Analyzing Stapler Kinematics to Predict Per Os (PO) Intolerance after Robotic Sleeve Gastrectomies

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Introduction

Multiple studies have shown that the shape of the stomach in sleeve gastrectomies can affect patient outcomes, but limited research has defined the best way to achieve the optimal sleeve shape. Robotic surgery allows for the collection of precise kinematic and event data including the angles at which a stapler is fired. We hypothesize that the angles at which a stapler is fired determine the sleeve shape and can influence post-operative outcomes including per os (PO) intolerance.

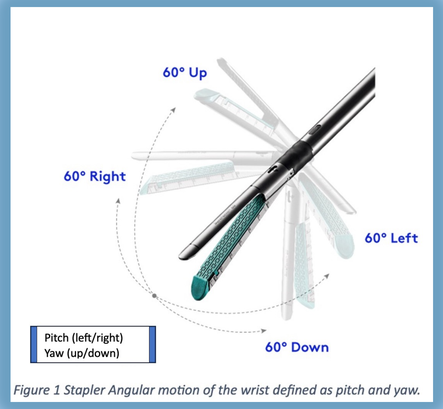


Figure 1 Stapler Angular motion of the wrist defined as pitch and yaw.

Methods

The Intuitive da Vinci Surgical system and data Recorder was used to record 344 sleeve gastrectomies from our tertiary hospital center from November 2020 to April 2023. The sleeve was tailored over a 40 Fr Bougie and stapling was started at 6 cm from the pylorus from the midline port in all cases. Two different objective performance indicators (OPIs), pitch and yaw, were analyzed from the robotic stapler during the first and second stapler fires (figure 1). Patients who presented with severe PO intolerance, determined by vomiting more than once daily in the first 6 months after the procedure, underwent esophagastroduodenoscopy (EGD) +/- dilation. An independent samples t-test was then performed between the two groups for each outcome and the three OPIs.

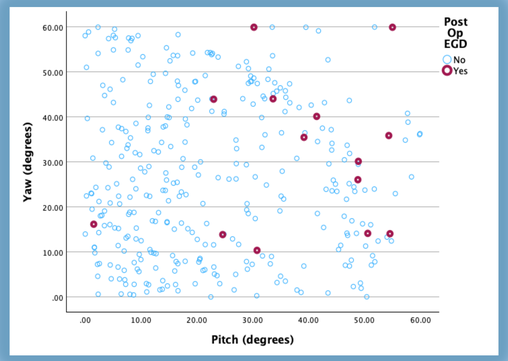


Figure 2 Pitch and Yaw of First staple fire for patients with PO intolerance

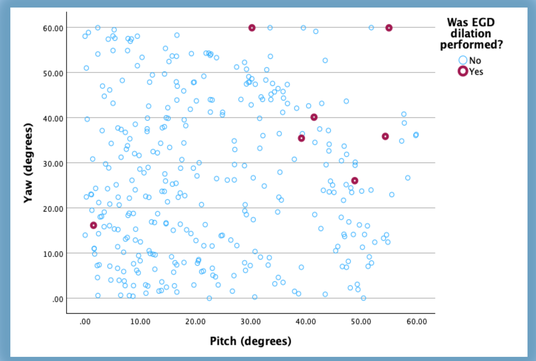


Figure 3 Pitch and Yaw of First staple fire for patients requiring EGD dilation

Results

Fourteen patients were found to have severe PO intolerance and underwent post operative EGD with 7 undergoing dilation with achalasia balloon (15-40 mm). Pitch and yaw were analyzed from these two groups and the mean pitch of the first stapler fire for patients with severe PO intolerance is 38.3 degrees compared to 22.4 degrees for those without PO tolerance (p=.002)(figure 2). The mean pitch of the first stapler fire for patients who underwent dilation is 38.6 degrees compared to 22.8 degrees for those who did not undergo dilation (p=.009)(figure 3). Yaw of the first stapler fire was not significantly different between the two groups for neither those with severe PO intolerance or EGD dilation.

Conclusions

Our findings demonstrate that, with the aforementioned port configuration, having a steeper left to right angle with the first staple fire may result in outflow obstruction and therefore PO intolerance amongst patients. This study is the first step in identifying ideal stapler angles to prevent post-operative complications and could have significant impact on patient's well-being after sleeve gastrectomy.

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