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Intermittently Occurring Right-Posterior Slow Waves (IRP) in Psychiatric Patients

An Electroencephalographic Indicator of Cerebral Dysfunction

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Summary. Intermittent right-posterior accentuated slow waves (irregular theta and/or delta waves: IRP phenomenon) in the EEG showed an incidence of about 5% in the total in-patients of a psychiatric university hospital. The IRP phenomenon was found in 7.5% of patients with schizophrenic psychoses, 2% of patients with affective psychoses and in 2.4% of patients with neurotic and personality disorders. The IRP groups differed from control groups in a number of sociobiographical and clinical characteristics. Having repeatedly confirmed these relationships with different samples, we regard IRP patients, irrespective of the diagnosis given, as having a maturational deficit of brain function.

Key words: Right-posterior slow waves in EEG – Schizophrenia – Maturational deficit

Introduction

Two recent publications Ulrich and Otto (1984a, b) have drawn attention to the relatively frequent finding of intermittently occurring right-posterior accentuated theta and/or delta waves (IRP phenomenon) in the EEGs of psychiatric patients. An incidence of about 5% in the total number of in-patients treated at the Department of Clinical Psychiatry of the Free University of West Berlin was found. The sample ($n = 70$) was nosologically heterogeneous, although the schizophrenic patients were markedly over-represented, and males predominated. Computer tomograms showed no evidence of an underlying cerebral lesion. Some 20% of the patients showed the IRP phenomenon before therapy with psycho-active drugs was initiated. Both the 48 schizophrenic (Ulrich and Otto 1984a) and the 22 non-schizophrenic (Ulrich and Otto 1984b) IRP patients were compared with control groups which were matched according to diagnosis and sex. In both comparisons the IRP patients were characterised by:

- a lower average age
- a lower age at clinical onset of the psychiatric disorder
- a higher frequency of perinatal complications
- a shading of the respective syndrome towards motor restlessness, increased drive and irritability.

Kasper and Kick (1987) compared 11 schizophrenic IRP patients over a 1-year period (among a total of 148 schizophrenic in-patients this number represented 7%) with a non-IRP control group, which had been matched according to main ICD diagnosis (No. 295), age and sex. In accordance with our previous findings (Ulrich and Otto 1984a, b) the IRP group proved to be younger and more frequently showed signs of minimal cerebral dysfunction. However, they found no differences concerning either the onset or the psychopathology of the disorder. With regard to the latter finding it appears significant that patients with schizo-affective psychoses (ICD No. 295.7, 45%) outnumbered those with paranoid psychoses (ICD No. 295.3, 27%), whereas our sample (Ulrich and Otto 1984a) consisted of 15% schizo-affective and 76% paranoid psychoses.

Based on these findings we speculated (Ulrich and Otto 1984b) as to whether the IRP phenomenon could be regarded as a neurophysiological indicator of a constitutional or acquired disposition towards psychopathological decompensation. The hypothesis of a maturational deficit had previously been advocated by Hill (1952) and Aird and Gastaut (1959) with regard to bilateral posterior slow wave rhythms.

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Regarding the high representation of schizophrenics within the IRP group, we suggested the possibility of a sub-group based on pathogenetic, psychopathological and prognostic distinctions. Because the IRP groups were considerably younger than the control groups the possibility that the differences in psychopathology were only a function of age, could not be ruled out entirely.

The present study served to re-examine the findings obtained up to this time.

Materials and methods

Within a 3-year period (1983–1985) EEGs from psychiatric in-patients which demonstrated a more or less pronounced IRP phenomenon on routine diagnosis were collected by one of us (G.U.). At least one EEG was recorded for each patient. For the present study we restricted ourselves to those EEGs which had been assessed by both authors (G.U. and D.B.) as representing a clear IRP phenomenon. This second evaluation was done without knowledge of the diagnosis. As a criterion of inclusion we settled on a certain degree of visual distinctness (Fig. 1). From the original 113 patients, 88 were included in the study.

