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Post-traumatic epilepsy: its complications and impact on occupational rehabilitation — an epidemiological study from India

A. K. Dasgupta
Steel Authority of India Ltd., Rourkela Steel Plant, Rourkela – 769011, Orissa, India

The objective of this study was to assess the prevalence of seizure disorder, neuropsychiatric disorders and reproductive outcome of employees with post-traumatic epilepsy (PTE) and their effect on occupational rehabilitation. A case-comparison group study design was used to compare 30 subjects with PTE with (1) 129 non-PTE and (2) 55 non-PTE matched control employees. The 55 non-PTE matched controls were selected from the 129 non-PTE employees on the basis of age, age at onset of seizure, age at marriage and length of employment. The PTE group had a lower fertility rate than the controls and more neuropsychiatric disorders and seizure disability. PTE employees were more occupationally rehabilitated than non-PTE employees ($p = 0.033$). Of the 30 PTE subjects, thirteen who were rehabilitated by placement had more seizure disability ($p = 0.007$) and a higher fertility rate ($p = 0.018$). High prevalence of seizure disability and increased fertility rate among the placed PTE employees suggested that there might be some association between severity of seizures and increased production of live offspring and work placement. Work suitability or placement should not be judged on clinical assessment only but psychosocial seizure assessment, disability evaluation and other psychometric tests which are of equal importance.

Key words: Disability, fertility, occupational rehabilitation, post traumatic epilepsy.

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INTRODUCTION

The relationship between head injury and the development of seizure disorder is well-recognized, and it can lead to secondary seizure disorder, or post-traumatic epilepsy (PTE). Active epilepsy, seizure disability and associated handicaps such as neuropsychiatric disorder, sexual dysfunction, *etc.* are all important factors for the rehabilitation prognosis of people with PTE. An increasing range of suitable anticonvulsants to give better control of epilepsy is becoming available. Marriage, parenthood, sexual disorders, neuropsychiatric performances, job, career, *etc.* all give rise to challenges that have to be overcome to achieve successful rehabilitation in people with PTE.

The aims of the study were: (1) to investigate the prevalence of seizure disability, neuropsychiatric disorders and reproductive outcome with respect to fertility and congenital deformity of 30 people with PTE and (2) explore their rehabilitation outcome in respect to occupation or employment.

Correspondence and reprint requests to: 'Hilltop', 18 Woodland View, Lovedean, Waterlooville, Hants PO8 9TR, UK. Tel: (+44) 1705 593587.

MATERIALS AND METHODS

Subjects

One hundred and sixty-nine male, married employees, working in the steel industries and associated organizations in India took part in the study. All were established employees with epilepsy with or without associated complications or disabilities. They were selected from the same population as an earlier survey on epileptic employees working in the steel plants of India.[1]

Ten persons were rejected because of inadequate information, leaving 159 subjects for detailed study. All had suffered from epilepsy for at least one year. Etiologically, the 159 subjects were classified into (1) 30 PTE subjects and (2) 129 non-PTE (idiopathic) subjects. The PTE group was further subdivided on the basis of

'placement status' into (a) 13 'placed' PTE employees and (b) 17 'non-placed' PTE employees.

Selection criteria

The 30 PTE cases all had a history of head injuries and all had developed post-injury epilepsy. The clinical histories and clinical findings were supported by: (1) clinical documents of trauma (head injury) as well as seizure activities; (2) normal or abnormal electroencephalography and (3) evidence of imaging technique.

The 129 non-PTE controls were taken from the same population but they did not have any history of head injury and the causes of their epilepsy were unknown. They also all had a history of seizures (idiopathic epilepsy) which were supported by normal or abnormal electroencephalography, and/or imaging technique.

This was an unmatched comparison as the control group (129 non-PTE) was younger than 30 PTE subjects. To overcome this problem, two controls were chosen from the 129 non-PTE subjects to match each of the 30 PTE cases on the basis of age; age at onset of seizure; age at marriage and length of employment. Only 55 suitable controls were available for matched comparison.

Information

Information on the occupational history including type and nature of job, length of employment; the history of epilepsy, including type, frequency, anti-convulsant treatments and underlying causes of epilepsy and family data was collected from each male, married employee with epilepsy. The family data included age at marriage, length of marriage, number of live births and children born with epilepsy and congenital deformity.

Assessment

Seizure disability, neuropsychiatric disability and reproductive outcome were assessed further on the basis of the collected information.

Seizure disability. Disability was assessed in light of the severity of epilepsy.[2] This was categorized according to the method of Nussbaum and O'Connor[3] which was modified on the basis of classification of seizure disorders.[4] Severity of epilepsy depended upon the frequency and magnitude of seizures and the impairment. The clinical severity was thus categorized as no disability (completely controlled two or more years); mild disability (under one major motor seizure a year); moderate disability (1–4 major seizures a year or 1–2 minor motor seizures a month which included partial complex, mixed and absence seizures); moderate severe disability (5–12 major motor seizures a year or 3–4 minor motor seizures a month which included partial complex, mixed and absence seizures) and severe disability (over 12 major seizures a year or over 1 minor motor seizure a week which included partial complex, mixed and absence seizures with associated postictal phenomena).

