Plasmablastic Lymphoma of the Stomach: An Unusual Presentation

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Abstract

Plasmablastic lymphoma (PBL) is listed in the World Health Organization (WHO) classification as a subtype of diffuse large B-cell lymphoma (DLBCL). Some morphologic features of PBL are similar to DLBCL; however, PBL has minimal or no expression of CD20 and leukocyte common antigen. Instead, PBL has been characterized by the plasmablastic morphology of the cancer cells, with high mitotic figures. It is believed to be an aggressive lymphoma. We describe a case of a patient who seemed to pose a diagnostic dilemma, and who was later found to have PBL.

Case Report

A 41-year-old man presented with a 3-week history of left upper quadrant abdominal pain associated with nausea and vomiting. He reported a gradual decrease in his oral intake and a 50-pound weight loss over the past 3 months. There was no history of immunosuppression or steroid use.

Physical examination revealed a firm, palpable mass in the left upper quadrant. It did not move with respiration and it extended towards the umbilicus. His abdomen was otherwise soft, with no guarding or rebound tenderness, and bowel sounds were positive.

Initial laboratory data showed the following: hemoglobin of 12.2 g/dL; hematocrit of 39.2%, with a mean corpuscular volume (MCV) of 86.9 fL; white blood cell (WBC) count of 5,300 cells/mL; and platelet count of 298,000/µL. Liver function tests revealed albumin of 4.2 g/dL; total protein of 7.3 g/dL; total bilirubin of 0.3 mg/dL; alkaline phosphatase of 75 IU/L; alanine transaminase (ALT) of 12 IU/L; aspartate transaminase (AST) of 16 IU/L; and normal serum LDH at 215 IU/L. The hepatitis A, B, and C serology was negative, and Epstein-Barr virus (EBV) testing was not performed. A computed tomography (CT) scan of the abdomen and pelvis showed diffuse marked thickening of the stomach body and fundus with an associated large left adrenal mass (Figure 1).

The patient subsequently underwent an endoscopic biopsy of the stomach, the results of which showed a severe chronic gastritis and nonspecific necrotic debris. However, in view of the history and strong clinical suspicion, a repeat endoscopic ultrasound-guided biopsy, including a fine needle aspiration (FNA) of the adrenal mass via a transgastric approach, was performed. The adrenal biopsy showed necrotic tissue mixed with a group of discohesive cells that were positive for CD45 and CD43, and negative for AE1/3, CD20, CD138, and CD3. The FNA also showed cells staining positive for LCA and CD43, with some cells partially 138-positive. Stains for keratin, MAK-6, CD20, CD3, UCHL-1, CK7, CK20, CD10, cyclin D1, synaptophysin, and chromogranin were negative. The cells stained diffusely for kappa and negative for lambda in situ hybridization. In view of these results, the suspicion for a plasmacytoma was high. However, the stomach biopsy was still inconclusive. During the hospital course, the patient then underwent a bone marrow biopsy and third endoscopic stomach biopsy, all of which did not conclude an appropriate diagnosis.

General surgery was consulted, and a laparoscopic gastric biopsy with wedge excision was performed. Flow cytometric analysis of the gastric wall biopsies revealed aneuploid plasmacytic cells, which were CD19-positive, CD20-negative, CD138-positive, CD38-positive,

