Case Report

Journal of INTERNATIONAL MEDICAL RESEARCH

Journal of International Medical Research
2019, Vol. 47(6) 2728–2739

DOI: 10.1177/0300060519842049
journals.sagepub.com/home/imr
SAGE

Enormous primary renal diffuse large B-cell lymphoma: A case report and literature review

Xu Cheng[1,*], Zhichao Huang[1,*], Daiqiang Li[2] and Yinhuai Wang[1]

Abstract

Introduction: Primary renal lymphoma is a rare malignant lymphoma that is difficult to differentiate from renal cell carcinoma. Positron emission tomography/computed tomography and image-guided percutaneous biopsy are valuable tools for diagnosis.

Case report: A 64-year-old woman presented with a 2-year history of repeated right waist pain and a 1-month history of nausea, vomiting, and frequent and urgent urination. A computed tomography scan showed a huge mass that was initially considered to be renal cell carcinoma at the upper pole of the right kidney. The mass had invaded the renal pelvis, narrowed the right renal artery, and constricted the inferior vena cava and liver. Postoperative examination of the tumor confirmed lymphoma. We herein present this case and its multidisciplinary team management.

Conclusion: Multidisciplinary team management is efficient for preoperative assessment and surgery in difficult and high-risk cases. Based on our literature review, we suggest biopsy before chemotherapy whenever possible. Chemotherapy can be implemented after surgery for better survival outcomes.

Keywords

Kidney, diffuse large B-cell lymphoma, primary, multidisciplinary teams, computed tomography, renal cell carcinoma

Date received: 22 October 2018; accepted: 14 March 2019

[1]Department of Urology, The Second Xiangya Hospital, Central South University, Changsha, Hunan, China
[2]Department of Pathology, The Second Xiangya Hospital, Central South University, Changsha, Hunan, China

*These authors contributed equally to this work.

Corresponding author:
Yinhuai Wang, Department of Urology, The Second Xiangya Hospital of Central South University, 139 Renmin Middle Road, Changsha 410000, China.
Email: wangyinhuai@csu.edu.cn

Background

Malignant lymphoma, especially non-Hodgkin lymphoma (NHL), may infiltrate into extranodal tissues such as the kidney. However, NHL primarily arising in extranodal tissue is rare and accounts for only one-third of all cases of NHL.[1] NHL arising in the kidney is extremely rare[2] and difficult to differentiate from renal cell carcinoma (RCC). Lymphoma that originates from the kidney is called primary renal lymphoma (PRL), and only a few cases have been reported. Clinical information regarding the diagnosis, treatment, and prognosis of PRL is scarce. We herein report a case of enormous primary renal diffuse large B-cell lymphoma (DLBCL) with management by multidisciplinary teams (MDTs) and present a review of the literature.

Case presentation

Ethics approval and consent were not applicable in this case because the case was reported retrospectively without personal information and the patient underwent no non-routine procedures.

A 64-year-old woman presented with a 2-year history of repeated right waist pain and a 1-month history of nausea, vomiting, and frequent and urgent urination. A previous computed tomography (CT) scan had revealed a huge renal mass. The patient was admitted to the urology department of our hospital for further treatment. Her medical history also included diagnoses of coronary heart disease (cardiac function grade II, high blood pressure (level 3, high-risk group), and calculous cholecystitis. Physical examination showed percussion tenderness over the kidney region but no superficial lymph node enlargement. Laboratory tests revealed the following: red blood cell count, 3.72×10^{12}/L; hemoglobin concentration, 102 g/L; white blood cell count, 2.39×10^{9}/L; generally normal coagulation function, liver and renal function, electrolyte levels, and brain natriuretic peptide concentration; 24-h urine free cortisol level, 827.3 nmol/24 h; supine position plasma renin activity, 30 ng/L; supine position angiotensin II, 367 ng/L; supine position aldosterone, 192 ng/L; standing position plasma renin activity, 202 ng/L; standing position angiotensin II, 91 ng/L; standing position aldosterone, 297 ng/L; high aldosterone-to-renin ratio; and neuron-specific enolase, 62.57 ng/mL. A CT scan of the urinary system and CT angiography of the renal vasculature revealed a huge mass that was primarily considered to be RCC at the upper pole of the right kidney. The mass invaded the renal pelvis, narrowed the right renal artery, and constricted the inferior vena cava and liver (Figure 1(a)–(c)). Additionally, the presence of a large gallbladder stone was suspected (Figure 1(d)). A comprehensive evaluation with MDT consultation (including radiologists, vascular surgeons, anesthesiologists, general surgeons, urologists, and intensive care unit doctors) was completed. This evaluation revealed that the tumor was closely related to the inferior vena cava, liver, gallbladder, and other surrounding tissues and that careful preparation was needed for repair of the damaged inferior vena cava. Because the tumor was next to the gallbladder stone, cholecystectomy during the surgery was suggested. The MDT concluded that the patient should be sent to the intensive care unit after the surgery for intensive nursing. Generally, the operation was considered difficult and high-risk.

