

CAROL DAVILA UNIVERSITY OF MEDICINE AND PHARMACY
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TRANSORAL APPROACH TO VISCEROCRANIAL AND CERVICAL
REGION NEOPLASMS

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1. Introduction

Head and neck neoplasms represent a heterogeneous group of oncological diseases with a major impact on survival, function and quality of life. Their location in the oral cavity, oropharynx, pharyngolaryngeal region and larynx makes treatment difficult, because the same anatomical region is involved in breathing, phonation, swallowing, airway protection and communication. In this context, therapeutic success cannot be defined exclusively by local disease control, but must also be interpreted in terms of functional preservation and patient reintegration.

The topic of the thesis, entitled “Transoral Approach to Viscerocranial and Cervical Region Neoplasms”, is aligned with the current development of minimally invasive oncological surgery. The work analyzes the role of transoral surgery in the treatment of ENT neoplasms, with emphasis on two techniques applicable in institutional practice: transoral CO₂ laser microsurgery and transoral ultrasonic surgery, known by the acronym TOUSS. In the absence of transoral robotic infrastructure, TOUSS is analyzed as a non-robotic, accessible and economically sustainable alternative for carefully selected cases.

The fundamental problem of this research derives from the particular nature of head and neck neoplasms, in which therapeutic success cannot be assessed solely by disease control. Tumors located in the oral cavity, oropharynx, larynx and pharyngolaryngeal regions involve structures directly responsible for breathing, phonation, swallowing, airway protection, communication and nutrition. Consequently, any oncological treatment applied in this region must pursue both oncological radicality and functional preservation, because patient survival is insufficient if it is achieved at the cost of major functional disability.

The evolution of ENT oncology has progressively changed the therapeutic paradigm, moving from extensive and mutilating external surgical approaches toward conservative, multimodal and minimally invasive treatments. Open surgery maintains its role in advanced tumors, in cases with deep extension or when transoral exposure does not allow safe resection, but it may be associated with increased morbidity, the need for tracheostomy, prolonged use of a feeding tube, longer hospitalization and difficult functional recovery. At the same time, radiochemotherapy may preserve the organ anatomically, but can cause important acute and late toxicities, including dysphagia, xerostomia, fibrosis and impairment of quality of life. For this

reason, modern treatment of ENT neoplasms must be individualized within a multidisciplinary tumor board, according to current guideline principles [1].

Transoral surgery developed precisely as a response to this need for balance between tumor control and reduced morbidity. By using natural access routes, transoral techniques allow excision of the primary tumor without extensive cervical incisions, without mandibulotomy and, in carefully selected cases, without complex reconstructions. However, the minimally invasive character should not be confused with a reduction in oncological standards. The transoral approach is justified only when it allows adequate resection margins, local disease control and maintenance of acceptable postoperative function. Thus, the central problem of the thesis is not whether transoral surgery can replace classical surgery, but under which conditions it provides a real benefit to the patient.

In oropharyngeal cancer, this issue has become even more complex due to the increasing incidence of tumors associated with HPV infection. HPV-positive oropharyngeal tumors have a different prognosis from those classically associated with tobacco and alcohol consumption, and this biological difference has been integrated into modern staging through the 8th edition of the AJCC system [2]. At the same time, the existence of several curative options for early stages, including transoral surgery, radiotherapy or combined treatments, requires careful analysis of toxicity, quality of life and the risk of multimodal treatment. The ORATOR trial and its long-term results showed that radiotherapy and transoral robotic surgery may both be curative options in selected cases, but with different toxicity profiles and functional impact [3,4].

In laryngeal cancer, the fundamental issue concerns the real meaning of organ preservation. Anatomical preservation of the larynx is not sufficient if the patient remains with a nonfunctional voice, severe dysphagia, aspiration or dependence on tracheostomy. From this perspective, transoral CO₂ laser microsurgery must be evaluated not only through oncological parameters, but also through vocal, swallowing and nutritional outcomes. The use of standardized surgical classifications and validated instruments for voice, dysphagia and oral intake becomes essential for the objective assessment of therapeutic outcome [5-8].

