Development of a Wearable Intracranial Pressure Monitoring Device

Seminar Presentation

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Project Summary: Wireless ICP Monitoring Device

- Goals:
  - Prototyping a **wearable monitoring device**
  - **Wirelessly transferring pressure sensor data**
  - **Live-tracking** and feedback analysis
- Significance:
  - Creation of a monitoring device that is not only user-friendly but can also advance current ICP telemonitoring techniques

Paper Selection

Selected Paper: “Long-term telemetric intracranial pressure monitoring for diagnosis and therapy optimisation of idiopathic intracranial hypertension”

Authors: Victor F. Velazquez Sanchez, Giath Al Dayri & Christoph A. Tschan

Relevance:

- Recent publication on long-term ICP telemonitoring
- Analyzing how to design a wireless system that can improve telemonitoring procedures **both for the patient and the physician**

Problem Statement and Background

- **Goal**: improved diagnosis and consequent therapy of ICP
- Specifically studying idiopathic intracranial hypertension (IIH)
    - ICP measurement is crucial in the diagnosis of IIH
        - Characterized by increased intracranial pressure
- Overall difficulty of establishing IIH diagnosis
- Prior to the paper, there are no published trials that have incorporated long-term ICP monitoring exclusively in IIH patients

Method

NEUROVENT-P-tel catheter:

- Long-term ICP monitoring and patient's daily activities

Participants: 20 participants (16 females, 4 males) with suspected IIH

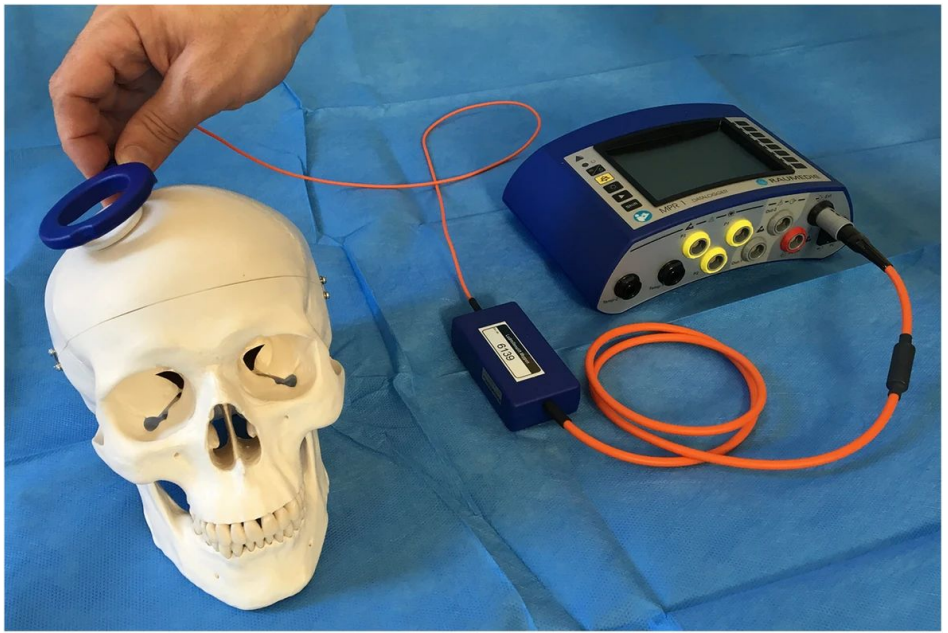
- Home telemonitoring and home monitoring

Home-monitoring vs telemonitoring:

- Different frequencies

Data analysis:

- ICP data measurements, daily activities, and symptoms



Illustrating the NEUROVENT® ICP-Monitoring System and its approximate relation to the skull during ICP monitoring [1]

Results

- Duration of P-tel catheter implantation:
  - **Min-Max:** 17 days-1554 days. **Average** 388 hours
- IIH was confirmed in 18/20 patients
  - Next steps: implantation of VP shunts for their therapy
- In 2 patients, long-term telemetric ICP monitoring lead to the exclusion of IIH
  - **Patient #1:** concluded at the early stage of the diagnosis
  - **Patient #2:** treated as IIH with VP shunting but home-telemonitoring dismissed it (the VP shunt was then removed)
- **Overall:** less outpatient visits in home-telemonitoring v. home-monitoring

Relevance to Current Work/Key Takeaways

User-Friendly:

- Software and hardware is easy to use for the patient
  - Usability
  - Data depiction
- Easy system integration into daily life

Telemonitoring:

- Effective data storage
- Easy communication between patient and clinician

Critical Assessment

Strengths:

- Provides details on both the advantages and disadvantages of ICP home-telemonitoring

Weaknesses:

- Small sample size
- Non-randomization of monitoring settings
- Participant involvement in the study varied

Possible Future Work:

- Study on long-term safety of system implantation
- Noninvasive ICP monitoring

References

[1] Velazquez Sanchez, V.F., Al Dayri, G. & Tschan, C.A. Long-term telemetric intracranial pressure monitoring for diagnosis and therapy optimisation of idiopathic intracranial hypertension. *BMC Neurol* 21, 343 (2021). https://doi.org/10.1186/s12883-021-02349-8

Thank you!

Questions?