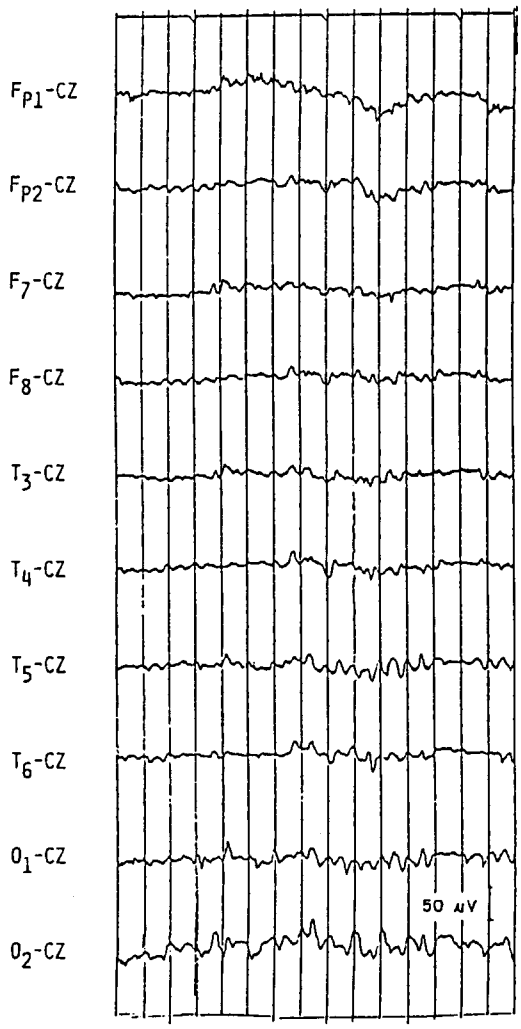

Fig. 1. Intermittently occurring right-posterior slow waves (IRP) (occipital accentuation). The example represents the visual distinctness required for the IRP phenomenon. Pat. H.-J. L., ♂, 39 years, ICD No. 295.3, drug-free for 1 week

The IRP phenomenon essentially consisted of intermittently occurring irregular 4–7/s theta waves, sometimes interspersed with 2–3/s delta waves. In the vast majority of cases IRP manifested itself in the right occipital region (O2/CZ or O2/A2) but there were also cases which showed a right parietal accentuation, possibly due to a different shape of the skull which was not accounted for by the 10–20 system.

All EEGs were recorded using the same apparatus (Schwarzer Encephaloscript 1220/10) under resting conditions (eyes closed, semi-recumbent position, instruction to relax), electrode placement according to the 10–20 scheme, reference montage to the ipsilateral ear and bipolar montages, time constant 0.3 s, low pass filter at 70 Hz.

The IRP group consisted of 42 males and 46 females (mean age: 32.2 ± 11.9 years, range: 18–75 years). Using the discharge files for the years 1983–1985 control patients without IRP were consecutively matched, both according to 5 age classes (≤ 20 years, 21–25, 26–30, 31–35, ≥ 36 years) and to sex. Additional matching according to diagnosis, as had been originally intended, proved to be impossible since there were not enough non-IRP patients to represent the younger age classes. Between group comparisons were based upon retrospective viewing of the case notes.

Results

Among the 2,153 psychiatric in-patients of the 3-year period (each of the patients had at least one EEG), 88 patients, i.e. 4.1% (46 ♀, 42 ♂) were identified as IRP bearers. With regard to the total number of patients (1189 ♀, 964 ♂) a sex predominance could not be established.

A supplementary retrospective examination of the EEGs of 300 unselected in-patients (age mean: 46.5 ± 14.1 years; 192 ♀, 108 ♂) of the Department of Neurology (taken consecutively over a 5-month period) yielded 4 (1.3%) patients with an IRP phenomenon in which no topographical correspondence (structural lesion) had been shown by imaging techniques.

Within the first 3 age classes (up to 30 years) there were 27 males and 17 females, whilst the females predominated in the age groups over 30 years (29 females vs 15 males – see Fig. 2). The age difference between IRP males and females (Table 1) did not attain statistical significance.

