Symposium on Medical Aspects of Genitourinary Surgery

Disordered Mental States in the Postoperative Period

March-Marcel Musulam, M.D.,* and Norman Gescheider, M.D.†

The postoperative course of a surgical patient may occasionally be complicated by unforeseen and severe disorders in mental status. While most of these are totally reversible, in some cases, the patient's welfare becomes seriously threatened. Most physicians and surgeons are not aware of the importance of such disorders as a cause of death. Thus if a patient undergoes prostatectomy and dies in the postoperative period, his cause of death may be listed as the result of pulmonary embolism, pneumonia, or a wide variety of other causes. Yet the pulmonary embolus or the hypostatic pneumonitis may be the result of a confusional state which prevents early mobilization. Death from blood loss or electrolyte disorder may result from constant testing out of vena caval ligation or the failure of the confused patient to take adequate nourishment by mouth. Yet because confusional states are not listed as the cause of death the surgeon is often not fully aware of its importance as a cause of morbidity and mortality. It is our purpose in this article to call attention to this important postoperative complication.

The first systematic description of such postoperative alterations in mental status was offered by Baron Depuytren, the celebrated French surgeon. In a clinical lecture delivered at the Hôtel-Dieu in Paris, Depuytren (1804) noted: "An operation, gentleman, may have been performed in the most dexterous manner; yet, notwithstanding, the life of the patient may be threatened by the intervention of very severe accidents... the brain itself may be overcome by pain, terror, or every joy, and reason leave the patient at the instant when it is most necessary to his welfare that he should remain calm and undisturbed. I wish to fix your attention today upon accidents of this latter kind. Nervous delirium, though its causes are obscure, its progress uncertain, and the symptoms through which it declares itself most alarming, is still rarely fatal when early and properly treated... individuals affected with this species of delirium are often so extremely inexcusable, that patients with comminuted fractures of the lower extremity, have dragged off all the dressing, and walked about on the broken limb, without exhibiting any sign

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of pain, others whose ribs were broken, tossed themselves about, and sang without seeming to suffer."

Quite in agreement with Dupuytren's description, the acutely confused post-surgical patient may, indeed, pull out intravenous lines, disconnect Foley catheters, undo surgical dressings, or alternatively, gradually slip into stupor and coma. It is quite evident that such a turn of events would frustrate the surgical team, dismay the patient's family, hinder the effectiveness of postoperative management, and subject the patient to the possibility of serious injury. However, since most of these alterations in mental status are potentially reversible, the surgeon would benefit from an understanding of their clinical manifestations, cause, course, and treatment.

**NOMENCLATURE, CLASSIFICATION, AND INCIDENCE**

In the sizable literature which has appeared since Dupuytren's lecture, terms such as "postoperative psychosis," "postoperative delirium," "postanesthetic delirium," "postanesthetic psychosis," or "postoperative syndromes" have been used, almost interchangeably, in order to designate a heterogeneous group of patients. This group contains at least two distinct populations: first, there are patients who develop confused or delirious states as the result of a variety of toxic, metabolic, or infectious insults to the brain or as a consequence of an abnormal physical environment in the postoperative period; secondly, there are patients who, as a response to the psychological stress associated with the operation, may emerge from the experience of surgery with undue anxiety, anger, or depression and related symptoms.

In this article, we will deal primarily with patients in the first group since they often suffer from reversible diseases which constitute medical or surgical emergencies. These patients respond to a heterogeneous collection of metabolic, toxic, infectious, or environmental insults with a relatively homogeneous pattern of abnormalities in mental status which is usually of a central nervous system origin.

Although the clinical details of these altered mental states do not vary significantly, the literature contains a confusing diversity of nomenclature. Thus, "delirium," "acute confusional state," "toxic psychosis," "infarctive-exhaustive psychosis," and "acute brain syndrome" have each come to denote this same clinical entity. Since "delirium" has been associated almost exclusively with the agitated and hallucinating states of alcohol withdrawal, since "psychosis" implies unresolved analogies to functional psychiatric decompensation, and since the term "brain syndrome" is singularly uninformative, we have chosen to use the term "acute confusional states" (ACS) for this pattern of altered mental status.

The incidence of postoperative ACS has not been determined adequately. The heterogeneity in nomenclature and diagnostic criteria, the retrospective nature of most studies, and the considerable biases in patient selection have largely under-mined the universality of such determinations. The incidence which is most often quoted in the literature is 1 ACS per 400 cases of surgery, even though most of the author's sample had undergone gynecologic procedures and despite the fact that the retrospective collected patient group contained patients with primarily functional disorders as well as those with ACS. It has become apparent, however, that the type of surgery and the age of the patient influence the incidence of postoperative ACS. For example, as a result of a thorough prospective investigation, Tischler et al.3 found 7.8 cases of postoperative ACS per 100 admissions to a general surgical service, while Tufo et al.4 reported a 24 per cent incidence of severe ACS following open heart surgery. It is also known that postoperative complications, in general, as well as postoperative ACS are more common in adults and in elderly patients, and occur more frequently in patients with an acute rather than chronic disease state.

**Postoperative Mental States**

occurrences in the elderly. Although various authors have postulated an increased likelihood of altered mental states following surgery on the reproductive or genital organs, the only pertinent study, on a small and selected sample, shows that the incidence of postoperative agitated depression is higher in women after pelvic surgery than after cholecystectomy; the relative incidence of ACS is not mentioned. While the incidence of ACS following urologic surgery has not been investigated specifically, two retrospective studies from the Mayo Clinic show that approximately 12 to 17 per cent of all postoperative ACS follows urologic surgery. However, this information cannot provide an adequate estimate of incidence since the total number of urologic procedures performed within the target period is not specified in either of these studies.

**THE CLINICAL PICTURE OF ACUTE CONFUSION STATES**

The most common denominator, probably the sine qua non of the ACS, is its proximity to elective surgery. The patient's attention either wanders aimlessly or is suddenly focused with inappropriate intensity, even if only for a fleeting moment, on an irrelevant stimulus. A slight noise in the corridor or in the next bed will often completely capture his attention: head and eyes will be directed towards the stimulus and a word or two will be uttered as if the irrelevant noise had been misinterpreted as human conversation. In the meantime, the ongoing activity, whether it be eating, grooming, or answering the physician's query, becomes interrupted and the patient cannot then recall the point of interruption or the goal of the activity, thus assuming a helpless and perplexed expression in front of a half-empty tray, wash basin, or frustrated physician. Alternatively, the patient may simply roll over and go to sleep in the middle of a conversation.

