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DETERMINING QUALITY OF LIFE IN PATIENTS WITH VALVULAR HEART DISEASE TREATED MINIMALLY INVASIVE VERSUS MEDIAN STERNOTOMY

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INTRODUCTION

Valvular heart disease continues to represent one of the most important challenges of contemporary cardiology and cardiac surgery. With the increase in life expectancy and the accentuated phenomenon of demographic ageing, the clinical burden of these conditions has grown considerably over recent decades [1, 2]. The lesional spectrum covers isolated or combined involvement of the four cardiac valves, with a generally slow evolution but whose final outcome, in the absence of intervention, is the alteration of intracardiac haemodynamics and the progressive worsening of the clinical picture.

Surgical intervention, either through repair or valve replacement, continues to represent the gold standard for patients with severe valvular lesions when medical treatment can no longer ensure adequate symptom control or disease stabilization [3]. Traditionally, these procedures are performed through median sternotomy, which provides excellent exposure and a high degree of operative safety, but is associated with significant surgical trauma, postoperative pain and delayed functional recovery [4].

Over the last three decades, technological evolution in cardiac surgery has enabled the establishment of less invasive approaches for valvular heart disease, generically grouped under the acronym MIVS (minimally invasive valve surgery). This umbrella encompasses techniques such as right anterior mini-thoracotomy, upper partial sternotomy or, more recently, robotically assisted interventions — variants which each, in their own way, aim to reduce surgical trauma without compromising the functional outcome or safety margin [5, 6]. Data accumulated to date indicate, compared to classic median sternotomy, lower intraoperative blood loss, shorter hospital stay, faster return to usual activities and a perceived superior cosmetic result [7].

The extent to which these short-term advantages translate into a real and durable improvement in quality of life remains an open question in the literature. In contemporary cardiac surgery, quality of life has gradually established itself as an evaluation benchmark of its own weight, exceeding the classical framework of mortality and morbidity indicators and bringing to the foreground the way in which the patient himself perceives his physical state, emotional balance and capacity for social integration [11, 12].

The discussion concerning these techniques, when restricted to the classical morbi-mortality indicators, frequently arrives at a reassuring conclusion: perioperative results are

comparable, major complications have similar incidences, and the duration of cardiopulmonary bypass is similar in experienced hands. This is good news from a safety perspective and is sufficient, in many contexts, to justify the adoption of a new technique. However, for this very reason, the question relevant to the patient is no longer whether he will survive the intervention, but rather what state he will be in six months later, in a year, in five years. Will he be able to return to work? Will he be able to go shopping or visit his grandchildren without difficulty? Will he sleep at night without parietal pain? Will he feel, in time, that the intervention was the right decision?

These questions, by their nature, escape classical measurement instruments. They belong to the domain of health-related quality of life, a conceptual construct that has gradually gained ground in cardiology and cardiovascular surgery. Quality of life does not substitute for mortality or complication indicators; it complements them. It offers a glimpse from inside the patient's experience of a medical journey that, until recently, we evaluated almost exclusively from the outside. Standardized instruments, internationally validated and, for some of them, culturally adapted to the population of Romania, allow the transformation of this subjective experience into a reproducible score, comparable between groups and between centres.

The comparative literature regarding the impact of the surgical approach on quality of life is in continuous accumulation but remains, in many respects, heterogeneous. Some studies suggest an advantage of minimally invasive techniques in the first months postoperatively, especially on the physical component of recovery and on patient-reported satisfaction [4, 7]. Other studies do not identify significant differences at distance, suggesting that, after the initial adaptation period, scores tend to homogenize. The causes of this heterogeneity are multiple: different selection criteria between cohorts, non-uniform assessment instruments, diverse evaluation moments, varying sample sizes, demographic and cultural profiles specific to each region. In the medical landscape of Romania, research dedicated explicitly to this subject, starting from the Romanian patient and from the local clinical reality, is still scarce.

The present work emerged at the meeting point of these observations and aims to add to the international conversation a perspective anchored in the practice of a Romanian cardiovascular centre. The central subject is the quality of life in patients operated for valvular pathology, approached through validated instruments and, where possible, adapted to the population of Romania. The hypothesis from which this research starts is not that one

technique is, in itself, superior to another, but that the real result of a valvular intervention cannot be measured without the patient's words.

This summary synthesizes the structure of the thesis in two complementary components: a general part, dedicated to the current state of knowledge, anatomy, physiology, epidemiology, diagnosis and surgical treatment of valvular heart disease, and a special part with personal contributions, organized around two studies conducted at SANADOR Clinical Hospital, between January 2024 and October 2025: a retrospective study on 200 patients, which compared procedural safety and early clinical outcomes between median sternotomy, right mini-thoracotomy and transcatheter approaches, and a prospective study on 170 patients with valid response, in which quality of life was assessed using the EQ-5D-5L questionnaire with the population value set validated for Romania.

CURRENT STATE OF KNOWLEDGE

Despite substantial therapeutic progress in recent decades, valvular heart disease continues to represent a considerable clinical burden for healthcare systems, especially against the background of increased life expectancy and demographic ageing [1]. Over the last three decades, technological evolution in cardiac surgery has enabled the establishment of less invasive approaches for valvular heart disease. Data accumulated to date indicate, compared to classic median sternotomy, lower intraoperative blood loss, shorter hospital stay, faster return to usual activities and a perceived superior cosmetic result [4, 6, 7].

Quality of life as a therapeutic objective in valvular surgery

Over the last two decades, the evaluation of cardiovascular surgery outcomes has surpassed the narrow framework of classical indicators. Operative mortality, 30-day mortality, long-term survival and major morbidity rates remain essential criteria but have been progressively complemented with patient-centred parameters capable of capturing the subjective dimensions of therapeutic benefit [42]. This paradigm shift reflects the maturation of the field: in high-volume centres, mortality after isolated aortic valve replacement has reached values below the 2% threshold [34], and degenerative mitral valve repair achieves technical success rates of over 95%, with a value of 96% recently reported in the multicentre randomized UK Mini Mitral trial, both for the mini-thoracotomy approach and for sternotomy [4]. Under these conditions, the margin of real clinical progress shifts from the area of immediate survival towards the area of functional recovery and quality of life over the medium and long term.

Health-related quality of life (HRQoL) is a multidimensional, profoundly subjective concept which cannot be evaluated from outside but only through direct patient reporting. Its components cover physical functioning, emotional state, social integration, residual symptomatology, sleep quality, personal autonomy and the capacity to resume daily and occupational activities prior to illness. The quantification of these dimensions is performed exclusively through standardized, psychometrically validated questionnaires that transform a subjective experience into a reproducible and comparable score across patients and populations [12].

The importance of HRQoL evaluation in valvular surgery derives from at least three practical arguments. First, in the era of minimally invasive approaches, the differences between competing surgical techniques no longer manifest at the level of perioperative mortality, where outcomes tend to be comparable, but at the level of functional recovery and quality of life at distance; patients operated through a minimally invasive approach show a higher level of spontaneous physical activity and improved HRQoL scores compared to those treated through sternotomy [23]. Second, in the elderly patient and in the frail patient, the benefit of the intervention is not limited to the years gained but is better expressed by the Quality-Adjusted Life Years (QALY) indicator [4]. Third, in comparisons with percutaneous strategies, quality of life parameters have acquired increasing regulatory significance, becoming formal criteria for non-inferiority or superiority comparison.

Instruments used to assess quality of life

Instruments for assessing HRQoL in the valvular surgical patient are grouped, by international consensus, into three categories: generic questionnaires, cardiac disease-specific questionnaires and valvular disease-specific questionnaires [12]. The three categories provide complementary information, which is why contemporary studies most often combine a generic instrument with a disease-specific one, as was done in the UK Mini Mitral trial, in which the Short Form Health Survey was used as the primary instrument and the Euro Quality of Life Questionnaire with five dimensions and 5 levels (EQ-5D-5L) as the secondary instrument [4].

Generic questionnaires evaluate HRQoL without reference to a specific condition and allow comparisons between populations with different pathologies, related to population normative values. The most widely used generic instrument in cardiac surgery is the Short Form Health Survey (SF-36), developed within the Medical Outcomes Study, alongside its reduced variant SF-12. SF-36 evaluates eight domains (physical functioning, role limitations due to physical health, bodily pain, general health, vitality, social functioning, role limitations due to emotional problems and mental health), which are synthesized into two summary scores, Physical Component Summary and Mental Component Summary, with standardized population mean values. At the European level, the equivalent place is occupied by the EQ-5D questionnaire, whose particularity lies in transforming patient responses into a single utility value, situated on an interval ranging from the complete absence of perceived health to the theoretical optimal state, opening the way to the

quantification of quality-adjusted life years (QALY) and to the integration of results into pharmacoeconomic cost-utility analyses [29, 30].

Cardiac disease-specific questionnaires capture with greater sensitivity the subtle clinical variations following correction of the valvular lesion. Applied to patients who have benefited from cardiac valve surgery, the Minnesota Living with Heart Failure (MLHFQ) questionnaire has demonstrated its psychometric qualities in several directions: it provided reproducible scores between its items, correlated closely with results obtained through SF-36 and proved capable of detecting changes occurring in the patient's condition after surgery. The Kansas City Cardiomyopathy Questionnaire (KCCQ) is the reference instrument for patients with heart failure and valvular heart disease, being preferentially used in pivotal trials that have compared transcatheter aortic valve implantation (TAVI) with surgical aortic valve replacement [38].

