

# Baseline Rate of Intraventricular Hemorrhage Clearance in Small-Diameter External Ventricular Drain in Intraventricular Hemorrhage

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## Introduction

External ventricular drains (EVD) are often employed in patients with primary intraventricular hemorrhage (IVH) or intraventricular extension (IVE) of intracerebral hemorrhage (ICH), not only as a method to treat hydrocephalus and control intracranial pressure (ICP), but often to promote the clearance of blood products. Despite ongoing clinical trials (i.e. CLEAR-IVH) investigating the impact of this therapy on functional outcome following IVH, little objective data exists on the rate of IVH clearance in these patients.

## Methods

All patients admitted to the Neurological ICU at Columbia University Medical Center with primary IVH or IVE following ICH between December 2009 and July 2011 were screened and enrolled in our prospective ICH database. Demographic, clinical, and radiographic data were collected during admission. Volumetric analysis for imaging was performed by an experienced observer using MIPAV volumetric software (NIH, Bethesda, MD). We assumed a steady IVH clearance rate through the EVD to facilitate our analysis.

## Results

During the study time, 151 patients were enrolled into our database. Of the 43 patients with IVH/ICH and an EVD in place, 6 were excluded due to the administration of intrathecal thrombolytics, and a further 16 excluded due to insufficient radiographic imaging, for a total cohort of 21 patients. All EVDs placed were antibiotic-impregnated and had a small lumen (1.3 mm internal diameter). Mean age was 57.7 years, and 15 of 21 patients were male (71.4%). On admission imaging, mean ICH volume was 29.9 +/- 28.6 cubic centimeters (cc) with a mean IVH volume of 12.46 +/- 10.7 cc. EVDs were placed within 2 days of admission for 90.5% (19/21) of patients, and within 4 days for the remaining 2 patients. The overall mean rate of IVH clearance was 0.22 cc/hr, though it was increased in the first 12 hours after placement, with an early mean of 0.63 cc/hr. Over an average of 3 days, the mean IVH volume decreased by almost 50%, from a pre-EVD baseline of 16.8 cc to 8.5 cc. The duration of EVD therapy ranged from less than one day up to two weeks. Three patients (14.2%) developed ventriculitis during their index admission.

## Conclusions

Small-lumen EVDs are a valuable therapeutic option for IVH clearance in patients with primary IVH or ICH with intraventricular extension. The rate of IVH clearance is increased in the first 12 hours following EVD placement relative to the average rate of clearance over the entire course of EVD therapy. Placement of EVDs should be considered for patients with clinically significant IVH, not only for cerebrospinal diversion and control of intracranial pressure, but also for clearance of hemorrhage.

## Learning Objectives

By the conclusion of this session, participants should be able to: (1) Discuss the role of EVD placement in patients with IVH; (2) Describe the temporal effect of EVDs on the clearance of blood products from the ventricular system; and (3) Identify patients that may benefit from this treatment.