nanoflex robotics

Hospital of the Future

Dr. Christophe Chautems

Dr. Alice Segato

February 8th 2023

Reimagining endoluminal therapy

Wyss Zurich Translating Science into Life

BRIDGE

Innosuisse - Swiss Innovation Agency
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ETH zürich

Kantonsspital Aarau

venture leaders

Reimagining Endoluminal Therapy

Nanoflex robotics is a Medtech startup company from ETH Zurich.

- We increase patient access to highly specialized, time-sensitive and life-saving clot removal procedures (thrombectomies) for stroke.
- Soft robotic platform precisely controls catheters and wires magnetically
  - Reaches clots faster, safer, capable of remote operation
  - Fully functional prototype tested in large animal model

Nanoflex team

comprises strong mix academic and medtech industry expertise

Founders

Dr. Christophe Chautems
CTO

10+y robotics
8+y medical robotics
4+y medical robotics start-up

Matt Curran
CEO

20+y medical devices
Former VP for Medtronic Cranial and Spine EMEA

Prof. Bradley Nelson
Advisor

15+y medical robotics
Co-founder of 5 companies
Boards of 3 companies

Dr. Grace Katzchmann

8+y Biotech start-ups
Strategy, Operations & Business Development

Dr. Margarita Brilkova

Physician & PhD
neurodegeneration analytics

Dr. Pengpeng Cao

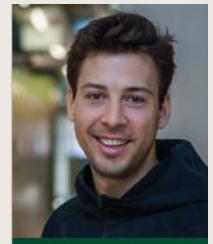
Regulatory & Quality lead
4+y regulatory lead MedTech

Dr. Simone Gervasoni

Robotics Engineer
6y+ electromagnetic navigation

Norman Pedrini

4y+ Robotics Mechanical Engineer



Dr. Jonas Lussi

Robotics Engineer
6y+ electromagnetic navigation

Tamara Willauer

3y+ Administrator & Finance

Matteo De Donatis

Design Engineer
10y+ medical device development & former CPO

Silvia Viviani

3y+ Robotics Development Engineer (Magnetic Catheters)

Julian Stiefel

5y+ Robotics Software Engineer

Dieter Flubacher

Robotics Systems Engineer
8y+ Control Systems

Dr. Alice Segato

Robotics Engineer
6y+ Neurosurgical Robotics

Dr. Med. Peter Novinszky

Medical Specialist

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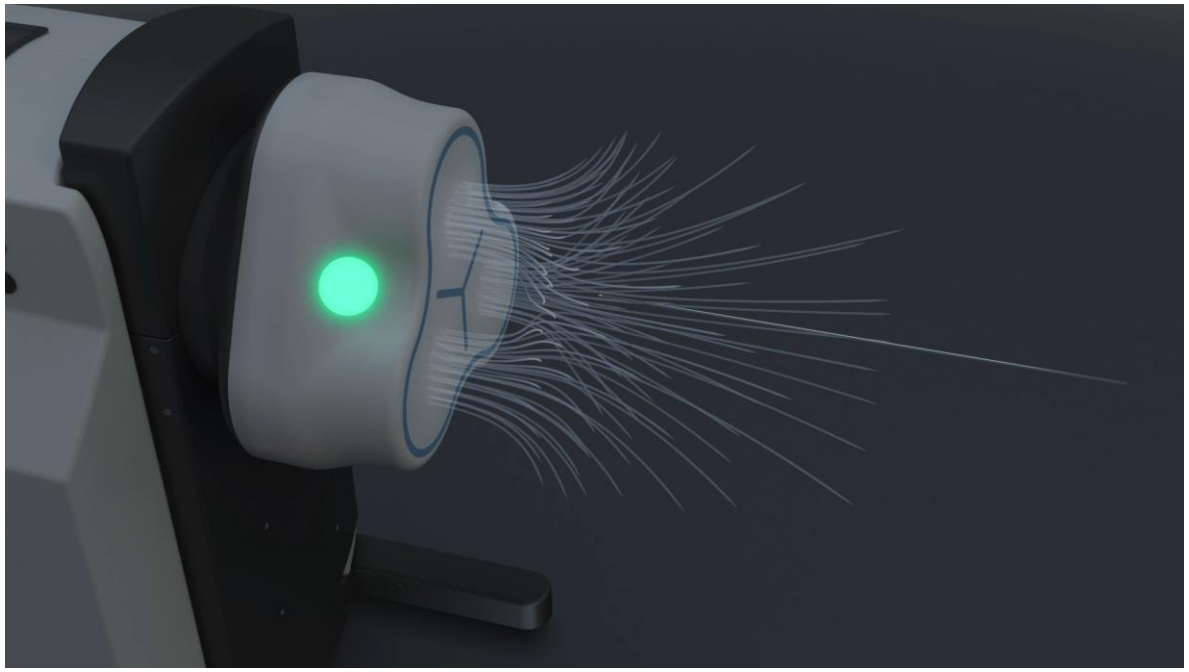
Nanoflex Robotic platform

