Can Artificial Intelligence Assist Surgeons Identify Landmarks During Laparoscopic Cholecystectomy Surgery?

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Introduction

• The artificial intelligence software Cholecystectomy AI/Surgeon’s JARVIS (JARVIS) may help train students and residents to better identify anatomical landmarks and avoid complications during Laparoscopic Cholecystectomy (LC).

• Bile Duct Injury (BDI) is a devastating adverse outcome of LC with an incidence of 2,500/year, primary cause being misidentification of anatomy.1-6

• JARVIS may help to correctly identify critical anatomical landmarks intraoperatively.

Methods

• Twenty-five (25) photos of purported Critical Views of Safety (CVS) were analyzed using JARVIS.

• The photos were scored by the evaluators using a published 6-point scale (6PS)7 for analyzing the CVS.

• 6PS is based on structures going into the gall-bladder, visualization of the cystic plate, and a cleared Hepatocystic Triangle.

• Medical students (3), a surgery resident (1), and an attending surgeon (1) evaluated the photos.

• Spearman’s statistical analysis was used to determine correlation between the subjects’ 6PS and JARVIS data.

• Fig.1 and Fig.2 show JARVIS analyses of well-achieved CVS and a poorly-achieved CVS, respectively.

Results

• The attending’s and resident’s 6PS evaluations were more significantly correlated to JARVIS’s output than the medical students’ 6PS—when all evaluators were blinded to the output of JARVIS.

• When all evaluators were able to use JARVIS’s output to help score the 6PS, the surgery resident, MS1, and one MS3 exhibited statistically significant improvements in their correlation between 6PS and JARVIS outputs.

• The attending surgeon exhibited the most significant correlation when blinded to JARVIS, and the least significant correlation with the aid of JARVIS.

Discussion/Conclusions

• Without the aid of JARVIS, the more experienced surgeons had the greatest correlation with the output of the artificial intelligence software.

• This affirms that experience plays a role in the correct identification of anatomical landmarks during LC.

• The less experienced evaluators exhibited the greatest improvement, compared to the attending surgeon.

• Reflecting on the attending’s numbers, the data suggests that while JARVIS may not be an effective tool to help experienced surgeons identify LC structures, it could still play a major role in the education of medical students and residents.

Future Plans

• To collect more analyses performed by medical students, surgical residents and surgery attendings.

• The attending surgeon will be used as the ‘gold standard’ to which the students and residents’ performance compared to the attending surgeons’ analysis.

• Performances done by the students and residents will be compared to the analyses done by experienced surgeons—with and without using JARVIS.

• This would better assess JARVIS as a teaching tool, bringing the abilities of students and resident physicians closer to those of experienced surgeons.

1. Schreuder AM;Busch OR;Beselentink MG;Grijpstra P;Gulansen A;Barnes JO;Gillen GL. TIM; (2019, January 17). Long-Term Impact of Iatrogenic Bile Duct Injury. Retrieved October 23, 2020, from https://gastro.wustl.edu/publichealth.wustl.edu/50614366/882