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An evaluation of the strategic approach to the rehabilitation of traumatic brain injury (TBI) patients

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- A** Study Design
- B** Data Collection
- C** Statistical Analysis
- D** Data Interpretation
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- F** Literature Search
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Summary

Background:

The objective of our study was to evaluate a goal-driven strategic plan for the step-by-step rehabilitation of traumatic brain injury (TBI) patients, with effectiveness measured in terms of quality of life, as compared to patients treated according to a standard, progressive rehabilitation program.

Material/Methods:

We studied 40 patients after TBI awakened from a long-term coma. The patients were divided into two equal groups: a control group (n=20) involving patients treated before the introduction of the strategic approach, and an experimental group (n=20) involving patients rehabilitated under the strategic approach. In evaluating the effectiveness of rehabilitation we used a structured interview with clinical observation and a scale for assessing the quality of life of patients after TBI.

Results:

The deterioration in the quality of life of TBI patients is mainly related to difficulties in satisfying physiological needs, self-care, reduced mobility and disorders of cognitive, regulatory, and social functions. In both groups, the feature most susceptible to rehabilitation related change was movement, while the least susceptible functions were associated with the use of different means of transport. This change is significantly greater in persons in the experimental group, as compared to controls.

Conclusions:

We found that a rehabilitation program controlled by a strategic plan, with the cooperation of the patient, is more effective in improving the quality of life, as the patient is more self-motivated to individually designed objectives.

key words:

brain injury • coma • a goal-driven strategic plan • quality of life

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BACKGROUND

Each year in Europe, approximately 1 million people suffer traumatic brain injury (TBI). In up to 75 to 80% of these cases, this is mild, while for the other 10% to 15% this results in severe brain damage [1]. Following on from this damage are observed somatic disorders, as well as, cognitive, emotional and behavioral disorders, which are often wrongly regarded as being psychogenic in nature [2]. In any case, these disorders reduce the quality of life of TBI patients [3].

An injury to the brain, especially one that corresponds with major consequences, dramatically and permanently alters the quality of a patient's life [3,4]. In this context, more important than all the inconveniences and complaints is the sense of a radical disruption to the course of life, a life that is now split into two periods:

1. before the accident,
2. after the accident.

In the literature on the subject there can be found hundreds of reports on the various consequences of brain injury [5]. The authors discuss the deficits in cognitive, emotional and behavioral problems, difficulties in learning and adaptive behavior disorder [1,4,6-8].

The person affected by the severe brain trauma must learn a host of new skills and ways to cope with difficulties, of which some (e.g. using a wheelchair) are quite new, while others are ones initially learned in childhood (for example walking or bathing), but which now, however, need to be performed in quite different conditions. These difficult lessons, ones to be learnt after TBI, brain surgery, various hospital and rehabilitation visits etc., last for weeks, months and even years [3,4,7]. A large obstacle in mastering these skills is, in the opinion of many patients, the cause of social isolation and fear that they will be alone, and not able to count on anyone's help. The basic question: "what next?" rarely finds a reply [7,8], leading the patient to the conclusion that all of these are routinely uttered empty words of consolation, and that the future is hopeless [9,10].

This situation is aggravated by the fact that the victims of TBI, which are most frequently caused by road accidents, are often young and active in their personal and/or professional life; individuals who have aimed to study, work or get married. Patients after TBI often lament that after the accident nothing is like it was before. "I had my whole life in front of me," they say, "and now what will become of me?" It also happens that an individual who before the accident had an important position points out that: "I was someone, and now I'm nobody!"

It is worth pointing out that we still know surprisingly little about the social functioning and quality of life of people after severe TBI [2,3]. There is often stressed the importance of social competence, as forecast in a broad range of effects, including psychological adjustment, achieved in one's life and health status [4-8]. The weak results within social functioning may play a major role in reducing the quality of life of individuals after TBI. However, the authors note that these results do not correlate with the patients quality of life after an accident [2,7].

The observations of clinicians and researchers [3-5,9,10] indicate that the fate of TBI patients at a later stage, after the accident, are different:

1. some are successful, they are routed through the barriers and way of life, which gives them a sense of satisfaction,
2. other are falling into mourning after the loss of their earlier performance, more and more alone, social isolated and dependent.

Meanwhile, the factors responsible for the success or failure in the process of rehabilitation are not definitively known. According to many scholars, the failures of rehabilitation, are considered to be one of the main factors responsible for the deterioration of the adaptability of the organism [11,12] and the quality of life after TBI [2,13]. According to these authors, it is therefore important to conduct further research on the relation between the effectiveness of rehabilitation and the quality of life of patients after TBI.

