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Case Report

Novel case of primary intracranial solitary plasmacytoma presenting with significant intratumoral hemorrhage

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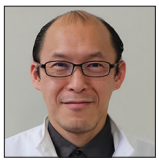

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ABSTRACT

Background: Solitary plasmacytoma is a localized lesion comprising monoclonal neoplastic proliferation of plasma cells. This disease is rarely encountered and few reports have described primary intracranial solitary plasmacytoma (PISP).

Case Description: We report a case of PISP that presented initially as status epilepticus and exhibited massive intratumoral hemorrhage at the subcortical area. To the best of our knowledge, this is the first recorded presentation of this pathology in this manner. Following evacuation of the hematoma and decompressive craniectomy, the patient underwent radiation therapy and showed no sign of tumor recurrence at 3 years after diagnosis.

Conclusion: This case reveals that PISP can present as subcortical intraparenchymal hemorrhage. It should be emphasized that the precise diagnosis of this disease is of utmost importance, because solitary plasmacytoma without a background of multiple myeloma responds well to radiation therapy.

Keywords: Decompressive craniectomy, Intratumoral hemorrhage, Primary intracranial solitary plasmacytoma, Radiotherapy

INTRODUCTION

In general, plasma cell neoplasms are characterized by monoclonal proliferation of neoplastic plasma cells; these neoplasms include multiple myeloma, monoclonal gammopathy of undetermined significance, and solitary plasmacytoma.[4,14,25] Accounting for <5% of all plasma cell neoplasms, solitary plasmacytoma is classified into intraosseous or extraosseous occurrence.[1,4,8,17,28-30,33] Extraosseous solitary plasmacytoma is far less common and primary intracranial solitary plasmacytoma (PISP) is exceedingly rare.[4,10,12,21,26,29,32] Although intracranial hemorrhage from plasmacytoma has been reported sporadically in the setting of multiple myeloma,[3,5,13,15,18,26] there has been no report of spontaneous intraparenchymal hemorrhage from PISP. We here describe a case of PISP that presented with life-threatening massive intratumoral hemorrhage and investigate the hemorrhagic propensity of this rare intracranial tumor based on a review of the literature.

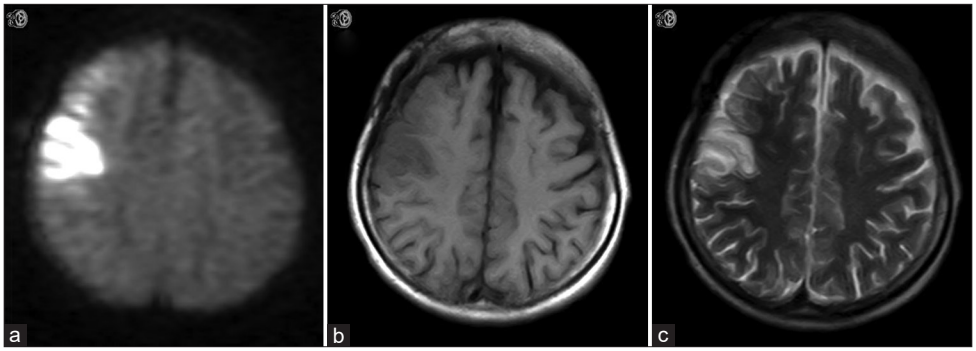

Figure 1: MRI examination shows involvement of the lesion in the precentral gyrus and postcentral gyrus. The lesion shows strong diffusion restriction on diffusion-weighted imaging (a); and hypointensity on T1-weighted (b) and hyperintensity on T2-weighted imaging (c). The structural preservation of the gyri and sulci is a characteristic of this case and may reflect the pathology.

CASE ILLUSTRATION

A 54-year-old female presented to hospital with status epilepticus. She had a previous history of subarachnoid hemorrhage (World Federation of Neurological Surgeons' Grade II) due to a ruptured aneurysm at the bifurcation of the right middle cerebral artery that was treated by open clipping surgery when the patient was 44 years old. The initial computed tomography (CT) revealed a low-density area around the right central sulcus, apparently involving the primary motor area. Magnetic resonance imaging (MRI) demonstrated an intracerebral mass lesion that showed diffusion restriction, hypointensity on T1-weighted images, and hyperintensity on T2-weighted images [Figures 1a-c]. The epilepsy was controlled with medication, but the patient became increasingly drowsy in the days that followed. Repeat CT examinations revealed a hematoma and associated edematous change around the lesion and progressive expansion of the hematoma despite efforts to control blood pressure and treatment by hemostatic agents [Figures 2a and b]. The patient showed considerable neurological decline and semi-emergently underwent hematoma evacuation and decompressive frontotemporal craniectomy.

