A cost-effective milestone based training protocol on 3D printed model for gastric bypass surgery

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Objective

To design a novel training protocol and a 3D printed model for the Roux-en-Y gastric bypass (RYGB) surgery training, utilizing the concept of milestone, in order to achieve the training goal while saving the cost of both the models and staplers.

Methods

A series of 3D printed model for laparoscopic or robotic RYGB was designed, including the training box, the diaphragm, the stomach, the 4m-long jejunum, the surrounding organs such as the liver and the spleen were made with 3D printing technique, the 1cm thick posterior peritoneum was made as the underling background, which the crus and the origin of jejunum were both fixed onto, the connecting tissues including the posterior side of the stomach was made of polyethylene-foamed mat for simulation of the necessary dissection as in RYGB. After dissection, for very due stapling during the RYGB either on the stomach or jejunum, marked zone of the supposed position was made on both the stomach and jejunum, with commercially available invisible ink, which is only invisible with specific lighting on it, the lighting on the site will reveal whether the zone is mostly covered, to satisfactorily cover the zone means the accomplishment of a certain tasks called a milestone. On the accomplishment of one milestone with the staplers without firing, the trainee move to the next set of model, where the stomach will be replaced by a new one according to the supposed result of last step, for gastric pouch with series of stomach models from an intact one to one with one stapling, till the finalization of the pouch. The preparation of both limbs were similarly simulated, including measurement and stapling. Both the jejunum-jejunum anastomosis and gastrojejunostomy were set for hand sewn. Three residents and two bariatric surgeons practiced on this series of models, their performance were recorded and their opinions towards the models were reviewed.

Results

All procedures were accomplished. The residents took much longer time on each step to reach milestones than the bariatric surgeons, all of them think the models simulates the gastric bypass surgery well.

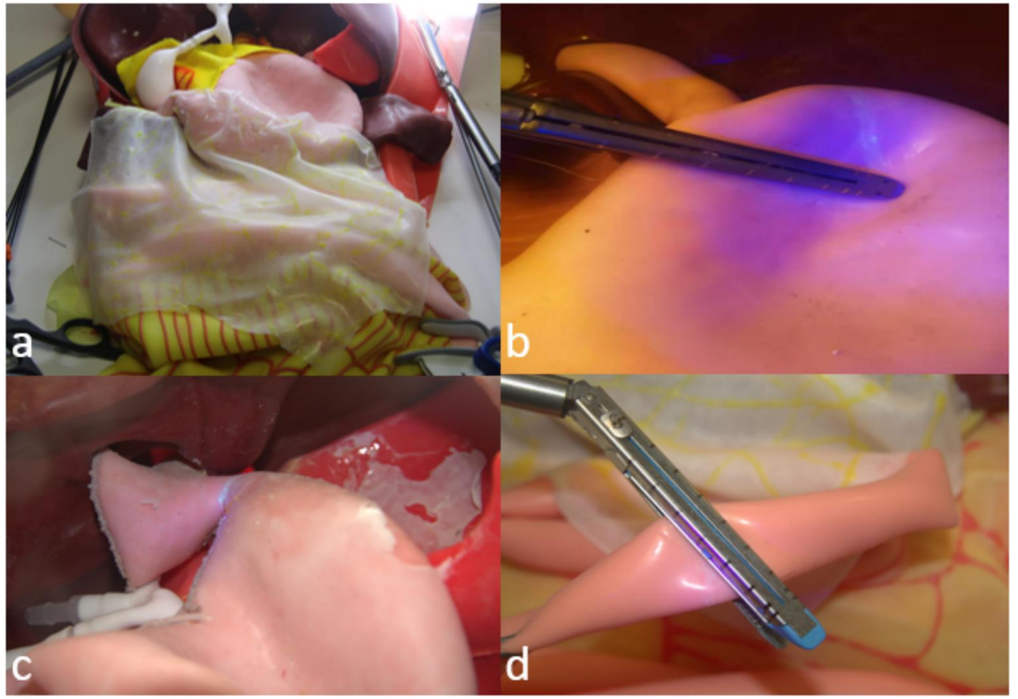


Fig 1. 3D printed model for gastric bypass surgery
a.3D printed model of the Roux-en-Y gastric bypass surgery
b. c. d. The cost-effective milestone technique

Conclusions

This study provides a novel RYGB training on 3D printed models. The milestones of each section of procedure creates a stepwise training protocol. By invention of invisible ink marking zones. Meanwhile, such training saves both the stapler and models.