MUSCULOSKELETAL MORBIDITY WITH UNMODIFIED ECT MAY BE LESS THAN EARLIER BELIEVED

CHITTARANJAN ANDRADE, KIRAN RELE, R. SUTHARSHAN & NILESH SHAH

ABSTRACT

Official guidelines for the practice of electroconvulsive therapy (ECT) recommend routine seizure modification to minimize musculoskeletal complications; nevertheless, unmodified ECT continues to be administered in India. We therefore assessed musculoskeletal morbidity with unmodified ECT with particular reference to the development of vertebral fractures and backache. X-rays of the thoraco-lumbar spine were routinely obtained before and after a course of 6 ECTs in 50 consecutive schizophrenic patients receiving unmodified sinusoidal wave treatment.

Backache was reported by 52% of patients: the symptom was severe in 14%. Severe backache developed early during the ECT course and was commoner in older patients. Gender, height and weight did not predict either presence or severity of backache. One patient experienced a vertebral fracture which was not considered serious; this contrasts with the 20-40% incidence of adverse orthopedic events described with unmodified ECT in early studies. There were no other untoward events. It is concluded that, with specific reference to Indian patients, musculoskeletal morbidity with unmodified ECT may be less than earlier believed. Risks with modified vs unmodified ECT therefore need to be systematically reassessed, and decision-making processes may need to be reformulated taking individual situations into account. The findings, conclusions and recommendations of this study carry much medicolegal significance for practitioners of ECT in India.

Key words: Adverse effects of unmodified ECT, complications of unmodified ECT, direct ECT, electroconvulsive therapy, India, administration of ECT, modified ECT, practice of ECT & unmodified ECT

Musculoskeletal events comprise the commonest and the most distressing morbidity associated with unmodified electroconvulsive therapy (ECT). These events include compression fractures of the dorsal spine, fractures of long bones, dislocation of shoulder and temporomandibular joints, muscle or ligament tears, and other complications.

Three large studies used serial roentgenograms to study orthopedic morbidity with unmodified ECT. Lingley and Robbins (1947) found that in 230 patients treated with unmodified ECT, 37% of men and 13.2% of women experienced vertebral fractures. The commonest event was a compression of the T4 and T5 vertebral bodies. Young adult males, elderly patients, and those with osteoporosis were particularly at risk.

Meschan et al. (1950) studied 212 males treated with ECT. Only 13 patients complained of backache, and 8 of these had vertebral fractures. Overall, 75 (35.4%) patients had fractures, with a mean of 2.5 fractures per patient. The commonest fractures were at T3, T4 and T5 vertebrae. Nearly two-thirds of patients experienced their fractures by the third ECT; four-fifths of the fractures occurred by the fifth treatment. Patients aged 30-39 years were most at risk.
Dewald et al. (1954) studied 69 men and 195 women after a total of 285 courses of ECT, averaging 7.5 treatments per patient. In 231 courses of unmodified ECT, 48 (20.8%) cases of vertebral fracture were detected; the incidence was 42.9% in men and 13.7% in women. An average of 2.2 fractures was observed per patient. About 71% of the fractures occurred by the third ECT. Most of the fractures were observed in patients aged <40 years. Glissando stimulation did not reduce the risk for fracture. Osteoporosis was associated with a doubled risk. The commonest sites of fracture were at T4, T5 and T6 vertebrae. Two patients suffered severe compression fractures; the remaining patients with fractures had minimal compression of the superior cortical plates of the vertebral bodies. Nearly 20% of patients who received unmodified ECT complained of backache, of these, 75.6% had fractures. In 30.6% of patients, the fractures were asymptomatic, and were discovered only through routine X-rays. In addition to the spinal fractures, 3.5% of patients experienced miscellaneous orthopedic events such as humeral fracture or dislocation, mandibular dislocation etc. In 54 courses of decamethonium modified ECT, there was just one fracture.

The clinical significance of ECT-induced vertebral fractures is uncertain. Polatm and Lin (1949) found no orthopedic or neurologic sequelae in a 10 year follow up of patients who had experienced vertebral compression during pentylenetetrazol treatment. In none of the cases of fractures reported by Dewald et al. (1954) was orthopedic treatment considered necessary.