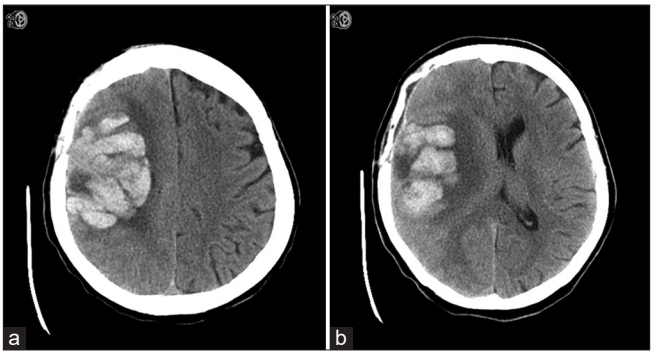

Figure 2: CT images obtained before surgery show massive hemorrhage surrounding the lesion (a) with significant mass effect (b).

Histopathological sections revealed numerous red blood cells with fibrin and debris and massive infiltration of atypical round blue cells [Figure 3a]. Atypical cells demonstrated clumped nuclear chromatin pattern and eccentric eosinophilic cytoplasm [Figure 3b] suggesting plasma cell origin. Immunohistochemistry study showed CD138 positivity [Figure 3b; inset] and *in situ* hybridization demonstrated uniform lambda light chain positivity and negative kappa signal, reinforcing the diagnosis of plasma cell neoplasm [Figures 3c and d].

Further imaging studies performed following the diagnosis, including F-18 fluorodeoxyglucose positron emission tomography and bone scintigraphy, revealed no involvement of other organs. Serum and urine electrophoresis showed no increase in monoclonal protein. Bone marrow biopsy showed plasma cell infiltration of 5%–10%, but without light chain restriction. A final diagnosis of PISP was confirmed. Although the patient was obtunded and showed severe left hemiparesis soon after the surgery, correlating with the focus of the lesion in the right central sulcus, postoperative CT revealed apparent brain decompression [Figure 4a]. She showed a dramatic recovery over time, finally becoming alert and conscious. Postoperative MRI demonstrated extensive near-total resection of the lesion with small residual tumor at the periphery of the cavity [Figures 4b and c]. She underwent intensity-modulated radiation therapy (IMRT) with a total dose of 50 Gy in 25 fractions. The lesion showed an excellent response to IMRT, showing a complete disappearance on MRI [Figures 4d and e]. There were no signs of tumor relapse at the 3 years follow-up visit. After intensive rehabilitation, the patient has resumed her daily life as a housekeeper.

DISCUSSION

We report a case of PISP that presented with significant intratumoral hemorrhage at the subcortical level, causing considerable mass effect requiring surgical decompression.

This case did not exhibit involvement of other organs. No monoclonal protein was detected. The bone marrow biopsy

showed plasma cell infiltration of 5–10% in the bone marrow, which did not reach the diagnostic criteria of multiple myeloma. Furthermore, she did not exhibit other features of multiple myeloma (anemia, renal failure, hypercalcemia, and osteolytic lesions). Therefore, we diagnosed as PISP.

