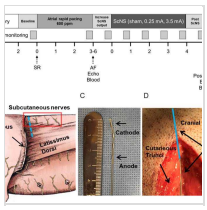


Nov 18, 2021

Subcutaneous nerve stimulation in canine model of persistent atrial fibrillation

Takashi Kusayama[1,2], Juyi Wan[1,3], Yuan Yuan[1,4], Xiao Liu[1,5], Xiaochun Li[6], Changyu Shen[7], Michael C. Fishbein[8], Thomas H. Everett IV[1], Peng-Sheng.Chen [1,5]

[1]Krannert Institute of Cardiology, Division of Cardiology, Department of Medicine, Indianapolis, Indiana;

[2]Department of Cardiology, Kanazawa University Graduate School of Medical Sciences, Ishikawa, Japan;

[3]Department of Cardiothoracic Surgery, the Affiliated Hospital of Southwest Medical University, Luzhou, Sichuan Province, China;

[4]Department of Cardiac Surgery, Xinhua Hospital, School of Medicine, Shanghai Jiao Tong University, Shanghai, China;

[5]Cedars-Sinai Medical Center, Los Angeles, California;

[6]Department of Biostatistics, Indiana University School of Medicine, Indianapolis, Indiana;

[7]The Richard and Susan Smith Center for Outcomes Research in Cardiology, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Massachusetts;

[8]Department of Pathology and Laboratory Medicine, University of California, Los Angeles, California

dx.doi.org/10.17504/protocols.io.bz5wp87e

SPARC
Tech. support email: info@neuinfo.org

Marlena S. Pela

This animal protocol was approved by the Institutional Animal Care and Use Committee of the Indiana University School of Medicine and the Methodist Research Institute, Indianapolis, IN, and conformed to the Guide for Care and Use of Laboratory Animals. The surgical procedure is performed under anesthesia and should incorporate all local requirements for standards of animal experimentation, including methods of anesthesia, surgical environment, and post-operative monitoring and care.

DOI

dx.doi.org/10.17504/protocols.io.bz5wp87e

Takashi Kusayama, Juyi Wan, Yuan Yuan, Xiao Liu, Xiaochun Li, Changyu Shen, Michael C. Fishbein, Thomas H. Everett IV, Peng-Sheng.Chen 2021. Subcutaneous nerve stimulation in canine model of persistent atrial fibrillation. **protocols.io** https://dx.doi.org/10.17504/protocols.io.bz5wp87e

protocol ,

Nov 16, 2021

Nov 18, 2021

55190

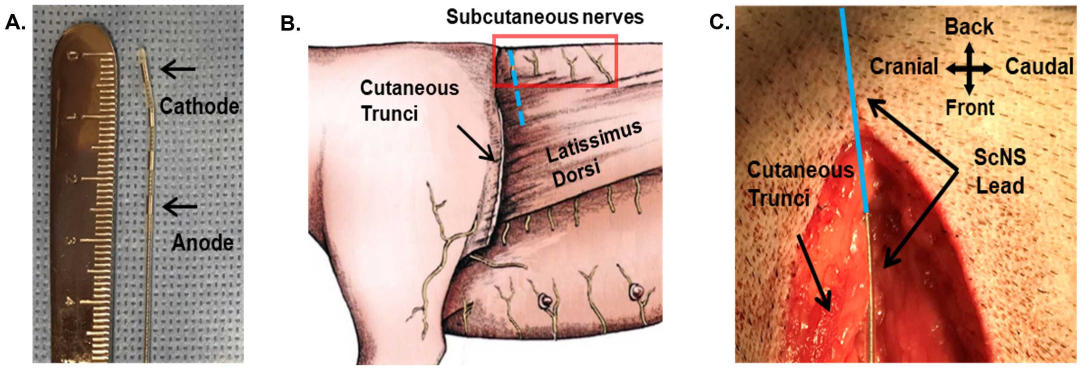
Surgical Procedure

1 Under isoflurane inhalation general anesthesia, perform left thoracotomy through the 4th intercostal space.

2 Implant a radio transmitter (D70-EEE, Data Sciences International), InterStim II neurostimulator (Medtronic Inc.), and a modified Secura implantable cardioverter defibrillator (ICD) (Medtronic Inc.).

