The walking wounded of head injury: when subtle deficits can be disabling

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Mild head injury often results in excess emotional "baggage": irritability, anxiety, distraction, fatigue, depression, compulsive habits, and eventually, social withdrawal. Understanding the symptoms of the walking wounded assists these weary travelers in their search for treatment.

The following is an excerpt from Dr. Lezak's oral presentation at BMRH in May, 1988.

My perception of the problems of mildly head injured persons is based on an understanding of how the brain functions. Knowing what the brain does, where, and what happens to it in typical motor vehicle accidents, makes sense of the deficits and problems of head trauma victims. The predominant focus here will be on the effects of damage to the brain sites most vulnerable to motor vehicle accidents.

Decades ago, a neurologist named Courville doing autopsies on head trauma victims found that, no matter what the site of impact, the same general areas showed the most bruising, the most damage. As this was several decades ago, he didn't have the advantage of some of our present-day high-powered instrumentation. Courville delineated where the bruises to the brain were occurring. The areas that were most commonly involved were the undersides of the frontal lobes, the area between them, and the temporal lobe and their undersides.

This damage pattern makes sense in terms of what occurs in the course of head injury. The key to the trauma pattern is rapid deceleration. What happens is that a driver or passenger riding in a car suddenly is hit or hits something and the car stops very rapidly. There may or may not be an impact of the head against anything. What is important is that the head that's been going along, the skull that's been moving along at 30, 40 or more miles an hour, suddenly comes to an instant halt. The skull is stopped against a windshield or seat headrest or the car body. Unfortunately, the contents of the skull don't stop moving because they too have been carried along at the rate of 30 or 40 miles an hour. When the skull stops, the brain—which in its natural state is kind of a gelatinous mass that floats on a slender stalk in a liquid bath—has all of the momentum of its forward motion added to the sudden impact momentum. This sends shock waves through the brain and sets up a rotatory motion of the brain within the skull. It has been demonstrated that the brain ends up being bounced around onto the bony cage of the skull

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as it's being forced back and forth with great rapidity. The force of the spin shears and snaps nerve fibers and tiny blood vessels. Knocking about within the bony skull cage bruises the vulnerable areas of the brain.

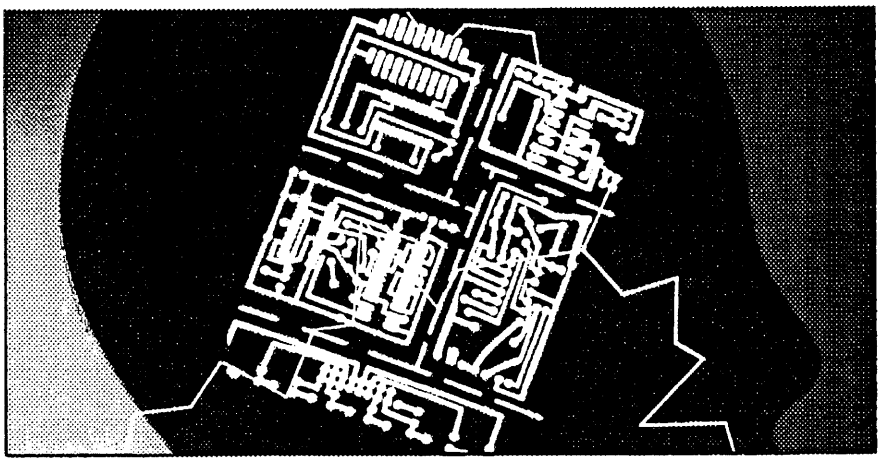
Major lesion sites tend to occur predominantly in the frontal and temporal poles, the brain stem, and the corpus callosum, that thick band of neural tissue that maintains the most efficient and the fastest connections between the brain hemispheres. Temporal lobe damage, frontal lobe damage, hemispheric disconnections, and damage to the brain's alerting and arousal system are the most common results of the mechanical forces set in motion by impact and rapid deceleration.

Effects of diffuse damage

Diffuse damage to these areas causes attentional deficits, slow thought processing, and diminished bilateral integration. These may be thought of as the primary effects on mental functioning and mental efficiency. This may not be physiologically or anatomically appropriate, but slow processing in head trauma patients can be understood when likening the brain to a most enormous, elaborate computer. This computer has billions of connections and programs that run its various parts and intermesh with each other. Then mild diffuse damage is created by someone coming along with a little hammer who knocks off a few connections here and a few connections there. When you turn on the machine and try one program, you would discover subtle but important alterations. Most of the programs would run. Some would show up with a few small errors. By and large, most of them would be slowed down and, of course, as they grow more complex, as more programs become involved with more connections, processing speed would become slower and slower. Destruction of any single connection would create something like a short circuit that would have to be bypassed and compensatory programs would have to be developed: all of this increases processing time.

I use this analogy to understand mild head injury. Somebody bright can do almost anything after an accident they had done before, with certain exceptions, but they are slower. These patients frequently cannot do two things at once; they are easily distracted from what they do, and their every action involves slowed processing.

The other problem that many head trauma patients experience is that of diminished bilateral integration. This contributes to slowed thinking and to difficulty with complex material which depends upon integrative processing involving major contributions from the entire brain.