Cerebral computer tomograms were routinely performed in 30 of the IRP patients and in 20 of the control patients. For the IRP patients an anomaly was confirmed in 10 cases (33%), in 9 cases global cerebral atrophy and in 1 case ventricular asymmetry. In no case was an anomaly found showing any topographical correspondence to IRP. Among the control patients global cerebral atrophy was confirmed in 4

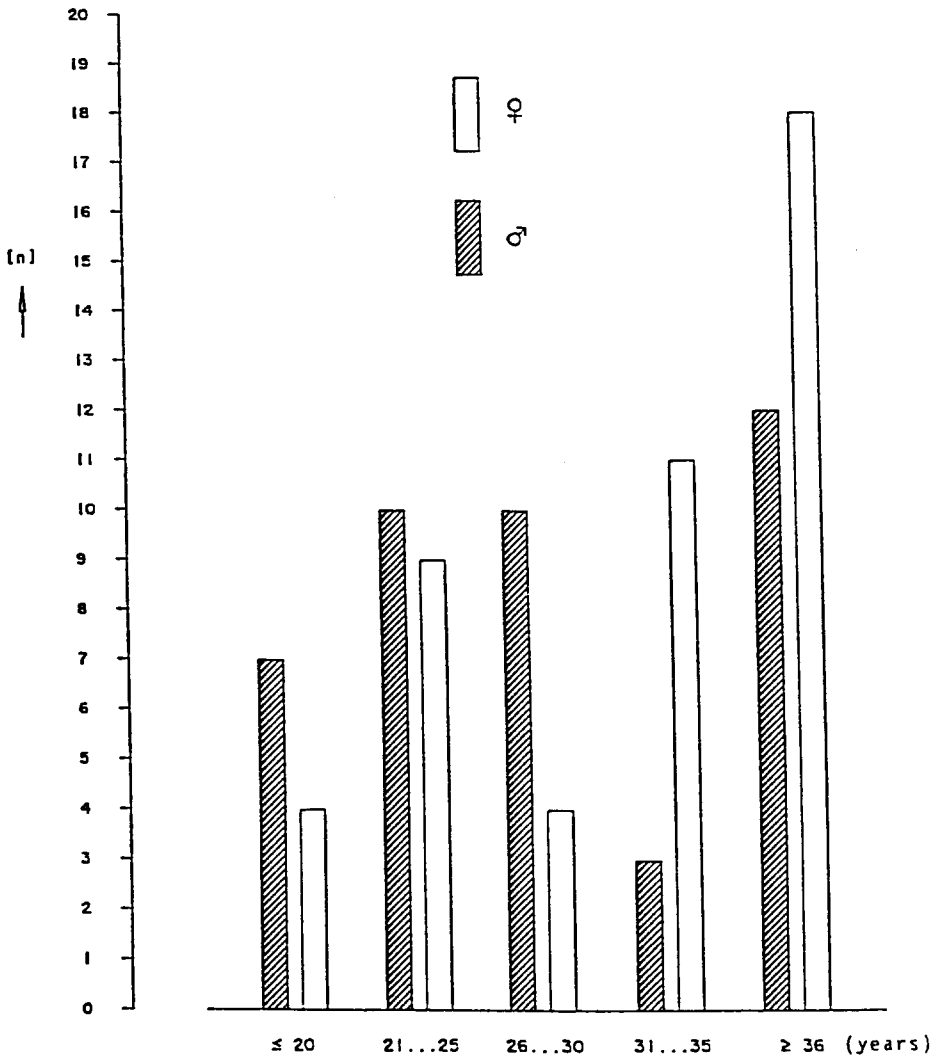

Fig. 2. Frequency distribution according to 5 age classes, subdivided into males and females

Table 1. Age at EEG recording – median, mean and SD

	IRP group		Control group	
	$\tilde{x}$	$\bar{x}$	$\tilde{x}$	$\bar{x}$
♀ + ♂ ($n = 88$)	30.5	33.2 ± 11.9	30.5	33.8 ± 11.6
♀ ($n = 46$)	32.0	35.4 ± 12.8	32.0	36.3 ± 12.6
♂ ($n = 42$)	27.5	30.7 ± 10.5	28.0	31.1 ± 9.8

Table 2. Psycho-active medication on the day of EEG recording

Psycho-active medication	IRP group	Control group
None	20	30
Neuroleptics (alone or combined with other psycho-active drugs	65	53
Anti-depressants	2	5
Lithium	1	0

Table 3. Sub-division of patients according to ICD diagnosis (9th revision): numbers and percentages

