ARTICLE

ECT in the 21st century: ultrabrief pulse stimulation

Colleen Loo
Professor of Psychiatry
University of New South Wales

Medical director of ECT
Wesley Hospital
Kogarah

Academic chair
Psychiatry
St George Hospital

Psychiatrist
Black Dog Institute and
Northside Clinic
Sydney

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SUMMARY

Ultrabrief pulse stimulation is a new advance in electroconvulsive therapy and results in more focal stimulation. An ultrabrief pulse given in the right unilateral position retains the high efficacy of standard electroconvulsive therapy for depression.

Cognitive adverse effects are greatly reduced. Studies of ultrabrief electroconvulsive therapy found that cognition was either unchanged or even improved, after the course of treatment.

The efficacy and cognitive adverse effects of ultrabrief electroconvulsive therapy in disorders other than depression need further examination.

Introduction

Electroconvulsive therapy (ECT) involves the therapeutic induction of a seizure while the patient is under general anaesthesia. It is mainly used to treat severe depression, although there is evidence to support its use in some other psychiatric disorders.[1,2]

A recent large multicentre trial showed that approximately a third of depressed patients failed to attain remission, even after trying four antidepressant drugs.[3] Many of these patients will require treatment with ECT. This is effective in 50–60% of the patients with drug-resistant depression. ECT has also been shown to have superior efficacy to antidepressants in head-to-head comparisons.[1] A study showed improvement in quality of life and function immediately after ECT treatment in 87% of patients and in 78% six months later.[4]

There are concerns over the risk of cognitive adverse effects of ECT. A recent systematic review and meta-analysis found that cognitive impairment tends to be transient and often resolves in the week after ECT.[5] Nevertheless, some patients experience significant and more persistent impairment. This has constrained the use of this otherwise highly effective treatment.

Research in typical clinical settings showed that while efficacy was high and did not differ significantly between treatment centres,[6] cognitive adverse effects varied from minimal to severe, depending on the treatment approach used.[7] This has led to research into modifications that could minimise the cognitive adverse effects of ECT.

Ultrabrief pulse width stimulation

A major advance which is currently emerging into clinical practice throughout Australia is ultrabrief pulse width ECT. In this approach, pulses in the electrical stimulus are shortened from about 1 millisecond to 0.3 millisecond. This is close to the ideal pulse width for activating neurons (0.1–0.2 millisecond) so seizures are induced at lower energy levels. The electrical dose used is 30–50% of that used in standard ECT. Computer modelling suggests that a smaller area of brain tissue is directly activated when the pulse width of the ECT is reduced – that is, the stimulation becomes more focal.[8] Although the pulse is brief an anaesthetic is still required.

Evidence (Table)

A double-blind, randomised trial found that for right unilateral ECT (where the stimulus was mainly applied to the right hemisphere, which for most patients is the non-dominant hemisphere) the efficacy of ultrabrief and standard pulse width treatment was similar (with 77% and 73% of patients attaining remission). Cognitive outcomes were far superior in the ultrabrief group.[9] Detailed neuropsychological testing done in the week after the end of ECT found no impairment on any test, compared to pre-ECT baselines, in the ultrabrief group, while some impairment was found with standard ECT. For bilateral ECT (where the stimulus is applied equally to both cerebral hemispheres), the ultrabrief stimulation was not so effective, for reasons that are not well understood.

Another trial confirmed good efficacy with ultrabrief unilateral ECT. There was no cognitive impairment, tested at one and six weeks after the end of ECT, compared to pre-ECT baselines.[10,11] On some measures, patients actually showed improvement in cognitive function after ECT, probably reflecting the significant improvement in depression.

A Sydney hospital compared ultrabrief and standard pulse width right unilateral ECT in the largest sample reported to date (96 patients).[12,13] This was not a randomised controlled trial but enrolled a range of patients typically prescribed ECT in clinical services. Efficacy outcomes were good for ultrabrief ECT.

However the results suggested that, compared to standard ECT, a few more treatments may be required for full therapeutic response. This may mean a longer hospital stay, depending on whether patients can receive the later treatments of an ECT course as outpatients. The speed of response to ultrabrief ECT may be slower, but this requires further exploration. Cognitive outcomes after ECT were substantially superior in the ultrabrief group.

The clinical trials are further supported by a number of subsequent reports about ultrabrief pulse width ECT.[14] No safety concerns specific to ultrabrief ECT have been reported, and given the substantial advantage in cognitive outcomes, it may overall be considered a safer treatment than standard ECT. Not all patients will respond to ultrabrief right unilateral ECT. Some patients may require switching to standard pulse width ECT.

Future developments

The studies which have reported on the use of ultrabrief pulse width ECT were almost exclusively in depressed patients.[14] It is likely that the dramatic reduction in cognitive adverse effects with this treatment approach will also be seen in other psychiatric disorders, such as mania and schizophrenia. This will need to be confirmed in future studies. At present, ultrabrief pulse width ECT is gradually emerging into clinical practice, but is not yet offered in the majority of Australian hospitals. ◁

Professor Loo is the chief investigator for an ongoing clinical trial of ultrabrief pulse width ECT at the Wesley Hospital in Sydney, funded by the National Health and Medical Research Council.

Q:

SELF-TEST QUESTIONS

True or false?

3. No anaesthetic is needed for ultrabrief pulse width ECT.
4. Depressed patients respond more rapidly to ultrabrief ECT than to standard ECT.

Answers on page 35

Table **Comparison of ultrabrief and standard electroconvulsive therapy**

Design	Number of patients	Therapeutic outcomes % responders (mean number of treatments required)				Cognitive outcomes
		Ultrabrief right unilateral ECT	Standard right unilateral ECT	Ultrabrief bilateral ECT	Standard bilateral ECT	
Retrospective comparison, age and gender matched[12]	60	57% (after 11.8 treatments)	50% (after 8.8 treatments)			Not assessed
Open label, non-randomised trial[13]	96	74 patients: 43% (after 10.3 treatments)	50% (after 7.6 treatments)			Ultrabrief right unilateral ECT had superior outcomes in frontal and memory (anterograde and retrograde) function
Double-blind, randomised, controlled trial[9]	90	77% (after 8.7 treatments)	73% (after 8.5 treatments)	48% (after 8.9 treatments)	70% (after 8.2 treatments)	Ultrabrief groups had superior outcomes in orientation, attention and concentration, memory (anterograde and retrograde) and frontal function
Double-blind, randomised, controlled trial[10,11]	64	78% (after 7.8 treatments)		78% (after 10.1 treatments)		Ultrabrief groups showed improved functioning in memory, attention, frontal functioning and global cognitive functioning after ECT, compared to pre-ECT performance

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