



Ten years of the Regional Pulmonary Embolism Registry (REPER) and Balloon Angioplasty Pulmonary Embolism Registry (BAPER)

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The foundation of the Regional Pulmonary Embolism Registry (REPER)

Regional pulmonary embolism registry (REPER) started as a single center registry in 2011 at Military Medical Academy in Belgrade. It was founded by Professor Slobodan Obradovic and Assistant Professor Boris Dzudovic, both interventional cardiologists. The first aim of registry was to create a score for bleeding prediction in acute PE patients. When we realized that we would not be able to collect enough patients for this purpose, we asked our friends from other hospitals to participate. Institute of Pulmonary Diseases Vojvodina with Professor Jovan Matijasevic was the first to join us in 2015. University cardiology clinics from Nis, Kragujevac and Zvezdara followed, thanks to Professor Vladimir Miloradovic, Professor Sonja Salinger and Natasa Markovic-Nikolic. After that Clinical Center of Banja Luka (Professor Tamara Kovacevic-Preradovic), Clinical Center of Podgorica (Professor Nebojsa Bulatovic, then Sinisa Dragnic) and Clinical Center of Skopje (Professor Irena Mitevska) joined in and REPER became a multinational registry. One general hospital also contributes very much to REPER: the General hospital Pancevo with doctor Ana Kovacevic Kuymanovic. The last large hospital to join us was Clinical Center Zemun with Professor Aleksandar Neskovic as the principal investigator.

Today, REPER includes more than 2600 patients who were hospitalized due to acute PE. Thirty original papers and one review article were published in the medical journals on Scientific Citation Index list. Thanks to our work, Professor Slobodan Obradovic was part of the task force of the European Society of Cardiology which authored the Guidelines for Catheter Interventions in acute PE published in 2022 in *Eurointervention*¹⁵.

Eight doctoral theses were completed and four more are under way using the REPER data.

Three books with some data from the REPER were published in 2024:

Pulmonary embolism, contemporary diagnosis, risk stratification and management. Ed. by Irena Mitevska, Sonja Salinger, Marjan Bosevski, Elizabeta Srbinovska and Slobodan Obradovic, New York: NOVA Medicine & Health.

Atlas of Thromboembolic Disease of the Lungs. Editors and authors: Slobodan Obradovic, Jovan Matijasevic, Zoran Jovic, Nemanja Djenic and Boris Dzudovic, Belgrade: Odbrana.

REgional Pulmonary Embolism Registry (REPER): published papers 2013-2025. On behalf of all contributors: Slobodan Obradovic, Boris Dzudovic, 2025, Beograd.

The foundation of Balloon Angioplasty of Pulmonary Arteries Registry (BAPER)

The BAPER was started at 2016 when the first BAPA was performed in the Military Medical Academy, Belgrade, by professor Slobodan Obradovic and assistant of professor Boris Dzudovic. Since then more than 50 patients underwent to this complex procedure, and more than 230 procedures were done. More than 20 procedures were performed in the Institute of Pulmonology Vojvodina under leadership of professor Jovan Matijasevic and proctorship of professor Slobodan Obradovic. Several interventions were performed under supervision of prof Obradovic in the Clinical Center of Serbia (professors Arsen Ristic and Dejan Simeunovic, and assistant of professor Stefan Zaharijev), and in the Clinical Center Zemun (professor Aleksandar Neskovic and assistant of professor Srdjan Kafedzic). The first BPA procedures were performed in Podgorica (dr Sinisa Dragnic) and in Split (with dr Mislav Lozo) under proctorship of professor Obradovic. The Clinical Center of Banja Luka also planned the first procedures at the end of September 2025.

The majority of procedures were done in the Military Medical Academy, where in the last two years the number of BPA procedures exceeds 50 per year. The registry of balloon angioplasties in chronic thromboembolic pulmonary hypertension patients were founded, and with these procedures almost 90% of patients achieved functional improvement and significant decrease of pulmonary hypertension. The world first series of stents implantation after failed BPA procedures with long-term follow-up was published in *extenso* and it is presented in the ESC 2025 in Madrid (Obradovic S and Dzudovic B). The main principles of our work are open data for all, equality of participants, full inclusion of young investigators.

We wish to specially commend the younger doctors who worked with great dedication to input precise data into the data-base: Bojana Subotic (Military Medical Academy), Milica Miric and Marija Benic (Institute for pulmonary diseases Vojvodina), Ema Jevtić and Maja Nikolic (Clinical Center Kragujevac), Ljilja Kos (Clinical Center Banja Luka), Bjanka Božović (Clinical Center Podgorica), Tatjana Mrđen and Milos Svircev (General hospital Pancevo), Marko Lazic (General hospital Cuprija), and Bojan Mitrovic (Clinical Center Zemun).

Special thanks to Professor Sonja Salinger and Assistant Professor Bojan Mitrovic, who registered the highest number of patients.

Achievements of the REPER

Using the REPER data, we attempted to explore the most important questions about the management of acute PE:

- The association of gender, age and body mass index and PE presentation (symptoms and signs of acute PE) with respect to PE mortality risk were thoroughly investigated. The role of different biomarkers, C-reactive protein²⁷, brain-natriuretic peptide^{9,11}, cardiac troponin^{9,11}, admission glycaemia³, serum creatinine level¹⁸, antithrombin²⁵ and d-dimer³² were investigated for the prediction for early mortality of spontaneous and provoked PE, according to risk stratification in PE and in diabetics versus non-diabetics.
- ECG patterns were also investigated for the risk stratification and fast resolution of S waves in standard DI and AVL were discovered as a marker of good prognosis and improvement of right ventricle function^{14,22}.
- The relationship between PE severity, symptoms and signs of PE at presentation in respect of age, gender and body mass index⁴.
- Gender related differences in the risk stratification and management of PE^{5,10,12,28,31}.
- The results of the management of Cancer associated PE⁶.
- We also investigated timing of death according to PE risk stratification, which is very important for the strategy of reperfusion in high risk and intermediate-high risk PE patients¹⁶.
- Our data pointed out that left ventricle systolic function is an independent prognostic parameter for hospital mortality in acute PE¹³.
- The potential methods for apixaban determination, and the activity of coagulation parameters on different direct oral anticoagulants were also objects of our research².
- The very important aspect of our work was the creation of risk score for major bleeding which we called Pulmonary Embolism Bleeding Score Index (PEBSI)⁽²⁴⁾.
- The role of different thrombolytic protocols, slow systemic infusion of lower t-PA dose, catheter directed thrombolysis and classic t-PA protocols, were compared in patients with intermediate high PE patients^{1,8,23}.
- Here, we present the first series of coronary stents implanted into pulmonary arteries after failed balloon angioplasty in patients with chronic thromboembolic pulmonary disease⁷.

Published papers in alphabetic order of the journals:

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8. Jermakow MT, Obradovic S, Salinas P, Roik M, Dzudovic B, Sekulic I, Macaya F, Paredes Vazquez J, Velázquez M, Melón NMM, Nedeljkovic Dj, Matijasevic J, Łabyk A, Krakowian M, Stępniewski J, Araszkievicz A, Pruszczyk P. "Initial results of investigator initiated international database on catheter directed therapy of acute pulmonary embolism". *Cardiol J* 2024; 31(3):390-7. M22
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