	ICD No.	IRP group		Control group	
		n	(%)	n	(%)
Schizophrenic psychoses	295	58	(65.9)	40	(45.5)
Neurotic disorders	300	10	(11.4)	11	(12.5)
Affective psychoses	296	9	(10.2)	13	(14.8)
Psychogenic reactions	309	4	(4.5)	6	(6.8)
Drug psychoses	292	3	(3.4)	2	(2.3)
Paranoid states	297	2	(2.3)	8	(9.1)
Personality disorders and other non-psychotic mental disorders	301–307	2	(2.3)	8	(9.1)

cases (20%). Minor neurological signs were described for 5 IRP and 3 control patients.

Table 2 shows a slight preponderance in neuroleptic medication for the IRP group. Approximately

Table 4. Sub-division of patients into schizophrenics and non-schizophrenics: numbers and percentages

	IRP group ($n = 88$)		Control group ($n = 88$)	
Schizophrenics	58	(65.9)	40	(45.5)
Non-schizophrenics	30	(34.1)	48	(54.5)

Table 5. Frequency distribution of perinatal complications

	IRP group ($n = 88$)	Control group ($n = 88$)
Birth complications followed by delayed development	3	2
Birth complications without delayed development	9	2
Complicated pregnancy	1	0
Premature birth	0	2
Total	13 (14.7%)	6 (6.8%)

Table 6. Sub-division of patients according to their school education: numbers and percentages

	IRP group		Control group	
	n	(%)	n	(%)
Elementary school (or less)	49	(55.7)	34	(38.6)
Non-classical or classical secondary school	39	(44.4)	54	(61.4)

every fourth IRP patient was not receiving psychoactive drugs at the time of recording.

The groups did not differ from each other with regard to the mean number of previous hospitalizations (IRP group: 3.1 ± 1.6; control group: 3.2 ± 3.4) or with regard to the mean duration of their respective last hospitalization (IRP group: 57.9 ± 15.2 days; control group: 60.3 ± 13.1 days).

Comparison of the ICD diagnoses (Table 3) showed a markedly higher percentage of schizophrenics (fulfilling the RDC criteria, Spitzer et al. 1978) within the IRP group (65.9% vs 45.5%). Regarding the other diagnoses there were no relevant differences.

With regard to the total numbers of in-patients IRP was found in 7.5% of patients with schizophrenic psychoses ($n = 774$), in 2.0% of patients with affective psychoses ($n = 438$) and in 2.4% of patients with neurotic disorders, personality disorders and other non-psychotic mental disorders ($n = 503$). A coarse sub-division into schizophrenics and non-schizophrenics (Table 4) showed a preponderance of schizophrenics in the IRP group and of non-schizophrenics in the control group. The 4-fold distribution of numbers narrowly missed statistical significance ($\chi^2 = 3.67$, $df = 1$, $P < 0.10$, two-tailed). Comparison of only those patients diagnosed as schizophrenics (ICD No. 295) yielded no important sub-group differences.

Information concerning perinatal complications generally has to be regarded as unreliable. Hence, it supplied only a coarse hint regarding group differences, not warranting statistical comparison. Perinatal complications (Table 5) were noted twice as frequently for the IRP group as for the control group. Five patients from the IRP group but none from the control group exhibited suggestions of a delayed speech development with no corresponding birth anamnesis.

As can be seen from Table 6, the majority of IRP group patients completed elementary education (or less), whereas more than 60% of the controls completed at least a non-classical secondary school. The 4-fold distribution of numbers was significantly different ($\chi^2 = 4.22$, $df = 1$, $P < 0.05$, two tailed). An intelligence test was performed on 11 IRP and 23 control patients (Table 7). Although the 4-fold distribution did not attain statistical significance (Fisher's exact test: $P < 0.13$, two-tailed), there was a tendency towards lower intelligence in the IRP group. Because the clinical reason for this test was unclear

Table 7. Distribution of scores obtained from Wechsler's reduced intelligence test, according to 4 classes: numbers and percentages

	IQ score	IRP group		Control group	
		n	(%)	n	(%)
Low intelligence	63–78	6	(55)	1	(26)
	79–90	0		5	
Average to high intelligence	91–109	4	(45)	9	(74)
	110–118	1		8	

the result of the group comparison should be regarded with caution.

