

ABSTRACT

The habilitation thesis entitled **“Integrated Contributions, Vision and Progress in Contemporary Cardiovascular Surgery: From Child to Adult”** synthesizes my professional, clinical, and academic trajectory developed over more than three decades within the Institute of Emergency Cardiovascular Diseases and Transplantation in Târgu Mureș and in the university environment, with a central focus on advancing programs in advanced cardiovascular surgery, integrating technological innovation into daily practice, and consolidating a “school” capable of ensuring continuity through training and applied research. The work starts from the premise that modern cardiovascular surgery is defined by the convergence of technical excellence, quality standardization, and multidisciplinary collaboration. From this perspective, the domains that have shaped my activity-pediatric and adult congenital surgery, heart transplantation, mechanical circulatory support (LVAD), minimally invasive cardiac surgery, and experimental research-are viewed as complementary components of the same objective: improving safety, efficiency, and patient access to life-saving therapies under conditions of institutional sustainability.

The thesis aims to present, in a coherent manner, how clinical activity, the training of younger generations, and institutional development have been interconnected within a field where performance is measured through outcomes, safety, continuity, and the capacity to build teams and programs that remain functional over time. The thesis is organized into three major chapters, in accordance with the structure recommended by academic standards for such a work. Chapter I includes the general introduction, the early years of professional and teaching training, the stage following the attainment of the title of Doctor of Medicine, as well as contributions in heart transplantation, acquired and congenital cardiovascular surgery, mechanical circulatory support (LVAD), minimally invasive cardiac surgery, experimental cardiac surgery, and teaching, academic and administrative activity. Chapter II covers the plans for the development of scientific, professional, and educational activity (transplantation and LVAD, minimally invasive surgery and hybrid/interventional procedures, training of residents and students, simulators, research, and internationalization of teaching), while Chapter III includes the bibliographic references of the thesis.

Chapter I presents the professional, scientific, and academic contributions, with an emphasis on the implementation and maturation of clinically complex programs. In the field

of heart transplantation, the main focus has been the consolidation of an integrated care system, from selection and preoperative optimization to postoperative management and long-term follow-up and the development of the institutional collaboration required for a robust program. The expansion of transplantation and LVAD-type therapies is approached as a strategic necessity in a context where the need for advanced treatment exceeds current coverage capacity, and performance depends on stable protocols, dedicated teams, and functional intensive care pathways. An element discussed explicitly, with a direct impact on outcomes, is cardiac graft logistics: reducing non-surgical times and limiting ischemia through a standardized pathway and dedicated, monitored, and predictable transport, including air transport solutions when distances require it. Within this vision, increasing transplant volume is linked to greater institutional reliability, achieved through standardization and inter-institutional coordination.

In the area of mechanical circulatory support, the work reflects both the clinical dimension of managing end-stage heart failure and the integration of LVAD therapy (bridge-to-transplant, bridge-to-recovery, and selectively destination therapy), emphasizing perioperative challenges and the need for multidisciplinary expertise. Relevant contributions are highlighted, including in pediatric LVAD and in rejection surveillance through endomyocardial biopsy, illustrating the developmental trajectory toward advanced therapies and modern monitoring standards.

A defining direction of recent years, presented as an expanding program, is minimally invasive cardiac surgery, developed with the goal of reducing surgical trauma and accelerating functional recovery while maintaining safety and efficacy standards comparable to conventional surgery. The program is described as being in consolidation and includes minimally invasive surgery of the mitral valve and the aortic valve, management of cardiac tumors, correction of simple congenital defects, and endoscopic saphenous vein harvesting. These directions require dedicated infrastructure and instrumentation, with a significant budgetary impact, but with clinically and organizationally relevant medium- and long-term benefits. In parallel, the work integrates experimental research as a natural extension of clinical questions, including preclinical projects in tissue bioengineering, valves and vascular grafts, animal models, and histological/functional assessments. Both the translational value and the limitations and inherent difficulties of preclinical models are emphasized (including the issue of early thrombogenicity in certain graft configurations, alongside favorable

biological signals such as endothelialization and tissue integration in patent grafts), which supports realistic directions for optimization and further research. The teaching, academic and administrative dimension is presented as a structural axis of my career, in which clinical progress depends directly on the quality of training and on institutional structures capable of sustaining complex programs and competitive projects. The thesis summarizes postgraduate training and the professional pathway, together with leadership and academic representation roles, within the logic of coherent development of the discipline and the team.

