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## Declaring a Patient Brain Dead on Extracorporeal Membrane Oxygenation (ECMO): Are There Guidelines or Misconceptions

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# Declaring a Patient Brain Dead on Extracorporeal Membrane Oxygenation (ECMO): Are There Guidelines or Misconceptions?

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## Introduction

- ECMO is becoming a widely used therapy for the supportive care of patients with respiratory and/or cardiac failure, acute MI, and cardiac arrest.
- One of the complications of ECMO is neurological injury resulting in brain death.
- Patients who have been pronounced brain dead on ECMO have gone on to become viable organ donors, which is important in the setting of a rapidly growing transplant list.
- A key aspect in the pronunciation of brain death, the apnea test, can be technically challenging and confusing to interpret in the setting of ECMO.
- A lack of consensus exists among clinicians regarding the correct way to declare a patient brain dead on ECMO.

## Objectives

- To review the clinical practice variations and trends with declaring patients brain dead on ECMO
- To highlight the need for the development of consensus guidelines to assist clinicians in the accurate diagnosis of brain death in this specific patient population

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## Methods

**Study Type:** IRB approved retrospective chart review

**Patients:** Organ donors from our local organ procurement organization who were declared brain dead on ECMO

**Study Period:** October 1995- July 2014

**Exclusion Criteria:**

- Pronounced brain dead on another form of mechanical circulatory support, such as biventricular assist device or left ventricular assist device
- Not on ECMO at the time of brain death

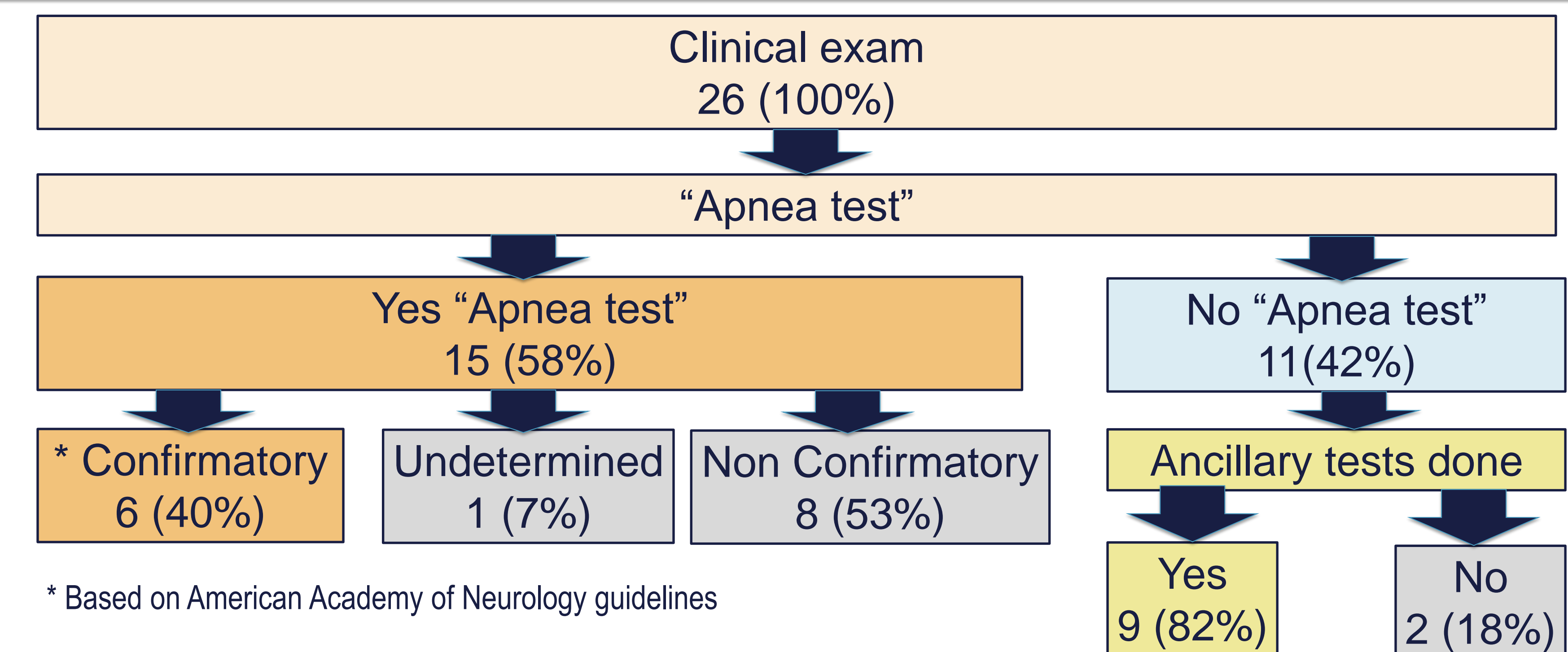
**Number of Patients Identified: 26**

- Mean Age (years): 26.9 ± 21.7
- Male : Female = 13 : 13
- Mean Length of ECMO (days) : 5.4 ± 6.6

**Modalities for Determining Brain Death on ECMO**

#	Year	Clinical	Apnea	EEG	CBF	TCD	Angio	CT
1	1995	xx	x	x				
2	1997	x		x				
3	2001	xx	x					
4	2006	xx	x					
5	2007	xx	x					
6	2007	x	x		x			
7	2008	xx	x	x				
8	2008	xx						
9	2009	xx		x		x		
10	2009	xx	x	x				
11	2010	xx	x			x		
12	2011	xx	x			x		
13	2012	xx	x					
14	2012	xx						x
15	2012	xx	x					
16	2013	xx	x					
17	2013	xx						
18	2013	xx		x				
19	2013	xx				x		
20	2013	x				x		
21	2013	xx	x			x		
22	2014	xx	x	x			x	
23	2014	x				x		
24	2014	xx				x	x	
25	2014	xx	x					
26	2014	xx						x

## Results



Apnea testing in ECMO patients:

- Even when an apnea test was performed, at least one ancillary test was also performed in 47% of cases.
- There were five documented examples of how the apnea test was performed while the patient was on ECMO and all five were performed differently.
- In several of the cases, even when an apnea test was documented as confirmatory, it was not considered confirmatory based on American Academy of Neurology guidelines.

