary, but agreed to WBRT with a prescribed dose of 50 gray in 10 fractions delivered. Subsequent to this, additional remote pathological consultation with chromosomal analysis revealed isochromosome 12p amplifications, consistent with a TGCT. Tumor markers with alpha-fetoprotein (AFP), beta-human chorionic gonadotropin (BhCG), and lactate dehydrogenase (LDH) were not elevated. With evidence supporting the

potential for response to chemotherapeutic intervention in TGCT, the patient was started on cisplatin and etoposide, with the plan to include bleomycin in subsequent cycles if his pulmonary function improved [14-16]. Unfortunately the patient’s clinical course consisted of progressive brain metastases (Figure 4), seizures, and pulmonary embolism.



**FIGURE 4: MRI Five Months After Initial Presentation**

Marked progression in a multiple ring-enhancing lesions with vasogenic edema.

He rapidly deteriorated before receiving a full course of treatment and succumbed to his disease only five months after initial presentation. Informed consent was obtained from the patient initially and from the patient’s family after he passed away.

## Discussion

### Literature review

English publications of ‘burned out’ TGCT case reports were identified from Medline and EMBASE databases via OVID engine without restrictions on year of publication. The keywords were “germ cell tumor,” “burned out phenomenon,” and “testicular tumor.” Additional studies were identified from reference lists of retrieved papers and review articles. Studies that did not discuss primary testicular origin were excluded. The search yielded 38 results and each abstract was reviewed. A total of 27 articles were thoroughly reviewed and 79 cases of ‘burned out’ TGCTs were identified. The presenting sites, age of patient, tumor markers, histology, treatments employed, and outcomes were tabulated (Table 1) [5, 7-8, 17-40].

First Author/Citation	Year of Study	Presenting/Metastatic Site	Age of Patient	Tumor Markers	Histology	Treatment	Outcome
Balalaa N [17]	2011	Retroperitoneal (n=1)	31	aFP N BhCG N LDH +	NR	BEP	Treatment response
Balzer BL [18]	2006	Retroperitoneal (n=20) Widely disseminated tumor (n=2) Lung and Liver (n=1) Mediastinum (n=1) Other (thyroid, neck)	17-67 (mean 32)	BhCG + (n=2)	Seminoma (n=26)	NR	NR

		thoracic cavity) (n=1)							
		Testicular mass (n=7)							
Castillo C [19]	2003	Retroperitoneal (n=1)	25	aFP + BhCG +	Mature teratoma	BEP		Initial clinical resp	
Comiter CV [20]	1995	Retroperitoneal (n=1) Supraclavicular (n=1)	22-36	NR	NR	NR		NR	
Curigliano G [21]	2006	Retroperitoneal (n=1)	42	aFP N BhCG + LDH N	Seminoma	Orchiectomy, BEP, and RPLND		NR	
Fabre E [5]	2004	Testicular (n=1)	32	aFP N BhCG N LDH N	Seminoma	Orchiectomy and Radiotherapy (30Gy)		Free of disease 16 ) the diagnosis	
		Retroperitoneal (n=1)	35	aFP + BhCG +	Mature teratoma	Orchiectomy, BEP plus vincristine, and RPLND		Free of disease 6 ) the diagnosis	
		Retroperitoneal (n=1)	50	aFP N BhCG N LDH +	Seminoma	Orchiectomy, RPLND, and EP		Total remission 3 ) the diagnosis	
		Retroperitoneal (n=1)	17	aFP N BhCG N LDH N	Mature teratoma	BEP, retroperitoneal mass resection, and orchiectomy		Free of disease 4 ) the diagnosis	
		Supraclavicular (n=1)	39	aFP N BhCG N LDH N	Seminoma	BEP followed by salvage chemo (vinblastine, etoposide, ifosfamide, and cisplatin)		Total remission 3 ) the diagnosis	
George SA [22]	2015	GIST (n=1)	24	aFP N BhCG N LDH N	Mixed GCT	Orchiectomy		NR	
Gurioli A [23]	2013	Retroperitoneal (n=1)	35	aFP N BhCG N LDH +	Seminoma	BEP and orchiectomy		Free of disease 2 ) the diagnosis	
		Retroperitoneal (n=1)	50	aF N BhCG +	Seminoma	Orchiectomy, vincristine, ifosfamide, bleomycin, and surgical debulking of mass		Free of disease 4 ) the diagnosis	
Hu B [24]	2015	Retroperitoneal (n=1)	37	aFP N BhCG N LDH N	Seminoma	NR		NR	
Jaber S [25]	2010	Retroperitoneal (n=1)	32	aFP N BhCG N	Seminoma	Orchiectomy and surgical removal of the retroperitoneal mass		NR	
Kebapci M [26]	2001	Supraclavicular (n=1)	22	aFP N BhCG +	GCT having choriocarcinoma and probable embryonal cell carcinoma components	Orchiectomy and BEP		NR	
Leleu O [27]	2000	Pulmonary (n=1)	30	aFP +	Malignant germ cell	Orchiectomy and BEP		Stable 3 years afte	

