

Review:

from Prof. Dr. **Boyan Dobrev Balev**, MD, Scientific specialty: Imaging diagnostics.
Institution: Department of Imaging and Interventional Radiology, Medical University
"Prof. Dr. P. Stoyanov" Varna, Imaging Department of UMBAL "St. Marina" Varna,

for the procedure "Professor"

by Order No. R – 109-514/ 30.11.2023 of the Rector of the Medical University – Varna,
in SG, no. 83/3.10.2023

Documents were submitted within the deadline by one candidate: Assoc. Professor Dr. **Radoslav Yosifov Georgiev** at the Department of Imaging and Interventional Radiology, Medical University "Prof. Dr. P. Stoyanov" Varna.

1. Biographical data and career development.

Dr. Georgiev was born on 04/07/1976 in the city of Dobrich. In 1995, he graduated from the English High School, Dobrich with excellent results, and in 2001 - medicine at the Medical University - Sofia. Since 2007, he has a recognized specialty in imaging diagnostics, and since 2014 - a European diploma in neuroradiology. In 2015, he successfully defended his dissertation on "Magnetic resonance diffusion and perfusion for differentiation and assessment of primary glial brain tumors" to obtain the educational and scientific degree "doctor". Since 2002, he has been a resident in the X-ray department of the MBAL - Dobrich, since 2003 - an assistant in the Department of Imaging and Radiation Therapy of the Medical University - Varna, since 2011 - a chief assistant, and since 2016 - an associate professor. Prof. Dr. Georgiev has periodically increased his qualification in numerous educational events in Austria, Germany, Spain, Italy, Belgium, Greece, Turkey, Hungary and Switzerland, among which the ECONR course "Pierre Lasajunias" of the European Society of Neuroradiology in Tarragona and Rome, the MRI specializations at Hacettepe University in Ankara and Ioannina University Hospital. He is a member of the Bulgarian Association of Radiology, the European Society of Radiology, and the European Society of Neuroradiology. Chairman of the upcoming XX Congress of the Bulgarian Association of Radiology. He is fluent in written and spoken English, German and Russian.

2. General characteristics of scientific research and applied scientific activity.

The candidate participates in the competition with the following scientific production:

1. Dissertation work for the acquisition of ONS "Doctor" on the topic: "Magnetic resonance diffusion and perfusion for differentiation and assessment of primary glial brain tumors", Varna, 2015. 106 pages (index A1).

2. Equivalent to a habilitation work, full-text publications in publications that are referenced and indexed in world-renowned databases with scientific information - 11 items (indicator B4). 3. Publications and reports published in scientific publications, referenced and indexed in world-famous databases with scientific information - 3 items (indicator D7).

4. Publications and reports published in non-refereed journals with scientific review or published in edited collective volumes - 29 items (indicator D8).

The total publication activity of the candidate contains 143 scientific papers, of which 53 were published after the award of the academic position "Docent".

To participate in the announced competition, the following are presented:

Full-text articles – 44 items;

Published reports from scientific forums at home and abroad - 2 pcs.;

Published summaries of reports from scientific forums at home and abroad - 7 nos.;

The distribution of the submitted publications according to the order of the candidate among the authors is as follows:

	The only one author	First position	Second position	Third and next position	All
Indicator B4 Publications in publications referenced in world-renowned databases of scientific information, equivalent to a habilitation thesis	–	1	3	7	11
Indicator G7 Publications and reports in scientific publications, referenced and indexed in world-renowned databases of scientific information	2	–	–	1	3
Indicator D8 Publications and reports in non-refereed peer-reviewed journals or edited collective volumes	–	3	15	11	29
Additional publications beyond the minimum scientometric requirements	–	–	7	3	10

The total number of points covers the required standard.

Assoc. Prof. Georgiev submitted 7 citations for the current competition with a total number of 105 points (indicator D10). Citing articles are published only in international editions, which popularizes the scientific output of Medical University - Varna.

Dr Georgiev participates as an expert in educational activities in an expert group in two scientific projects: project No. BG05M2OP001-2.016-0025 "Creation of a multi-disciplinary educational environment for the development of personnel with integral competences in the field of biomedicine and health care", under OP "Science and education for intelligent growth" and scientific project "Physical breast anthropomorphic models and technology for their production", (PHENOMENO), No. 101008020, under OP "Horizon 2020" to the EC (indicator E16).