Valve-specific questionnaires represent the most recent category, still insufficiently methodologically mature. The emergence of the Toronto Aortic Stenosis Quality of Life (TASQ) questionnaire is closely linked to the rapid expansion of transcatheter aortic valve replacement procedures, which imposed the need for an instrument capable of capturing the symptom picture specific to this pathology — syncope, anginal episodes, exertional dyspnoea — but also the patient's recovery trajectory in the weeks following the intervention [12].

The pivotal trial and current methodological paradigm

The multicentre randomized UK Mini Mitral trial is today the methodological benchmark for assessing quality of life in minimally invasive valvular surgery [4]. A total of 330 patients (mean age 67 years, 30% women) from 10 British centres with established minimally invasive mitral surgery programmes were randomized, with the primary objective being the change in the SF-36v2 score in the physical functioning domain at 12 weeks postoperatively. At this moment, the scores were similar between groups (mini-thoracotomy 43.12 ± 10.13 versus sternotomy 41.75 ± 10.68; $p = 0.61$), but functional recovery was faster in the mini-thoracotomy group during the first 6 weeks postoperatively and the duration of hospitalization was significantly shorter (median 5 versus 6 days). Echocardiographic results at 12 months confirmed the procedural efficacy of both approaches, with mitral regurgitation absent or mild in 92% of patients in each group.

The importance of this trial exceeds the numerical values reported. Its design established a methodological standard for contemporary research in valvular surgery through the integration of objective measurements with classical questionnaires. Specifically, triaxial accelerometry worn on the non-dominant wrist for 7 days, at preoperative timepoints and at 6, 12, 18, 24, 38 and 52 weeks postoperatively, was combined with SF-36v2 as the primary instrument and EQ-5D as the secondary instrument for cost-utility analysis. This hybrid approach, in which the patient's subjective perception is correlated with continuously quantifiable behavioural indicators, is today recognized as the gold standard of research in the field.

Quality of life after aortic valve replacement

Aortic Valve Replacement (AVR) is the cardiac procedure with the richest comparative literature on postoperative quality of life, a fact explained by the high prevalence of degenerative aortic stenosis in the elderly population. Preoperatively, patients with severe symptomatic aortic stenosis have markedly reduced SF-36 scores in the domains of physical function, vitality and general health, as a result of exertional dyspnoea, syncope and angina. Postoperatively, improvements are rapid and ample, frequently reaching age-adjusted population normative values. The current question is therefore no longer whether AVR improves HRQoL, but rather which surgical approach optimizes this improvement. Perioperative mortality does not differ significantly between minimally invasive approaches and full sternotomy, but quality of life and patient satisfaction clearly favour minimally invasive approaches [34].

Upper mini-sternotomy is associated with accelerated functional recovery and superior HRQoL scores compared to full sternotomy, with important practical implications for the extension of this technique including in centres with limited resources [28]. Right anterior mini-thoracotomy, known in the international literature under the acronym RAMT (Right Anterior Mini-Thoracotomy), is the most studied minimally invasive alternative in recent years for AVR. Its benefits regarding perioperative morbidity, hospitalization duration and early postoperative HRQoL, without compromising procedural safety, are confirmed through propensity score-matched meta-analyses [6]. A recent meta-analysis on this topic converges on the conclusion that, regardless of which of the two minimally invasive variants is chosen, the gain obtained by the patient in terms of functional recovery and health-related quality of life lies at practically similar values [34].

Quality of life after mitral valve surgery

Unlike aortic stenosis, in which preoperative HRQoL is uniformly compromised, degenerative mitral valve disease frequently affects relatively young patients (mean age 67 years in the UK Mini Mitral trial), with relatively preserved preoperative HRQoL [4]. This makes it difficult to demonstrate spectacular improvements at the level of summary scores postoperatively and transforms the sensitivity of instruments and the timing of measurements into critical determinants of published results.

Mitral valve repair is today the therapeutic standard in degenerative pathology, additionally offering the advantage of preserving the native subvalvular apparatus, with haemodynamic and functional benefits demonstrated over the long term. In the long run, survival and freedom from reintervention are comparable between sternal-sparing approaches and median sternotomy for mitral repair, while HRQoL slightly favours the minimally invasive approach at all follow-up moments [33]. A particular place is occupied, especially in female patients, by the periareolar approach performed under video assistance, in which the incision path follows the pigmented edge of the areola, making the final scar practically imperceptible [35].

Quality of life after tricuspid valve surgery

Tricuspid valve surgery has long been considered the "forgotten valve" of cardiac surgery, due to historically less favourable results and unfavourable preoperative prognosis of patients, frequently associated with advanced right heart failure, ascites and cachexia [85]. In recent years, the development of minimally invasive approaches has enabled the reconsideration of this pathology and the consolidation of a body of evidence regarding the impact of the intervention on quality of life. Repair and isolated replacement of the tricuspid valve through right mini-thoracotomy produce significant improvements in functional class and in postoperative HRQoL. In high-risk patients, transcatheter tricuspid replacement and surgery through mini-thoracotomy both produce significant improvements in functional class and quality of life, thus opening a broader therapeutic palette [88].

Methodological limitations and research directions

The synthesis of data available in the recent literature outlines a stable consensus: minimally invasive valvular surgery, in experienced hands and in adequately selected patients, offers substantial benefits on postoperative quality of life, without compromising procedural safety or the durability of long-term results [4, 6, 33, 34]. The advantages of this approach emerge most strongly during the days and weeks immediately following the operation, the interval in which the contrast between the two groups becomes clearest in terms of chest wall morbidity, the intensity of pain experienced by the patient and the speed with which he manages to get out of bed and resume movement [4, 23].

The results currently available come, however, with several methodological limitations that deserve to be flagged for a balanced critical reading. The diversity of instruments used to measure quality of life represents a first obstacle, as it makes both the conduct of truly unitary meta-analyses and direct comparisons between works difficult [12]. To these is added the impossibility of applying a blinded design, which is otherwise inevitable in any intervention that leaves a visible scar on the patient's skin. Promising research directions in this field include the integration of objective digital measurements (accelerometry and continuous monitoring through wearable devices) alongside classical questionnaires, the development of valve-specific instruments rigorously validated psychometrically, the correlation of HRQoL with serum biomarkers (NT-proBNP, high-sensitivity troponin) and with advanced echocardiographic parameters [4].

GENERAL PART – SYNTHESIS

1. General considerations on valvular heart disease

Valvular heart disease represents a broad category of structural and functional conditions affecting the four cardiac valves — mitral, aortic, tricuspid and pulmonary. Valvular dysfunction manifests through two fundamental mechanisms: stenosis, defined by narrowing of the valvular orifice and obstruction of blood flow, and insufficiency (regurgitation), characterized by incomplete leaflet closure and reflux of blood into the upstream cardiac cavity. Frequently, both types of lesion coexist on the same valve, configuring the clinical picture of mixed valvular disease [2].

The aetiology of valvular heart disease has undergone a significant transformation in recent decades, in parallel with the modification of the population's epidemiological profile. While rheumatic conditions, dominant in the 20th century, have gradually lost their share in developed countries, degenerative pathology has become the most frequently encountered form, in close connection with increased life expectancy [2, 36]. Calcified aortic stenosis represents today the prototype of degenerative valvular disease, with a prevalence that increases exponentially after the age of 65 and a complex pathogenic mechanism involving chronic inflammation, calcium deposition and remodelling of the extracellular matrix. In turn, degenerative mitral regurgitation, through leaflet prolapse or chordal rupture, occupies the second place in frequency in valvular pathology of the adult [4].

Congenital valvular conditions, although much rarer, have acquired increasing clinical importance as a result of the growing number of patients surviving to adulthood. Infective endocarditis, in turn, remains an important cause of valvular disease in the young population, especially in persons with risk factors such as intravenous drug use, presence of valvular prostheses or immunosuppression [76].

2. Epidemiology and risk factors

Population echocardiographic screening studies suggest that significant valvular heart disease affects approximately 2.5% of the adult population, with a prevalence that increases dramatically with age — over 13% in persons over 75 years of age [9]. The

OxVALVE study, conducted in the United Kingdom, confirmed that an important proportion of moderate or severe valvular conditions remain undiagnosed, underlining the need for systematic strategies for early detection [9].

The distribution by sex shows certain important particularities: degenerative aortic stenosis predominantly affects men, while degenerative mitral regurgitation and especially mitral valve prolapse have a higher prevalence in women [4]. Cardiovascular and metabolic comorbidities, especially arterial hypertension, diabetes mellitus, dyslipidaemia and chronic kidney disease, accelerate the progression of degenerative valvular conditions and worsen the postoperative prognosis [10].

The main risk factors for degenerative valvular disease largely overlap with the classic risk factors of atherosclerosis: advanced age, smoking, hypertension, dyslipidaemia, diabetes mellitus. Congenital valvular anomalies, particularly aortic bicuspidy, predispose to early aortic stenosis, frequently diagnosed a decade before typical tricuspid aortic stenosis [36]. For rheumatic valvular disease, the determining factor is untreated streptococcal pharyngitis in childhood, followed by acute rheumatic fever; although this aetiological form is rare in Western Europe, it continues to represent a major cause of valvular disease in Eastern Europe and in low- and middle-income countries.

