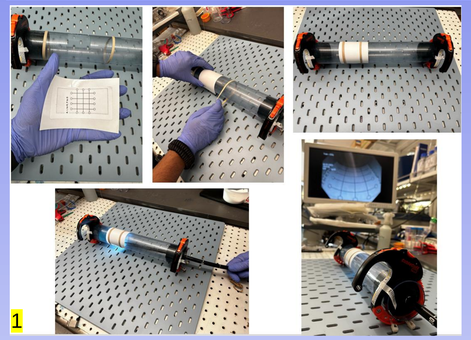
Teaching Advanced Colonoscopic Skills: A Modular Approach Utilizing Both Inanimate and ex vivo Bovine and Porcine Models

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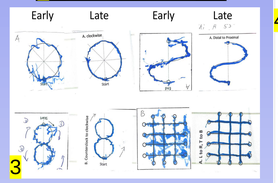
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Background/Aim

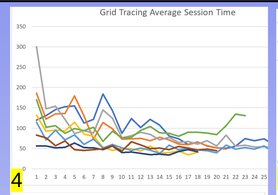
It is difficult to learn and become proficient in advanced colonoscopic procedures such as bowel wall injection (tattoo, mucosal lift), ESD, EMR, and mucosal wound closure.[1] Unique skill sets beyond those required for biopsy and simple snare polypectomy are required for these procedures. If all the training is carried out in the clinical arena, it may take many years to become proficient.[1] If inanimate (INAN) and ex vivo animal (EVA) models are used, and the component skills/tasks are practiced & performed multiple times over a relatively short period of time, skills can be mastered, and the training completed more quickly. Furthermore, the component skills required for ESD or EMR can be identified and taught separately via focused teaching modules. The ability to reliably inject the submucosal layer, finely control the moving scope tip (with knife extended) in 3-D, and close large mucosal wounds are examples of necessary skill sets. This poster presents a 5 module INAN and EVA training program designed for motivated residents, fellows, and attendings meant to be completed in 1 year's time.


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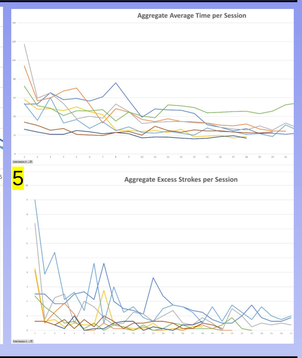

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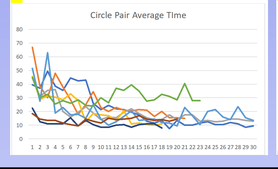
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Methods

The advanced colonoscopic teaching program includes 5 modules: 1) Bowel wall injections (both sclerotherapy needle & high-pressure puncture-less methods), 2) Inanimate figure tracing model (teaches scope tip control), 3) Ex vivo animal ESD in plastic tube, 4) ESD in intact ex vivo porcine large bowel, & 5) Mucosal wound closure. There is a mandatory teaching video and quiz for each module that must done before hands on training. Modules 1, 4, and 5 utilize intact ex vivo porcine large bowel (about 30 cm long including the colon, rectum, anus/sphincter) that comes frozen. Modules 2 and 3 utilize an inanimate hollow plastic tube with a rectangular window cutout over which either a piece of paper with a line figure or a full thickness piece of pig/cow colon is placed (with overlying Bovie pad); a round sponge with a central slit in placed at one end and serves as the anus. A brief description of each module follows. Please note that an endoscopic tower, dedicated non-clinical scope, and an assistant is needed. All sessions were videotaped, timed, and scored.

•**Module 1 - Bowel wall injections:** Goal is to learn to make and recognize submucosal bowel wall injections; each **trainee makes 40-60 injections using both methods over 1 hour session.**

•**Module 2 - INAM Figure Tracing:** Goal is to learn to finely control the moving scope tip which simulates use of needle knife. In each session, 8 line figures are traced with a sclerotherapy "pen"; a minimum of 12-15 sessions per trainee. [Note: Trainees must be able to generate mucosal lifts and to finely control the scope tip before starting the ESD modules.]

•**Module 3 - Ex vivo ESD in Plastic Tube**: Goal is to perform 20-30 full ESD excisions of a 2cm² mucosal disc in the hollow plastic tube model (no insufflation/perforation issues) using needle knife. A square of ex vivo cow or pig colon wall (+ Bovie pad) is placed over open window in the tube.