				BhCG	+	tumor												diagnosis
				aFP	N													
Lopez JI [28]	1994	Retroperitoneal (n=1)	20	BhCG	+	Choriocarcinoma				Orchiectomy, biopsy of retroperitoneal masses, BEP plus vincristine								Deceased 7 months after initial complaints
				LDH	+													
Mesa H [29]	2009	Gastric ulcers (n=1)	55	aFP	N	Poorly differentiated adenocarcinoma- further studies revealed seminoma				Orchiectomy, vincristine, ifosfamide and cisplatin								Free of disease 1 year after the diagnosis
				BhCG	N													
Onishi K [30]	2014	Para-neoplastic neurological syndrome (n=1)	41	NR		Seminoma				Orchiectomy and chemotherapy								Free of disease 15 months after the diagnosis
				aFP	N													
Patel MD [8]	2007	Testicular (n=1)	23	BhCG	N	Mixed GCT				Orchiectomy								NR
				LDH	N													
Perimenis P [31]	2005	Retroperitoneal (n=1)	40	aFP	N					Orchiectomy, resection of retroperitoneal mass, and radiotherapy to para-aortic nodes								Free of disease 2 years after the diagnosis
				BhCG	N	Seminoma												
				LDH	N													
Peroux E [32]	2012	Retroperitoneal (n=1)	18	aFP	+	Non-seminoma NOS				Orchiectomy and chemotherapy								Full remission
				BhCG	N													
Preda O [33]	2011	Retroperitoneal (n=1)	43	aFP	N					Orchiectomy and chemotherapy								Free of disease 5 months after the diagnosis
				BhCG	N	Seminoma												
				LDH	+													
Qureshi JM [34]	2014	Retroperitoneal and Pulmonary masses (n=1)	20	aFP	N					BEP followed by orchiectomy, RPLND, and hepatic mass resection								Free of disease 2 years after the diagnosis
				BhCG	+	Teratoma GCT												
				LDH	+													
Rzeszutko M [35]	2015	Spermatic cord (n=1)	56	aFP	N	Non-seminoma NOS				Resection of spermatic cord mass								Free of disease 6 months post operatively
				BhCG	N													
Sahoo PK [36]	2013	Retroperitoneal (n=1)	33	aFP	N	Seminoma vs poorly differentiated carcinoma (seminoma confirmed on IHC)				Orchiectomy and BEP								Patient under observation at time of publication
				BhCG	N													
				LDH	N													
Suzuki K [37]	1998	Mediastinum (n=1)	27	aFP	N	Teratoma GCT and sarcomatous elements				BEP								NR
				BhCG	N													
Tasu J [7]	2003	Retroperitoneal (n=1)	23															Free of disease after 5 years follow up (n=1)
		Retroperitoneal (n=1)	35															
		Retroperitoneal (n=1)	50	NR		Non-seminoma NOS (n=3)	seminoma (n=2)	Non-seminoma NOS: BEP (n=3)	Metastatic seminoma: radiotherapy and RPLND (n=1)	Seminoma: orchiectomy (n=1)	Complete remission (n=3)							
		Retroperitoneal (n=1)	17															
		Supraclavicular (n=1)	33															
Yamamoto H [38]	2007	Gastric tumor (n=1)	39	aFP	N					Orchiectomy and EP								Free of disease 2 years after the diagnosis
				BhCG	N	Seminoma												
				LDH	+													
Yucel M [39]	2009	Retroperitoneal (n=1)	28	aFP	N					Orchiectomy and BEP								Free of disease 5 years after the diagnosis
				BhCG	N	'Burned out' testicular tumor NOS												
				LDH	+													

Yucel M [40]	2009	Prostate (n=1)	49	aFP	N	Seminoma	Orchiectomy, BEP plus vincristine, and radiotherapy to mediastinum retroperitoneal and pelvic lymph nodes	Free of disease 7 ) the diagnosis
				BhCG	N			