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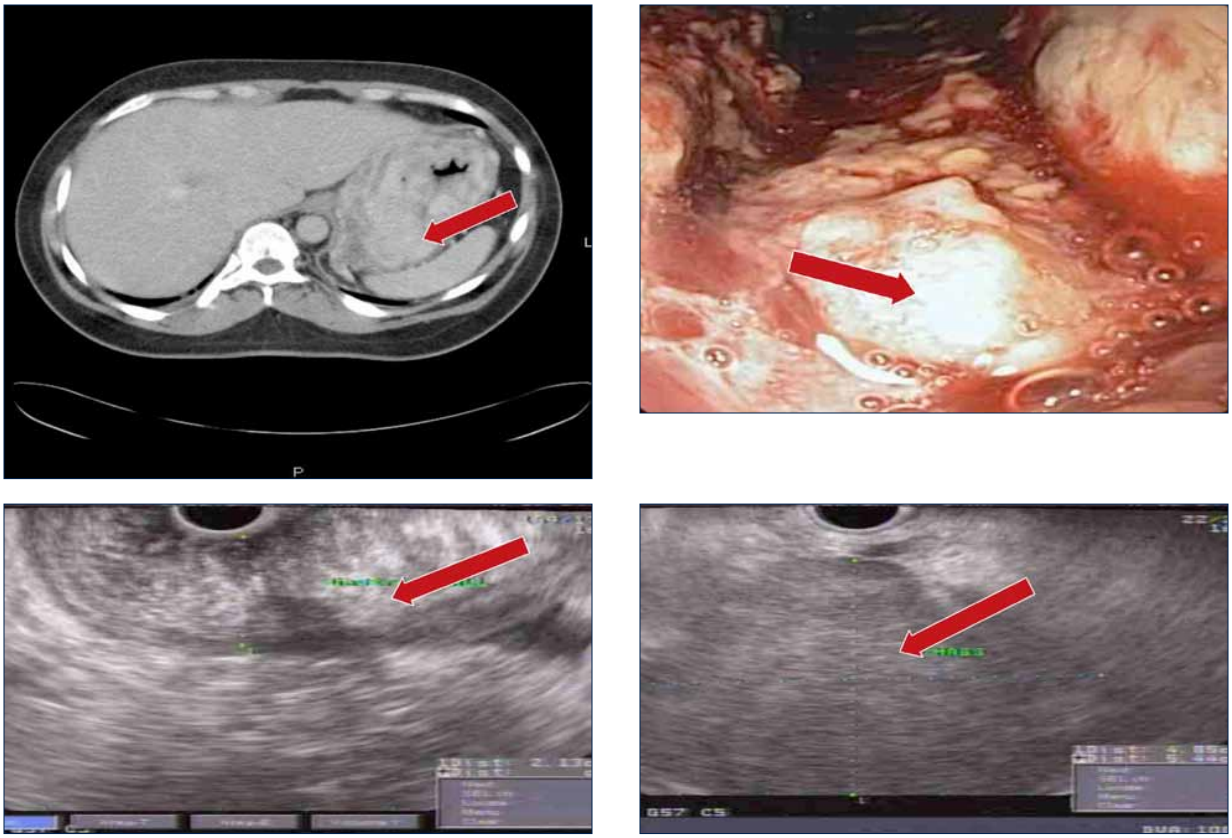

Figure 1. A) Computed tomography (CT) scan showing stomach wall thickening and a large mass. B) Upper gastrointestinal (GI) endoscopy depicting the infiltrating stomach mass. C) Endoscopic ultrasound showing thickened stomach wall. D) Endoscopic ultrasound showing the adrenal mass.

CD56-negative, IgG-positive, and kappa light chain–positive. The Ki67 was not checked. These findings were consistent with plasmablastic lymphoma. Notably, human immunodeficiency virus (HIV) screen was negative. The serum protein electrophoresis (SPEP) revealed a monoclonal spike (0.42 g/dL) in the gamma region, and the serum immunofixation (IFE) showed an IgG kappa monoclonal paraprotein, but the free light chain ratio was a normal 1.05. The patient was started on the following chemotherapy regimen: cyclophosphamide 600 mg/m^2, doxorubicin 50 mg/m^2, vincristine 2 mg, with intrathetical methotrexate for central nervous system (CNS) prophylaxis due to the highly aggressive nature of plasmablastic lymphoma, alternating with high-dose methotrexate 1,000 mg/m^2 and cytarabicine 3 g/m^2 (hyper-CVAD) every 3–4 weeks for a total of 8 cycles. The patient tolerated treatment well and had an excellent response; after 8 cycles of chemotherapy, positron emission tomography (PET)/CT scans, esophagogastroduodenoscopy (EGD), and biopsy of the stomach were negative for any residual disease. Currently, the patient is doing well and has returned to work.