Answering the simplest question necessitates an unusually strenuous mental effort, and the patient sometimes volunteers that he cannot "think straight" or "concentrate." Correct and perspicacious answers are often indistinguishably mixed with inaccurate, exorable, or facetious ones. The most casual conversation with the patient, or an observation of his spontaneous behavior betrays an inability to maintain either a coherent stream of thought or an ordered sequence of goal-directed behavior. Components of the immediate situation cannot be grasped in their entirety, thoughts are vague and circulatory, speech is incoherent, and behavior is perseverative.

The technical term "confusional state" most appropriately refers to this inability to maintain a coherent stream of thought and behavior. The disorder of attention is the major characteristic. Many of the descriptions in the literature do not, however, lay stress on this central feature but on other aspects of the confusional states which are either secondary to the disorder of attention or are not constant aspects of the syndrome.

Depending on the nature of the etiologic factors, the confusional state may begin anytime within the postoperative period. It may be continuous with the "emergence delirium" of anesthesia and be apparent immediately; or, alternately, it may appear many days later and then be associated only indirectly with the surgery. Most commonly, however, the postoperative ACS is noticed 3 days after surgery and will have recovered in four days.

The onset may announce itself abruptly, when the surgeon receives a telephone call, usually late at night, informing him that the patient has just liberated himself from a fully inflated Foley catheter; or, more gradually, when the patient is noted, on successive mornings, to have become less lucid, more irritable, and less appropriate in social interactions.

In the height of the ACS, the patient may be awake and even hyperactive or, on the other hand, drowsy or obtunded. Periods of normal alertness may abruptly or gradually alternate with periods of hyperirritability or drowsy torpor, the latter two not infrequently being noted within the clinical course of the same patient. Sensory illusions may occur and are sometimes incorporated into persecu-
of pain, others, whose ribs were broken themselves about, and sung without seeming to suffer." Quine in his agreement with Dupuytren's description, the acutely confused post-surgical patient may, indeed, pull out intravenous lines, disconnect Foley catheters, undo surgical dressings, or alternatively, gradually slip into stupor and coma. It is quite evident that such a turn of events would frustrate the surgical team, dismay the patient's family, hinder the effectiveness of postoperative management, and subject the patient to the possibility of serious injury. However, since most of these alterations in mental status are potentially reversible, the surgeon would benefit from an understanding of their clinical manifestations, cause, course, and treatment.

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very ideas of reference, the delusion usually occurs so early. In some tight agitation is listed as a typical feature. In fact, however, while agitation is often present, other cases may display extreme sluggishness. In any case, unfortunately for the hurried physician, the disorder of attention leads to a gross lack of cooperation during the examination or diagnostic procedures. Indeed, a consultant may occasionally make the diagnosis of ACS from a distance, by overhearing the surgeon's vain pleas for cooperation and loud exhortations.

There is no simple characteristic emotional tone. The affects of fear, elation, anger, or despair may all be seen in intense form, but they lack continuity and consistency so that the intense anger of the previous moment may change into quiescence or hypomania without apparent cause. A superficial examination of such patients may, therefore, result in an incorrect diagnosis of functional emotional disorder. As a result of the disordered attention, the judgment of the patient is also severely affected as can be surmised from a casual observation of spontaneous behavior. In many cases one notes a curious tendency to deny illness so that a patient with a recent delusional of his abdominal wound may ask to have his clothes brought so he can go home; another patient may deny that he is blind.

The patient may also perform poorly on tests of memory: recall of remote events is sluggish and the ability for memorizing new facts may be devastating, probably as a result of inadequate attention to the environment. Yet some patients with severe ACS may show an ability to key down new memories and in the midst of a rambling discussion mention quite accurately recent experiences. Here too this memory is not an unattainable feat. Disorientation is frequently first, in time, then in location, and finally concerning persons. The manipula-
tion of old knowledge usually cannot be done with customary clarity so that the performance of the simplest calculation or motor skill requires great effort.

Speech may show one of two abnormalities in naming. First, there is difficulty in naming common objects: an "ash tray" is called a "trash can," or the band of a wrist watch is called a "ring." Second, the patient may consistently refer to hos-
torial objects and persons in terms of analogous ones in a hotel in his office: a "nurse" may be called a "secretary" and the intravenous bottle may be called a "water cooler." The patient understands written language is relatively well preserved whereas writing is typically impaired. Words are grossly mis-
spelled and grammar is strikingly poor. Since the ability to write in the first place, the test of writing is a very simple and useful test for ACS. Finally, the guise of the patient is almost always impaired, often displaying a drabten
dency for repetitiveness. A marked sense of the present moment is lost, the patient's recent events as at a time when he himself is entering the confessional state of sleep deprivation.

The clinical account of this picture is consistent with other systematic descriptions by Adams and Vincent, Chedzho and Geschwind, Cohen, Engel and Rumano, and Lipowski. A more phenomenological discussion has been published by Ludwig.

**COMMON DIAGNOSTIC ERRORS**

Errors in diagnosis are remarkably common. Functional psychiatric diag-
noses are often made incorrectly. Abnormal responses may be called "schi-
zomatoid word salad." A variety of depression, or the elation and denial of illness as mania. These diagnostic errors may have tragic conseq
cuences if they influence treatment. This is the disorder underlying the patient's confusional state. Indeed, we have seen patients with postoperative ACS who have been transferred to mental hospitals because

### Postoperative Mental States

functional diagnoses were made. Among these patients were cases with peri-
tonitis, surgical scarlet fever, ureteric perforation, and other treatable disorders.

While the diagnosis of functional psychiatric disorders is common and may lead to the neglect of treatable disease, another common error is the tendency to diagnose untreatable neurologic disorder. Thus a patient who had undergone renal transplantation developed ACS and was diagnosed as having a stroke. Not until 2 months later was the true cause, cryptogenic meningoencephalitis discovered. In elderly patients the diagnosis of irreversible encephalitis may be made, so that the surgeon may be reluctant to treat such a patient. The patient may be in
correctly considered to be aphasic. In patients with alcoholism the diagnosis of Korsakoff's psychosis may be made. All of these misdiagnoses may lead to neglect of treatable non-neurologic medical illness.

It should also be stressed that when a patient presents with ACS, incor
correct functional or neurologic diagnoses may be made leading to neglect of the true causes. Thus an elderly man who developed ACS was investigated thoroughly and a meningeal injection was found to be the primary illness. Clinical points to be considered in the differential diagnosis of ACS will be discussed in a later section of this article.

### Etiologic Factors

**Factors Originating in the Preoperative Period**

#### The Addicted Patient

Suburban as well as urban hospitals must all too often face the special challenge of treating patients who are also addicts of alcohol, barbiturates, or other substances (Table 1). As the hospital admission necessitates an abrupt cessa
tion in the habitual intake of these drugs, symptoms of acute withdrawal may emerge.

