The modern effort to use sound scientific principles in the management of traumatically brain injured patients followed the introduction of intracranial pressure monitoring. Other technologies, including the application of controlled ventilation, cerebral blood flow monitoring, computed tomographic brain scanning, and sophisticated brain electrophysiological monitoring, enhanced methodologies for earlier diagnosis and continuous evaluation of a brain-injured patient's intracranial pathobiological condition. Dependable neurological evaluation scales (e.g., the Glasgow Coma Scale) contributed a critical method for defining and comparing patients according to their level of coma. In 1977, a published report in the *Journal of Neurosurgery* from the brain injury group at the Medical College of Virginia demonstrated an astounding 30% reduction in mortality rate for those with severe brain injuries after application of early diagnosis and treatment of mass lesions coupled with modern organized intensive care management.

The mortality reduction translated directly into an increase in good outcomes. The percentage of poor functioning survivors (severely disabled or vegetative individuals) did not increase. That report has subsequently been confirmed in multiple studies utilizing various designs. The management principles initially promulgated in that publication, which were based on scientific knowledge and expert opinion, are today widely applied, and the outcome data are generally accepted as accurate.

The knowledge that traumatic brain injury management could be defined according to scientific principles provided the stimulus for this area to be the first identified by organized neurosurgery for the development of "guidelines." This resulted in the 1995 creation by the Brain Trauma Foundation of *Guidelines for the Management of Severe Head Injury*.

These guidelines, although useful and widely referenced, have limitations, primarily because the pathobiology of traumatic brain injury is complex and because the physiological, chemical, and anatomic status of the injured brain will often change from hour to hour and day to day. Controlled, randomized, and blinded studies in brain trauma are notoriously difficult to construct, in large part because patients vary in degree, extent, and location of pathobiological cellular and subcellular injury. Thus brain trauma guidelines demanding a full and rigorous scientific basis presently have major limitations.

Alex B. Valadka and Brian T. Andrews, the editors of this book, make a remarkably useful contribution by enhancing the guidelines concept with the addition of expert opinion. The result is a readable, workable, interesting, and up-to-date book, which provides authoritative information that will no doubt be applied to and improve patient management. Their selection of authors to provide expert opinion is especially outstanding, and I enjoyed reading the individual chapters because of the practical and accurate presentations. Patients with severe traumatic brain injury and individuals caring for them will benefit from this timely and carefully developed contribution.

*Donald P. Becker, M.D.*
Los Angeles, CA 2004
The introduction and widespread acceptance of the guidelines process has had a noticeable impact on the care of neurotrauma patients. Guidelines serve to remind us of what we should be doing all the time: treating our patients based on the best available evidence. However, the downside of a rigorous guidelines process is that it does not allow the formulation of meaningful recommendations on a topic for which well-conducted clinical trials have not been carried out and reported. In certain quarters, this problem has led to some backlash against guidelines and to a sense of disillusionment with how little they often tell us.

This book is intended to combine clinical evidence with the wisdom and experience of experts in order to give answers to specific questions. The questions themselves were chosen in no particular order. Instead, they arose on daily rounds and during everyday conversations with colleagues and trainees. For the purposes of this book, these questions were organized into sections on resuscitation and initial assessment, general critical care, brain injury, spinal cord injury, recovery, sports medicine, and trauma systems. Undoubtedly, many other questions could have been asked, and new questions will continue to arise. Such topics can easily form the basis of future books, monographs, and review articles.

The target audience for this book is anyone who needs information about these questions. Certainly, students and residents fit this category, but physicians who are unfamiliar with this material, who may not have had to use it for a long time, or who would like an update or simple verification that they are treating patients in an acceptable manner could also benefit from this book. In addition to neurosurgeons, interested specialists might include intensivists, trauma surgeons, emergency physicians, neurologists, anesthesiologists, pediatricians, and virtually anyone else who comes into contact with these patients. Allied health practitioners who might be interested in these questions include nurses, physician assistants, certified registered nurse anesthetists, paramedics, speech therapists, respiratory therapists, and a host of others.

This book would not have been possible without the efforts of a great many people. The authors of the individual chapters tolerated our insistence that they adhere to a strict format for their chapters. They also put up with numerous edits, revisions, and rewrites with a minimum of complaining. At Thieme, Brian Scanlan was always optimistic that this book would be completed, even when such optimism did not seem warranted. Finally, Sylvia Melendez spent countless hours finding references, verifying the accuracy of citations, organizing mountains of correspondence and hundreds of e-mails, proofreading each version of each chapter several times, and shepherding this project along to its completion.

We hope that the readers find this book to be interesting and informative. Most of all, we hope that the material contained in these pages may help at least a few neurotrauma patients achieve better outcomes.