Discussion

Initially believed to have a predilection for the jaw or oral mucosa of human immunodeficiency virus (HIV)-infected patients,[1] PBL was later reported in patients with and without HIV. PBL can involve sites other than head and neck, and can have discrete morphologic appearances.[2–11] The largest case series of about 50 patients was reported by Colomo and associates, who defined PBL as a diffuse large B-cell lymphoma with morphologic and immunophenotypic features indicative of terminal B-cell differentiation and expression of plasma cell–associated markers (CD38 and/or CD138).[10] This series also described a second major category that included cells with more prominent plasmacytoid appearance, which they distinguished as PBL with plasmacytic differentiation. A third variation associated with Castleman's disease, with nodal and splenic involvement, has also been described.

Some morphologic features of PBL are similar to DLBCL; however, PBL has minimal or no expression of CD20 and leukocyte common antigen. Instead, PBL has been characterized by the plasmablastic morphology of

the cancer cells, with high mitotic figures, the expression of plasma cell markers such as Vs38c and CD138/syndecan-1,[1,5,12] and EBV-encoded RNA (EBER) positivity.[13]

Differential diagnoses of these tumors based on a morphologic basis include poorly differentiated carcinoma, anaplastic large cell lymphoma, immunoblastic variant of DLBCL, Burkitt lymphoma, primary effusion lymphomas (PEL), and anaplastic plasmacytoma. Carcinomas can be differentiated from PBLs based on more cluster formation in carcinomas, absent lyphoglandular bodies, increased cell size, and positive immunoreactivity for cytokeratin. It should be noted that CD138 can also be positive in neoplasms of the epithelium.[14] Anaplastic large cell lymphomas are not immunoreactive for CD38 or CD138[10]; PBLs are negative for CD20, while immunoblastic variants of DLBCLs are negative for CD138.[10] In Burkitt lymphoma, CD20 is immunoreactive and CD138 is negative, as opposed to PBLs, which are the opposite.[10] PEL is a neoplasm that usually presents with serous effusions and without detectable tumor masses.[15] It is usually associated with HIV infection and positive for human herpesvirus (HHV)-8.[15] This peculiar tumor has many immunophenotypic similarities with PBL, such as expression of CD45, CD38, and CD138, while it is negative for CD19, CD20, CD79a, and immunoglobulin expression.[15] Thus, flow cytometric studies are essential to help confirm the diagnosis.

The most common site of origin of extranodal lymphomas is the stomach.[16] Most of these are marginal zone lymphomas of mucosa-associated lymphoid tissue (MALT)-type.[17] They are divided into low-grade and high-grade tumors with a low-grade component. PBL differentiates from high-grade MALT lymphomas in the absence of a low-grade component, as well as any sign of *Helicobacter pylori* infection diffuse plasmablastic differentiation, and it lacks CD45 and CD20, but has CD38 expression.[17] De Mascarel and colleagues reported the case of a patient with a gastric large cell lymphoma composed by plasmablasts, which expressed cytokeratin and monotypic IgA but no leukocyte common antigen.[18] These data suggest that PBL may develop in extranodal locations other than the oral mucosa, and the presence of HIV infection is not necessary.

There is no clear-cut explanation regarding the pathogenesis of PBL. In a study by Delecluse and colleagues, Bcl-2 protein overexpression was found in only a fraction of cases, there was no evidence of *Bcl-2* gene rearrangement, and all cases also lacked *Bcl-6* expression. They concluded that PBL probably does not arise from the follicular center cells.[1]

In summary, PBL is a variant of large cell lymphoma with heterogeneous cytologic findings, but distinct immunophenotypic features. PBL is believed to be an aggressive lymphoma. In the original report by Delecluse and coworkers,[1] 10 of 12 patients with available follow-up died, nearly all within 12 months of diagnosis. Although most of these neoplasms display a fairly good response to initial chemotherapy, this response is transient, and others have also reported such short survival durations.[10,19,20] The cytomorphologic spectrum of PBL and detection of CD138 expression by flow cytometry can aid in achieving a correct diagnosis.