3. Diagnosis of valvular heart disease

The clinical picture of valvular heart disease is dominated by symptoms reflecting the haemodynamic imbalance produced by the valvular lesion. Exertional dyspnoea, fatigability, syncope, angina pectoris and peripheral oedema are most frequently reported, but their specificity is limited, especially in the early stages [36]. Severe symptomatic aortic stenosis is clinically expressed by the classic triad of dyspnoea, syncope, angina, each component signalling a turning point in the natural history of the disease.

Transthoracic echocardiography represents the first-line investigation in the diagnosis of valvular heart disease, providing quantitative and qualitative information regarding anatomy, lesion severity and haemodynamic consequences [40, 41]. Transoesophageal echocardiography completes the picture in cases with suboptimal transthoracic acoustic windows, in complex mitral pathology and in infective endocarditis, providing superior anatomical resolution. Advanced imaging through cardiac computed

tomography and cardiac magnetic resonance has gained an important role in the preoperative evaluation of candidates for transcatheter interventions and minimally invasive approaches.

Integrated preoperative evaluation includes classical operative risk scores, such as EuroSCORE II and STS Score, evaluation of clinical and anatomical-procedural frailty, alongside integrated decision-making within the multidisciplinary Heart Team [40, 41]. This collaborative approach, supported by current guidelines of the European Society of Cardiology and the European Association for Cardio-Thoracic Surgery [40], as well as those of the American College of Cardiology [41], ensures an individualized selection of the therapeutic strategy.

4. Surgical treatment of valvular heart disease

Classic median sternotomy has represented, for over six decades, the reference approach for open-heart cardiac surgery, providing excellent exposure of all cardiac structures and allowing the performance of a wide range of procedures, including complex multivalvular interventions. Its main advantages are familiarity for any cardiac surgeon, optimal exposure, rapid access for managing intraoperative complications and the possibility of simultaneously performing concomitant procedures. The limitations are, however, primarily related to parietal trauma — significant postoperative pain, risk of sternal dehiscence or deep infection, delayed functional recovery and cosmetic impact [4].

Minimally invasive cardiac surgery emerged as a response to these limitations and has undergone accelerated development over the last three decades. Under the umbrella of MIVS fall several technical variants: right anterior mini-thoracotomy (RAMT), used predominantly for the mitral valve and, more recently, for the aortic valve; upper partial mini-sternotomy, indicated primarily for AVR; the transaxillary approach, preferred by young patients for the excellent cosmetic result; and video-assisted or robotic approaches [6, 35]. All these variants share the fundamental principle of reducing parietal trauma without compromising the functional outcome.

Equipment and technologies used in minimally invasive surgery include peripheral cannulation for cardiopulmonary bypass, long-handled instruments adapted to the restricted operative field, atrial retraction systems and video systems for illumination and magnification. The learning curve is significant, and outcomes are closely dependent on institutional volume and team experience. Data consolidated through meta-analyses support

that, in experienced hands, right mini-thoracotomy provides comparable results to sternotomy in terms of mortality, major complications and durability of long-term results, with clear advantages regarding blood loss, hospitalization duration and early functional recovery [6, 33, 34].

In parallel with the evolution of minimally invasive surgery, transcatheter interventions — TAVI, MitraClip, TriClip, Pascal — have profoundly reconfigured the therapeutic landscape of valvular heart disease over the last decade. Initially reserved for patients with extreme or prohibitive operative risk, indications have progressively expanded to high- and intermediate-risk patients and, at least for TAVI in aortic pathology, to low-risk patients [37]. This expansion has been supported by randomized trials that have demonstrated non-inferiority and, for certain subgroups, superiority of transcatheter interventions compared to classic surgery.

SPECIAL PART – PERSONAL CONTRIBUTIONS

Chapter 7. Retrospective study: Comparative analysis of patients operated minimally invasively vs. through median sternotomy

7.1. Introduction and objectives

The current spectrum of therapeutic strategies in valvular heart disease comprises three main directions applied differentially according to the clinical, anatomical and risk profile of each patient: classical median sternotomy, minimally invasive approaches through right mini-thoracotomy and transcatheter interventions [40, 41]. Under the conditions in which all these options have been validated through randomized trials and meta-analyses, the concrete choice for each case represents an individualized decision, taken within the multidisciplinary Heart Team.

The retrospective study presented in this chapter aimed to comparatively analyse the preoperative profile, intraoperative parameters and early clinical outcomes of a consecutive cohort of 200 patients treated for valvular heart disease through the three contemporary strategies, in a single cardiovascular centre in Romania, between January 2024 and October 2025. The specific objectives were the characterization of the demographic and clinical profile of patients allocated to each strategy, the evaluation of procedural safety through 30-day mortality and the incidence of major complications, and the analysis of procedural parameters — aortic clamp time, duration of cardiopulmonary bypass and length of hospital stay.

7.2. Material and methods

Patients consecutively operated for valvular heart disease between January 2024 and October 2025 were included in the study, regardless of the type of valvular pathology or the therapeutic strategy applied. The inclusion criteria were: age over 18 years, indication of invasive treatment for valvular heart disease established by the Heart Team according to current guidelines [40, 41], and signed informed consent. Patients with urgent valvular interventions or with incomplete data in the institutional database were excluded.

Patients were stratified into three groups: classical median sternotomy, minimally invasive right mini-thoracotomy and transcatheter valvular interventions (TAVI, MitraClip,

TriClip, Pascal). Preoperative data included demographic profile, cardiovascular and metabolic comorbidities, EuroSCORE II score and NYHA functional class. Intraoperative data included, for patients with cardiopulmonary bypass, aortic clamp time and CPB duration. Postoperative data included length of hospital stay, 30-day mortality and the incidence of major complications (stroke, myocardial infarction, acute renal failure requiring dialysis, major haemorrhagic complications, deep infection).

Statistical analysis was performed with dedicated packages (R and SPSS). Continuous variables were described by mean and standard deviation for normal distributions, respectively by median and interquartile range for asymmetric distributions, compared through the Kruskal-Wallis test. Categorical variables were compared through Chi-square test or Fisher exact test, as appropriate. The threshold of statistical significance was set at $p < 0.05$.

7.3. Results

The final cohort comprised 200 patients, distributed as follows: 103 patients (51.5%) were treated through classical median sternotomy, 43 patients (21.5%) through minimally invasive right mini-thoracotomy, and 54 patients (27.0%) through transcatheter valvular interventions (TAVI, MitraClip, TriClip, Pascal).

Figura 1. Distribuția pacienților în funcție de strategia de tratament (n = 200)

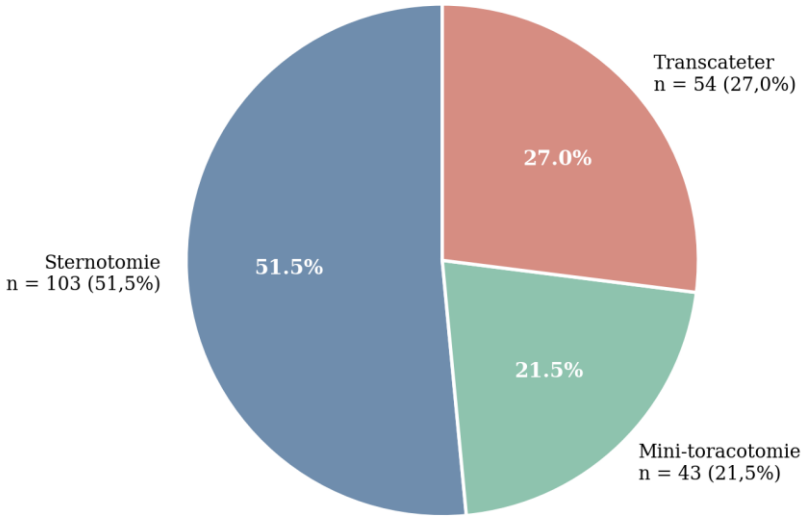


Figure 1. Distribution of patients by treatment strategy (n = 200). Source: own processing.

The three groups presented significant differences both at the level of demographic profile and at the level of the initial clinical picture, in line with expectations for modern clinical selection. Patients who benefited from transcatheter interventions presented a significantly higher mean age, of 74.8 ± 8.2 years, compared to those treated through median sternotomy (62.2 ± 14.3 years) or through mini-thoracotomy (61.5 ± 13.5 years), the difference reaching high statistical significance ($p < 0.001$). This finding mirrors the current orientation of clinical practice towards the preferential use of transcatheter approaches in elderly patients with increased operative risk.