The urologists, vascular surgeons, hepatobiliary surgeons, and cardiothoracic surgeons all played an important part in the collective effort of radical nephrectomy, cholecystectomy, inferior vena cava repair, diaphragm repair, and regional lymph node dissection. During the surgical exploration,

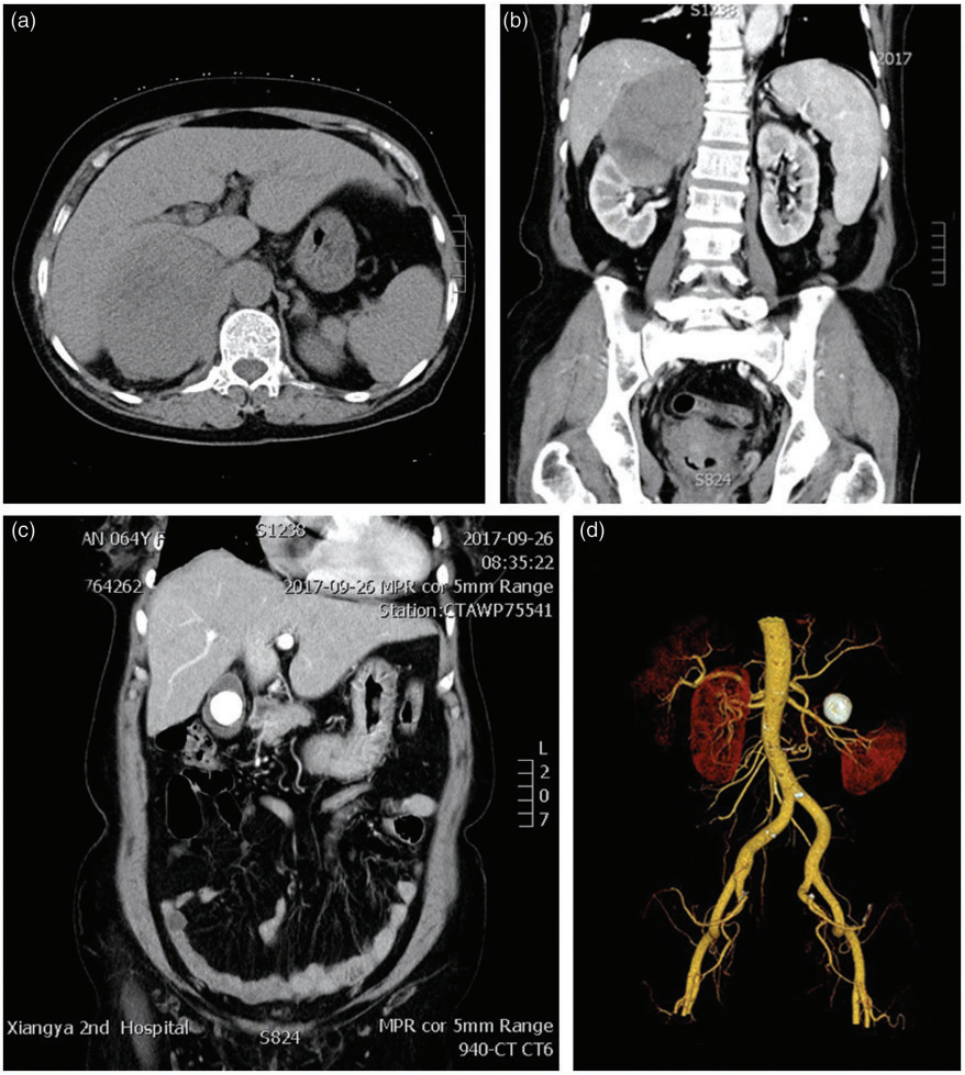

Figure 1. Abdominal computed tomography scan. (a) Transverse section. (b) Coronal section. (c) Three-dimensional reconstruction. (d) Gallbladder stone.

