How To Use Virtual Reality Simulation To Train More Interventional Doctors To Safely And Effectively Perform Intracranial Thrombectomy For Acute Strokes

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On behalf of friends and colleagues of the VINNOVA Sweden and ASSERT CORK GROUP
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Purpose

• To develop, operationally define and seek expert consensus on metrics which best characterize a reference approach to neurothrombectomy.
• To determine if the performance metrics implemented in a physics-based virtual reality (VR) simulation can distinguish between expert and novice INRs performance.

The Mentice VIST

The VIST® virtual reality simulator
The Phases and steps of the reference approach to mechanical thrombectomy and the changes agreed and voted on by the Delphi panel at the consensus meeting in Aachen.

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Results

- The main performance parameters assessed and compared were:
  - Duration of the procedure in minutes
  - The number of procedure phases completed
  - The number of procedure steps completed
  - The number of handling errors made
  - The amount of contrast agent used during the procedure (in ml)
  - The amount of fluoroscopy (in minutes) used in performance of the procedure.

Differences were compared for statistical significance with one-factor analysis of variance (ANOVA) using SPSS.
Consultant INRs performed the procedure 47% faster and their performance times were also more homogeneous than trainee \( p = 0.029 \).

The Consultant INRs completed 22% more procedure phases Vs Trainee \( p < 0.009 \).

Consultant INRs also completed 15% more procedure steps Vs Trainee \( p < 0.007 \).

The largest difference was observed for handling errors. Trainees made 97% more handling errors than the Consultant INRs \( p < 0.009 \).

**CONCLUSION**

- Acute ischaemic stroke is a leading cause of death and long-term disability.
- MT is the recommended treatment of choice for ischaemic stroke due to large vessel occlusion in the anterior cerebral circulation.
- It has led to an improvement in outcomes in comparison to other treatments with a reduction in long-term disability.
- Worldwide, there is a shortage of clinicians trained and skilled enough to perform the procedure, which is a significant impediment to the benefits that this treatment can confer on patients and health-care systems.

**CONCLUSION**

- Complex interventional procedures such as MT for acute ischemic stroke can be broken down into subcomponent procedure phases and tasks (steps), necessary for the effective completion of the procedure.

**CONCLUSION**

- The performance characteristics or metrics that accurately identify the skill related to a specific task or an error can be unambiguously defined.
- Behaviours that deviate from optimal performance can be characterized (errors) including those of a more serious nature (critical errors).
- We were able to characterized a referenced approach to neurothrombectomy.

**CONCLUSION**

- A consensus was reached on the essential phases, steps as well as procedural errors to be avoided in depth panel of a group of international expert INRs.
- We were able to replicate a real patient's anatomy in the VR environment using the VIST.
- The metrics were successfully incorporated into a physics-based virtual reality endovascular simulation.
- We have compared the performance of two groups consisting of either expert INRs or trainees, each asked to perform a straightforward virtual reality simulated neurothrombectomy case.
- The results showed that the supervised trainee performed the case 47% faster, completed 22% more procedural phases, 15% more steps and made 97% fewer errors.
- These results mean that the metrics have demonstrated construct validity.
- The next step in the validation of these VR enabled metrics would be to use them as part of a systematic MT training program.