Alternatives to Sodium Amobarbital in the Wada Test

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Request

What are some alternatives to sodium amobarbital for use in the Wada test?

Response

BACKGROUND

Determining language dominance is important before epilepsy surgery to lateralize seizure focus and predict outcomes after surgery. The intracarotid amobarbital procedure, also known as the Wada test, was introduced 50 years ago as a method to determine cerebral dominance prior to surgical resection. The rationale was that temporary anesthetization of the cerebral hemispheres, individually, would allow for evaluation of the relative contribution made by each temporal lobe to support of language and memory function.[1] It was later modified to evaluate memory function and predict the risk of amnesia following temporal lobe resection.[2,3] Currently, the Wada test has emerged as the gold standard method to lateralize speech and memory function.[4] On rare occasions, it has been used

Author information provided at end of text.

OBJECTIVE: To review the literature and identify alternatives to sodium amobarbital for use in the Wada test.

DATA SOURCES: A search of PubMed (1960-October 2010) was performed using the following key words alone or in combination: Wada test, intracarotid amobarbital procedure, intracarotid, intraarterial, sodium amobarbital, methohexital, Brevital, pentobarbital, etomidate, propofol, and alternative anesthetics. References of the identified articles were reviewed for relevant information.

STUDY SELECTION AND DATA EXTRACTION: All articles in English identified from the data sources were evaluated. Review included comparative, prospective, and retrospective studies along with case series and case reports.

DATA SYNTHESIS: Methohexital, pentobarbital, etomidate, and propofol have all been studied as alternatives to sodium amobarbital in the Wada test. Four controlled experimental trials, 1 uncontrolled experimental trial, 6 retrospective chart reviews, and 2 case reports were reviewed. Methohexital, pentobarbital, and propofol required a second injection due to their short duration of action. Etomidate was studied as a bolus injection followed by a continuous infusion until the critical speech and memory tests were administered, which differed from the standard Wada test procedure. Patients had an increased risk of seizures with methohexital, whereas 1 patient developed transient respiratory depression immediately after receiving pentobarbital. Furthermore, propofol caused increased tone with twitching and rhythmic movements, which interfered with the completion of the Wada test for 1 patient. All authors concluded that these agents were equivalent to amobarbital for the Wada test.

CONCLUSIONS: Methohexital, pentobarbital, etomidate, and propofol are viable alternatives to sodium amobarbital for use in the Wada test, but each has shortcomings.

KEY WORDS: etomidate, intracarotid, methohexital, pentobarbital, propofol, sodium amobarbital, Wada test.

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to determine speech dominance in patients with brain tumors and no epilepsy.

During the procedure, sodium amobarbital is injected into the internal carotid artery to temporarily inactivate the ipsilateral cerebral hemisphere, allowing independent testing of the contralateral hemisphere. The patient is asked to respond to a series of memory and speech-related tests.[2,4] After complete recovery of neurologic function, at least 30 minutes after the initial anesthetic injection, the procedure is repeated for the other hemisphere.[2,4,5] Scores for language and memory performance are derived in each hemisphere and used to predict the likelihood of a catastrophic memory outcome.

Sodium amobarbital is the standard drug used in the Wada test due to its short duration of action and low toxicity, as well as clinicians' extensive experience with its effects. The dosage varies from 60 to 200 mg, with 125 mg being the most frequently used.[5] However, amobarbital possesses some undesirable characteristics. Selwa et al. found that electrographic recovery after the second injection was prolonged if the interval between the 2 injections was less than 40 minutes.[6] The authors recommended successive injections to be separated by at least 45 minutes, which may limit the number of procedures that can be carried out in a day.[6,7]

Continued use of the Wada test has been challenged. First, less-invasive procedures have been proposed, such as functional magnetic resonance imaging or magnetoencephalography.[8] Second, amobarbital availability has been a problem, with frequent shortages worldwide.[2-4,8,9] Uncertainty about when or whether amobarbital will be available has led to exploration of different anesthetics, such as methohexital, pentobarbital, etomidate, and propofol, for use in the Wada test.[2,8,9]

LITERATURE REVIEW

A literature search of PubMed (1960-October 2010) was performed using the following key words alone or in combination: Wada test, intracarotid amobarbital procedure, intracarotid, intraarterial, sodium amobarbital, methohexital, Brevital, pentobarbital, etomidate, propofol, and alternative anesthetics. The search was limited to English language and human subjects. References of the identified articles were reviewed for relevant information.