**Delirium Tremens (DT)**

Usually developing 12 to 48 hours after alcohol or barbiturate withdrawal this is certainly a most dramatic and alarming ex
cample of ACS. The symptoms are usually dominated by hypervigilance, agita
tion, visual illusions, and autonomic hyperactivity, occasionally including hyper
pyrexia. The seriousness of this disorder is understood by the 15 per cent mortal
ty rate which at one time was seen among patients with DT. When DT develops in the postoperative period, its management becomes a medical and surgical emergency since, in addition to the morbid and mortality intrinsic to this con
dition, the agitated patient also struggles, with unique determination, to discom
tinue any intravenous lines, Foley catheters, drainage tubes, and surgical dressings. Although this dramatic agitation and the colorful and fluid visual illusions at
ttract a great deal of attention from the staff, the surgeon should also be aware of a sizable group in whom alcohol withdrawal may be manifest in the form of an apathetic ACS: whether or not this syndrome also deserves to be called delirium tremens is largely a matter of individual preference.

**Tiamine Deficiency**

The state of thiamine deficiency in which mal

enourished alcoholics are frequently vulnerable may also cause ACS. Further

more, the administration of intravenous glucose to bedridden or compensated cases prior to the administration of parenteral thiamine may precipitate a severe and occasionally fatal encephalopathy. Thus, alcoholic patients may emerge from surgery with severe ACS or develop it a few days after intravenous glucose. The encephalopathy of thiamine deficiency is known as Wernicke-Korsakoff's dis
case: the associated clinical findings often include nystagmus, extrapyramidal dys
tonias, ataxia, and the amnesic syndrome. The amnesic disorder described by Korsakoff may not be detected readily in the acute stages when the confusion is dominant. Indeed, confusion is the most common presenting symptom in this dis
case. Thiamine supplementation usually reverses the confusion, nystagmus, opthalmoplegia, and ataxia.
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It should also be stressed that when a patient presents de novo with ACS, incorrect functional or neurologic diagnoses may be made leading to neglect of the true cause. Thus an elderly man who developed ACS was investigated thoroughly and a mesentric infarction was found to be the primary illness. Clinical points to be considered in the differential diagnostic of ACS will be discussed in a later section of this article.

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Delirium Tremens (DT). Usually developing 12 to 48 hours after alcohol or barbiturate withdrawal this is certainly a most dramatic and alarming example of ACS. The symptoms are usually dominated by hyperactivity, agitation, visual illusions, and autonomic hyperactivity, occasionally including hyperpyrexia. The seriousness of this disorder is underscored by the 15 per cent mortalility rate which at one time was seen among patients with DT. When DT develops in the postoperative period, its management becomes a medical and surgical emergency since, in addition to the mortality and morbidity intrinsic to this condition, the agitated patient also struggles, with unique determination, to discontinue intravenous lines, Foley catheters, drainage tubes, and surgical dressings. Although this dramatic agitation and the colorful, florid visual illusions attest to a great deal of attention from the staff, the surgeon should also be aware of a sizable group in whom alcohol withdrawal may be manifested in the form of an analgesic ACS. Whether or not this syndrome also deserves to be called delirium tremens is largely a matter of individual preference.

Thiamine Deficiency. The state of thiamine deficiency to which malnourished alcoholics are frequently vulnerable may also cause an ACS. Further, the administration of intravenous glucose to bedridden or compensated cases prior to the administration of parenteral thiamine may precipitate a severe and occasionally fatal encephalopathy. Thus, alcoholic patients may emerge from surgery with severe ACS or develop it after a few days of intravenous glucose. The encephalopathy of thiamine deficiency is known as Wernicke-Korsakoff's disease: the associated clinical findings often include synarthroisis, external ophthalmoplegia, ataxia, and the amnestic syndrome. The amnestic disorder described by Korsakoff may not be detected reliably in the acute stages when the confusion is dominant. Indeed, confusion is the most common presenting symptom in this disorder. Thiamine supplementation usually reverses the confusion, synarthroisis, external ophthalmoplegia, and ataxia.
Table 1. Factors Which Cause Confusional States in the Surgically Patient

<table>
<thead>
<tr>
<th>Factors Originating in the Preoperative Period</th>
<th>Factors Originating in the Perioperative or in the Postoperative Period</th>
<th>Perioperative Factors Causing Special Vulnerabilities</th>
</tr>
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<tbody>
<tr>
<td>The addicted patient</td>
<td>Operative hypotension, hypoxia, hypoventilation, choice of anesthetic</td>
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</tr>
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<td>Withdrawal</td>
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<td>Acute intermittent porphyria, drug sensitivity</td>
</tr>
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</tr>
<tr>
<td>The patient with trauma</td>
<td>Postoperative electrolyte, abnormality, Foley, hyperglycemia, hyperkalemia, hypotension, uremia, hyperammonemia, endocarditis</td>
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<td>Contraction</td>
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<td>Retinopathy cell carcinoma</td>
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<td>The patient with seizures</td>
<td>Fever and infection</td>
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Surgical Hematoma. Finally, alcoholics (but also the elderly) are prone to develop chronic subdural hematoma from causes sometimes totally unrelated to the surgical disease. These hematomas may expand spontaneously, and the gradual consequence of ACS may be the only clinical manifestation. The treatment in such cases consists of surgical evacuation. The advance of a definite episode of significant head trauma may thus be missed if the possibility of a subdural hematoma is not considered. On the other hand, lateralizing neurologic signs in the presence of a declining level of consciousness should alert the index of suspicion. When present, signs of motor dysfunction may be ipsilateral or contralateral, but a unilaterally large pupil which does not react to light is almost always on the same side as the hematoma.

The Patient with Trauma

The urologic surgeon may be involved in the acute management of trauma cases. Such immediate concerns as maintaining an airway or stopping uncontrolled bleeding may interfere with an examination of mental status at admission. The patient may then be noted to have a characteristic ACS in the postoperative period. At least three mechanisms may be implicated in the production of ACS and respiratory distress may develop 12 to 72 hours after the trauma. In conclusion suffered during the trauma. Secondly, subdural hematomas may develop and should be expected in the face of the clinical picture described above. Thirdly, in cases with long bone fractures, the fat embolism syndrome consisting of ACS and respiratory distress may develop 12 to 72 hours after the trauma. In this last group, the ACS is associated with the presence of fat and petechial hemorrhages in the brain.

The Patient with Seizures

The prevalence of seizure disorders in the general population has been estimated to be approximately 1 per cent. Therefore, patients with seizure disorders will occasionally be admitted for unrelated surgical procedures. Such patients may have seizures and subsequent postictal ACS in the postoperative period. This confusion state begins immediately after the seizure and may last several days. The severity of the motor convulsions is often not correlated to the depth and duration of the postictal confusion. In any case the seizure may not be observed and this cause may be overlooked.