The rapid rate of proliferation and associated necrosis in this patient's tumor confounded the initial diagnosis, since it was difficult to obtain viable tissue for analysis and flow cytometry via conventional EGD-guided biopsy. A laparoscopic surgical approach was required, and biopsy of the gastric muscle finally secured tissue for adequate diagnosis. This outcome underscores the necessity of understanding the tumor characteristics and the importance of clinical su ɨ icion in the approach to managing these patients.

References

1. Delecluse HJ, Anagnostopoulos I, Dallenbach F, et al. Plasmablastic lymphomas of the oral cavity: a new entity associated with the human immunodeficiency virus infection. *Blood*. 1997;89:1413-1420.
2. Pruneri G, Graziadei G, Ermellino L, Baldini L, Neri A, Buffa R. Plasmablastic lymphoma of the stomach. A case report. *Haematologica*. 1998;83:87-89.
3. Brown RS, Campbell C, Lishman SC, Spittle MF, Miller RF. Plasmablastic lymphoma: a new subcategory of human immunodeficiency virus-related non-Hodgkin's lymphoma. *Clin Oncol (R Coll Radiol)*. 1998;10:327-329.
4. Porter SR, Diz Dios P, Kumar N, Stock C, Barrett AW, Scully C. Oral plasmablastic lymphoma in previously undiagnosed HIV disease. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 1999;87:730-734.
5. Carbone A, Gaidano G, Gloghini A, Ferlito A, Rinaldo A, Stein H. AIDS-related plasmablastic lymphomas of the oral cavity and jaws: a diagnostic dilemma. *Ann Otol Rhinol Laryngol*. 1999;108:95-99.
6. Lin Y, Rodrigues GD, Turner JF, Vasef MA. Plasmablastic lymphoma of the lung: report of a unique case and review of the literature. *Arch Pathol Lab Med*. 2001;125:282-285.
7. Borrero JJ, Pujol E, Perez S, Merino D, Montano A, Rodriguez FJ. Plasmablastic lymphoma of the oral cavity and jaws. *AIDS*. 2002;16:1979-1980.
8. Nguyen DD, Loo BW Jr, Tillman G, et al. Plasmablastic lymphoma presenting in a human immunodeficiency virus-negative patient: a case report. *Ann Hematol*. 2003;8:521-525.
9. Chetty R, Hlatswayo N, Muc R, Sabaratnam R, Gatter K. Plasmablastic lymphoma in HIV+ patients: an expanding spectrum. *Histopathology*. 2003;42:605-609.
10. Colomo L, Loong F, Rives S, et al. Diffuse large B-cell lymphomas with plasmablastic differentiation represent a heterogeneous group of disease entities. *Am J Surg Pathol*. 2004;28:736-747.
11. Feldstein JT, Chiao E, Filippa DA, et al. CD20 negative large cell lymphoma with plasmablastic features: a clinically heterogenous spectrum in both HIV positive and negative patients. *Ann Oncol*. 2004;15:1673-1679.
12. Montes-Moreno S, Gonzalez-Medina AR, Rodriguez Pinilla SM, et al. Aggressive large B cell lymphoma with plasma cell differentiation: immunohistochemical characterization of plasmablastic lymphoma and diffuse large B cell lymphoma with partial plasmablastic phenotype. *Haematologica*. 2010;95:1342-1349.
13. Carbone A, Gloghini A, Larocca LM, et al. Expression profile of MUM1/IRF4, BCL-6, and CD138/syndecan-1 defines novel histogenetic subsets of human immunodeficiency virus-related lymphomas. *Blood*. 2001;97:744-771.
14. O'Connell FP, Pinkus JL, Pinkus GS. CD138 (syndecan-1), a plasma cell marker immunohistochemical profile in hematopoietic and nonhematopoietic neoplasms. *Am J Clin Pathol*. 2004;121:254-263.
15. Nador RG, Cesarman E, Chadburn A, et al. Primary effusion lymphoma: a distinct clinicopathologic entity associated with the Kaposi's sarcoma-associated herpes virus. *Blood*. 1996;88:645-656.
16. Isaacson PG, Spencer J, Finn T. Primary B-cell gastric lymphoma. *Hum Pathol*. 1986;17:72-82.