the tumor was measured as $10 \times 9 \times 6$ cm and was located close to inferior vena cava, liver, diaphragm, and surrounding structures. The tumor had an incomplete capsule and brittle quality, and some fish-meat-like sections were present. The pathology specimens were evaluated in our hospital (Figure 2(a)–(f)), and the examination findings confirmed right renal DLBCL (non-germinal center type). Immunohistochemical analysis showed that the tumor cells were positive for vimentin, CD20, bcl-2, and PAX-5; negative for CK, CD23, CD21, CD5, bcl-6, CD10, cxcl-13, Mum-1, cyclin D1, CD30, TdT, EMA, and EBER; and equivocal for CD3 and C-myc. The Ki67 labeling index was 70%. The four removed lymph nodes were

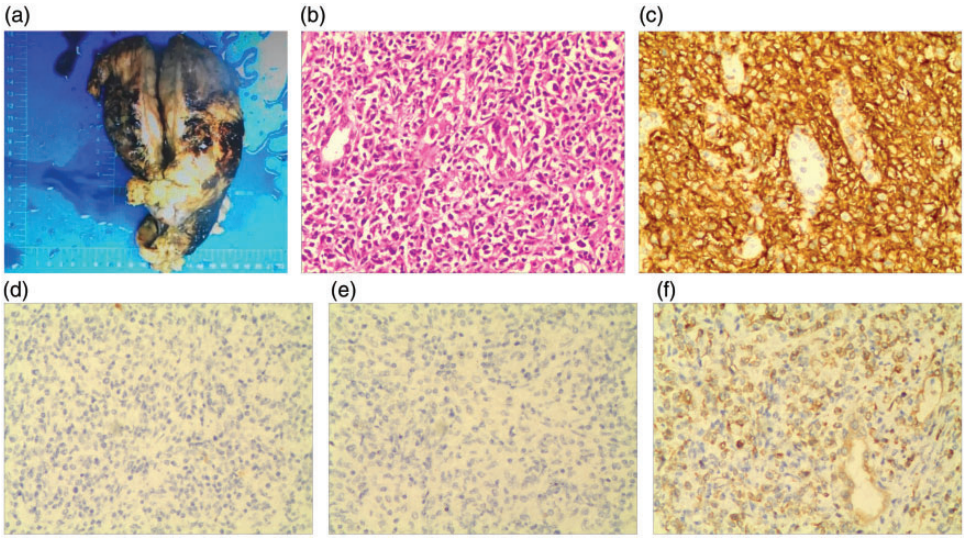

Figure 2. Histological findings of the resected right renal kidney. (a) Gross specimen ($10 \times 9 \times 6$ cm). (b) Hematoxylin and eosin staining (200×). (c) CD20 staining (200×). (d) CD10 staining (200×). (e) Negative for bcl-6 (200×). (f) Positive for bcl-2 (200×).

negative. After the surgery, the patient received the first course of chemotherapy comprising cyclophosphamide, doxorubicin, vincristine, and prednisolone (CHOP regimen), and she was undergoing follow-up at the time of this writing.

Discussion

The prevalence of MDTs for management of complex cases has been increasing globally. There is evidence showing the benefits of MDTs for both patients and health-care professionals.[3] Our MDTs provide a means of effective group consultation for the management of complex cases. MDTs collaborate in the decision-making process in a highly time-efficient manner. Although the establishment of MDTs has financial implications, it provides patients numerous benefits.

Primary renal DLBCL constitutes a majority of cases of PRL; however, only a few cases have been reported.[4] In 2000, Stallone et al.[5] reviewed the available literature and reported only 29 cases of PRL fulfilling 3 diagnostic criteria: lymphomatous renal infiltration, nonobstructive unilateral or bilateral kidney enlargement, and no extrarenal localization at the time of diagnosis. In the present case, CT showed a single occupying lesion of the right renal parenchyma that had not invaded the surrounding tissues, nor had it invaded other organs of the body. According to the available clinical data, it was reasonable to diagnose the patient with primary renal DLBCL.

Yang et al.[6] reviewed the clinical data of 24 cases of renal DLBCL (including primary DLBCL) and concluded that primary renal DLBCL mostly existed in people of advanced age who experienced abdominal or low back pain, abdominal distension, and palpation of a renal mass. Clinicobiological features and pathological characteristics showed a very aggressive malignancy and poor prognosis. The clinical manifestations in the present case were generally consistent with the previous

reports except that the patient developed nausea, vomiting, and frequent and urgent urination for 2 years. In addition, the enormous tumor was closely associated with the inferior vena cava, liver, gallbladder, and surrounding tissues, which increased the difficulty and risk of surgery.