Factors Originating in the Operative and Postoperative Periods

Intraoperative Complications

Some postoperative changes in mental status are referable to intraoperative hypotension, hypoxia, hypoventilation, or, more directly, to the choice of anesthetic as in cases of nitrous oxide anesthesia. The common denominator in all of these processes is cerebral anoxia. The patient then emerges from surgery with ACS and, often, other neurologic signs; in a significant number of such cases the alterations in mental state are permanent. Neuropathologic examination may reveal foci of anoxia or multiple microinfarcts in the brain. This is a most serious consequence of surgery. Two groups which are most at risk for this kind of complication are those subjected to open heart surgery and the elderly. For instance, Bedford found 18 cases of severe and permanent postoperative demiasis in elderly patients with intact preoperative mental status.

Toxic-Metabolic Insults

The majority of postoperative ACS cases are caused by factors in this group. Electrolyte abnormalities, dehydration, acid-base imbalance, anemia, hypoxia, hypoglycemia, hyperglycemia, hyperammonemia, hyperuricemia, and other metabolopathies may each cause ACS. For example, the significance of magnesium deficiency as a cause of abnormal mental status in the urologic patient has been noted by Kalra. There are usually no other neuromuscular and no distinctive features in mental status to assist in the identification of the precipitating cause. Although acetazolamid (inability to maintain posture of the extended arm) has been associated with hepatic encephalopathy, it is also commonly noted in uremia, hyperuricemia, and a variety of other states. Multifocal myoclonus is also occasionally present.

The elderly patient, the individual with cardiac, hepatic, or renal failure, and the patient dependent on the parenteral administration of fluids, electrolytes, and calories are obviously most susceptible to these causes of ACS. A discussion of the pathophysiology of these various processes is beyond the scope of this communication. These disorders originate outside the nervous system and presumably interfere with the metabolism of the neurons and glial elements. Further interference with this metabolism may lead from ACS to stupor and coma.

Fever and Infection

Otherwise normal individuals will respond to sufficient elevations of temperature with confusional states. In the debilitated postoperative patient a relative minor deviation from normothermia may be sufficient to induce an ACS. Many systemic infections may also cause ACS. In fact, pyrexia is probably the one condition most commonly associated with postoperative ACS in the elderly.

Intracranial infections such as meningitis, encephalitis, or brain abscess may also result in severe confusional states. Patients who receive immunosuppressive agents after renal transplants or those receiving antimetabolites for cancer are also vulnerable to intracranial fungal infections. In the presence of confusion, a stiff neck may not be present. Therefore, a lumber puncture becomes the only means of establishing the diagnosis of a treatable meningitis.
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<td>Choice of anesthetic</td>
<td>Acute intermittent porphyria</td>
</tr>
<tr>
<td>Subdural hematomas</td>
<td>Choice of anesthetic</td>
<td>Drug sensitivities</td>
</tr>
<tr>
<td>The patient with trauma</td>
<td>Postoperative electrolyte</td>
<td>Chronic renal disease</td>
</tr>
<tr>
<td>Convulsion</td>
<td>abnormality, acid-base disturbance</td>
<td>Electrolethrombosis</td>
</tr>
<tr>
<td>Subdural hematomas</td>
<td>albumin, serum, ions</td>
<td>Uremia</td>
</tr>
<tr>
<td>Fat embolism</td>
<td>albumin, serum, ions</td>
<td>Anemia</td>
</tr>
<tr>
<td>The patient with seizures</td>
<td>Fever and infection</td>
<td>Dialysis disequilibrium</td>
</tr>
<tr>
<td>Postural confusion</td>
<td>Cardiac, pulmonary, or abdominal complications</td>
<td>Subdural hematomas</td>
</tr>
<tr>
<td>Mediations</td>
<td>Deep depriorization, sensory deprivation, and immobilization</td>
<td>Brittle bone sarcoma</td>
</tr>
<tr>
<td>Cerebrovascular accidents</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Surgical Hematoma. Finally, alcoholics (but also the elderly) are prone to develop chronic subdural hematomas from causes sometimes totally unrelated to the surgical disease. These hematomas may expand spontaneously, and the gradual consequence of ACS may be the only clinical manifestation. The treatment in such cases consists of surgical evacuation. The absence of a definite episode of significant head trauma at the time of operation is the index of suspicion. When present, signs of motor dysfunction may be ipsilateral or contralateral, but a unilateral large pupil which does not react to light is almost always on the same side as the hematoma.

The Patient with Trauma

The urologic surgeon may be involved in the acute management of trauma cases. Such immediate concerns as maintaining an airway or stopping uncontrolled bleeding may interfere with an examination of mental status at admission. The patient may then be noted to have a characteristic ACS in the postoperative period. At least three mechanisms may be implicated in the production of ACS and respiratory distress may develop 12 to 72 hours after the trauma. In conclusion, the subdural hematoma may develop and should be suspected in the face of the clinical picture described above. Thirdly, in cases with long bone fractures, the fat embolism syndrome consisting of ACS and respiratory distress may develop 12 to 72 hours after the trauma. In this last group, the ACS is associated with the presence of fat and petechial hemorrhages in the brain.

The Patient with Seizures

The prevalence of seizure disorders in the general population has been estimated to be approximately 1 per cent. Therefore, patients with seizure dis-
Organ Diseases

The first, and occasionally the only, clinical sign of myocardial infarction, cardiac arrhythmia, pulmonary embolism, atelectasis, or acute abdomen in the postoperative patient may be an ACS. To complicate matters further, the physical symptoms and signs of pain and tenderness may be absent in these acutely confused patients. Thus, the emergence of an ACS must alert the physician to these possibilities. In fact, Titchener notes that a deterioration of mental status very frequently heralded a systemic or surgical complication in the patient's course.

Medication

Many drugs are potentially capable of producing an ACS. This is where the phrase for a preoperative patient describes a more modest sedation. The routine orders for sedative and hypnotics at admission and the addition to these of analgesics and tranquilizers in the postoperative period may easily trigger acute confusional states. Sedatives, hypnotics, tranquillizers, analgesics, as well as such medicines as digoxin, propranolol, lidocaine, sympathomimetic substances, and Parkinsonian drugs, steroids, and many other chemicals may each induce severe confusional states. When Morse and Libman compared 60 patients with postoperative confusion to 57 matched controls, they found that the postoperative administration of five or more drugs was significantly more common in the group with ACS. Of course, this correlation cannot specify whether the drugs preceded the confusion or whether they were merely prescribed to combat it. The surgeon should be aware, however, of the potential vicious cycle inherent in treating confusional states with tranquilizers which may exacerbate the mental state abnormality.

