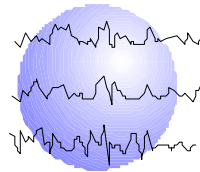


# **FACTORS AFFECTING AMOBARBITAL PROCEDURE (IAP) MEMORY PERFORMANCE IN CHILDREN AND ADOLESCENTS**

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## REVISED ABSTRACT

**RATIONALE:** Previous studies have suggested that children's memory performance on the IAP is associated with intellectual functioning and dominant (DOM) vs. nondominant (ND) hemisphere injection. This study was aimed at assessing these and other factors that are associated with successful IAP memory performance in children and adolescents.

**METHODS:** Patients included seven young (5-7 years), 24 middle (8-11 years) and 41 older (12-17) children and adolescents who underwent the IAP as part of their presurgical evaluation. Patients were included if hemispheric language dominance was successfully classified, they underwent injection of both the left and right hemispheres, and side of seizure onset was unilateral. Data were analyzed with the chi-square, Fisher Exact, and Sign tests.

**RESULTS:** Obtundation or agitation was associated with increased IAP memory failure following injection of either the side ipsilateral (Ipsi) or contralateral (Contra) to seizure onset. Obtundation or agitation was not more often observed among younger or mentally impaired patients. Among those who did not experience agitation or obtundation, patients in the young and middle groups were as likely as adolescents to pass Ipsi and Contra injections. Patients were less likely to pass Dom than ND injection ( $p < .05$ ), and patients with  $IQ < 70$  were less likely than normal IQ patients to pass Dom injection ( $p < .01$ ). Patients were more likely to pass Ipsi than Contra injection, but only when the Ipsi hemisphere was also ND ( $p < .05$ ). Patients with  $IQ < 70$  were less likely to pass Contra injection regardless of whether the contralateral hemisphere was dominant or nondominant ( $p < .01$ ).

**CONCLUSIONS:** In themselves, neither age nor side of injection relative to side of seizure onset were found to be related to satisfactory IAP memory performance. However, children/adolescents were less likely to pass Dom than ND injection when Dom was contralateral to seizure onset. Passing Dom and Contra injections was less likely in low IQ patients. Lower dose of amobarbital was associated with increased likelihood of passing either injection, particularly in younger patients.

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## **INTRODUCTION**

Studies on the IAP in children suggest that language lateralization is successfully classified in most children and adolescents, supporting the use of the procedure in young individuals<sup>1,2,4</sup>. However, the value of the IAP for assessing hemispheric memory capacity in children and adolescents is less clear, as are factors affecting IAP memory performance in this population. Szabo and Wyllie<sup>3</sup> reported lower memory scores among patients with below-normal intellectual functioning. Williams and Rausch<sup>1</sup> reported that older individuals ( $\geq 13$  years) outperformed younger patients following injection of the hemisphere ipsilateral to seizure focus, although this appeared due to younger children's decreased likelihood of passing memory testing with dominant hemisphere injection. Patients in that study were also more likely to fail memory testing following injection contralateral to seizure focus independent of side of language dominance.

The purpose of this study was to further explore variables affecting IAP memory performance in children and adolescents. A larger sample size in this study than in previous studies permitted a more specific analysis of the single and combined effects of variables such as age, IQ, side of injection (ipsilateral vs. contralateral to seizure onset, dominant vs. nondominant hemisphere), and dose of amobarbital.

## **METHODS**

The sample included 34 males and 38 females (age five to 17 years) who underwent the IAP prior to epilepsy surgery and/or tumor resection between 1992 and 2000 (see Table 1). The sample was divided into three groups: Group 1 included patients age 5-7 years, Group 2 included patients age 8-11 years, and Group 3 included patients age 12-17 years.

Initial dose of amobarbital per injection was 50-75 mg for children in Group 1, 75-100 mg for Group 2, and 100-125 mg for Group 3. Additional amobarbital was injected in 25 mg boluses when the initial injection failed to result in complete contralateral hemiplegia. Agitation (Ag) and obtundation (Ob) were scored if symptoms persisted for at least 60 seconds post-injection and prevented the patient from clearly visualizing and attending to stimuli.

Children's memory protocol. The children's version of the IAP was administered to children under 12 years of age and to lower functioning older children/adolescents. Memory items in the children's protocol consist of two objects, four pictures, doll clothing, and for children who are able to read, two words. Recognition items consist of the target stimulus interspersed with three foils.

Standard memory protocol. The standard (adult) protocol, which is administered to most children 12 years and older, consists of two sets of eight items, one of which is presented during the early post-injection period and serves as the basis for the patient's primary memory score. Each set consists of four pictures, two words, and two abstract designs. During recognition memory testing, the four pictures are interspersed with eight foils in a yes/no format, and a  $\frac{1}{2}$  point is deducted for each false positive response. Each of the other items are presented simultaneously with three foils.

Passing was defined as 50% correct, as 50% exceeds chance performance in both the children's and adult protocols.