3 Connect 3 pairs of bipolar electrodes to D70-EEE to record:
- Left stellate ganglion nerve activity (SGNA)
- Left thoracic vagal nerve activity (VNA)
- Subcutaneous nerve activity (ScNA)

4 Blindly insert a quadripolar sacral stimulating lead (Medtronic Inc., model 3889) into the subcutaneous fat layer under the cutaneous trunci muscle and connect it to InterStim II in a subcutaneous pocket.



A. The quadripolar sacral stimulating electrode (Medtronic Inc., model 3889, to be connected to InterStim II neurostimulator).

B. The anatomy of subcutaneous nerves in left lateral thorax. Blue dotted line indicates the location of stimulation electrodes.

C. Surgical approaches for Subcutaneous Nerve Stimulation (ScNS). The ScNS lead was blindly inserted into the subcutaneous fat layer under the cutaneous trunci muscle. The blue line indicates the electrode lead under the skin.

Source: https://doi.org/10.1016/j.hrthm.2020.09.009

To record ScNA bracket the point of stimulation with a pair of bipolar electrodes from D70-EEE

Citation: Takashi Kusayama, Juyi Wan, Yuan Yuan, Xiao Liu, Xiaochun Li, Changyu Shen, Michael C. Fishbein, Thomas H. Everett IV, Peng-Sheng.Chen Subcutaneous nerve stimulation in canine model of persistent atrial fibrillation
https://dx.doi.org/10.17504/protocols.io.bz5wp87e

5 placed in the subcutaneous tissue.

6 Screw a 5076 screw-in pacing lead (Medtronic Inc.) into the left atrial appendage and connect it to a modified Secura ICD for rapid atrial pacing to induce sustained AF.

7 Turn off the defibrillator function of the ICD.

8 2 weeks after the surgery turn on D70-EEE for baseline recording of ECG and nerve activities (NA) during sinus rhythm (SR).

Atrial Fibrillation (AF) Induction Procedure

9 2 weeks post surgery turn on D70-EEE. After baseline recording of ECG and NA during sinus rhythm (SR), turn on the ICD.

10 The ICD should deliver high rate continuous atrial pacing (600 bpm, 2X the diastolic threshold output) for at least 3 weeks to induce persistent AF (>48 hours).

11 Halt the pacing protocol every 3 weeks to determine if sustained AF was induced.

12 Repeat the protocol until sustained AF is induced and study data as the baseline of the sustained AF.

Subcutaneous Nerve Stimulation (ScNS)

13 After the baseline recording during SR and sustained AF, turn on the neurostimulator.

13.1 In 3.5 mA and 0.25 mA groups:
- Program the neurostimulator to 20-s ON and 60-s OFF (10 Hz, 450 µs pulse width).
- Program the output current (mA) to deliver ScNS at 3.5 mA group and 0.25 mA group. Progressively increase the output until the desired level is

Citation: Takashi Kusayama, Juyi Wan, Yuan Yuan, Xiao Liu, Xiaochun Li, Changyu Shen, Michael C. Fishbein, Thomas H. Everett IV, Peng-Sheng.Chen Subcutaneous nerve stimulation in canine model of persistent atrial fibrillation
https://dx.doi.org/10.17504/protocols.io.bz5wp87e

reached.

13.2 In sham group:
- Program the output current to 0 mA (sham stimulation).

14 Weekly measure the impedance and adjust the voltage output to maintain the desired current output for 4 weeks.

15 After ScNS for 4 weeks turn off the neurostimulator.

16 Turn on D70-EEE to record final post ScNS state.

17

Euthanize animals and harvest tissues for additional readouts if needed.

Citation: Takashi Kusayama, Juyi Wan, Yuan Yuan, Xiao Liu, Xiaochun Li, Changyu Shen, Michael C. Fishbein, Thomas H. Everett IV, Peng-Sheng.Chen Subcutaneous nerve stimulation in canine model of persistent atrial fibrillation
https://dx.doi.org/10.17504/protocols.io.bz5wp87e