CLINICAL-EEG CORRELATIONS IN THE ACUTE STAGE OF SEVERE CRANIOCEREBRAL INJURY

R. Zjumbjuleva

The bicelectric activity (BEA) dynamics of the brain in severe craniocerebral injury (SCCI) is insufficiently investigated owing to a number of technical and methodological difficulties: heavy impairment of consciousness, motor excitation and injury to soft tissues (P. S. Kinderene — 1970). According to O. M. Grindel (1973), the task of the electrophysiologist is to determine objectively the state of the brain, to prognosticate normal activity restoration on the basis of EEG picture, or establish brain death.

In this work the characteristic features of the clinical picture and EEG in a series of 36 patients with SCCI will be discussed, giving a more detailed description of the cases with arrest of spontaneous respiration and absent BEA, ending with exitus lethalis.

Material

The observation is conducted in a total of 36 patients with SCCI, aged 15 to 83 years, of which twenty seven men and nine women. According to clinical criteria the patients are distributed as follows: with severe brain contusion — 13 cases, and with heavy brain contusion complicated by intracraniahematoma — 23 cases. Of the latter group 14 are with subdural, 5 — with epidural and 4 — with intracerebral hematoma. All patients with hematomas are operatively verified while the thirteen cases with lethal outcome are subjected to pathoanatomical study also.

Clinical data

According to severity of the clinical signs and course of the disease the patients are divided up in two groups. Twenty three patients overcoming the grave conditions, with recrudescence of the clinical symptoms but favourable prognosis for life salvage are assigned to the first group. Here unconsciousness ranging from several hours to several days is present with ensuing amnesia and focal symptomatics of varying intensity. The patients of group II (13 cases) are distinguished for the heavy impairment of consciousness, hypo-to areflexia, extension convulsions, absence of corneal reflexes, dilated not responding pupils and arterial pressure fall. All died within 1—10 days of the trauma. In eight controlled respiration was resorted to because of spontaneous respiratory activity arrest. In these patients the clinical signs passed through an additional phase which occurred after the tenth hour by the addition of signs for relaxation of the spinal cord formations, and appearance of spinal reflexes.

Eeg data

In all patients the first tracing is made within 24 hours of injury. Marked to exclusively heavy changes in BEA are invariably established. The changed form, amplitude and localization of the alpha rhythm to its complete absence is the most constant finding in thirteen patients. In nineteen patients

