

Bedside External Ventricular Drain Placement: Can Multiple Passes Be Predicted on the Computed Tomography Scan Before the Procedure?

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Key words

- Bedside
- External ventricular drain (EVD)
- Hemorrhage
- Ventricular volume
- Ventriculostomy

Abbreviations and Acronyms

CSF: Cerebrospinal fluid
CT: Computed tomography
EVD: External ventricular drain
IVH: Intraventricular hemorrhage
MRH: Midline rostral hematoma
SAH: Subarachnoid hemorrhage



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INTRODUCTION

The placement of an external ventricular drain (EVD) at the bedside is a life-saving procedure commonly performed by neurosurgery residents. Few studies describe the number of attempts taken or the location of the EVD within the ventricle. In reality, the freehand procedure is less than perfect and often requires multiple passes to achieve cerebrospinal fluid (CSF) flow. Studies show that junior residents require 2.4 passes to achieve CSF flow (10) and the tip of the catheter frequently terminates in a not ideal ventricular location or outside of the ventricular system (1, 5-7).

Multiple passes are sometimes necessary, and it is still unclear whether multiple attempts to place an EVD increase the risk of procedure-related hemorrhage. In the present study, we prospectively recorded

■ **OBJECTIVE:** Bedside external ventricular drain (EVD) placement is less than perfect and often requires multiple passes to achieve cerebrospinal fluid flow. We conducted this prospective study to understand why multiple passes are necessary and whether this affects the incidence of hemorrhage.

■ **METHODS:** We compared the number of passes in 47 EVD placement procedures to the incidence of hemorrhage after the procedure. We also analyzed computed tomography scans before the procedure to identify variables that correlate with multiple passes.

■ **RESULTS:** Of the procedures analyzed, 72% (34/47) were single pass whereas 28% (13/47) required multiple passes. Average number of passes was 1.85 (± 1.8), but average number of passes when multiple passes were made was 4.1 (± 2.29 ; range, 2-9). Incidence of tract hemorrhage was 10.6% (5/47). Of those, 11.8% (4/34) were in the single-pass group and 7.7% (1/13) from the multiple-pass group. There was no statistical relationship between the number of passes and hemorrhage ($P > 0.99$). Subarachnoid hemorrhage, intraventricular hemorrhage, and midline shift were not found to be statistically significant in relation to the number of passes. The presence of midline rostral hematoma significantly correlated with multiple passes. One of 34 patients (2.9%) needed a single pass and 5/13 (38.5%) needed multiple passes in the presence of midline rostral hematoma ($P = 0.0011$). The average targeted frontal horn volume was larger in patients who needed single pass EVD ($12.4 \pm 6.3 \text{ cm}^2$ vs. $8.0 \pm 4.7 \text{ cm}^2$; $P = 0.035$).

■ **CONCLUSIONS:** Multiple passes are inherent to the bedside EVD procedure, but did not increase the rate of intracranial hemorrhage.

the number of passes needed for bedside EVD placement and compared this with the incidence of hemorrhage. In addition, we analyzed computed tomography (CT) scans before the procedure to identify variables that correlate with multiple passes.

METHODS

Population

This Institutional Review Board-approved study (#5314) took place from September 2007 to March 2009 and includes only inpatients and emergency room patients who required bedside EVD placement. The average age of the patients was 58.4 years (median, 59 years; range, 21-87 years).

Only "fresh" EVD procedures were recorded. Therefore patients who required EVD replacements on the same side and patients with pre-existing shunt catheters were excluded. Our database included 47 prospectively recorded EVD placement procedures on 46 patients (one patient required bilateral EVDs). Forty-four patients had communicating or noncommunicating hydrocephalus from multiple etiologies including, but not limited to, subarachnoid hemorrhage (SAH), intracerebral hemorrhage, intraventricular hemorrhage (IVH), brainstem hemorrhage, and posterior fossa hemorrhage or infarct. One patient had an enlarged "trapped" ventricle secondary to meningitis, and another patient had an EVD

