O190 - Robotics, Telesurgery and Virtual Reality

A Single Surgeon's Learning Curve of Robot-Assisted Colorectal Surgery

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Aim: To investigate the learning curve of Robot-Assisted Colorectal Surgery (RACS).

Methods: RACS was implemented in December 2014 and all data was registered in a prospective outcome database. Consecutive patients operated by an experienced laparoscopic colorectal surgeon from the first patient until December 2016 were included. Casemix parameters included age, sex, BMI, ASA classification, type of resection performed and type of pathology (benign vs. malign). The primary outcome parameter was total operative time and other outcome parameters were surgical operative time, non-surgical operative time, conversion rate, severe complications (Clavien-Dindo grade≥3), reoperation rate, hospital length of stay and mortality. Centered exponentially weighted moving average analysis was used to create graphical learning curves and CUSUM analysis was used to calculate when the plateau was reached if a learning curve was found.

Results: One hundred and six patients were included. Sixty-two percent was male, mean age was 69 years, mean BMI was 26 and patients were classified as ASA 1 (24%), ASA 2 (57%) or ASA 3 (19%). Patients underwent right hemicolectomy (27.4%), left hemicolectomy (1%), sigmoid resection (34.9%), low-anterior resection (29.2%) or abdominoperineal resection (7.5%). Total operative time decreased from 190 min to 169 min at the plateau, which occurred after 28 cases. In regression analysis, this could be explained by casemix or type of resection. Surgical operative time decreased from 139 to 124 min and non-surgical operative time decreased from 51 min to 46 min. No learning curve effects were found regarding other, clinical outcome parameters. The conversion rate was 2.8%, severe complications occurred in 18.9% and the reoperation rate was 12.3%. Median hospital length of stay was 5.5 days and 30-day mortality was 0.9%.

Conclusion: Implementation of RACS is associated with a learning curve of approximately 30 cases for operative time. No learning curve was found regarding clinical outcome parameters and we conclude that RACS was successfully implemented without causing learning associated morbidity to patients.

O191 - Technology

Usefulness of Mems-Based Optical Coherence Tomography in Intraoperative Evaluation of Lymph Node Status of Laparoscopic Gastrectomy in Gastric Cancer

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Background: Evaluation of lymph node (LN) status is an important factor for detecting metastasis and thereby staging gastric cancer. Currently utilized clinical techniques involve the surgical disruption and resection of lymphatic structure for histological examination. While these techniques are reasonably effective at detection of macrometastasis, the majority of the resected lymph nodes are histologically negative. Improvements need to be made to better assess the microarchitecture of lymph nodes, minimize or eliminate lymphatic disruption complications, and provide immediate and accurate intraoperative feedback for in vivo cancer staging to better guide surgery. In contrast to all other imaging techniques that either require resection, bisection, and disruption of lymph nodes, or offer insufficient resolution to visualize morphology in situ, microelectro-mechanical system (MEMS)-based three-dimensional optical coherence tomography (3-D MEMS OCT) imaging can be performed through the intact capsule of surgically-exposed lymph nodes that can remain in situ.

Methods: A unique MEMS optical scanning technique was used to make miniature OCT probes that can directly fit into the biopsy channel of laparoscopes. We evaluated the use of 3-D MEMS OCT, a high-resolution, noninvasive, label-free imaging modality for the intraoperative assessment of human LNs for advanced gastric cancer. The ROC curve was used to analyze intraoperative OCT LN images for presence of metastasis, using co-registered postoperative pathologic result as the gold standard.

Results: Our preliminary findings suggest that intraoperative OCT imaging of LNs using the MEMS OCT probe is an appropriate, label-free, non-invasive alternative to frozen-section analysis, potentially offering faster interpretation and results to empower superior intraoperative decision-making.

Conclusions: Intraoperative OCT enabled by MEMS technology has strong potential to supplement current post-operative histopathology with real-time in situ assessment of LNs to preserve both non-cancerous nodes and their lymphatic vessels, and thus reduce the associated risks and complications from surgical disruption of lymphoid structures following biopsy.