Methohexital

Buchtel et al.[7] reported their experience using methohexital in the Wada test compared to historical data on amobarbital (Table 1). Eighty-six patients (173 procedures) with intractable epilepsy received methohexital during presurgical evaluation with the Wada test. Of the 173 procedures, 10 required a third dose and 1 required a fourth dose of 2 mg. Motor and electroencephalogram (EEG) recovery times were compared to previously published data of 48 patients who received a single 125-mg dose of amobarbital. The authors concluded that the agents did not differ in determining language dominance, but patients recovered more completely after each injection of methohexital compared to a single injection of amobarbital.

Andelman and colleagues[10] presented the results of Wada memory scores obtained using an intracarotid methohexital injection compared to historical data on patients who had received intracarotid amobarbital (Table 1). During a 2-year period, 20 patients were identified. Methohexital 3 mg was injected twice in each hemisphere. The hemisphere ipsilateral to the epileptogenic lesion was injected first. Language dominance was determined after the first injection and memory function was assessed after the second injection. Four patients did not receive a second injection in the right hemisphere: 1 patient was obtunded and in 3 patients the length of hemiparesis was long enough to allow both language and memory testing. The mean dose of amobarbital was 107 mg for each hemisphere, with no adverse events reported.[11] Wada ipsilateral and contralateral memory scores were compared. The authors concluded there is higher memory potential in the hemisphere ipsilateral to the epileptogenic lesion when using methohexital. Furthermore, since none of the patients received both drugs, the results are correlative and no direct comparison can be made.

Loddenkemper et al.[12] conducted a retrospective chart review to determine the incidence of seizures during the Wada test and to compare the occurrence of seizures after injection of amobarbital and methohexital (Table 1). A total of 760 patients were identified. Intracarotid amobarbital was given as a single injection, whereas intracarotid methohexital was given as 2 injections. Seizure frequency increased significantly after a methohexital injection compared to an amobarbital injection (baseline range: 2 per day to 2 per month). Incidence of seizures was less following the amobarbital injection than the methohexital injection (0.7% vs 4.1%; $p = 0.001$). The authors concluded that patients with a previous seizure history may be at a higher risk of seizures after methohexital.

In another retrospective chart review, Loddenkemper and colleagues[13] showed that methohexital and amobarbital were not significantly different in determination of language and memory lateralization. Longer aphasia in the amobarbital group was attributed to a longer half-life.

In summary, methohexital is a rapid, ultrashort-acting barbiturate anesthetic with a quick onset. It does not concentrate in body fat to the extent that other barbiturate anesthetics do. Its short duration of action requires administration of multiple injections during the Wada test. However, patients recover more completely with 3 or 4 separate injections, allowing multiple tests in a single session without the drowsiness seen with amobarbital. Methohexital

Table 1. Summary of Trials Evaluating Alternatives to Amobarbital for the Wada Test