In the attached documents, the candidate presents a certificate of participation in Bulgarian and international scientific forums with lectures and posters, which for the period 2016-2023 are 20 in number. There is also an award for the best poster at the international symposium Glioma workshop: from A to Z, 2017 in Larissa, Greece.

Dr. Georgiev has a registered and active scientific profile on Google scholar and Research Gate.

What unites all these works is their thoroughness, didactic nature, scientific and practical relevance and recognized contributions they bring.

3. Educational and teaching activity.

Prof. Radoslav Georgiev has more than 20 years of teaching experience in the field of diagnostic imaging. He has successively held various academic positions over the years: assistant professor (2003-2010), senior assistant professor (2010-2011), senior assistant professor (2011-2016) and associate professor (from 2016 to present). He conducts lectures and exercises on imaging diagnostics, as well as participates in the exam sessions of students of II, IV year medicine BEO and AEO; X-ray laboratory technician specialty; specialty rehabilitator; specialty kinesitherapist; specialty nurse; specialty of midwifery, as well as specialists in imaging diagnostics at MU-Varna. Meets the requirements for the study load.

From 2020 until now, he has been participating in the state examination committee in the specialty of imaging diagnostics at the Pleven University of Medical Sciences. Under his leadership, two doctoral students have obtained the ONS "Doctor" and three specialists have successfully passed the state exam in imaging diagnostics.

4. Main scientific and scientific-applied contributions:

Prof. Georgiev shows a certain desire to introduce new methods in the field of imaging diagnostics, as well as expanding and detailing already known applications, especially in the field of neuroradiology. The introduction and validation of magnetic resonance methods such as diffusion and perfusion studies as part of the optimal MR protocol in neuro-oncology in our country contributes significantly to the improvement and refinement of diagnostics in patients with brain tumors.

These modern magnetic resonance techniques allow, in addition to purely anatomical, morphological information about the tumor, to obtain an assessment of the pathophysiology of the tumor - assessment of cell atypia, cell cellularity, tumor neovascularization, the state of the blood-brain barrier. This assessment grades the tumor's biologic potential, dictates the choice of therapy, and predicts prognosis.

The application of ASL (arterial spin labelling) perfusion and 3D TOF angiography help the rapid and non-contrast assessment of perfusion disorders in acute vascular accidents, asymptomatic ischemic disorders and arterio-venous malformations.

Modern functional magnetic resonance techniques enable differentiation of pseudotumor inflammatory lesions from tumors, differentiation of tumor recurrence from radiation necrosis, identification of optimal sites for biopsy or surgical resection, prognosis, planning and monitoring of the effect of therapy.

Determining the exact boundaries of the tumor is of great importance in planning radiotherapy.

The author's work in the field of artificial intelligence and its application in imaging diagnostics, specifically for magnetic resonance examination of the spine, seems relevant and useful. The evaluation of lumbar stenosis and the comparison of the work of the radiologist with and without the help of artificial intelligence is very important for the future integration of the methodology and improvement of the diagnostic activity.

The presented scientific works and the results of the research work of Assoc. Dr. Radoslav Yosifov Georgiev, d.m. are thematically divided into the following scientific

Scientific field 1: Neuroradiology

Most of Assoc. Prof. Georgiev's research work is related to neuroradiology.

a) The author describes the role of magnetic resonance imaging in the assessment of the tumor after radiotherapy, including the side and unwanted effects,

the follow-up over time of such patients. Mandatory inclusion in the magnetic resonance protocol of diffusion and perfusion help to differentiate cases with radiation necrosis from tumor recurrence and the phenomena of pseudoprogression. The author examines and discusses the moderate radiosensitivity of brain PNET (primitive neuroectodermal tumor) and the possibilities of overcoming it by hyperfractionated craniospinal radiotherapy in combination with chemotherapy and subsequent bone marrow transplantation of peripheral stem cells.

b) The author draws attention to the role of contrast-enhanced magnetic resonance imaging of the head and neck for the detection of leptomeningeal metastases, as well as a possible link to metastasis via the lymphatic route through the newly discovered glial lymphatics, the so-called glymphatic system. The author reports a case of extracranial cervical metastasis in a patient with glioblastoma, addressing the role of the glymphatic system as a potential pathway for tumor dissemination.

