CASE REPORT

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Neurosurgical rare disease: solitary plasmacytoma of the skull – case report and literature review

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Abstract

Solitary extranevraxial plasmacytoma (SEP), as a clinical entity without signs of systemic myelomatosis, is extremely rare; it is difficult to find literature on the issue of patient management and proper course of action in the presence of associated pathology. The authors present a rare case of plasmacytoma of the skull vault associated with severe cardiac pathology, which made surgery extremely difficult and possible only through temporization of the interventions, as presented. We discuss our findings and opportunities for treatment in this case, which seemed unapproachable at presentation, in connection with the associated cardiac pathology. The case was followed-up for eight years with no recurrences.

Keywords: solitary plasmacytoma, skull vault, neurosurgery, severe cardiac pathology.

Introduction

Solitary plasmacytoma (SP) is a tumor lesion resulted after the local proliferation of a tumor plasma cells clone, without any proliferative changes of the systemic plasma cells [1]. It is a relatively rare disease, representing only 5–10% of the total number of plasma cells and neoplastic conditions [1–3]. Because of the fact that it has a low incidence and may occur outside a preexistent multiple myeloma, the diagnosis of solitary plasmacytoma is difficult, the disease being confused clinically with other malignant or benign conditions [4]. The diagnosis is always clearly specified through histopathological and immunohistochemical (IHC) examinations [5].

According to the development localization, there are two types of solitary plasmacytomas: bone solitary plasmacytomas and soft tissues plasmacytoma (extramedullary plasmacytomas). Bone plasmacytomas mainly affect the axial skeleton bones, such as vertebras and skull bones, while extramedullary plasma cells most often appear in the soft parts of the head and neck [6–9]. Plasma cells most often affect persons aged over 50 years old, mainly males, the male/female ratio being 2:1 [1, 10].

True solitary plasmacytoma of the skull, as a clinical entity without signs of systemic myelomatosis, is extremely rare [11] and less than 50 cases have been reported so far [12–21]. The majority of the SPs in literature were reported only in isolated cases [11–20]. Moreover, even skull plasmacytoma had good outcome when diagnosed properly [1, 2]. The presence of associated apparently unlinked severe cardiac pathology was reported in the literature. From the studied cohort, only four cases were in the age group of 20–30 years old [2–4].

We present the case of a relatively young man (28 years old), known with a severe cardiovascular pathology, who presented a brain tumor, with complex clinical symptoms and signs.

Case presentation

A 28-year-old (FC), high-altitude worker, presented in September 2007 with headache and an exophytic, pulsating, soft mass on the left side of his skull. The patient was admitted to the Department of Neurosurgery, "Bagdasar–Arseni" Emergency Hospital, Bucharest, Romania (Medical Record No. 6689 from November 19, 2007). The neurological exam showed no findings, aside from palpebral ptosis of the left eye and sectorial papilledema on the nasal side of the left eye fundus. The patient gives informed consent for participation in this research study.

The computed tomography (CT) scan performed on the patient showed a large frontal mass on the left side, with mass effect on the anterior portion of the lateral ventricle with right displacement of the median structures (Figure 1).

Native and contrast magnetic resonance imaging (MRI) were also performed, showing a large frontal intra- and extracerebral mass, intensely enhancing with gadolinium,

with no edema surrounding the tumor and an osteolytic lesion on approximately 2 cm of the skull vault. The left lateral ventricle was shown to be compressed and the median structures displaced to the right (Figure 2).

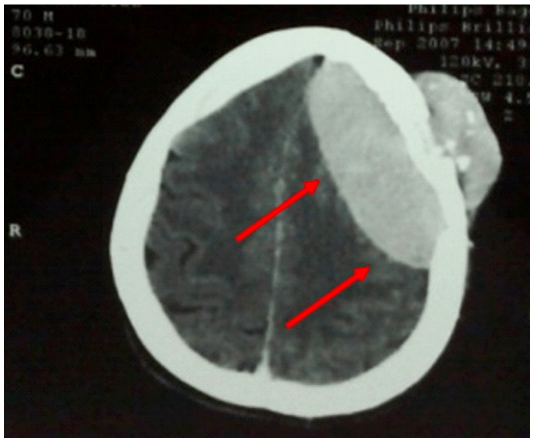

Figure 1 – ***The first CT scan shows a left frontal tumor with intra- and extracranial extension, with mass effect on the anterior portion of the lateral ventricle with right displacement of the median structures.***

