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SPARC - Acute surgery and experimentation of the gastrointestinal tract and vagus nerve in the ferret

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1 Works for me dx.doi.org/10.17504/protocols.io.6a7hahn

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ABSTRACT

This protocol is used for acute surgery and electrophysiological experimentation on the anesthetized ferret, specifically for manipulating the vagus nerve and gastrointestinal tract nerve stimulation and myoelectric recording.

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EXTERNAL LINK

https://www.biorxiv.org/content/10.1101/607242v2

THIS PROTOCOL ACCOMPANIES THE FOLLOWING PUBLICATION

Machine learning prediction of emesis and gastrointestinal state in ferrets Ameya C. Nanivadekar, Derek M. Miller, Stephanie Fulton, Liane Wong, John Ogren, Girish Chitnis, Bryan McLaughlin, Shuyan Zhai, Lee E. Fisher, Bill J. Yates, Charles C. Horn bioRxiv 607242; doi: https://doi.org/10.1101/607242

GUIDELINES

animal should be monitored for stability of respiration, heart rate, blood pressure, and temperature

MATERIALS

NAME	CATALOG #	VENDOR
Vetbond	View	3M corporation
30 ml barostat balloon	CT-BP-1017	MUI Scientific
3-point retractor	110-3445	George Tiemann

Remove food

1 Remove food from the home cage 3 h before anesthesia 03:00:00

1.1 Measure body weight

Preparation: Before first incision

2 Induce anesthesia using isoflurane in a chamber, then move to a facemask (1 to 2%).

3 Shave abdomen and ventral neck.

4 Place ferret supine on table. Connect EKG leads and place rectal probe for recording body temperature (keep at 36 to 40C).

5 Monitor heart rate and body temperature throughout procedure and testing.

CED Power 1401 running Spike 2 version 7.15
electrophysiology recording
CED CED Power 1401 running Spike 2 version 7.15

First incisions: Endotrachel tube and blood pressure catheter

6 Make a ~4cm incision in the ventral neck and dissection the trachea.

7 Insert an endotracheal tube and coonect to pressure transducer to monitor respiration rate.

Small Animal Ventilator
ventilator with expiration pressure transducer
CWe SAR-830/AP

8 Make a ~3 cm incision on the medial surface of the right leg.

9 Place blood pressure catheter in left femoral artery.

Direct Blood Pressure System
pressure transducer
Kent Scientific DBP1000

Abdominal Surgery: Placement of electrodes and gastric tube/balloon

10 Make an incision in the midline abdominal muscle to expose the organs.

11 Open abdominal cavity using a 3-point retractor (Balfour pediatric retractor, George Tiemann), applied to the lateral edges of the abdominal incision and sternum. This retractor is elevated using a vertical post attached to a surgical board under the animal.

12 Make incision (~0.5 cm) on the left lateral edge of the gastric fundus and insert gastric catheter with the tip resting in the antrum; in parallel with the gastric catheter is a 30 ml barostat balloon. Place a purse-string suture around the incision and tied. And, additional knot is made around the catheter and the free ends of this knot and purse-string suture are tied together. Finally surgical glue (Vetbond) is applied to the incision area.

13 In some experiments, a cuff electrode is placed on either the ventral or dorsal abdominal vagus nerve trunk. Suture a ground electrode lead to connective tissue on the greater curvature of the stomach.

13.1 This is accomplished by caudal retraction of the stomach and retraction of the liver to the right side of the animal using saline moistened gauze. In this position, the esophagus and vagi become accessible.

14 Place planar electrodes on surface of stomach and duodenum using 8-0 silk suture. Suture a ground electrode lead to connective tissue on the greater curvature of the stomach

15 Test electrode impedances.

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Testing

16 Following this initial setup various tests can be performed, including testing the effects of stomach distension, nerve electrical stimulation, and emetine infusion on gastrointestinal myoelectric responses. Emetine is a chemical emetic agent that produces retching and emesis when infused into the stomach and small intestine. Because emesis can produce strong abdominal contractions it is recommended that the abdominal incision is securely sutured.

Gastric distension trials

17 Measure impedances of electrodes. Record 5 minutes baseline before and after each distension trial.

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18 Fill balloon using a syringe pump with 5 ml, 10 ml, or 20 ml saline. Infusion rate is 10ml/min. Saline is held in balloon for 5 minutes before deflation.

Emetine Trial

19 Record 20 min of baseline gastrointestinal myoelectric activity.

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20 Use a syringe pump to infuse 5 mg/kg emetine into the stomach. Record for 1 hour.

Cuff Stim Trials

21 Apply desired stimulation parameters (pulse width, current applitude, frequency) to abdominal vagus while recording. Record baseline data before and after trials and meaure impedances at the end.

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22 Open abdomen and remove electrodes, balloon, and catheter.

23 Euthanize animal with intracardiac euthasol injection.