c) In a series of publications, the author investigates gliomagenesis, imaging characteristics and structure of gliomas. According to the new WHO classification of brain tumors, it describes their rarer variants with a focus on their genetic and pathological structure and looks for a correlation with imaging signs. The author draws attention to the most aggressive representative of diffuse gliomas - glioblastoma, which according to the guidelines of the World Health Organization (WHO) from 2021 is isocitrate dehydrogenase (IDH) wild type without change in histone 3, has glomeruloid vascular proliferation, tumor necrosis, telomerase reverse transcriptase (TERT) promoter mutation, epidermal growth factor receptor (EGFR) gene amplification or +7/-10 chromosomal copy number changes, and describes the very rapid growth and dismal prognosis in these patients. The author investigated the role in gliomagenesis of the Diaph3 gene, which encodes a protein stabilizing the cytoskeleton and, based on its different expression, can be used to differentiate between normal brain parenchyma, reactive gliosis and tumor proliferation, as well as to predict response to some chemotherapeutics. Prof. Georgiev also points out the difficult differential diagnosis between pleomorphic xanthoastrocytoma and giant cell glioblastoma due to the significant overlap of histological, immunohistochemical criteria and imaging features, but with a very different prognosis, much more favorable in astrocytoma. The author describes a rare localization of DNET (dysembryoplastic neuroepithelial tumor) – a complex variant in the cerebellum with atypical clinical and

radiological features – such as gait instability, strabismus and a cystic-solid structure with contrast enhancement.

d) Prof. Georgiev also draws attention to the role of MRI in the differential diagnosis of demyelinating diseases - multiple sclerosis, transverse myelitis, Lyme disease with other pathology, monitoring the effect of treatment and the presence of activity. In rare cases, it also describes a possible combination of different diseases in one patient. Participated as a co-author in the introduction of software techniques for evaluating the volume of multiple sclerosis lesions in the brain parenchyma and correlation with the severity of the disease. The author points to magnetic resonance imaging as an important tool for early detection of encephalitis, especially with the diffusion technique, clarifying that the often described changes are non-specific and require a wider differential diagnosis.

e) An important direction in the works of Prof. Georgiev is the work with non-contrast ASL (arterial spin labeling) magnetic resonance perfusion for the assessment of arterio-venous malformations, often undetectable on conventional images, even post-contrast ones. Publications are devoted to the evaluation of asymptomatic cerebrovascular disorders and microangiopathy. The author examines the magnetic resonance findings in patients with dementias - Alzheimer's disease, etc., emphasizing the physiological assessment through non-contrast ASL (arterial spin labeling) perfusion to detect early hemodynamic disorders, and not only the morphological assessment of brain atrophy.

f) Prof. Georgiev contributes with new cases of relatively rare and newly discovered diseases - such as CLIPPERS syndrome, rather a diagnosis of exclusion, but sometimes with very characteristic magnetic resonance imaging characteristics, which, in combination with clinic, follow-up and histology, can recognize the disease and contribute to the understanding of its etiology, pathogenesis and prognosis.

g) The author describes interesting cases from clinical practice of a combination of seemingly random diseases and looks for a possible causal relationship between the different disease entities, such as syringomyelia and neuropathic arthropathy.

Scientific field 2: Head and neck tumors

a) The author points to magnetic resonance imaging as the method of choice for the detection and staging of nasopharyngeal carcinoma because of its exceptional soft tissue resolution, sensitivity to perineural and intracranial spread, and assessment of bone marrow for possible infiltration. The author presents a case of advanced

achromatic sinonasal melanoma, with an excellent outcome after combined treatment, without complications of the type of radiation-induced optic nerve demyelinating syndrome, thanks to the high radiosensitivity of this tumor variant.

b) In connection with the current situation in hospitals, Prof. Georgiev describes the potential complications of the seemingly simple manipulation for taking nasopharyngeal secretions, which has gained particular popularity in connection with the COVID-19 pandemic, one of which is a brain rhinogenic abscess.

c) The author contributes interesting cases of rare syndromes and diseases such as proliferative trichilemm cysts of the scalp, which can mimic squamous cell carcinoma due to cellular atypia, etc. empty nose syndrome, described as a paradoxical sensation of nasal obstruction in the presence of actually enlarged nasal airways, resulting from the dissociation of the efferent neuronal signal accompanying changes in the nasal mucosa. The author also describes a rare localization of a giant cell tumor in the sinonasal region and discusses the complex approach to treatment, which includes, in addition to surgery, postoperative radiotherapy, with a good outcome for the patient. The author also reports a case of Ritscher-Schinzel (RTSC) syndrome, also known as 3C (cranio-cerebellar-cardiac) syndrome, a rare disorder with a variable spectrum of CNS (predominantly cerebellar), craniofacial, and congenital heart defects in which retardation is also observed in growth, most likely due to isolated growth hormone deficiency.