Although, the blood test results were not indicative of any disease – electrolytes (chloride 95–105 mmol/L; ionized calcium 1.13 mmol/L; magnesium 1.6 mEq/L; potassium 3.8 mmol/L; sodium 138 mmol/L; total calcium 2.1 mmol/L), creatinine 0.8–1.3 mg/dL, ferritin 253 ng/mL, glucose 75 mg/dL, transferrin 228 mg/dL, urea 1.3 mmol/L, uric acid 0.38 mmol/L, hematology [hemoglobin (Hb) 13.7 g/dL; hematocrit (Ht) 48%; mean corpuscular volume (MCV) 89 fL; red blood cell distribution width (RDW) 12.8%; mean corpuscular hemoglobin (MCH) 0.45 fmol/cell; mean corpuscular hemoglobin concentration (MCHC) 32 g/dL; white blood cells (WBC) 7.4×10^9/L; neutrophils 3×10^9/L; lymphocytes 3.8×10^9/L; monocytes 0.6×10^9/L; eosinophils 0.1×10^9/L; platelets 250×10^9/L; prothrombin time (PT) 12 s; International normalized ratio (INR) 1.1; activated partial thromboplastin time (aPTT) 24 s; fibrinogen 1.8–4 g/L; bleeding time 4.9 min], lipids [triglycerides 89 mg/dL; total cholesterol 3.5 mmol/L; high-density lipoproteins (HDL) 48 mg/dL; low-density lipoproteins (LDL) 115 mg/dL] –, the multidisciplinary preoperative consult showed severe pathology in the cardiovascular area.

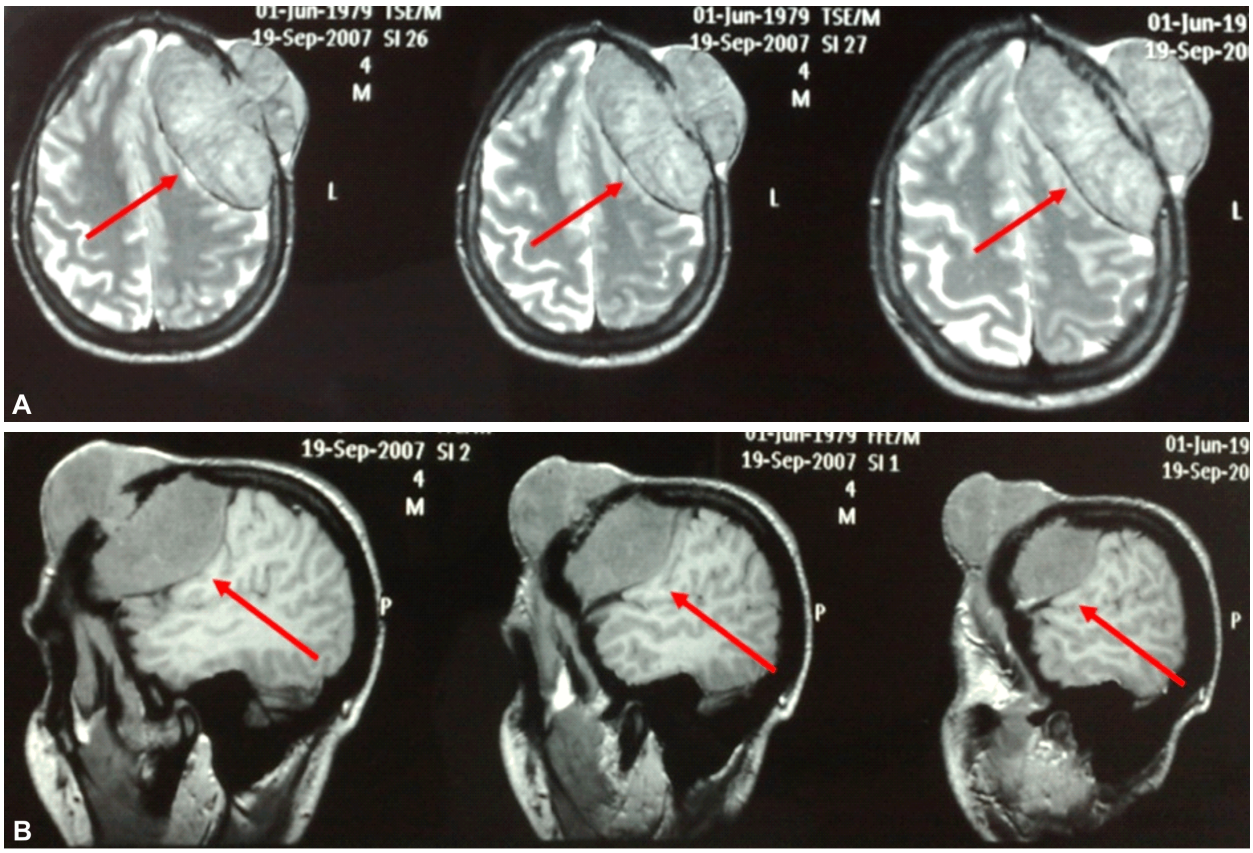

Figure 2 – ***(A and B) An MRI taken nine days after the first CT scan reveals large frontal intra- and extracerebral mass, intensely enhancing with gadolinium, with no edema surrounding the tumor and an osteolytic lesion on approximately 2 cm of the skull vault, the lesion being already slightly bigger than the lesion seen on the CT scan.***

The cardiological consult indicated that the patient suffered from severe aortic stenosis, mild aortic insufficiency, concentric hypertrophy of the left ventricle and diastolic dysfunction with delayed relaxation, thus assigning the patient a very high risk for intra operative bleeding.

