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IS INTERHEMISPHERIC CONNECTIVITY REDUCED AFTER CALLOSOTOMY? A CRITIQUE[1]

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Summary.—A recent case report of interhemispheric correlational measures in a callosotomized patient by Corsi-Cabrera, Trías, Guevara, Haro, and Hernández in 1995 provided evidence taken by the authors of the study to suggest that the corpus callosum may not be crucial to interhemispheric coupling. This conclusion was proposed even though (1) presurgical correlation measures necessary for evaluating coherence *changes* produced by surgery were not available for this subject and (2) previous studies presenting evidence inconsistent with their conclusions were not discussed. In view of these two shortcomings, the authors' conclusion concerning callosal function may be premature.

Recently, Corsi-Cabrera, Trías, Guevara, Haro, and Hernández (1995) reported that measures of interhemispheric EEG correlation for a single callosotomised adult in a relaxed, eyes-closed waking state were not substantially different from those for two groups of matched comparison subjects. Moreover, the pattern of correlations observed were not consistent with the locus of underlying surgery, i.e., lower correlations were seen primarily in posterior regions where the corpus callosum was intact. The authors tentatively took their results to suggest that ". . . the role of the corpus callosum is not crucial for interhemispheric coupling . . ." and that other factors such as subcortical processes or similarities in the functional organization of neuronal networks, provide a more plausible explanation (p. 506).

Drawing this conclusion, however tentatively, from the results presented seems to us to be unwarranted for two principal reasons. First, the findings, though suggestive, do not include any presurgery measures with which to make meaningful comparisons. The authors indicate that the interhemispheric measures from their subject fall within the range of normal control measures (a finding which cannot be evaluated because no raw scores, group means or standard deviations are provided), but this fact alone does not exclude the possibility that the subject's presurgical EEG values were atypically high. Similarly, even though the topographic pattern of correlations does not match that of the underlying surgery, pre- to postsurgery decreases

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may indeed have matched such a pattern. The authors' finding of higher coherence in anterior vs posterior sites may well correspond to normal brain activity, but whether this pattern has been changed considerably by surgery can be determined only by comparison with presurgical values. These considerations are especially important since the authors are studying one relatively rare individual with a long-standing history of anomalous brain activity and medications known to influence the structure of the EEG. Given such chronic influences, this subject's presurgery profile of interhemispheric correlation values can not be inferred to be similar to those of normal control subjects.

Second, the authors do not place their findings within the context of previous research which has addressed the same question of whether the EEG is a valid measure of underlying neurophysiological activity. In fact, previous research on both waking and sleep EEG measures is almost uniformly contrary to their conclusion. We previously reported (Montplaisir, Nielsen, Côté, Boivin, Rouleau, & Lapierre, 1990) that callosotomy in two adult female patients produced a substantial decrease in measures of interhemispheric EEG coherence during sleep. We measured EEG coherence two weeks prior to and six months following surgery in a subject aged 21 yr., who underwent partial anterior callosotomy, and a subject aged 30 yr., who underwent partial posterior callosotomy. Coherence was evaluated for two sleep states (Stage 2 and Stage REM) and was shown to decrease as a function of surgery in all states. The patient who underwent surgery to the posterior corpus callosum showed a specific and marked reduction in coherence over the posterior regions while high coherence persisted over the frontal regions. The patient who underwent partial anterior callosotomy showed reduction in EEG coherence over all brain regions except the central one.

These findings are consistent with other assessments of EEG coherence in subjects with agenesis of the corpus callosum, a congenital condition in which the corpus callosum is absent from birth. Such subjects show significantly lower EEG interhemispheric coherence than a matched, normal control group. In fact, the amount of reduction in EEG coherence due to callosotomy (35%) is similar to the relative difference between subjects with agenesis and controls (27%). The results from our two studies also parallel previous findings for either wakefulness or sleep reported for callosotomized adults (Ten Houten, Walter, Hoppe, & Bogen, 1988), an acallosal adult (Nagase, Terasaki, Okubo, Matsuura, & Toru, 1994) and acallosal newborns (Kuks, Vos, & O'Brien, 1987).

From the convergence of our results with those of others we are more inclined than Corsi-Cabrera, *et al.* to conclude that the corpus callosum is crucial for interhemispheric connectivity in the intact brain and that the EEG coherence function is a valid measure of this connectivity. That the

measures from Corsi-Cabrera's subject do not fit this general pattern may be due to differences between interhemispheric coupling during different wakefulness and sleep states or to some other factor. Nevertheless, their discrepant findings bear further study and reflection, especially considering that the authors employed a measure of interhemispheric coupling (correlation) which differs in some important respects from the measure (coherence) employed in previous studies.

In sum, the results from the Corsi-Cabrera, *et al.* study do not provide a firm basis for concluding that the corpus callosum is not crucial for interhemispheric coupling. Without presurgical measures for comparison and without an adequate explanation for discrepancies with previous findings, such a conclusion seems premature. Rather, the discrepant results highlight the need to use more standardized measures of connectivity, to continue to validate such measures on larger groups of patients with epilepsy before and after callosotomy, and to compare and contrast results with findings from previous research.

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