We thoroughly reviewed all 54 cases of PRL reported in the literature since 2002 (Table 1).[4,7–49] DLBCL was found to be the most common pathological type, and more male than female patients (64.8%) were reported. Additionally, PRL was generally located in the bilateral kidneys in younger patients (<30 years old) and in a unilateral kidney in older patients, indicating that the site of PRL is age-related. Of the 40 patients whose laboratory results were reported, 25 (62.5%) developed renal impairment. In addition, bilateral PRL and younger age seem to be associated with a shorter survival time according to the limited follow-up data. Unexpectedly, however, the review showed no significant relationship between pathological type and survival. Moreover, chemotherapy was the main treatment for PRL, and R-CHOP was the most common chemotherapeutic regimen. Patients treated with surgery plus chemotherapy had a longer survival time when treated with single-agent chemotherapy; combined treatments appeared to result in slower disease progression. However, the data were obtained from different cases, and significant bias might therefore be present.

PRL has frequently been misdiagnosed as RCC, although they can coexist with each other.[50] Supplementary examinations of PRL include three steps: imaging, minimally invasive biopsy, and surgical exploration. PRL frequently produces complex CT and magnetic resonance images,[51] which can show single or multiple focal lesions or diffuse renal enlargement. A main difference between PRL and RCC is that PRL often lacks a blood supply and rarely invades the inferior vena cava as shown by CT, while RCC is rich in blood vessels and invades the inferior vena cava. In addition, the center of the PRL tumor is outside the renal collection system, which helps to differentiate PRL from other urothelial tumors. A benign hyperdense cyst would measure ≥70 HU on unenhanced CT images, whereas a PRL would measure 30 to 50 HU on unenhanced CT images and would be of lower density than other benign renal tumors.[52] CT is the imaging modality most commonly used to evaluate renal lymphoma. However, magnetic resonance imaging may also be useful in selected patients and usually shows PRL with low to intermediate signal intensity on T1- and T2-weighted sequences.[51] In 2010, Ye et al.[53] revealed that positron emission tomography/CT appeared to be useful in the differential diagnosis of PRL because RCC, including the papillary and chromophobe subtypes, is not as intensely fluorodeoxyglucose-avid as PRL.[54] Positron emission tomography/CT also helps to assess the response to therapy.[51] Hagihara et al.[2] suggested that imaging-guided percutaneous biopsy could be of high sensitivity and specificity for the diagnosis of PRL. Previous studies indicated that patients diagnosed with PRL receiving chemotherapy alone can also achieve a good treatment response and avoid radical nephrectomy.[33,40,55] Nevertheless, the sensitivity of needle biopsy is 70% to 92%, which is well below 100%, and has risks of adjacent organ and vessel damage. Therefore, the gold standard diagnostic technique is still surgery and pathological examination.

In addition to surgery, chemotherapy is also an important part of integrated therapy and may achieve a satisfactory curative effect. One study showed that rituximab combined with high-dose chemotherapy (R-CHOP regimen) may improve progression-free survival and that

Table 1. Literature review of the 54 cases of primary renal lymphoma reported in the literature since 2002.

No.	Sex	Age (years)	Site	Renal impairment	Treatment	Chemotherapeutic agents	Histology	Follow-up
1	Male	62	Bilateral	Yes	Chemotherapy	CHOP	B-cell lymphoma, follicular type	Died at 2 months
2	Male	45	Right	Yes	Surgery + chemotherapy	B-ALL	B-cell lymphoma, Burkitt-like type	Alive at 47 months
3	Male	14	Bilateral	Yes	Chemotherapy	CCG-5942	Diffuse large B-cell lymphoma	Alive at 2 weeks
4	Male	79	Left	Yes	Surgery	None	Marginal-zone B-cell lymphoma	Alive at 2 months
5	Male	43	Right	Unknown	Surgery	None	B-cell lymphoma of MALT	Alive at 28 months
6	Male	46	Bilateral	Yes	Surgery + chemotherapy	Pro-MECE-Cyta, BOM + Flu-Ctx-Idec	Diffuse large B-cell lymphoma	Alive at 67 months
7	Female	70	Right	No	Surgery + chemotherapy	R-CHOP	Diffuse large B-cell lymphoma	Alive at 8 months
8	Female	65	Left	Unknown	Surgery + chemotherapy + radiation	R-CHOP	Diffuse large B-cell lymphoma	Alive at 18 months
9	Female	68	Bilateral	Yes	Unknown	Unknown	Large B-cell lymphoma	Died at 10 days
10	Male	2	Bilateral	Yes	Chemotherapy	cpa + L-asp + vcr + prednisolone	T-cell lymphoma	Unknown
11	Female	71	Left	No	Surgery + chemotherapy	CHOP	B-cell lymphoma	Died at 4 months
12	Male	50	Right	No	Surgery + chemotherapy	CHOP	Diffuse large B-cell lymphoma	Alive at 1 month
13	Male	62	Left	No	Surgery + chemotherapy + interferon	R-CHOP	Diffuse B-cell lymphoma	Alive at 5 years
14	Male	84	Left	Yes	Surgery + chemotherapy + interferon	COP	B-cell lymphoma	Alive at 5 years
15	Male	58	Right	Unknown	Surgery + chemotherapy	R-CHOP	Diffuse large B-cell lymphoma	Unknown

(continued)

Table 1. Continued.

