Harry Barberian Scholarship Application

March 3, 2017

Criteria:

* Originality of the research question and its importance
* Feasibility – do you have the skills and resources to carry out the study?
* Impact – long –term or short-term potential for application?

Applicant’s name: Arushri Swarup

Supervisor: Dr. Adrian James

Location of Laboratory or Institution: Hospital for Sick Children Toronto

Project Title:

Description: - in lay terms describe (500 words)

Objectives

The objective of this project is to evaluate and develop innovative surgical instruments for the new and growing technique of transcanal endoscopic ear surgery (TEES). TEES is performed by employing an endoscope, to visualize the surgical field, and instruments through the ear canal, eliminating the need for an external incision [1] [2]. As with traditional, invasive microscope-guided surgery, TEES allows the surgeon to perform common procedures such as ear drum reconstruction, tumor removal and bone repair [1].

TEES reduces the length of hospital stay, overall procedure cost and reduces scarring, which is very important to patients [3]. However, with all of these benefits, a survey of 80 Canadian otologists (ear surgeons) reported the adoption rate of TEES as less than 10% [4]. Although the literature has not yet reported specific reasons for this low adoption, one possible explanation is that existing instruments are developed for two-handed microscope-guided surgery and are not optimized for one-handed TEES, making the surgery challenging.

The Hospital for Sick Children (SickKids) in Toronto, the institution where the surgeon and graduate student are working on this project, remains one of the very few centres in North America where a surgeon completes the majority of middle ear procedures using TEES. Thus, SickKids and the University of Toronto provide the resources and skills to develop technology to complement this unique project to complement TEES.

This project aims to understand the limitations of current TEES tools to develop criteria against which new, better surgical instruments can be designed to facilitate and increase the use of TEES. The following methodology will be employed to direct this project. Firstly, a survey will be sent out to ask expert ear surgeons around the world to rate the importance of various tool functionalities. Secondly, a time flow study will record the duration of steps during surgery, performed by experienced endoscopic ear surgeons at SickKids. The results of these studies will help determine what types of tools are required by surgeons and what the current inefficiencies are during TEES. A Research Ethics Board application has been submitted to SickKids for these two studies. Next, by using the resources available at the CIGITI lab at SickKids, a virtual model of TEES will be created. This model will integrate the barriers of the ear canal, endoscope, and instrument, to provide a platform to develop new tools for TEES. These novel instruments will thus have improved functionality within the constraints of the ear canal. 3D ear-canal models are being developed from CT scans of patients who are candidates for TEES surgery. This will provide a platform for developing novel instrumentation.

After development, the tools will be tested in cadaver models by surgeons to obtain feedback to optimize the tool so it can later be used in patients in the operating room, thus having a long lasting impact on the future of TEES.

These studies will identify the ways in which instruments can be designed to ease TEES for surgeons which will aim to increase its use and send patients home sooner and safer.

**Significance:** These studies will identify limitations of existing instrumentation at different levels, and will provide criteria for the development of novel, safe and efficient TEES tools which will be disseminated in otolaryngology publications. As well, in collaboration with other minimally invasive tool innovation at CIGITI, a functional prototype instrument was designed and tested by the supervisor and student to facilitate ear drum reconstruction surgery. Thus, this project represents a valuable collaboration within minimally invasive tool development research. The new instruments will aim to facilitate minimally invasive TEES which would thereby reduce surgical morbidity, length of hospital stay and associated costs to ensure patients can return to their normal lives safely.

Potential Impact of the findings:

Detailed Budget