The essence of the quality of life

In medical patients with various defects of the brain, the most commonly used definition is "Health-Related Quality of Life – HR-QOL" [3,7,14-20]. The essence of the quality of life associated with "the state of health" is often connected with the degree of the perceived economic well-being, lack of symptoms of disease, along with psychological status and the ability to take part in a variety of activities [14].

A review of the literature allows one to observe that this term is used in at least three different ways. And so the quality of life is understood as:

- a measure adversely affecting the mental health of the patient of some chronic and/or secondary symptoms of illness or injury while not constituting a direct risk to his life [9,21-24],
- a measure of the effectiveness of treatment, i.e. the final effect of the treatment (the "outcome"), which is assessed on a scale of the "quality of life" of the patient after the completion of a specific treatment, e.g. more self-pro rehabilitation [25-27],
- the reference point in taking difficult decisions, for weighty life decisions e.g. the stopping of patient reanimation when serious damage to the organism seems irreversible [28-33].

In this work we have developed the definition elaborated by Pachalska et al. [34-36]. The basis for the definition is that the sense of satisfaction and happiness considered essential for the quality of life depends within the patient on the perception of the differences between:

1. the needs (at the physiological level),
2. desires (at the emotional level),
3. dreams (at the intellectual and spiritual level).

and their current implementation and other real (or perceived) possibilities of their implementation in the future. Thus understood, the essence of the quality of life appears to be more useful in a clinic for damage to the nervous system [32,33], especially for those who have suffered brain and/or brain stem injury [3]. Indeed, it determines the difference between the current and the desired state of mind for the patient in the light of the limited possibilities of reducing this difference to an acceptable level given the nature of the illness [3,7].

Thanks to the comprehensive approach to the functioning of man in all his dimensions (physiological, emotional and intellectual and spiritual), which as a matter of fact are difficult to separate from each other, there is also created the possibility to assess the effects of rehabilitation themselves [3,7,37]. It is widely known that serious emotional problems can affect the human physiology. Spiritual crisis often leads to adverse changes in multiple layouts, and only an exceptional individual in the face of a serious, long-term illness or disability of mind is able to feel peace of mind and the nearness of God [37]. This does not mean that a therapist must be a physician, psychotherapist and priest in one for his patients. However, without drawing attention to the totality of the life situation of the patient there may be doubts as to whether our interactions will have satisfactory results or not.

Therefore, it seems obvious, that there is a need to evaluate a goal-driven strategic plan for the step-by-step rehabilitation of TBI patients, with effectiveness measured in terms of quality of life, as compared to patients treated according to a standard, progressive rehabilitation program.

The aim of the research

The objective of our study was to evaluate a goal-driven strategic plan for the step-by-step rehabilitation of TBI patients, with effectiveness measured in terms of quality of life, as compared to patients treated according to a standard, staged rehabilitation program [36].

Starting from the assumption that the conducting within rehabilitation programs of standard individual treatments and techniques of therapy solely in response to current problems, does not lead to the implementation of the overarching objective of rehabilitation, which is to set in motion the respective mechanisms of adaptation and compensation, allowing the patient to obtain the best possible quality of life [20,38–40], the strategic plan has been governed by the rehabilitation program developed by Pachalska et al. [36,41]. According to the authors, this program is directed to the goal, is implemented with the cooperation of the patient after TBI, and adapted to the individual needs of the patient. In this approach there is an assumption for a significant patient input within the elaboration and implementation of the plan.

Special attention has been given to such factors as:

1. The specificity and complexity of the clinical picture, in the absence of appropriate rehabilitation programs.
2. The overall situation of the patient's rehabilitation after the concentration and, in particular, its isolation and dependence.
3. The effectiveness of existing, standard programs of rehabilitation for people after the injury of the brain and brain stem.

MATERIAL AND METHODS

The research included 40 patients after TBI treated in the Rehabilitation Clinic at the Ludwik Rydygier's Medical Academy in Bydgoszcz and in the Medical Rehabilitation Department of the Krakow Rehabilitation Centre. The control group (n=20; 11 men and 9 women) constituted patients

treated via a staged rehabilitation program [18]. The experimental group (n=20, including 13 men and 7 women) are patients also treated by a staged rehabilitation program with the addition of a strategic approach to the rehabilitation, focusing on the goal [36].