O192 - Technology

From 'Big Data' Meaningful Use of Real Time Data on Smart Visors in the OR

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Background: In the Academic Medical Center (AMC) Amsterdam, the Netherlands, a Surgical Black Box®, developed in St. Michael's hospital Toronto (Canada) in collaboration with Air Canada, was installed in one of the endoscopic Operating Rooms (OR's). This medical data recorder analyzes perfectly synchronized data. The data is being generated from the actual use of the Olympus Endosuite, and is stripped from personal identifiers. Data includes laparoscopic videostream, videostreams from OR ceiling cameras, OR sounds, door movements, OR temperature and patient biometrics during operation. Aforementioned data is used to create a performance report for postoperative debriefing of the OR team.Ideally, feedback is not provided solely postoperative, but also intra-operatively when considered to be relevant. Adverse events or errors in the OR are usually not an isolated incident, but part of a cascade. By providing relevant real time feedback on a head-mounted display, relevant information is 'in focus'; making such information hard to ignore instead of easy to miss. It is interesting to explore and investigate action and reaction on such real time cues. Resulting actions are recorded in the Black Box® OR, so information can be used in root-cause analysis of accidents.

Aim: First, to identify which data are considered to be suitable and considered relevant for real time feedback in laparoscopic surgery. Second, to identify the optimal routing for such feedback and third, to decide on optimal timing for data to alarm users during surgery. For this purpose, surgeons with expertise in laparoscopic intra-abdominal surgery were surveyed.

Methods: A Delphi study was conducted within the AMC Amsterdam. A total of 33 experts in laparoscopic intra-abdominal surgery was approached. This Delphi study consists of three iterations, in the first rounds the panel is asked to generate ideas, in the second round expert panelists will prioritize their ideas and in the final iteration agreement amongst panelists is measured.

Results: During this presentation the results of this Delphi analysis will be presented, recommendations stated and future initiatives explained.

O193 - Technology

Smart Use of Wearables in Reducing Intraoperative Muscular Stress During Laparoscopy

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Background: Performing laparoscopic surgery can be physically challenging. Prolonged duration of high levels of muscular stress may cause ergonomic problems and physical discomfort. This phenomenon is known in literature as "minimal access surgery (MAS)-related surgeon morbidity syndrome". A common complaint is having physical strain of the upper extremity, most often reported in the dominant forearm and by beginning laparoscopic surgeons. This can be explained by the fact that less experienced surgeons have less laparoscopic skills and, as a consequence, tend to have higher muscle tension when operating. As for patient safety, the risk of operating with high muscle tension is that movements tend to grow rougher and be less precise. The Myo armband by Thalmic Labs, is an armband capable of capturing real-time surface electromyography (sEMG) measurements that can be worn under the sterile overcoat on the forearm. Myo can be calibrated to the users normal muscular tension. When tension is out-of-normal boundary, the laparoscopic surgeon can be provided with real time haptic external biofeedback during surgery that cannot be ignored. As a result, sEMG biofeedback may reduce (MAS)-related surgeon morbidity syndromes.

Aim: Before real time feedback can be provided, an individual's normal muscle tension patterns when performing laparoscopic tasks must be determined. This study aims to identify individuals normal muscle tension patterns in the non-dominant as well as the dominant forearm, and second to define thresholds for exceeding normal tension profiles for providing a biofeedback signal to the user. Together with TedCas a personalized biofeedback signal is developed for prevention of the minimal access surgery syndrome.

Methods: Laparoscopic surgeons from the department of urology, gynecology and surgery with different levels of experience are included in the study. Of participants, a baseline sEMG of the forearm is established and an optimal tension profile created. Participants perform predefined laparoscopic tasks in a calibrated simulation setting, while sEMG values will be continuously measured with the Myo armband; one group receiving biofeedback of Myo when muscular thresholds are surpassed and one group without biofeedback.

Results: During this presentation the study protocol is discussed and results will be presented.