can control soft magnetic catheters and wires remotely using electromagnetism



Navion unit

- Generates electromagnetic field to bend catheter tip
- Compact and movable, easily integrates into current hospital settings
- Weighs less than 10% of other eMNS systems on the market
- Requires high voltage and water supply

Magnetic catheters and wires

- Soft and flexible
- Magnets at tip align to magnetic field
- Compatible with third-party non-magnetic catheters

Nanoflex Robotic platform

can control soft magnetic catheters and wires remotely using electromagnetism

Software and user interface

- Advanced algorithm and mathematical modeling precisely control strength and direction of magnetic field
- Easy-to-use interface allows remote operation of system

Advancer unit

Pushes or retracts one or more catheters

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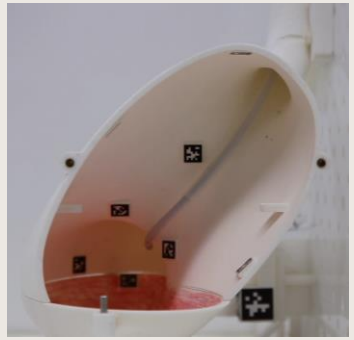
Video link: https://youtu.be/cM7-ZMwMkrc

Nanoflex Robotic Platform Potential

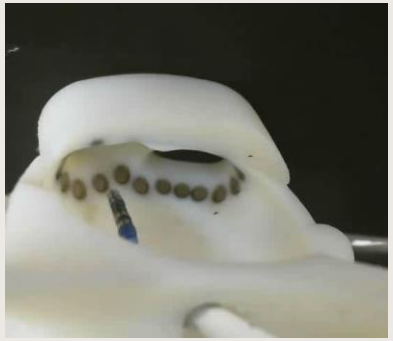
Endoscopy



Demonstration of navigation of a magnetic endoscope in gastro model

Potential application:
- Automate navigation for gastroendoscopy
- Navigation of endoscope in lung

Electrophysiology



Demonstration of magnetic steering in a model.

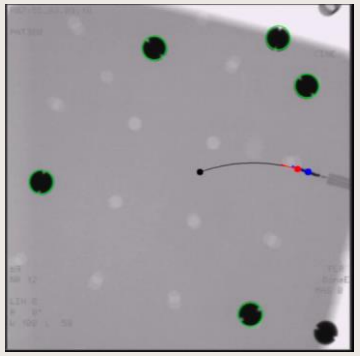
Potential application:
- Ablation of cardiac arrythmias

Surgical Procedure

Demonstration of Spina Bifida Surgery using magnetic surgical tools.

Potential application:
- All surgical procedure requiring the control of miniaturized surgical tools.

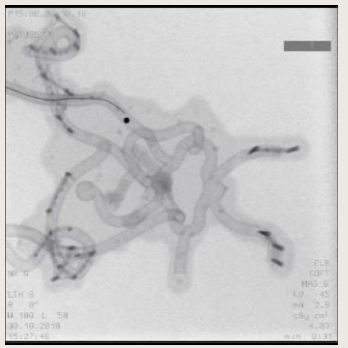
Curved trajectory in soft organ



Demonstration of magnetic steering in ex-vivo porcine brain.