•**Module 4 - Ex vivo ESD in porcine large bowel** (most challenging): Goal is to perform 20-30 full ESD excisions of a 2cm² mucosal disc. Proximal end of colon is closed with zip tie, and Bovie pad placed around the bowel.

•**Module 5 - Mucosal Wound Closure:** Goal is for trainee to gain experience by closing 6-8 ex vivo pig or cow large bowel mucosal defects with endoscopic clips or X-Tack device.

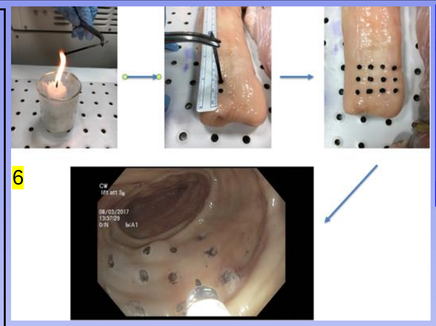
Results

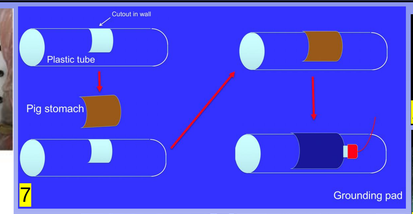
The number of trainees, thus far, for each section have been: bowel wall injection model, 10 (60-80 injections each); figure tracing model, 8; inanimate ex vivo bovine ESD model, 6 (10-20 cases each); bovine ESD, 1 (>20 cases); wound closure model, 1. It is anticipated that it will take 1 year to complete the full training if sessions are done every 2 weeks with the main limiting factor being the availability of the fellows and residents. Photos of the various models and some preliminary results from the figure tracing model follows. Of note, thus far, we have not vetted this training system as regards demonstrating, by comparing pre and post training clinical procedure results, the impact of this training on clinical practice. Subjectively, when the trainees were asked if they felt that the training had improved their overall endoscopic skills, 83% answered in the affirmative; 60% also felt that their C-scope insertion skills had improved.

Figures:

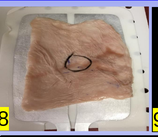
Left:
1) INAN tracing set-up
2/3) INAN tracing examples
4) INAN Grid/Circle times
5) INAN aggregate times

Right:
6) Bowel wall injection setup
7/8) Ex vivo plastic tube setup
9-12) Ex vivo ESD technique
13) Ex vivo porcine colon setup
14) Mucosal wound closure technique
15) Endo tower & ESD excision

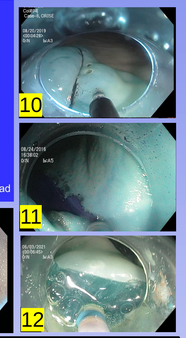

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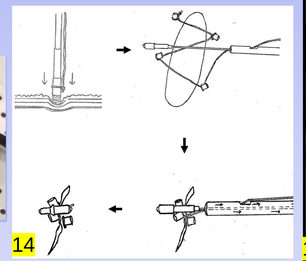
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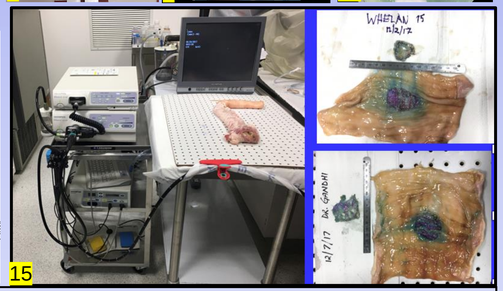

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Conclusion

It is the authors' firm belief that because of the relative paucity of advanced clinical cases in the U.S., novel advanced colonoscopic skills training programs that utilize non-clinical models are needed. Further, the individual skills that are collectively required to perform the most challenging method, ESD, can be more rapidly acquired via focused training models with well defined goals & finite training periods. It is our belief that repetition of a skill, maneuver, or procedure many times is critical to skill acquisition & retention. The training system presented above, we believe, fulfills these requirements. Clearly more trainees must complete the program & undergo evaluation pre & post training in the clinical arena.

References

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2. Whelan, R. L., MD. (2019, January). https://www.vumedi.com/video/ex-vivo-bovine-large-bowel-an-esd-training-model/
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