Programmable Electrically-stimulated Penile Erection: a Chronic Study on Baboons

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There were several attempts to use electrical nerve stimulation to trigger and hold a penile erection.


Electro-stimulation of the cavernous (CN) and pudendal (PN) nerves was studied on rhesus-macaques using implanted electrodes for a chronic study.

Significant limitations:
- conducted on sedated animals;
- less than 50 stimulation sessions;

Electrostimulation of CN in humans, has only been done intra-operatively during radical prostatectomy.
No studies answered the following fundamental questions:

• [Q1]: Can a full erection be achieved via electrostimulation of erectile nerves on non-sedated subjects without side effects (pain, pelvic or leg muscle contractions from current spread etc.)?

• [Q2]: Is the effect of Q1 sustainable over time without the need to increase electric stimulation (due to fibrosis around the implanted electrodes)?

Objective: The study is designed to answer Q1 and Q2 on baboons, a model that is close to the human penile erection.
Methods

Our study was conducted in a Medical Primatology Research Center (Sochi, Russia) with ethical approval.

The subjects were 14 baboons:
- mean age 7 ± 1.5 years
- healthy and without erectile dysfunction (ED) (verified with the Doppler color test).

In each subject we implanted electrodes on CN and PN and connected them to the power generators implanted in the abdominal area (nerve cuff electrodes, Microprobes, MD, USA).
Intra-operationally we found the optimal location for electrodes and parameters for electrostimulation that allowed to achieve a full erection with a supra-systolic intracavernosal pressure (verified with direct measurement).

Each subject was then placed into an individual cage.

Implants were programmed to perform 8 electrostimulations per day, each 3 minutes long.

The subjects were observed for 12 months during which each subject received 2600 stimulation sessions (~130 hours) in total.

We did continuous video-recording and gathered data on how many times the subjects got an erection during electrostimulation.
Observation during the 12 months after implantation showed:
  • up to 90% stimulations were successful (video confirmed)
  • the remaining 10% was not recorded, due to the subjects turning their back side to the camera;

Histological study 12 months after implantation showed:
  • a low degree of fibrosis between the electrode and nerve
  • the absence of chronic inflammation
  • a 15 ± 3% increase in the stimulation threshold during the 1st month, and no change later
  • a constant electrode impedance for each subject during the observation period (250-300 Ohm)
Our data showed that in 14 non-sedated baboons without ED:

• stimulation of CN and PN leads to sustained full erection without side effects (thus answering Q1).

• the effect was sustainable for 12 months (thus answering Q2).
The developed stimulation technique can be applicable to humans.
Clinical application needs a detailed list of indications and contraindication.
The developed stimulation technique might be used as an addition to pharmacological therapy of ED.
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