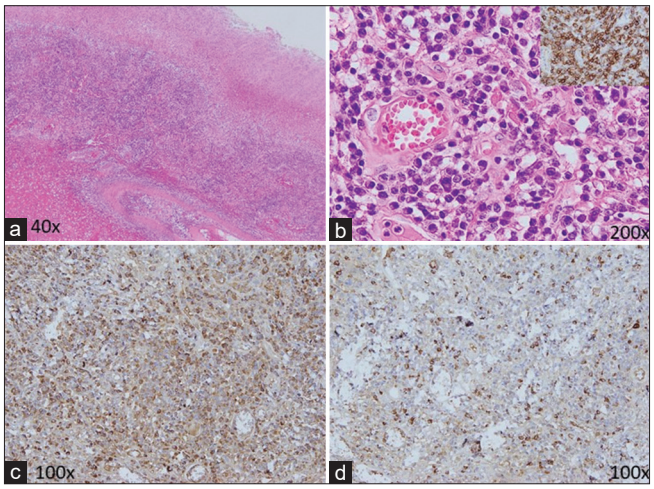

Figure 3: Histopathologically, numerous red blood cells with fibrin and debris are present, with massive infiltration of atypical round blue cells (a: ×40). The infiltrating cells are composed of clumped nuclear chromatin and eccentric eosinophilic cytoplasm (b: ×200), suggesting a plasma cell origin. Immunohistochemistry study shows CD138 positivity (b; inset). *In situ* hybridization demonstrates uniform lambda light chain positivity and negative kappa signal, reinforcing the diagnosis of plasma cell neoplasm (c and d: ×100).

Intracranial involvement of plasmacytoma is rare, most frequently involving the cranial vault, skull base, nose, or paranasal sinuses. Primary dural or leptomeningeal involvement is less frequent, and intraparenchymal involvement is exceedingly rare and seldom described.[4,9-11,16,19] The characteristic findings of PISP on MRI are iso- to hyperintensity on T1-weighted images, iso- to hyperintensity or marked hypointensity on T2-weighted images, and strong contrast enhancement after gadolinium administration.[4,12,17] As it is a highly vascular tumor, plasmacytoma can be confirmed on digital subtraction angiography as a blush supplied mainly by branches arising from the external carotid artery system.[4] The radiological differential diagnoses include chordoma, sarcoma, lymphoma, metastasis, carcinoma, invasive pituitary adenoma, and meningioma.[1,12] Histological staining with hematoxylin and eosin reveals a proliferation of atypical plasma cells, usually showing dispersed nuclear chromatin, prominent nucleoli, and a high nuclear-to-cytoplasmic ratio.[12]

Although there have been several reports of intratumoral hemorrhage from intracranial lesions in the setting of multiple myeloma, there are no reports of intra-axial hemorrhage from PISP, with only acute subdural hematoma[13] and intraparenchymal hemorrhage[3,5,6,7,15,18,20,23,24,26,27] reported previously [Tables 1 and 2]. Of the cases complicated with intraparenchymal hemorrhage in relation to multiple myeloma, most had a miserable clinical course. As demonstrated in [Table 2], all five of the cases of PISP that was complicated with intracranial hemorrhage presented with extra-axial

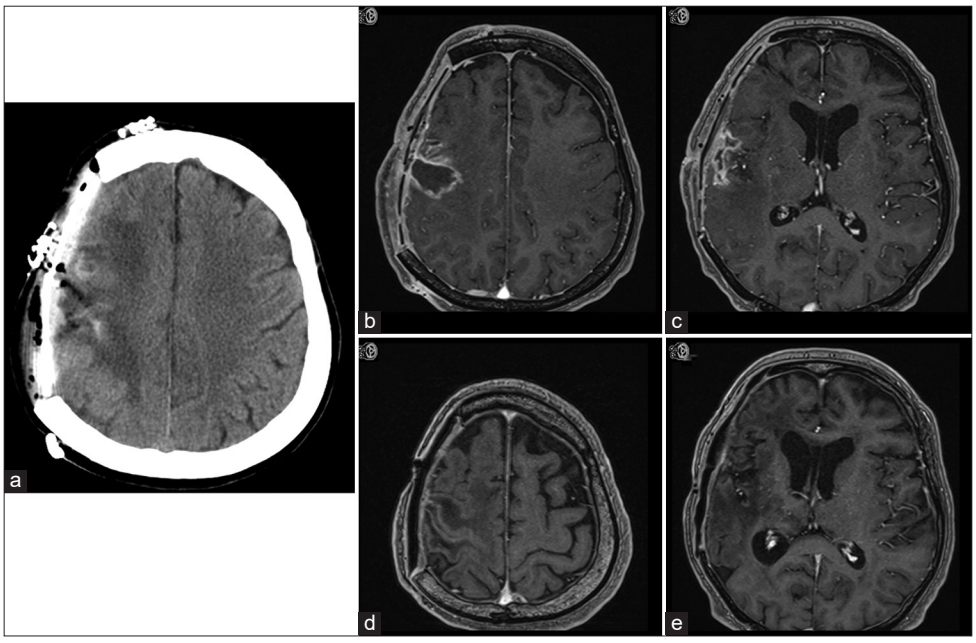

Figure 4: Postoperative CT shows evacuation of the hematoma and relaxation of the brain (a). Gadolinium-enhanced MRI demonstrates resection of the lesion, with a small amount of contrast enhancing tumor at the periphery of the cavity (b and c). Imaging obtained after intensity-modulated radiation therapy reveals a complete disappearance on gadolinium-enhanced MRI (d and e).