Potential application:
- Navigation of DBS electrode around curved trajectory to reach multiple target

Targeted Therapeutic Delivery



Demonstration of microrobot navigation in the neurovascular network

Potential application:
- Targeted delivery of therapeutic to treat distal stroke

Nanoflex Robotic platform – Clinical Application

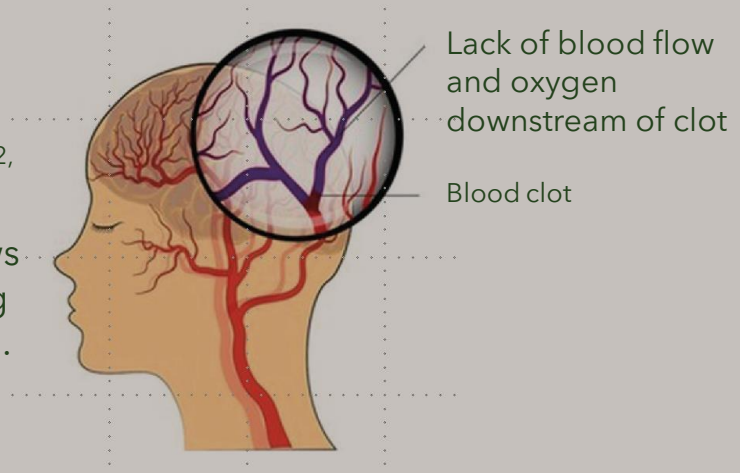
Clinical Problem

Stroke is the leading cause of serious, long-term disability

Annually, there are:

- over 13.7m new strokes[1]
- over 116m years of healthy life lost due to stroke[1]
- 5.5m people who die of stroke[1]

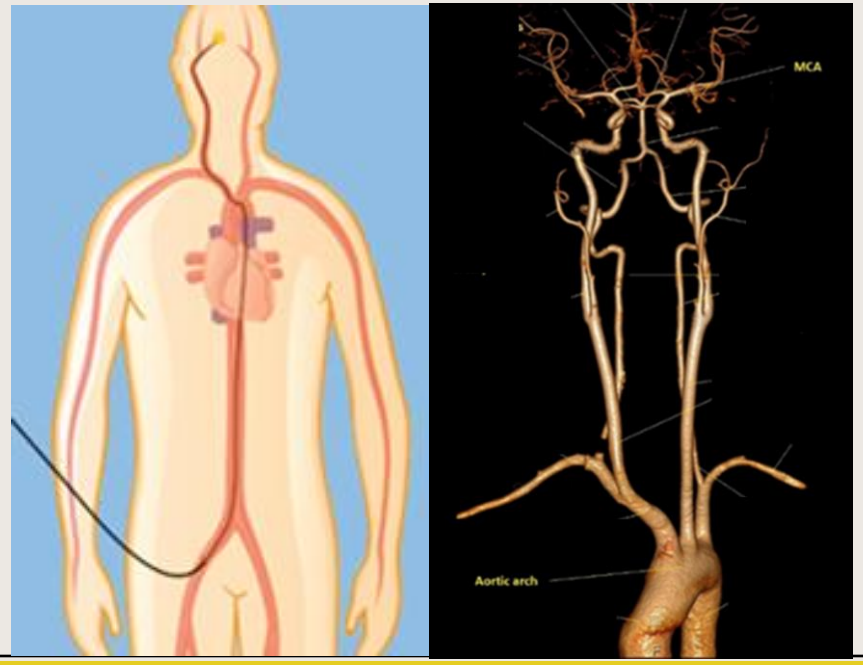
In 87% of stroke[2], a blood clot blocks or narrows an artery leading to or in the brain.



Clinical Solution

Thrombectomies recently proven superior to standard-of-care intravenous alteplase in large trials[3]

Catheters guided through blood vessels to brain to remove clot by aspiration and/or stent retrieval



Chance of functional independence rapidly drops below 50% if not reperfused within 150 min[4]