17. Harris NLH, Jaffe ES, Stein H, et al. A revised European-American classification of lymphoid neoplasms. A proposal from the International Lymphoma Study Group. *Blood*. 1994;84:1361-1392.
18. De Mascarel A, Merlio JP, Coindre JM, Goussot JF, Broustet A. Gastric large cell lymphoma expressing cytokeratin but no leukocyte common antigen. A diagnostic dilemma. *Am J Clin Pathol*. 1989;91:478-481.
19. Flaitz CM, Nichols CM, Walling DM, Hicks MJ. Plasmablastic lymphoma: an HIV-associated entity with primary oral manifestations. *Oral Oncol*. 2002;38:96-102.
20. Nasta SD, Carrum GM, Shahab I, Hanania NA, Udden MM. Regression of a plasmablastic lymphoma in a patient with HIV on highly active antiretroviral therapy. *Leuk Lymphoma*. 2002;43:423-426.

Review

Plasmablastic Lymphoma of the Stomach

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Discussion

Plasmablastic lymphoma (PBL) is a unique lymphoma, first described by Delecluse and associates as a rare variant of diffuse large B-cell lymphoma (DLBCL) involving the oral cavity.[1] It is associated with human immunodeficiency virus (HIV) and latent Epstein-Barr virus (EBV) infection.[1] PBL is an aggressive form of lymphoma associated with poor survival, usually presenting in the oral cavity with rapid progression to extra oral sites. It has also been known to present in other sites, including the orbits,[2] paranasal sinuses,[3] cervical lymph nodes,[4,5] lungs,[6] rectum,[7] and extremities.[8] Only a few cases of PBL involving the stomach have been reported.[9] PBL is usually diagnosed in the setting of HIV infection, and is characterized as an AIDS-defining lymphoma.[10] While the most common types of AIDS-associated non-Hodgkin lymphoma (NHL) are Burkitt lymphoma and DLBCL, including immunoblastic lymphoma, other rare types are seen, including human herpesvirus (HHV)-8-positive primary effusion lymphoma (PEL), primary central nervous system lymphoma (PCNSL), and PBL. PBL has also been described in association with other forms of immunosuppression, including autoimmune disorders and advanced age.[11] Recently, cases of PBL have been reported in immunocompetent patients in extraoral locations.[4,5,8,12,13]

DLBCL with plasmablastic differentiation represents a clinically heterogeneous spectrum with different clinicopathologic characteristics representing distinct entities. Important subtypes include PBL of oral mucosa type, PBL with plasmacytic differentiation, extramedullary plasmablastic plasmacytomas, and plasmablastic myelomas. Differentiation of these discrete disease entities is often very difficult, albeit still important, as it may guide therapeutic recommendations. Morphologically, PBL can vary from a diffuse and cohesive proliferation of cells resembling immunoblasts to cells with plasmacytic differentiation.[14] Immunophenotypically, the tumor cells characteristically express plasmacytic markers: CD38, CD138, VS38c (p63), MUM-1, and cytoplasmic immunoglobulins. They may have weak to absent expression of mature B-cell markers, such as CD45, CD20, and PAX5. EBV viral association is found in 80% of PBL patients.[15] Remarkably, recent studies have shown a high incidence of *MYC* deregulation through translocation or amplification of the *MYC* gene region, suggesting an important role in the pathogenesis of PBL,[16,17] and possibly accounting for the aggressive nature of this lymphoma. Furthermore, the immunoglobulin (*IG*) genes were the *MYC* partners in the majority of examined tumors.[16] A similar genomic rearrangement pattern, involving *MYC/IG* gene rearrangement, has been implicated in the pathogenesis of multiple myeloma (MM).[18] The cytogenetic features of PBL linking it to aggressive lymphoma and MM may provide insight into the pathophysiology, treatment paradigm, and possible targeted therapies.