Abnormalities in the Physical Environment

The postoperative period often subjects the patient to a number of unfamiliar and stressful environmental influences. Even the otherwise normal individual may respond to sensory deprivation with ACS. In the postoperative patient, this cause is most readily implicated during the ACS following extirpation surgery. However, sensory deprivation and resultant ACS may also develop following any surgery in patients with compromised auditory or visual acuity, especially of eye glasses or hearing aids are not readily accessible. Sleep deprivation imposed by pain, nocturnal physical examination, and the constant level of ambient illumination as well as the immobilization of some patients by casts, dressings, and instrumentation may contribute to the development of ACS, 22, 36, 37, 40, 41. The so-called “ICU syndrome” is caused probably by a combination of these factors; the contribution of such emotional responses as anxiety or depression to the clinical picture may also be quite significant.

Cerebrovascular Accidents

Stroke is often blamed for ACS but is, in fact, an uncommon cause. However, cerebral infarcts in the interconnected temporal lobe or in special sites of the right cerebral hemisphere may cause an ACS in the absence of hemiplegia. 19, 20 Furthermore, in certain cases of subarachnoid hemorrhage, an ACS may be the only sign. A lumbar puncture would be necessary in order to reach the diagnosis.

Preoperative Factors Causing Special Vulnerabilities in the Postoperative Period

The Demented Patient

Families are quite tolerant of mental state abnormalities in the elderly; and the surgeon is usually too busy to conduct a mental status test, collect, and judgment in the preoperative period. Thus, some mildly demented pa-

Postoperative Mental States

tients may not be identified prior to surgery. These patients are exquisitely sensitive to low doses of such insulins described in the previous section. A fever of 103° F, a BUN of 30, or a hematocrit of 32 could be sufficient to trigger a most alarming ACS; furthermore, this may not be reversible despite the elimination of the underlying disorder. In retrospect, the family may then report such gradual and subtle changes in mental status as forgetfulness or a neglect of personal appearance in the preoperative period. It then becomes very difficult to determine what fraction of the postoperative mental state abnormality had already been present preoperatively. Nevertheless, it is quite likely that surgical episodes initiate and accelerate the decomposition in a significant number of such mildly demented individuals.

Acute Intermittent Porphyria

This is a rare disorder whose clinical manifestation consists of recurrent bouts of neuropathy, acute confusional state, and colicky abdominal pain. The abdominal pain occasionally resembles that of renal colic or cystitis and the neurologic surgeon may have to be involved in the acute care of such patients. Furthermore, the administration of barbiturates and a number of other drugs to these patients exacerbates the condition and may precipitate a dramatic confusional state not unlike delirium tremens. Treatment is symptomatic; but the immediate withdrawal of the offending drug, when one is present, is imperative. When properly executed by experienced personnel, the Watson-Schwartz test is rapid and definitive for diagnostic purposes.

The Patient with Chronic Renal Disease

The urologist and nephrologist commonly come in contact with cases of chronic renal disease. There are several processes which may cause an ACS in these patients. First, such patients are quite vulnerable to electrolyte abnormalities, uremia, and anemia. These abnormalities may become quite pronounced as a result of surgery or postoperative management. Secondly, patients on hemodialysis may develop an ACS as part of the “diabetes dysregulation syndrome” which is seen following initial treatments. With repeated episodes of hemodialysis, these patients also develop an increased incidence of subdural hematomas and associated ACS. 32. The vulnerability of transplant patients who are on immunosuppressants to intramural fungal infections and resultant ACS was mentioned earlier. Finally, there is an increased incidence of renal cell carcinoma in the brain following renal transplantation. An early symptom of this condition may be an ACS. Diagnosis is important since these tumors are often sensitive to radiation therapy.

The Patient with Neoplasm

Cerebral metastases may certainly cause ACS. However, an often overlooked cause of ACS in cancer patients consists of multiple cerebral microinfarcts resulting from disseminated intravascular coagulation or from nonbacterial thrombotic endocarditis. 19, 21

The Patient with Neurosyphilis

The administration of antibiotics to patients with asymptomatic and often unsuspected neurosyphilis may result in a dramatic Jarisch-Herxheimer reaction caused by the release of treponemal endotoxin. In addition to fever, myalgias, leukocytosis, and autonomic abnormalities, this reaction may include a severe ACS. This possibility must be entertained in cases where the administration of antibiotics is followed by ACS.

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Individual Susceptibilities

There are wide variations in the susceptibility of individuals to each of the causes listed in this section. The probabilities that a given dose of any one of these insults will produce an ACS in a population of patients are distributed along a
bell shaped curve. The observations of Eliahou and colleagues who studied the emergence of delirium under conditions of isorotate hyperammonemia are relevant. Of 200 patients undergoing 1324 hyperammonemic episodes, only 108 developed 331 episodes of ACS. Neither the diagnostic classification nor the rectal temperature at the height of the delirium could explain the differences in susceptibility. However, patients with central nervous system atrophy were more likely to develop a severe type of delirium when compared to patients with normal brain tissue, illustrating again the importance of preserving brain tissue.

It is also well recognized that elderly patients are more susceptible than younger patients when developing ACS in response to mild c-isthineol.

This is an important consideration for the urologist surgeon who is frequently called to perform prostatectomies in a population of elderly patients.

Finally, the discovery of multiple factors operating simultaneously is the rule rather than the exception. How the multiple factors interact with each other to modify individual susceptibilities is not known. In any case, the physician must be ready to deal with the simultaneous treatment of a number of factors.

**DIAGNOSIS**

The diagnosis of "cancer metastatic states" is reached, almost exclusively, on the basis of a careful clinical examination of mental status. The sequential logic inherent in this examination is not unlike that found in the physical examination of the cardiovascular system or of the abdomen. A brief summary of this examination, especially as it applies to the acutely confused patient, will now be provided.

**State of Consciousness**

A person may be alert, drowsy, lethargic, stuporous, or comatose. This is determined by the minimum intensity that a stimulus must have in order to elicit a response. For example, a sudden smile elicits recognition from the alert patient whereas deep pain may be necessary to elicit a reaction from the stuporous patient. The confused patient is usually drowsy; however, stupor or coma may develop if the underlying disorder worsens. This part of the mental status is always mentioned first since it significantly influences the interpretation of other abnormal findings. For example, an alert and attentive patient has localizing value whereas the same finding cannot be interpreted in the same fashion if the patient is drowsy or lethargic.

**State of Cooperation**

It is important to determine whether or not the patient is cooperative. Abnormalities observed in the uncooperative patient are less readily ascribed to focal neurologic disease than the same abnormalities in the cooperative patient. The patient with ACS is usually uncooperative or combative.