## **RESULTS**

Agitation/obtundation (Ag/Ob). Patients were significantly less likely to pass memory testing when they experienced Ag or Ob regardless of side injected (Fisher Exact Test ( $p < .05$ )). Ag/Ob was somewhat more likely following dominant injection, but this was only true when the dominant hemisphere was also contralateral to seizure onset/tumor (Sign Test  $p < .05$ ). Younger patients were not more likely than older individuals to evidence Ag/Ob.

Memory performance without Ag/Ob. Patients were more likely to pass following nondominant (ND) injection (Sign Test  $p < .05$ ), even when verbal memory items were eliminated from the analysis ( $p < .05$ ). However, the dominant hemisphere advantage was seen only in those whose seizure onset/tumor was in the nondominant hemisphere (Sign Test  $p < .01$ ). Patients were less likely to pass second injection only when the dominant hemisphere was the second injected (Sign Test  $p < .05$ ).

Age was unrelated to rates of passing or failing either injection (Table 2). Patients with  $IQ < 70$  were as likely as normal IQ patients to pass following injection ipsilateral to seizure onset/tumor. However, none of the patients with  $IQ < 70$  passed contralateral injection, whereas 68% of patients with  $IQ \geq 70$  passed (Fisher Exact Test  $p < .01$ ). Patients with  $IQ < 70$  were also less likely to pass dominant injection (Fisher Exact Test  $p < .01$ ), whether the dominant injection was ipsilateral or contralateral to seizure onset/tumor (Table 3).

Memory performance and dose. Because six of seven patients in Group 1 received 50 mg per injection, the relationship between dose and memory performance could not be analyzed in this group. In Groups 2 and 3, patients receiving lower doses ( $< 100$  mg for Group 2,  $\leq 100$  Group 3) were not significantly more likely than those receiving higher doses to pass memory testing with either injection. However, the relationship between dose in mg/kg and memory performance was significant for ipsilateral injections and approached significance for contralateral injections; on average, those who passed received a lower dose than those who failed (Table 4). This effect was most pronounced in Groups 1 and 2.

## **CONCLUSIONS**

- ❖ Agitation or obtundation was associated with increased fail rates on IAP memory testing, particularly following dominant hemisphere injection contralateral to seizure onset or tumor.
- ❖ Even without agitation or obtundation, patients were more likely to fail dominant hemisphere injection contralateral to seizure onset or tumor.
- ❖ Most patients passed ipsilateral injection, even children under eight years of age and patients with  $IQ < 70$ .
- ❖ Patients with  $IQ < 70$  were more likely than those of normal IQ to fail contralateral and dominant injections.
- ❖ Dose of amobarbital for either injection was lower in those who passed memory testing, particularly in children under age 12.

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**Table 1 SAMPLE CHARACTERISTICS**

Age – years (mean, SD)	12.4 (3.4)	
IQ (mean, SD)	95 (18.6)	
<b>Group</b>	<b>n</b>	<b>%</b>
1 (5-7 years)	7	10
2 (8-11 years)	24	33
3 (12-17 years)	41	57
<b>Gender</b>		
Male	34	47
Female	38	53
<b>Side of seizure onset/tumor</b>		
Left	44	61
Right	28	39
<b>Side of seizure onset/tumor</b>		
Dominant	24	33
Nondominant	28	39
<b>Language classification</b>		
Left	47	65
Right	6	8
<b>IQ</b>		
< 70	14	19
≥ 70	58	81

**Table 2 % PASSING MEMORY TESTING BY AGE GROUP (No Agitation/Obtundation)**

	Group 1	Group 2	Group 3
Ipsilateral Injection	60	69	71
Contralateral Injection	80	56	55

**Table 3 PATIENTS PASSING MEMORY TESTING FOLLOWING DOMINANT HEMISPHERE INJECTION - BY IQ (No Agitation/Obtundation)**

	Pass	Fail	% Pass
<b>IQ &lt; 70</b>	<b>1</b>	<b>5</b>	<b>17</b>
Dominant = Ipsilateral	1	2	33
Dominant = Contralateral	0	3	0
<b>IQ ≥ 70</b>	<b>15</b>	<b>13</b>	<b>54</b>
Dominant = Ipsilateral	7	8	47
Dominant = Contralateral	8	5	62

**Table 4****MEAN AMOBARBITAL DOSE  
(mg/kg)**

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	<b>Pass</b>	<b>Fail</b>	<b>p</b>
<b>Ipsilateral</b>	<b>2.23</b>	<b>2.68</b>	<b>.02</b>
Group 1	2.05	3.12	.11
Group 2	2.51	3.20	.05
Group 3	2.13	2.14	ns
<b>Contralateral</b>	<b>2.26</b>	<b>2.55</b>	<b>.10</b>
Group 1	2.79	3.28	ns
Group 2	2.44	2.99	.07
Group 3	2.08	2.24	ns