The first surgery was carried out in October 2007, after all the patient had his blood tests completely carried out and after the cardiologist had deemed him fit to undergo the procedure, even though he still remained at high risk for intraoperative bleeding. The tumor could be clearly seen growing macroscopically, being subjectively apparent to all those who saw the patient daily. There was an arcuate frontotemporal incision, which revealed a mass protruding of about 3 cm (compared with 2 cm one week before on the CT scan) in diameter protruding out of the calvarium.

A craniotomy was performed and once the bone flap was removed and the extracranial part of the tumor taken out profuse bleeding began, which was extremely difficult to control (Figure 3).

The intracranial part of the tumor was then partially removed (Figure 4). The blood was constantly filling up the operating field and as the patient had already lost a considerable amount of it, hemostasis was performed with great difficulty, using electrocautery, Surgicel® and TachoComb, while remnants of the tumor were scheduled for removal at a second intervention in three weeks, giving the body some time to recover (Figure 5).

The patient had difficulties cooperating with the medical staff and was thus only admitted again for the reintervention two weeks after the operation had been scheduled to take place. The cardiac issues were still unresolved. A preoperatively CT scan showed a hyperdense tumoral lesion remaining in the left frontal area, intensely iodophilic, with a normal ventricular system and the median structures well aligned (Figure 6).

The second surgery was uneventful and managed to successfully take out the rest of the tumor, which had also grown to some extent from the previous intervention (Figure 7).

For the histopathological and IHC examination, fragments of the excised tumor were taken and were fixed in 10% neutral formalin solution for 48 hours and then included in paraffin using the classic histopathological protocol.

The pathological examination confirmed the diagnosis as being plasmacytoma. The criteria for this diagnosis were: absence of M-protein in serum and/or urine; single area of bone destruction due to clonal plasma cells; bone marrow not consistent with multiple myeloma (plasma cells <5%); normal skeletal survey (and MRI of spine and pelvis if done); no related organ or tissue impairment.

For the positive and differential diagnosis, the histopathological examination was performed on Hematoxylin–Eosin (HE) samples, and for the IHC study there were used the antibodies: anti-CD20 (monoclonal mouse anti-human CD20cy, clone L26, 1:50 dilution, Dako), anti-CD3 (monoclonal mouse anti-human CD3, clone F7.2.38, 1:25 dilution, Dako), anti-CD79α (monoclonal mouse anti-human CD79α, clone JCB117, 1:50 dilution, Dako), anti-Ki67 (monoclonal mouse anti-human Ki67, clone MIB-1, 1:50 dilution, Dako).

The microscopic examination showed the presence of a numerous population of mature and immature plasma cells, with a heterogeneous basophilic cytoplasm, with large, round nucleus, arranged eccentrically, rich in euchromatin, frequently condensed in a "wheel spoke" (Figures 8 and 9). The IHC expression of anti-CD20 and anti-CD79α antibodies was quite intense (Figures 10 and 11), while the expression of anti-CD3 antibody was moderate (Figure 12). The IHC expression of anti-Ki67 antibody was also moderate, which shows the presence of a moderate aggressiveness of the tumor (Figure 13).

In this situation, our conclusion was that the tumor might be a B-cell lymphoma with plasmacytic differentiation.

Figure 3 – ***The bone flap with the osteolytic lesion in the middle.***

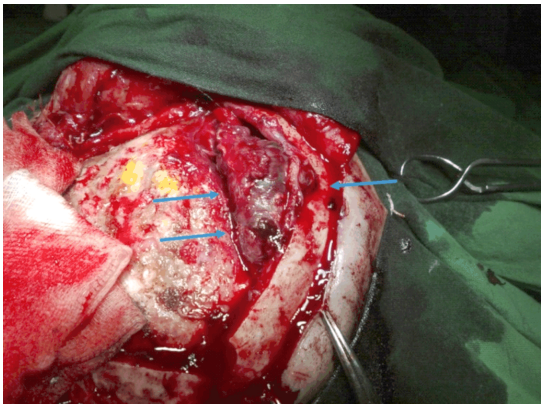

Figure 4 – ***Intraoperative aspect of the tumor: a soft, reddish, partly elastic mass.***

