Dr. Ryan K. Orosco: robotic surgery will make surgery safer and help to enable challenging procedures

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Editor's note

The focused issue "*The Management of Thyroid Tumors in 2020 and Beyond*" edited by Drs. Jonathon Russell and Jeremy Richmon is going to be released in *Annals of Thyroid* (*AOT*) in the coming months. This issue aims to review the state-of-art in the management of thyroid pathology, to provide a venue for original research focused on remote access or minimally invasive thyroid management and to review the success at extending proven management strategies into new geographic regions. Taking this opportunity, we have done a series of interviews with the authors discussing the highlights of their articles and sharing their experiences or stories in this field. It is great honor for *AOT* to interview Dr. Orosco on his stories, recent research, and article "*Robotic autonomy in endocrine surgery*" contributing to the focused issue.

Expert's introduction

Dr. Orosco (*Figure 1*) is an Assistant Professor of Surgery at the University of California San Diego. He completed fellowship training in head and neck cancer and microvascular reconstruction at Stanford University School of Medicine following residency training in Otolaryngology at UC San Diego School of Medicine. He received his medical degree from Johns Hopkins School of Medicine.

Dr. Ryan Orosco specializes in head and neck surgery and reconstruction, and he cares for patients with head and neck cancer and thyroid and parathyroid disorders. Dr. Orosco is skilled in advanced reconstruction techniques, including microvascular free flaps, the transplant of tissue to restore function and appearance. He also is passionate about minimally invasive surgical techniques, such as transoral robotic surgery.

Presently, Dr. Orosco is engaged in collaborative research working with Professor Michael Yip, PhD in the UC San Diego Contextual Robotics Institute. Dr. Yip and Dr. Orosco are working on translational research that is devoted to advancing the field of robotic surgery by melding engineering and medicine. Dr. Orosco's research has been featured in numerous peer-reviewed publications, including *Oral Oncology*, *Laryngoscope*, *Thyroid*, *Nature Genetics*, and *JAMA Otolaryngology-Head and Neck Surgery*. He has authored book chapters on topics such as robotic surgery of the head and neck and surgical techniques in Otolaryngology.

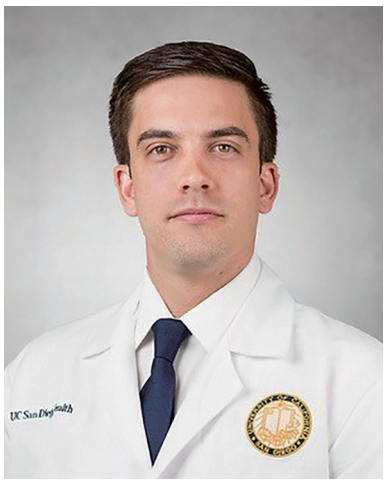

Figure 1 Ryan K. Orosco, MD.

Interview

AOT: What brought you to the field of ENT?

Dr. Orosco: Early-on in my medical education, I knew that surgery was the right field for me. I enjoy being creative and using my hands and tools to fix things. I was drawn to Otolaryngology because I was fascinated with the intricate anatomy with the cranial nerves and blood vessels, and the complexity of the form and function of the head and neck. I enjoy using technology to provide my patients with cutting

edge care, and there is a lot of tech in Otolaryngology-Head & Neck Surgery. Surgical robotics is an exciting technology to be able to offer patients because minimally-invasive surgery brings the potential for the chance for quicker recovery and better function and quality of life compared to alternative treatment options like open surgery or radiation-based therapy.

AOT: What was your proudest achievement until now?

Dr. Orosco: Outside of medicine, my proudest achievement was earning my Eagle Scout. That achievement was the culmination of a lot of years of work, and the lessons and skills that I learned through that process have been a strong guiding force in my medical career, and my life.

AOT: What research have you been working on?

Dr. Orosco: I use the surgical robot in the operating room and the research lab too. My main research efforts are aimed at incorporating engineering technology in robotic surgery so that it can be used safely and efficiently, in new and innovative ways. Robotic surgeons today can only operate on a patient if they are in the same room. I believe that in the future, robotic surgery will evolve to the point that surgeons are able to help patients beyond arms-reach in the operating room. The development of telerobotic surgery would allow surgeons of all specialties to operate on patients across town, or across the country. Currently, remote telesurgery is not feasible for several reasons, the most significant being that it is not as safe as current standard-of-care robotic surgery. In remote telesurgery, video and robotic control signals are delayed as they are sent back and forth between the surgeon's instrument controls and the robot that is with the patient, leading to unsafe surgical conditions. Before we can treat our patients with robotic telesurgery, we need to ensure that it can be performed efficiently, reliably, and safely. This is where exciting collaboration with robotics engineers comes in. We are working to bring things like augmented reality, creative control systems, and artificial intelligence and semi-autonomy to surgical robotics. We are testing technologies in the engineering lab, and translating them to more sophisticated surgical models so we can advance toward the realization of remote telesurgery. And I hope that the things we learn through this research can also be applied to traditional robotic surgery to make is safer and better.

AOT: In the focused issue "The Management of Thyroid Tumors in 2020 and Beyond", you have contributed an article on "Robotic autonomy in endocrine surgery". What is robotic autonomy? How does it apply to endocrine surgery today? And how might it apply in the future? Do you think an autonomous robot will replace a surgeon in the future?

Dr. Orosco: Robotic autonomy refers to the ability of a surgical robot to do work without direct surgeon control. You can think of robotic autonomy as a spectrum. The clinical robotic surgery technology of today is at the far left of the spectrum—without any robotic autonomy. Current surgical robots can be thought of as "robotic manipulators" that are essentially a mechanical extension of the surgeon's hands. The surgeon moves and grasps the robotic controller, and the robotic instrument carries out that motion without intelligence or alteration. The far right of the spectrum are fully-autonomous robots performing surgery without any surgeon involvement. This idea currently resides in the realm of science fiction and I don't foresee an autonomous robot replacing a surgeon anytime in the foreseeable future. We have autonomous, self-driving automobiles, but doing a surgery on a living human is many times more complex than driving a car.

Autonomy, and semi-autonomy, in surgical robotics is in its infancy, and I would say that autonomous robotic endocrine surgery is really yet to be born. There are potential ways that robotic autonomy could be applied to endocrine surgery in the future. Endocrine surgery has a unique set of constraints and considerations pertaining to access, exposure, delicate dissection of intricate anatomy, and potential role for novel imaging of tumors and nerves. I think what we will start to see is semi-autonomous robotic capabilities that will make surgery safer and help to enable procedures that were challenging or not-possible before. This goes for all realms of robotic surgery, including robotic endocrine surgery.

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Footnote

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