Selecting work groups was due to the lack of a strategic program: focusing on the objective in the course of the rehabilitation of the control group, the need to verify the new program in terms of clinical trials by comparing the results obtained in the process of the rehabilitation of patients with the experimental and control group undergoing same program of rehabilitation, where in addition we used within the experimental group the strategic approach to rehabilitation, one focusing on the goal.

Characteristics of the patients

Patient age in both the treatment groups was within the limits of 14 to 63 years, 90% of the surveyed group K and 70% of the Group E are young, falling within the range of 20 to 40 years, the average age in Group K was 26.3 years (s=9.48), while in Group E it was 33.6 years (s=12.71) and this did not differ statistically (t=2.11; df=19; p<0.05).

The direct cause of injury in the vast majority of those investigated was a road accident. And thus in Group K all have suffered a TBI following a road accident, including 9 persons as a driver, 3 individuals as car passengers, 4 persons as motorcyclists, 1 person as a cyclist and 3 individuals as pedestrians struck by a car. In turn, in Group E, the vast majority of those surveyed suffered TBI following a road accident, including 8 persons as drivers, 1 person as a car passenger, 3 individuals as cyclists and 6 persons as pedestrians. Only 2 people suffered brain injury for other reasons including 1 person due to another injury of the brain and 1 person as a result of being crushed by a wall.

According to previous reports [1–3], severe brain injury was determined after reanimation, by the lowest result in the Glasgow Coma Scale-GCS [1], with 8 points or less. Moderate brain injury was identified by the GCS as being from 9–12 points and 13–15 points, with the accompanying damage to the skull, or cerebral injury, neurological disturbances and changes in brain neuroimaging; a loss of consciousness of longer than 15 min.

All tested patients, both in Group K and in Group E, have suffered TBI, and were as a consequence of injury in a long-term coma from 21 days to 9 months. At the time of admission to an intensive care department, patients had from 3 to 7 points on the GCS and were suffering as a consequence of the various neurological abnormalities, post-traumatic amnesia. Neuroimaging studies (CT, MRI) confirmed brain injury in them.

And so in Group K, 2 of the tested patients had 3 points, 4 had 4 points in the GCS, 8 tested patients 5 points, 3 tested 6 points while 3 others obtained 7 points in the GCS. In Group E, 15 tested patients had 3 points, 4 – 4 points and one patient 5 points in the GCS. The average value of the GCS in Group K was higher (x=5.05; s=1.16) than in Group E (x=3.3; s=0.56), and the difference was statistically significant (t=5.55; df=19; p<0.01).

In the majority of the patients hematoma occurred within the brain. And so in Group K hematoma occurred in 13 tested patients, with its disappearance without the need for brain surgery in 4 patients, while 9 patients needed to undergo a brain operation. In Group E, hematoma occurred in 10 patients, with its disappearance without brain surgery occurring in 5 cases, while 5 tested patients had to undergo surgery.

In the patients tested both in Group K and in Group E, there was a variety of neurological disorders. And so in Group K epilepsy was found in 6 patients, headaches in 18, visual disturbances in 11 patients, vertigo in 12. In turn, in Group E, epilepsy was found in 7 tested patients, headaches in 19, vision disorders occurred in 9 cases, and dizziness in 13 of the patient tested s.

Two patients had to have a lower limb amputated, this being one patient from Group K and one from Group E.

Methods and tools used

The following methods and tools were used in our research:

1. analysis of the documentation (the history of the disease, the results of MRI and CT research),
2. clinical interviews, properly oriented research [3]. Particular emphasis was placed on: how to cope with the constraints arising from illness, the patient's attitudes, with particular reference to the patient's self image and specific future, the hierarchy of values and life goals, the patient's personality and satisfaction with life before the disease,
3. screening neuropsychological testing, with the use of standard procedures for the assessment of cognitive processes and consciousness disorders: in this memory and attention disorders, the visual-spatial functions, disorders of speech, emotional and behavioural disorders [7],
4. the Quality of Life scale for TBI patients [34]. An evaluation of the quality of life was conducted in 8 main factors determining the quality of life:
 - helping oneself (performing activities in daily life),
 - physiological needs (control of urinal and sexual needs),
 - psychophysical comfort (control of pain and disorders of sleep and mood),
 - motor abilities (e.g. locomotion),
 - communication (e.g. aphasia, aprosodia),
 - cognitive disabilities (memory, attention, logical thinking),
 - social functions (contact with other human beings in standard situations)
 - transport (using various means of transport).

