CASE REPORT – OPEN ACCESS

International Journal of Surgery Case Reports 10 (2015) 173–175

Contents lists available at ScienceDirect

International Journal of Surgery Case Reports

journal homepage: www.casereports.com

Transoral surgery for oropharyngeal tumors using the Medrobotics® Flex® System – a case report

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ARTICLE INFO

Article history:
Received 13 November 2014
Received in revised form 13 March 2015
Accepted 14 March 2015
Available online 18 March 2015

Keywords:
Head and neck cancer
Robotic surgery
Transoral surgery
Oropharyngeal tumor

ABSTRACT

INTRODUCTION: Transoral resection of pharyngeal tumors with acceptable oncological and functional results can be challenging due to their location in a narrow anatomic space.
CASE PRESENTATION: In this case report, we demonstrate successful visualization and resection of a squamous cell carcinoma of the oropharynx using the novel Medrobotics® Flex® System.

The Medrobotics® Flex® System (Medrobotics Corp., Raynham, MA, USA) is an operator controlled flexible endoscope system that includes a rigid endoscope and computer-assisted controllers, with two external channels for the use of compatible, 3.5 mm flexible instruments.
DISCUSSION: In a 74-year old female patient a T1 squamous cell carcinoma of the oropharynx was visualized and completely resected using this system.

The Medrobotics® Flex® System is a promising device for transoral approaches in resection of tumors within the pharynx.
CONCLUSION: Good visualization, access, and flexibility of the endoscope and instruments are hereby clear advantages of the system compared to commonly used systems.

1. Introduction

Transoral resection of tumors within head and neck region can be a challenge due to restricted proper access to the targeted region. As a less invasive approach compared to open surgery, transoral surgery aims for improving functional and cosmetic results in patients with head and neck cancer.

Transoral laser microsurgery (TLM) has been applied for many decades in the treatment of pharyngeal as well as laryngeal lesions with satisfying oncological results and improved functional results [1–3] compared to open approaches. Limitations of this method include the resection in a strict unilateral direction not allowing for resection around corners without manipulation on the tissue and frequent rearrangements of retractors or laryngoscopes.

In recent years, transoral robotic surgery (TORS) was introduced and rapidly adopted, especially in North America, where TLM is not widely applied. The most commonly used robotic system nowadays to perform TORS is the da Vinci Si robotic system (Intuitive Surgical®, Sunnyvale, CA, USA). TORS has shown to achieve acceptable functional and oncological results in the treatment of patients with pharyngeal and supraglottic tumors [4–6]. However, as a system developed to be used in various surgical disciplines, including urology, gynecology, general surgery etc., the da Vinci system has tremendous short-comings for TORS, as instruments are bulky and rigid, and lack tactile feedback. Even very experienced TORS surgeons would appreciate smaller and more flexible tools to navigate through the narrow anatomic spaces within the pharynx and larynx, ideally in form of a single-port system. Especially, adequate exposure of structures distally from the base of tongue remains a challenge in TORS.

The Medrobotics® Flex® System (Medrobotics Corp., Raynham, MA – USA) is an operator controlled flexible endoscope that includes a flexible endoscope and computer-assisted controllers, consisting of numerous articulating segments that are capable of rotating and provide lateral motion [7,8]. The endoscope is comprised of two segments, an inner and outer segment, which are arranged in a concentric mechanical assembly to form the endoscope. The distal segment, which is controlled by the surgeon using a joystick-like controller, embodies a digital camera providing HD vision, three LED lamps, a lens washer, and two external accessory channels. The endoscope is equipped with two external accessory channels for introducing 3,5 mm flexible instruments (Design

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http://dx.doi.org/10.1016/j.ijscr.2015.03.030

Fig. 1. (A) Photograph of the set-up of the Medrobotics Flex System during intraoperative use. The system consists of the Flex Console, which houses the physician control handle, a touch screen visual display, and the touch screen monitor (1); the Flex Base, a reusable assembly that translates electronic signals from the console into mechanical motions; to which the Flex Scope, a sterile, single-patient-use component, which contains the multiple articulating links, the vision system and instrument channels for deployment in the patient (2). (B) Photograph of the physician control handle.

Standards Corporation, Charleston, NH, USA). The surgeon moves the endoscope under visual control on a monitor on the Flex console. The Medrobotics® Flex® System consists of four primary components: (A) the Flex console which houses the physician control handle, a touch screen visual display and the touch screen monitor, (B) the Flex base, a reusable assembly that transfers electronic signals from the console into mechanical motions, (C) the Flex Scope, a sterile, single-use component that mounts on the Flex Base and houses the Endoscope and components to move the Endoscope, and the (D) Flex Cart and Stand as support for the Flex Base and Flex Scope. The system is aligned at the distal part of the operating table to reach the oral cavity (Fig. 1A). The system is driven by the physician control handle on the Flex console under visual control (Fig. 1B).

This system is particularly designed to provide visualization and access for surgical procedures, which require a nonlinear advancement of surgical instruments, such as in transoral surgery.

In this case report study, we demonstrate successful visualization and resection of a T1N0M0 squamous cell carcinoma of the oropharynx using the Medrobotics® Flex System in a 74 year old female patient.