No.	Sex	Age (years)	Site	Renal impairment	Treatment	Chemotherapeutic agents	Histology	Follow-up
16	Female	21	Bilateral	Yes	Chemotherapy	VACOP-B	Diffuse large B-cell lymphoma	Unknown
17	Male	5	Bilateral	Yes	Chemotherapy	CCG-1961	T-cell lymphoblastic lymphoma	Died at 2 months
18	Male	57	Bilateral	Yes	Chemotherapy + autologous stem cell transplantation	R-CHOP	Unknown	Unknown
19	Male	62	Right	Unknown	Surgery + chemotherapy	R-CHOP	Diffuse large B-cell lymphoma	Alive at 1 year
20	Female	77	Left	Yes	Surgery + chemotherapy	CVP	Diffuse large B-cell lymphoma	Alive at 15 months
21	Male	46	Right	Unknown	Chemotherapy	R-CHOP	Diffuse large B-cell lymphoma	Alive at 7 months
22	Male	47	Renal graft	Unknown	Surgery	None	B-cell lymphoma	Alive at 6.5 years
23	Male	74	Left	Unknown	Surgery + chemotherapy	Unknown	Diffuse small B-cell lymphoma	Died after chemotherapy course 2
24	Male	71	Right	Unknown	Chemotherapy	R-CHOP	Diffuse large B-cell lymphoma	Alive at 2 years
25	Female	75	Left	Unknown	Surgery + chemotherapy	R-CHOP	Diffuse large B-cell lymphoma	Alive at 1 year
26	Male	81	Right	Unknown	Surgery + chemotherapy	Unknown	Small B-cell lymphoma	Unknown
27	Female	52	Bilateral	Yes	Chemotherapy	R-CHOP	Diffuse large B-cell lymphoma	Alive at 2 years
28	Male	3	Bilateral	No	Chemotherapy	BFM-90	B-cell lymphoma	Died after chemotherapy course 5
29	Male	60	Right	No	Surgery + chemotherapy	CHOP	Follicular non-Hodgkin lymphoma	Unknown
30	Male	70	Right	Unknown	Surgery	None	Diffuse large B-cell lymphoma	Unknown

(continued)

Table 1. Continued.

No.	Sex	Age (years)	Site	Renal impairment	Treatment	Chemotherapeutic agents	Histology	Follow-up
31	Male	32	Left	No	Surgery + chemotherapy	CHOP	B-cell lymphoma	Died at 2 months
32	Male	72	Left	Yes	Chemotherapy	R-CHOP	Diffuse large B-cell lymphoma	Alive at 15 months
33	Female	7	Bilateral	No	Chemotherapy	CHOP	Unknown	Unknown
34	Female	67	Bilateral	Yes	Chemotherapy	R-CHOP	Large B-cell lymphoma	Alive at 4 weeks
35	Female	77	Left	Yes	Surgery + chemotherapy	CVP + R	Diffuse large B-cell lymphoma	Alive at 5.5 years
36	Male	46	Left	Yes	Surgery + chemotherapy + radiation	R-CHOP	Diffuse large B-cell lymphoma	Alive at 5 years
37	Male	73	Right	Yes	Surgery	None	Large B-cell lymphoma	Unknown
38	Female	82	Right	Yes	Chemotherapy	R-CHOP	B-cell lymphoma	Unknown
39	Female	27	Bilateral	Yes	Chemotherapy	R-CHOP	Diffuse large B-cell lymphoma	Unknown
40	Male	77	Left	No	Radiation therapy	None	Marginal zone B-cell lymphoma	Alive at 3 years
41	Female	12	Right	No	Surgery + chemotherapy	vcr + dex + cpa + mtx + ara-c + other drugs	Diffuse large B-cell lymphoma	Alive at 3 years 2 months
42	N/A	8	Bilateral	Yes	Chemotherapy	R-CHOP	B-cell lymphoma	Alive at 1 year
43	Male	49	Right	Unknown	Surgery	None	B-cell lymphoma	Alive at 1 year
44	Male	42	Left	Yes	Chemotherapy	R-CHOP	Diffuse large B-cell lymphoma	Alive at 28 months
45	Male	52	Bilateral	Yes	Chemotherapy	R-CHOP	Intravascular large B-cell lymphoma	Alive at 26 months
46	Male	50	Left	Unknown	Surgery + chemotherapy	CHOP	Diffuse large B-cell lymphoma	Died at 5 months
47	Male	56	Right	No	Surgery + chemotherapy	R-CHOP	Diffuse large B-cell lymphoma	Alive at 14 months
48	Male	84	Left	No	Chemotherapy	R-CHOP	Diffuse large B-cell lymphoma	Recurrence at 58 days