**Attentional State**

The span of attention is always abnormal in ACS. The patient is distractible or inattentive. In a suspected case of early ACS, the span of attention may be measured by asking the patient to count backwards by serial 3's; to repeat a sequence of 6 digits forward or 4 digits backward; to count the days of the week or the months of the year in reverse order. The normal person should perform all of these tasks correctly. Asking the patient to describe a familiar sequence of activities such as sitting in a chair helps to evaluate the ability to maintain a coherent stream of thought. Observation of spontaneous activity helps in determining the ability to perform a well directed behavior. The proper exercise of selective attention is necessary for maintaining either a coherent stream of thought or an ordered sequence of goal directed behavior; the confused patient is deficient in both processes.

**Postoperative Mental States**

**Memory**

Questions concerning items of remote world events and details of the present illness test the faculty of recall. On the other hand, inquiries concerning the events of the present day, the menu of the previous meal, or the identity of the last visitor assist in evaluating the ability to memorize new facts. Patients with the amnesic syndrome e.g., Korsakoff's disease, have better recall for distant than for recent events, cannot remember new facts, and are perfectly alert and attentive. This clinical pattern has specific localizing value and points to a discrete lesion within the limbic system. In contrast, the patient with ACS has a generally sluggish recall with no consistent temporal gradient, a defective ability to memorize, and impaired attentiveness. He may also show marked variability, at times showing quite good memory performance. This pattern is often not indicative of focal brain damage.

**Orientation**

A corollary to defective memorization is an impairment of orientation. First there is disorientation only in time, then in place, and finally with regard to person if the ACS is sufficiently severe. The patient is disoriented to person when he is unable to identify the physician, the nurse, or members of his family. It is extremely unusual for a patient to be unaware of his own identity. When this occurs, the possibility of a hysterical conversion reaction or of malingering should be entertained. Because of the case with which it may be tested, orientation has received undue importance to the diagnosis of ACS. Although orientation is a rapid index of ataxia and memorization, its impairment is not a necessary criterion for the diagnosis of ACS.

**Judgment and Affect**

Judgment is assessed by observing the patient's actions. When a patient acts in a way which is not appropriate to the demands of the immediate situation, he suffers from impaired judgment. This is almost always the case with the confused patient. There is no characteristic affect. The patient with ACS may act sad, elated, or anxious, but the affect lacks consistency or continuity.

**Manipulation of Old Knowledge**

The ability to abstract similarities, to grasp concepts, to use deductive or inductive logic, and to calculate may be evaluated by presenting problems of increasing complexity. The confused patient is usually quite sluggish and inaccurate in performing these tasks. This contrasts with the relative agility in similar tasks of the patient with Korsakoff's disease; with the slow, reflector, but often accurate responses of the depressed patient; and with the almost consistent bizarre answers of the schizophrenic.

**Special Abilities**

Language, praxis, and constructions are tested in this portion of the mental status examination. Language is evaluated by testing the ability to produce, repeat, and comprehend spoken language; name objects and colors; write spontaneously or to dictation; read aloud and comprehend written material. Praxis is tested by asking the patient to perform or imitate sequences of behavior with individual limbs, face, or trunk. Constructions are evaluated by asking the patient to draw or copy a cube or a flower. The patient with ACS may have difficulties in naming parts of objects, may have a circumlocutory spontaneous speech, cannot write properly, and has poorly organized constructions. The patient with Korsakoff's disease as well as the patient with functional psychiatric disorders will lack these abnormalities.

The sine qua non for the ACS is the derangement of attention. Although the other abnormalities noted above are frequently associated findings, their absence does not rule out the diagnosis of ACS.

With practice, this examination of mental status may be performed in about
The diagnosis of acute confusional states is reached, almost exclusively, on the basis of a careful clinical examination of the mental status. The sequential logic inherent in this examination is not unlike that found in the physical examination of the cardiovascular system or of the abdomen. A brief summary of this examination, especially as it applies to the acutely confused patient, will now be provided.

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10 minutes. Although this examination becomes necessary when a deterioration in mental state is noted, its routine administration would be invaluable in providing an objective premedication baseline. The clinical diagnosis of ACS may be further confirmed by an electromyelogram (EEG) which might show excessive slowing of the basic rhythm in both hemispheres. However, in most clinical settings of postoperative ACS, a diagnostic impression must be reached and treatment initiated before an EEG can be obtained.

Once the clinical diagnosis has been established, the search for etiologic factors must begin at once. Since the patient with ACS cannot provide a coherent history and since such clinical signs as a stiff neck or rebound tenderness may not be apparent, the strategy for discovering the responsible factor consists of a complete reevaluation of various clinical and laboratory parameters. This includes a thorough physical examination, a lumbar puncture (LP), electrocardiogram, chest and abdominal x-rays, as well as complete analysis of cerebrospinal fluid, blood, urine, sputum, and drainage fluids. Additional tests may be ordered when necessary. Lumbar puncture is mandatory in nearly all confused patients but is so often neglected that we cannot strongly enough stress its importance. We are constantly mystified by the reluctance of physicians to use this valuable procedure. When done properly, it should provide the following information: opening pressure; protein and glucose content; VDRL or Hinton tests; red and white cell counts in the first and third tubes (this determination is done immediately, preferably by the physician); when indicated, microscopic analyses of preparations with the Wright, Ziehl-Nielsen, Gram, and India ink techniques. The main purpose of the lumbar puncture is to determine infection or hemorrhage. Brain scan, computerized axial tomography, or arteriography becomes indicated when a space occupying lesion is suspected. The EEG is often useful.

DIFFERENTIAL DIAGNOSIS

The issue of differential diagnosis may arise in distinguishing among ACS, functional psychiatric disorders, Wernicke's aphasia, Korsakoff's disease, chronic dementias, and a number of other conditions (see Table 2).

The distinction may usually be made by functional disorders by the nocturnal exacerbation, abnormal state of consciousness, disorientation, intellectual deterioration, abnormal speech and writing, incontinence, and gait disorder of the patient with ACS. Furthermore, the affect of the patient is often sociative depth, thematic consistency, or temporal continuity. Nevertheless, a frequent error is to misinterpret the patient's apathy for depression, his sensory

| Table 2. Features Differentiating Acute Confusional States from Other Conditions |
|-----------------------------|---------------------|----------------|-----------------|-----------------|
|                             | ATTENTION | MEMORY | SPEECH     | FOCAL SIGNS     |
| ACS                         | +++       | ++     | +           |                |
| Korsakoff                   | N         | +++    | N           |                |
| Functional**                | N         | N      | N           | N               |
| Small stroke                | +++       | +      |             |                 |

+++ markedly abnormal; ++ moderately abnormal; + mildly abnormal; * occasionally present. N, normal; ? cannot be tested; ** patient with focal disease there may be signs of brain stem pathology. *** in the occasional case of "pseudodementia" the patient may perform poorly on tests of attention and memory (see text). **** usually left hemisphere signs.