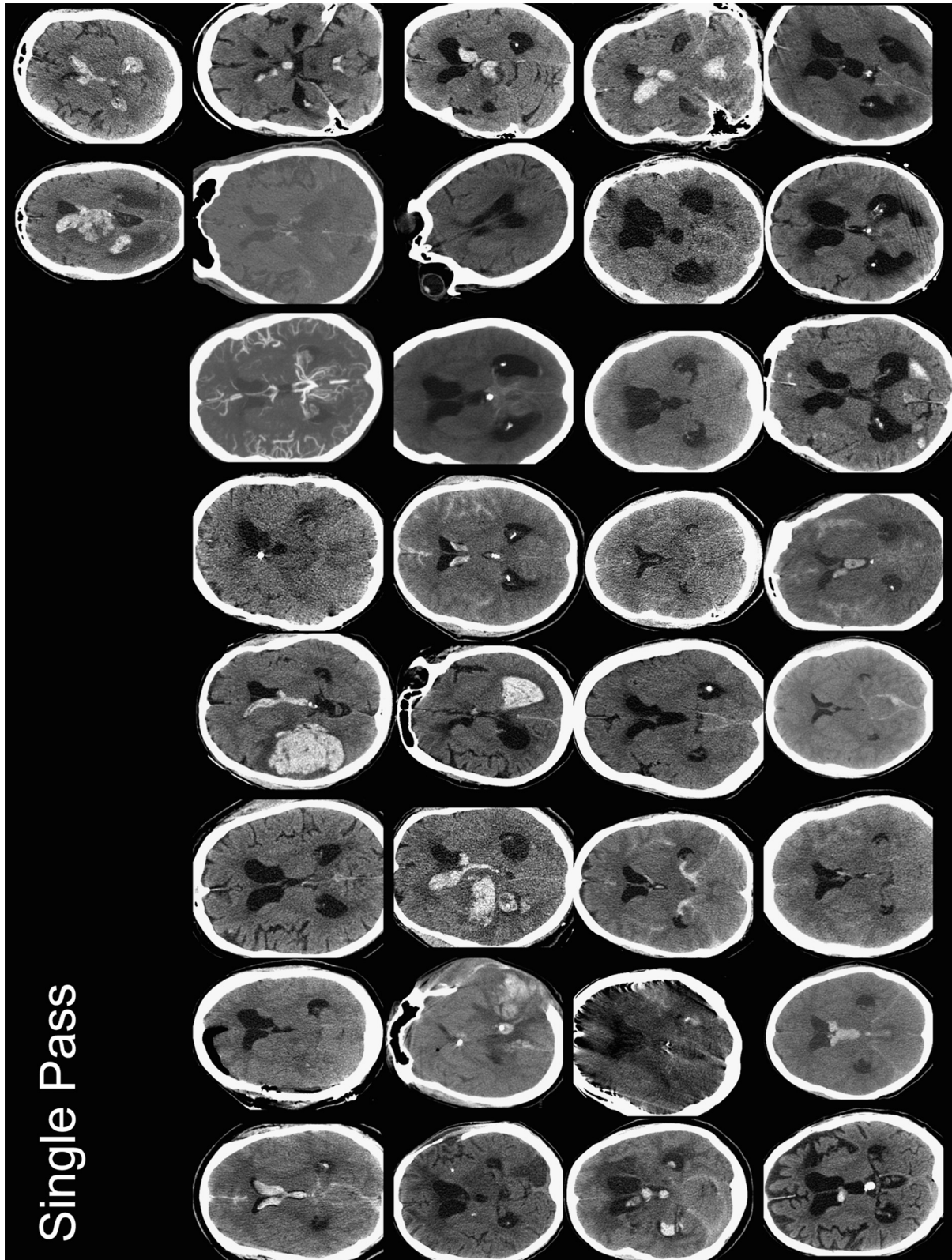


Figure 1. Head computed tomography scans showing the “single pass” group. External ventricular drains were placed in the larger ventricle and on

the right side if the ventricles were symmetrical.

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