2. Case presentation

A 74-year old patient, who is status post primary radiochemotherapy for a T3N2bM0 squamous cell carcinoma of the hypopharynx present with dysphagia on the regular follow-up examination. Upon examination a suspicious lesion was evident on the left anterior palatal arch. The patient underwent a orohypopharyngoscopy and biopsy, which confirmed the diagnosis of a T1N0M0 squamous cell carcinoma of the left oropharynx (Fig. 2A).

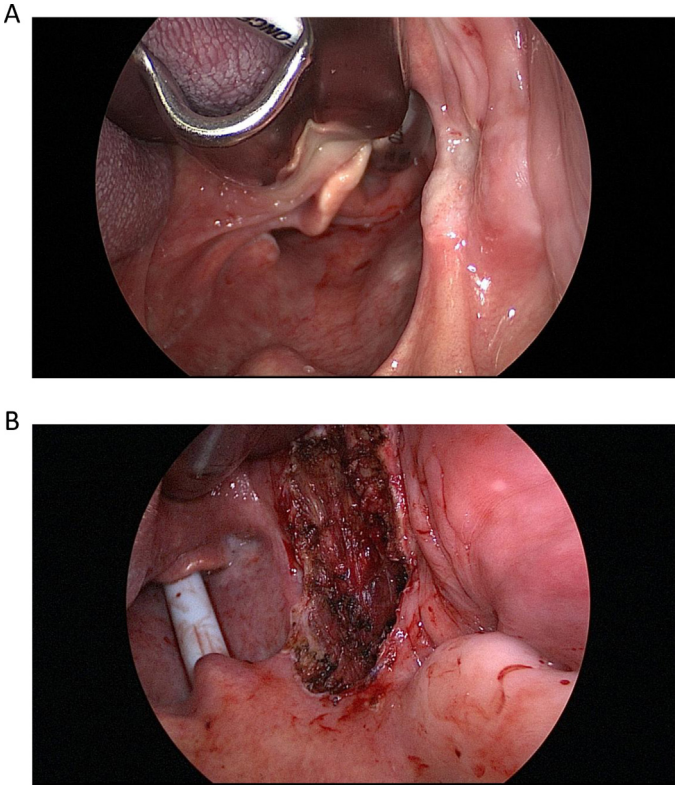

Fig. 2. (A) Preoperative endoscopic picture of the lesion in the right oropharynx. (B) Postoperative result after resection using the Medrobotics Flex System. The size of the defect is explained by the visible mucosal alterations beyond the tumor margins visible under high magnification.

The tumor resection was ultimately performed using the Medrobotics Flex System under general anesthesia. The patient was placed in a supine position on the operating table. An endotracheal tube was inserted transnasally. The Flex System was positioned next to the surgical table and arranged to approach the oral cavity.

The procedure was performed using the McIvor mouth gag (NovoSurgical, Oak Brook, USA) with a size 2 blade. A 3.5 mm grasper was used for tissue retraction and manipulation, and a 3.5 mm-cauterizing instrument for resection. The obtained frozen sections were all negative for tumor cells (Fig. 2B). The patient made a full recovery and was discharged home six days after the procedure.

3. Discussion

Minimally-invasive surgical techniques in the treatment of head and neck cancer have been developed with the desire for better functional and cosmetic results compared to radical open approaches without sacrificing oncological safety.

Here we present our experience in using the Medrobotic Flex System for visualisation and resection of an oropharyngeal tumor. The procedure was completed successfully with obtaining negative margins under general anaesthesia. For resection, we used a monopolar cautery, however, there is a commercially available laser fiber holder that is compatible with this novel system.

Transoral head and neck surgery would benefit from a system providing access to deep anatomical structures within in the pharynx and especially larynx by conforming to the given anatomy without causing trauma to surrounding tissue. Additionally, the ability to introduce multiple instruments along this predefined path to reach the anatomical site of interest would be greatly beneficial.

The Medrobotics® Flex System addresses the limitations of current robot and laser technology by providing an operator-controlled flexible endoscope system, which can be maneuvered in a nonlinear fashion to targets within the pharynx, and larynx. The presented case would be also suitable to be approached using other established transoral methods such as laser technology or the da Vinci robotic system, however this system allows for introduction of flexible instruments along the pre-defined path to perform surgery, an advantage which will be more apparent in further distally located lesions.

The procedure presented in this case report was completed successfully in an adequate time frame. The case would be also suitable to be approached using laser technology or the da Vinci robotic system set-up time of the system for beginners is very short and easy compared to times reported for setting up the da Vinci system.

In the present case report, feasibility in visualisation and resection of an oropharyngeal tumor within the oropharynx using the Medrobotics Flex System was demonstrated. Neither adverse nor unanticipated events have occurred and we found the system as easy to use and safe in performing this procedure.

The system is currently under development and trialed by four institutions in Europe.

Conflict of interest

All authors declare that they have no conflict of interest.

Sources of funding

No sources of funding.

Ethical approval

No approval required.

Consent

A written consent from the patient was obtained, which can be provided upon request.

Author's contribution

Magis Mandapathil: concept and design, surgery, writing paper, data analysis and interpretation.Umamaheswar Duvvuri: study concept and design.Christian Güldner: data analysis and interpretation.Afshin Teymoortash: data analysis and interpretation.George Lawson: concept and design, surgery, writing paper.Jochen A Werner: writing paper, data analysis and interpretation.

Guarantor

Magis Mandapathil.

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