Neuropsychiatric disability. The presence of neuropsychological disorders was assessed on the basis of information on aggression (behaviour which might be harmful to the subject or others), depression (feelings of hopelessness including affecting symptoms and mood changes), personality disorder (change of personality syndrome) and cognitive sequence such as intellectual impairment from each employed person with epilepsy.

Reproductive outcome. Increased or decreased production of life births was measured by calculating

$$\text{Fertility rate} = \frac{\text{Number of children (life births)}}{\text{Length of marriage (in years)}}$$

and thus male reproductive outcome in terms of life births among the wives of employees with epilepsy was measured.

To overcome the validity problem of this method of measurement of fertility rate, two additional measurements were also conducted: (1) total and average number of children per family and (2) average number of children per proband.

Reproductive outcome included history of epilepsy among the offspring and number of offspring with congenital deformity.

Information on 'placement' status

Information on employment rehabilitation among the 'placed' and 'non-placed' epileptic employees was, collected retrospectively on the basis of:

- Epileptic employees who were working in operation, in maintenance and in service areas with a special emphasis on activities in hazardous, less hazardous and non-hazardous places.
- Epileptic employees whose jobs were changed (relocated) from hazardous areas to less hazardous or non-hazardous areas along with departmental changes from operation to maintenance, or from operation to services or maintenance to service areas, *etc.*
- Epileptic employees whose jobs were modified or restricted because of working in dangerous or hazardous areas.

The method of placement of this study was similar to an earlier survey.[1]

Methodology

A proforma was completed with the information, collected on the basis of records, interviews and clinical examination and the analysis was conducted using a 'case–control' methodology.[5] Three groups of comparisons were made: (1) an unmatched comparison between the 30 PTE and 129 non-PTE subjects; (2) a matched comparison between the 30 PTE subjects and 55 controls

and (3) a comparison between the 13 'placed' PTE employees and 17 'non-placed' PTE employees.

Statistical analysis

Mean differences were analysed using Student's t-test and proportions using the chi-squared test. Fertility was analysed by the chi-squared test using expectations based on the length of marriage. Statistical significance was taken as 5%.

RESULTS

Of the 159 married employees, 30 had PTE and only the mean age of the 30 with PTE was significantly different from the 129 non-PTE employees ($p = 0.035$). No significant differences were found when all mean values were compared between the 30 PTE and 55 non-PTE matched controls in respect of age, marriage, seizure episodes and length of employment (Table 1).

When the onset of epilepsy before and after marriage, that of before and after employment, and employment after and before marriage were compared between the 30 PTE and 129 non-PTE subjects, and between the 30 PTE and 55 non-PTE control subjects, there were no significant differences.

The clinico-demographic characteristics were compared between the 30 PTE and the other two groups (non-PTE and matched controls). Job status revealed that the majority were manual, skilled employees, but a higher percentage of non-manual employees was observed in the PTE than in the non-PTE group ($p = 0.045$). The employment rehabilitation outcome showed 43.33% subjects with PTE who were placed against 24.03% of the non-PTE subjects ($p = 0.033$). However, no further significant differences were found (Table 2).

Moreover, when the 30 PTE subjects were compared with the 55 non-PTE matched controls, there were no significant differences in respect to the nature of job ($p = 0.480$), type of job ($p = 0.932$), type of seizures ($p = 0.244$), seizure disability ($p = 0.372$), neuropsychiatric disorders ($p = 0.524$), anti-epileptic treatment ($p = 0.168$) and occupational rehabilitation ($p = 0.148$).

Table 3 shows that the 30 PTE subjects had a total of 92 children in comparison with the 129 non-PTE subjects who had a total of 438 children, and there was no difference with respect to the average number of children (three), or fertility rate. When family size was categorized on the basis of length of marriage then there were no significant differences between the PTE and non-PTE groups. This suggests that the number of live

Table 1. Comparative differences of age, marriage, length of employment, and seizure episodes of the study population