Because of the low incidence and prevalence of the disease, no standard recommendations have emerged for the treatment of PBL. Thus, common systemic multidrug chemotherapies used for lymphoma are commonly employed for the treatment of PBL. Examples of reported regimens include: cyclophosphamide, doxorubicin, vincristine, prednisone (CHOP)[13,19]; hyper-CVAD (hyperfractionated cyclophosphamide, vincristine, doxorubicin, dexametha-

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sone); and EPOCH (etoposide, prednisone, vincristine, cyclophosphamide, and doxorubicin) with intrathecal methotrexate.[20] Rituximab (Rituxan, Genentech/Biogen Idec) is unlikely to play a role in the treatment of PBL because of the lack of CD20 expression on the neoplastic cells. The majority of patients with PBL have a median survival of less than 1 year.[20] Improvement in outcome has been observed in HIV-infected patients with the combination of highly active antiretroviral therapy (HAART) and lymphoma-specific chemotherapy.[21] Interestingly, it was reported that immunocompetent patients with PBL actually had a worse prognosis (12 months) compared to HIV-positive patients with PBL (22 months),[20] supporting an active role for HIV infection in disease pathophysiology and adding to the heterogeneity of the disease. A recently published literature review described 76 cases of HIV-negative PBL based on morphology and minimal immunohistochemical criteria.[22] The authors reported that this group had a median survival of 9 months and a 2-year survival of 10%, consistent with previous literature reports. Despite a small sample size, achievement of a complete response was significantly correlated with survival. In a single institutional case series, 9 HIV-negative PBL patients were treated with CHOP or hyper-CVAD.[23] Responses were observed in 8 cases (7 complete, 1 partial). Four patients underwent consolidation with autologous hematopoietic stem cell transplant (HSCT) in first complete remission. At a median follow-up of 23.9 months, 7 patients were alive and 5 patients were disease-free. This study supports aggressive induction chemotherapy and consolidation with autologous HSCT for patients with HIV-negative PBL.

The report by Riaz and colleagues[24] illustrates an unusual presentation of PBL in a seemingly immunocompetent patient without associated EBV infection. There is a paucity of data to guide the choice of therapy in this case, and the benefit of traditional lymphoma therapies, such as hyper-CVAD, is as reasonable as any other. New advances in the management of both B-cell lymphoma and MM may provide a premise to evolve the treatment paradigm in PBL. Of course, thinking about drugs that might have activity in both myeloma and lymphoma may be one approach. The use of bortezomib (Velcade, Millennium Pharmaceuticals), a proteasome inhibitor, has been reported in 2 cases of PBL, with encouraging results in the relapsed and refractory setting.[5,25] Possible integration of proteasome inhibitors with other potentially active drugs like steroids and immunomodulatory drugs may represent an alternative strategy. Irrespective of the logic, there remains the considerable challenge that these particular disease entities are incredibly rare, making it difficult to establish standards of care. Thus, reporting of published experiences with these diseases will begin to establish possible recurrent themes that can be used to produce guidance for care.

