A Rare Association Between Prostate Cancer and Polycythemia Vera

Maab F. Elhaj 1, Mohamed A. Yassin 2

1. Internal Medicine, Hamad Medical Corporation, Doha, Qatar 2. Hematology and Oncology, Hamad General Hospital, Doha, Qatar

Corresponding author: Maab F. Elhaj, maabfaisal123@gmail.com

Abstract

The association of polycythemia vera (PV) and localized prostate cancer is uncommon. PV is one of the myeloproliferative neoplasms that is characterized by an increased red cell mass and uncontrolled formation of blood cells owing to an acquired mutation in Janus kinase-2. PV has numerous complications and could raise the hazard of other tumors. Here, we report an extremely rare association of localized prostate cancer in a 62-year-old male with PV. He was treated by CyberKnife surgery and completed four doses of goserelin and radiotherapy, his follow up Magnetic Resonance Imaging (MRI) four months after completion of treatment showed no recurrence, and the PV was treated with hydroxyurea 500 mg twice per day and repeated phlebotomies, when needed, to keep his hematocrit level under 45%.

Introduction

One of the subclasses of myeloproliferative neoplasm (MPN) is the Polycythemia vera (PV), which is described as the existence of a mutated Janus kinase-2 (JAK2) exon 12 or 14 that cause panmyelosis in the bone marrow and elevated red blood cell production [1,2]. Generally, PV is an uncommon disease with a yearly occurrence of two to three for every 100,000 patients, with an average age of 65 years [2]. There has been a doubtful link between solid tumors and MPNs; nevertheless, current research has showed that the risk of acquiring solid tumors in MPN patients is twice greater than in the overall population [3]. In men, the prostate, lung, and stomach were the highest cancer risk areas; whereas, in women, the thyroid, stomach, and lungs were the most common locations [3].

We report a case of a rare association between PV and localized prostate cancer in a man with an age of 62 years. As far as we know, this is the first case report of PV, identified relying on the World Health Organization (WHO) criteria [4], to be associated with localized prostate cancer. The outcomes of the current case could assist in future identification and treatment of patients with prostate cancer and PV.

Case Presentation

A 62-year-old man presented in 2015 with a history of multiple myocardial infarctions, following percutaneous coronary intervention to the right coronary artery, left anterior descending artery, and diagonal arteries. He had a history of deep vein thrombosis and pulmonary embolism in October 2018 on lifelong anticoagulant with rivaroxaban. Also, he was diagnosed with type 2 diabetes mellitus for which oral hypoglycemic medications were prescribed. He was diagnosed with localized prostate cancer in another institution in 2018 and was treated with CyberKnife surgery and completed four doses of goserelin and radiotherapy.

The patient was followed up in National Center for Cancer Care and Research (NCCCR) in Qatar with prostate-specific antigen (PSA) level, magnetic resonance imaging (MRI) pelvis prostate, and nuclear medicine whole body fluorodeoxyglucose (FDG)-positron emission tomography–computed tomography (PET-CT).

PSA level was repeated every six months. Initially, levels were rising steadily, then they started to decline (0.16, 0.30, 0.47, 0.30 ng/mL; reference range according to the patient age: 0 to 4.5 ng/mL).

So, follow up MRI pelvis was done to rule out local recurrence, which showed no evidence of active neoplastic disease of the pelvis (Figure 1).
FIGURE 1: Axial T2 fat-saturated image of the prostate shows no definite masses in the peripheral zone (blue arrows). Artefacts are noted from previous intervention (red arrows).

Moreover, NM whole-body FDG PET-CT was done, which confirmed no evidence of local, regional, or distant metastasis (Figure 2).
While hospitalized, he was found to have a high hemoglobin level of 18 g/dL (reference range: 12 to 15 g/dL) and a high hematocrit of 54 (reference range: 36 to 46). The findings of his general physical examination were normal, and his heart, chest, and abdominal examination findings were normal as well.

His JAK2 V617F mutation screen came back positive for exon 14. He had a low erythropoietin level of 1.2 (reference range: 3.7 to 36 IU/L) and had bone marrow and peripheral blood findings in accordance with MPN for which he met the 2016 WHO criteria for PV [4]. He was treated with hydroxyurea 500 mg twice per day and repeated phlebotomies, when needed, to keep his hematocrit level lower than 45%. His most recent hematocrit was 43, and his hemoglobin level was 14 g/dL.

**Discussion**

Polycythemia vera is defined as a clonal disorder described by the unwarranted formation of red blood cells and is linked with JAK2 mutations (V617F or exon 12) in nearly all cases [5]. Absolute polycythemia has two kinds: primary and secondary polycythemia [6]. Usually, secondary polycythemia results from other conditions that raise the formation of erythropoietin and it is commonly linked with solid tumors [2,3], while the primary polycythemia is developed by bone marrow disorders, which mainly cause abnormal erythroid cell line production [7]. Furthermore, in rare occasions, PV can be familial when one or various MPN affect diverse kinsfolk of the same family [8]. Patients with familial MPN demonstrate similar clinical features and suffer the same complications as those with sporadic illness [8].

A pilot study was done in Qatar disclosed that familial cases of MPNs are more often acquired than defined in the literature [9], they use Clinical Exome Sequencing (CES) to sort six Qatari subjects that were supposed of clinical diagnosis of MPNs, according to the WHO 2008 diagnostic criteria for hematologic malignancies, and label variants that can probably justify the phenotypic diversity of MPNs [9].