Figura 2. Distribuția vârstei pe grupuri terapeutice

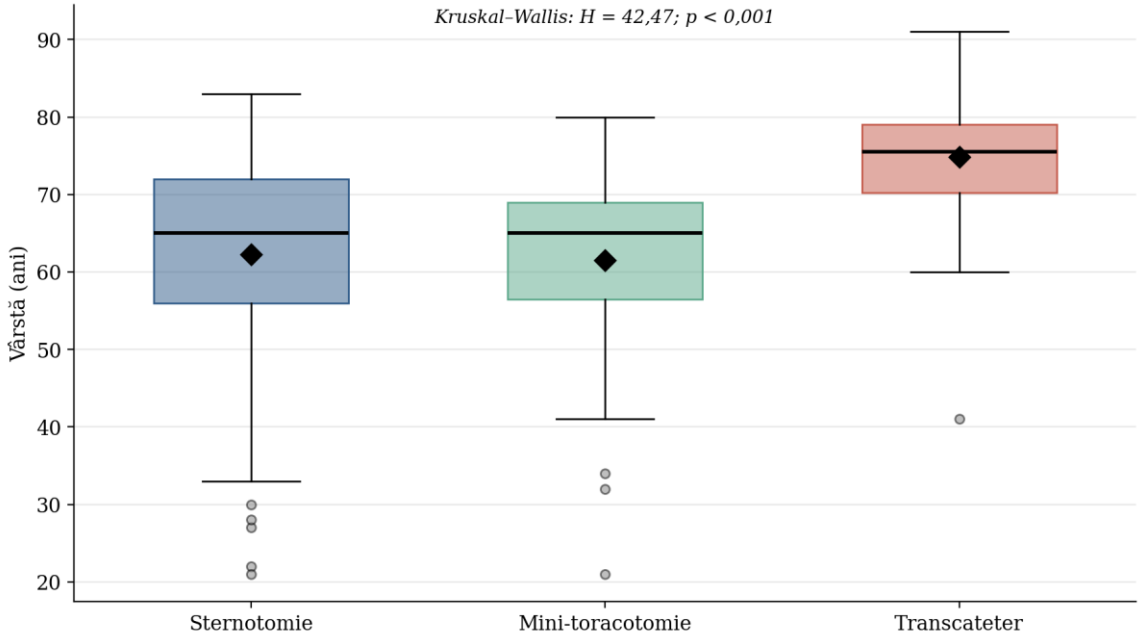


Figure 2. Age distribution by therapeutic groups. Source: own processing.

The distribution by sex was balanced between groups (33.0% women in sternotomy, 32.6% in mini-thoracotomy and 40.7% in transcatheter; $p = 0.584$). The body mass index had comparable values between the three groups (mean 27.0–27.3 kg/m²; $p = 0.984$).

Cardiovascular and metabolic comorbidities recorded high values in the entire cohort, with some significant differences between groups. Arterial hypertension was present in 95.5% of patients, without significant differences between groups ($p = 0.149$). Diabetes mellitus was significantly more frequent in the transcatheter group (53.7%) compared to sternotomy (24.3%) and mini-thoracotomy (16.3%) ($p < 0.001$), reflecting the older profile and increased comorbidities of these patients. Cerebrovascular disease was also more frequent in the transcatheter group (22.2%; $p = 0.012$). Peripheral artery disease was more

frequent in patients operated through sternotomy (17.5%; p = 0.024), an aspect that may be explained by the higher proportion of complex cardiovascular pathologies in this group.

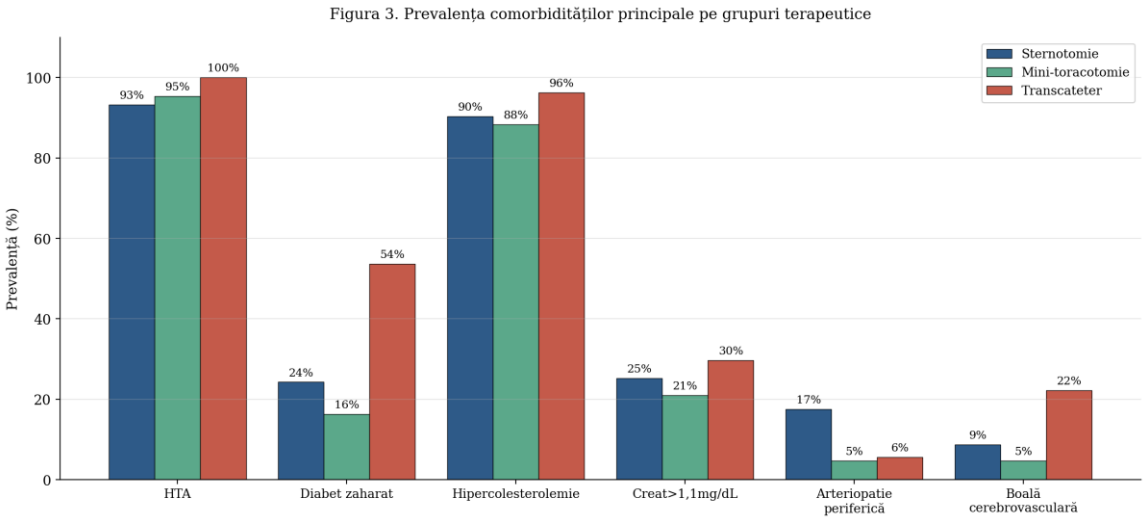


Figure 3. Prevalence of main comorbidities by therapeutic groups. Source: own processing.

Variable	Sternotomy (n=103)	Mini-thoracotomy (n=43)	Transcatheter (n=54)	p-value
Age (years), mean ± SD	62.2 ± 14.3	61.5 ± 13.5	74.8 ± 8.2	< 0.001
Female sex, n (%)	34 (33.0%)	14 (32.6%)	22 (40.7%)	0.584
BMI (kg/m²), mean	27.0	27.3	27.1	0.984
Hypertension, n (%)	96 (93.2%)	41 (95.3%)	54 (100.0%)	0.149
Diabetes mellitus, n (%)	25 (24.3%)	7 (16.3%)	29 (53.7%)	< 0.001
Hypercholesterolaemia, n (%)	93 (90,3%)	38 (88,4%)	52 (96,3%)	0.312
Chronic kidney disease, n (%)	26 (25,2%)	9 (20,9%)	16 (29,6%)	0.618
Peripheral artery disease, n (%)	18 (17.5%)	2 (4.7%)	3 (5.6%)	0.024
Cerebrovascular disease, n (%)	9 (8.7%)	2 (4.7%)	12 (22.2%)	0.012

Table 1. Baseline demographic and clinical characteristics of the three therapeutic groups. Source: own processing.

The EuroSCORE II score was significantly different between groups, with superior values in the transcatheter group, conforming to the clinical selection for this strategy of patients with increased operative risk. The distribution of valvular pathology types

confirmed the well-established specialization of each strategy: TAVI held a dominant position for aortic pathology (94.4% of transcatheter interventions), mini-thoracotomy emerged as the standard approach for the mitral valve (83.7% of mini-thoracotomy cases), and sternotomy retained its central role for complex or multivalvular cases.

Despite these major baseline differences, early clinical outcomes were comparable between the three groups. The 30-day mortality was low across the entire cohort (1.5% overall), with comparable values between groups: 1.0% for sternotomy, 0.0% for mini-thoracotomy and 3.7% for transcatheter. The cumulative incidence of postprocedural complications was also similar (12.6% for sternotomy, 9.3% for mini-thoracotomy and 9.3% for transcatheter; $p = 0.756$). The need for permanent pacemaker implantation was recorded in 2.9% in the sternotomy group and 3.7% in the transcatheter group, the value for TAVI patients placing itself below the threshold classically reported in the literature (5–15%).

Intraoperative parameters in patients with cardiopulmonary bypass — aortic clamp time and CPB duration — were comparable between sternotomy and mini-thoracotomy, confirming that, in experienced hands, the minimally invasive approach does not significantly prolong operative duration [6]. Hospital length of stay was significantly shorter for transcatheter patients, in line with expectations for a less invasive procedure.

7.4. Discussion

The results of the retrospective study confirm the procedural safety of each contemporary strategy when applied to the corresponding population through the multidisciplinary decision of the Heart Team. The reduced mortality across the entire cohort and the similar incidence of complications between groups, despite major baseline profile differences, are consistent with data from randomized trials and recent observational studies [4, 6, 33, 34].

The distribution of pathologies by strategy reflects the current paradigm of integrated valvular care, in which surgical and transcatheter strategies function in a complementary manner, each addressing well-defined segments of the clinical spectrum [40, 41]. TAVI has become the standard of treatment for elderly patients with severe aortic stenosis, mini-thoracotomy has emerged for degenerative mitral pathology, and sternotomy has retained its role in complex or multivalvular cases.

The intrinsic limitations of the retrospective, single-centre design, with modest sample size and exclusively in-hospital follow-up, are well known. The retrospective and single-centre nature restricts the degree of generalization of results. The relatively modest sample size, with unequal distribution between groups, limits statistical power for detecting differences in rare events. The capacity to isolate the independent effect of the procedural strategy is also limited by the absence of advanced statistical adjustment methods such as propensity scores. These limitations are partially compensated through analysis in a single centre, which reduces operator- and protocol-related variability [34].

The follow-up limited to the in-hospital period and to 30 days does not allow evaluation of late evolution, durability of interventions or impact on quality of life. These essential dimensions are addressed in the subsequent prospective study, presented in the next chapter.