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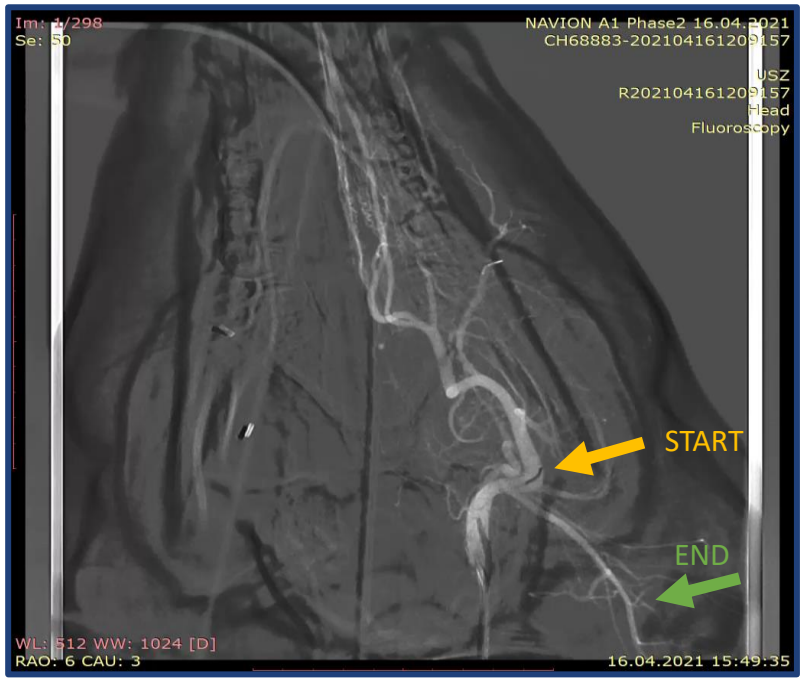
Feasibility test of research prototype in porcine model

Supported by interventional neurologist, Prof. Philip Gruber from Aarau Cantonal Hospital



- Tested basic functionality of navigation and interaction with Philips imaging system
- Deployed and maneuvered multiple catheter designs, including magnetically steered rotate-to-advance catheter
- Deployed third-party stent retrievers (Medtronic, Stryker, MicroVention) successfully through our system

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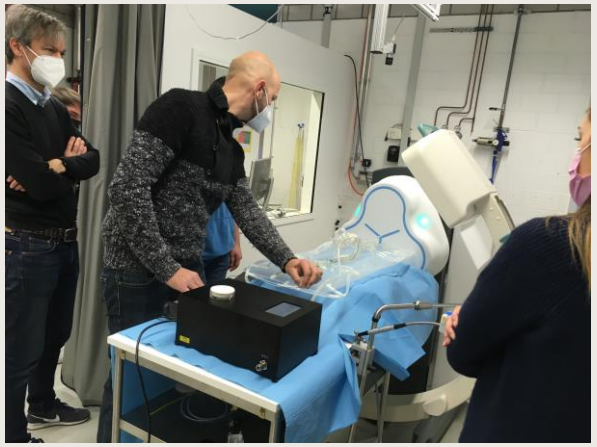
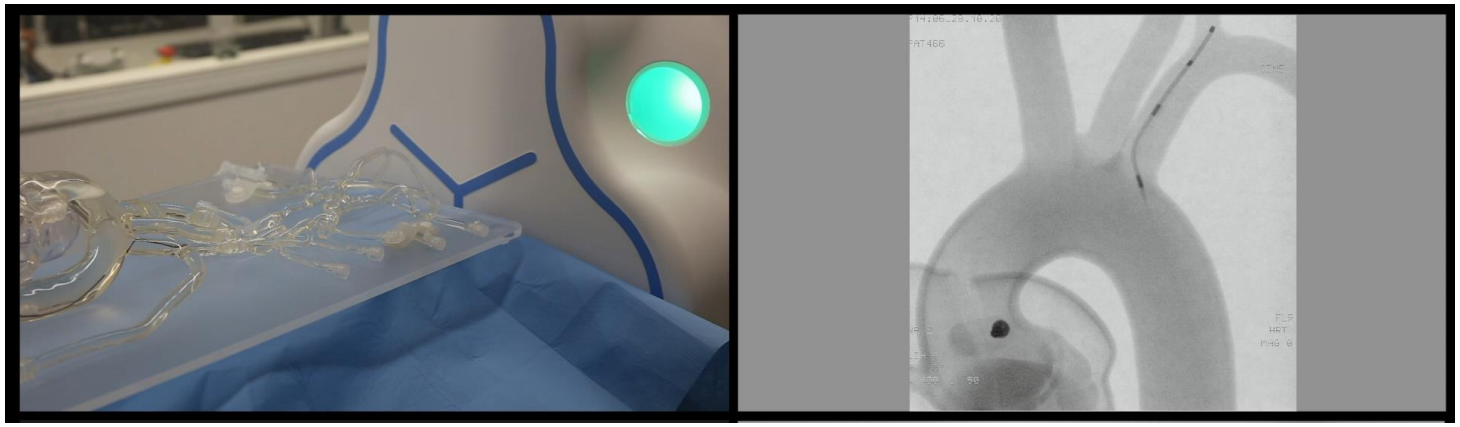
Video link: https://youtu.be/cM7-ZMwMkrc