	a *PTE* *(n = 30)*	*b* *Non-PTE* *(n = 129)*	*c* *Control* *(n = 55)*	*Differences (mean values)*	
				(a–b)	*(a–c)*
Age (yrs)					
Mean (SD)	43 (6.7)	40.04 (6.9)	42.40 (6.5)	2.96	0.6
Range	31–55	21–56	31–56	$t = 2.124$	$t = 0.402$
				$p = 0.035$	$p = 0.689$
				($p = 0.05$)	
Onset of seizure					
Age (yrs)					
Mean (SD)	35 (7.8)	32.99 (8.2)	34.53 (7.7)	2.01	0.47
Range	18–48	7–50	16–49	$t = 1.220$	$t = 0.268$
				$p = 0.224$	$p = 0.789$
Marriage					
Age (yrs)					
Mean (SD)	24.42 (6.8)	23.33 (4.7)	23.78 (4.3)	1.09	0.64
Range	14–45	5–35.5	16–33	$t = 1.043$	$t = 0.643$
				$p = 0.299$	$p = 0.522$
Seizure episodes (yrs)					
Mean (SD)	8.47 (6.7)	7.17 (6.4)	8.15 (6.4)	1.3	0.32
Range	1–27	1–35	2–28	$t = 0.992$	$t = 0.216$
				$p = 0.323$	$p = 0.827$
Length of marriage (yrs)					
Mean (SD)	18.57 (8.9)	16.87 (7.6)	18.45 (7.0)	1.7	0.12
Range	1.75–38	1–42	5–30	$t = 1.069$	$t = 0.069$
				$p = 0.287$	$p = 0.945$
Length of employment (yrs)					
Mean (SD)	16.28 (7.3)	15.27 (7.3)	17.69 (7.7)	1.01	−1.41
Range	1–28	2–29	4.5–34	$t = 0.661$	$t = 0.822$
				$p = 0.510$	$p = 0.413$

Table 2. Clinico-demographic comparison between PTE and non-PTE subjects

	PTE (a) (n = 30)		*Non-PTE (b) (n = 129)*		*Significance test (a) vs. (b)*
	No.	*%*	*No.*	*%*	
Nature of job*					
Manual	20	66.67	107	82.95	$\chi^2 = 4.012$
Non-manual	10	33.33	22	17.05	df = 1, $p = 0.045$
Type of job					
Skilled	17	56.67	69	53.49	$\chi^2 = 0.402$
Semi-skilled	4	13.33	14	10.85	df = 2
Unskilled	9	30.00	46	35.66	$p = 0.818$
Type of seizures					
Generalized	27	90.00	116	89.92	$\chi^2 = 0.0002$
Partial (focal)	3	10.00	13	10.08	df = 1, $p = 0.989$
Seizure disability					
No	12	40.00	50	38.76	
Mild	8	26.67	22	17.05	$\chi^2 = 1.963$
Moderate	7	23.33	37	28.68	df = 3
Moderate severe/Severe	3	10.00	20	15.50	$p = 0.580$
Neuropsychiatric disorders					
Present	8	26.67	20	15.50	$\chi^2 = 2.090$
Absent	22	73.33	109	84.50	df = 1, $p = 0.148$
Anti-epileptic treatment					
No treatment	8	26.67	24	18.60	$\chi^2 = 3.353$
On phenytoin	16	53.33	57	44.19	df = 2
Other than phenytoin	6	20.00	48	37.21	$p = 0.187$
Occupational rehabilitation*					
Placement	13	43.33	31	24.03	$\chi^2 = 4.531$
No placement	17	56.67	98	75.97	df = 1, $p = 0.033$

*$p < 0.05$.

Table 3. Comparison of family data on reproductive outcome between PTE and non-PTE subjects

	PTE (n = 30)		*Non-PTE (n = 129)*	
	No.	*%*	*No.*	*%*
Number of children				
Total ($n = 530$)	92	17.36	438	82.64
Median (range)	3 (0–7)		3 (0–9)	
Offspring				
With epilepsy	1	1.09	3	0.68
With defective births	2	2.17	5	3.87
Epilepsy among close relatives	0	—	8	6.20
Fertility				
Children per proband	3.067		3.395	
Rate	0.16		0.20	

Parenthood with number of children and family on the basis of length of marriage*

Length of marriage	*Family*		*Children*		*Mean*	*Family*		*Children*		*Mean*
	No.	*(%)*	*No.*	*(%)*		*No.*	*(%)*	*No.*	*(%)*	
0–10 yrs	7	(23.33)	8	(8.70)	1.14	28	(21.70)	59	(13.47)	2.11
11–20 yrs	10	(33.33)	33	(35.87)	3.3	57	(44.19)	186	(42.47)	3.26
21–30 yrs	10	(33.33)	40	(43.48)	4	40	(31.10)	174	(39.73)	4.35
31 + yrs	3	(10.00)	11	(11.96)	3.7	4	(3.10)	19	(4.34)	4.75

*$p < 0.01$.

Table 4. Comparison of family data on reproductive outcome of persons with PTE and matched controls

	PTE (n = 30)		*Control (n = 55)*	
	No.	*%*	*No.*	*%*
Number of children				
Total ($n = 298$)	92	44.23	206	62.13
Median* (range)	3 (0–7)		4 (0–9)	
Offspring				
With epilepsy	1	1.09	1	0.48
With defective births	2	2.17	2	0.97
Fertility				
Children per proband	3.067		3.745	
Rate*	0.16		0.21	

*Parenthood with number of children** and family on the basis of length of marriage*

Length of marriage	*Family*	*Children*	*Mean*	*Family*	*Children*	*Mean*
	No. (%)	*No. (%)*		*No. (%)*	*No. (%)*	
0–10 yrs	7 (23.33)	8 (8.70)	1.14	11 (20.00)	30 (14.46)	2.73
11–20 yrs	10 (33.33)	33 (35.87)	3.3	19 (34.54)	70 (30.98)	3.68
21–30 yrs	10 (33.33)	40 (43.48)	4	25 (45.45)	106 (51.46)	4.24
31 + yrs	3 (10.00)	11 (11.96)	3.7	0 (—)	0 (—)	0

* $p < 0.01$; ** $p < 0.001$.

births were equally distributed in all groups. However, later parenthood was found in the PTE group when compared to the non-PTE group ($p = 0.0092$), although the mean number of children per family did not differ significantly between the two groups.

