Reliability of CT Angiography as a Confirmatory Test for Brain Death Determination

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Introduction

Conventional cerebral angiography has long been considered the gold standard as a confirmatory test in assessing intracranial blood flow in brain death determination. Computerized tomographic angiography (CTA) is a non-invasive test that can provide the same information with certain advantages, however, there is no consensus pertaining to the technical protocol or interpretation of CTA in this context. We aimed to compare CTA with invasive angiography in determining intracranial blood flow as a confirmatory test in brain death determination.

Methods

We prospectively enrolled 22 patients with brain death determined by neurologic examination and apnea testing (when possible) to receive confirmatory testing by both CTA and conventional angiography. Eighteen patients received both CTA and conventional angiography as a confirmatory test. Four patients (18%) did not receive either one or both tests due to cardiac arrest before both tests could be performed or hemodynamic instability precluding patient transportation. Radiographic data was evaluated by a neuroradiologist.

Results

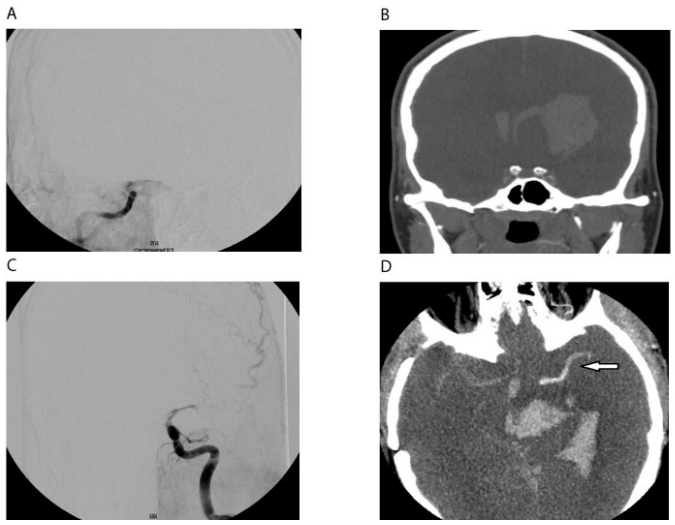
Of patients receiving both tests, fifteen (83.3%) had conventional angiograms that showed complete lack of intracranial blood flow consistent with brain death. All fifteen of these patients (100%) had CTA studies that were consistent with brain death. The three patients with persistent intracranial flow on conventional angiography also had distal arterial and deep venous flow on CTA.

Table 1

Patient	Age	Sex	Diagnosis
1	48	F	hCVA
2	22	M	GSW
3	37	M	TBI
4	57	F	SAH
5	49	F	hCVA
6	44	M	hCVA
7	42	F	hCVA
8	53	M	hCVA
9	46	F	TBI
10	67	M	hCVA
11	42	F	SAH
12	48	F	SAH
13	29	M	SAH
14	64	F	iCVA
15	48	M	iCVA
16	24	M	SAH
17	61	M	hCVA
18	50	M	hCVA
19	66	M	TBI
20	22	M	TBI
21	54	F	hCVA
22	53	M	SAH

M = male, F = female, TBI = traumatic brain injury, hCVA = hemorrhagic cerebrovascular accident, iCVA = ischemic cerebrovascular accident, GSW = gun show wound, SAH = subarachnoid hemorrhage

Figure 1



Digital subrtraction angiography (A) and CT angiogaphy (B) for a patient with no intracranial blood flow. Digital subtraction angiography (C) and CT angiography (D) for a patient with persistent intracranial blood flow.

Conclusions

In this prospective study, CTA was equivalent to conventional angiography as a confirmatory test in brain death determination. Clinical examination and apnea testing remain the gold standard but when confirmatory testing is necessary, our data suggests that CTA is equivalent to angiography and should be considered as a reliable and efficient alternative to other accepted forms of confirmatory testing.