References

1. Delecluse HJ, Anagnostopoulos I, Dallenbach F, et al. Plasmablastic lymphomas of the oral cavity: a new entity associated with the human immunodeficiency virus infection. *Blood*. 1997;89:1413-1420.
2. Valenzuela AA, Walker NJ, Sullivan TJ. Plasmablastic lymphoma in the orbit: case report. *Orbit*. 2008;27:227-229.
3. Schichman SA, McClure R, Schaefer RF, Mehta P. HIV and plasmablastic lymphoma manifesting in sinus, testicles, and bones: a further expansion of the disease spectrum. *Am J Hematol*. 2004;77:291-295.
4. Lin F, Zhang K, Quiery AT Jr, Prichard J, Schuerch C. Plasmablastic lymphoma of the cervical lymph nodes in a human immunodeficiency virus-negative patient: a case report and review of the literature. *Arch Pathol Lab Med*. 2004;128:581-584.
5. Lipstein M, O'Connor O, Montanari F, Paoluzzi L, Bongero D, Bhagat G. Bortezomib-induced tumor lysis syndrome in a patient with HIV-negative plasmablastic lymphoma. *Clin Lymphoma Myeloma Leuk*. 2010;10:E43-E46.
6. Lin Y, Rodrigues GD, Turner JF, Vasef MA. Plasmablastic lymphoma of the lung: report of a unique case and review of the literature. *Arch Pathol Lab Med*. 2001;125:282-285.
7. Khan MA, Jakate S, Komanduri S. Rare AIDS-associated plasmablastic lymphoma as the initial presentation of AIDS. *Clin Adv Hematol Oncol*. 2010;8:55-57.
8. Thakral C, Thomas L, Gajra A, Hutchison RE, Ravizzini GC, Vajpayee N. Plasmablastic lymphoma in an immunocompetent patient. *J Clin Oncol*. 2009;27:78-81.
9. Pruneri G, Graziadei G, Ermellino L, Baldini L, Neri A, Buffa R. Plasmablastic lymphoma of the stomach. A case report. *Haematologica*. 1998;83:87-89.
10. Carbone A, Gloghini, A. AIDS-related lymphomas: from pathogenesis to pathology. *Br J Haematol*. 2005;130:662-670.
11. Colomo L, Loong F, Rives S, et al. Diffuse large B-cell lymphomas with plasmablastic differentiation represent a heterogeneous group of disease entities. *Am J Surg Pathol*. 2004;28:736-747.
12. Takahashi Y, Saiga I, Fukushima J, et al. Plasmablastic lymphoma of the retroperitoneum in an HIV-negative patient. *Pathol Int*. 2009;59:868-873.
13. Masgala A, Christopoulos C, Giannakou N, Boukis H, Papadaki T, Anevlavis E. Plasmablastic lymphoma of visceral cranium, cervix and thorax in an HIV-negative woman. *Ann Hematol*. 2007;86:615-618.
14. Swerdlow S, Campo E, Harris N, et al, eds. *WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues*. 4th ed. Lyon, France: IARC Press; 2008.
15. Campo E, Swerdlow SH, Harris NL, Pileri S, Stein H, Jaffe ES. The 2008 WHO classification of lymphoid neoplasms and beyond: evolving concepts and practical applications. *Blood*. 2011;117:5019-5032.
16. Valera A, Balagué O, Colomo L, et al. IG/MYC rearrangements are the main cytogenetic alteration in plasmablastic lymphomas. *Am J Surg Pathol*. 2010;34:1686-1694.
17. Taddesse-Heath L, Meloni-Ehrig A, Scheerle J, Kelly JC, Jaffe ES. Plasmablastic lymphoma with MYC translocation: evidence for a common pathway in the generation of plasmablastic features. *Mod Pathol*. 2010;23:991-999.
18. Gabrea A, Martelli ML, Qi Y, et al. Secondary genomic rearrangements involving immunoglobulin or MYC loci show similar prevalences in hyperdiploid and nonhyperdiploid myeloma tumors. *Genes Chromosomes Cancer*. 2008;47:573-590.
19. Panos G, Karveli EA, Nikolatou O, Falagas ME. Prolonged survival of an HIV-infected patient with plasmablastic lymphoma of the oral cavity. *Am J Hematol*. 2007;82:761-765.
20. Riedel DJ, Gonzalez-Cuyar LF, Zhao XF, Redfield RR, Gilliam BL. Plasmablastic lymphoma of the oral cavity: a rapidly progressive lymphoma associated with HIV infection. *Lancet Infect Dis*. 2008;8:261-267.
21. Lim ST, Karim R, Tulpule A, Nathwani BN, Levine AM. Prognostic factors in HIV-related diffuse large-cell lymphoma: before versus after highly active antiretroviral therapy. *J Clin Oncol*. 2005;23:8477-8482.
22. Castillo JJ, Winer ES, Stachurski D, et al. HIV-negative plasmablastic lymphoma: not in the mouth. *Clin Lymphoma Myeloma Leuk*. 2011;11:185-189.
23. Castillo JJ. Plasmablastic lymphoma: are more intensive regimens needed? *Leuk Res*. 2011;35:1547-1548.
24. Riaz H, Zaiden R, Khan M, Latif N. Plasmablastic lymphoma of the stomach: an unusual presentation. *Clin Adv Hematol Oncol*. 2012;10:477-480.
25. Bose P, Thompson C, Gandhi D, Ghabach B, Ozer H. AIDS-related plasmablastic lymphoma with dramatic, early response to bortezomib. *Eur J Haematol*. 2009;82:490-492.