Another dimension of the fundamental problem is technological accessibility. Transoral robotic surgery is an advanced technique, but the costs of acquisition, maintenance and consumables limit its implementation in many centers. In this context, transoral ultrasonic

surgery, known by the acronym TOUSS, emerges as a non-robotic alternative with potential for precise dissection and efficient hemostasis, usable in centers that have advanced endoscopic infrastructure but not robotic platforms [9,10]. The evaluation of this technique in the Romanian context represents one of the original directions of the thesis and responds to a major practical problem: adapting modern minimally invasive surgery to local clinical and logistical realities.

2. Research Hypothesis

The general hypothesis of the thesis is that minimally invasive transoral surgical techniques, applied in carefully selected cases of ENT neoplasms, can provide a favorable balance between oncological safety and functional preservation. This hypothesis is based on the premise that oncological radicality does not depend exclusively on the extent of the external surgical approach, but on the quality of patient selection, correct staging, adequate exposure, achievement of resection margins and integration of the intervention into a multidisciplinary therapeutic plan.

The first derived hypothesis refers to early-stage oropharyngeal cancer. The choice between transoral surgery and conservative management cannot be reduced to a simple comparison of survival, because the final outcome depends on treatment toxicity, impact on swallowing, quality of life and the probability that the patient will require adjuvant therapy. In this logic, transoral surgery may be advantageous when it allows complete resection and avoidance of multimodal therapy, but its benefit decreases when the patient ultimately bears both surgical morbidity and the toxicity of postoperative radiochemotherapy [3,4].

The second derived hypothesis concerns transoral CO₂ laser surgery in laryngeal neoplasms. It is considered that TLM can ensure favorable functional outcomes in T1-T2 tumors and acceptable outcomes in certain strictly selected T3 tumors, provided that cases with cartilaginous invasion, extralaryngeal extension or severe preoperative functional impairment are excluded. The hypothesis includes the fact that the postoperative result must be measured using validated instruments, not only described clinically, because voice, dysphagia and oral intake are essential dimensions of the patient's quality of life [5-8].

The third derived hypothesis concerns the TOUSS technique. The thesis starts from the premise that TOUSS may represent a feasible, safe and clinically relevant option for the

treatment of selected tumors of the oral cavity, oropharynx and pharyngolaryngeal region, especially in centers where robotic surgery is unavailable or economically unsustainable. This hypothesis is supported by preliminary data from the international literature and is tested in the thesis through the analysis of the first documented Romanian experience with this technique [9,10].

Through these hypotheses, the thesis proposes an integrated interpretation of transoral surgery. The transoral approach is not presented as a universal solution, but as a strategy dependent on patient anatomy, tumor biology, stage, team experience and functional objectives. The central hypothesis can be summarized as follows: when the indication is correctly established, transoral surgery can maintain oncological principles and, at the same time, reduce treatment morbidity, contributing to better functional recovery.

3. Research Objectives

The general objective of the thesis was to evaluate the role of transoral surgery in the treatment of viscerocranial and cervical region neoplasms, by critically integrating data from the literature with results obtained from the author's clinical experience. The research aimed to define the place of transoral approaches in contemporary ENT oncology, with emphasis on the balance between local disease control, reduction of morbidity and preservation of essential functions of the upper aerodigestive tract.

A first specific objective was the comparative analysis of transoral surgical treatment and conservative management in early-stage oropharyngeal cancer. This objective sought to clarify the advantages and limitations of each strategy, with emphasis on oncological outcomes, functional toxicity, quality of life, the role of HPV status and the impact of adjuvant treatment. The paper published in Journal of Personalized Medicine formed the basis of this direction and allowed critical positioning of transoral surgery in relation to radiotherapy and radiochemotherapy [11].

A second specific objective was the evaluation of functional outcomes after transoral CO₂ laser surgery for laryngeal neoplasms. This included analysis of voice, swallowing and oral intake using validated instruments, namely VHI-10, EAT-10 and FOIS. The objective was not only to describe postoperative evolution, but also to correlate functional outcomes with tumor

stage, lesion location and type of resection, using the ELS classification for endoscopic cordectomies [5-8].