POSTOPERATIVE MENTAL STATES

illusions, persecutory ideas of reference, and incoherence for schizophrenia, or his agitation and denial of illness for mania. This is a costly mistake since it may discourage the search for organic disease. This is not to say that primary emotional disturbances are not important causes of deteriorated mental status in the postoperative period. Reactivity or depression may be encountered. Since these affect are disturbing to the patient and since they may interfere with the patient's cooperation with the preservative regime, it is important to provide prompt psychiatric diagnosis and treatment. Occasionally, a primary emotional derangement may mimic features of ACS. These cases of so-called "pseudodementia" are relatively rare in the postoperative period, and are often difficult to diagnose even by highly trained neuropsychologists or psychiatrists.

In some instances, the incoherent and excessive speech and lack of comprehension of the patient with Wernicke's aphasia may be mistaken for ACS. In some cases, however, the distinction may be made by noting the striking rapidity and accuracy with which patients with Wernicke's aphasia will carry out a special class of commands such as opening and closing of the eyes or standing up and sitting down. This contrast will with the utter inability to obey commands directed at single limbs or to answer simple questions with a "yes" or "no." Furthermore, the spontaneous speech of the patient with Wernicke's aphasia is more agnogomastical and richer in audiations. Thirdly, these patients will usually not comprehend written language whereas, with sufficient encouragement, the patient with ACS may display perfect reading comprehension.

In the acute phase, the patient with Korsakoff's disease may not be distinguished from the patient with ACS. However, as soon as the acute phase is over, the patient with Korsakoff's disease is easily differentiated by his alertness, attentiveness, relatively intact intellect and speech, all in the presence of severely deranged memory.

There are no clinical or logical criteria for distinguishing ACS from "dementia." "Dementia" is a descriptive term which designates a Heterogeneous group of patients who have a progressive and irreversible deterioration in the abilities to think, behave, concentrate, or feel properly and in whom a structural or physiologic abnormality in the central nervous system is implicated. In contrast, the ACS has a specific and rapid onset and is potentially reversible. However, in certain cases, the clinical patterns may be indistinguishable. It is therefore possible to conceive of ACS as a reversible "dementia," or, alternatively, to consider certain subtypes of dementia as chronic confusional states.

Finally, some small strokes will produce a syndrome identical to ACS. The presence, in one of these cases, of focal findings such as sensory neglect, hemisplasia, or hemiparesis may assist in the diagnosis. The distinction may be particularly difficult between such small strokes and a subdural hematoma. However, the presence of pronounced focal findings in a patient who is alert or only mildly drowsy favors a stroke; by the time focal findings become obvious, the patient with a subdural is usually very drowsy or lethargic.

In general, diagnostic and etiologic considerations should be directed towards a search for reversible diseases, especially those which have grave consequences when not treated rapidly. Consequently, a premature diagnosis of functional disorders, Korsakoff's disease, chronic dementias, or small strokes is inadvisable and potentially harmful since these disorders rarely require immediate intervention and since the search for other etiologic agents may be obstructed.

PREVENTION, TREATMENT, AND PROGNOSIS

The management of ACS may be analyzed in terms of two interrelated processes. First, the definitive treatment of the ACS is always the normalization of the underlying medical, surgical, or environmental factors listed in Table 1. Thus, each case of ACS requires a different treatment even though the clinical picture may be identical to the others. Secondly, the abnormal mental status may
Differential Diagnosis

The issue of differential diagnosis may arise in distinguishing among ACS, functional psychiatric disorders, Wernicke's aphasia, Korsakoff's disease, chronic dementias, and a host of other (Tables 2, 3).

The distinction may usually be made from functional disorders by the nocturnal mania, incoherence, abulistic state of consciousness, disorientation, abnormal motor behavior, writing, and language. It may be distinguished by the patient's history, often acting out in a socially dangerous manner. Furthermore, the difference may be made by the patient's history and mental status; the diagnosis may include a sociopathic depth, thematic consistency, or temporal continuity. Nevertheless, a frequent error is to misinterpret the patient's apathy for depression, his sensory

Table 2. Features Distinguishing Acute Confusional States from Other Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Attention</th>
<th>Memory</th>
<th>Speech</th>
<th>Focal Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACS</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>1</td>
</tr>
<tr>
<td>Korsakoff</td>
<td>N</td>
<td>+++</td>
<td>N</td>
<td>2</td>
</tr>
<tr>
<td>Wernicke's aphasia</td>
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require symptomatic treatment which aims at controlling the abnormal behavior rather than at eliminating it. This type of treatment is practical in its goals and rather stereotyped in its details.

Treatment

As far as definitive treatment is concerned, since each factor listed in Table 1 requires a different and specific management, a detailed consideration of these is beyond the scope of this article.

However, a few practical points may stand reiteration. As a rule, patients suspected of alcoholism, especially if already abnormally at admission, should receive a generous dose of 100 mg of thiamine intramuscularly in order to prevent or reverse a deficiency encephalopathy. Furthermore, in the postoperative period, abnormalities in electrolytes, blood glucose, hematocrit, blood pressure, and arterial gas should be corrected, with proper deliberation and yet with dispatch, according to the needs of the individual case. For example, a hematocrit of 30 per cent which may not disturb a young patient with a chronic anemia, may prove devastating; if not treated, for the mental status of an older patient whose hematocrit is usually 40 per cent. In addition to the management of factors in the internal milieu, manipulating the environment in the postoperative period may also be preventive or curative. For instance, arranging the nursing procedures in order to enable periods of uninterrupted sleep, encouraging speedy ambulation, alleviating the nocturnal loss of sensory cases by leaving a light in the patient's room, encouraging visits from members of the family, facilitating access to eye glasses and hearing aids each may prevent or cure ACS due to sleep deprivation, immobilization, and sensory deprivation. Finally, sedative, hypnotic, or anesthetic drugs which may produce or potentiate ACS should be prescribed only when absolutely indicated. A brief explanation by the surgeon of what to expect after surgery may allay preoperative insomnia and postoperative anxieties which herald doses of hypnotics or sedatives may not counter.

Elderly Patient

The elderly patient presents a special challenge with respect to the prevention and treatment of postoperative ACS. The increased incidence in this group of postoperative complications, in general, as well as ACS, in particular, has been mentioned earlier. It has been argued, for example, that “hypotensive surgery” should not be undertaken at unacceptable rate of subsequent morbidity in mental status. Until further information is available on this issue, the indications for surgery should also consider the possibly increased rate of postoperative ACS or permanent dementia in the elderly.

