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COGNITIVE ABILITIES OF HEMATOLOGY- ONCOLOGY PATIENTS IN PRE- AND POST-TREATMENT OF ANEMIA MEASURED WITH A COMPLEX REACTIOMETER DRENOVAC (CRD)

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Summary

Anemia is commonly present in hematology and oncology patients and influence significantly their quality of life.

The aim of this study was to evaluate the effect of anemia and malignant disease on cognitive functions in hematology-oncology patients. Four hundred patients were evaluated for cognitive functions and hemoglobin levels before and after correction of anemia in the Clinical Hospital Center of Rijeka, Croatia. The patients were divided in four groups (100 patients in each group): Experimental Group 1 – patients with malignancy plus anemia, and controls: Group 2 – patients with malignancy and without anemia, Group 3 – patients without malignancy but anemic and Group 4 – healthy controls without malignancy and without anemia. Cognitive functions were measured by Complex Reactiometer Drenovac (CRD) before and after therapy of anemia.

Group 1 showed the worst cognitive achievement ($p<0.001$) compared with all other groups. After correction of anemia, cognition improved (except visual orientation and memory) but did not reach the results of other groups. Cognitive improvement was in correlation with hemoglobin levels. This study confirmed that anemia significantly influence cognitive functions in hematology-oncology patients and that cognitive functions could be improved by correction of anemia.

KEYWORDS: *anemia, cognition, malignancy*

KOGNITIVNE SPOSOBNOSTI MJERENE KOMPLEKSNIM REAKCIOMETROM DRENOVAC (CRD) U ONKOLOŠKO HEMATOLOŠKIH BOLESNIKA PRIJE I POSLIJE LIJEČENJA ANEMIJE

Sažetak

Kognitivna disfunkcija uzorkovana anemijom vrlo je česta u onkoloških i hematoloških bolesnika te značajno utječe na njihovu kvalitetu života.

Cilj ovog istraživanja bio je procijeniti u kolikoj se mjeri maligna bolest i anemija odražavaju na kognitivne sposobnosti onkološko-hematoloških bolesnika. Istraživanjem je obuhvaćen uzorak od 400 bolesnika liječenih u Kliničkom bolničkom centru Rijeka, koji su bili svrstani u 4 skupine izjednačene po spolu, dobi i stručnoj spremi (po 100 ispitanika u svakoj sku-

pini). Skupina 1 bila je eksperimentalna (bolesnici sa zloćudnim tumorom koji pri postavljanju dijagnoze imaju i anemiju) dok su ostale skupine bile kontrolne: skupina 2 (bolesnici sa zloćudnim tumorom koji nemaju anemiju), skupina 3 (anemični bolesnici koji nemaju malignu bolest), skupina 4 (zdravi ispitanici koji nemaju ni malignu bolest niti anemiju). U svih bolesnika provedeno je psihometrijsko testiranje različitih kognitivnih funkcija pomoću kompjutoriziranih testova CRD-serije (Complex reactiometer Drenovac) prije i poslije liječenja anemije.

U skupini 1 zabilježeni su lošiji rezultati na kognitivnim testovima ($p<0,001$) u odnosu na ostale skupine. Nakon korekcije anemije većina kognitivnih funkcija je bila poboljšana (osim vizualne orijentacije i memoriranja), ali nisu dostignuti rezultati ostalih skupina. Porast kognitivnih sposobnosti bio je proporcionalan razini hemoglobina. Rezultati istraživanja pokazuju da je anemija značajno utjecala na kognitivne funkcije onkološko-hematoloških bolesnika i da se liječenjem anemije može utjecati na poboljšanje kognitivnih sposobnosti.

KLJUČNE RIJEČI: *anemija, kognitivna sposobnost, maligna bolest*

INTRODUCTION

Cognitive dysfunction is a common problem in patients with malignancy (1-5). It may be caused by malignant tumor *per se*, chemo- or radiotherapy, infection, anemia, metabolic dysfunctions, nutritive deficits or by combination of all these factors (6-7).

Anemia could deteriorate cognitive functions, diminish quality of life (9-10) and influence even malignant disease as a bad prognostic factor (11-14).

AIM

The aim of this study was to evaluate the effect of anemia and malignant disease on cognitive functions in hematology-oncology patients.

PATIENTS AND METHODS

Four hundred patients were evaluated for cognitive functions and hemoglobin level before and after correction of anemia in the Clinical Hospital Center of Rijeka, Croatia. The patients were divided in four groups (100 patients in each group): Experimental Group 1 including patients with malignancy plus anemia, and controls: Group 2 - patients with malignancy and without anemia, Group 3 – patients without malignancy but anemic and Group 4 – healthy controls without malignancy and without anemia.

