Analysis of hemoglobin values in prostate cancer patients treated with external radiotherapy

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ABSTRACT
Introduction: The world estimate points to prostate cancer as the second most frequent cancer in men worldwide, and radiotherapy is an important modality of curative treatment to manage this neoplasm. The prevalence and impact of cancer-related anemia are not widely known and may be overlooked or considered clinically significant. It is believed that the results and toxicity of radiation therapy in the treatment of prostate cancer may be influenced by hemoglobin levels in the blood. Objective: To evaluate hemoglobin levels in patients with prostate cancer before and after radiotherapy treatment. Methods: This was a retrospective and longitudinal study of patients diagnosed with malignant prostate cancer who underwent external radiotherapy. Hemoglobin levels were measured before radiotherapy and after completion of treatment (20-40 days). Anemia was defined by the World Health Organization as values below 13 g/dl. The classification of the risk of prostate cancer recurrence was based on the National Comprehensive Cancer Network risk criteria. Results: Forty patients were evaluated with measurement of hemoglobin levels before and after radiotherapy treatment. The mean age was 67 years. According to the classification of the risk group, 4 patients were at low risk (10%), 27 patients were at intermediate risk (67.5%), and 9 patients were at high risk (22.5%). Mean pre-radiotherapy hemoglobin levels were 13.3 g/dL and mean post-radiotherapy hemoglobin levels were 10.4 g/dL, $p < 0.0001$. Conclusion: In this study, a reduction in serum hemoglobin levels was observed after radiotherapy, highlighting the need for better monitoring of these patients.

Keywords: Radiotherapy, Prostate neoplasms, Anemia.

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INTRODUCTION

The world estimate points to prostate cancer as the second most frequent cancer in men worldwide1, and radiotherapy is an important curative treatment modality in the management of this neoplasm. The prevalence and impact of cancer-related anemia are not widely known and may be overlooked or considered clinically significant. However, the restoration of normal hemoglobin (Hb) concentrations in patients undergoing radiotherapy has the potential to improve local tumor control and survival, as well as significantly improve patient quality of life[2]. While there is emerging data on the importance of Hb levels in some cancers, there is limited published data on its role in prostate cancer. It is believed that the results and toxicity of radiotherapy in the treatment of prostate cancer may be influenced by blood levels of Hb[3].

OBJECTIVE

To assess hemoglobin (Hb) levels in prostate cancer patients before and after radiation therapy treatment.

METHODS

This was a retrospective, longitudinal study of patients diagnosed with malignant prostate neoplasms who underwent external radiotherapy. Hb levels were measured before radiotherapy and after completion of treatment (20-40 days). Anemia was defined by the World Health Organization (WHO) as men with values lower than 13 g/dl[4]. The classification of the risk of prostate cancer recurrence was based on the National Comprehensive Cancer Network (NCCN) risk criteria5, with patients classified as low risk, favorable intermediate and unfavorable intermediate, and high-risk groups. PSA levels were also assessed. Patients indicated for hormonal blockade (central and/or peripheral) started hormonal treatment after Hb collection and measurement in this study. Inclusion criteria: prostate neoplasm with confirmatory histopathological diagnosis, referred for radiotherapy with or without antiandrogen therapy. Exclusion criteria: metastatic disease, initiation of chemotherapy, or hematologic diseases. For the descriptive statistical analysis of the collected data, the Statistical Package for the Social Sciences (SPSS), version 23.0, was used. Only results with a significance level of 5% probability (P £ 0.05) and a 95% confidence interval were considered. The study was approved by the Research Ethics Committee of the Faculty of Medicine of the Universidade Federal Fluminense - CAAE: 58121422.1.0000.5243.

RESULTS

Forty patients were evaluated with measurement of Hb levels before and after radiotherapy treatment. The mean age was 67 years (range 55-79 / 95% CI 65-69 / SD ± 5.4). The mean PSA was

13.5 ng/ml (3.2-70/95%CI 11.0-16.0/SD ± 12.2). According to the classification of the risk group, 4 patients were at low risk (10%), 27 patients were at intermediate risk (67.5%), and 9 patients were at high risk (22.5%). Patients received an external radiotherapy dose of 70 Gy in 28 fractions (moderate hypofractionation). Table 1 shows the general characteristics of the patients evaluated.

Table 1 – General characteristics of patients		
	n	%
Race		
White	14	35%
Brown / Black	26	65%
Smoking		
Yes	07	17,5%
No	33	82,5%
Alcohol use		
Yes	13	32,5%
No	27	67,5%
Staging		
T1	07	17,5%
T2	33	82,5%
ISUP (International Society of Urulogical Pathology)		
1	20	50,0%
2	07	17,5%
3	06	15%
4	07	17,5%

Mean pre-radiotherapy Hb levels were 13.3 g/dL (range 12-16.5/95% CI 13.0-13.6/SD ± 0.9), and mean post-radiotherapy Hb levels were 10.4 g/dL (range 9-13/95% CI 10.0-10.7/SD ± 1.1), with a statistically significant difference, $p < 0.0001$. DISCUSSION It has been suggested that prostate cancer survival outcomes and radiotherapy toxicity may be influenced by Hb levels. The *Trans-Tasman Radiation Therapy Oncology Group* (RTOG 96.01) study reported late radiation toxicity at its median 5-year follow-up of 818 prostate cancer patients treated with androgen deprivation therapy and radiotherapy. They found that patients with higher pre-treatment Hb had a reduction in late rectal toxicity[6]. In our study, a lower Hb level was observed after radiotherapy. NCCN guidelines recommend transfusion or erythropoietin for symptomatic patients with Hb of 10-11 g/dL and state that erythropoietin should be strongly considered if Hb falls below 10 g/dL. These recommendations were based on studies that showed an improvement in the quality of life of cancer patients, but not in their survival with the correction of anemia[5].

CONCLUSION

In this study, a reduction in serum Hb levels was observed after radiotherapy, highlighting the need for better monitoring of these patients.

REFERENCES

1. Instituto Nacional de Câncer (Brasil). (2022). Estimativa 2023: incidência de câncer no Brasil. Rio de Janeiro: INCA.

2. Hofmann, A., Aapro, M., Fedorova, T. A., Zhiburt, Y. B., Snegovoy, A. V., Kaganov, O. I., & Poddubnaya, I. V. (2022). Patient blood management in oncology in the Russian Federation: Resolution to improve oncology care. *Journal of Cancer Policy, 31*, 100315.

3. Yu, S., Tao, X., Suyan, Z., & Hongbin, X. (2023). Characteristics of adverse drug reactions induced by flutamide and bicalutamide: a real-world pharmacovigilance study using FAERS. *Expert Opinion on Drug Safety*. https://doi.org/10.1080/14740338.2023.2267978.

4. Jordão, R. E., Bernardi, J. L. D., & Filho, A. A. B. (2009). Prevalência de anemia ferropriva no Brasil: uma revisão sistemática. *Rev. Paul. Pediatr., 27*(1), 90-98.

5. National Comprehensive Cancer Network (NCCN). (n.d.). Guidelines. Prostate Cancer. Disponível em: https://www.nccn.org/login?ReturnURL=https://www.nccn.org/professionals/physician_gls/pdf/prostate.pdf.

6. Denham, J. W., Steigler, A., Lamb, D. S., Joseph, D., Turner, S., Matthews, J., ... D'Este, C. (2011). Short-term neoadjuvant androgen deprivation and radiotherapy for locally advanced prostate cancer: 10-year data from the TROG 96.01 randomised trial. *The Lancet Oncology, 12*(5), 451-459.