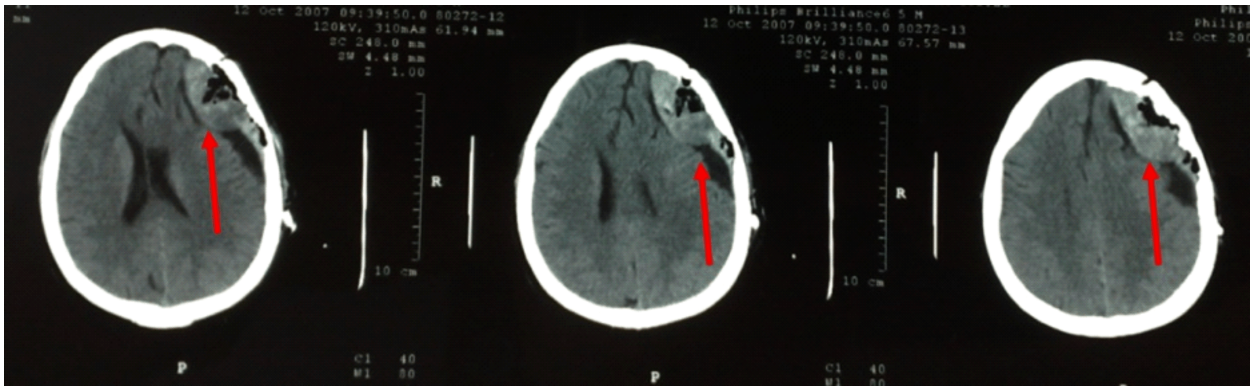

Figure 5 – ***The postoperative CT scan after the first surgery reveals remnants of the tumor, with some persistent displacement of the ventricles and midline structures.***

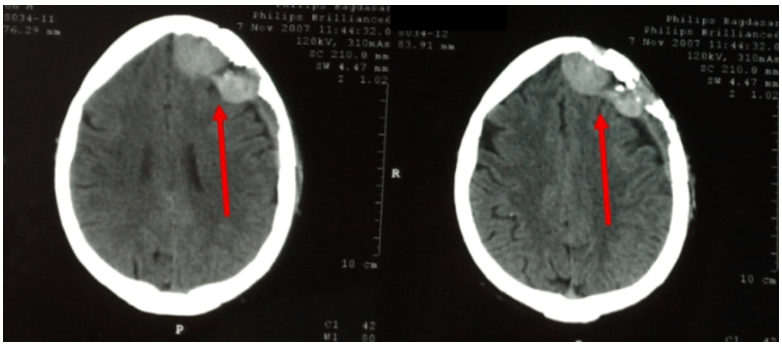

Figure 6 – ***The CT scan performed before the second surgery shows the tumor remnants, the tumor again invading extracranially and no displacement of the midline structures.***