A third specific objective was to evaluate the feasibility, perioperative safety and initial results of the TOUSS technique in the treatment of selected head and neck tumors. Through this direction, the thesis aimed to determine whether a non-robotic transoral technique could expand the arsenal of minimally invasive surgery in a Romanian center while maintaining oncological principles and acceptable perioperative morbidity [9,10].

An additional objective was the descriptive analysis of total transoral laryngectomy performed using the TOUSS technique, as an element of feasibility and personal contribution. This component of the thesis has particular relevance because published international experience is limited, and the description of cases contributes to defining the potential and limitations of a technique that is still in the process of clinical validation [21].

Overall, the specific objectives aimed to build a coherent framework for the evaluation of transoral surgery. This framework integrates bibliographic data, perioperative parameters, oncological indicators, functional assessments and original technical contributions. Through this structure, the thesis is not limited to presenting patient cohorts, but proposes a clinical interpretation applicable to multidisciplinary therapeutic decision-making.

4. Research Methodology

The research methodology was built as a progressive architecture consisting of a bibliographic synthesis component and two retrospective observational clinical components. This structure allowed the transition from critical analysis of the literature to the evaluation of the author's results for two relevant transoral techniques: transoral ultrasonic surgery and transoral CO₂ laser surgery. Thus, the thesis combined the theoretical perspective on the indications and limitations of transoral surgery with clinical data from the practice of a reference center.

The first study consisted of a narrative review of the literature regarding transoral surgical treatment versus conservative management in early-stage oropharyngeal cancer. Oncological, functional and quality-of-life outcomes reported for transoral surgery, radiotherapy and radiochemotherapy were analyzed, with emphasis on the impact of HPV status, adjuvant

treatment and cumulative toxicity. This component provided the conceptual basis for the entire doctoral project and delineated the main controversies in the field [11].

The second clinical study evaluated the TOUSS technique in a cohort of selected patients with head and neck tumors. The analysis included clinical and demographic characteristics, tumor location, HPV status when available, perioperative parameters, need for tracheostomy, use of nasogastric tube, duration of hospitalization, postoperative complications, margin status and oncological evolution at follow-up. The technique was analyzed both as a transoral resection method for oropharyngeal or oral cavity tumors and as a possible approach for ultrasonic transoral total laryngectomy [9,10].

The third clinical study had a retrospective observational design and included 137 consecutive patients diagnosed with primary laryngeal neoplasms and treated by transoral CO₂ laser surgery between 2022 and 2025. Cases of tumor recurrence, salvage surgery after previous oncological treatments and patients with a history of radiotherapy were excluded, in order to reduce cohort heterogeneity and allow clearer assessment of functional outcomes after primary surgical treatment.

Preoperative patient evaluation included ENT clinical examination, flexible and rigid endoscopy, imaging evaluation when necessary to assess tumor extension, staging according to the TNM/AJCC system and analysis within the multidisciplinary tumor board. For laryngeal cases, the type of resection was reported according to the European Laryngological Society classification, which enables standardization of endoscopic cordectomies and comparability of results across series [5].

In the laryngeal study, functional outcome was evaluated using three complementary instruments. The Voice Handicap Index-10 was used to quantify the impact on voice, the Eating Assessment Tool-10 to assess dysphagia from the patient's perspective, and the Functional Oral Intake Scale to assess the level of oral intake and degree of nutritional independence [6-8]. The use of these instruments allowed transition from subjective clinical description to reproducible assessment of postoperative function.

The parameters followed throughout the research were grouped into four main categories: demographic and clinical parameters, tumor parameters, perioperative parameters and functional/oncological parameters. Age, sex, smoking, alcohol consumption, HPV status, tumor

location, T stage, type of resection, need for tracheostomy, use of feeding tube, hospitalization duration, complications, recurrence, disease-free survival and status at follow-up were analyzed. In the laryngeal study, association analyses were also performed between tumor stage and relevant clinical variables.

The retrospective nature of the clinical studies, the relatively small size of the TOUSS cohort and variable follow-up represent important methodological limitations. Nevertheless, the value of the research derives from the integration of these data into a coherent clinical framework, the use of validated functional instruments and the reporting of a nationally relevant experience for the implementation of non-robotic transoral surgery.