7.5. Conclusions

In the cohort of 200 patients studied, the three contemporary strategies (median sternotomy, right mini-thoracotomy and transcatheter approaches) were applied to populations significantly different in demographic profile, comorbidities and clinical severity, according to current recommendations of the institutional Heart Team. Despite these major baseline differences, early clinical outcomes were comparable between the three groups, a fact which confirms the procedural safety of each strategy when applied to the corresponding population [40, 41].

The optimal selection of the therapeutic strategy depends on an individualized, multidisciplinary, integrated evaluation, and the results of the study support that, under conditions of adequate experience and correct patient selection, each of the three strategies can offer acceptable early clinical outcomes. Future research, multicentre and with long-term follow-up, is needed to define more precisely the role of each strategy and to optimize decisional algorithms in the context of personalized medicine.

Chapter 8. Prospective study: Postoperative quality of life assessment

8.1. Introduction and objectives

The retrospective data presented earlier allowed the outlining of a detailed profile of valvular patients approached through the three therapeutic strategies, capturing preoperative

characteristics, intraoperative parameters and the in-hospital course. The analysis highlighted comparable procedural safety, with perioperative mortality and major complication rates standing at low values, without statistically significant differences between the three approaches [4, 14, 34].

It must be emphasized, however, that the cardinal parameters recorded during hospitalization reflect only one facet of the real benefit brought by valvular intervention. The true measure of therapeutic success exceeds perioperative survival and extends to the way in which the patient regains autonomy, exercise tolerance and general state in the weeks and months following discharge [11, 16, 17]. This patient-centred angle of approach has reshaped, over the last two decades, the way in which contemporary valvular surgery is evaluated [42].

The prospective study presented in this chapter aimed to evaluate health-related quality of life (HRQoL) in patients operated for valvular heart disease through the three contemporary strategies (median sternotomy, right mini-thoracotomy and transcatheter approaches), using the EQ-5D-5L questionnaire with the population value set validated for Romania [29, 30]. The specific objectives were: descriptive characterization of postoperative quality of life at the level of the global cohort; comparison of EQ-5D Index and EQ-VAS scores between the three therapeutic groups; identification of independent predictors of quality of life through multivariate analysis; and characterization of the recovery trajectory of quality of life over the first 12-18 months postoperatively.

8.2. Material and methods

Patients from the retrospective cohort (n = 200) who were alive at the moment of the prospective evaluation and who were contacted for the application of the EQ-5D-5L questionnaire in the version validated for the Romanian language were included [29, 30]. The evaluation was carried out either at the routine postoperative follow-up consultation or through telephone contact, depending on patient availability.

The EQ-5D-5L questionnaire is a generic instrument for assessing HRQoL that comprises five dimensions — mobility, self-care, usual activities, pain/discomfort and anxiety/depression — each evaluated on a 5-level severity scale (1 = no problems, 5 = extreme problems). Responses were transformed into a single utility score (EQ-5D Index) using the population value set validated for Romania by Olariu and colleagues [30]. The

visual analogue scale EQ-VAS, which expresses the global self-assessment of health status on a scale from 0 to 100, was evaluated in parallel.

Statistical analysis included descriptive statistics (mean, standard deviation, median, interquartile range), univariate comparisons through Kruskal-Wallis test for continuous variables and Chi-square test for categorical variables, Spearman correlation analysis, and multivariate analysis through multiple linear regression with predictors: therapeutic group, age, sex, EuroSCORE II score, preoperative NYHA functional class, postoperative interval (in months) and type of valvular pathology. Categorical variables with more than two levels were dummy-coded. Multicollinearity was evaluated through VIF, with values between 1.10 and 1.25, below the critical threshold of 5.

8.3. Results

Of the 200 patients included in the retrospective cohort, 197 were alive at the moment of the prospective evaluation. Of these, 170 responded to the EQ-5D-5L questionnaire (87 sternotomy, 36 mini-thoracotomy, 47 transcatheter), for an overall response rate of 86.3% — a value that exceeds the conventional threshold accepted in the specialized literature. The distribution of refusals between groups did not reveal significant differences ($p = 0.545$).

Group	Alive	Refusal	Eligible	Valid response	Loss	Response rate
Sternotomy	103	1	102	87	15	85.3%
Mini-thoracotomy	43	0	43	36	7	83.7%
Transcatheter	54	2	52	47	5	90.4%
Total	200	3	197	170	27	86.3%

Table 2. EQ-5D-5L questionnaire response rates by therapeutic groups. Chi-square test for refusal distribution: $\chi^2 = 1.22$; $p = 0.545$. Source: own processing.

The mean interval from operation to questionnaire was 10.6 months (standard deviation 6.5 months; median 10.0 months; range 0.2-21.7 months). Transcatheter patients had a significantly shorter interval (mean 7.4 ± 5.7 months) compared to surgical patients (sternotomy 11.7 ± 6.5 months; mini-thoracotomy 11.3 ± 6.1 months; $p < 0.001$), reflecting the predominance of transcatheter interventions in the more recent period of the study.

In the global cohort of 170 patients with valid response, the EQ-5D Index score calculated using the population value set validated for Romania [30] had a mean of 0.827 (standard deviation 0.105; median 0.843; interquartile range 0.779-0.899). These values indicate a globally reasonably good level of health-related quality of life in the studied cohort, comparable to age-adjusted population normative values for the represented age groups. The EQ-VAS score had a mean of 74.9 (standard deviation 14.8; median 80; interquartile range 70-80), confirming the central tendency towards good to very good values of self-perceived quality of life.

The dimensional profile of recovery showed that the dimension with the largest proportion of patients reporting problems (level ≥2) was pain/discomfort (64.7%), followed by mobility (58.2%), usual activities (55.3%), anxiety/depression (52.4%) and self-care (34.7%) [31]. This distribution pattern mirrors the specifics of recovery following cardiac valvular interventions: residual pain felt at the level of the chest wall and the limitations of effort capacity emerge as the problems with the highest reporting frequency in the postoperative period, while the patient's capacity to ensure personal self-care is preserved at the best levels, in line with clinical expectations [16, 17].

Figura 3. Distribuția nivelurilor de severitate pe cele cinci dimensiuni EQ-5D-5L (lot global, n=170)

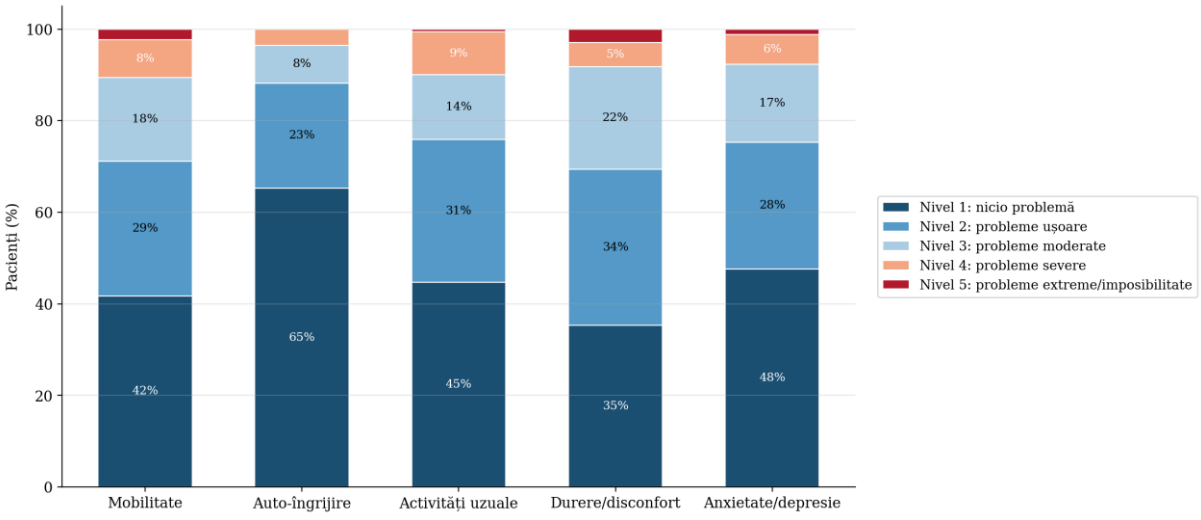


Figure 4. Distribution of severity levels across the five EQ-5D-5L dimensions (global cohort, n=170). Source: own processing.

The comparison of EQ-5D Index values between the three therapeutic groups revealed comparable scores, without reaching the threshold of statistical significance (Kruskal-Wallis test: H = 5.06; p = 0.080). Patients undergoing median sternotomy recorded the highest mean value (0.842 ± 0.104; median 0.861), followed by those in the transcatheter group (0.814 ± 0.096; median 0.836) and those in the mini-thoracotomy group (0.807 ±

0.114; median 0.833). The observed differences remained below the limit which the specialized literature establishes for the minimal clinically relevant difference for the EQ-5D-5L (estimated around the interval 0.05-0.08 units).