Cognitive functions were measured by Complex Reactiometer Drenovac (CRD), a PC-based psyhodiagnostic laboratory based on the chronometric approach allowing for examination of: *perceptive abilities (*detection, identification, visual orientation, spatial visualization*), memory* (short-term memory, maze learning, actualization of memorized contents), *thinking* (operative thinking, problem solution, convergent thinking), *psychomotor reactions* (simple and complex), *dynamic features of CNS function* (excitability, agility, stability, balance, endurance, reliability), *attention* (attention span, concentration, vigilance) and *functional disturbances* (rigidity, agitation, perseverance, regression). All parameters were measured twice: T0 – basal measurement,T1 – after one month (+/- 7 days). In the interval between T0 and T1, patients received therapy for their anemia according to their anemia type and Hb level but no chemo, radio or immunotherapy for their disease, or Epo agents.

RESULTS AND DISCUSSION

Hemoglobin level significantly increased after correction of anemia in Groups 1 and 3. Cognitive test showed significant differences among the groups. Group 1 had the worst cognitive performance ($p=0.0001$) even after correction of anemia, however, compared to the pretreatment period, their cognition significantly improved in almost all categories except for visual orientation and memory.

Cognitive improvement was proportional to hemoglobin level. When statistically partitioned, the effects of gender, age, education and Hb level showed the Hb level as the most effective variable on cognition analyzed by beta weights (beta-0.458, $p<0.000$). Table1 shows the average total time taken for a test of convergent inductive thinking (CRD 11 test).

Table 1.

AVERAGE TOTAL TIME (IN SECONDS) FOR PERFORMING TEST OF CONVERGENT INDUCTIVE THINKING (CRD 11) IN VARIOUS GROUPS

Patients	Total time	Standard deviation
With malignancy and anemia (Group 1)	336.05	153.14
Group 1 after correction of anemia	263.12	113.80
With malignancy without anemia (Group 2)	197.31	77.73
Anemia without malignancy (Group 3)	197.30	55.45
Anemia after correction of anemia	175.15	48.15
Healthy controls (Group 4)	141.36	40.37

CONCLUSION

It may be concluded that anemia significantly influences cognitive function in hematology-oncology patients. Hemoglobin elevation has a large positive influence on their cognitive functions. Even in the so-called non-anemic persons the highest hemoglobin level shows a strong correlation with better cognitive achievements. Anemia should therefore be detected and treated early in the course of malignant disease.

REFERENCES

1. Meyers CA. Neurocognitive dysfunction in cancer patients. Oncol 2000;14(1):75-81.
2. Ahles TA, Saykin AJ, Furstenberg CT, et al. Neuropsychologic impact of standard-dose systemic chemotherapy in long-term survivors of breast cancer and lymphoma. J Clin Oncol 2002;20:485–93.
3. Anderson-Hanley C, Sherman ML, Riggs R, et al. Neuropsychological effects of treatments for adults with cancer: a meta-analysis and review of the literature. J Int Neuropsychol Soc 2003;9:967–82.
4. Ahles TA, Saykin AJ. Candidate mechanisms for chemotherapy-induced cognitive changes. Nat Rev Cancer 2007;7:192–201.
5. Meyers CA,Wefel JS. The use of Mini-Mental State Examination to assess cognitive functioning in cancer trials: No ifs, and, buts, or sensitivity. J Clin Oncol 2003; 21(19):3557-8.
6. Ludwig H. Anemia of hematologic malignancies: what are the treatment options. Semin Oncol 2002;29 (Suppl 8):45-54.
7. Balducci L. Anemia, cancer, and aging. Cancer Control 2003;10:478-86.
8. Crawford J, Cella D, Cleeland CS, et al. Relationship between changes in hemoglobin level and quality of life during chemotherapy in anemic cancer patients receiving epoetin alfa therapy. Cancer 2002; 95:888-95.
9. Demetri GD. Anaemia and its functional consequences in cancer patients: current chalenges in management and prospects for improving therapy. Br J Cancer 2001;84(suppl 1):31-7.
10. Nowrousian MR. Patophysiology of cancer-related anemia. In: Nowrousian MR (Ed.) Recombinant human erythropoietin (rhEPO) in clinical oncology: scientific and clinical aspects of anemia in cancer. Wein: Springer-Verlag 2002:39-62.
11. Dubray B, Mosseri V, Brunin F. Anemia is associated with lower local-regional control and survival after radiation therapy for head and neck cancer. A prospective study. Radiology.1996;201:553-8.
12. Caro JJ, Salas M, Ward A et al. Anemia as an independent prognostic factor for survival in patients with cancer: a systemic, quantitative review. Cancer 2001; 91:2214–21.
13. Harper P, Littlewood T. Anaemia of cancer: Impact on patient fatigue and long-term outcome. Cancer 2005; 69:2-7.
14. Denny SD, Kuchibhatla MN, Cohen HJ. Impact of anemia on mortality, cognition and function in community-dwelling elderly. Am J Med 2006;119:327-34.

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