5. Synthesis of the Thesis Chapters

The general part of the thesis presents the conceptual and technological foundations of transoral surgery in ENT oncology. The chapter devoted to the evolution of transoral surgery describes the transition from radical surgical approaches to minimally invasive treatments centered on the patient and on functional preservation. The principles of minimally invasive surgery, selection criteria, anatomical and technical limitations of the transoral approach, and the relationship between oncological radicality and functional outcome are analyzed. This part emphasizes that transoral surgery is not less radical surgery, but a different means of access to the primary tumor, with potential to reduce morbidity when the indication is correctly established.

The general chapters discuss the main techniques used in transoral surgery: transoral CO₂ laser microsurgery, transoral robotic surgery and transoral ultrasonic surgery. The CO₂ laser is presented as a precise technique, established especially in the treatment of laryngeal neoplasms, but with limitations related to exposure, interpretation of margins in fragmented resections and control of larger-caliber vessels. Robotic surgery is described as an advanced technology, with three-dimensional visualization and articulated instruments, but with economic and logistical limitations. TOUSS is presented as a promising non-robotic alternative, based on ultrasonic and bipolar energy, with potential application in selected tumors of the oral cavity, oropharynx and pharyngolaryngeal region [9,10].

The chapter on the clinical applicability of transoral surgery integrates literature data regarding oropharyngeal, oral cavity and laryngeal neoplasms. It is emphasized that treatment

choice must take into account tumor location, stage, HPV status, exposure, possibility of achieving negative margins, need for adjuvant treatment and the patient's functional objectives. The role of the multidisciplinary tumor board is central, because therapeutic decision-making does not belong exclusively to the surgeon, but results from the integration of ENT, oncology, radiotherapy, radiology and pathology expertise.

The first study in the special part analyzes transoral surgical treatment compared with conservative management in early-stage oropharyngeal cancer. The main result of this analysis is that no universal superiority of transoral surgery or radiotherapy can be stated. Both strategies may have curative intent in selected cases, but they differ in toxicity profile, impact on swallowing, quality of life and probability of requiring combined treatment. Available randomized studies, including ORATOR, support individualized decision-making and inclusion of functional outcomes in the evaluation of therapeutic success [3,4].

This analysis also highlights the essential role of HPV status in oropharyngeal cancer. HPV-positive tumors have a more favorable prognosis and a distinct biological profile, which has generated interest in therapeutic de-escalation strategies. However, the thesis underlines that favorable prognosis does not justify uncontrolled treatment reduction. De-escalation must be evaluated in well-defined clinical contexts, with maintenance of oncological safety and careful monitoring of functional outcomes [2].

The second study in the special part presents the Romanian TOUSS experience. The analyzed cohort included 39 patients treated by transoral ultrasonic surgery for selected head and neck tumors. Of these, 21 had oropharyngeal squamous cell carcinoma, 14 had tumors of the lateral tongue or tongue base, one case was represented by a vallecular tumor, one case by Kaposi sarcoma of the epiglottis, and two cases by ultrasonic transoral total laryngectomies. HPV status was known in 27 patients, of whom 13 were HPV-positive and 14 HPV-negative, while in 12 patients HPV status was not available.

The results of the TOUSS study showed favorable perioperative evolution. Tracheostomy was not required in the analyzed cohort, the nasogastric tube was removed by the tenth postoperative day when it had been used, and mean hospitalization was 7 days. Postoperative hemorrhage occurred in 4 patients, representing 10.2% of the cohort, all cases being surgically controlled. At 3 years, 31 patients were disease-free, corresponding to a disease-free survival of

79.5%; 4 patients were lost to follow-up and 4 patients developed recurrence. Recurrences were observed exclusively in HPV-negative patients who were smokers and/or alcohol consumers, supporting the importance of correlating the surgical technique with tumor biology and the patient's risk profile.

The component dedicated to ultrasonic transoral total laryngectomy has the character of feasibility and personal contribution. International literature has previously described only very limited case series, and the inclusion of the author's cases in the thesis supports the potential of TOUSS to expand the indications of transoral surgery beyond standard oropharyngeal or supraglottic resections. However, the thesis interprets these results cautiously, emphasizing the need for larger cohorts, long-term follow-up and strict definition of selection criteria [12].