**TABLE 1: Reported Cases of ‘Burned Out’ TGCT**

n = number of cases

aFP = alpha-fetoprotein

BhCG = beta-human chorionic gonadotropin

LDH = lactate dehydrogenase

N = normal level

+ = elevated level

BEP = bleomycin, etoposide, cisplatin

RPLND = retroperitoneal lymph node dissection

NR = not reported

NOS = not otherwise specified

### Results

The sites of symptomatic metastasis identified were retroperitoneal (51.9%), testicular (12.7%), mediastinal (3.8%), pulmonary (3.8%), gastric (3.8%), and others (24.1%) consisting of prostate, supraclavicular, head and neck, and widely disseminated. The average patient age at presentation was 32.7 years old. Tumor markers were not found to be consistently elevated, with only 12.7%, 10.2%, and 5.1% of the cases found to be increased for BhCG, aFP, and LDH respectively. The most common treatment employed was orchiectomy with chemotherapy (57.5%), followed by chemotherapy alone (32.5%). Radiation therapy was utilized in four (10%) cases, all of which were seminoma [5,7,31,40]. The majority of reported cases had a good treatment response with only one reported death in the literature [28]. Tabulated case details are summarized in Table 2 [5, 7-8, 17-40].

Presenting Site of 'Burned Out' TGCT	Total Cases	Age (Mean, Range)	+BhCG	+aFP	+LDH	Orch Alone	Chemo Alone	Orch + Chemo	Radiation Therapy Included	Treatment Unknown	Treatment Response, Death, Outcome Unknown
Retroperitoneal	41	32 (17-67)					4	9	2	21	15,1,26
<i>Seminoma</i>							4		2		
<i>NSGCT</i>											
Testicular	10	33, (23-56)				2			1	7	2,0,8
<i>Seminoma</i>									1		
<i>NSGCT</i>						2					0,0,3
Mediastinum	3	30.3 (27-32)					1			2	
<i>Seminoma</i>											
<i>NSGCT</i>							1				
Pulmonary	3	27.3 (20-32)						2			2,0,1
<i>Seminoma</i>											
<i>NSGCT</i>								2			
Gastric	3	39 (24-55)					1	2			
<i>Seminoma</i>								2			
<i>NSGCT</i>											
Other	19	32 (20-49)					1	3	1	8	4,0,13
<i>Seminoma</i>								1	1		
<i>NSGCT</i>							1	2			
Total	79	32.7 (17-67)	10	4	8	4	13	16	4	38	23,1,51
<i>Seminoma</i>				0	4				4		
<i>NSGCT</i>				4	2						
<i>Other/unknown</i>					2						

**TABLE 2: Summary of 'Burned Out' TGCT Cases**

NSGCT= non-seminomatous germ cell tumors

+BhCG= elevated beta-human chorionic gonadotropin level

+aFP= elevated alpha-fetoprotein level

LDH= elevated lactate dehydrogenase level

Orch= orchiectomy

**Case discussion**

A salient feature of all invasive TGCTs is a gain in material in the short arm of chromosome 12, and is diagnostic if present [41]. Although the initial pathology revealed a non-diagnostic metastatic tumor, further



testing revealed an amplification of chromosome 12p leading to the diagnosis of TGCT. This suggests that the examination of poorly differentiated carcinomas of an unknown primary site using light microscopy and immunohistochemical profiling may be inadequate, and should undergo additional testing modalities with molecular chromosomal analysis [41-42].

The behavior and aggressive nature of the tumor discussed throughout this case combines the complexity of the evolving field of tumor biology and unique patient characteristics. Interestingly, the patient had a confirmed family history of factor V Leiden mutation. It has been suggested that clotting factor polymorphisms such as factor V Leiden are associated with cancer onset and progression. The theoretical mechanism behind such adverse effects stems from the involvement of tissue factor and thrombin in tumor angiogenesis, which is essential for tumor growth and metastasis [43]. Furthermore, such factors may contribute to a more radio-resistant tumor profile despite advanced diagnostic techniques and treatment modalities. Thus, this case reflects the arising need for further research to explore the dynamic interplay of tumor biology and patient characteristics for targeting tumor response.