Reference	Design	Pts.	Interventions	Endpoints	Results
Buchtel (2002)[7]	Controlled experimental	N = 86; inclusion: pts. with intractable epilepsy who received presurgical Wada test; exclusion: none specified	Intracarotid methohexital 3 mg over 3 sec followed by 2 mg over 2 sec; comparable data from previous pts. who received amobarbital	Motor recovery, EEG recovery	Motor recovery from the effects of methohexital (259 ± 63 sec) much faster vs amobarbital (385 ± 108 sec); average time to EEG baseline after methohexital (355 ± 76 sec) faster with amobarbital (468 ± 110 sec); no ADEs reported
Andelman (2006)[10]	Controlled experimental	N = 20; inclusion: pts. with TLE (complex partial seizures with or without secondary generalization); exclusion: pts. with a primary psychiatric diagnosis and/or mental retardation	Intracarotid methohexital 3 mg (each hemisphere injected twice); 32 pts. with TLE who underwent Wada test with amobarbital identified from previously published data	Contralateral Wada memory score, ipsilateral memory score, standard neuropsychological memory scores	No significant difference between contralateral Wada memory score (84.91 vs 81.17); methohexital showed significantly higher level of memory function vs amobarbital (55.26 vs 30.74); correlation between Wada ipsilateral memory score and standard memory test scores higher with amobarbital vs methohexital
Loddenkemper (2007)[12]	Retrospective chart review	N = 760; inclusion: pts. with intractable epilepsy who received presurgical Wada test; exclusion: none specified	Intracarotid methohexital 3 mg followed by 2 mg (range 3-10) (n = 222) Intracarotid amobarbital 75-250 mg (n = 538)	Incidence of seizures	16 (2.1%) pts. had seizure during Wada test; 3 before barbiturate injection (amobarbital, 2; methohexital, 1); 13 after barbiturate injection (amobarbital, 4; methohexital, 9)
Loddenkemper (2009)[13]	Retrospective chart review	N = 582; inclusion: pts. undergoing Wada test; exclusion: none specified	Amobarbital 100 mg (range 75-250) Methohexital 3 mg followed by 2 mg (range 3-10)	Language lateralization, speech arrest, memory lateralization	No difference in language lateralization; speech arrest significantly longer with amobarbital (left: 130 vs 5 sec; right: 8 vs 5 sec); no difference in memory lateralization
Kim (2007)[14]	Retrospective chart review	N = 60; inclusion: pts. with TLE who underwent presurgical Wada test; exclusion: none specified	Intracarotid amobarbital (n = 32) Intracarotid pentobarbital (n = 28)	Time to recovery of grade 3 and 5 motor activity; aphasia time; duration of EEG delta slowing; ADEs	Time to recovery of grade 3 and 5 motor activity not significantly different; drowsiness and confusion more common with amobarbital; respiratory depression in 1 pentobarbital pt.
Jones-Gotman (2005)[15]	Uncontrolled experimental	N = 16; inclusion: pts. with right frontal-lobe tumor requiring intracarotid amobarbital for presurgical evaluation of memory and/or speech lateralization; exclusion: none specified	Intracarotid etomidate 2 mg (0.03-0.04 mg/kg) bolus injection followed by infusion at 6 mL/h (0.003-0.004 mg/kg/min)	Neurologic findings during drug effect EEG monitoring Language ADEs	Dysarthria, contralateral facial weakness, contralateral visual field defect reported during infusion Interictal spike activity activated or induced in 8 injections Complete speech arrest in all but 1 pt. during infusion Shivering-like tremor during infusion in 9 pts. (12 injections)
Bazin (1998)[17]	Case report	N = 1; 43-year-old male with left temporal occipital tumor	Intracarotid propofol 20 mg	NA	Pt. experienced rapid psychomotor recovery with no ADEs (but he perceived an intense blue light)
Silva (2000)[18]	Case report	N = 1; 26-year-old with refractory TLE	Intracarotid propofol 20 mg; required an additional injection	NA	Propofol can replace amobarbital for Wada test (pt. experienced hot sensation in head and speech arrest for 2 min)
Takayama (2004)[19]	Retrospective chart review	N = 67; inclusion: right-handed pts. undergoing presurgical Wada test; exclusion: none specified	Intracarotid propofol 10 mg (n = 12) Intracarotid amobarbital 100 mg (n = 55)	Time to recovery of grade 3 and grade 5 motor activity Onset time of first verbal response and nonverbal after injection ADEs	Recovery time shorter with propofol (p = NS) Onset time of first verbal response longer with propofol (p < 0.001) 2 pts. experienced laughing and 2 pts. showed head and eye version to the side immediately after propofol injection

ADEs = adverse drug events; AVM = arteriovenous malformation; TLE = temporal lobe epilepsy.