Similarly the family data of the 30 PTE subjects was also compared to the 55 non-PTE matched controls and Table 4 shows a significant difference with respect to the average number of children (three *vs.* four), fertility rate ($p = 0.099$) and later parenthood ($p = 0.001$). Once again, there was no significant difference in the number of live births categorized on the basis of the length of marriage between the two groups. This suggests that the number of children was equally distributed between the groups, and also that the mean number of children per family in the categorized groups did not differ significantly between the PTE subjects and the matched controls.

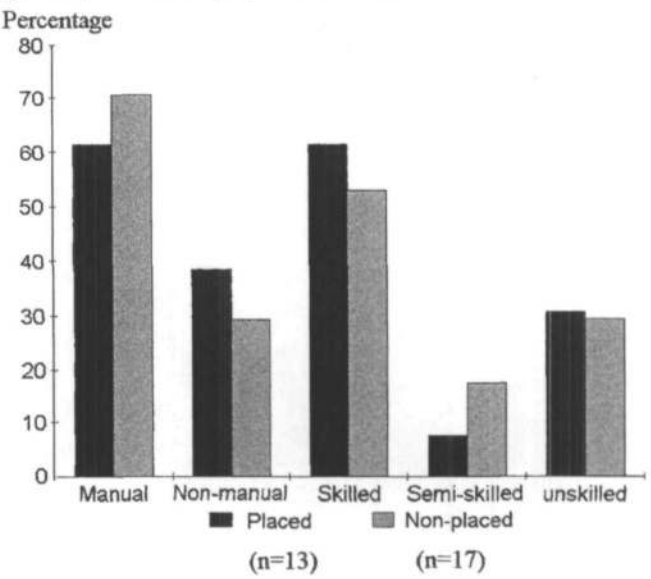
Figure 1 shows comparative differences in the nature and types of jobs between the 13 'placed' and 17 'non-placed' employees. A higher number of non-manual, skilled PTE employees were found in the placement group although this was not significant at the level of 0.05.

Figure 2 shows that employees with PTE along with seizure disability were more significantly placed than the PTE employees with no seizure disability ($\chi^2 = 7.285$, df = 2, $p = 0.007$).

Four out of 13 PTE subjects with neuropsychiatric disorders were found in the placement group *vs.* four out of 17 in the non-placed group (Figure 3) and the difference was also not significant at the level of 0.05 (Yate's $\chi^2 = 0.001$, df = 1, $p = 0.978$).

Having more than two children ($p = 0.042$) and having a significantly greater than average number of children (four) ($p = 0.002$) and high fertility rate ($p = 0.018$) were found among the 13 subjects in the placement group (Table 5).

Figure 1. The percentage-wise frequency differences in nature and types of jobs of 30 employees with PTE.



Over one year, the 30 PTE subjects had 52 seizure episodes and the 13 PTE subjects who were placed had 42 seizures with a mean seizure frequency of 3.23 per person per year. On the other hand, the 17 PTE employees who were not placed had 10 seizure episodes with a mean frequency of 0.59 per person per year. An increased mean seizure frequency and increased number of offspring were observed among the placement group (Figure 4).

Figure 2. Differences in percentage frequency of seizure disability of 30 employees with PTE ($p < 0.05$).

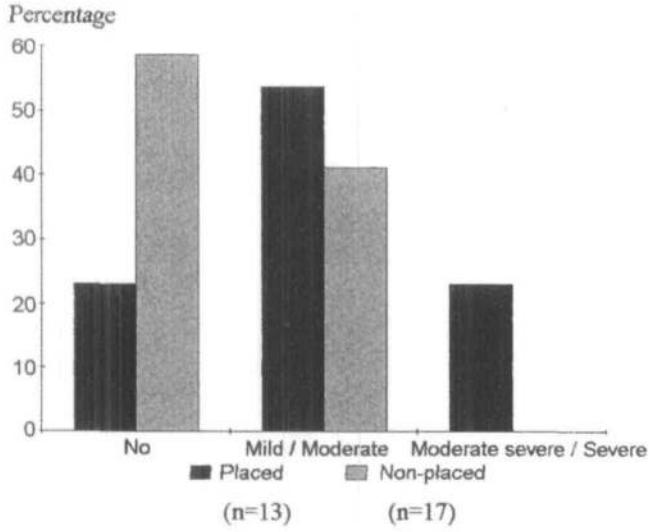


Table 5. Comparison of reproductive outcome between 'placed' and 'non-placed' PTE employees ($n = 30$)

Reproductive outcome	*a Placed (n = 13)*		*b Non-placed (n = 17)*	
	No.	*%*	*No.*	*%*
Number of children				
Total	53	57.61	39	42.39
Median (range)*	4 (1–7)	2 (0–4)		
Offspring				
With epilepsy	0	—	1	5.88
With defective births	2	15.38	0	—
Parenthood**				
< 2	2	15.38	10	58.82
> 2	11	84.62	7	41.18
Fertility rate***	0.21		0.13	

*$p < 0.01$; **$p < 0.05$; ***$p < 0.02$.