## Conclusions

This case is presented for its unconventional presentation, rarity of occurrence, and difficulty in diagnosis. It brings forward the discussion of both the commonality of TGCT in young male adults, as well as the anomaly of a 'burned out' TGCT. With unreliable tumor markers, nonspecific symptoms, and pathological findings, the 'burned out' phenomenon accounts for a challenging diagnosis, particularly with the presenting symptom arising from a less common metastatic site. This case adds to the increasing literature on the rare entity of the 'burned out' TGCT, and upon literature review, presents itself as the first reported case presenting with brain metastasis. By establishing a strong foundation of 'burned out' TGCT in the literature leading to familiarity of the diagnostic process, a deeper understanding into medical management may arise.

## Additional Information

### Disclosures

**Human subjects:** Consent for the use of case details with intent of publication was obtained from the individual described in the case study. Consent was discussed and documented by the first author of the case report. As the patient unfortunately was deceased at the time of publication, further written consent was also obtained by the family of the patient. .

## References

1. International Germ Cell Cancer Collaborative Group: International germ cell consensus classification: a prognostic factor-based staging system for metastatic germ cell cancers. *J Clin Oncol.* 1997, 15:594-605.
2. Surveillance, Epidemiology and End Result Program: SEER stat fact sheets: testis cancer. National Cancer Institute. (2015). Accessed: September 1, 2015: <http://seer.cancer.gov/statfacts/html/testis.html>.
3. McGlynn KA, Devesa SS, Sigurdson AJ, Brown LM, Tsao L, Tarone RE: Trends in the incidence of testicular germ cell tumors in the United States. *Cancer.* 2003, 97:63-70. [10.1002/cncr.11054](https://doi.org/10.1002/cncr.11054)
4. Bosl GJ, Motzer RJ: Testicular germ-cell cancer. *N Engl J Med.* 1997, 357:242-254. [10.1056/NEJM19970724370406](https://doi.org/10.1056/NEJM19970724370406)
5. Fabre E, Jira H, Izard V, Ferlicot S, Hammoudi Y, Theodore C, Di Palma M, Benoit G, Droupy S: 'Burned-out' primary testicular cancer. *BJU Int.* 2004, 94:74-78. [10.1111/j.1464-410X.2004.04904.x](https://doi.org/10.1111/j.1464-410X.2004.04904.x)
6. Azzopardi JG, Mostofi FK, Theiss EA: Lesions of testes observed in certain patients with widespread choriocarcinoma and related tumors. The significance and genesis of hematoxylin-staining bodies in the human testis. *Am J Pathol.* 1961, 38:207-225.
7. Tasu J, Faye N, Eschwege P, Rocher L, Bléry M: Imaging of burned-out testis tumor: five new cases and review of the literature. *J Ultrasound Med.* 2003, 22:515-521.
8. Patel MD, Patel BM: Sonographic and magnetic resonance imaging appearance of a burned-out testicular germ cell neoplasm. *J Ultrasound Med.* 2007, 26:143-146.
9. Choyke PL, Hayes WS, Sesterhenn IA: Primary extragonadal germ cell tumors of the retroperitoneum: differentiation of primary and secondary tumors. *Radiographics.* 1993, 13:1365-1375.
10. Savatovsky I, Paugam B, Piekarski JD: Retroperitoneal lymph node metastasis of an infraclinical testicular seminoma (author's transl). [Article in French]. *J Urol (Paris).* 1981, 87:235-237.
11. Bohle A, Studer UE, Sonntag RW, Scheidegger JR: Primary or secondary extragonadal germ cell tumors?. *J Urol.* 1986, 135:939-943.
12. Albany C, Einhorn LH: Extragonadal germ cell tumors: clinical presentation and management . *Curr Opin Oncol.* 2013, 25:261-265.
13. Einhorn LH: Curing metastatic testicular cancer. *Proc Natl Aca Sc USA.* 2002, 99:4592-4595. [10.1073/pnas.072067999](https://doi.org/10.1073/pnas.072067999)
14. Einhorn L, Williams S: Chemotherapy of disseminated testicular cancer. a random prospective study . *Cancer.* 1980, 46:1339-1344. [10.1002/1097-0142\(19800915\)46:6<1339::AID-CNCR2820460607>3.0.CO;2-J](https://doi.org/10.1002/1097-0142(19800915)46:6<1339::AID-CNCR2820460607>3.0.CO;2-J)
15. Kollmannsberger C, Nichols C, Bamberg M, Hartmann JT, Schleucher N, Beyer J, Schöfski P, Derigs G, Rütther U, Böhlke I, Schmoll HJ, Kanz L, Bokemeyer C: First-line high-dose chemotherapy +/- radiation therapy in patients with metastatic germ-cell cancer and brain metastases. *Ann Oncol.* 2000, 11:553-559. [10.1023/A:1008388328809](https://doi.org/10.1023/A:1008388328809)
16. Bokemeyer C, Nowak P, Haupt A, Metzner B, Köhne H, Hartmann JT, Kanz L, Schmoll HJ: Treatment of brain metastases in patients with testicular cancer. *J Clin Oncol.* 1997, 15:1449-1454.
17. Balalaa N, Salman M, Hassen W: Burned-out testicular tumor: a case report. *Case Rep Oncol.* 2011, 4:12-15.