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has been associated with faster motor recovery times and higher memory function scores compared to amobarbital, but the clinical significance of these findings is relatively low. The findings also suggest that memory scores may depend on the anesthetic used, which raises the question of the distribution of the drugs' effect in the epileptogenic hemisphere. An increased incidence of seizures has been reported with its use and has led to premature termination of the procedure in some cases. There have also been reports of seizures associated with methohexital use outside the Wada test; however, different dosing and clinical settings make the comparison difficult.

Pentobarbital

Kim et al.[14] conducted a retrospective chart review to compare the usefulness of pentobarbital to that of amobarbital in the Wada test (Table 1). During a 1-year period, 60 patients were identified. The interval between the first and

Table 1. Summary of Trials Evaluating Alternatives to Amobarbital for the Wada Test (continued)

Reference	Design	Pts.	Interventions	Endpoints	Results
Mikuni (2005)[20]	Retrospective chart review; case series for ADEs	N = 58; inclusion: pts. with brain tumors, TLE, or AVM undergoing presurgical Wada test; exclusion: none specified	Intracarotid propofol 10 mg; maximum dose 15 mg for brain tumors, 10 mg for TLE, 17 mg for AVM	ADEs grade 1: eye pain, shivering, laughing, apathy, face contortion, lacrimation grade 2: involuntary movement, shivering, head and eye version, face contortion, lacrimation, eye pain grade 3: increased tone with twitching and rhythmic movements, confusion, tonic posture	ADEs in 19 pts.: 6 grade 1, 6 grade 2, 7 grade 3; grade 3 symptoms associated with older age (>55 y), higher doses (total dose >20 mg or 2nd injection >10 mg), and AVM; no risk factors associated with grade 1 and 2 symptoms
Masters (2000)[21]	Retrospective chart review	N = 24; inclusion: age <18 y with refractory epilepsy, AVMs, cavernoma, and opercular tumor undergoing Wada testing; exclusion: none specified	During angiography: propofol boluses + infusion (n = 10) or propofol infusion only (n = 13) or propofol boluses only (n = 1); during Wada test: amobarbital (n = 24)	Blood pressure, heart rate	Propofol decreased blood pressure (systolic, 12.4%; diastolic, 13.9%), heart rate (4.7%)
Mikati (2009)[22]	Controlled experimental	N = 40; inclusion: pts. undergoing the Wada test for presurgical evaluation; exclusion: none specified	Intracarotid propofol 20 mg (n = 25) Intracarotid amobarbital 120 mg (n = 15); comparable data from previous pts. who received amobarbital were used	Number of doses; percentage of pts. requiring more than 1 dose Time to recovery of grade 3 motor activity Onset time of first nonverbal and verbal response after injection ADEs	Number and percentage significantly higher in propofol group vs amobarbital group (dose for 2nd injection ranged from 5 to 20 mg) Recovery time not significantly different between the left and right side (propofol and amobarbital groups combined) Left side responses prolonged vs right side (propofol and amobarbital groups combined) 1 pt. experienced confusion, combativeness, and agitation
Mikuni (2010)[23]	Controlled experimental	N = 75; inclusion: pts. with brain tumors, TLE, or AVM undergoing presurgical Wada test; exclusion: none specified	Intracarotid propofol 10 mg (n = 58) (previously reported data[20]) Intracarotid propofol 10 mg plus methylprednisolone 500 mg 5 min prior to propofol (n = 75)	ADEs	ADEs in 9 pts.: 4 grade 1, 4 grade 2, 1 grade 3; grade 3 symptoms not significantly associated with older age (>55 y), higher doses (total dose >20 mg or 2nd injection >10 mg), and AVM

ADEs = adverse drug events; AVM = arteriovenous malformation; TLE = temporal lobe epilepsy.

second injection was 40 minutes for amobarbital and 30 minutes for pentobarbital. Amobarbital doses ranged from 75 to 125 mg, with 75 mg being the initial dose and any additional doses being 25 or 50 mg. Pentobarbital doses ranged from 20 to 24 mg for the initial dose and 12 to 16 mg for any additional doses. Eight patients in the amobarbital group and 10 patients in the pentobarbital group received an additional injection due to incomplete paralysis after the first injection. One patient (3.1%) experienced drowsiness and no patients experienced confusion in the pentobarbital group, whereas 4 patients (14.3%) experienced drowsiness and 2 patients (7.1%) experienced confusion in the amobarbital group. One patient experienced transient respiratory depression immediately after receiving the pentobarbital injection when the Wada test was repeated for the other hemisphere. The patient did not experience cardiac rhythm or other cardiovascular changes or show seizure activity on EEG monitoring. The authors found pentobarbital to be equivalent to amobarbital for language and memory lateralization.