The third study in the special part evaluates functional outcomes after transoral CO₂ laser surgery for laryngeal neoplasms. The cohort included 137 consecutive patients, with a mean age of 68.0 years, diagnosed with primary laryngeal tumors and treated by TLM. In terms of tumor stage, 38.0% of patients had T1 tumors, 40.1% had T2 tumors and 21.9% had selected T3 tumors. Selection of T3 cases was strict, accepting only cases without cartilaginous invasion, without extralaryngeal extension and with the possibility of safe transoral resection.

Types of resection were reported according to the ELS classification. The most frequent intervention was type III cordectomy, performed in 36 patients, followed by type II cordectomy in 27 patients, type IV cordectomy in 26 patients, type I cordectomy in 18 patients, type V cordectomy in 15 patients and transoral laser supraglottic laryngectomy in 15 patients. No intraoperative conversion to open surgery was recorded, supporting the technical feasibility of the approach in selected cases [5].

Functional outcomes confirmed the benefit of TLM in T1-T2 tumors. Patients with T1 tumors had low VHI-10 scores, EAT-10 equal to 0 and maintenance of normal oral intake, corresponding to FOIS 7. Patients with T2 tumors had a moderate vocal impact, but no clinically significant dysphagia, with FOIS 6-7. In selected T3 tumors, VHI-10 scores were higher, reflecting the impact of more extensive resections on voice, and 20% of patients had EAT-10 scores compatible with clinically significant dysphagia. Nevertheless, oral intake improved progressively, with most patients reaching FOIS 6-7 in the first postoperative months [6-8].

The integrated analysis of the chapters shows that the three directions of the thesis are complementary. The review on oropharyngeal cancer delineates the decision-making context and therapeutic controversies. The TOUSS study provides an original contribution regarding implementation of a non-robotic technique in Romania. The TLM study offers a structured functional assessment of CO₂ laser surgery in laryngeal cancer. Together, these chapters support the idea that the transoral approach must be evaluated in relation to three conditions: oncological safety, correct selection and measurable post-therapeutic function.

6. Conclusions

The doctoral research confirms that transoral surgery occupies an important place in modern ENT oncology, but only under conditions of rigorous case selection. The transoral approach should not be interpreted as a simplified alternative to open surgery or to non-surgical treatments, but as a therapeutic strategy dependent on tumor location, stage, exposure, functional status, tumor biology, team experience and the possibility of obtaining safe oncological margins.

In early oropharyngeal cancer, the choice between transoral surgery and conservative management must go beyond the survival paradigm. Radiotherapy, radiochemotherapy and transoral surgery may have similar oncological results in certain patient subgroups, but differ in toxicity, functional impact and quality of life. Therefore, therapeutic decision-making must be individualized, discussed in a multidisciplinary setting and directed not only toward disease control, but also toward reducing the overall morbidity of treatment [3,4].

HPV status represents a major biological and prognostic determinant in oropharyngeal cancer. Its integration into modern staging has changed prognosis interpretation and has generated interest in de-escalation strategies. However, the thesis results support a cautious approach: de-escalation should not be applied empirically, but only under validated conditions, because maintaining oncological control remains the priority.

The TOUSS study demonstrates the feasibility of introducing a non-robotic transoral technique in a Romanian center. Perioperative results were favorable, without the need for tracheostomy in the analyzed cohort, with a mean hospitalization of 7 days and a 3-year disease-free survival rate of 79.5%. These data support that TOUSS may represent an accessible and

clinically relevant alternative in centers without a robotic platform, provided that case selection is rigorous and endoscopic experience is adequate.

Recurrences in the TOUSS cohort occurred exclusively in HPV-negative patients who were smokers and/or alcohol consumers. This observation confirms that oncological outcome depends not only on the surgical technique, but also on tumor biology and the patient's risk profile. In this respect, transoral surgery must be integrated into a complex strategy in which the surgical indication is correlated with etiological factors, tumor stage and the probability of adjuvant treatment.

The study dedicated to transoral CO₂ laser surgery confirms the role of TLM as an effective method of laryngeal preservation. In T1-T2 tumors, vocal and swallowing outcomes were very good, with low vocal handicap, absence of clinically significant dysphagia and maintenance of nearly normal oral intake. In strictly selected T3 tumors, functional outcomes were more modest, but acceptable, supporting the possibility of cautiously extending TLM indications to certain locally advanced cases without compromising functional preservation principles.

