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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EXTERIOR LINK

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

PROTOCOL CITATION

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MANUSCRIPT CITATION

please remember to cite the following publication along with this protocol


KEYWORDS

surgery, gastrointestinal tract, stomach, intestine, vagus nerve, electrophysiology, emesis
animal should be monitored for stability of respiration, heart rate, blood pressure, and temperature

MATERIALS

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

1. Remove food

1.1 Measure body weight

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 40°C).

5. Monitor heart rate and body temperature throughout procedure and testing.
First incisions: Endotrachael tube and blood pressure catheter

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

7 Insert an endotracheal tube and connect 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

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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.

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.

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

Record 20 min of baseline gastrointestinal myoelectric activity.
Grapevine Neural Interface Processor and a Nano2 recording headstage
electrophysiological recording and stimulation
Ripple LLC

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 amplitude, frequency) to abdominal vagus while recording. Record baseline data before and after trials and measure impedances at the end.

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

23. Euthanize animal with intracardiac euthasol injection.