Pentobarbital is a short-acting barbiturate whose duration of action is longer than that of methohexital, but shorter than that of amobarbital. Unlike methohexital, it does not always require an additional injection. Although patients experienced drowsiness and confusion, the incidence was not clinically or statistically significant. However, 1 patient developed transient respiratory depression, which required early termination of the procedure. It is difficult to attribute this episode to pentobarbital because the patient hyperventilated for 3 minutes before he stopped breathing. The respiratory depression could be due to hyperventilation-induced hypercapnea. However, respiratory status should be monitored when using pentobarbital in the Wada test.

Etomidate

Jones-Gotman et al.[15,16] reported their experience using etomidate for the Wada test (Table 1). All patients received a 2-mg initial bolus, which is part of the standard procedure, followed by an infusion at a rate of 6 mL/h, an adaptation introduced by the investigators, referred to as the Etomidate Speech and Memory test (eSAM). The infusion was maintained until the critical speech and memory tests were administered and then testing continued, as in the standard Wada procedure. Interictal spike activity was activated or induced in 8 injections. The shivering-like tremor during the infusion was considered mild in all but 2 patients whose shaking was characterized as moderate. The authors concluded that etomidate appears to be a safe alternative to amobarbital for intracarotid speech and memory testing. Additionally, eSAM may provide an extended period of hemianesthesia between the bolus injection and the beginning of recovery compared to the standard procedure.

Etomidate is a potent nonbarbiturate hypnotic agent with a rapid onset, short duration of action, and minimal hemodynamic effects. It requires a continuous infusion following the initial bolus due to its short half-life. The continuous infusion could be advantageous, allowing the procedure to continue until language and memory functions have been satisfactorily tested. Facial weakness and visual field defect were observed in many patients, but these effects waned within 4 minutes after stopping the infusion. Patients had preserved attention and cooperation throughout the complete speech arrest and returned to baseline speech shortly after the infusion was stopped. These adverse effects did not cause early termination of the procedure and were not considered clinically significant. Etomidate can cause myoclonus tremor and dystonic posturing, most often at the beginning of deep anesthesia. Finally, etomidate has a dose-dependent and cumulative suppressive effect on adrenal function, which may limit its use, particularly in critically ill patients.

Propofol

The use of propofol in the Wada test has been described in 2 case reports,[17,18] 3 retrospective chart reviews,[19-21] and 2 controlled experimental studies.[22,23] Bazin and Picard[17] described successful use of propofol 20 mg for the Wada test without any major adverse events (Table 1). Silva and colleagues[18] reported that propofol was a suitable alternative to amobarbital for the Wada test but recommended a lower dose for the second injection, as the drug's effect lasted 2 minutes longer after the second injection (Table 1).

Takayama et al.[19] evaluated the usefulness of propofol (mean dose 11 mg) as an alternative to amobarbital (mean dose 104 mg) for the Wada test in 67 patients (Table 1). Additional injections were administered if complete paralysis was not achieved. No persistent neurologic defects or cardiopulmonary dysfunction were observed. Laughing and head and eye version lasted for 5 minutes and 1 minute, respectively, and did not warrant early termination of the procedure. Differences between the groups in verbal and nonverbal responses were not clinically significant. The authors preliminarily reported that propofol could replace amobarbital in the Wada test.

A retrospective study[20] was conducted to evaluate the safety of intracarotid propofol injection in 58 patients (Table 1). A 10-mg dose of propofol was used, with additional administered if contralateral hemiplegia was not achieved. Nineteen patients experienced adverse events, which resolved within 5 minutes of injection and were mild enough to continue the Wada test in all but 1 patient. The authors concluded propofol was reasonably safe but careful monitoring was necessary for high-risk patients.