- [10.1159/000324041](https://doi.org/10.1159/000324041)
18. Balzer BL, Ulbright TM: Spontaneous regression of testicular germ cell tumors: an analysis of 42 cases. *Am J Surg Pathol.* 2006, 30:858-865. [10.1097/01.pas.0000209831.24230.56](https://doi.org/10.1097/01.pas.0000209831.24230.56)
  19. Castillo C, Krygier G, Carzoglio J, Cepellini Magariños R, Cepellini Olmos R, Jubín J, Sabini G: Gastrointestinal bleeding as the first manifestation of a burned-out tumour of the testis. *Clin Transl Oncol.* 2005, 7:458-463. [10.1007/BF02716597](https://doi.org/10.1007/BF02716597)
  20. Comiter CV, Benson CJ, Capelouto CC, Kantoff P, Shulman L, Richie JP, Loughlin KR: Nonpalpable intratesticular masses detected sonographically. *J Urol.* 1995, 154:1367-1369. [10.1016/S0022-5347\(01\)66865-4](https://doi.org/10.1016/S0022-5347(01)66865-4)
  21. Curigliano G, Magni E, Renne G, De Cobelli O, Rescigno M, Torrasi R, Spitaleri G, Pietri E, De Braud F, Goldhirsch A: "Burned out" phenomenon of the testis in retroperitoneal seminoma. *Acta Oncol.* 2006, 45:335-336. [10.1080/02841860500401175](https://doi.org/10.1080/02841860500401175)
  22. George SA, Al-Taleb A, Hussein S: Retrogressed (burned-out) testicular germ cell tumor disguising as duodenal gastrointestinal stromal tumor. *Onc Gas Hep Rep.* 2015, 4:114-115. [10.4103/2348-3113.152335](https://doi.org/10.4103/2348-3113.152335)
  23. Gurioli A, Oderda M, Vigna D, Peraldo F, Giona S, Soria F, Cassenti A, Pacchioni D, Gontero P: Two cases of retroperitoneal metastasis from a completely regressed burned-out testicular cancer. *Urologia.* 2013, 80:74-79. [10.5301/RU.2013.10768](https://doi.org/10.5301/RU.2013.10768)
  24. Hu B, Shah S, Shojaei S, Daneshmand S: Retroperitoneal lymph node dissection as first-line treatment of node-positive seminoma. *Clin Genitourin Cancer.* 2015, 13:265-269. [10.1016/j.clgc.2015.01.002](https://doi.org/10.1016/j.clgc.2015.01.002)
  25. Jaber S: Retroperitoneal mass and burned out testicular tumor. *Saudi J Kidney Dis Transpl.* 2010, 21:542-543.
  26. Kebapci M, Can C, Isiksoy S, Aslan O, Oner U: Burned-out tumor of the testis presenting as supraclavicular lymphadenopathy. *Eur Radiol.* 2002, 12:371-373. [10.1007/s003300101038](https://doi.org/10.1007/s003300101038)
  27. Leleu O, Vaylet F, Debove P, Levagueresse R, L'her P: Pulmonary metastasis secondary to burned-out testicular tumor. *Respiration.* 2000, 67:590. [10.1159/000029579](https://doi.org/10.1159/000029579)
  28. Lopez JI, Angulo JC: Burned-out tumour of the testis presenting as retroperitoneal choriocarcinoma. *Int Urol Nephrol.* 1994, 26:549-553. [10.1007/BF02767657](https://doi.org/10.1007/BF02767657)
  29. Mesa H, Rawal A, Rezcallah A, Iwamoto C, Niehans GA, Druck P, Gupta P: "Burned out" testicular seminoma presenting as a primary gastric malignancy. *Int J Clin Oncol.* 2009, 14:74-77. [10.1007/s10147-008-0804-0](https://doi.org/10.1007/s10147-008-0804-0)
  30. Onishi K, Tomioka A, Maruyama Y, Otani T, Ishikawa H, Fujimoto K: Burned-out testicular tumor diagnosed triggered by paraneoplastic neurological syndrome; a case report (Article in Japanese). *Hinyokika Kiyo.* 2014, 60:651-655.
