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What is This?
Laryngeal Advanced Retractor System: A New Retractor for Transoral Robotic Surgery

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Currently, applications for transoral robotic surgery (TORS) in the treatment of oropharyngolaryngeal tumors are being explored.1-3 Early results indicate that TORS may provide advantages over traditional surgery in the areas of organ preservation, development of functional recovery, and improvement in oncologic outcomes. Multiple small case series have been published in the literature describing the learning curve required for the successful application of TORS techniques. One advantage of TORS—after the technical learning curve has been passed—is a reduction in the overall surgical time. However, despite this reduction in surgical time, the time needed for the initial exposure of the surgical site, as well as additional time for retractor repositioning, does not diminish significantly with surgeon experience.1-3

On the basis of these findings and our own operative experience with existing systems, we determined that the exposure for TORS may be difficult because the retractors available were not optimally designed. Therefore, we developed a new instrument for exposure—the Laryngeal Advanced Retractor System (LARS; Fentex, Tuttlingen, Germany)—to make exposure for TORS more readily accessible.

This report presents our experience with the new retractor from the first 5 patients in whom it was used.

Materials and Methods
This report is a descriptive case series from a tertiary referral center, comprising patients who underwent TORS using the LARS. We received approval from our institutional review board (Ethics Committee, Louvain University Clinics of Mont-Godinne, Belgium) to conduct this study. Still photography and video capture were used to document the procedures.

Figure 1. The Laryngeal Advanced Retractor System (LARS) features. 1, Adaptable and removable vertical bars. 2, A very large set of blades and 3 screwing devices allowing the movement of the blades in multiple directions.

Description of the New Retractor
Features unique to the LARS system (Figures 1 and 2):
• A framework with bended curves to adapt to the shape of the patient’s face
• A framework extending horizontally to make the movement of the robot arms easier
• Adaptable and removable vertical bars to attach additional instruments
• A large choice of blades
• Two systems allowing the movement of the blades in multiple directions
One ratchet system to assist with the vertical suspension process

Results
We were able to obtain exposure with the LARS in 5 successive patients: 2 with T1 oropharyngeal tumors, 1 with a T2 supraglottic tumor, 1 with hypertrophy of the palatine tonsils, and 1 with a schwannoma of the parapharyngeal space. The average setup time was 30 ± 15 minutes, including the insertion of the robot arms. The average operative segment time was 75 ± 44 minutes. The time of exposure was not different from the mean time of exposure when using other retractors in our patients; however, because of the reduced interference with robotic arms, we had to change the position of the retractor and/or the robotic arms less frequently. No complications were related to the use of the LARS.

Discussion
Transoral robotic surgery is gaining greater acceptance for the management of head and neck tumors. However, the major difficulty encountered with TORS is the ability to obtain exposure of tumors and the operative field transorally. Difficulty with exposure is often because of tumor location and volume, the patient’s anatomic features such as a small mouth, the large size of the robotic arms, and the characteristics of the existing retractors.

Until now, there were only 3 retractors available for exposure during TORS. First, the Dingman mouth retractor (Mueller, San Diego, California) with adjustable blades for cheek retraction achieves satisfactory exposure, unimpeded instrument movement, precise handling of tissue, and an ability to perform endolaryngeal suturing for lesions in the oral cavity and oropharynx. However, the Dingman does not allow adequate exposure of the larynx and hypopharynx. Second, the Crow-Davis mouth gag (Storz, Tuttingen, Germany), which can be used for radical tonsillectomy, has the same limitations as the Dingman in that it cannot be used for exposure of the larynx.

Third, the Feyh-Kastenbauer (FK) retractor (Gyrus ACMI, Southborough, Massachusetts) was the only suitable retractor for supraglottic partial laryngectomy and hypopharyngeal tumors. However, although the FK retractor allows exposure of the hypopharynx and supraglottic larynx, this particular retractor often restricts insertion and access of the robot arms due to the vertically oriented framework. Moreover, it is not possible to clip additional instruments for assistance with exposure onto the FK retractor.

The LARS as proposed is better adapted to human anatomy, as well as the features of the robotic arms. This facilitates access to the larynx and hypopharynx when needed. The LARS was conceived with a framework extending horizontally (Figure 3). The framework is curved to adapt to the shape of the patient’s face. The vertical bars are adjustable and...
provide the surgeon with the ability to attach additional instruments when needed. The LARS is provided with a large choice of blades. Therefore, this one retractor can be used in the oral cavity, oropharynx, hypopharynx, larynx, and upper esophagus. The LARS has also 2 threaded adjustment systems allowing the vertical blades to slide upward and downward as well as backward and forward. Finally, the retractor is fitted to facilitate the suspension process and to allow small adjustments that are crucial for adequate exposure.

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Author Contributions
Marc Remacle, conception and design, revision, final approval; Nayla Matar, conception, design, acquisition of data, analysis and interpretation of data, drafting the article, final approval; Georges Lawson, conception and design, revision, final approval; Vincent Bachy, acquisition of data, revision, final approval.

Disclosures
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