Masters et al.[21] retrospectively reviewed the use of propofol in pediatric patients undergoing Wada testing

(Table 1). Twenty-four cases were identified during a 6-year period. Propofol was administered only during the angiographic portion of the procedure. The mean dose for infusion was 3.15 mg/kg/h and the mean dose for boluses was 1.05 mg/kg. Seven patients received either nitrous oxide and/or fentanyl concomitantly. After angiography, propofol was discontinued and the Wada test was completed with amobarbital. Propofol caused hypotension and decreased heart rate in all patients. No complications were reported during the Wada test and the use of propofol did not compromise its results.

Mikati and colleagues[22] compared their experience using intracarotid propofol to use of amobarbital (Table 1). Forty patients undergoing the Wada test for presurgical evaluation were included. After the propofol injection, 1 patient with recurrent seizures experienced confusion, combativeness, and agitation, which lasted 5 minutes and subsided with a dose of diazepam. All patients in the propofol group exhibited ipsilateral facial and ocular flushing and discomfort after the injection, which lasted 1-2 minutes. Some patients in both groups had short-lived chills. The Wada test was completed in all patients on the same day despite these symptoms. The authors concluded that propofol was as successful as amobarbital in the Wada test.

Mikuni and colleagues[23] evaluated the efficacy of methylprednisolone for improving the safety of propofol administration during the Wada test (Table 1) compared to the rate of adverse events reported previously.[20] There was a statistically significant reduction in grade 3 symptoms in the methylprednisolone group (11% vs 37%) and no significant difference for grade 1 and 2 symptoms.[23] The authors concluded that administering methylprednisolone prior to propofol is a safe approach.

In summary, propofol is a short-acting anesthetic with short duration of action requiring administration of 2 injections during the Wada test. Reported adverse events include confusion and head and eye version, which can also be caused by amobarbital, and are usually short-lived. More serious events, such as increased muscle tone with twitching and rhythmic movements, interfere with completion of the Wada test and warrant close monitoring. However, these events appeared to be self-limiting and did not persist beyond the duration of the drug's effect. Administration of methylprednisolone prior to propofol reduced serious events. Propofol has also been associated with "seizure-like phenomena"[24] and "propofol infusion syndrome"[25] that can limit its use.

Summary

Several alternatives to amobarbital have been identified for use in the Wada test, each with shortcomings. Due to the lack of well-designed experimental studies using large numbers of subjects, clinical recommendations are based on retrospective chart reviews, controlled or uncontrolled experimental trials, and case reports. Propofol has been most extensively studied, followed by methohexital. Adverse events with all agents, except etomidate, have interfered with completion of the Wada test. Use of etomidate is limited by the need for a continuous infusion. Administration of methylprednisolone may reduce adverse events caused by propofol, but further studies are needed to confirm these results. The occurrence of respiratory depression with pentobarbital may be infrequent, since it was reported in only 1 of the 60 patients included in the study. Since there are no comparative studies between the alternatives, clinicians must rely on the clinical significance of the evidence published. Propofol appears to be a better alternative to amobarbital in the Wada test compared to the other agents, but risks and benefits should be considered on an individual basis.