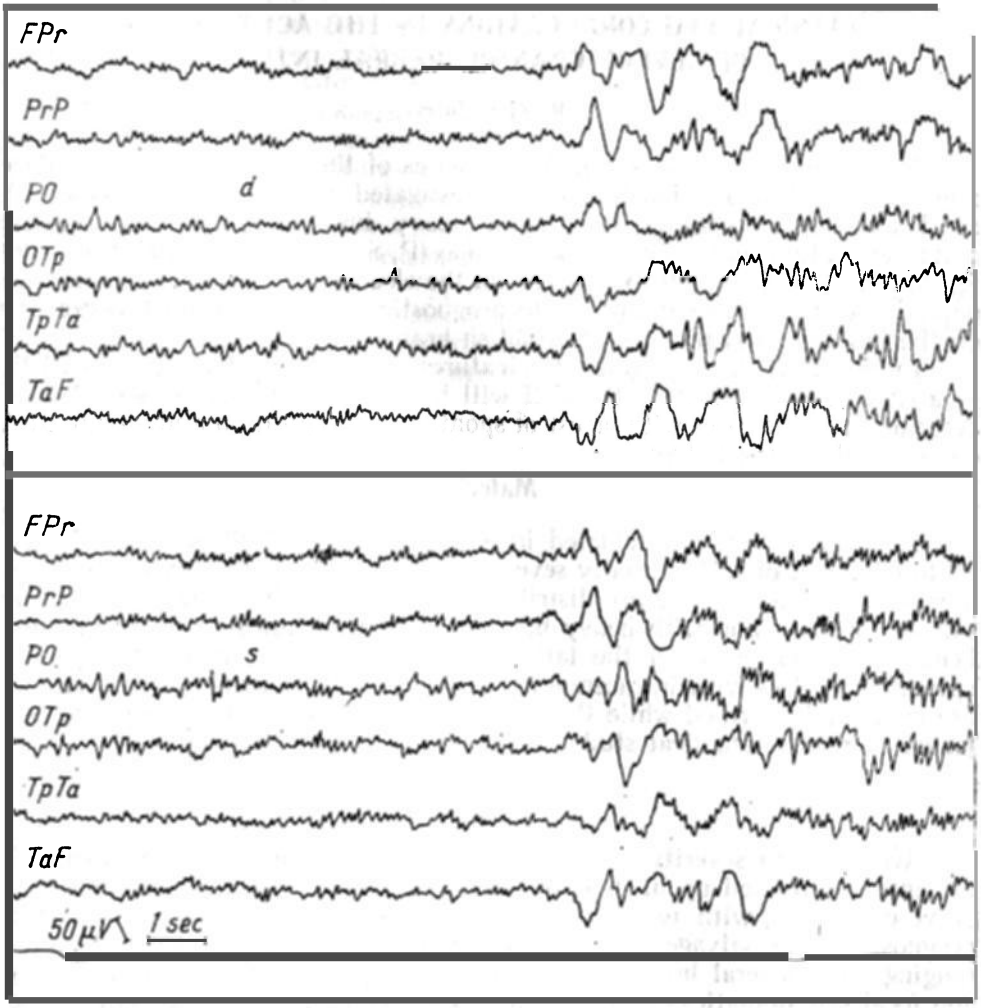


Fig. 1. Case report: T. T., aged 50, case history 1067/71. Diagnosis — Brain contusion III stage. Acute BEA delay and increase in amplitudes upon rhythmic photostimulation.

the EEG tracing is dominated by polymorphic slow waves against the background of which focal manifestations are clearly outlined. Occasionally, the focus is characterized by a more substantial delay of activity, while in others — by a localized amplitude depression. The dynamic BEA study by the 30th day after injury in the rest of the living patients shows signs of improvement,

although a full normalization of the tracing did not occur in any of the cases. The presence of a lowered, and in some cases paradoxical reaction to external stimuli is characteristic of the patients in this group. In eight cases of the series an abrupt delaying of BEA along with an increase in amplitudes upon

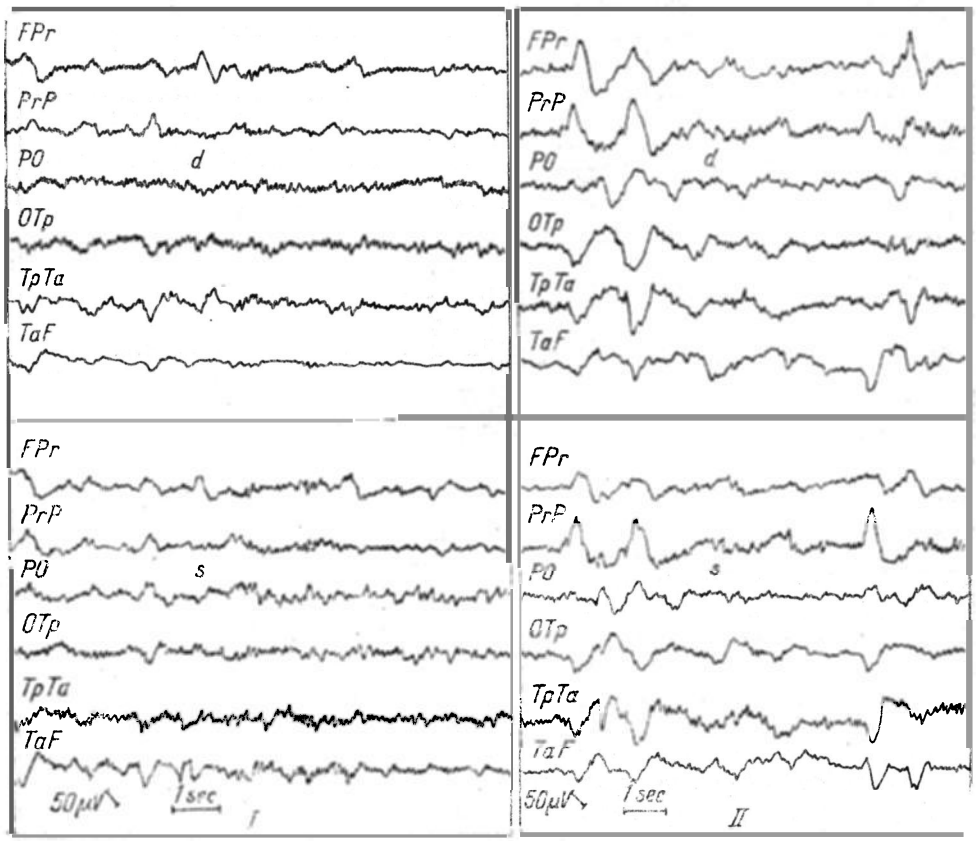


Fig. 2. Case report: H. T., ageday: 24, case history 30043/74. Diagnosis — Brain contusion III degree.