Figure 3. Presence or absence of neuropsychiatric disorders of 30 'placed' (a) and 'non-placed' (b) employees with PTE ($p = 0.978$).

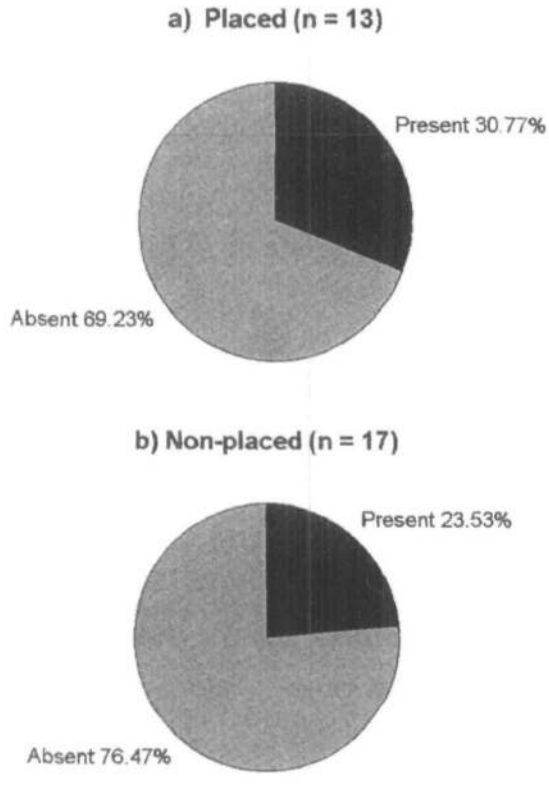
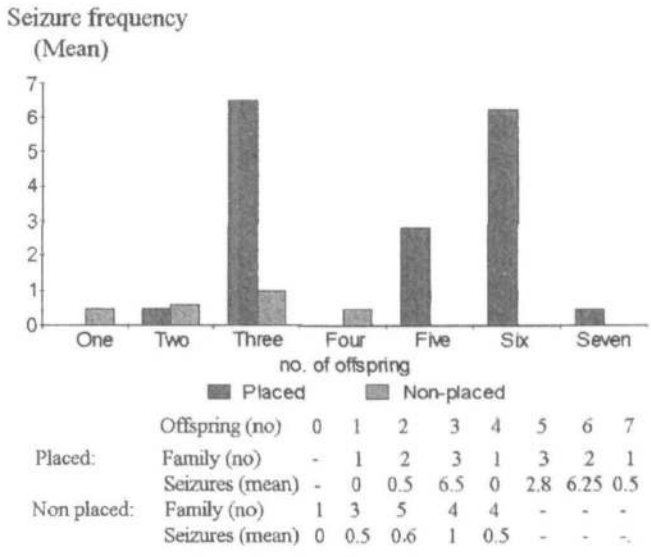


Figure 4. Differences in mean seizure frequency (according to the number of offspring and family) between 13 'placed' and 17 'non-placed' employees with PTE.



	Offspring (no)	0	1	2	3	4	5	6	7
Placed:	Family (no)	-	1	2	3	1	3	2	1
	Seizures (mean)	-	0	0.5	6.5	0	2.8	6.25	0.5
Non placed:	Family (no)	1	3	5	4	4	-	-	-
	Seizures (mean)	0	0.5	0.6	1	0.5	-	-	-

DISCUSSION

The analysis of this case–control study revealed that the 13 PTE employees were appropriately placed in less- or non-hazardous areas, because of their seizures and other associated disabilities.

Disadvantages of the study

Information was collected retrospectively and there might have been some drawbacks in collection of data, resulting in limited information on defining the degree and extent of head injury, selection of neuropsychiatric cases and less reported cases of defective children and in details of sexuality of male epileptic employees.

Information on sexuality was analysed on the basis of actual production of life births (fertility rate) rather than the history of sexual behaviour of both partners. This was due to a restriction on data collection in occupational settings from both partners on lifelong history of sexual behaviour (*e.g.*, frequency of intercourse, question of intimacy, *etc.*) in a wide variety of cultural settings, where male employees were interviewed rather than their wives. Of course, the validity of measurements of reproductive function is often problematic.[5,6]

However, considering the disadvantages, findings like increased severity of seizure disability, increased production of life births and suggestions of drug-related (anti-epileptic) reproductive dysfunction merit further study.