(continued)

Table 1. Continued.

No.	Sex	Age (years)	Site	Renal impairment	Treatment	Chemotherapeutic agents	Histology	Follow-up
49	Male	22	Right	No	Chemotherapy	EPOCH	Diffuse large B-cell lymphoma	Alive at 8 weeks
50	Male	50	Left	Unknown	Chemotherapy	CHOP	B-cell lymphoma	Died after chemotherapy course 3
51	Female	52	Bilateral	No	Chemotherapy	R-CHOP	Intravascular large B-cell lymphoma	Alive at 26 months
52	Female	54	Right	Yes	Surgery + chemotherapy	R-CHOP	Diffuse large B-cell lymphoma	Unknown
53	Female	64	Right	Unknown	Chemotherapy	R-CHOP	Diffuse large B-cell lymphoma	Alive at 2 months
54	Female	70	Right	No	Surgery + chemotherapy	CHOP	Diffuse large B-cell lymphoma	Alive at 2 months

MALT, mucosa-associated lymphoid tissue.
Chemotherapeutic agents: C/ctx/cpa, cyclophosphamide; H, hydroxydaunorubicin; O, Oncovin; vcr, vincristine; P, prednisone; R, rituximab; M, methotrexate; B, bleomycin; D/dex, dexamethasone; Flu, fludarabine; L-asp, L-asparaginase; mtx, methotrexate; ara-c, cytarabine.
CHOP, R-CHOP, B-ALL, LSA2-L2, CCG5942, Pro-MECE-CytaBOM, Flu-Ctx-Idec, VACOP-B, CCG-1961, CVP, and BFM-90 are combinations of chemotherapeutic agents used to treat lymphoma.

chemotherapy combined with hematopoietic stem cell transplantation may further improve the prognosis and reduce recurrence.[6] The application of CHOP after surgery plays an important part in the patient's MDT treatment.

Acknowledgment

We thank the staff of the Department of Pathology at The Second Xiangya Hospital, especially Dr. Daiqiang Li, for providing support.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ORCID iD

Yinhuai Wang http://orcid.org/0000-0003-4731-0252

References

1. Airaghi L, Greco I, Carrabba M, et al. Unusual presentation of large B cell lymphoma: a case report and review of literature. *Clin Lab Haematol* 2006; 28: 338–342.
2. Hagihara M, Hua J, Iwaki Y, et al. Primary renal lymphoma: a case report and literature review. *Intern Med* 2015; 54: 2655–2659.
3. Lamb BW, Jalil RT, Sevdalis N, et al. Strategies to improve the efficiency and utility of multidisciplinary team meetings in urology cancer care: a survey study. *BMC Health Serv Res* 2014; 14: 377.
4. Cupisti A, Riccioni R, Carulli G, et al. Bilateral primary renal lymphoma treated by surgery and chemotherapy. *Nephrol Dial Transplant* 2004; 19: 1629–1633.
5. Stallone G, Infante B, Manno C, et al. Primary renal lymphoma does exist: case report and review of the literature. *J Nephrol* 2000; 13: 367–372.
6. Yang P, Jing HM, Zhao W, et al. Analysis of clinical feature and treatment outcome of patients with renal diffuse large B cell lymphoma. *Zhongguo Shi Yan Xue Ye Xue Za Zhi* 2016; 24: 1737–1742 [in Chinese, English Abstract].
7. Gellrich J, Hakenberg OW, Naumann R, et al. Primary renal non-Hodgkin's lymphoma-a difficult differential diagnosis. *Onkologie* 2002; 25: 273–277.
8. Ahmad AH, Maclennan GT and Listinsky C. Primary renal lymphoma: a rare neoplasm that may present as a primary renal mass. *J Urol* 2005; 173: 239.
9. Levendoglu-Tugal O, Kroop S, Rozenblit GN, et al. Primary renal lymphoma and hypercalcemia in a child. *Leuk Lymphoma* 2002; 43: 1141–1146.
10. Olusanya AA, Huff G, Adeleye O, et al. Primary renal non-Hodgkins lymphoma presenting with acute renal failure. *J Natl Med Assoc* 2003; 95: 220–224.
11. Tuzel E, Mungan MU, Yorukoglu K, et al. Primary renal lymphoma of mucosa-associated lymphoid tissue. *Urology* 2003; 61: 463.
12. Zomas A, Leivada A, Gortzolidis G, et al. Primary renal lymphoma presenting with chronic low-grade fever. *Int J Hematol* 2004; 79: 361–363.
13. Kaya A, Kanbay M, Bayrak O, et al. Primary renal lymphoma associated with hepatitis C virus infection. *Leuk Lymphoma* 2006; 47: 1976–1978.
14. Sharma SB, Debnath PR and Tripathi R. Primary renal lymphoma in a child. *Indian J Pediatr* 2006; 73: 947.
15. Ladha A and Haider G. Primary renal lymphoma. *J Coll Physicians Surg Pak* 2008; 18: 584–585.
16. Tefekli A, Baykal M, Binbay M, et al. Lymphoma of the kidney: primary or initial manifestation of rapidly progressive systemic disease? *Int Urol Nephrol* 2006; 38: 775–778.
17. Fang FS, Zhu HL, Song ZG, et al. Three cases of primary renal lymphoma. *Zhongguo Shi Yan Xue Ye Xue Za Zhi* 2007; 15: 1107–1111 [in Chinese, English Abstract].
18. Rajappa S, Digumarti R, Immaneni SR, et al. Primary renal lymphoma presenting