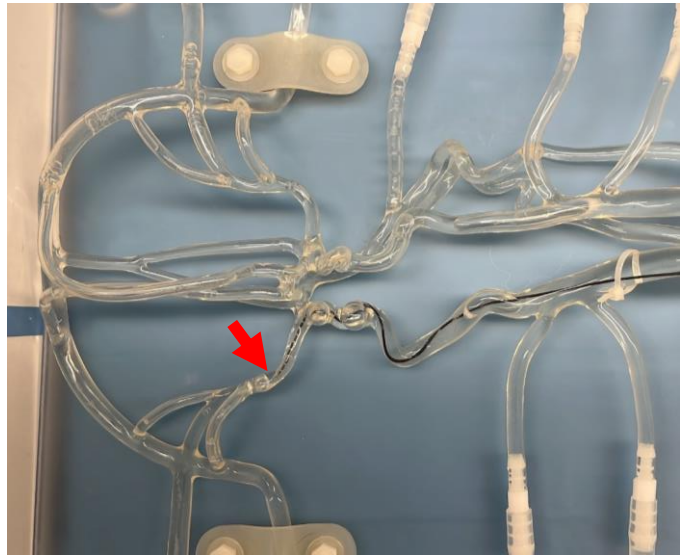
Testing our initial system with manual advancement

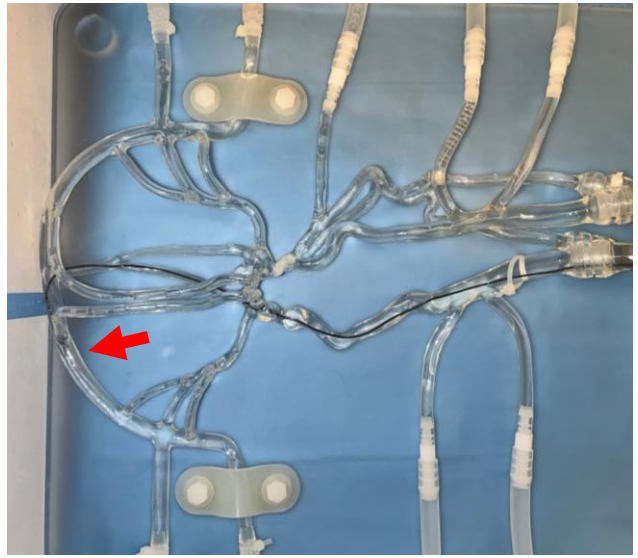


Visit from Dr. Christian Maegerlein and Dr. Jan Kirschke, Neurokopfzentrum, MRI Institute, TUM, Munich



- Magnetic guidewire prototypes can navigate up to MCA and PCA in silicon phantom

