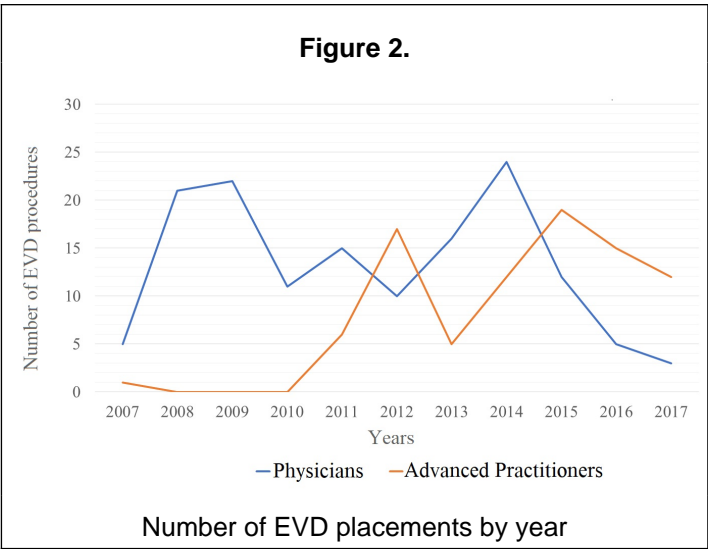
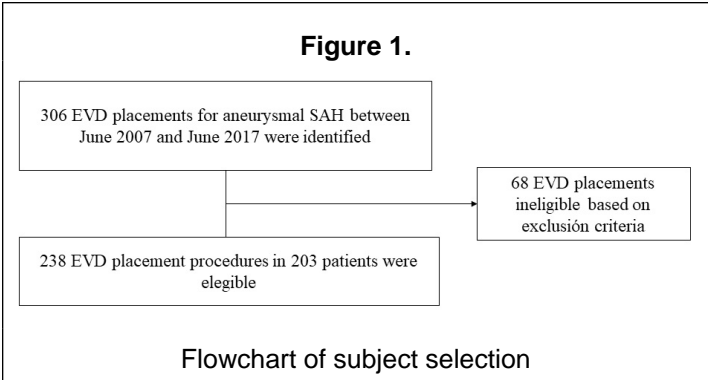


Introduction

Although intracranial pressure monitor insertion safety has been documented among advanced practitioners (nurse practitioners and physician assistants), there are no studies describing the safety and outcomes of external ventricular drain (EVD) placements by specially trained advanced practitioners. The aim of this study is to compare the safety and outcomes of EVD placement by advanced practitioners in patients with subarachnoid hemorrhage (SAH).

Methods

A retrospective chart review was performed from a non-traumatic SAH database selecting patients treated with external ventricular drains from a single major academic institution in the United States between June 2007 and June 2017 (**Figure 1**). A comparison of safety, accuracy of placements, and complications of EVD placement was performed between advanced practitioners and neurosurgical physicians (attending neurosurgeon and subspecialty clinical fellow).



Results

Eighty-seven (36.6%) EVD placements were performed by advanced practitioners and 151 (63.4%) were performed by neurosurgeons. The number of placements per group during the study period is illustrated in **Figure 2**. Most EVDs were placed in the emergency room (114; 47.9%; **Table 1**). Additional procedures performed concurrent with the EVD placements were significantly higher among the physicians group ($p<0.001$). Bedside placement and usage of Ghajar guide during the placement was significantly higher among mid-levels ($p<0.001$ for both). There were, however, no significant differences between the evaluated groups in terms of number of attempts for placements, intraprocedural complications, EVD tract hemorrhages, accuracy of placement EVD infection rates, CSF leaks, catheter dislodgments and need for repositioning/replacement of EVD.

Conclusions

After appropriate training, EVD placement can be safely performed by mid-levels with an adequate accuracy of placement.

Table 1.

Parameter	Physicians n=151 (63.4%)	Advanced Practitioners n=87 (36.6%)	p-Value
Second placement	21 (13.9%)	15 (17.2%)	0.48
Midline shift	22 (15.5%)	11 (13.7%)	0.73
Bedside placement	88 (58.3%)	86 (98.9%)	<0.001
Additional procedure	33 (21.8%)	4 (4.6%)	<0.001
Navigation aid during placement			
None (Free-hand insertion)	136 (90.1%)	31 (35.6%)	<0.001
Ghajar guide	15 (9.9%)	56 (64.4%)	
Number of attempts for placement			
1	147 (97.4%)	79 (90.8%)	
2	2 (1.3%)	3 (3.5%)	0.08
3	2 (1.3%)	5 (5.8%)	
Intraprocedural complications	2 (1.4%)	1 (1.2%)	0.90
EVD tract hemorrhages			
0	124 (82.1%)	76 (87.4%)	
1	16 (10.6%)	7 (8.1%)	0.60
2	9 (6.0%)	4 (4.6%)	
3	2 (1.3%)	0 (0%)	
Accuracy placement			
Grade 1	120 (79.5%)	72 (82.8%)	
Grade 2	16 (10.6%)	10 (11.5%)	0.53
Grade 3	15 (9.9%)	5 (5.8%)	
EVD infection	14 (9.3%)	5 (5.8%)	0.33
Catheter dislodgement	6 (4.0%)	4 (4.6%)	0.82
Need for repositioning and replacement	29 (19.2%)	18 (20.7%)	0.78
EVD duration in place (Days)	10 (IQR 6 - 14)	10 (IQR 5 - 16)	0.73

n(%), p-Value: Chi2 test
Median (Interquartile range), p-Value: Mann Whitney U test.

Comparison of EVD placement safety and outcomes

Learning Objectives

- By the conclusion of this session, participants should be able to:
- 1) Discuss the importance of the role of midlevel care providers in the neurosurgical daily practice.
 - 2) Discuss the role of the Ghajar guide in the placement of external ventricular drains.