with paraneoplastic limbic encephalitis. *J Clin Oncol* 2007; 25: 3783–3785.
19. Omer HA and Hussein MR. Primary renal lymphoma. *Nephrology (Carlton)* 2007; 12: 314–315.
20. Becker AM, Bowers DC, Margraf LR, et al. Primary renal lymphoma presenting with hypertension. *Pediatr Blood Cancer* 2007; 48: 711–713.
21. James TC, Shaikh H, Escuadro L, et al. Bilateral primary renal lymphoma. *Br J Haematol* 2008; 143: 1.
22. Vázquez Alonso F, Sánchez Ramos C, Vicente Prados FJ, et al. Primary renal lymphoma: report of three new cases and literature review. *Arch Esp Urol* 2009; 62: 461–465 [in Spanish, English Abstract].
23. Kose F, Sakalli H, Mertsoylu H, et al. Primary renal lymphoma: report of four cases. *Onkologie* 2009; 32: 200–202.
24. Belbaraka R, Elyoubi MB, Boutayeb S, et al. Primary renal non-Hodgkin lymphoma: an unusual diagnosis for a renal mass. *Indian J Cancer* 2011; 48: 255–256.
25. Al-Salam S, Shaaban A, Alketbi M, et al. Acute kidney injury secondary to renal large B-cell lymphoma: role of early renal biopsy. *Int Urol Nephrol* 2011; 43: 237–240.
26. Pinggera GM, Peschel R, Buttazzoni A, et al. A possible case of primary renal lymphoma: a case report. *Cases J* 2009; 2: 6233.
27. Reuter S, Rahbar K, Busch V, et al. Acute renal failure due to primary bilateral renal large B-cell lymphoma: diagnostics and follow-up by FDG-PET/CT. *Clin Nucl Med* 2009; 34: 722–724.
28. Jindal B, Agarwala S, Bakhshi S, et al. Bilateral primary renal lymphoma with orbital metastasis in a child. *Pediatr Blood Cancer* 2009; 52: 539–541.
29. Chatzipantelis P, Mastorakis E, Tzortzakakis D, et al. Fine needle aspiration cytology diagnosis of primary renal lymphoma involving the pleura: a case report. *Acta Cytol* 2010; 54: 71–74.
30. Gupta A, Bhatt A, Khaira A, et al. Primary renal lymphoma: a differential diagnosis of renal mass in a young male. *Saudi J Kidney Dis Transpl* 2010; 21: 544–545.
31. Dash SC, Purohit K, Mohanty SK, et al. An unusual case of bilateral renal enlargement due to primary renal lymphoma. *Indian J Nephrol* 2011; 21: 56–58.
32. Vázquez-Alonso F, Puche-Sanz I, Sánchez-Ramos C, et al. Primary renal lymphoma: long-term results of two patients treated with a chemotherapy+rituximab protocol. *Case Rep Oncol Med* 2012; 2012: 726424.
33. Brancato T, Alvaro R, Paulis G, et al. Primary lymphoma of the kidney: case report and review of literature. *Case Rep Oncol Med* 2012; 10: 60–62.
34. Hart S, Ellimoottil C, Shafer D, et al. A case of primary renal lymphoma. *Urology* 2012; 80: 763–765.
35. Hu R, Zhang R, Miao M, et al. Central nervous system involvement of primary renal lymphoma with diffuse large B-cell type lymphoma. *Am J Case Rep* 2013; 14: 292–294.
36. Dedekam E, Graham J, Strenge K, et al. Primary renal lymphoma mimicking a subcapsular hematoma: a case report. *J Radiol Case Rep* 2013; 7: 18–26.
37. Dhull VS, Mukherjee A, Karunanithi S, et al. Bilateral primary renal lymphoma in a pediatric patient: staging and response evaluation with 18F-FDG PET/CT. *Rev Esp Med Nucl Imagen Mol* 2015; 34: 49–52.
38. Hayakawa A, Shimotake N, Kubokawa I, et al. Primary pediatric stage III renal diffuse large B-cell lymphoma. *Am J Case Rep* 2013; 14: 34–37.
39. Naveen Kumar BJ, Barman P, Chowdhury N, et al. Primary renal lymphoma: an unusual presentation of non-Hodgkin's lymphoma. *Indian J Cancer* 2014; 51: 370–371.
40. Geetha N, Shahid A, Rajan V, et al. Primary renal lymphoma - a case report. *E cancer medical science* 2014; 8: 466.
41. Das RN, Dasgupta S, Mondal S, et al. Diffuse large B-cell lymphoma of the kidney: a rare neoplasm. *Indian J Pathol Microbiol* 2013; 56: 449–452.
42. Desclaux A, Lazaro E, Pinaquy J, et al. Renal intravascular large B-cell lymphoma: a case report and review of the literature. *Intern Med* 2017; 56: 827–833.
43. Li Y, Wang W, Li Y, et al. [Primary renal lymphoma with the initial symptom of nephrotic syndrome: a case report]. *Zhonghua Xue Ye Xue Za Zhi* 2016; 37: 277 [in Chinese, English Abstract].