Other complications of unmodified ECT include bradycardia, tachycardia, other cardiac arrhythmias and, rarely, cardiac failure or myocardial infarction. Pulmonary complications may arise from aspiration of respiratory secretions. Hemorrhage at various sites may also occur. Pitts (1982) has provided a further discussion on modified vs unmodified ECT, and on the medical physiology and complications of unmodified ECT. Due consideration must also be paid to the psychological stress occasioned by unmodified ECT. The flash of light that many patients see at the start of the ECT, just before they lose consciousness, may also be frightening (Swartz, 1993).

Modified ECT has for long been a worldwide norm, and is the procedure recommended in official guidelines (American Psychiatric Association 1990; Freeman, 1995). Although unmodified ECT is considered by many to represent unethical practice (Andrade, 1990), it continues to be administered, especially in ECT units that do not have anaesthesiological facilities. In a survey of the psychiatrists of the Indian Psychiatric Society, it was found that only 44.2% of respondents who used ECT invariably administered modified treatments; a further 24.2% invariably administered unmodified treatments, while the remainder administered modified and unmodified treatments in varying proportions (Andrade, 1992; Andrade et al., 1993). The administration of unmodified ECT invites malpractice litigation; in this context, the High Court of Bombay at Panaji, Goa, directed the Institute of Psychiatry and Mental Health, Goa, to prefer modified ECT (Andrade, 1999). The present study therefore sought to assess musculoskeletal morbidity with unmodified ECT. It was conceived that the findings of this study would carry much medicolegal significance for practitioners of ECT in India.

**MATERIAL AND METHOD**

The study was conducted at a general hospital in Bombay. The sample comprised 50 consecutive ECT-treated patients with ICD-10 schizophrenia. No patient had significant medical comorbidity. All patients received 6 bilateral, unmodified, sinusoidal wave treatments using the Delta Medical Appliances (Bombay) constant voltage device set at 110 volts for 1.1 secs. Routine physical restraint limited the violence of the convulsion. All patients experienced motor seizures lasting 25-35 secs.

A sinusoidal wave device was used because the hospital did not have a constant current, brief-pulse instrument. Six treatments were administered as a fixed course for all
patients because this was the hospital practice for schizophrenic patients prescribed ECT as part of routine clinical care. Unmodified ECT was the norm because the hospital was understaffed and could not spare its anaesthesiologists for the administration of ECT premedication.

ECT was administered on alternate days, thrice a week. Patients were interviewed after each ECT to assess the effects of treatment. If patients confirmed the experience of backache, they were asked whether it was mild, moderate or severe. Lateral and anteroposterior X-rays of the dorsolumbar spine were obtained in all patients, before and after the ECT course. In patients who complained of severe backache, X-rays were also obtained immediately the complaint was received. Informed consent was obtained for the administration of ECT.

Statistical analysis: Means were compared between two groups using the independent sample t-test with modified degrees of freedom, if required, to correct for heterogeneity of variances. Proportions were compared between groups using Fisher's exact test. Prediction of the presence and severity of backache was undertaken using a backward stepwise regression procedure. All tests of significance were two-tailed. Alpha for significance was set at 0.05.

RESULTS

There were 40 men and 10 women. The mean (standard deviation) [M(SD)] description of the sample was 32.4 (9.9) years for age, 161.7 (5.9) cm for height and 55.1 (8.8) kg for weight.

Twenty-six patients (52%) complained of backache. The intensity of pain was mild in 17 (34%), moderate in 2 (4%) and severe in 7 (14%) patients. Patients with mild to moderate backache were treated with nonsteroidal anti-inflammatory drugs (NSAIDs); their pain subsided spontaneously, and their course of unmodified ECT was continued without a break. With the exception of the case described below, patients with severe backache were treated with NSAIDs and subsequently (by special arrangement) with modified ECT, and the rest of their course was uneventful.

A 45 year old female, 157.5 cm tall and weighing 45 kg, complained of severe backache after her second ECT. Her X-rays revealed an avulsion fracture disruption at pars interarticularis at the L5 vertebra, with subluxation of the left L4-L5 facet joint. ECT was stopped and she was treated with antipsychotic drugs. Her orthopedic management was conservative and uneventful.