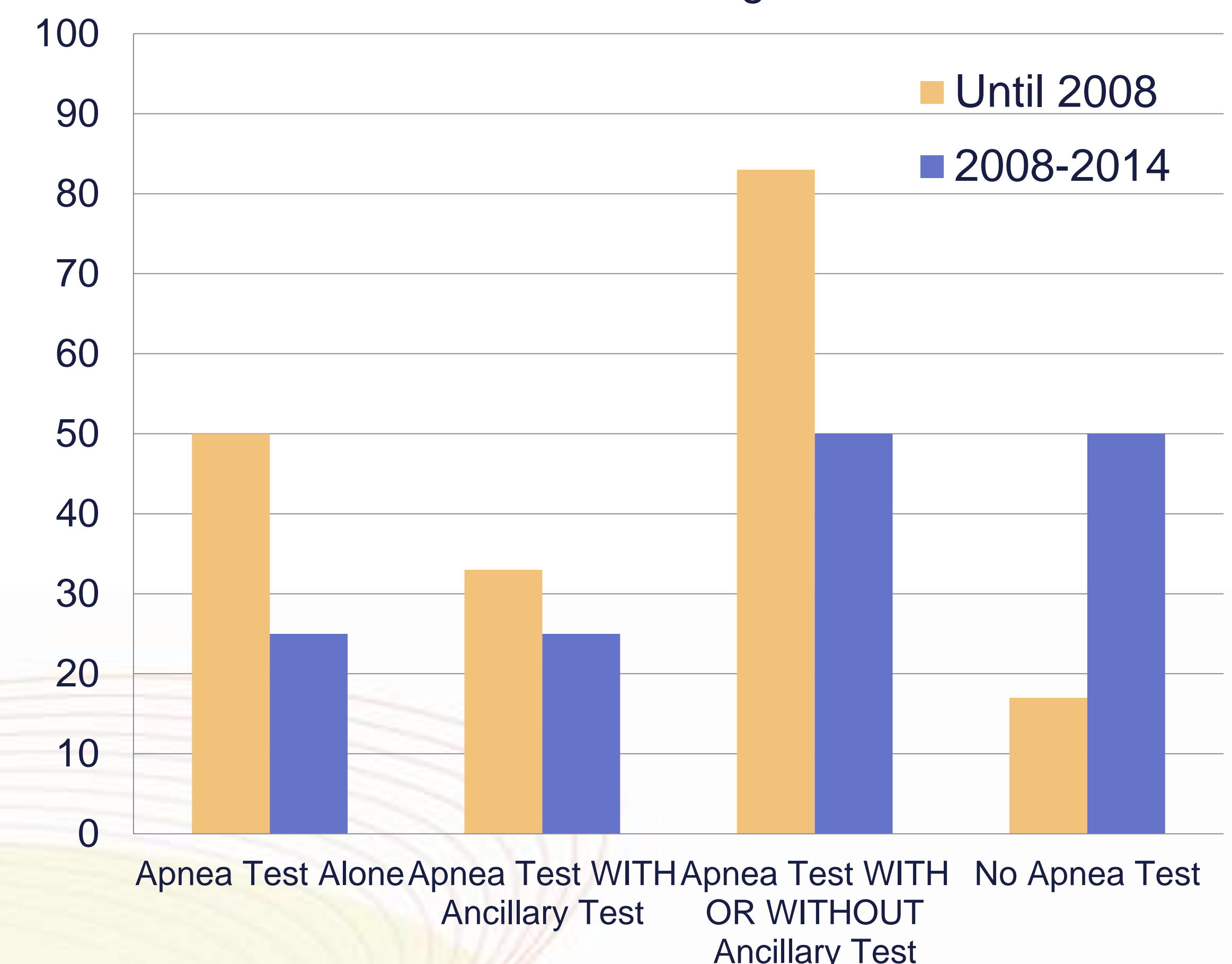
Lack of apnea testing in ECMO patients:

- When an apnea test was not performed, 55% of clinicians documented ECMO or patient instability as the reason for not performing an apnea test.
- In the other 45% of patients in whom an apnea test was not performed, there was no documentation available in regards to why an apnea test was not performed.

## Conclusions

- This study shows that the diagnosis of brain death on ECMO lacks consensus guidelines regarding clinical exam, performance of apnea testing and use of definitive ancillary testing.
- There appears to be a trend towards utilizing ancillary tests as opposed to the apnea test in the diagnosis of brain death for patients on ECMO.
- The difficulty and controversy with performing a standard apnea test while on ECMO has led to inconsistent performance of and interpretation of the test, which has prompted unguided use of ancillary studies.
- Due to the substantial increase in the use of ECMO, it is vital that guidelines are developed to assist clinicians in the accurate diagnosis of brain death in patients on ECMO.

Trends in Modalities for Determining Brain Death on ECMO



Most common ancillary test:

- From 1995 to 2010: EEG
- From 2010 through 2014: CBF study