In each category, an evaluation from 3 to 5 was carried out in relation to the estimated percentage of the patient's own input in its implementation. The level of assistance required by the patient was determined by a scale adapted from the well-known international standards of the Neurological and Functional Classification of Spinal Cord Injury – the ASIA scale [42]:

- 1 or 2 points: total dependence (patient input: 0–25%),
- 3 to 5 points: limited autonomy (patient input: 50%, 75% as well as independently but under the supervision of a carer),
- 6 to 7 points: autonomy (patient input: 100% using adapted equipment or not).

The points were given on the basis of our own research and the clinical interview.

An assessment of the brain damage, in which we used GCS, the scale of post-traumatic amnesia, documentation analysis and neuroimaging (CT and/or MRI).

The procedure

All the tests were carried out by one and the same person in similar conditions, facilities and test situation, as this gives a more reliable evaluation of the results of the treatment. The choice of groups was targeted, all individuals both from Group K and from Group B were after a long-term (non pharmaceutical) coma. We selected persons available for research and without intellectual disabilities before the accident.

Patients were examined twice, the first test was conducted before the administration of rehabilitation program, and the other after eight weeks of treatment.

RESULTS

The results of the study of the quality of life of patients after TBI obtained by the patients from both groups in the various categories of a scale for assessing the quality of life of patients after TBI [34] are shown in Table 1.

As a result of the studies it was found that the quality of life after TBI has a particular impact on difficulties in helping oneself, difficulties in the realization of physiological needs and the loss of psychophysical comfort, mobility, cognitive functions and social functions.

Statistical analysis performed with the use of a student's t-test for associated pairs shows that by comparing the average evaluation achieved by patients within both tested groups in each of eight categories that are included in the applied scale, the differences between the results of the first and second study are highly statistically significant both in the patients in Group E ($p=0.000035$), and in the patient in Group K ($p=0.0069$). However, it should be noted that the results of the group K are substantially higher in the first examination ($p=0.00016$), while in the second study, patients in Group E, have significantly higher results ($p=0.016$). This means, that the bigger significant improvements which occurred in Group E, are the result of rehabilitation. This was achieved despite the slightly higher age and significantly worse results in GCS.

The results obtained by the patients of both groups in the various categories of a scale for assessing the quality of life of patients after TBI, are also presented graphically in Figures 1, 2.

One can see that the differences between the results of the I and II studies in Group E are much larger than in Group K. In Group K the shape of the profile has changed little in the period from the first to the second test, while in Group E, the shape clearly differs. In Group K changes in category D are only indicated, mobility, and in category E, i.e. capabilities of communication, while in Group E, change also occur in category C in terms of psychophysical comfort

Table 1. Presentation of the average results obtained in (I) and (II) examination of patients from both test groups in the various categories on a scale for assessing the quality of life of patients after TBI.

Group	Examination	Categories							
		A	B	C	D	E	F	G	H
Experimental	I	3.45	2.70	2.97	2.89	3.15	3.10	2.30	1.42
	II	5.05	3.82	5.30	4.69	4.63	4.74	3.73	2.00
Control	I	4.54	3.50	3.75	4.22	4.04	3.80	3.04	1.53
	II	4.98	3.63	3.72	4.72	4.20	3.96	3.26	1.60

A – Helping oneself; B – Physiological needs; C – Psychophysical comfort; D – Mobility; E – Communication; F – Cognitive functions; G – Social functions; H – Transportation.

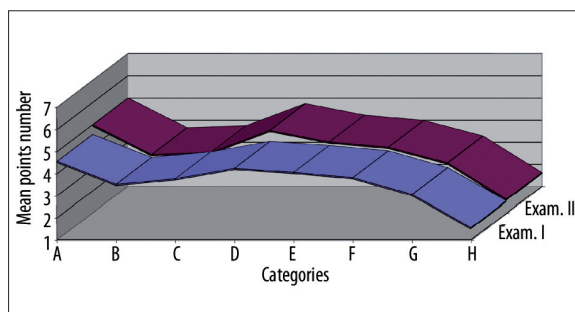


Figure 1. Average results obtained in Test I and II by patients with control group in the individual terms of quality of life assessment.