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References

1. Loddenkemper T, Morris HH, Moddel G. Complications during the Wada test. Epilepsy Behav 2008;13:551-3.
2. Abou-Khalil B. An update on determination of language dominance in screening for epilepsy surgery: the Wada test and newer noninvasive alternatives. Epilepsia 2007;48:442-55.
3. Kloppel S, Buchel C. Alternatives to the Wada test: a critical view of functional magnetic resonance imaging in preoperative use. Curr Opin Neurol 2005;18:418-23.
4. Abou-Khalil B. Methods for determination of language dominance: the Wada test and proposed noninvasive alternatives. Curr Neurol Neurosci Rep 2007;7:483-90.
5. Acharya JN, Dinner DS. Use of the intracarotid amobarbital procedure in the evaluation of memory. J Clin Neurophysiol 1997;14:311-25.
6. Selwa LM, Buchtel HA, Henry TR. Electrocerebral recovery during the intracarotid amobarbital procedure: influence of interval between injections. Epilepsia 1997;38:1294-9.
7. Buchtel HA, Passaro EA, Selwa LM, Deveikis J, Gomez-Hassan D. Sodium methohexital (Brevital) as an anesthetic in the Wada test. Epilepsia 2002;43:1056-61.
8. Baxendale S. The Wada test. Curr Opin Neurol 2009;22:185-9.
9. Grote CL, Meador K. Has amobarbital expired? Considering the future of the Wada. Neurology 2005;65:1692-3.
10. Andelman F, Kipervasser S, Reider-Groswasser II, Fried I, Neufeld MY. Hippocampal memory function as reflected by the intracarotid sodium methohexital Wada test. Epilepsy Behav 2006;9:579-86.
11. Andelman F, Kipervasser S, Neufeld MY, Kramer U, Fried I. Predictive value of Wada memory scores on postoperative learning and memory abilities in patients with intractable epilepsy. J Neurosurg 2006;104:20-6.

12. Loddenkemper T, Moddel G, Schuele SU, Wyllie E, Morris HH. Seizures during intracarotid methohexital and amobarbital testing. Epilepsy Behav 2007;10:49-54.
13. Loddenkemper T, Moddel G, Dinner DS, et al. Language assessment in Wada test: comparison of methohexital and amobarbital. Seizure 2009; 18:656-9.
14. Kim JH, Joo EY, Han SJ, et al. Can pentobarbital replace amobarbital in the Wada test? Epilepsy Behav 2007;11:378-83.
15. Jones-Gotman M, Sziklas V, Djordjevic J, et al. Etomidate speech and memory test (eSAM): a new drug and improved intracarotid procedure. Neurology 2005;65:1723-9.
16. Jones-Gotman M, Sziklas V, Djordjevic J. Intracarotid amobarbital procedure and etomidate speech and memory test. Can J Neurol Sci 2009; 36:S51-4.
17. Bazin JE, Picard P. Propofol administered via the carotid artery to achieve a Wada test. Can J Anaesth 1998;45:707-8.
18. Silva TM, Hernandez-Fustes OJ, Bueno ML, Hernandez-Fustes OJ, Varela AM, Machado S. The Wada test with propofol in a patient with epilepsy. Arq Neuropsiquiatr 2000;58:348-50.
19. Takayama M, Miyamoto S, Ikeda A, et al. Intracarotid propofol test for speech and memory dominance in man. Neurology 2004;63:510-5.
20. Mikuni N, Takayama M, Satow T, et al. Evaluation of adverse effects in intracarotid propofol injection for Wada test. Neurology 2005;65:1813-6.
21. Masters Lt, Perrine K, Devinksy O, Nelson PK. Wada testing in pediatric patients by use of propofol anesthesia. AJNR Am J Neuroradiol 2000; 21:1302-5.
22. Mikati MA, Naasan G, Tarabay H, El Yamen S, Baydoun A, Comair YG. Intracarotid propofol testing: a comparative study with amobarbital. Epilepsy Behav 2009;14:503-7.
23. Mikuni N, Yokoyama Y, Matsumoto A, et al. Intravenous methylprednisolone reduces the risk of propofol-induced adverse effects during Wada testing. Neurol Med Chir (Tokyo) 2010;50:622-6.
24. Walder B, Tramer MR, Seeck M. Seizure-like phenomena and propofol, a systemic review. Neurology 2002;58:1327-32.
25. Kam PCA, Cardone D. Propofol infusion syndrome. Anaesthesia 2007; 62:690-701.

Alternativas al Amobarbital Sódico en la Prueba de Wada

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EXTRACTO

OBJETIVO: Revisar la literatura e identificar alternativas al amobarbital sódico para uso en la prueba de Wada.

FUENTES DE INFORMACIÓN: Se llevó a cabo una búsqueda en la literatura mediante PubMed (1960 – octubre 2010) utilizando las siguientes palabras clave solas o en combinación: prueba de Wada, procedimiento intracarotídeo de amobarbital, intracarotídeo, intraarterial, amobarbital sódico, metohexital, Brevital, pentobarbital, etomidato, propofol, y anestésicos alternativos. Se revisaron las referencias de los artículos identificados en busca de información relevante.