The international dimension of the Cardiovascular Center in Târgu Mureș has represented a key pillar of its development, through collaborations with leading European centers focused on human resource training, the introduction of advanced procedures, and the increasing complexity of medical care. These partnerships have contributed decisively to strengthening the center's position as a regional and European reference in cardiovascular surgery, while also supporting the development of the future Emergency Institute for Cardiovascular Diseases.

A distinct topic, with symbolic and pragmatic value, is the initiation and materialization of the new Heart Institute in Târgu Mureș, conceived as a paradigm shift: integrating cardiac surgery (including congenital), transplantation, and interventional cardiology within a space designed to modern standards, with appropriate circuits and integrated equipment. The project has a completion deadline in 2026, with an estimated progress of around 70% and a target for completion of construction by 30 June 2026.

Chapter II presents the directions I aim to develop in the next stage, starting from real and concrete needs. At the center of these plans are the expansion of advanced heart-failure therapies and the maturation of minimally invasive and interventional programs, within an institutional framework that enables volume growth without compromising safety. The major priority is expanding heart transplantation and the LVAD program, in collaboration with the National Transplant Agency, including campaigns to raise awareness of heart transplantation. From an organizational standpoint, I will pursue full standardization of the transplant pathway, with clear responsibilities, stable protocols, and, critically, dedicated transport of the cardiac graft, so that the heart can be transported safely, rapidly, and predictably. In transplantation, system quality is as important as the operative act, and logistical efficiency translates directly into opportunities for patients. In parallel, my objective is to mature minimally invasive cardiac surgery in our center and transform it into a model that can be

expanded nationally: the aortic valve, the mitral valve, cardiac tumors, congenital defects in adults, with stepwise expansion toward combined pathologies, as well as toward surgical myocardial revascularization and where indicated toward pediatric pathology. A key element for this stage is the development of hybrid procedures and combined treatments, which will naturally require the hybrid operating room within the new Institute. In the interventional area, I aim to increase both the volume and complexity of transcatheter/endovascular procedures, integrated into Heart Team decision-making. An essential direction is training the younger generation. I intend to educate residents through courses adapted to minimally invasive and interventional procedures, emphasizing standardization and shortening the learning curve. The implementation of simulators and structured training programs in the UMF simulation center can shorten the initial stage, reduce technical variability, and increase safety. I will continue exchanges of experience and collaborations with centers in Germany, France, and Italy, facilitating transfer of techniques, proctoring, and thematic fellowships, so that experience accumulation becomes accelerated and structured.

Finally, all these directions have a concrete foundation: the new Târgu Mureș Heart Institute. I expect the new infrastructure to enable a realistic growth in procedural volume and a significant increase in efficiency, including through enhanced recovery, proper circuits, and integration between surgery and interventional procedures. The objective is for this evolution to be reflected not only in numbers but also in quality: fewer complications, a shorter perioperative pathway, and a better patient experience. A pragmatic objective stated is improving efficiency by approximately 30-40%, through workflow standardization, enhanced recovery, and optimization of perioperative resources.

In conclusion, the habilitation thesis brings together my clinical, scientific, and institutional contributions in a synthesis oriented toward continuity and building: developing advanced programs (transplant/LVAD, pediatric cardiovascular surgery), maturing minimally invasive surgery and hybrid strategies, strengthening modern teaching and applied translational research. In my view, the title of Doctor Habilitated marks the transition to a stage in which experience and knowledge must be projected toward future generations through a “school” model supported by infrastructure, predictable training, a culture of quality and real capacity for institutional progress.