Scientific field 3: Oncology

a) In a series of publications, the author examines locally advanced chordomas in the lumbosacral and paravertebral regions, emphasizing the role of magnetic resonance imaging, pathohistological and immunohistochemical analysis for the accurate diagnosis, the radioresistance of this tumor and the prognosis closely related to the histological variant - bad in rhabdoid and anaplastic variants. Good results are achieved with early diagnosis and with combined therapy - maximum radical surgery and post-operative combined photon and proton radiation therapy. The author describes a case of giant cell tumor of the sacrum, a borderline benign but locally aggressive tumor in which radiotherapy is not routinely used because of the increased risk of secondary neoplasms in young people, as well as the risk of cellular transformation to sarcoma, but appropriate in incomplete resection and recurrence.

b) Associate Professor Georgiev also draws attention to the peculiarities of the course of COVID-19 in patients with oncological diseases who have a weakened immune system due to radiation-chemotherapy. Chest CT does not have full sensitivity

and cannot independently rule out this disease. The author and his team demonstrate the role of combined targeted therapy and radiosurgery in a patient with advanced non-small-cell lung adenocarcinoma with brain metastases, who, despite a COVID-19 infection, achieved a 3-year survival with local tumor control and good quality of life.

c) The author contributes a reported case of a very rare tumor - an extremely malignant rhabdoid gastrointestinal stromal tumor with a mixed subtype of rhabdoid signet-ring GIST - the third case described in the English medical literature. Its diagnosis requires expert pathohistological and immunohistochemical evaluation to determine the differential diagnosis with a number of other malignant mesenchymal tumors.

d) The author discusses the application of the LI-RADS system for categorizing findings in patients at high risk of developing hepatocellular carcinoma. Even with the correct application of LI-RADS, for a finding defined as LR-5 there remains a 5% probability that the histological diagnosis is different from HCC - specifically in one clinical case - MALT lymphoma - low-grade B-cell lymphoma of the mucosa - the associated lymphoid tissue.

e) The author reviews the modern radiotherapy techniques VMAT and IGRT for the treatment of vulvar carcinoma with their advantages - a significant reduction of doses in the small intestine, rectum, bladder and femur, also describing the role of MRI in determining the most important prognostic factor in this disease – the nodal status.

Scientific field 3: Gastroenterology

a) In a series of publications, Prof. Georgiev pays attention to the diagnosis and follow-up in patients with Crohn's disease, pointing out the importance of low-dose CT enterography in the conditions of dual-energy mode and magnetic resonance diffusion, perfusion with dynamic contrast to assess inflammatory changes in intestinal wall and mesentery.

b) The author pays attention to adenomyomatosis of the gallbladder - a benign degenerative condition of the gallbladder, characterized by mucosal proliferation and thickening of the muscle layer and the entire wall, and emphasizes cholecystectomy as the first method of choice for treatment due to the premalignant nature of the segmental and the diffuse type of adenomyomatosis in patients with pronounced clinical symptoms.

c) The role of magnetic resonance cholangio-pancreatography in the diagnosis of liver abscesses and the proof of a possible connection between the abscesses and

the biliary tree, detection of important accompanying pathology such as strictures, gallstones, tumors and secondary hepatic lesions is described.

Task 4: Cardiology

a) The role of magnetic resonance imaging of the heart for morphological and functional assessment in various heart diseases and the possibility of differential diagnosis through tissue suppression techniques (double and triple inversion-recovery) between myxoma and lipoma are presented.

b) Possible cardiotoxic effects have been described with 5-fluorouracil treatment, and the incidence of these effects may reach 20%. Specifically, we are talking about a chemotherapy patient with acute toxic myocardial damage with involvement of both chambers and development of cardiogenic shock, with complete reversal within 7 days of systolic dysfunction.