The use of VHI-10, EAT-10 and FOIS demonstrated the importance of standardized evaluation of postoperative function. Voice, swallowing and oral intake should not be assessed only by general clinical observation, but quantified through reproducible instruments that allow comparison between stages, techniques and types of resection. This conclusion is relevant not only for research, but also for clinical practice, because it allows more precise patient counseling before treatment [6-8].

The general conclusion of the thesis is that minimally invasive transoral surgery can provide a favorable balance between oncological control and functional preservation in selected ENT neoplasms. Its value does not lie in universal applicability, but in its capacity to offer personalized treatment, with reduced morbidity and preservation of essential functions. Long-term validation of these results requires prospective, multicenter studies with larger cohorts, prolonged follow-up and uniform reporting of oncological and functional indicators.

7. Personal Contributions

The first personal contribution of the thesis consists of integrating three research directions into a unified framework dedicated to transoral surgery in ENT oncology. The thesis does not analyze a single technique in isolation, but correlates data regarding early oropharyngeal treatment, transoral ultrasonic surgery and laryngeal CO₂ laser surgery within a common model of clinical interpretation. The central axis of this model is the relationship between oncological safety, patient selection and functional outcome.

The second contribution is represented by the critical analysis of transoral surgical treatment compared with conservative management in early oropharyngeal cancer. Through this paper, published in Journal of Personalized Medicine, the thesis highlights that therapeutic decision-making must include not only survival, but also toxicity, swallowing, quality of life, HPV status and the probability of adjuvant treatment.

The third contribution is represented by the reporting of the first Romanian TOUSS experience in a cohort of 39 patients. This component has national novelty, because it documents the implementation of a modern non-robotic transoral surgical technique in a Romanian center and demonstrates its applicability in selected head and neck tumors.

The fourth personal contribution is the inclusion and analysis of cases of ultrasonic transoral total laryngectomy. Considering the limited number of international reports, this component supports the feasibility of the technique and provides a basis for the further development of studies dedicated to TOUSS-TL. The contribution should be interpreted as one of feasibility and clinical exploration, not as definitive validation of a generalizable indication.

The fifth contribution is positioning TOUSS as a realistic strategy for centers without access to robotics. Instead of presenting the absence of a robotic platform as an absolute limitation, the thesis proposes an accessible technological alternative based on endoscopic instruments, ultrasonic energy and specialized surgical experience. This perspective is relevant for healthcare systems in which the costs of robotic surgery limit patient access to modern minimally invasive treatments.

The sixth contribution is the structured functional evaluation of a significant cohort of patients with laryngeal neoplasms treated by transoral CO₂ laser surgery. The analysis included

137 patients and used validated instruments for voice, dysphagia and oral intake. By reporting results according to tumor stage and type of resection, the thesis contributes to clarifying the real functional impact of TLM in early laryngeal tumors and in selected T3 tumors.

The seventh contribution is the definition of a methodological approach that combines TNM/AJCC staging, assessment of general status, ELS classification and validated functional instruments within a common analytical framework. This structure allows a more complete assessment of therapeutic outcome, going beyond exclusively oncological reporting and introducing postoperative function as a major clinical result.

Through these contributions, the thesis supports the adaptation of modern transoral surgery to ENT oncological practice in Romania. The personal contribution does not consist only in presenting clinical results, but in formulating an integrated clinical perspective: transoral surgery must be oncologically safe, functionally justified, technically feasible and applied only to patients in whom the anticipated benefit exceeds the risk of multimodal treatment or insufficient resection.

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List of Published Papers

1. Rujan SA, Bertesteanu SVG, Grigore R, et al. A Review and Comparative Analysis of Transoral Surgical Treatment versus Conservative Management in Early-Stage Oropharyngeal Cancer. *Journal of Personalized Medicine.* 2024;14(3):283. doi:10.3390/jpm14030283. <https://pubmed.ncbi.nlm.nih.gov/38541025/>

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3. Paper 3 – citation and link.