I — first postinjury: diffuse polymorphic slow waves; II — fourth postinjury day; BEA furthermore delayed and rather pronounced polymorphism of waves. Exitus iethalis on the same day.

rhythmic photostimulation was observed (Fig. 1). Similar manifestations of an existing though inadequate response to afferent stimuli in SCCI is considered as a favourable prognostic sign by some authors (P. S. Kinderene — 1970, Courjon — 1970). In the series under review this category of patients are likewise with a favourable prognosis regarding the threat of life.

Among the patients with lethal outcome, occasionally BEA runs a steady course toward disorganization and reduction of frequencies (Fig. 2) in conjunction with absent reactions to afferent stimuli. In the cases with spontaneous respiration arrest, the condition is promptly followed by a flattening of the tracing to isoelectric record (Fig. 3). The pathoanatomical study shows that BEA disappears earlier on the side of rather massive brain lesion as the re-

sult of contusion or hematoma. In the latter group all recordings are made by strict abiding to the conditions for irreversible brain death determination, namely: standard and even distribution of electrodes, derivations from the greatest possible number of points, periodic amplification increases, continuous recording. We present a case report for illustration:

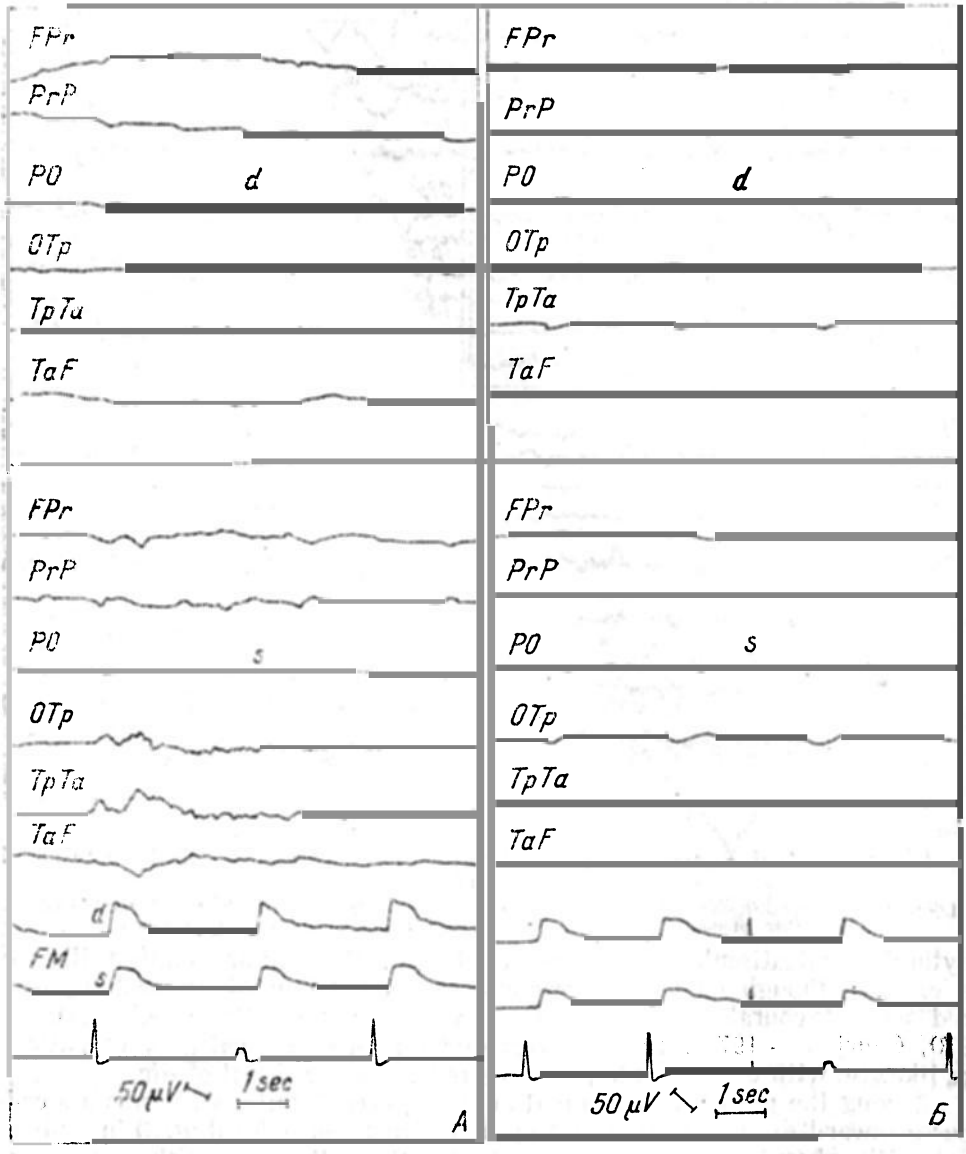


Fig. 3. Case report: K. I., aged 31, case history 10704/70. Diagnosis — Brain contusion III degree. Arrest of spontaneous respiration

A — in the early hours after injury; practically complete BEA absence in the right hemisphere. In the left hemisdhere the tracing is slightly waveq temporally.
B — second postinjury day; isoolectric bilaterally. The patint dies on the same day.