Disabilities

Active epilepsy is defined as the occurrence of a fit in the past two years and/or continuing anticonvulsant treatment. Handicap is divided into primary, associated and secondary.[7] When these categories were applied to the 30 PTE subjects, 18 people (60%) were found to have active epilepsy and could be classed as having primary handicaps or disabilities; neuropsychiatric manifestations in eight people (26.67%) could be attributed to associated handicaps or disabilities.

Seizures

The degree of seizure disability in the 18 active epilepsy subjects with primary handicaps showed that eight were mildly, seven were moderately and three were moderately-severely or severely disabled. In contrast, in a study from the British Steel Industry,[2] eight were mildly disabled, 17 were moderately-severely and two were severely disabled among 27 epileptic subjects with active epilepsy (both traumatic and non-traumatic).

Neuropsychiatric

Association between epilepsy and psychiatric disorders in relation to head trauma are well-documented.[8–13] In this study from India, associated disability can be described as neuropsychological disorders manifested by aggression, depression, intellectual impairment or loss of memory, *etc.* These were more observed in PTE subjects, although not significantly at the level of 0.05.

Reproductive outcome

Fertility. Here, the fertility rate of the PTE subjects (0.16) was lower than among the non-PTE subjects (0.20) and the matched controlled population (0.21). Overall reduced fertility rates[14] were found among the men and women with epilepsy as compared with the fertility rates of the general population, when reproduction rates, live birth ratios and cumulative fertility were compared. The present study estimated the average fertility rates of the 30 male PTE subjects were 3.067 children per proband which was lower than the 3.395 children per proband of the 129 non-PTE subjects and 3.745 children per proband of the 55 controlled subjects. Those figures were higher, however, than the fertility rates of 41 males with complex partial epilepsy of 0.536 children per proband.[15]

However, of the 30 PTE subjects, a higher fertility rate (0.21) and higher number of children (average = 4) were found in the 13 placement employees and they also had more seizure disability. This indicated that there might be some association between seizure disability and increased production of life births (hypersexuality). To control the male hypersexuality, family planning is necessary which gives importance to the existing family planning programme in the industrial community. Sexual dysfunction was observed more frequently in partial seizure subjects[16–18] and sexual behaviours in the form of hyposexuality and hypersexuality were associated with temporal lobe dysfunction.[17,19]

Congenital abnormality. The role of genetic factors in PTE is not fully established[20,21] and here one offspring (1.1%) with epilepsy was found in the 30 male subjects with PTE and three (0.68%) in non-PTE subjects. This value is low according to data of genetic factors in clinical practice,[22] where epilepsy in offspring varies from 6% to 8% among the fathers with epilepsy.

Epilepsy among close relatives (6.2%) was mostly noted in non-PTE employees. However, epilepsy in family members in a study of Indian probands[23] showed that the incidence of family history in probands with generalized epilepsy (GES) and syndrome of single, small, enhancing lesions (SSEL) was higher than that in probands with localization-related epilepsy (LRES). Of probands, 19% had first- and second-degree relatives affected with seizures.

Birth defects like cleft lip, cleft palate, limb deformity, deafness, *etc.* among the offspring of PTE and non-PTE employees were observed in this study. Of course, the majority (95.60%) of the offspring of the epilepsy employees were born without birth defects. However most epileptic employees received anticonvulsants therapy in the form of monotherapy or polytherapy. All were treated with first line drugs such as phenytoin, phenobarbitone, primidone, carbamazepine and sodium valproate. The majority (53.33% of the PTE and 44.19% of the non-PTE subjects) had treatment with phenytoin.

The older anti-epileptic drugs like phenytoin and phenobarbitone have been found to be associated with increased risk[24] of cleft lip and/or palate among the offspring of mothers with epilepsy who received those anti-epileptic treatments. Malformations associated with anti-epileptic drugs (teratogenicity) are therefore well-documented, although the role of fathers' epilepsy in these malformations needs to be evaluated.[25,26] Moreover, drug-related hormonal changes may be the primary cause of hyposexuality among men with epilepsy, as suggested by some[27] and in this study decreased fertility rate might be drug-related.

Occupational rehabilitation

In respect to active employment, epileptic persons are usually rehabilitated by placement, as the work status following head injury is changed and some are unable to work in their former occupations. Thus severe employment problems are caused by post-traumatic epilepsy[9] and some of the problems faced by people with epilepsy in relevance to employment are reviewed.[28]

However in this study, the PTE employees were placed more often than non-PTE employees (43.33% *vs.* 24.03%). Of the 30 PTE subjects, 13 were placed in contrast to 17 who were not placed. PTE subjects were employed more in non-manual jobs than non-PTE subjects and they were also placed more in non-manual work. Although not significant at the level of 0.05, the number of subjects with PTE were doing more skilled and semi-skilled jobs than non-PTE subjects but placements

among PTE subjects were observed more in skilled and unskilled work.

