

Title: **Personalized anesthesia and advanced intensive care: from pharmacokinetics to the management of the septic patient**

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Abstract

This habilitation thesis, titled "**Personalized anesthesia and advanced intensive care: from pharmacokinetics to the management of the septic patient**", synthesizes the author's scientific, professional, and educational activity, with a focus on total intravenous anesthesia (TIVA), particularly target-controlled infusion (TCI), and the management of septic patients in intensive care. Additionally, it highlights academic development by emphasizing and implementing medical simulation-based education within our university. The contributions are reflected in original research, the optimization of clinical protocols, and the modernization of specialist training in anesthesia and intensive care.

1. Development and optimization of TIVA-TCI techniques

A central aspect of my professional and scientific work is the in-depth study and optimization of TIVA and TCI, techniques that have revolutionized anesthesia administration by increasing precision and improving patient safety. My research has focused on refining administration guidelines, personalizing drug dosages based on patient-specific factors, and integrating advanced intraoperative monitoring models.

Therefore I performed a comparative analysis of pharmacokinetic models Marsh and Schnider, used in propofol infusion, to achieve more predictable administration and personalized adjustments based on individual patient characteristics and have optimized the intravenous anesthesia protocols for advanced-stage Parkinson's disease, adapting infusion parameters for optimal control.

Other aspects studied and implemented within the Clinical Department of Anesthesia and Intensive Care include depth-of-anesthesia monitoring using the bispectral index (BIS), which has helped to prevent both under-anesthesia and over-anesthesia, thereby reducing the incidence of perioperative complications. Additionally, I have studied and analyzed the impact of TIVA-TCI on postoperative recovery, demonstrating a significant reduction in adverse effects, such as postoperative nausea and vomiting (PONV), and an improvement in the quality of patient awakening, leading to a shortened recovery time.

The safety of TIVA-TCI administration in laparoscopic surgery has also been analyzed, with a focus on evaluating hemodynamic stability during surgical interventions and developing adapted strategies to minimize intraoperative risks.

These studies have improved intravenous anesthesia standards and facilitated the successful implementation of TIVA-TCI in the ICU, providing evidence-based solutions for the large-scale optimization of anesthesia protocols.

2. Intensive care and the management of septic patients

Sepsis remains one of the leading causes of mortality in intensive care, requiring a comprehensive and multidisciplinary approach. Therefore, my research has focused on early diagnosis and personalized therapy for septic patients.

One important direction was analysing the role of biomarkers for early sepsis detection – investigating parameters such as procalcitonin (PCT), C-reactive protein, angiopoietin-2 (ANG-2), and the Ang2-Tie ratio, and their correlation with patient prognosis.

I have studied sepsis and genetic mutations, focusing on the identification of biomarkers associated with the exaggerated inflammatory syndrome, with particular emphasis on the Ang-2 gene mutation and its role in the progression and severity of the disease.

During the COVID period, we encountered an atypical form of sepsis, and the establishment of the Emergency County Clinical Hospital Târgu Mureș, external COVID unit posed a major challenge. This experience provided me with the opportunity to develop advanced skills in organization and medical management, as well as to conduct an in-depth study on the evolution of patients admitted to this facility.

3. Contributions to Medical Education through simulation

In addition to scientific research, I have actively contributed to the development of medical education through simulation, recognized as an essential training method for future anesthesiologists and intensivists. My efforts have focused on developing simulation programs for residents, optimizing training curricula, and promoting young faculty members in the field of medical simulation.

Thus, I have contributed to the implementation of complex medical simulation scenarios aimed at training resident physicians in managing perioperative emergencies and critical situations specific to anesthesia. Additionally, I have been involved in training young faculty members in simulation techniques, developing mentorship programs designed to support and encourage the growth of young specialists in the field of simulation-based medical education.

I have actively participated in projects aimed at developing national and international partnerships for simulation-based training, strengthening the exchange of expertise with leading reference centers across Europe to align with the highest educational standards.

These initiatives have had a significant impact on the modernization of medical education, preparing young specialists for clinical challenges in anesthesia and intensive care while enhancing the overall quality of medical practice.

4. Future perspectives and research directions

In conclusion, I have outlined my plan for professional, scientific, and academic development, emphasizing my strong commitment to excellence in research, scientific innovation, and interdisciplinary collaboration. Through a forward-looking approach and the integration of the latest scientific advancements, I aim to make a significant contribution to the advancement of knowledge in the field of anesthesia and intensive care, as well as to the development of a dynamic and collaborative academic community.

My efforts focus on promoting multidisciplinary research, training future generations of researchers and specialists, and establishing rigorous standards in medical practice. By incorporating scientific findings into education and clinical practice, I seek to generate a lasting impact, supporting both the progress of evidence-based medicine and the modernization of the educational process.

This habilitation thesis reflects a substantial contribution to the development of safe and innovative intravenous anesthesia techniques, the advanced management of critically ill patients—particularly those with sepsis—and the promotion of modern medical education through simulation. Through these research directions and their practical implementation, I have aimed to strengthen the link between science, education, and clinical practice, with the goal of supporting the development of predictive, personalized, and integrated medicine.