In patients with severe backache, onset of symptoms was at the first or second treatment. In patients with mild or moderate backache, onset of symptoms was at any time during the course. Onset of backache occurred after a mean (SD) of 1.4 (0.5) treatments with severe symptoms, and 3.5 (1.5) treatments with mild to moderate symptoms; the earlier onset of severe backache was statistically significant (t=5.02, d.f.=24, p<0.001).

A comparison of patients with and without backache (table 1) found no differences in age, sex, height or weight. A comparison of patients

| Variable | Backache present (n=26) | Backache absent (n=24) | Significance |
|----------|------------------------|------------------------|--------------|
| Sex: Male | 21                     | 19                     | Fisher's exact test, NS |
| Female   | 5                      | 5                      | NS           |
| Age (years) | 30.4 (7.7)             | 34.2 (11.5)            | t=1.34, d.f=48, NS |
| Height (cm) | 161.8 (5.1)            | 161.8 (5.8)            | t=0.08, d.f=48, NS |
| Weight (kg) | 54.2 (8.0)             | 55.9 (9.5)             | t=0.70, d.f=48, NS |

* Data are mean (standard deviation) for quantitative variables, and frequency counts for qualitative variables.

| Variable | Severe Backache present (n=7) | Severe Backache absent (n=43) | Significance |
|----------|-------------------------------|-------------------------------|--------------|
| Sex: Male | 5                             | 35                            | Fisher's exact test, NS |
| Female   | 2                             | 8                             | NS           |
| Age (years) | 39.6 (14.0)                  | 31.2 (8.7)                   | t=2.15, d.f=48, p=0.04 |
| Height (cm) | 163.7 (6.0)                  | 161.4 (5.8)                  | t=0.91, d.f=48, NS |
| Weight (kg) | 54.1 (6.7)                  | 55.2 (9.1)                   | t=0.30, d.f=48, NS |

* Data are mean (standard deviation) for quantitative variables, and frequency counts for qualitative variables.
with and without severe backache (table 2) found that patients with severe backache were significantly older. Since sex did not predict backache, men and women were compared. Men were significantly younger (t=2.04, d.f.=48, p=0.047), taller (t=2.89, d.f.=48, p<0.006) and heavier (t=2.16, d.f.=48, p=0.036).

A backward stepwise regression analysis was undertaken to identify predictors of severity of backache. The dependent variable was the experience of backache, coded as absent=0, mild=1, moderate=2 and severe=3. The independent variables were age, height and weight; sex was included as a dummy variable (male=0, female=1). Age was the only significant predictor (p=0.049), but explained just 5.9% of the variance in severity.

No patient experienced persistent muscular pains in any part of the body, fractures of any bone except as already described, dislocation of any joint except as already described, or any other adverse effect ascribable to unmodified ECT. All X-rays were examined by a senior radiologist and a senior orthopedician who were blind to the temporal relation of the films to the ECT course, as well as to the patients' complaints (if any); the middle thoracic vertebrae were scrutinized with particular care. With the exception of the post-ECT film of the patient who experienced the fracture dislocation, all films were normal.

**Discussion**

Literature suggests that the incidence of vertebral fractures with unmodified ECT ranges from 10-40%. The risk is greater in men, in young patients, in old patients, and in those with osteoporosis. Complaints of backache with ECT are not common but when occurring, are often due to an underlying fracture. The commonest fracture is a compression of the middle thoracic vertebral bodies. Such fractures are frequently asymptomatic, and are usually detected only by routine X-rays (Lingley & Robbins, 1947; Meschan et al., 1950; Dewald et al., 1954).

In this study, 52% of patients experienced backache with unmodified ECT; in 14% of the sample, the backache was severe, developed early during the ECT course, and necessitated a switch to modified ECT. While one patient (2%) experienced a vertebral fracture-dislocation event, the remaining patients with backache obtained adequate relief with NSAIDs.

Backache occurs even in patients receiving modified ECT; one study found that 37.5% of 32 patients experienced mild, transient backache which subsided with NSAID treatment (Andrade, 1986). While the present study was not a controlled investigation, a scrutiny of literature suggests that backache is commoner with unmodified ECT. Obviously, the more violent muscular contractions in an unmodified seizure are more likely to occasion subsequent muscular discomfort, and areas of large muscle mass, such as the low back, are vulnerable sites for the experience of pain.