Male patient S. A., aged 26, case history No 38481/68. He sustained a severe craniocerebral injury with ensuing comatose condition in a road accident. The pupils were dilated bilaterally, not reacting to light, with disappearing corneal reflexes. The beginning of extension convulsions was noted. Because of suspected subdural hematoma in the right hemisphere, osteoclastic trephination of the skull was performed, and accordingly a hematoma discovered on the same side temporally. On the next day the spontaneous respiration ceased, and controlled respiration was embarked on. The clinical picture was characterized by complete coma, total absence of reflexes, muscular and arterial hypotonia. On the fourth day after injury, all the reflexes were elicited at analogical, heavy comatose state. At nine days areflexia was sustained once again, but plantar flexion of the feet provoked triple bending of the lower limbs. The EEG study produced evidence of complete bioelectric silence in all the leads. The patient died ten days after spontaneous respiration arrest.

Discussion

The comparatively studied clinical and EEG data in the series under review correlate well in the acute stage of SCCI. Among the patients with a favourable outcome, the brain BEA runs a course with slight fluctuations pointing to a gradual improvement. In all instances with lethal outcome evidence of heavy BEA impairment is demonstrated. Those of them with lack of spontaneous breathing, placed on controlled respiration, exhibit a comparatively uniform clinical picture. The latter is characterized by the loss of brain functions, and by the relieve of spinal-cord automatic behaviors. The occurrence of tendon and protective reflexes in SCCI just prior to death and following a period of prolonged absence, and in case of isoelectric EEG recording has been referred to by a number of authors (F. W. Bronisch — 1960, F. Findji et al. — 1970, M. Jouvet — 1959).

In the past few years, the problem of brain death and its diagnosis worries an ever increasing number of medical specialists throughout the world. Such an interest is to be attributed, up to a great extent, to the possibilities of organ transplantation created. EEG is essential in the set of diagnostic means for demonstrating brain death. B. Schwartz and E. Vandreli (1965) studied BEA in sixteen patients in the state of severe coma with pupilar areflexia and "zero tracing" of EEG. All patients died. B. Asgian et al (1973) recommend polygraphic recording to establish brain death. Some authors (J. Courjon — 1970, E. O. Jorgensen — 1974) advise the derivation of BEA from different brain levels. According to Gros et al (1959), to prove brain death the registration of biopotentials should be performed through maximum area utilization, since BEA may be manifested focally also.

Proceeding from literature reports and personal experience, the inference is reached that any patient should be considered as irretrievably doomed whenever an isoelectric recording is made in the state of deep coma and concomitant areflexia. The policy in such patients, and the reaching of a definite decision in terms of the duration of controlled respiration is a highly responsible task. In our patients with arrest of spontaneous respiration and isoelectric EEG recording, the resuscitation measures were never discontinued prior to cessation of the heart activity.

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КЛИНИКО-ЭЭГ КОРЕЛЛЯЦИИ В ОСТРОЙ СТАДИИ ТЯЖЕЛОЙ ЧЕРЕПНОМОЗГОВОЙ ТРАМЫ

Р. Зюмбюлева

РЕЗЮМЕ

У 36 больных в острой стадиитя желой черепномозговой травмы сопоставляют клинические и ЭЭГ данные. У всех больных установлены грубые нарушения БЕА под формой диффузного замедления ритма, локальной и генерализованной депрессии амплитуд. У больных с благоприятным исходом хорошим прогностическим признаком были реакции на ритмические световые стимулы, выраженные резким замедлением активности и повышение амплитуд. У 8 больных с остановкой спонтанного дыхания наступает быстрая депрессия амплитуд до изоэлектрической записи. Все погибли, несмотря на своевременное применение командуемого дыхания. В клинической картине этих больных были установлены признаки полного отпадения функции головного мозга и растормаживание спинно-мозговых автоматизмов.

В работе отмечают хорошую зависимость между клиническими и ЭЭГ показателями в острой стадии тяжелой черепномозговой травмы.