hemorrhage. Our case was unique in that the hemorrhage was intraparenchymal and life threatening. In addition, it is noteworthy that whereas the cases of intracranial hemorrhage with a background of multiple myeloma had a poor prognosis [Table 1], the prognosis was relatively good in cases of intracranial hemorrhage without multiple myeloma [Table 2]. Although the exact mechanism of hemorrhage is uncertain, we suspect that tumor cell infiltration into the vessels led to loosening of the vessel wall, finally resulting in destruction of the vessels.[18] This suggests that solitary plasmacytoma can masquerade as subcortical hematoma and that this pathology should be noted as a rare but important differential entity to subcortical hemorrhage, for the following reason.

In general, multiple myeloma is known to have a poor prognosis; it is sometimes termed a "disseminated form."[2,10,28] The 5-year overall survival is estimated to be 34.5–49.6% and the median survival is ~56.3 months despite treatment by a chemotherapy regimen that includes melphalan, prednisolone, lenalidomide, and others.[31] In contrast, solitary plasmacytoma has a better prognosis and is generally termed "a localized form" and even as a "benign lesion" in one previous report.[2] The 5-year overall survival of solitary plasmacytoma has been estimated as 76.3%, and one patient exhibited no recurrence of plasmacytoma or signs of multiple myeloma at the 25-year follow-up examination.[2] Intracranial plasmacytoma secondary to multiple myeloma displays a very poor prognosis, and the median overall survival after diagnosis has been reported as only 6.7 months in a previous study.[22] Therefore, if an intracranial solitary plasmacytoma is a truly "solitary" lesion, it could be interpreted as a benign lesion, rather than as an intracranial lesion associated with

Table 1: Previously published cases of intracranial plasmacytoma secondary to MM (except our case) associated with intraparenchymal hemorrhage.

Author, year	Age (years)	Sex	Hemorrhage location	Surgery	Time to CNS relapse	Follow-up	Clinical course post-CNS relapse
Kramer *et al*., 1963	77	Male	Right temporal lobe	Conservative	Simultaneous	6 days	Death
McCarthy and Proctor, 1978	49	Male	Right caudate nucleus	Conservative	1 year	2 weeks	Death
Husain *et al*., 1987	47	Male	Cerebrum and cerebellum	Conservative	12 years	N/A	Death
Chen *et al*., 2003	28	Male	Cerebrum	N/A	<1 month	7 months	Death
Reddy *et al*., 2007	44	Female	Right temporal lobe	STR	3 years	2 days	Death
Crowley *et al*., 2010	57	Male	Left temporal lobe	GTR	2 years	4 years	No recurrence
Present case	54	Female	Right frontoparietal lobe	GTR	-	3 years	No recurrence

CNS: Central nervous system, GTR: Gross total resection, MM: Multiple myeloma, N/A: Not available, STR: Subtotal resection

Table 2: Previously published cases of primary intracranial solitary plasmacytoma presenting with hemorrhage.

Author, year	Age (years)	Sex	Location	Initial diagnosis	Symptoms	Surgery	Adjuvant treatment	Follow-up	Progression to multiple myeloma
Rutherford *et al*., 2004	43	Male	Epidural	Acute epidural hematoma	Headache, vomiting, and confusion	GTR	N/A	N/A	None
Mitsos *et al*., 2004	62	Male	Subdural	Chronic subdural hematoma	Headache, vomiting, and left hemiparesis	STR	Radiation	2 years	None
Kumar *et al*., 2016	27	Female	Epidural	Acute epidural hematoma	Headache and vomiting	GTR	N/A	N/A	None
Chen *et al*., 2019	67	Female	Epidural	Acute epidural hematoma	Headache and confusion	GTR	Chemotherapy Radiation	12 months	None
Present case	54	Female	Frontoparietal lobe	Intracerebral hemorrhage	Seizure and confusion	GTR	Radiation	3 years	None