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Brian T. Andrews, M.D., F.A.C.S.
San Francisco, California
Why do we do the things we do? When it comes to taking care of our patients, common reasons include, “That’s how I was told to do it as a resident,” or “That’s how we’ve always done it,” or “I had a case once in which I didn’t do that, and I regretted it.”

Similarly, during neurosurgical training, residents observe that different attendings manage patients with the same problems in different ways. Of course, each of us thinks that our own way of doing things is the best, but what is our basis for that assumption? Such questions were the genesis of this book.

This book is a review of the literature that answers specific questions that frequently arise during the care of neurotrauma patients. The authors, who were chosen on the basis of their expertise in specific areas, were asked to sift through the data. Because the literature pertinent to most of these questions was expected to be rather weak, the authors were asked, when appropriate, to incorporate their expert opinions into their answers.

However, this book is not a collection of formal guidelines. Creation of formal guidelines is often a complex, collaborative, and multistep process. Instead, these chapters were written by an individual or by a small group of authors; a group process of evaluating the literature was not used.

All too often, rigorously constructed guidelines documents cannot make firm recommendations because no prospective, randomized, controlled, blinded trials have been (or can be) constructed to answer a specific question. In neurosurgery, perhaps the best example of this problem concerns the need for immediate evacuation of a large, rapidly expanding epidural hematoma in a previously awake patient whose neurologic condition abruptly deteriorates. No one would randomize half of such patients to the nonoperative arm of a clinical trial. Thus, “proof” of the benefit of immediate surgery can never be obtained, and therefore a standard of care that recommends immediate evacuation will never be promulgated if one adheres to a rigorous methodology that allows only strict interpretation of the published literature.

Instead, the authors of this book were encouraged to give their best advice, even if based more on experience than on evidence. After all, clinicians confronted with a sick patient or difficult clinical problem don’t need laundry lists of therapeutic options that might be weakly supported by the literature. What might be more useful is a brief review of the relevant literature on a specific topic, followed, when appropriate, by some suggestions from an expert in the field. Readers who want to review the literature are encouraged to do so for themselves. Perhaps they might even conduct their own clinical studies to answer some of these questions!

Such an approach may sometimes cause these answers to deviate from the published literature. On the other hand, it also allows common sense and experience to play a role in the analysis of the available data. After all, the synthesis of published evidence with experience and common sense represents the optimal practice of “evidence-based” medicine. Moreover, allowing authors to state their opinions explicitly acknowledges the biases and prejudices of individual reviewers. Such subjective sources of error often seem to be glossed over or even ignored in formal guidelines documents. This issue is quite important because the end product of a formal process of guidelines construction may be heavily influenced by the biases of the particular experts who participated in it.

The approach to literature review that is used in this book follows the common practice of classifying evidence as class I, class II, or class III (Table 1). However, to avoid confusing the conclusions in these chapters with those reached by a formal guidelines process, a different format of weighting recommendations was used. This format classifies recommendations as level I, level II, or level III (Table 2).

The astute reader will notice that different authors may classify the same study differently. Sometimes these differences arise because the authors use the same article to answer different questions. For example, a particular study may do a very good job of investigating the effects of a treatment on intracranial pressure (class I data), but it may provide only very

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**Table 1  Strength of Evidence**

<table>
<thead>
<tr>
<th>Type of Evidence</th>
<th>Examples</th>
</tr>
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<tbody>
<tr>
<td>Class I</td>
<td>Prospective, randomized, controlled, blinded clinical trials</td>
</tr>
<tr>
<td>Class II</td>
<td>Studies based on prospectively collected data and retrospective analyses of reliable data, e.g., observational and cohort studies</td>
</tr>
<tr>
<td>Class III</td>
<td>Studies based on retrospectively collected data, e.g., clinical series, registry-based reports, case reports, expert opinion</td>
</tr>
</tbody>
</table>
Introduction

Table 2  Strength of Recommendations

<table>
<thead>
<tr>
<th>Strength of Recommendation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I</td>
<td>Accepted management strategies with a high degree of clinical certainty</td>
</tr>
<tr>
<td>Level II</td>
<td>Management strategies with moderate clinical certainty</td>
</tr>
<tr>
<td>Level III</td>
<td>Management strategies with unclear clinical certainty</td>
</tr>
</tbody>
</table>

Interest in evidence-based medicine is growing rapidly. The Internet contains many Web sites with considerable information about this topic. Among the more useful sites are www.guidelines.gov, the “Trauma Practice Guidelines” link on the Web site of the Eastern Association for the Surgery of Trauma (www.east.org), and the “Guidelines” link on the Web site of the Brain Trauma Foundation (www2.braintrauma.org).

References


Poor data about clinical outcome (class III data). At other times, however, authors may honestly disagree about the strength of a study. In such cases, we again encourage the reader to analyze the data and formulate his or her own answer.