

“Describe the Wada test including indications, the procedure itself and possible complications. What alternative tests exist to determine lateralization of language and/or memory.”

The Wada test, also known as the Intracarotid amobarbital procedure (IAP) is a test used to determine hemispheric language and memory dominance. The procedure was developed by Dr Juhn Wada of British Columbia in the late 1940s to establish cerebral language dominance as part of the preoperative evaluation for epilepsy surgery. Memory testing was added in the 1960s to evaluate the risk of significant memory decline following anterior temporal lobectomy.¹

The Wada test requires a multi-disciplinary approach. The test is often performed in the angiography suite with the presence of an epileptologist, neuroradiologist, neurophysiologist and potentially an anesthesiologist. With EEG, pulse oximetry, ECG and NIBP monitoring, amobarbital is injected into one of the internal carotids through a cannulated femoral artery. This causes suppression of the function of the ipsilateral hemisphere confirmed by drug-induced EEG slowing and contralateral hemiplegia. While one hemisphere is anaesthetized, language and memory functions of the hemisphere contralateral to the injection site can be tested. To test cerebral dominance for language, the patient has to perform a number of simple tests involving expressive and receptive language. While protocol and procedure may vary between centers, tasks usually include counting and object or picture naming to probe frontal language areas. It will also include responding to verbal commands and reading in order to assess posterior language zones. If the hemisphere dominant for speech is anaesthetized, the patient is temporarily rendered mute. This is not the case when the non-dominant hemisphere is deactivated. To assess memory functions, neuropsychologists will ask the patient to recall or recognize pictures or objects that have been shown to the patient prior to the injection.

Amobarbital was the drug of choice for this test and anesthesiology was not routinely present as radiologists were the ones to inject the sodium amobarbital. Owing to drug shortages and limited availability of sodium amobarbital, alternative anesthetic agents have been sought out. Methohexital, pentobarbital, etomidate, and propofol have all been studied as viable alternatives.³

The Wada test is an invasive procedure which carries its own set of risks and limitations. A retrospective study conducted by Loddenkemper et al. reviewed 677 patients. Complications were observed in 74 patients (10.9%) and included encephalopathy (7.2%), seizures (1.2%), strokes (0.6%), transient ischemic attacks (0.6%), localized hemorrhage at the catheter insertion site (0.6%), carotid artery dissections (0.4%), allergic reaction to contrast (0.3%), bleeding from the catheter insertion site (0.1%), and infection (0.1%).⁴

With the development of non-invasive functional neuroimaging methods such as functional magnetic resonance (fMRI), magnetoencephalography (MEG), and transcranial magnetic

stimulation (TMS) to lateralize language and memory function, the continued use of the Wada test has been questioned. fMRI consists of a high-resolution MRI acquisition protocol and can be used to lateralize language function with a 95% accuracy.⁵ It can also be used to facilitate the localization of seizure foci by detecting the cerebral hemodynamic changes produced by epileptiform discharges.⁶ Therefore, functional imaging techniques represent a potential alternative for the traditional Wada procedure in the presurgical exploration of language lateralization in epilepsy patients. On the other hand, the exploration of memory functions remains a major challenge for neuroimaging techniques. There is no alternative to the Wada procedure to assess the risk of severe postoperative memory loss in individuals with evidence of bitemporal disease or dysfunction.⁷

References

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