GTR: Gross total resection, N/A: Not available, STR: Subtotal resection

multiple myeloma. In other words, when physicians make a diagnosis of intracranial plasmacytoma, it is crucial to scrutinize the involvement of other organs and consider the possibility of unrecognized lesions, because the clinical course and treatment strategy differ completely on that basis. The relationship of these two diseases has been described as a two ends of the same disease spectrum.[29]

In a 2018 study that pooled and analyzed the clinical characteristics of 17 cases of PISP, multivariate analysis revealed a negative outcome if radiotherapy was not performed.[22] This finding corroborates the well-known fact that PISP responds to radiation therapy.[2,12,17,29] In addition, undergoing chemotherapy was found to adversely affect overall survival.[22] Therefore, it is clear that adequate radiation therapy is essential in the treatment of PISP.

CONCLUSION

PISP is an exceedingly rare lesion and each case is valuable in terms of the accumulation of treatment experience. Here, we reported the first case of PISP exhibiting massive subcortical hemorrhage. Despite its rarity, solitary plasmacytoma should be considered among the etiologies that cause clinically significant intraparenchymal hemorrhage. It should be noted that careful examination to exclude multiple myeloma is essential, because the clinical course and treatment regimens differ substantially. Following appropriate surgical resection of PISP, radiation therapy is of utmost importance to achieve an optimal outcome.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Amita R, Sandhyamani S, Nair S, Kapilamoorthy TR. Plasmacytoma of the clivus. Asian J Neurosurg 2017;12:573-5.
2. Bindal AK, Bindal RK, van Loveren H, Sawaya R. Management of intracranial plasmacytoma. J Neurosurg 1995;83:218-21.
3. Blade J, Rosinol L. Complications of multiple myeloma. Hematol Oncol Clin North Am 2007;21:1231-46, xi.
4. Cerase A, Tarantino A, Gozzetti A, Muccio CF, Gennari P, Monti L, *et al*. Intracranial involvement in plasmacytomas and multiple myeloma: A pictorial essay. Neuroradiology 2008;50:665-74.
5. Chen CC, Gau JP, Ho CH, Lin JS, Chiou HJ, Lirng JF. Aggressive multiple myeloma with brain involvement in a young patient. J Chin Med Assoc 2003;66:177-80.
6. Chen Z, Li X. Plasmacytoma of the skull mimicking an epidural hematoma: A case report. Medicine (Baltimore) 2019;98:e15443.
7. Crowley RW, Sansur CA, Sheehan JP, Mandell JW, Kassell NF, Dumont AS. Intracranial plasmacytoma with apoplectic presentation and spontaneous intracerebral hemorrhage: Case report and review of the literature. Clin Neurol Neurosurg 2010;112:172-5.
8. Dimopoulos MA, Hamilos G. Solitary bone plasmacytoma and extramedullary plasmacytoma. Curr Treat Options Oncol 2002;3:255-9.
9. Eum JH, Jeibmann A, Wiesmann W, Paulus W, Ebel H. Multiple myeloma manifesting as an intraventricular brain tumor. J Neurosurg 2009;110:737-9.
10. Ferrari S, Tecchio C, Turri G, Richelli S, Ghimenton C, Monaco S, *et al*. Unusual case of solitary intraparenchymal brain plasmacytoma. J Clin Oncol 2012;30:e350-2.
11. French JD. Plasmacytoma of the hypothalamus; clinical pathological report of a case. J Neuropathol Exp Neurol 1947;6:265-70.
12. Gagliardi F, Losa M, Boari N, Spina A, Reni M, Terreni MR, *et al*. Solitary clival plasmocytomas: Misleading clinical and radiological features of a rare pathology with a specific biological behaviour. Acta Neurochir (Wien) 2013;155:1849-56.
13. Harper L, LeBlanc HJ, McDowell JR. Intracranial extension and spontaneous hemorrhage of a sphenoid plasmacytoma. Neurosurgery 1982;11:797-9.
14. Hoover KB. Plasma Cell Dyscrasias. Musculoskeletal Imaging Volume 2: Metabolic, Infectious, and Congenital Diseases; Internal Derangement of the Joints; and Arthrography and Ultrasound. United Kingdom: Oxford University Press; 2019. p. 33-8.
15. Husain MM, Metzer WS, Binet EF. Multiple intraparenchymal brain plasmacytomas with spontaneous intratumoral hemorrhage. Neurosurgery 1987;20:619-23.
16. Kanie N, Banno T, Shibuya M, Toyama K, Shamoto M. Solitary intracerebral plasmacytoma (author's transl). Neurol Med Chir (Tokyo) 1981;21:337-43.
17. Khalili RP, Mokhtari M, Fard SA, Neshat A, Norouzi R. Solitary dural plasmacytoma with parenchymal invasion. Asian J Neurosurg 2015;10:102-4.
18. Kramer W. Plasmycotoma of the brain in Kahler's disease (multiple myeloma). Acta Neuropathol 1963;3:438-50.
19. Krumholz A, Weiss HD, Jiji VH, Bakal D, Kirsh MB. Solitary intracranial plasmacytoma: two patients with extended follow-up. Ann Neurol 1982;11:529-32.
20. Kumar B, Kumar H, Ghosh S. Intracranial plasmacytomas mimicking epidural hematoma and revealed by head trauma. Asian J Neurosurg 2016;11:72-3.
21. Liu ZY, Qi XQ, Wu XJ, Luo C, Lu YC. Solitary intracranial plasmacytoma located in the spheno-clival region mimicking chordoma: A case report. J Int Med Res 2010;38:1868-75.
22. Ma XJ, Li D, Wang L, Hao SY, Zhang LW, Zhang JT, *et al*. Clinical features, radiological profiles, and surgical outcomes of primary intracranial solitary plasmacytomas: A report of 17 cases and a pooled analysis of individual patient data.