Of the 13 PTE employees who were placed, 10 (76.92%) were working in less hazardous areas (maintenance, services, *etc.* instead of direct operation). Of the 10, six persons had job restriction (modified) and four persons had change of job (relocation) from hazardous to less hazardous areas.

Of the 13 PTE subjects, three (23.08%) persons who were working in non-hazardous areas (mainly services) had job relocation from hazardous/less hazardous to non-hazardous areas.

Sensible restrictions on the work placement of people with epilepsy[1,29] seems to be reasonable practise in some industries in some countries as opposed to a complete denial of employment in industry.

Of the 30 PTE subjects, four persons had associated disabilities with neuropsychiatric disorders, and three persons were suffering from moderate-severe to severe seizure disabilities and all were rehabilitated by placement in less- or non-hazardous areas with or without work restrictions. Eighteen (60%) subjects with active epilepsy with mild to severe disabilities and six with associated disabilities or handicaps were gainfully employed in respect of their disabilities or handicaps. Work suitability should therefore be judged on an individual basis and can not be generalized, which is in accordance with other views and earlier findings.[1,30–32] Thus assessment of medical fitness for work is important,[32,33] especially among the PTE subjects, as certain findings[34] suggest that PTE patients ranked lower than non-PTE patients in ADL (Activities of Daily Living) at the workplace. Sometimes job loss is due to seizure disabilities, but as opposed to seizure occurrence, additional disabilities like emotional/attitudinal difficulties were found to be the primary reason for job loss in a epilepsy rehabilitation programme.[35]

In this study, fitness, placement, *etc.* were assessed individually through clinical judgement and job analysis on the basis of work process, although some studies have suggested that 'disability score',[35] general aptitude test battery (GATB) scale,[36] Wechsler Adult Intelligence Scale (WAIS),[37] Washington Psychosocial Seizure Inventory (WPSI) scale[38] and other psychometric tests are the best tools for assessing the likelihood of return to work of persons with PTE.

CONCLUSION

The prevalence of seizure disability and neuropsychiatric disability of persons with PTE were 60% and 26.67% respectively. Diminished fertility rate was observed in PTE employees, and PTE employees who were placed had an increased severity of seizure as well as increased production of life births. This supports associations between severity of seizure disability and hypersexuality and successful placement of persons with PTE, and family planning is therefore also important. However, the overall analysis of the results suggests some male reproductive dysfunction (additional disability or handicap) amongst persons with PTE, although the degree of involvement was low.

For the effective occupational rehabilitation of employees with PTE, apart from an objective physical test, a standardized psychosocial seizure assessment is helpful to employees as well as the employer. Moreover, a system of disability evaluation is important for focusing an individual's ability rather than their incapacity and limitations, bearing health and safety standards in mind.

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REFERENCES

1. Dasgupta AK. Epilepsy and employability: A comparative evaluation of epileptic employees working in steel plants of India. *Occup Med* 1992; 42: 137–142.
2. Dasgupta AK, Saunders M, Dick DJ. Epilepsy in the British Steel Corporation: An evaluation of sickness, accident and work records. *Br J Ind Med* 1982; 39: 145–148.
3. Nussbaum K, O'Connor JS. Impairment severity in seizure disorders, some suggestions for reliable assessment. *J Occup Med* 1977; 19: 615–618.
4. Commission on classification and terminology of the international League against Epilepsy. *Epilepsia* 1981; 22: 489–501.
5. MacMahon B, Pugh TF. *Epidemiology Principles and Methods.* Boston, MA (USA): Little, Brown and Co., 1970: 1–375.
6. Zoffe M. Time to pregnancy: a measure of reproductive function in either sex. *Occup Environ Med* 1997; 54: 289–295.
7. Oxley J. Epilepsy. In: Goodwell CJ, Chamberlain MA, eds. *Rehabilitation of the Physically Disabled Adult.* London, UK: Groom Helm Ltd., 1988; 25: 426–443.
8. Lishman WA. Brain damage in relation to psychiatric disability after head injury. *Br J Psychia* 1968; 114: 373–410.
9. Walker AE, Caveness WF, Critchley M, eds. *The Late Effects of Head Injury.* Springfield, IL (USA): Charles C Thomas, 969: 1–560.
10. Reynolds EH, Trimble MR, eds. *Epilepsy and Psychiatry.* Edinburgh, UK: Churchill Livingstone, 1981: 1–379.
11. Slagle DA. Psychiatric disorders following closed head injury: an overview of biopsychosocial factors in their aetiology and management. *Int J Psychia Med* 1990; 20: 1–35.
12. Gualtieri T, Cox DR. The delayed neurobehavioural sequelae of traumatic brain injury. *Brain Injury* 1991; 5 (32): 219–232.
13. Schwab K, Grafman J, Salazar AM, Kraft J. Residual impairments and work status 15 years after penetrating head injury: report from the Vietnam Head Injury study. *Neurology* 1993; 43: 95–103.
14. Webber MP, Hauser WA, Ottman R, Anneger JF. Fertility in persons with epilepsy: 1935–1974. *Epilepsy* 1986; 27: 746–757.
15. Lindsay J, Ounstead C, Richard P. Long term outcome in children with temporal lobe seizures. II: Marriage, parenthood

