Is that a robot operating in your mouth?

If you were undergoing a Trans Oral Robotic Surgery (TORS) procedure, (and if you could answer), the answer would be "yes!"

TORS from now on here, is more than a high-tech surgical procedure using a daVinci robot. TORS avoids external incisions, mandibular splits, and tracheotomies. By using small robotic instruments and high-quality 3D optics, surgeons are able to provide minimally invasive surgery through the patients' mouth. TORS also allows smaller doses of adjuvant radiation therapy as well as sparing use of chemotherapy agents based on pathological findings from the primary site tumor resections and neck node surgical specimens.

My surgical colleagues, at University of Pennsylvania in Philadelphia, Drs. Bert O’Malley and Greg Weinstein, both Professors in the Department of Otorhinolaryngology - Head and Neck Surgery, are the co-inventors of TORS and have created a program to train US and international surgeons at our hospital. Over 200 surgeons have received this training. Of the almost 4,000 cases of TORS performed worldwide, almost 700 cases of have been done at this institution and I have had the privilege of participating in about a hundred of those. At the University of Pennsylvania, TORS is being currently investigated as a potential therapeutic modality for sleep apnea in the subset of patients with enlargement of lingual tonsils and or tongue base which contribute to the obstruction of the airway. The first 50 or so patients have done well and this has the potential to become a very common surgery involving a robotic approach.

The differences for TORS cases start with the room selection; all of the cases are posted in one of two very large operating rooms; this is not a case where intimacy with among the crew is a good thing. All the team members, both physician and nonphysician, have experience with the special demands of robotic cases. The patients are carefully selected and screened by the surgical team, sometimes during a prior trip to the operating room with direct laryngoscopy, esophagoscopy, and bronchoscopy. There is a common misconception among many of the patients that the robot will be "doing" the surgery and the surgical team will just be watching. On arrival we explain to the patient that the "robot" is always controlled by the surgeon and "robotic surgery" is probably misnamed, because it is actually better explained as "robotic assisted surgery;" but somehow that one crucial word has been dropped or lost, at least in the public domain!

Robotically assisted surgery was developed to overcome the limitations of minimally invasive surgery and enhance the capabilities of surgeons performing open surgery. In minimally invasive surgery, instead of directly moving the instruments, the surgeon uses a telemanipulator, which is a remote manipulator that allows the surgeon to perform the surgery via robotic arms that carry out those identical movements using end effectors and manipulators to perform the actual surgery on the patient. By incorporating computers, two advantages emerge; removal of tremors, from tiredness or aging, and the capacity to do this surgery remotely, from across the room or across the world!

Historically, the PUMA 650 robot was first used in 1985, to place a needle for a brain biopsy using computed tomography guidance. In 1988, the PROBOT was used to perform prostatic surgery. In 1992 ROBODOC was utilized in hip replacement surgery for precise milling. In the 1990s, the first robotic-assisted fallopian tubes were reconnected and heart bypass cases were performed. In the 2000s, remote cholecystectomy was performed (surgeons in USA with the patient in France), heart arrhythmias were corrected, pediatric neurogenic bladder reconstruction was performed, kidney transplant were all performed for the first time using robotic assistance. Intuitive Surgical and Computer Motion introduced the daVinci (by the former) and AESOP and Zeus systems (by the latter). Currently, the daVinci system is the most popular robotic system and retails for about $1.2 million, with the HD model retailing for about $1.75 million. This is accompanied by almost $1,500 in disposable costs per procedure. The cost and training continue to be major disadvantages in this approach to surgery. The advantages are less pain, smaller incision, fewer infections, quicker discharges, and more rapid return to work. The robotically assisted surgery has now encompassed pancreatectomies, Whipple’s, CABG, stent placement in interventional cardiology, atrial septal defect repair, mitral valve repair, bariatric surgery, fibroid removal, hysterectomies, myomectomies, stereotactic neurointervention,
total hip replacement, total knee replacement and anterior cruciate ligament repair, in the pediatric realm it has been used for trachea-esophageal fistula repair and Nissen fundoplication, and in urology for prostatectomies, nephrectomies, and even some bladder repairs.

Robotic surgeries will become even more applicable as experience increases and robots become smaller and user interfaces become more and more intuitive.

The anesthetic issues with TORS that are specific to this procedure and require attention include little or no access to the airway once the case starts; patients head turned 180 away from you, the need for complete paralysis, and the possibility of airway swelling at the end of the case along with a need to change the reinforced endotracheal tube (ETT) to a regular polyvinyl chloride one for intensive care unit (ICU) care. Many times at the end of the case, when the decision has been made to leave the patient’s trachea intubated and patient is sent to the ICU intubated, the surgical team assists by exchanging the ETT using their rigid suspension laryngoscope. Fortunately, the distant placement of the airway is partly acceptable due to the fact that your surgical team consists of the only surgeons that you trust to secure an airway, the otorhinolaryngologists, should you fail in all your nonsurgical attempts!

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