Definite clarification of the question whether IRP patients exhibit more motor restlessness, drive and irritability independent of age would have required triple matching of the control group according to diagnosis, sex and age. Unfortunately, this requirement could not be met due to methodical limitations. Thus group differences, obtained on the level of individual symptoms (AMDP items, Helmchen 1979 – Kendall's rank correlation coefficient tau_c) would only be expected to reflect the different diagnostic composition of both groups (Table 3) at the time of admission.

The more pronounced symptom delusional behaviour, shown by the IRP group ($P < 0.01$), corresponded with the higher percentage of schizophrenics in this group. Similarly, the more pronounced affective ($P < 0.01$) and somatic-autonomic disturbances ($P < 0.05$), shown by the controls, can be attributed to the higher percentage of affective psychoses and personality disorders in this group.

Discussion

As a result of repeated confirmation the following findings can now be regarded as definitive:

1. With regard to the total number of in-patients in a psychiatric university hospital, an incidence of the IRP phenomenon of about 5% can be expected.
2. There is no underlying structural lesion detectable by computer tomography.
3. The appearance of the IRP is principally independent of psycho-active medication, although neuroleptics may be facilitative.
4. Although nosologically unspecific, IRP shows a particular relationship to schizophrenia.
5. IRP has no relationship to a particular schizophrenic sub-type.
6. IRP indicates a higher probability of having undergone perinatal complications.

The findings concerning sex preference, different age peaks in males and females, delayed development, school education and intelligence have yet to be re-examined.

Due to the different age distribution of IRP and control patients, triple matching, including diagnosis could not be carried out. Thus, the question of a particular shading of the respective psychiatric syndrome in IRP bearers could not be dealt with. However, such a relationship has already been shown to be probable by corresponding findings from two other clinical investigations (Ulrich and Otto 1984a, b). Due to the age matching with the controls we could not re-examine the previously reported findings of a correspondence between IRP and early onset of the psychiatric syndrome.

As has been indicated previously (Ulrich and Otto 1984a), IRP patients, irrespective of the diagnoses given, can be regarded as having a maturational deficit of brain function corresponding to a lack of social competence. Accordingly we considered the research hypotheses of Janzarik (1959) "vorauslaufender Defekt" (defect in advance), Meehl (1962) "subtle neurointegrative defect" and Huber (1980) "Basisstörungen" (basic disturbances).

Taking into consideration the particular relationship between IRP and schizophrenic psychoses, especially those with early onset, reports which suggest accumulation of cerebral dysfunctions (e.g. Kolvin 1971; Siedman 1983), minor physical anomalies (Guy et al. 1983; Green et al. 1987) and perinatal complications (McNeil and Kaij 1978) in schizophrenics gain in interest. Weinberger (1987) hypothesized that schizophrenic psychoses result from an interaction between a fixed brain lesion from early in life with certain normal maturational events that occur much later. Concerning the lesion he conceded that there may not be a true lesion at all but simply a relative hypoplasia or dysplasia of the system implicated, resulting in a quantitative physiological deficit. The lesion itself, be it a true structural lesion, or a quantitative physiological deficit, would be an insufficient explanation for the illness. Weinberger's hypothesis can easily be reconciled with our interpretation of the IRP phenomenon. It lends support to our view that IRP is a neurophysiological indicator of a diagnostic sub-group within the schizophrenic spectrum, assuming a corresponding pathogenesis, symptomatology and prognosis. This may be a single category or the extreme of a continuum in which the other extreme is occupied by schizophrenics with late onset and good prognosis.

Interestingly, an extensive overlap exists between the characterization of schizophrenic IRP patients which we ascertained and the characterization of the so-called Attention-Deficit-disorder (ADD) psychosis (Bellak 1985; Kay and Bellak 1986), which is said to be difficult to distinguish from true schizophrenia. Unsatisfactory responses or even deterioration in ADD psychoses in response to neuroleptics, but a favourable response to methylphenidate, imipramine, lithium or phenytoin has been suggested as a criterion for differential diagnosis. Thus, therapy with one of these drugs seems to be justified in schizophrenic IRP patients who respond unsatisfactorily to neuroleptics.

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