Only age predicted the experience of (severe) backache, a possible explanation is that older persons are biologically and psychologically more sensitive to the experience of treatment emergent adverse effects. The non significance of height and weight may have been because both are poor indices of muscularity; a better index of muscle mass may have better predicted backache. Curiously, sex did not predict backache although men are more muscular than women. A possible explanation is that the men were younger than women; the biasing effect of age may have cancelled out the expected effect of muscularity.

Severe backache consistently developed by the first or second treatment itself, or not at all; this suggests that some patients may be psychologically or biologically at risk. Of note, since backache is a subjective complaint, the reliability of its rating depends upon the ability of the patient to focus on the complaint despite the overall psychiatric morbidity, as well as upon the ability of the patient to communicate about the symptom despite the overall psychiatric disability. If the reliability of ratings is
compromised, as is possible in acutely psychotic patients. Prediction of backache may be difficult.

In striking contrast with literature (Lingley & Robbins, 1947, Meschan et al., 1950, Dewald et al., 1954), in this study only 1 patient experienced objective musculoskeletal morbidity. A likely explanation is that Indians are slight in build; orthopedic complications are commoner in muscular individuals who experience violent convulsions. Furthermore, Indian patients receiving ECT are usually young and are less likely to have osteoporosis; they may therefore tolerate unmodified ECT better.

Might this study have failed to produce orthopedic morbidity because of the short (6 ECT) course? It is unlikely. While the early studies did administer a large number of unmodified treatments, fractures usually occurred early during the course; for example, Meschan et al. (1950) found that about 80% of fractures occurred by the fifth ECT. Vulnerability to ECT-induced fractures may hence be biological rather than number-dependent.

In the only recent study on unmodified ECT, Tharyan et al. (1993) reviewed the charts of all patients who received ECT between 1980 and 1990, both years inclusive. The sample comprised 1835 patients who received 2002 courses of ECT. Of these patients, 56% were male, and 59% were aged 20-40 years. A total of 13,597 treatments were administered, and 98% of these were unmodified. Eleven patients experienced thoracic (n=10) or lumbar (n=1) vertebral body compression, and one had a scapular fracture. Only one of these patients was female. A further 63 cases developed muscular pain. X-rays obtained in 38 of these patients were normal. The patients with fractures were conservatively managed; in six of these patients, ECT was uneventfully continued with seizure modification. Follow up of 10 of these patients over the next 3 months to 8 years revealed no adverse sequelae of the fracture. Tharyan et al. called for an audit of modified ECT and for a scientific review of modified versus unmodified forms of the treatment. They concluded that the recommendation to routinely modify ECT is premature, and perhaps inappropriate in India, as it would result in the unnecessary exposure of patients to the risks of anesthesia, or the unfortunate denial of ECT to patients when anesthesiological facilities are unavailable.

The study of Tharyan et al. had two weaknesses, X-rays were obtained in only a tiny fraction of the cases, and all data were retrospective. The magnitude of musculoskeletal morbidity with unmodified ECT may hence have been grossly underestimated (Andrade, 1995). Irrespective of the recorded or unrecorded frequency of such morbidity, however, long term sequelae were noticeably absent. During the 11 years from which the study data were obtained, no orthopedic complications were observed in the ECT-treated patients at follow up. This finding fits with the observation of Polatin and Lin (1949) and Dewald et al. (1954) that vertebral fractures with unmodified ECT are subclinical, they do not require orthopedic intervention, and are not associated with long term sequelae.

Tharyan et al. (1993) administered only brief-pulse ECT; might brief-pulse stimuli elicit less violent convulsions than the sinusoidal wave stimuli used by clinicians during the early decades of ECT? It is unlikely. The present study also recorded low orthopedic morbidity despite utilizing a sinusoidal wave device.

We therefore conclude as follows:

1. Backache is common in patients receiving unmodified ECT, and appears to occur in about half of patients so treated. Severe backache affects about one-seventh of patients, develops early during the ECT course, and is commoner in older patients. While fractures do occur with unmodified ECT, they appear to be much less common than earlier believed. The present study recorded an incidence of only 2%, which is far lower than the 10-40% incidence recorded in studies conducted several decades ago. These conclusions, it is acknowledged, are best generalized only to medically healthy, young or middle-aged Indian patients of average build.