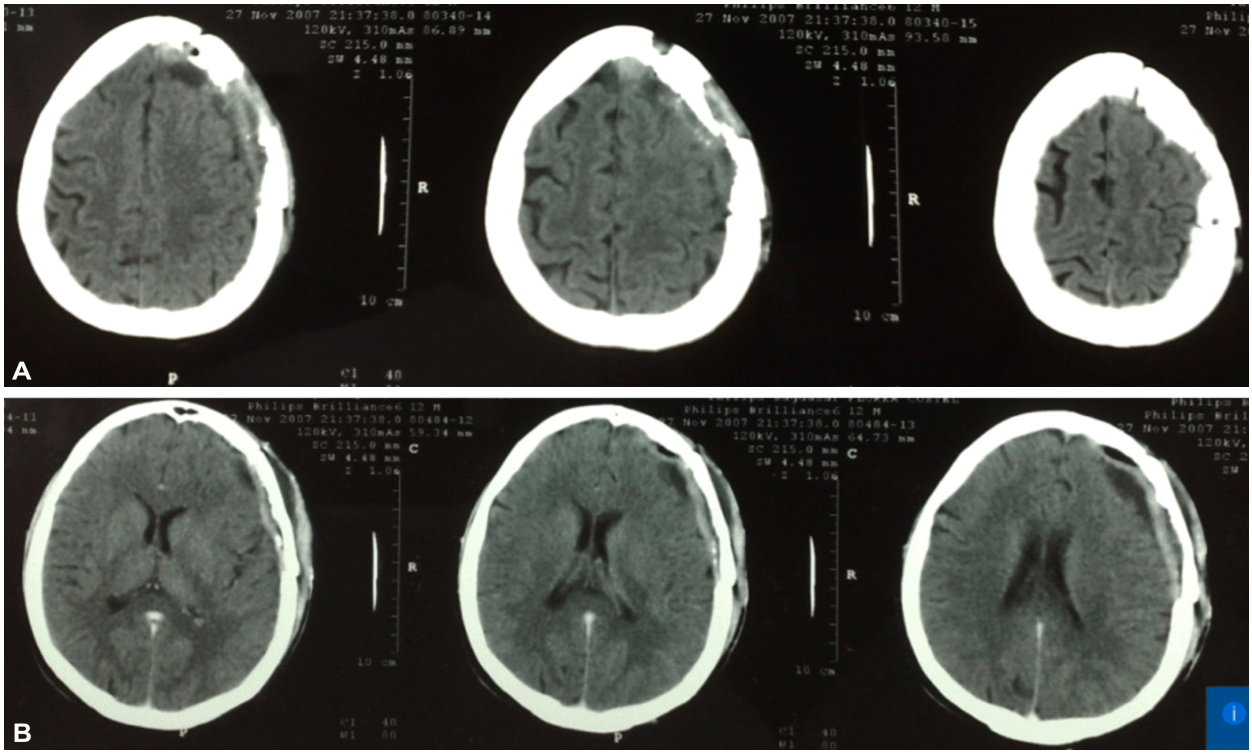

Figure 7 – ***(A and B) The final postoperative CT scan shows no tumor fragments remaining, with midline structures in place and a physiological ventricular system.***

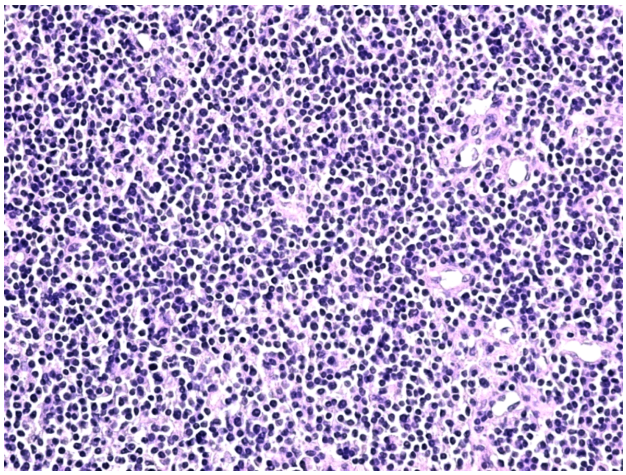

Figure 8 – ***The tumor microscopic image (HE staining, ×100).***

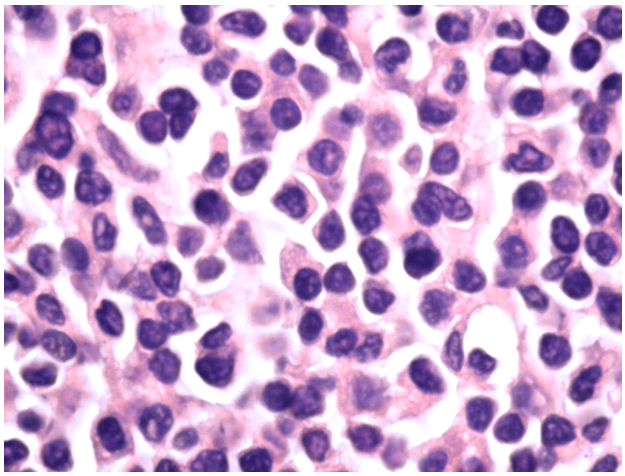

Figure 9 – ***Tumor detail showing the presence of mature plasma cells with basophilic cytoplasm, eccentric nucleus, and chromatin disposed "in the wheel". It is noted the presence of rare cells with reduced cytoplasm and the nucleus with the lax chromatin (immature plasmocytes) (HE staining, ×400).***

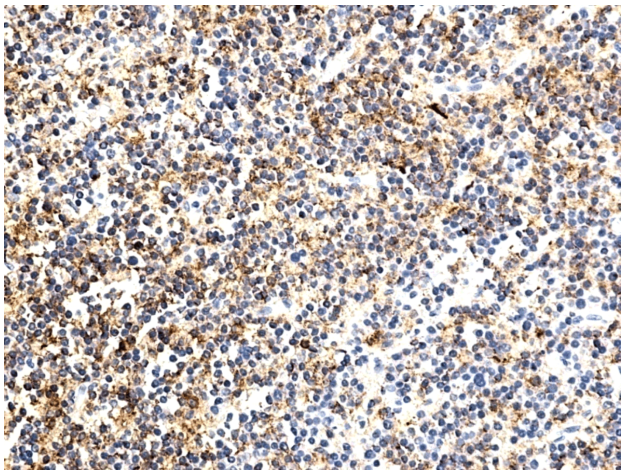

Figure 10 – ***Intense tumor cell response to anti-CD20 antibody (Immunostaining with anti-CD20 antibody, ×100).***