  31. Perimenis P, Athanasopoulos A, Geraghty J, Macdonagh R: Retroperitoneal seminoma with 'burned out' phenomenon in the testis. *Int J Urology.* 2005, 12:115-116. [10.1111/j.1442-2042.2004.00987.x](https://doi.org/10.1111/j.1442-2042.2004.00987.x)
  32. Peroux E, Thome A, Geffroy Y, Guema BN, Arnaud FX, Teriitehau CA, Baccialone J, Potet J: Burned-out tumour: a case report. *Diagn Interv Imaging.* 2012, 93:796-798. [10.1016/j.diii.2012.03.023](https://doi.org/10.1016/j.diii.2012.03.023)
  33. Preda O, Nicolae A, Loghin A, Borda A, Nogales FF: Retroperitoneal seminoma as a first manifestation of a partially regressed (burnt-out) testicular germ cell tumor. *Rom J Morphol Embryol.* 2011, 52:193-196.
  34. Qureshi JM, Feldman M, Wood H: Metastatic "burned-out" germ cell tumor of the testis. *J Urol.* 2014, 192:936-937. [10.1016/j.juro.2014.06.038](https://doi.org/10.1016/j.juro.2014.06.038)
  35. Rzeszutko M, Rzeszutko W, Nienartowicz E, Jeleń M: Paratesticular localization of burned out non-seminomatous germ cell tumor--NSGCT: a case report. *Pol J Pathol.* 2006, 57:55-57.
  36. Sahoo PK, Mandal PK, Mukhopadhyay S, Basak SN: Burned out seminomatous testicular tumor with retroperitoneal lymph node metastasis: a case report. *Indian J Surg Oncol.* 2013, 4:390-392. [10.1007/s13193-012-0207-6](https://doi.org/10.1007/s13193-012-0207-6)
  37. Suzuki K, Yoshida T, Inoue M, Yoshida I, Kurokawa K, Suzuki T, Imai K, Yamanaka H: Growing mediastinal metastatic tumour in a patient with burned out testicular cancer. *Int Urol Nephrol.* 1998, 30:181-184. [10.1007/BF02550574](https://doi.org/10.1007/BF02550574)
  38. Yamamoto H, Deshmukh N, Gourevitch D, Taniere P, Wallace M, Cullen MH: Upper gastrointestinal hemorrhage as a rare extragonadal presentation of seminoma of testis. *Int J Urol.* 2007, 14:261-263. [10.1111/j.1442-2042.2007.01685.x](https://doi.org/10.1111/j.1442-2042.2007.01685.x)
  39. Yucel M, Kabay S, Saracoglu U, Yalcinkaya S, Hatipoglu NK, Aras E: Burned-out testis tumour that metastasized to retroperitoneal lymph nodes: a case report. *J Med Case Rep.* 2009, 3:7266. [10.1186/1752-1947-3-7266](https://doi.org/10.1186/1752-1947-3-7266)
  40. Yucel M, Saracoglu U, Yalcinkaya S, Hatipoglu NK, Kabay S, Dedekarginoglu G: Burned-out testicular seminoma that metastasized to the prostate. *Cent European J Urol.* 2009, 62:195-197.
  41. Rodriguez S, Jafer O, Goker H, Summersgill BM, Zafarana G, Gillis AJ, van Gurp RJ, Oosterhuis JW, Lu YJ, Huddart R, Cooper CS, Clark J, Looijenga LH, Shipley JM: Expression profile of genes from 12p in testicular germ cell tumors of adolescents and adults associated with i(12p) and amplification at 12p11.2-p12.1. *Oncogene.* 2003, 22:1880-1891. [10.1038/sj.onc.1206302](https://doi.org/10.1038/sj.onc.1206302)
  42. Poorly differentiated neoplasms of unknown primary site. (2015). Accessed: August 25, 2015; [http://www.aboutcancer.com/cup\\_poor\\_neo\\_utd\\_507.htm](http://www.aboutcancer.com/cup_poor_neo_utd_507.htm).
  43. Vossen CY, Hoffmeister M, Chang-Claude JC, Rosendaal FR, Brenner H: Clotting factor gene polymorphisms and colorectal cancer risk. *J Clin Oncol.* 2011, 29:1722-1727. [10.1200/JCO.2010.31.8873](https://doi.org/10.1200/JCO.2010.31.8873)