Quality management in traumatic brain injury (TBI)
Lessons from the prospective study in 6.800 patients after acute TBI in respect of neurorehabilitation

K. R. H. von Wild¹ and P. Wenzlaff² in cooperation with the TBI Study Council***

¹ Medical Faculty, Westfälische Wilhelms University, Münster, North Rhine-Westphalia, Germany
² Centre for Quality Management in Healthcare (ZQ), Physicians’ Chamber of Lower Saxony, Hannover, Germany

Summary

Preliminary results on epidemiology, acute hospital care, and neurorehabilitation of TBI are presented of the first ever prospective controlled German study to analyse the use of regional structures and quality management as provided by the German social healthcare system. The sum of inhabitants in Hannover and Münster area was 2,114 million. Within an area of 100 kilometres diameter each. 6.783 acute TBI (58% male) were admitted for acute treatment from March 2000 to 2001. Definition of acute TBI was according to the ICD 10 S-02, S-04, S-06, S-07, S-09 in combination with dizziness or vomiting; retrograde or anterograde amnesia, impaired consciousness, skull fracture, and/or focal neurological impairment. The incidence was 321/100.000 population. Cause of TBI was traffic accident in 26%, during leisure time 35%, at home 30% and at work 15%. Initial GCS (emergency room) was only assessed in 3.731 TBI (=55%). Out of those 3.395 = 90.9% were mild, 145 = 3.9% were moderate, and 191 = 5.2% severe TBI. 28% of 6.783 patients were <1 to 15 years, 18% > 65 years of age. The number admitted to hospital treatment is 5.221 = 77%, of whom 72 patients (=1.4%) died caused by TBI. One year follow-up in 4.307 TBI patients (=63.5%) revealed that only 258 patients (=3.8%) received neurorehabilitation (73% male), but 68% within one month of injury. Five percent of these patients were <16 years of age, 25% > 65 years. Early rehabilitation “B” was performed in 100 patients (=39%), 19% within one week following TBI. The management of frequent complications in 148 patients (=57%) and the high number of one or more different consultations (n = 196) confirmed the author’s concept for early neurosurgical rehabilitation in TBI when rehabilitation centres were compared regarding GCS and GOS: Early GOS 1 = 4%; GOS 2 = 2.7%, GOS 3 = 37.3%, GOS 4 = 26.7%, GOS 5 = 29.3%, final GOS scores were 1 = 1.2%, 2 = 1.7%, 3 = 21.8%, 4 = 36.2%, and 5 = 39.1% of all patients at the end of rehabilitation. Mean duration for both “B” and “C” was 41 days compared to 80 days for “D” and “E”. An assessment of both GCS and GOS was insufficient (Fig. 1).

Keywords: Epidemiology; traumatic brain injury; prospective controlled clinical study; complications; polytrauma; TBI Guidelines; posttraumatic functional rehabilitation; early rehabilitation; neuropsychological sequelae; quality management; German social and healthcare system; quality of life.

Introduction

Acute traumatic brain injury (TBI) is a major ethical and social burden in industrialized countries with regard to life-long disability, unnatural death, and the enormous socio-economic costs. The costs have to be covered by the national social and healthcare systems together with the care providers and care givers regarding accident prevention, acute medical care, and social reintegration of the victims. Traffic accidents are known to cause most of the TBI-related deaths and disabilities, mainly among the younger population between 20 and 30 years [1, 2, 7–11, 13–15, 19, 23, 24].
The German social and healthcare systems today provide an exemplary high standard of structural and process quality for the medical management of acute TBI, aimed at the victim’s full social reintegration [7, 8, 14–18]. Holistic rehabilitation means an ongoing chain of functional neurorehabilitation that starts already at the site of the accident, with resuscitation of vital body functions, acute treatment, and restoration of the impaired higher nervous functions, proper treatment and, respectively, prevention of primary and/or secondary complications [3, 4, 12–14, 21, 22]. This applies to both the body as well as to the victim’s body-related structures (WHO-JCF classification) according to the Spectrum of functional neurological-neurosurgical neurorehabilitation [16]. Since the wearing of helmets for motorcyclists and the use of safety belts also for passengers occupying the rear seats of vehicles has become compulsory by law and specially designed safety seats for babies and small children are available, there has been a significant reduction in the number of severe and fatal TBI accidents in Germany and Austria [1, 2, 11]. In addition, modern techniques for road safety and speed limits in dangerous areas have also been quite successful in TBI prevention, although very costly. This is reported both for isolated TBI and cases of polytrauma regarding all traffic participants as published in the official governmental annual books of statistics in Germany [2, 6].

National and international guidelines for the acute management of TBI have become widely accepted and are being followed today, with some minor local modifications according to the experience of regional scientific experts such as intensive-care physicians, trauma- and neurosurgeons [3, 4, 11–14, 19, 21]. The senior author and two other participants of our study group, W. Bock and E. Rickels, actively took part in editing some of these guidelines and recommendations as well as in the planning of new structures for trauma care and neurorehabilitation, for example the Governmental Task Force of North Rhine-Westphalia [7], the interdisciplinary Task Force on ENNR [16, 24], and the recommendations for management of acute trauma care and for posttraumatic intracranial pressure of DIVI [4]. The network of regional structures for public healthcare are state-of-the-art throughout Germany, and they are also reported to be on a high standard level in Austria [1, 2, 11, 18, 21, 22]. The same should be true for quality management of posttraumatic functional neurorehabilitation with regard to the different design of institutions and specialized personnel, which is based on the philosophy of interdisciplinary team approach and treatment for all phases of neurorehabilitation: the (acute) early and, when necessary, continuous rehabilitation described as acute phase (“B”), post-acute (“C”) and long lasting phases “D”, “E”, as well as for outpatient rehabilitation “F” [6, 10, 11, 16–18, 20, 24]. This could be achieved owing to the close cooperation of politicians, care providers, and care givers together with expert physicians for neurorehabilitation and neuropsychology, although special guidelines for neurorehabilitation have not yet been published in Germany or in other Western countries. In Germany we are pursuing mainly the structural and management quality for functional neurorehabilitation as recommended by the expert opinion of the German Task Force for early neurological-neurosurgical rehabilitation (ENNR) in 1993 [16, 24].

Bearing this in mind it is surprising that even in Germany there is a lack of reliable figures for acute TBI care and posttraumatic functional neurorehabilitation to evaluate and qualify the efficiency of the regional structures and the medical treatment of TBI. This was the reason for carrying out the first controlled prospective multicentre study in two regions, where a sufficiently high number of TBI victims within one year could be anticipated to statistically evaluate the actual quality management with respect to acute treatment, neurorehabilitation, and early outcome in Germany.

Material and methods

The purpose of the clinical prospective controlled multicentre study was to analyse the epidemiology and quality management of acute medical care and posttraumatic functional neurorehabilitation within one year. One of the authors (E. Rickels) planned to use the data as a pilot study for a German TBI database while the senior author (K. von Wild) was especially interested in all questions regarding quality management in posttraumatic rehabilitation.

The initiative, both authors derived from this, was focused on two comparable regions because of their intensive personal experience in the acute management of neurotrauma care and rehabilitation as well as of the insight into regional structures. The catchment area was 2,114,385 inhabitants. In the Hannover region, the capital town of Lower Saxony and an industrialized urban region, there were 1,256,618 million inhabitants, and in the Münster region, the governmental capital of North Rhine-Westphalia, rural, with 858,767 population, each with a geographical diameter of 100 km.*

Both cities have major trauma centres and neurosurgical depart-