SELECCIÓN DEL ESTUDIO Y EXTRACCIÓN DE LOS DATOS: Todos los artículos en inglés identificados de las fuentes de información fueron evaluados para inclusión. La revisión incluyó estudios comparativos, prospectivos, y retrospectivos junto con casos en serie e informes de casos.

SÍNTESIS DE LOS DATOS: Metohexital, pentobarbital, etomidato y propofol han sido estudiados como alternativas al amobarbital sódico. Se revisaron un total de cuatro estudios experimentales y controlados, un estudio experimental no controlado, seis revisiones retrospectivas de expedientes y dos informes de casos. Metohexital, pentobarbital y propofol requirieron una segunda inyección debido a su corta duración de acción. Etomidato fue estudiado en una inyección tipo bolo seguido por una infusión continua hasta que se administraran las pruebas importantes de lenguaje y memoria, las cuales difirieron de la prueba estándar de Wada. Los pacientes tuvieron un aumento en el riesgo de convulsiones con metohexital mientras que un paciente desarrolló depresión respiratoria transitoria inmediatamente después de recibir pentobarbital. Aún más, propofol causó aumento en el tono con espasmos musculares y movimientos rítmicos, los cuales interfirieron con la terminación de la prueba de Wada en un paciente. Los autores llegaron a la conclusión de que estos agentes fueron equivalentes al amobarbital para la prueba de Wada.

CONCLUSIONES: Metohexital, pentobarbital, etomidato y propofol son alternativas viables al amobarbital sódico para uso en la prueba de Wada, pero cada uno tiene sus propias peculiaridades.

Traducido por Rafaela Menal

Alternatives à l'Amobarbital Sodique pour le Test de Wada

A Patel, C Wordell, et D Szarlej

Ann Pharmacother 2011;45:395-401.

RÉSUMÉ

OBJECTIF: Revoir la littérature et identifier les alternatives à l'amobarbital sodique utilisée dans le test de Wada.

SOURCE DES DONNÉES: Une recherche de littérature dans PubMed (1960-octobre 2010) a été effectuée avec les mots-clés suivants utilisés seuls ou en association: Wada test, intracarotid amobarbital procedure, intracarotid, intraarterial, sodium amobarbital, methohexital, Brevital, pentobarbital, etomidate, propofol, et alternative anesthetics. Les références croisées ont été étudiées pour trouver des références additionnelles.

SÉLECTION DES ÉTUDES ET EXTRACTION DES DONNÉES: Tous les articles identifiés en anglais ont été évalués et incluaient les études comparatives, prospectives, et rétrospectives, de même que les études, et les rapports de cas.

SYNTHÈSE DES DONNÉES: La méthohexital, la pentobarbital, l'étomidate, et le propofol ont tous été étudiés comme alternatives à l'amobarbital sodique. Un total de 4 expériences contrôlées, une non-contrôlée, 6 études rétrospectives, et 2 rapports de cas ont été revues. La méthohexital, la pentobarbital, et le propofol ont tous demandé une deuxième injection à cause de leur courte durée d'action. L'étomidate a été étudié avec une injection bolus suivie d'une infusion continue jusqu'à à l'administration des tests de diction et de mémoire, ce qui diffère de la procédure standard du test de Wada. Les patients ont présenté un risque accru de convulsions avec la méthohexital alors qu'un patient a développé une dépression respiratoire transitoire immédiatement après avoir reçu la pentobarbital. De plus, le propofol a causé une augmentation du tonus et des contractions musculaires rythmiques, ce qui a causé des interférences avec le test de Wada chez un patient. Tous les auteurs ont conclu que ces agents sont équivalents à l'amobarbital pour le test de Wada.

CONCLUSIONS: La méthohexital, la pentobarbital, l'étomidate, et le propofol sont tous des alternatives viables à l'amobarbital sodique pour le test de Wada bien que chacun présente ses propres désavantages.

Traduit par Nicolas Paquette-Lamontagne