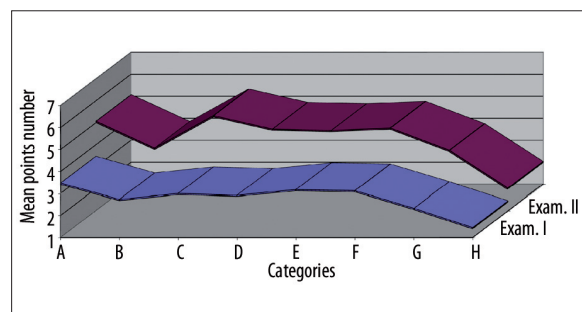


Figure 2. The average results obtained in (I) and (II) examination by the patients of the experimental group in the individual terms of quality of life assessment.

resulting from improving adaptability. The most susceptible to change related to the conducting of the rehabilitation process, are, in both test groups, mobility, while the least vulnerable functions associated with the use of difference is transportation. This change is significantly greater in persons in Group E, than people in Group K. No significant correlation between the stated (i.e. subjective) level of patient quality of life, and the objectively measured disability resulting from TBI is noted.

DISCUSSION

In the summary and discussion it is worth first noting that the results obtained in the tests may influence the depth of the damage of the brain associated with the results obtained by the treatment of patients within the Glasgow Coma Scale. These results in the first examination were substantially worse in Group E, than in Group K. The better final results obtained by the patients in Group E are all the more surprising given that the output of the patients of this group was significantly lower in results than was the case for the patients in Group K. The fact that the tested groups were not at the same level of efficiency at the beginning of the test was not due to a methodological error, but as a result of the neurological status of the patients. The patients studied in Group E have indeed statistically lower values on the GCS, than patients in Group K.

Statistically significant differences between groups acknowledge the point of concern we raised at the beginning of the chapter, that the quality of life of patients after brain injury

ultimately is not the same in respect of the assessment of the quality of life (as patients from both tested groups were well matched), but derives from the subjective perception of their own life. The specificity and complexity of the clinical picture of patients after brain injury reduces the effectiveness of different rehabilitation treatments, if the patients are not able to take a decision, or do not want to consult with anyone their problems. With an attitude of passive resistance, the patient allows for a situation to arise whereby his/her overall approach to life after rehabilitation is unchanged, which deepens his/her dependence and/or social isolation [3,7,23]. Existing, standard programs of rehabilitation for people with various brain defects are not adapted to the individual needs of the patient after brain injury and regardless of the possible improvement achieved on specific parameters (especially mobility) do not allow us to enhance the quality of life. This is because the patient is a passive subject of the physiotherapist's interactions and is devoid of a voice in the process of their treatment, which has an effect on the assessment of the quality of their life, something equally stressed by other authors [1,7,40–43]. Controlled by the strategic plan aimed at the implementation of a program of rehabilitation for individually designed purposes, with the cooperation of the patient, is more effective in improving the quality of life, because the patient himself is responsible for the implementation of the individually designed objectives. Progress in the objectivity of individual treatments have their reflection in the subjective quality of life for the patient. Benefits from the introduction to clinical practice of a strategic plan relate not exclusively to the parameters of the psychosocial, but also to

physiological and mobility needs. This Program is worthy of recommendation for the treatment and improvement of patients following brain injuries.

CONCLUSIONS

The results obtained allow one to draw the following conclusions:

1. The quality of life after TBI has a particular negative impact in self care, difficulties in fulfilling physiological needs and the loss of psychophysical comfort, mobility, cognitive functions and social functions.
2. No significant correlation between the stated (i.e. subjective) level of the quality of a patient's life, and the objectively measured depth of disability resulting from TBI were found.
3. The most susceptible to change related to the carrying out of the process of rehabilitation, is in both test groups that of mobility, while the least vulnerable functions is associated with the use of different means of transport. However, this change is significantly greater in persons in Group E, than people in Group K.
4. Existing, standard rehabilitation programs for people with various brain dysfunctions are not adapted to the individual needs of the patient after brain injury and regardless of the possible improvement achieved on specific parameters (especially mobility) do not allow one to raise the quality of life, because the patient is a passive subject of interactions and has no say with the physiotherapist regarding the course of their own treatment.
5. Control by a strategic plan rehabilitation program, with the cooperation of the patient, is more effective in improving the quality of life, as requested, the patient is more self-motivated to individually designed objectives. Progress towards the objective of individual treatments are obtained by reflection in the subjective quality of life for the patient.
6. Benefit from the introduction to clinical practice of a strategic plan concerns not only the parameters of the psychosocial, but also physiological and mobility needs. Have a specific, real purpose in rehabilitation has an impact on the patient's own attitude towards the future, as well as presenting him/her with a fair, cognitive picture of their own situation.
7. The rehabilitation program based on the strategic plan is worthy of recommendations in the treatment and improvement of a patient's life after brain injury.

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