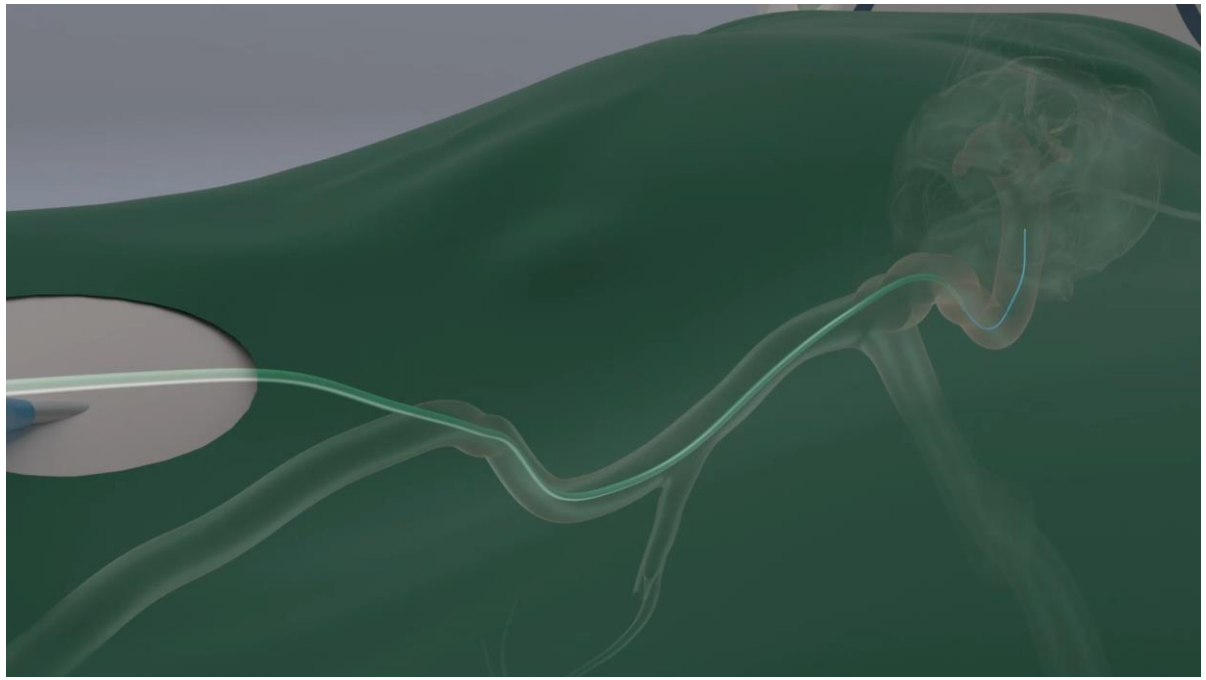




Nanoflex enables faster and safer thrombectomies

First focus on aspiration thrombectomy.

Potential for new tools and procedure.

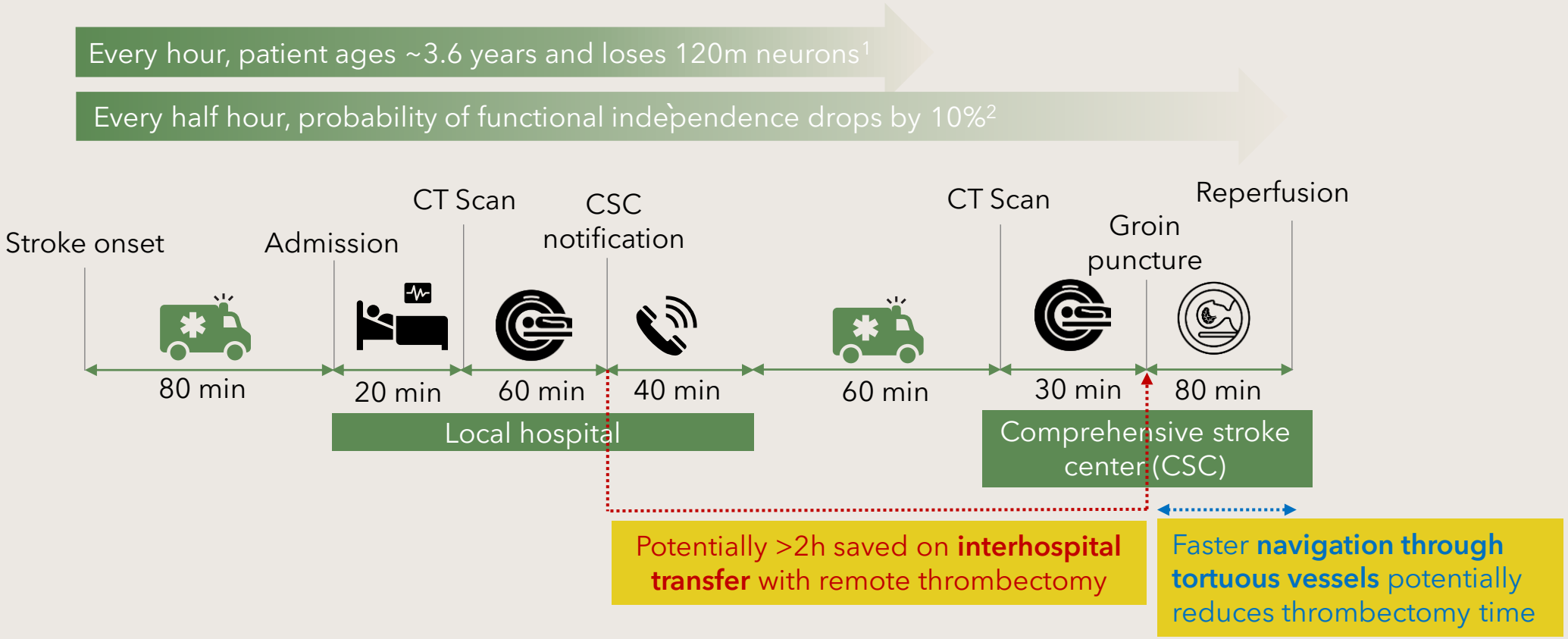


Key benefits of Nanoflex magnetic robotic system

- Safer navigation with compliant magnetic tools
- Faster navigation time as magnetic field directly bends tools into desired shape
- No moving part in the magnetic navigation system
- Softer catheters and guidewires reduce complications