and sexual indifference. *Devel Med Child Neurol* 1979; 21: 433–440.
16. Saunders M, Rawson M. Sexuality in male epileptics. *J Neurol Sci* 1970; 10: 577–583.
17. Sukla GD, Srivastava ON, Katiyar BC. Sexual disturbances in temporal lobe epilepsy: A controlled study. *Br J Psychia* 1979; 134: 288–292.
18. Morrell MJ. Sexual dysfunction in epilepsy. *Epilepsia* 1991; 32: S38–S45.
19. Taylor DC. Sexual behaviour and temporal lobe epilepsy. *Arch Neurol* 1969; 21: 510–516.
20. Caveness WF, Meirowsky AM, Rish BL, *et al.* The nature of post traumatic epilepsy. *J Neurosurg* 1979; 50: 545–553.
21. Schaumann BA, Annegers JF, Johnson SB, Moore KJ, Lubozynskie HF, Salinsky MC. Family history of seizures in post traumatic and alcohol associated seizure disorders. *Epilepsia* 1994; 35: 48–52.
22. Hauser WA, Annegers JF, Anderson VE. Epidemiology and the genetics of epilepsy. In: Wards AA Jr, Penry JK, Purpura D, eds. *Epilepsy.* New York, NY (USA): Raven Press, 1983: 267–294.
23. Jain S, Padma MV, Puri A, Jyoti, Maheshwari MC. Occurrence of epilepsies in family members of Indian probands with different epileptic syndromes. *Epilepsia* 1997; 38: 237–244.
24. Zanz D. On major malformations and minor anomalies in the offspring of parents with epilepsy: review of the literature. In: Janz D, Bossi L, Dam M, Helge H, *et al*, eds. *Epilepsy, Pregnancy and the Child.* New York, NY (USA): Raven Press, 1982: 211–222.
25. Wilder BJ, Bruni J. *Seizure Disorders. A Pharmacological Approach to Treatment: Drug Toxicity.* New York, NY (USA): Raven Press, 1981; 15: 151–168.
26. Chadwick D. Standard approach to antiepileptic drug treatment in the United Kingdom. *Epilepsia* 1994; 35: S3–S10.
27. Jouko I, Isojarvi T, Repo M, Pakarinen AJ, Lukkarinen O, Myllyla VV. Carbamazepine, phenytoin, sex hormones and sexual function in men with epilepsy. *Epilepsia* 1995; 36: 366–370.
28. Mclellan DL. Epilepsy and employment. *J Soc Occup Med* 1987; 37: 94–99.
29. Brown I, Shorvon SD. Epilepsy. In: Cox RAF, Edwards FC, McCallum RI, eds. *Fitness for Work; The Medical Aspects, Second Edition.* Oxford, UK: Oxford Medical Publications, 1995: 144–165.
30. Thorbecke R, Janz D. Guidelines for assessing the occupational possibilities of persons with epilepsy. In: Porter RJ, *et al*, eds. *Advances in Epileptology: XVth Epilepsy International Symposium.* New York, NY (USA): Raven Press, 1984: 571–575.
31. Brown I. Developing guidelines for epilepsy at work: The occupational physician's role. In: Edwards FA, Espir M, Oxley J, eds. *Epilepsy and Employment — A Medical Symposium on Current Problems and Best Practices.* London, UK: International Congress and Symposium Series: RSM, 1986; 86: 53–58.
32. Cox RAF, Edwards FC, McCallum RI, eds. *Fitness for Work; The Medical Aspects, Second Edition.* Oxford, UK: Oxford Medical Publications, 1995: 1–540.
33. Demeter SL, Andersson GBJ, Smith GM. *Disability Evaluation, First Edition.* Mosby, American Medical Association, 1996: 1–638.
34. Armstrong KK, Sahgal V, Bloch R, Armstrong KJ, Heinemann A. Rehabilitation outcomes in patients with post-traumatic epilepsy. *Arch Phys Med Rehabil* 1990; 71: 156–160.
35. Fraser RT, Clemmons D, Trejo W, Temkin NR. Program evaluation in epilepsy rehabilitation. *Epilepsia* 1983; 24: 734–746.
36. Clemmons D. Relationship of general aptitude test battery scores to successful employment for epileptics in a rehabilitation setting. *Epilepsia* 1983; 24: 232–237.
37. Fraser TR, Clemmons DC, Dodril CB, Trejo WR, Freelove C. The difficult-to-employ in epilepsy rehabilitation: predictions of response to an intensive intervention. *Epilepsia* 1986; 27: 220–224.
38. Dodril CB, Batzel LW, Queisser HR, Temkin NR. An objective method for the assessment of psychological and social problems among epileptics. *Epilepsia* 1980; 21: 123–135.