Variable	Global cohort (n=170)	Sternotomy (n=87)	Mini-thoracotomy (n=36)	Transcatheter (n=47)	p-value
EQ-5D Index, mean ± SD	0.827 ± 0.105	0.842 ± 0.104	0.807 ± 0.114	0.814 ± 0.096	0.080
EQ-5D Index, median	0.843	0.861	0.833	0.836	—
EQ-VAS, mean ± SD	74.9 ± 14.8	77.0 ± 15.2	73.5 ± 16.3	72.0 ± 12.3	0.075
EQ-VAS, median	80	80	80	70	—
Mobility	99 (58.2%)	51 (58.6%)	19 (52.8%)	29 (61.7%)	0.712
Self-care	59 (34.7%)	27 (31.0%)	15 (41.7%)	17 (36.2%)	0.514
Usual activities	94 (55.3%)	48 (55.2%)	18 (50.0%)	28 (59.6%)	0.685
Pain/discomfort	110 (64.7%)	54 (62.1%)	24 (66.7%)	32 (68.1%)	0.756
Anxiety/depression	89 (52.4%)	39 (44.8%)	22 (61.1%)	28 (59.6%)	0.131

Table 3. EQ-5D Index, EQ-VAS scores and prevalence of problems by dimensions (level ≥2) by therapeutic groups. Dimensional variables are expressed as n (%). Continuous variables are compared through the Kruskal-Wallis test; categorical variables through the Chi-square test. Source: own processing.

Figura 2. Distribuția scorurilor EQ-5D Index și EQ-VAS pe grupuri terapeutice

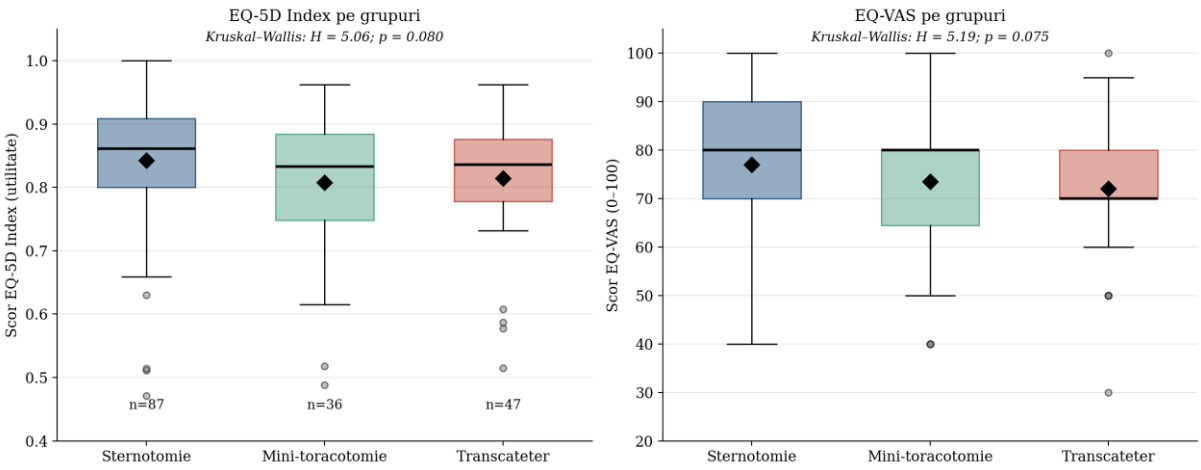


Figure 5. Distribution of EQ-5D Index and EQ-VAS scores by therapeutic groups. Source: own processing.

The comparison of EQ-VAS values followed a similar pattern (Kruskal-Wallis test: H = 5.19; p = 0.075), with a tendency of superiority of the sternotomy approach (mean 77.0)

compared to mini-thoracotomy (73.5) and the transcatheter approach (72.0). This result must be interpreted in the context of important baseline profile differences between groups: transcatheter patients have a significantly higher mean age, higher prevalences of major comorbidities and a higher EuroSCORE II score, factors that, in isolation, would have anticipated lower QoL scores but are apparently partially compensated by the less invasive nature of the procedure [37].

The dimension-by-dimension analysis did not reveal statistically significant differences between the three groups for any of the five subscales, but the global pattern deserves to be flagged. The frequency of mobility problems was slightly higher in the transcatheter group (61.7%), in line with the elderly profile. Self-care capacity was more affected in the mini-thoracotomy group (41.7%), an aspect potentially related to complex mitral pathology. The anxiety/depression component manifested a tendency of more pronounced prevalence in mini-thoracotomy (61.1%) and transcatheter (59.6%) compared to sternotomy (44.8%), without reaching statistical significance (p = 0.131).

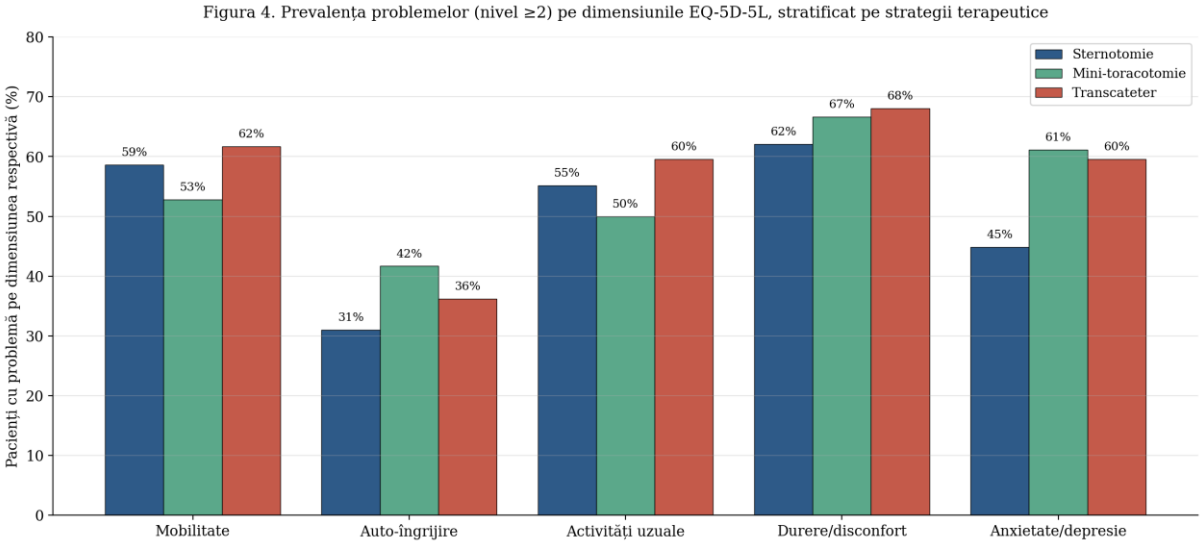


Figure 6. Prevalence of problems (level ≥2) on EQ-5D-5L dimensions, stratified by therapeutic strategies. Source: own processing.

Stratification by age revealed it as an important determinant of postoperative quality of life. Patients aged under 65 years presented the best mean EQ-5D Index score (0.848 ± 0.098), followed by those in the 65-75 age group (0.830 ± 0.107) and those aged 75 years or over (0.796 ± 0.104), with statistically significant difference (H = 8.14; p = 0.017). The difference is even more pronounced for EQ-VAS (79.5 → 75.8 → 67.9; H = 17.11; p < 0.001). The Spearman correlation between EQ-5D Index and age revealed a statistically significant weak-to-moderate negative correlation (rho = -0.249; p = 0.001).

Figura 5. Calitatea vieții postoperator în funcție de grupa de vârstă

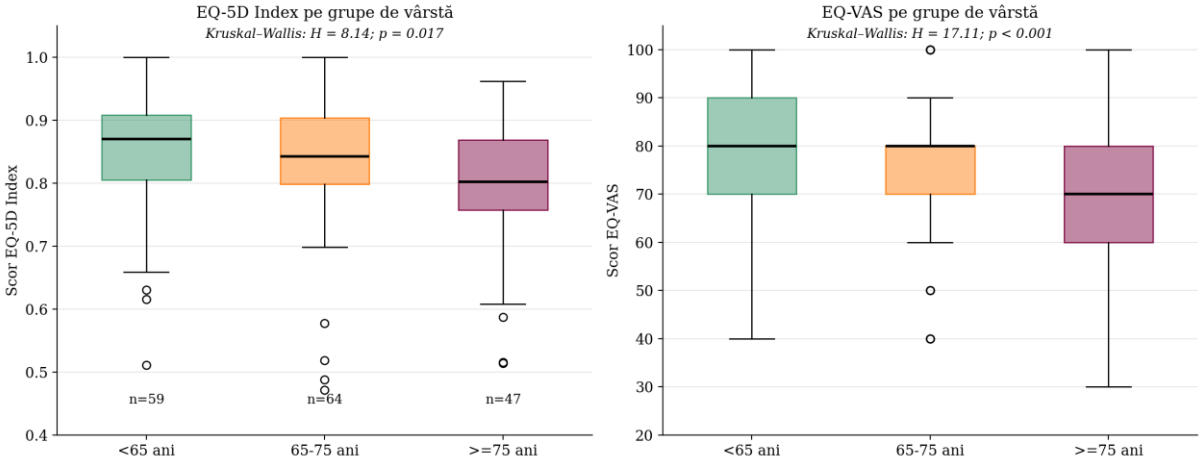


Figure 7. Postoperative quality of life by age group. Source: own processing.

The comparison between sexes did not reveal significant differences for any score (EQ-5D Index 0.826 in women vs 0.827 in men; p = 0.761). This finding contrasts with some studies that report slightly lower scores in women after cardiac surgery, but coincides with recent meta-analyses which, after adjusting for age and comorbidities, do not identify an independent effect of sex [16].

