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Automated Balloon Guide Catheter Aspiration Using an iPad App and Bluetooth-enabled Smart Pump: In-vitro Study

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Introduction:

Multiple studies suggest that addition of cervical balloon guide catheter (BGC) aspiration to intracranial suction aspiration or thrombectomy improves outcomes (1). Currently, stroke thrombectomy when performed with cervical BGC/Guide catheter (GC) aspiration requires two (2) operators. Utilizing an automated smart pump could enable a single (1) operator to perform BGC-assisted thrombectomy while varying the suction intensity in different segments of the intracranial and cervical vasculature.

Methods:

Phase 1: Staged BGC aspiration (initially low, medium, then high - to avoid vessel collapse) is manually performed using a 60cc syringe and a 9F BGC. The suction intensity levels for low, medium, and high (in inHg) are measured using a vacuum gauge (2). Phase 2: the Mean suction levels and duration from three sample measurements are entered into an iPad app (CLEAR Pro TM, Inera Therapeutics) to create a staged BGC suction pattern. Phase 3: With a BGC positioned in an in-vitro flow model simulating stroke thrombectomy, the feasibility of automated staged BGC aspiration is assessed. The iPad app activates a bluetooth-enabled smart pump (CLEAR Aspiration System TM, Inera Therapeutics) connected to the BGC.

Results:

Phase 1 testing was performed. Low suction ranged from 10-13 inHg (Mean: 12 inHg) with a duration ranging from 11-17s (Mean: 13s), Medium suction ranged from 15-18 inHg (Mean: 16 inHg) with a duration ranging from 8-11s (Mean: 9s), High suction ranged from 24-26 inHg (Mean: 25 inHg) with a duration ranging from 19-25s (Mean: 22s), The total duration of staged BGC aspiration ranged from 39-53s with a 60s safety pause or end of suction prior to another retrieval attempt. Phases 2 & 3 were successfully performed to create a customized BGC pattern and staged BGC aspiration was automated during simulated stroke thrombectomy.

Conclusions:

Automated staged BGC or GC aspiration is feasible using a customizable iPad app and a bluetooth-enabled smart pump.

Keywords: Acute Stroke, Acute Ischemic Stroke Intervention, Balloon Guide Catheter, Mechanical Thrombectomy, New Innovation

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