Defining a Standardized Approach for the Bedside Insertion of Temporal Horn External Ventricular Drains: Procedure Description and Case Series

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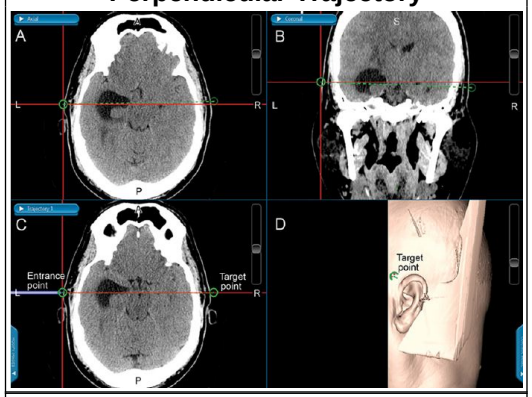
Introduction

Temporal horn entrapment is a potentially lethal form of hydrocephalus caused by obstruction of the trigone of the lateral ventricle. Emergent decompression can be achieved via the bedside insertion of an external ventricular drain directly into the temporal horn (tEVD). The purpose of this study is to identify and describe the safest, most accurate, and most easily standardized method for the bedside insertion of tEVDs.

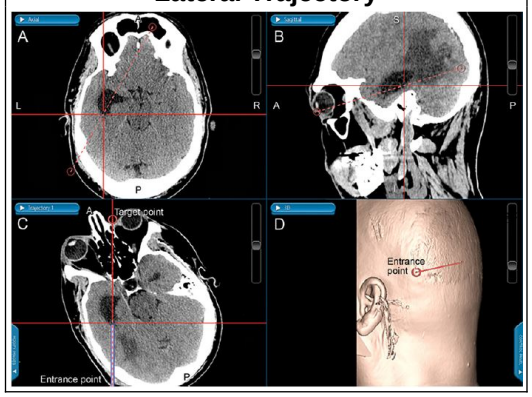
Methods

Volumetric imaging of 20 patients with trapped temporal horns were loaded onto an intraoperative imaging guidance workstation. Three trajectories were identified as most likely to be successful (named perpendicular, lateral, and medial approach). Trajectories were evaluated for success in penetrating the temporal horn, distance from vital structures, as well as for target error and accuracy.

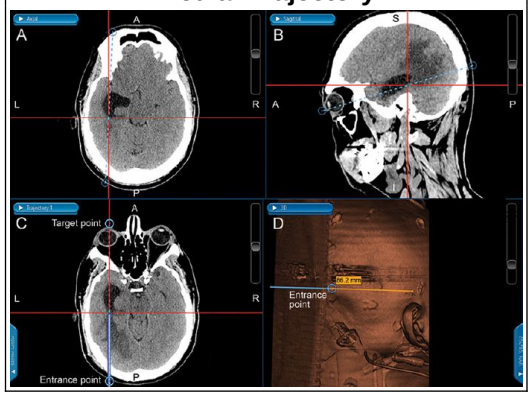
Perpendicular Trajectory



Lateral Trajectory



Medial Trajectory



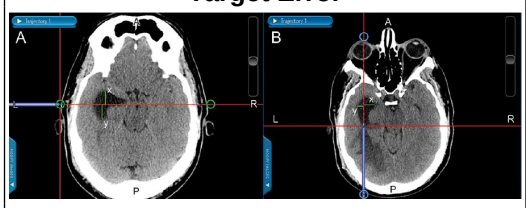
Results

Temporal horn penetration was achieved in 100% of perpendicular approaches and 84% of lateral and medial approaches. No significant difference existed between the three approaches in trajectory error. The perpendicular approach had significantly more accuracy than the lateral approach ($p=0.012$) and the medial approach ($p=0.002$). When evaluating a subset of patients with critical temporal horn dilation, the perpendicular approach had significantly less error than the medial approach ($p=0.020$). The perpendicular approach was also significantly more accurate than the medial approach ($p=0.019$) and trended toward more accuracy than the lateral approach ($p=0.057$).

Conclusions

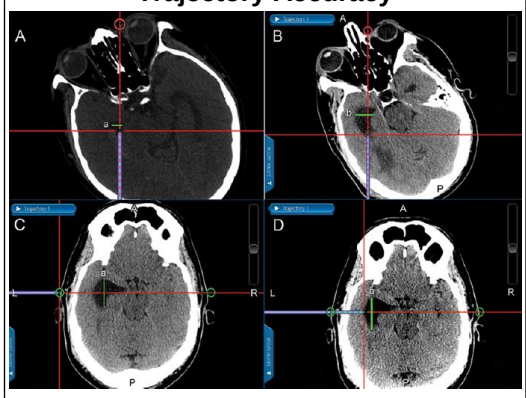
The perpendicular approach to bedside tEVD insertion appears to be the easiest, safest, and most reliable. Based on the above results, we recommend bedside tEVD placement in patients with critical temporal horn dilation who are clinically deteriorating at a rate that prohibits placement of an EVD or shunt in the OR under image guidance. Since the development of this standardized approach, three patients at our institution have required emergent bedside placement of a tEVD, and in each case the perpendicular approach was both safe and effective.

Target Error



$TE = |(x-y)/(x+y)|$

Trajectory Accuracy



Accuracy= a/b

Trajectory Testing

Approach	Success	Target Error	Accuracy
Perp (P)			
All cases	100%	0.39	0.86
Critical	100%	0.29	0.84
Lateral (L)			
All cases	84%	0.42	0.68
Critical	92%	0.35	0.69
Medial (M)			
All cases	84%	0.52	0.57
Critical	92%	0.48	0.60
Results			
All cases	P>(L=M)	-	P>L; p=0.01 P>M; p<0.01
Critical	P>(L=M)	P<M; p=0.02	P>M; p=0.02

Perpendicular approach outperforms the lateral and medial approaches