MPNs are categorized by the WHO into numerous subclasses, and this is used for sporadic illness more willingly than familial cases, one of which is PV [9]. PV 2016 WHO criteria for diagnosis consist of one minor criterion and three main criteria [4]. The main criteria are: hematocrit >49% (men)/>48% (women), or hemoglobin >16.5 g/dL and >16.0 g/dL in men and women, respectively, or rise in red cell mass; bone
We describe a rare relationship between localized prostate cancer and PV. However, the association between prostate cancer and PV has not been explored for localized prostate cancer. In addition, the simultaneous presence of these diseases should be well established. Moreover, the possible association between PV and prostate cancer should be well recognized by the physician in order to avoid missing or delaying the diagnosis of similar cases and to improve the quality of life of the affected patients. Finally, to our knowledge, our case could be the first case of localized prostate cancer found to have well-established PV diagnosis, based on the 2016 WHO criteria.

Conclusions

We describe a rare relationship between localized prostate cancer and PV. However, the association between prostate cancer and PV has not been explored for localized prostate cancer. We want to underline this rare finding in order to increase physicians’ alertness and promote further understanding of the nature of this disease.
association that would guide future therapy and improve patient quality of life.

**Additional Information**

**Disclosures**

**Human subjects:** Consent was obtained by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

**Acknowledgements**

We acknowledge the internal medicine residency program for scientific support.

**References**

1. Yassin MA, Taher A, Mathews V, et al.: MERGE: a multinational, multicenter observational registry for myeloproliferative neoplasms in Asia, including Middle East, Turkey, and Algeria. Cancer Med. 2020 Apr 30, 9:4512-4526. 10.1002/cam4.3004
2. Abdalhadi AM, Yassin MA: Parathyroid adenoma as a rare cause of persistent hypercalcemia in a female with polycythemia vera. Case Rep Oncol. 2020, 13:578-582. 10.1159/000507362
3. Hong J, Lee HJ, Ryu J, et al.: Risk of disease transformation and second primary solid tumors in patients with myeloproliferative neoplasms. Blood Adv. 2019, 26:3700-3708. 10.1182/bloodadvances.201900655
4. Babbar T, Thiele J, Gisslinger H, et al.: The 2016 WHO classification and diagnostic criteria for myeloproliferative neoplasms: document summary and in-depth discussion. Blood Cancer J. 2018, 9:1-1. 10.1038/s41408-018-0054-y
5. Tefferi A: Polycythemia vera and essential thrombocythemia: 2015 update on diagnosis, risk-stratification, and management. Hematology. 2015, 88:507-516. 10.1002/ajh.23417
6. Korfiasis EB, Avestas PA, Delibasis KK, Matsopoulos GK: A classification system based on a new wrapper feature selection algorithm for the diagnosis of primary and secondary polycythemia. J Comp Biol Med. 2013, 45:2118-2126. 10.1016/j.compbiomed.2013.09.016
7. S.M. Koopmans*1, A.M.W. van Marion2, H.C. Schouten3: Myeloproliferative neoplasia: a review of clinical criteria and treatment. Neth J Med. 2012, 70:159-167.
8. Rumi E, Cazzola M: Advances in understanding the pathogenesis of familial myeloproliferative neoplasms. Br J Haem. 2017, 178:689-698. 10.1111/bjh.14713
9. Af-Dewik N, Ben-Omran T, Zayed H, Trujillano D, Kishore S, Rolfs A, Yassin MA: Clinical exome sequencing unravels new disease-causing mutations in the myeloproliferative neoplasms: a pilot study in patients from the state of Qatar. Gene. 2019, 689:34-42. 10.1016/j.gene.2018.12.009
10. Kaifie A, Kirschner M, Wolf D: Bleeding, thrombosis, and anticoagulation in myeloproliferative neoplasms (MPN): analysis from the German SAL-MPN-registry. J Hematol Oncol. 2016, 9:10.1186/s13045-016-0242-9
11. Martin K: Risk factors for and management of MPN-associated bleeding and thrombosis. Curr Hematol Malig Rep. 2017, 12:389-396. 10.1007/s11899-017-0400-3
12. Litwin MS, Tan HJ: The diagnosis and treatment of prostate cancer: a review. JAMA. 2017, 27:2552-2542. 10.1001/jama.2017.7248
13. Jemal A, Siegel R, Xu J, Ward E: Cancer statistics, 2010. CA Cancer J Clin. 2010, 60:277-300.
14. Brown R, Kerr K, Hauoui A, Darzi A: Tackling cancer burden in the Middle East: Qatar as an example. Lancet Oncol. 2012, 1:501-508. 10.1016/S1470-2045(12)70461-8
15. Li Y, An W, Wei W, Liu M, Wang G, Wang X: Prostatic metastases and polycythemia vera on bone magnetic resonance imaging: a case report. Oncolo Lett. 2015, 1:1517-1520. 10.3892/ol.2014.2809
16. Papagoras C, Arelaki S, Botis I, Chrysafis I, Giannopoulos S, Skendros P: Co-occurrence of dermatomyositis and polycythemia unveiling rare de Novo neuroendocrine prostate tumor. Front Oncol. 2018, 8:534. 10.3389/fonc.2018.00534