The analysis of the recovery trajectory over the postoperative interval revealed a statistically significant increase in scores with the passage of time. At the level of the global cohort, the EQ-5D Index score increased from 0.795 ± 0.104 in the first 3 months to 0.847 ± 0.096 in the 6-12 month interval and 0.844 ± 0.093 beyond 12 months (Kruskal-Wallis test: H = 10.66; p = 0.014). The trend was more pronounced for EQ-VAS (67.0 → 79.6 points; H = 28.02; p < 0.001). The Spearman correlation between EQ-5D Index and postoperative interval confirmed a significant positive association (rho = 0.203; p = 0.008).

Figura 6. Traiectoria recuperării calității vieții pe intervalul postoperator

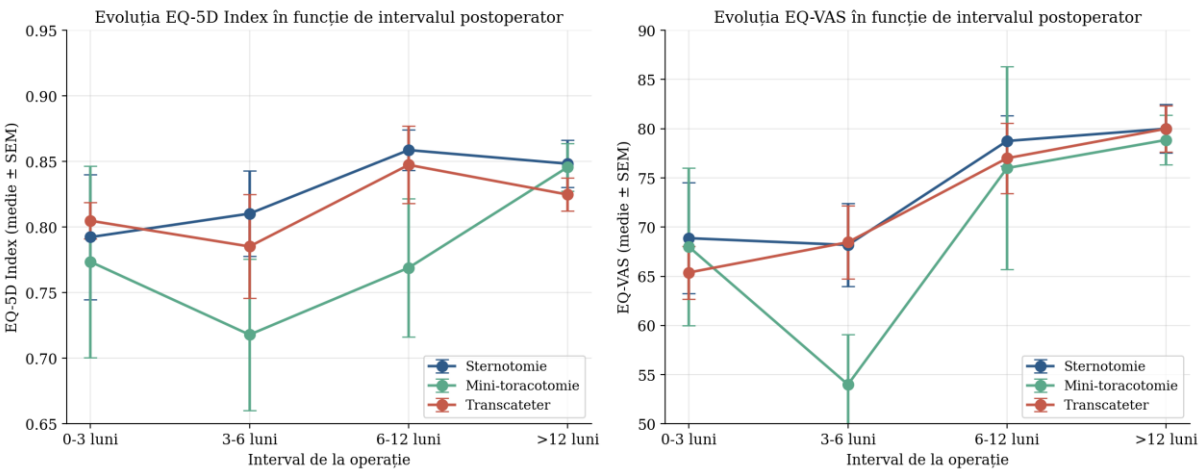


Figure 8. Trajectory of quality of life recovery over the postoperative interval, stratified by therapeutic groups. Source: own processing.

Multivariate analysis through multiple linear regression confirmed these observations. For EQ-5D Index, significant independent predictors were the postoperative interval (increase of 0.037 units per 10 months postoperatively; $p = 0.004$), age and EuroSCORE II score. For EQ-VAS, the postoperative interval was also the most robust predictor (increase of approximately 9 points per 10 months postoperatively; $p < 0.001$), followed by age ($\beta = -0.21$ points per year; $p = 0.013$) and EuroSCORE II ($\beta = -1.61$ points per EuroSCORE point; $p = 0.002$). Crucially, after adjusting for these factors, the coefficients for non-sternotomy approaches (mini-thoracotomy and transcatheter) did not reach statistical significance, confirming that the procedural strategy itself does not represent an independent determinant of postoperative quality of life [4, 17, 33].

8.4. Discussion

The central conclusion of the study is that the procedural strategy itself, considered in isolation from the patient's preoperative profile, does not represent an independent determinant of postoperative quality of life. At the univariate level, scores were comparable between the three groups, and the observed differences remained below the threshold of minimal clinically relevant difference. After adjustment through multiple linear regression for age, sex, EuroSCORE II, NYHA class, postoperative interval and type of valvular pathology, the coefficients for non-sternotomy approaches did not reach statistical significance in any model [4, 17, 33].

This observation has a fundamental conceptual implication: the choice of procedural strategy must be guided by anatomical criteria, technical feasibility and informed patient preference, rather than by a presumed superiority of one approach over quality of life in the medium term [40, 41]. The real determinants of postoperative quality of life identified in the multivariate analysis are the interval from intervention to evaluation, patient age and preoperative EuroSCORE II score.

The postoperative interval proved to be a robust predictor for both EQ-5D Index and EQ-VAS. The magnitude of the effect exceeds the threshold of minimal clinically relevant difference and confirms the existence of a real and progressive trajectory of quality of life recovery during the first 12-18 months postoperatively [4, 11, 17]. This observation pleads for the extension of the standard follow-up period beyond the classical 30 days and for the

integration of systematic quality of life assessment into routine postoperative follow-up at 3, 6 and 12 months.

Age confirmed its role as a determinant of self-perceived health status, with a significant negative effect that persisted after adjustment for EuroSCORE II and comorbidities. The physiological process of senescence exerts its own influence on the global perception of health status, beyond the cumulative burden of individual comorbidities [16], and pleads for adjusting preoperative expectations to the patient's age group through reference to specific population normative values [30].

The EuroSCORE II score, classically considered a predictor of perioperative mortality, confirmed its extended predictive value for self-perceived quality of life. This conceptual extension amplifies the operational utility of the score as an integrated instrument for prognosticating overall therapeutic benefit, exceeding its classical framework of mortality prediction. Patients with high preoperative scores require preoperative counselling that integrates both the increased perioperative risk and realistic expectations regarding the more modest trajectory of functional recovery.

The methodological limitations of the prospective study include the design with single evaluation per patient at variable postoperative moments, the absence of preoperative quality of life measurement, the modest sample size, the single-centre nature and the modest predictive capacity of the regression models. These limitations impose caution in the interpretation of results and open clear directions for future research: prospective multicentre studies with repeated measurements of quality of life at standardized moments, integration of objective digital measurements through accelerometry and wearable devices [4], development of valve-specific instruments [12].

8.5. Conclusions

The prospective study presented in this chapter assessed health-related quality of life in 170 patients operated for valvular heart disease through three contemporary strategies, using the EQ-5D-5L questionnaire with the population value set validated for Romania [29, 30]. The central conclusion of the study is that the procedural strategy itself, considered in isolation from the patient's preoperative profile, does not represent an independent determinant of postoperative quality of life.

The real determinants of postoperative quality of life identified in the multivariate analysis are the interval from intervention to evaluation, patient age and preoperative EuroSCORE II score. The dimensional profile of recovery showed that the most frequently affected dimensions are pain and discomfort, mobility and the psychoemotional anxiety-depression component, while the best preserved dimension remains self-care capacity. This profile pleads for the systematic integration of modern techniques of postoperative pain control [39], for the consolidation of structured cardiovascular rehabilitation programmes [11, 27] and for the integration of psychological assessment and support into the standard care of the operated valvular patient.

FINAL CONCLUSIONS AND PERSONAL CONTRIBUTIONS

The present work addressed a topic of major clinical and conceptual relevance in contemporary cardiology and cardiac surgery: the integrated evaluation of valvular therapeutic strategies through the corroboration of classical procedural safety indicators with the dimension, less explored in the Romanian literature, of health-related quality of life. The two-component, complementary, retrospective and prospective construction was deliberately chosen to provide a balanced characterization of the real therapeutic benefit of valvular interventions, capturing both early in-hospital safety and medium-term functional recovery [42].

Convergence of results from the two studies

The two components of the research converge towards a unitary conclusion, with fundamental conceptual implications for clinical practice. The retrospective study highlighted that, despite major differences in baseline profile between the three groups regarding age, comorbidities, EuroSCORE II score and NYHA functional class, early in-hospital clinical results were comparable. The 30-day mortality was reduced across the entire cohort (1.5% global), and the cumulative incidence of postprocedural complications was similar between groups (12.6% for sternotomy, 9.3% for mini-thoracotomy, 9.3% for transcatheter; $p = 0.756$). These observations confirm the procedural safety of each strategy [40].

The prospective study extended this observation into the domain of postoperative quality of life. In a cohort of 170 patients with valid evaluation, with a response rate of 86.3%, EQ-5D Index and EQ-VAS scores were comparable between the three therapeutic groups, and multivariate analysis through linear regression confirmed that, after adjustment for confounding factors, the procedural strategy does not represent an independent determinant of quality of life. This observation has a fundamental implication: the historical paradigm of direct comparison between approaches must be reformulated in light of the reality of contemporary clinical practice, in which each strategy is applied to its specific population and produces results adequate to the profile of that population.

Real determinants of functional recovery

Beyond the absence of a clear superiority of any procedural strategy, the study allowed the identification of factors with significant independent effect on postoperative quality of life. The postoperative interval proved to be the most robust predictor, with an increase in EQ-5D Index of 0.037 units per 10 months postoperatively ($p = 0.004$) and an increase in EQ-VAS of approximately 8 points in the same interval ($p < 0.001$). The magnitude of the observed effect lies above the threshold considered minimal clinically significant difference for EQ-VAS, thus confirming that functional recovery follows an authentic and ascending trajectory during the first 12-18 months from the moment of surgical intervention [4, 11, 17].

