11 - 4. Neurochemical effects of ECT

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© SPMM Course 4. Neurochemical effects of ECT Repeated subconvulsive electrical stimulation in animals reduces the seizure threshold – this process is called kindling. ECT does NOT produce a kindling effect; in fact it protects against kindling in animal studies. Thus, it can be termed an anti-kindling agent. As a result, dosing may need to be increased over the course of treatment to achieve the same seizure-inducing effect. Hippocampal neuronal loss occurs in kindling. But ECT results in neurogenesis in the rat. This could be mediated by an increased expression of brain-derived neurotrophic factor and its receptor, Blood–brain barrier permeability acutely increases following ECT but returns to baseline within 24 hours Imaging studies show that ECT is not associated with markers of cell loss or damage e.g. there is no change in myelin basic protein immunoreactivity or neuron-specific enolase in serum. Tau protein, neurofilament and S-100 beta protein, markers of neuronal and glial damage, are also unchanged after ECT. EEG shows delta and theta activity after applying ECT. This pattern returns to normal after 3 months of the end of treatment. An increase in 5HT2 receptors are noted in rodents after applying electrical stimulation; this change is opposite to the changes noted after administering antidepressant drugs. But note that using a [18F] setoperone PET scan Yatham et al. (2010) have now demonstrated that unlike in rodents, and similar to antidepressants, ECT reduces brain 5-HT2 receptors in individuals with depression. ECT also reduces β noradrenergic receptors and increases noradrenaline turnover. Further alpha 2 receptors are reduced after ECT, similar to antidepressants. Variables affected by ECT Changes Neurotrophic factors Increase in NGF,BDNF, NF3. Cell growth and synaptic connectivity Increased esp. In hippocampus Hormones Increased cortisol, prolactin, TSH coincides with good response. TRH gene expression increased in animals. Vasopressin, ACTH, oxytocin and opioid endorphins also increase consistently. Neurotransmitters and their receptors 5-HT-, NA-, cholinergic-, glutaminergic- and GABAergic systems, adenosine A1-receptor & 5-HT2A – all decrease in sensitivity. Activation of DA transmission and stimulation of 5-HT in hippocampus and amygdala.

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