Video link: https://youtu.be/cM7-ZMwMkrc

Time is the most important factor in stroke reperfusion therapy



Timeline adapted from Sun, C.-H. J. *et al. Circulation* **127**, 1139–1148 (2013).

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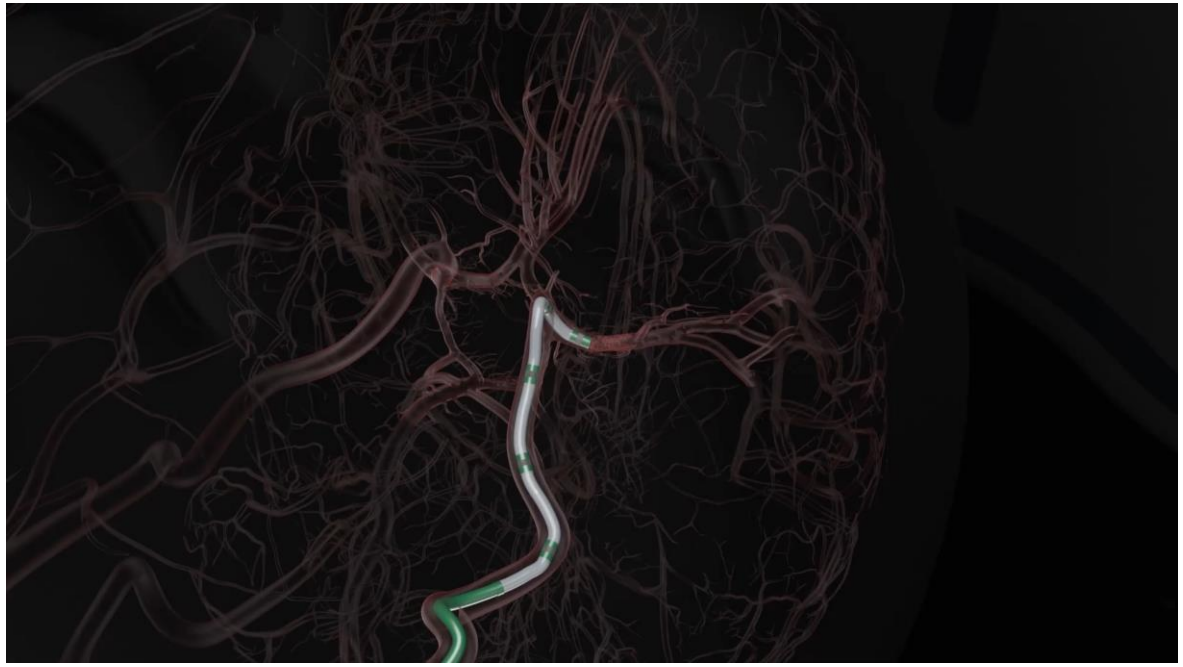
[1]Saver, J. L. *Stroke* **37**, 263–266 (2006). [2] Turc G, Bhogal P, Fischer U, et al. European Stroke Journal. 2019;4(1):6-12.

Nanoflex enables remote thrombectomies

Competing against no alternative if no interventional radiologist is present for thrombectomy



Key benefits of Nanoflex remote robotic system

- Teleoperation to decrease access disparity
- Less X-ray exposure for clinicians and more comfortable working environment
- Reduced time to recanalization by avoiding transfer to specialized stroke center

Remote demos feedback

Easy to use, intuitive, grasped steering concept quickly, many could navigate the most difficult route

All Clinicians were interested

- Multiple testers mentioned responsiveness even with lag
- Big advantage to be able to move device tip from vessel wall.
- “this is so cool, it’s amazing”, “make it look easy”

Nanoflex Mission

When a stroke happen?

Time is Brain

Provide fast access to care, to save brain

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