

Refinement and direct training strategies of intragastric catheter placement in the mouse to improve animal welfare and surgical outcomes

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Introduction

Microsurgeries performed in rodents are common for generating research models of human disease. These surgeries in mice possess risk factors for animal welfare if not performed appropriately due to the small size of the animals. Microsurgeries require a specific technical skill set. Equipment and training opportunities are often costly and may not be available for less common procedures. Thus, having the access and resources for such surgical training in an academic setting would be beneficial for animal welfare and advancing the availability and survival of research models in biomedical research. We used the intragastric catheter (IG) infusion model to assess the functional physiology of feeding circuits. This surgically complex procedure was utilized to compare whether direct training, that included new refined approaches, would improve the surgical outcome.

Methods

IG placement was performed in 165 C57Bl6 mice of 4-8 weeks of age, 88 were performed by surgeon 1 and 77 by surgeon 2. Both surgeons had basic to advanced understanding of aseptic techniques, suture methodology, and IG microsurgery procedure technique. Surgeon 2 received direct training by a University trainer, who is also a veterinarian with focus on refined surgical approaches on the IG placement, surgeon 1 was trained by a former lab manager. After assessing the training approaches on the surgical outcome, surgeon 1 was retrained by surgeon 2. The mice were followed for 2 weeks and the outcome was assessed as follows: 1) No complications; 2) minor complications with recovery; and 3) mortality.

Results

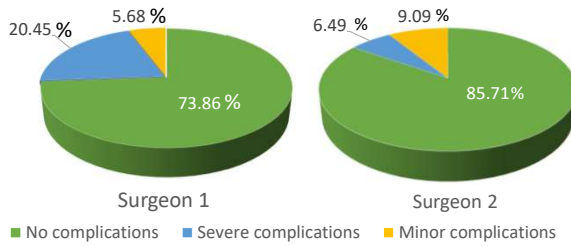


Figure A: The rate for no complication was 73% for surgeon 1 and 85% for surgeon 2, while severe complications resulting in mortality were higher with 20% for surgeon 1 compared to 6% for surgeon 2, respectively.

Common complications:	Surgeon 1	Surgeon 2
Difficult placement	0	3
Hemorrhages	1	6
Double suture of catheter	1	3
Hunched/dehydration	8	8
Vascular button reaction	2	6
Abscess	6	1

Figure B: List of common complications

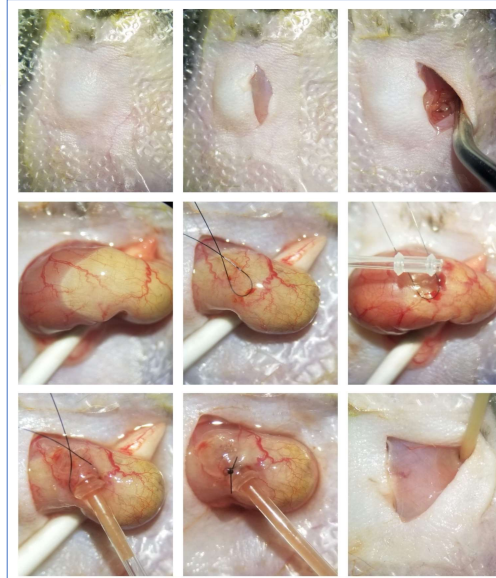


Figure C: Placement of IG catheter

Refined methods

- No anchor of the vascular button, leave it loose under skin
- Engage positive pressure using 1x weekly saline flush
- Cotton button soaked in saline before implanting (preferred over silicone)
- Change sequence of procedure - **Previous method:** First tunneling of catheter from neck to abdomen with more repositioning of animal with open abdominal space; **Refined method:** First IG placement (Figure C) and closing the abdomen before tunneling the catheter over scapula towards neck area; this leads to less repositioning and better maintenance of sterile field while abdomen is closed.
- Better recovery under isoflurane over ketamine/xylazine anesthesia
- Maintenance of aseptic techniques

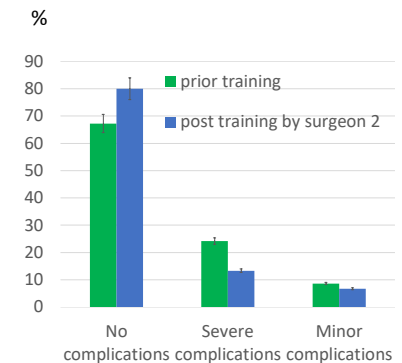


Figure D - Retraining for surgeon 1: The rate for no complications increased from 67% (39/58) to 80% (24/30) for surgeon 1 after receiving training from surgeon 2. Severe complications decreased from 24% (14) to 13% (4) and minor complications decreased from 8.6% (5) to 6.6% (2). 30 surgeries were performed after being retrained.

Conclusion

These results confirmed that the inclusion of refined approaches in the IG model under direct training is beneficial for the surgical outcome, animal welfare and research outcome.