44. Niitsu N, Okamura D, Takahashi, N, et al. Renal intravascular large B-cell lymphoma with early diagnosis by renal biopsy: a case report and review of the literature. *Leuk Res* 2009; 33: 728–730.
45. Rissman CM, Dagrosa LM, Pettus JR, et al. Primary renal lymphoma: an unusual finding following radical nephrectomy. *Clin Nephrol Case Stud* 2017; 5: 1–4.
46. Shetty S, Singh AC, Babu V, et al. Primary renal lymphoma - a case report and review of literature. *J Clin Diagn Res* 2016; 10: Xd05–Xd07.
47. Thawani R, Amar A, Patowary J, et al. Primary renal cell lymphoma: case report, diagnosis, and management. *Indian J Med Paediatr Oncol* 2017; 38: 545–547.
48. Wang Y and Guo S. Primary renal diffuse large B-cell lymphoma with central nervous system involvement: a rare case report and literature review. *Int J Clin Exp Pathol* 2015; 8: 7045–7049.
49. Chen X, Hu D, Fang L, et al. Primary renal lymphoma: a case report and literature review. *Oncol Lett* 2016; 12: 4001–4008.
50. Yilmaz H, Namuslu M, Bilgic M, et al. The coexistence of renal cell carcinoma and diffuse large B-cell lymphoma with hypercalcemic crisis as the initial presentation. *Endocr Regul* 2014; 48: 113–119.
51. Ganeshan D, Iyer R, Devine C, et al. Imaging of primary and secondary renal lymphoma. *AJR Am J Roentgenol* 2013; 201: W712–W719.
52. Heiken JP, Gold RP, Schnur MJ, et al. Computed tomography of renal lymphoma with ultrasound correlation. *J Comput Assist Tomogr* 1983; 7: 245–250.
53. Ye XH, Chen LH, Wu HB, et al. 18F-FDG PET/CT evaluation of lymphoma with renal involvement: comparison with renal carcinoma. *South Med J* 2010; 103: 642–649.
54. Zukotynski K, Lewis A, O' Regan K, et al. PET/CT and renal pathology: a blind spot for radiologists? Part 2. Lymphoma, leukemia, and metastatic disease. *AJR Am J Roentgenol* 2012; 199: W168–W174.
55. Pahwa M, Gupta N, Tyagi V, et al. Primary renal lymphoma: is prognosis really that bad? *Saudi J Kidney Dis Transpl* 2013; 24: 816–817.