In addition, there may be a considerable lag, in the older patient, between the elimination of the underlying insult and the recovery of mental function. For instance, a 26-year-old school teacher who was brought to the accident floor in hypoglycemic coma woke up 5 minutes after the administration of intravenous glucose, remained in a confusional state for 3 hours and then rapidly returned to her customary mental state. In contrast, a 74-year-old diabetic woman who was admitted with pulmonary edema, remained in a confusional state 6 to 7 days after her chest film and blood gases had reverted to baseline. In some cases, this lag may be even longer and recovery may extend over many weeks.

Restraints

It is obviously always preferable to treat the underlying cause of ACS. However, the occasional difficulty in reaching a specific diagnosis and the lag between the treatment of the underlying disease and the disappearance of the confusional syndrome may necessitate symptomatic treatment. This is especially necessary in the agitated patient if vital intravenous lines, drainage tubes, or endotracheal catheters are to remain in place. In general, such treatment consists of the judicious use of physical and chemical restraints.

Postoperative Mental States

The literature on this subject suffers from a certain lack of consensus. Disputes have been advanced foremost among these, and Gardner’s mentions the use of four minutes of liquor strychnica, British Pharmacopoeia, injected subcutaneously, three times daily. More contemporary authors, on the other hand, have compared the relative merits of physical restraints, minor tranquillizers, and phenothiazines. Unfortunately, there are no adequately controlled prospective studies on this subject. In one retrospective study, Moross and Litvinaitis state that the nature or even the presence of chemotheraphy did not influence the outcome of the postoperative ACS.

In our experience, physical restraints applied by a skilled nurse or physician offer an efficient and safe means for keeping the patient in bed and the necessary tubing in place. Every 3 hours, the placement of the restraints is modified in order to enable necessary peristaltic changes so that pressure ulceraions and pulmonary complications may be avoided. The patients merely react to these restraints with prolonged anxiety and the physician is spared the diagnostic dilemma of having to distinguish the effects of the tranquilizer from those of the primary process.

When physical restraints fail to control the undesirable consequences of the agitated state, chemotheraphy may become necessary. In such cases, the smallest effective doses of paraldehyde, chloralhydrate, diazepam, chlora promazine, or haloperidol may be used. Patients with prior central nervous system disease, those with liver or renal failure, and the elderly are usually quite sensitive to low doses of these drugs. Thus, initial doses in such patients should be somewhat lower than the generally recommended ones. Furthermore, each of these drugs may paradoxically exacerbate the confusional state or decrease the state of consciousness to the point where such complications as pulmonary aspiration become more likely. It is therefore best to order these medications only when necessary rather than relying on standing on prn orders if unnecessary and excessive doses are to be avoided.

Prognosis

In a significant proportion of postoperative ACS the prognosis is excellent if adequate therapy is instituted promptly. On the other hand, if diagnosis and treatment are unduly delayed, stupor, coma, and death may supervene. Therefore, each individual case deserves a meticulous diagnostic work-up and subsequent treatment. Of course, the prognosis in the individual case depends on the etiologic factor, the magnitude of its severity, the length of the period before the initiation of treatment, as well as the age and preexistent status of the patient.

The results of several retrospective studies offer a variety of opinions concerning prognosis. Moross and Litvinaitis note that about half the patients with post-operative confusional states leave the hospital with “minor cognitive impairment.” Knox estimates the incidence of severe and permanent deteriorations of mental status to be 1 in 1600 surgical procedures while Bedford finds 18 per cent of patients in 1103 cases of surgery in elderly patients. On the other hand, Doyles reports that 25 to 28 cases of “postpsychotic depressive” had recovered. The most adequate study is that of Tichauer and colleagues who studied 200 patients randomly chosen from all admissions to a surgical service within 1 year. These patients were examined at admission as well as after surgery. A 7.8 per cent incidence of ACS was noted; of these 32 per cent had regained their former mental sharpness at discharge. As a rule, therefore, each patient with a postoperative ACS should be approached with the realization that he may be the victim of a potentially reversible disorder which may prove irreversible or fatal if not treated. With an informed approach to prevention, clinical diagnosis, detection of the underlying cause, and management, the postoperative ACS may often be prevented from undoing the work of the surgeon and from jeopardizing the welfare of the patient. On the other hand, ignoring the organic basis of such degradations of mental status often leads to the common error of discharging the patient prematurely to rehabilitation centers or nursing homes. Since ACS represents a serious threat to the
require symptomatic treatment which aims at controlling the abnormal behavior rather than at eliminating it. This type of treatment is practical in its goals and rather stereotyped in its details.

Treatment

As far as definitive treatment is concerned, since each factor listed in Table 1 requires a different and specific management, a detailed consideration of these is beyond the scope of this article.

However, a few practical points may stand reiteration. As a rule, patients suspected of alcoholism, especially if already obtunded at admission, should receive a generous dose of 100 mg of thiamine intramuscularly in order to prevent or reverse a deficiency encephalopathy. Furthermore, in the postoperative period, abnormalities in electrolytes, blood glucose, hematocrit, blood pressure, and urine gases should be corrected, with proper deliberation and yet with dispatch, according to the needs of the individual case. For example, a hematocrit of 30 per cent which may not disturb a young patient with a chronic anemia, may prove devastating, if not treated, for the mental status of an older patient whose hematocrit is usually 40 per cent. In addition to the management of factors in the internal milieu, manipulating the environment in the postoperative period may also be preventive or curative. For instance, arranging the nursing procedures in order to enable periods of uninterrupted sleep, encouraging speedy ambulation, alleviating the nocturnal loss of sensory cues by keeping a light in the patient’s room, encouraging visits from friends of the family, facilitating access to eye glasses and hearing aids may each prevent or cure ACS due to sleep deprivation, immobilization, and sensory deprivation. Finally, sedative, hypnotic, or analgesic drugs which may produce or potentiate ACS should be prescribed only when absolutely indicated. A brief explanation by the surgeon of what to expect after surgery may allay preoperative insomnia and postoperative anxieties which bicornic doses of hypnotics or sedatives may not conquer.

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In addition, there may be a considerable lag, in the older patient, between the elimination of the underlying insult and the recovery of mental function. For instance, a 90-year-old school teacher who was brought to the accident floor in hypoglycemic coma woke up 5 minutes after the administration of intravenous glucose, remained in a confusional state for 3 hours and then rapidly returned to her customary mental state. In contrast, a 74-year-old diabetic woman who was admitted with pulmonary edema, remained in a confusional state 6 to 7 days after her chest film and blood gases had reverted to baseline. In some cases, this lag may be even longer and recovery may extend over many weeks.

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REFERENCES


patients' lives, one should be very conservative in order to avoid too hasty a transfer out of hospitals where facilities for managing acute illnesses are more readily available.

REFERENCES


POSTOPERATIVE MENTAL STATES


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