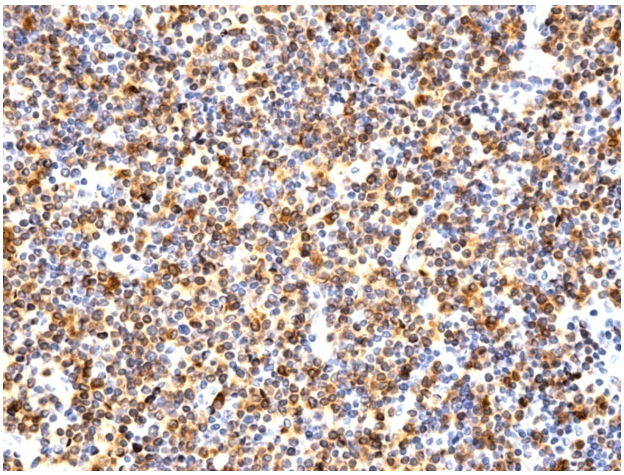

Figure 11 – ***Very intense reaction of tumor cells to anti-CD79α antibody (Immunostaining with anti-CD79α antibody, ×100.***

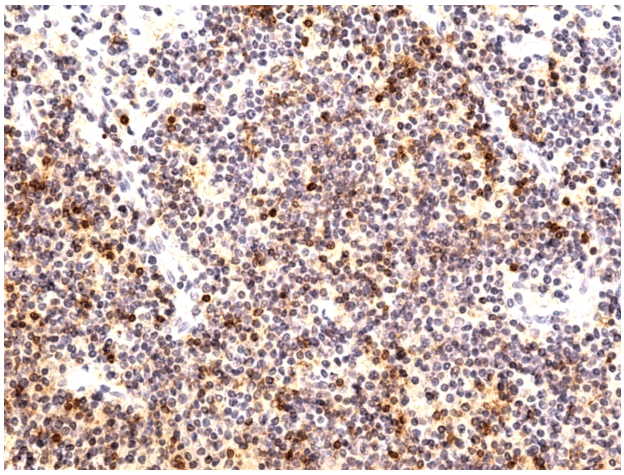

Figure 12 – ***Moderate response of tumor cells to anti-CD3 antibody (Immunostaining with anti-CD3 antibody, ×100).***

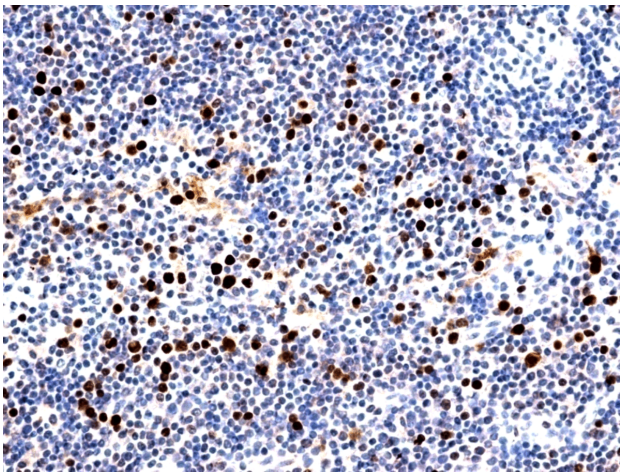

Figure 13 – ***Moderate tumor cell reaction to anti-Ki67 antibody (Immunostaining with anti-Ki67 antibody, ×100).***

The patient was referred to the Department of Hematology, where no other lesions or abnormalities were found. We had excluded multiple myeloma and metastatic tumor preoperatively and the subsequent tests showed no other hematological abnormalities. No later than three weeks, the patient underwent a third surgery at a Department of Cardiac Surgery to correct the aortic valve abnormalities; *Glasgow Outcome Scale* (GOS) at discharge was 5. Recovery was good and the one-year check-up revealed no tumor remnants as well as no other subjective or clinical abnormalities. The patient was then followed-up for eight years and had no local recurrences.

The difficulties of the case were represented by the cardiac pathology, which did not deter us, however, from following the only course of action possible albeit temporized in two subsequent surgeries, the high degree of bleeding the patient exhibited during the surgeries, which was extremely difficult to control, and the rapid size of his tumor growth, which was shocking to see even for the more experienced neurosurgeons.

Discussions

Multiple myeloma have three varieties of plasma-cell tumors: solitary plasmacytoma of bone, involving spine or skull, solitary extramedullary plasmacytoma (including dural type) and the last one, plasmacytoma with multiple osseous sites, infiltration of bone marrow and monoclonal immunoglobulin synthesis. The pelvis, ribs and spine are typically affected by solitary plasmacytoma of bone. The average age is between 40 and 60 years old, males are more affected than females (2:1). Twenty-five percent of cases have presented the serum monoclonal protein, but may disappear after treatment. Upper respiratory tract or lung, lymph nodes, spleen, kidney, breast or testes are generally affected by the solitary extramedullary plasmacytoma (SEP) [22].

Radiological diagnosis of dural plasmacytoma is difficult, because it may reveal a non-characteristic lytic lesion involving both inner and outer tables and the diploe. CT scans show an isodense or a slightly hyperdense tumor homogeneously enhanced by contrast. Bone windows may show an erosion of the inner table with hyperdense areas within the mass due to bony inclusions but no calcification inside the tumoral mass. MRI scans show that the tumor is generally isointense to gray matter on T1-weighted images, iso- or hyperintense on T2-weighted images, and homogeneously enhanced after contrast injection [23]. Margins of the lesion are better defined

after injection. SEP is a tumor that can closely simulate meningioma on MR imaging studies and the biopsy reached the diagnosis [24].