Scientific field 5: Musculoskeletal imaging diagnostics

a) The author participated in a country-unique study of the role of artificial intelligence in diagnostic imaging, investigating the level of correspondence between the magnetic resonance readings of the lumbar spine, created by a deep learning neural network (CoLumbo) and the radiologists' readings. This prospective study shows that radiologists' assessment supported by an artificial intelligence system for the classification of central stenosis results in high kappa agreement. The introduction into practice of such AI-based tools would accurately predict the presence of stenosis and thus reduce observer variability in assessing the severity of lumbar spinal stenosis based on MRI and its relationship to the cross-sectional area of the spinal canal. This would lead to timely and effective surgical treatment and improved quality of life for these patients.

b) Attention is paid to the diagnosis of spondyloarthropathies - a heterogeneous group of immune-mediated inflammatory arthritis affecting the spine, sacro-iliac joints and peripheral joints, describing the key role of MRI in the detection of sacroiliitis in the early stages of the disease, much more -early from the x-ray examination.

c) Prof. Georgiev describes the features of the magnetic resonance image of the child's knee, considering anatomical variants, variants of distribution of red bone marrow, additional centers of ossification, irregular ossification, etc. conditions that may mimic pathology.

d) The author also discusses bone hemangiomas, specifically in the long tubular bones and tibia, describes the differential diagnosis and imaging features, as well as the role of radiation therapy in inoperable cases.

e) In addition to theoretical contributions, Prof. Georgiev contributes methodological innovations by examining 382 patients in three different centers with magnetic resonance imaging of the lumbar spine for the presence of central stenosis at all lumbar levels. The author takes an interesting comparative approach to the performance of artificial intelligence, comparing the accuracy of measurements for lumbar stenosis of a radiologist using the software with the accuracy of a radiologist not using the software and the accuracy of the artificial intelligence (AI) algorithm itself. The study showed that the radiologist using the CoLumbo software achieved the best results. The algorithm's results were lower, but still better, than radiologists who did not use the software in any published study.

f) As an applied clinical-diagnostic contribution, I consider the practical use of software applications such as CoLumbo, which leads to a reduction in the time required to read MRI, without reducing the accuracy of the final report for some pathologies and improving it in others. This prospective study consistently demonstrated the performance evaluation of the software, showing very good sensitivity, specificity, positive and negative predictive values.

COLUMBO software supports some of the most common spine pathologies: disc herniation, general disc bulging, stenosis, spondylolisthesis, hypo- and hyperlordosis. It is an auxiliary type of software whose main task is to detect pathology through the artificial intelligence integrated into it. CoLumbo evaluates this pathology and draws the radiologist's attention to them, marks the relevant tissues and measurements with different colors in the images and gives an automated report.

5. Public activity and organizational skills

Prof. Georgiev participates as organizer and co-organizer of a number of educational and scientific forums in our country with international participation: member of the scientific committee of the XVII Congress of the Bulgarian Association of Radiology September 28-30, 2017, Plovdiv; member of the organizing committee of Balkan MR - 5th Magnetic Resonance Balkan Outreach Programme, Sofia, 12-14.09.2019; chairman of the local committee of the XVIII BAR Congress, Varna, 26-28.9.2019; member of the scientific committee of the XIX Congress of the Bulgarian Association of Radiology November 3-6, 2022, Plovdiv. Assoc. Prof. Georgiev has

been elected by BAR as Chairman of the upcoming 20th Congress of BAR 2024 in Albena, which is a recognition both for his dedicated work in the organization and for his successes in research and applied science.

Prof. Georgiev is a member of the Faculty Council of the Medical Faculty of the Medical University - Varna.

Prof. Georgiev is an active member of 3 scientific medical societies: the Bulgarian Association of Radiology (BAR), the European Society of Radiology (ESR), the European Society of Neuro Radiology (ESNR).

6. Conclusion

Prof. Georgiev is an established Bulgarian specialist with great scientific potential and clinical experience. The scientific production presented by him covers the most modern imaging methods, and the new techniques introduced into medical practice prove his contribution to the development of the specialty and to raising the authority of Bulgarian medicine internationally. He enjoys authority not only among the guild of Bulgarian radiologists and interventionalists, but also among other clinical specialties.

Based on the presentation made, including a comprehensive evaluation and analysis of the candidate's activity and according to the requirements and accepted evaluation criteria of the Medical University - Varna, I find it reasonable and without hesitation to propose to the respected scientific jury to award the academic position "Professor" to Assoc. Radoslav Georgiev.

10 Feb 2024 r Varna

Prof. Dr Boyan Balev:

Заличено на основание чл. 5,
§1, б. „В“ от Регламент (ЕС)
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