J Neurooncol 2019;142:263-72.
23. McCarthy J, Proctor SJ. Cerebral involvement in multiple myeloma: Case report. J Clin Pathol 1978;31:259-64.
24. Mitsos A, Georgakoulias N, Jenkins A. Intracranial plasmacytoma presenting as chronic subdural haematoma. Br J Neurosurg 2004;18:647-9.
25. Rajkumar SV, Dimopoulos MA, Palumbo A, Blade J, Merlini G, Mateos MV, *et al*. International myeloma working group updated criteria for the diagnosis of multiple myeloma. Lancet Oncol 2014;15:e538-48.
26. Reddy N, Karampelas I, Chanan-Khan A, Fenstermaker R, Padmanabhan S. Aggressive relapse of multiple myeloma with intracerebral extension and associated hemorrhage. Leuk Lymphoma 2007;48:1228-30.
27. Rutherford SA, Leach PA, Richardson PL. Solitary skull vault plasmacytoma masquerading as an extradural haematoma. Acta Neurochir (Wien) 2004;146:863-4.
28. Schwartz TH, Rhiew R, Isaacson SR, Orazi A, Bruce JN. Association between intracranial plasmacytoma and multiple myeloma: Clinicopathological outcome study. Neurosurgery 2001;49:1039-44; discussion 1044-35.
29. Siyag A, Soni TP, Gupta AK, Sharma LM, Jakhotia N, Sharma S. Plasmacytoma of the Skull-base: A Rare Tumor. Cureus 2018;10:e2073.
30. Soutar R, Lucraft H, Jackson G, Reece A, Bird J, Low E, *et al*. Guidelines on the diagnosis and management of solitary plasmacytoma of bone and solitary extramedullary plasmacytoma. Br J Haematol 2004;124:717-26.
31. Turesson I, Velez R, Kristinsson SY, Landgren O. Patterns of improved survival in patients with multiple myeloma in the twenty-first century: A population-based study. J Clin Oncol 2010;28:830-4.
32. Vujovic O, Fisher BJ, Munoz DG. Solitary intracranial plasmacytoma: case report and review of management. J Neurooncol 1998;39:47-50.
33. Zhang MJ, Su GH, Shen J, Liu FH, Xu YF, Zhang XL, *et al*. Multiple myeloma with intracranial extension and bilateral renal infiltration: A case report and review of the literature. Oncol Lett 2015;10:2337-40.

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