Differential diagnosis of dural masses includes meningeal neoplasms, non-neoplastic meningeal disorders and calvarial neoplasms [25]. Even though the first assumption and most likely diagnosis was meningioma or meningosarcoma, plasmacytoma must always be included in the differential diagnosis [26, 27].

Coexistence between SEP and an aortic valve abnormality is not mentioned in literature, this causing a multidisciplinary approach and a non-aggressive neurosurgical resection.

The particularities of our case consisted in the fact that the patient was young and presented a severe cardiovascular pathology, which allowed us the performance of a total surgical removal of the tumor in a single stage. The imagistic examination (CT scan, MRI) allowed us to highlight the tumor size and the bone and brain damage. Similar to other authors, we consider medical imagistics (CT scan, MRI) to be essential for the positive and differential diagnosis of the plasmacytoma [28]. Also, we consider that the histopathological and IHC examinations are essential for the differentiation from other types of tumors [29] and the establishment of a treatment conduct.

Conclusions

Because of the rarity of these solitary extranevraxial plasmacytic lesions in the intracranial cavity, these tumors are very difficult to diagnose. In this case, neurosurgical resection must be total resection. In our case, the difficulties were represented by severe cardiac pathology. The total resection was performed in two stages with good global outcome. The prognosis is still controversial in literature, but majorities of authors think the plasmacytoma is unrelated with myeloma and is an independent entity, which gives SEP another progress line. When SEP of the bone is surgically totally resected, patients usually remain symptom free, like in our case.

Conflict of interests

The authors declare that they have no conflict of interests.

References

[1] Kilciksiz S, Karakoyun-Celik O, Agaoglu FY, Haydaroglu A. A review for solitary plasmacytoma of bone and extramedullary plasmacytoma. Scientific World Journal, 2012, 2012:895765.

[2] Dimopoulos MA, Moulopoulos LA, Maniatis A, Alexanian R. Solitary plasmacytoma of bone and asymptomatic multiple myeloma. Blood, 2000, 96(6):2037–2044.

[3] Ozsahin M, Tsang RW, Poortmans P, Belkacémi Y, Bolla M, Dinçbas FO, Landmann C, Castelain B, Buijsen J, Curschmann J, Kadish SP, Kowalczyk A, Anacak Y, Hammer J, Nguyen TD, Studer G, Cooper R, Sengöz M, Scandolaro L, Zouhair A. Outcomes and patterns of failure in solitary plasmacytoma: a multicenter Rare Cancer Network study of 258 patients. Int J Radiat Oncol Biol Phys, 2006, 64(1): 210–217.

[4] Morgenstern P, Pisapia D, Ramakrishna R. Calvarial plasmacytoma mimicking meningioma as the initial presentation of multiple myeloma. Cureus, 2017, 9(3):e1126.

[5] Rajkumar SV, Dimopoulos MA, Palumbo A, Blade J, Merlini G, Mateos MV, Kumar S, Hillengass J, Kastritis E, Richardson P, Landgren O, Paiva B, Dispenzieri A, Weiss B, LeLeu X, Zweegman S, Lonial S, Rosinol L, Zamagni E, Jagannath S, Sezer O, Kristinsson SY, Caers J, Usmani SZ, Lahuerta JJ, Johnsen HE, Beksac M, Cavo M, Goldschmidt H, Terpos E, Kyle RA, Anderson KC, Durie BG, Miguel JF. International Myeloma Working Group updated criteria for the diagnosis of multiple myeloma. Lancet Oncol, 2014, 15(12):e538–e548.

[6] Alexiou C, Kau RJ, Dietzfelbinger H, Kremer M, Spiess JC, Schratzenstaller B, Arnold W. Extramedullary plasmacytoma: tumor occurrence and therapeutic concepts. Cancer, 1999, 85(11):2305–2314.

[7] Galieni P, Cavo M, Pulsoni A, Avvisati G, Bigazzi C, Neri S, Caliceti U, Benni M, Ronconi S, Lauria F. Clinical outcome of extramedullary plasmacytoma. Haematologica, 2000, 85(1): 47–51.

[8] Jawad MU, Scully SP. Skeletal plasmacytoma: progression of disease and impact of local treatment; an analysis of SEER database. J Hematol Oncol, 2009, 2:41.

[9] Gerry D, Lentsch EJ. Epidemiologic evidence of superior outcomes for extramedullary plasmacytoma of the head and neck. Otolaryngol Head Neck Surg, 2013, 148(6):974–981.