Age reconfirmed its status as a determinant of self-perceived health, exerting a statistically significant negative impact on EQ-VAS ($\beta = -0.21$ points per year of life; $p = 0.013$). The effect persisted after adjusting the model for EuroSCORE II and associated comorbidities, suggesting that the biological process of ageing itself imprints its own mark on the way the patient appreciates his general state [16]. The elderly patient deserves to be informed that, although the functional improvement following intervention is real and clinically relevant, the absolute values reached subsequently will inevitably incorporate the component attributable to chronological age, requiring their interpretation through reference to the normative landmarks of the age group to which they belong [30].

The EuroSCORE II score, classically considered a predictor of perioperative mortality, extended in our study its operational significance as a predictor of self-perceived quality of life, with a coefficient β of -1.61 points per EuroSCORE II point on the EQ-VAS scale ($p = 0.002$). This conceptual extension is coherent with the integrated nature of the score, which incorporates multiple dimensions of frailty and disease severity. Patients with higher EuroSCORE II scores predictably present both increased perioperative risk and more modest functional recovery, a fact that must be integrated into shared therapeutic decision and into the formulation of realistic expectations for the patient and family.

Dimensional profile of recovery

The analysis on the five dimensions of the EQ-5D-5L questionnaire revealed a characteristic pattern of recovery after valvular cardiac interventions. Among the complaints most frequently invoked by patients at distance from the operative moment are physical pain

and discomfort, reported by 64.7% of those evaluated, followed closely by mobility limitations (58.2%), difficulties encountered in carrying out daily activities (55.3%) and, last but not least, psychoemotional suffering (52.4%). The best preserved dimension among the five proves to be self-care capacity (34.7%) [16, 17].

Such a distribution of residual vulnerabilities entails immediate pragmatic consequences for the way postoperative care should be structured. The predominance of pain as a residual problem pleads for the systematic integration of modern techniques of postoperative pain control [31, 39], both in the early period, through regional anaesthesia, parasternal plane blocks for sternotomy patients, interfascial thoracic blocks for mini-thoracotomy patients and paravertebral blockade for complex cases, and in the home recovery period, through multimodal analgesia protocols adapted to the specifics of each patient. The frequency of mobility problems suggests the potential benefit of structured cardiovascular rehabilitation programmes which, in many Romanian centres, remain underutilized despite the consolidated evidence regarding their impact on functional recovery and quality of life [11, 13, 27].

The psychoemotional component, with a prevalence of anxiety or depression problems in over half of patients, represents a dimension less addressed in traditional cardiac surgery, but one that deserves increased attention. In the analysed cohort, an uneven distribution of anxious-depressive symptomatology between therapeutic strategies emerges: the proportion of patients with affectation in this sphere was higher in the groups treated through mini-thoracotomy (61.1%) and through transcatheter techniques (59.6%), compared to those operated through sternotomy (44.8%). The differences did not reach the threshold of statistical significance ($p = 0.131$), but their direction is suggestive and deserves to be explored in a study with a larger sample and specific psychological assessment instruments.

Quality of life as a therapeutic objective in modern valvular surgery

The data from the study consolidate an important conceptual transformation of the field. For decades, the evaluation of the success of a valvular intervention was based almost exclusively on technical parameters, namely perioperative mortality, residual transvalvular gradient and regurgitant fraction. Over the last two decades, this vision has gradually broadened, coming to also encompass the subjective side of therapeutic gain, captured through standardized questionnaires intended for the assessment of quality of life [12, 42].

Such a transformation should not be regarded as a mere concession to the current that places the patient at the centre of medical action, but rather constitutes the expression of recognition of an elementary empirical reality: in an era when perioperative mortality has dropped below the 2% threshold for isolated aortic valve replacement in centres with consistent volume [34] and remains at low values for TAVI even for patients with high procedural risk [37], the authentic margin of clinical progress shifts inexorably from immediate survival towards the dimension of functional recovery [11, 17].

Severe aortic stenosis offers, probably, the most eloquent illustration of this paradigm shift. Patients affected by such pathology accuse preoperatively considerably diminished scores on the entire range of dimensions evaluated through the established questionnaires. The improvement that occurs after the intervention arrives rapidly and with remarkable amplitude, postoperative scores not infrequently reaching the normative values of the reference population [37]. In the analysed casuistry, the mean value of the EQ-5D Index, situated at 0.814 in the transcatheter subgroup — in a population with a mean age of 74.8 years — becomes all the more telling considering that, prior to the procedure, the same patients would almost certainly have fallen at substantially lower levels. Confrontation with the normative landmarks published for the corresponding age group in the indigenous population [30] suggests, in fact, that functional recovery reaches after intervention a plateau close to the maximum individual potential attained.

Final conclusions

The central hypothesis of the thesis was confirmed: in the era when the procedural safety of contemporary valvular therapeutic strategies is consolidated, the margin of real clinical progress shifts to the area of functional recovery and quality of life over the medium and long term [11, 17, 42]. The true measure of the success of a valvular intervention manifests itself not in the first days postoperatively, but in the weeks and months that follow discharge — in the recovery of functional autonomy, in the resumption of daily and professional activities, in the peace regained after the struggle with disease. This perspective, anchored in the patient's subjective perception and objectified through validated psychometric instruments, naturally complements the evaluative arsenal of contemporary valvular surgery and consolidates the paradigm of a truly patient-centred medicine.

In conclusion, the work formulates the following key observations: (1) In the cohort studied, the three contemporary strategies (median sternotomy, right mini-thoracotomy, transcatheter approach) provided comparable early clinical results when applied to the populations specific to each, despite major baseline profile differences. (2) Postoperative quality of life, evaluated through EQ-5D-5L with the population value set for Romania, was similar between groups (global EQ-5D Index 0.827; global EQ-VAS 74.9), and the procedural strategy did not represent an independent determinant in the multivariate analysis. (3) The real determinants of quality of life were the postoperative interval, patient age and preoperative EuroSCORE II score. (4) The dimensional profile of recovery revealed pain/discomfort, mobility and the psychoemotional component as the most frequently affected dimensions, indicating the priority directions of postoperative care.

Personal contributions and applied value

The contributions with conceptual value of the thesis include: validation in a Romanian cohort of the observation that the procedural strategy itself is not an independent determinant of postoperative quality of life after adjustment for confounding factors [4, 33, 34]; extension of the operational significance of the EuroSCORE II score as a predictor of self-perceived quality of life, beyond the classical framework of mortality prediction; characterization of the real and ascending trajectory of quality of life recovery during the first 12-18 months postoperatively, with the highlighting of a significant and clinically relevant increase in scores; and characterization of the dimensional profile of recovery after valvular interventions in the Romanian population, through scores referenced to specific population normative values [30].

The contributions with concrete applied value include the following practical recommendations: (1) Systematic implementation of postoperative quality of life assessment through the EQ-5D-5L questionnaire in Romanian, with the population value set validated for Romania [29, 30], in routine postoperative follow-up of patients operated for valvular heart disease. This practice, feasible under the conditions of a standard cardiology or cardiac surgery consultation and undemanding in resources, would provide valuable information for individualized adjustment of postoperative care. The demonstration of feasibility of this approach in the studied cohort, with a response rate of 86.3%, constitutes a practical argument in favour of broad adoption.

(2) Use of EuroSCORE II not only as a predictor of perioperative mortality, but also as an integrated element in preoperative counselling regarding realistic expectations of postoperative quality of life. Patients with high preoperative scores should be informed not only about the increased perioperative risk, but also about the probably more modest trajectory of functional recovery, which allows expectation adjustment and consolidation of preoperative therapeutic consensus. (3) Systematic integration of modern postoperative pain control techniques (regional anaesthesia, parasternal or interfascial thoracic plane blocks, paravertebral blockade) [39] into the perioperative protocols of Romanian centres, supported by the observation that residual pain represents the most frequent problem reported by operated valvular patients.

(4) Strengthening of structured cardiovascular rehabilitation programmes intended for patients undergoing valvular interventions, with particular attention paid to the psychoemotional component of the recovery process [11, 13, 27]. (5) Extension of the standard period of postoperative follow-up beyond the classical 30 days and integration of systematic quality of life assessment into routine postoperative follow-up at 3, 6 and 12 months postoperatively. These recommendations are feasible under the current conditions of the Romanian medical system, without significant additional investments, and would represent an important conceptual step towards truly patient-centred care.

Research directions opened by the results of the thesis include prospective multicentre studies with repeated measurements of quality of life at standardized moments (preoperatively, 3, 6, 12, 24 months postoperatively), integration of objective digital measurements through accelerometry and wearable devices [4], development of valve-specific instruments with rigorous psychometric validation [12], correlation of quality of life with serum biomarkers (NT-proBNP, high-sensitivity troponin) and with advanced echocardiographic parameters (global longitudinal strain, estimated pulmonary pressures), and analysis of individual longitudinal trajectories of quality of life through modern statistical methodologies, capable of capturing the heterogeneity of response to intervention in apparently homogeneous populations. These directions, developed through national and international collaborations, will contribute to the consolidation of a truly patient-centred medicine in the Romanian medical space.

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The selected bibliography includes exclusively the sources actually cited in the present summary. The numbering corresponds to that used in the text of the summary and preserves the same references as in the integral thesis to facilitate direct correspondence.

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