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Cerebrospinal Fluid Filtration in Aneurysmal Subarachnoid Hemorrhage Patients: Results from the PILLAR Feasibility Trial

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Introduction

The presence of subarachnoid blood and toxic blood breakdown by-products in the cerebrospinal fluid (CSF) following aneurysmal subarachnoid hemorrhage (aSAH) is associated with poor outcomes. Rapid removal of these by-products may reduce complications and improve outcomes. We present the results of the PILLAR study, a Phase I safety study, evaluating the use of a novel dual lumen catheter and filtration system to remove blood products from the CSF after aSAH.

Methods

aSAH patients (Modified Fisher Scale (mFS) 2-4) had a dual-lumen lumbar, intrathecal catheter placed following aneurysm securement, but <48 hours from ictus, and received up to 24 hours of CSF filtration. Contaminated CSF was aspirated from the lumbar cistern, filtered CSF returned to the thoracic space, and filtered contaminants diverted to a waste bag. Neuro checks were performed q2hrs, CSF samples collected q4hrs during the procedure, and CT scans acquired at baseline and immediately post-filtration. Follow-ups occurred at 2 weeks and 30 days with SOC follow-up CTs collected out to 30 days.

Results

Thirteen patients (12 mFS 3, 1 mFS 4) had a catheter placed within 24:13±10:22 hours from ictus. The system processed an average 632.0 mL [180.6-1447.6] CSF in 15:07 hours [5:32-24:00] of filtration. Removal of contaminants from CSF was evident: initially elevated mean CSF total protein and RBCs were reduced by 73.2% and 57.9%, respectively, after filtration. Independent analysis of baseline and post-filtration CTs found notable cisternal blood decrease, with 45.5% average Hijdra Score reduction. No hematomas, localized inflammation or CNS infection occurred after the procedure. Four mild AEs were reported, no serious adverse events or unanticipated events were reported. Data was reviewed by a data safety monitoring board.

Conclusions

The PILLAR study found CSF filtration to be safe in aSAH patients, with the potential capability to rapidly remove blood. Future studies are planned to further characterize filtration impact.

Learning Objectives

1) Assess the feasibility and safety of the placement of the catheter component. (2) Assess the feasibility and safety of the operation of an extracorporeal CSF filtration system (3) Evaluate the ability of the CSF filtration system to remove blood and blood breakdown products from the CSF.

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