[10] Thumallapally N, Meshref A, Mousa M, Terjanian T. Solitary plasmacytoma: population-based analysis of survival trends and effect of various treatment modalities in the USA. BMC Cancer, 2017, 17(1):13.

[11] Jakubowski J, Kendall BE, Symon L. Primary plasmacytomas of the cranial vault. Acta Neurochir (Wien), 1980, 55(1–2): 117–134.

[12] Matsuda M, Nakazawa T, Kizuki H, Matsumura K, Nakasu S, Handa J. Solitary plasmacytoma of the skull vault – case report. Neurol Med Chir (Tokyo), 1996, 36(6):388–392.

[13] Tanaka M, Shibui S, Nomura K, Nakanishi Y. Solitary plasmacytoma of the skull: a case report. Jpn J Clin Oncol, 1998, 28(10):626–630.

[14] van Santbrink H, Cornips EMJ. A man with a hole in his head. Lancet, 2007, 369(9569):1286.

[15] Popescu M, Popov V, Popescu G, Dobrea C, Sandu A, Grigorean VT, Strâmbu V, Pleşea IE. Acute pancreatitis: the onset digestive manifestation, in a patient with adult T-cell leukemia/lymphoma. Rom J Morphol Embryol, 2012, 53(3 Suppl): 847–850.

[16] Popescu M, Popov V, Popescu G, Dobrea C, Sandu A, Grigorean VT, Strâmbu V. Spinal involvement with spinal cord compression syndrome in hematological diseases. Rom J Morphol Embryol, 2012, 53(4):1069–1072.

[17] Popov VM, Dobrea CM, Popescu M, Pleşea IE, Grigorean VT, Sinescu RD, Strâmbu VD. Diffuse large B-cell lymphoma and polycythemia vera discovered at the onset – a rare association and its possible importance in lymphoma prognosis. Rom J Morphol Embryol, 2016, 57(1):313–318.

[18] Du Preez JH, Branca EP. Plasmacytoma of the skull: case reports. Neurosurgery, 1991, 29(6):902–906.

[19] Prasad ML, Mahapatra AK, Kumar L, Khosla A, Sarkar C, Prasad A, Roy S. Solitary intracranial plasmacytoma of the skull base. Indian J Cancer, 1994, 31(3):174–179.

[20] Shih LY, Dunn P, Leung WM, Chen WJ, Wang PN. Localised plasmacytomas in Taiwan: comparison between extramedullary plasmacytoma and solitary plasmacytoma of bone. Br J Cancer, 1995, 71(1):128–133.

[21] Romano AJ, Shoemaker EI, Gado M, Hodges FJ 3rd. Neuroradiology case of the day. Plasmacytoma of the skull vault. AJR Am J Roentgenol, 1989, 152(6):1335–1337.

[22] Hsiang J, Moorhouse D, Barba D. Multiple plasma cell granulomas of the central nervous system: case report. Neurosurgery, 1994, 35(4):744–747.

[23] Makino K, Murakami M, Kitano I, Ushio Y. Primary intracranial plasma-cell granuloma: a case report and review of the literature. Surg Neurol, 1995, 43(4):374–378.

[24] Lebrun C, Chanalet S, Paquis P, Frenay M, Lagrange JL, Chatel M. Solitary meningeal plasmacytomas. Ann Oncol, 1997, 8(8):791–795.

[25] Wisniewski T, Sisti M, Inhirami G, Knowles DM, Powers JM. Intracerebral solitary plasmacytoma. Neurosurgery, 1990, 27(5):826–829; discussion 829.

[26] Provenzale JM, Schaefer P, Traweek ST, Ferry J, Moore JO, Friedman AH, McLendon RE. Craniocerebral plasmacytoma: MR features. AJNR Am J Neuroradiol, 1997, 18(2): 389–392.

[27] Hughes M, Soutar R, Lucraft H, Owen R, Bird J. Guidelines on the diagnosis and management of solitary plasmacytoma of bone, extramedullary plasmacytoma and multiple solitary plasmacytomas: 2009 update. British Committee for Standards in Haematology, London, UK, 2009.
[28] Dimopoulos M, Terpos E, Comenzo RL, Tosi P, Beksac M, Sezer O, Siegel D, Lokhorst H, Kumar S, Rajkumar SV, Niesvizky R, Moulopoulos LA, Durie BG; International Myeloma Working Group (IMWG). International Myeloma Working Group Consensus Statement and Guidelines regarding the current role of imaging techniques in the diagnosis and monitoring of multiple myeloma. Leukemia, 2009, 23(9):1545–1556.
[29] Pătraşcu AM, Rotaru I, Olar L, Pătraşcu Ş, Ghiluşi MC, Neamţu SD, Nacea JG, Gluhovschi A. The prognostic role of Bcl-2, Ki67, c-MYC and p53 in diffuse large B-cell lymphoma. Rom J Morphol Embryol, 2017, 58(3):837–843.

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