2. Since minimization of orthopedic
complications is the most important reason for the modification of the ECT seizure, these data suggest the need for a controlled reassessment of physical as well as psychosocial adverse reactions to modified and unmodified ECT. The results of such a comparison will guide decision-making about the desirability of routine modification of ECT, and the degree of leeway permissible (in patients who require the treatment) should facilities for the administration of modified ECT be unavailable.

3. The above notwithstanding, it is acknowledged that modified ECT is clearly preferable in special populations, such as patients with osteoporosis or other orthopedic problems (Kellner et al.,1991; Dighe-Deo & Shah,1998). Likewise, it should be recognized that modification of the treatment may actually increase risks in certain categories of patients, such as those who are poor candidates for anaesthesia (Swartz,1993). Therefore, individual clinical factors should also be considered while choosing between modified and unmodified ECT.

Caveat: The findings of this study are medicolegally important to practitioners of ECT in India. However, for reasons discussed in the preceding section, these findings do not constitute an endorsement for the routine use of unmodified ECT.

REFERENCES

American Psychiatric Association (1990) The practice of ECT : recommendations for practice, training and privileging. Task force report on ECT. Washington D.C. : American Psychiatric Press.

Andrade,C. (1992) The practice of electroconvulsive therapy in India : considerable room for improvement. Editorial. Indian Journal of Psychological Medicine, 15, 1-4.

Andrade, C. (1995) Unmodified ECT : a note of caution. Indian Journal of Psychiatry, 37, 99-100.

Andrade, C. (1999) Modified ECT in Goa. Psychiatry Update, 5, 20.

Andrade, C. Agarwal, A.K. & Reddy, M.V. (1993) The practice of ECT in India. 2. The practical administration of ECT. Indian Journal of Psychiatry, 35, 81-86.

Dewald, P.A., Margolis, N.M. & Weiner, H. (1954) Vertebral fractures as a complication of electroconvulsive therapy. Journal of the American Medical Association, 154, 981-984.

Dighe-Deo, D. & Shah, A. (1998) Electroconvulsive therapy in patients with long bone fractures. Journal of ECT, 14, 115-119.

Freeman, C.P. (1995) The ECT Handbook. The Second Report of the Royal College of Psychiatrists' Special Committee on ECT. London : Royal College of Psychiatrists.

Kellner, C.H., Tolhurst, J.E. & Burns, C.M. (1991) ECT in the presence of severe cervical spine disease. Convulsive Therapy, 7, 52-55.

Lingley, J.R. & Robbins, L.L. (1947) Fractures following electroshock therapy. Radiology, 48, 124-128.

Meschan, I., Scruggs, J.B. Jr. & Calhoun, J.D. (1950) Convulsive fractures of dorsal spine following electric shock therapy. Radiology, 54, 180-185.
Pitts, F. N. Jr. (1982) Medical physiology of ECT In: Electroconvulsive therapy. Biological Foundations and Clinical Applications. (Eds.) Abrams, R. & Essman, W. B., 57-89. Lancaster: MTP Press Ltd.

Polatin, P. & Linn, L. (1949) Orthopedic and neurologic follow-up study of vertebral fractures in shock therapy. American Journal of Psychiatry, 105, 824-827.

Swartz, C. M. (1993) Anaesthesia for ECT. Convulsive Therapy, 9, 301-316.

Tharyan, P., Saju, P. J., Datta, S., John, J. K. & Kuruvilla, K. (1993) Physical morbidity with unmodified ECT. a decade of experience. Indian Journal of Psychiatry, 35, 211-214.

CHITTARANJAN ANDRADE, M.D., Additional Professor, Department of Psychopharmacology, National Institute of Mental Health and Neurosciences, Bangalore 560 029. KIRAN RELE, DPM, R. SUTHARSHAN, DPM & NILESH SHAH, DPM, MD, DNB, Department of Psychiatry, LTM Medical College and General Hospital, Sion, Bombay-400 022

*Correspondence