What are the psychological consequences of diffuse damage? Three prominent ones trouble many of these patients. One is *perplexity*—a sense of not being sure about what comes to mind, so that these patients are continually dogged by a feeling that what they are doing may be wrong. When asked what is the capital of Italy, for example, a patient may say, "Well, Rome comes to mind, but I'm not really sure." Sometimes these patients won't even say, "Rome comes to mind," so that the questioner must pull and pull for an answer because many of these patients are so unsure about their mental contents they won't even risk a guess. That's perplexity and it is a dreadful burden. Happily, it tends to diminish in time, particularly when patients receive support and encouragement for their efforts and are not belittled for their failures.

A second very great problem is *distractibility*. This relates to the problem of not being able to do more than one thing at a time. Most mild head trauma patients can do well if they do one thing at a time. A task which requires more than one operation, however, or engages more than one train of thought at a time presents a problem. Distractibility is infrequently observed in the typical psychological or neurological examination because the patient is seen in a quiet setting where

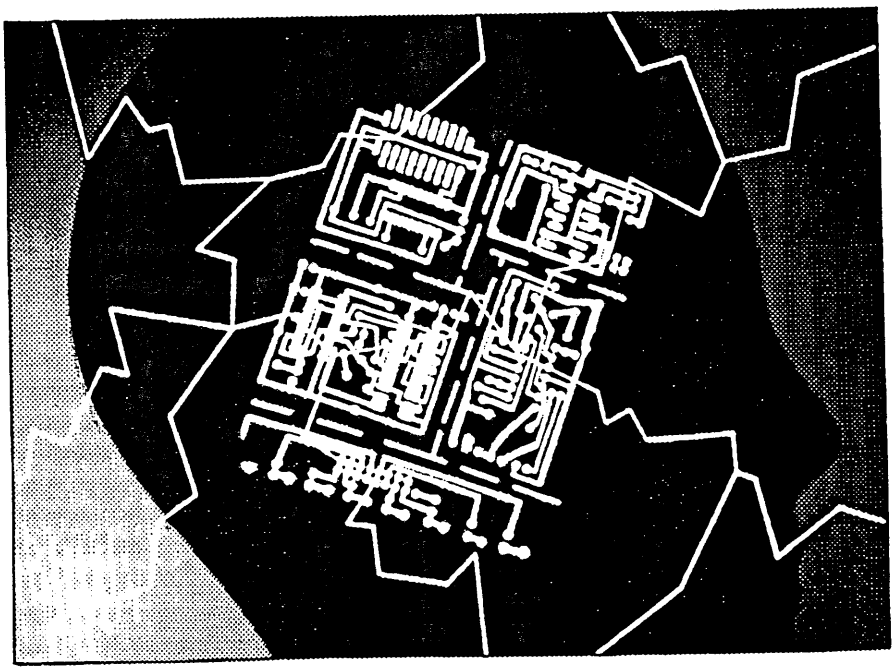
activities and discussions are focused and structured. The examiner has created an artificially good environment for the patient to function in so that the patient may perform quite well on a number of tasks. The examiner may even wonder if the patient has all of the problems he or she has reported. However, if the environment is changed and becomes noisy or the task is made more complex, some of these problems will emerge. For many of these people distractibility means that their continuity of experience is constantly being disrupted giving them a much more fragmented sense of ongoing events.

Added to that is *fatigue*. I cannot stress the deleterious role of fatigue too much. To appreciate why fatigue is so common a problem, think of a situation in which many of the things that you normally do automatically are no longer automatic: now you have to think about what you are doing. Take something simple such as adding numbers or making a shopping list. Translate that to a situation where minute by minute, constantly, you have to keep track of what you are doing, what you have just done, what you will do next, in a deliberate manner. You have to ward off confusion. If you are talking to someone on the phone, you must try, with great effort, to understand what you are hearing, to sort out other noises—a car honks out on the street, you get distracted by that—you have to go back to your phone conversation—and then somebody turns on the TV and again you are distracted. All of this activity requires an enormous expenditure of effort which results in an enormous amount of fatigue. Fatigue is often the primary or one of the most predominant complaints of mildly head-injured patients.

To test if fatigue is a problem for these patients, ask them if they can take the noise, the kids, and their spouse better in the morning than in the evening. Most will reply: "absolutely," for when they are refreshed they can process better. But they get fatigued easily so that by 5 o'clock many will have reached the point of irritability. At the end of the day, these patients are typically anxious, depressed, fatigued, and very inefficient mentally, unless they have been able to take rests and pace their activities throughout the day.

The more that patients and their families are prepared for fatigue and how to deal with it, the more they can understand the need for pacing, for naps, for earlier bed times, if the patient is to feel better. Many head trauma patients report that they were able to get along on 7 or 8 hours sleep before their injury and now they require 10 to 12. This is because they now must do consciously and deliberately a whole host of things that were once automatic.

Also important are more subtle attentional problems that often do not get attended to because they are subtle. Some involve a reduced auditory attention span after injury. Most head trauma patients, particularly after the acute stage has passed, are able to recite six or seven or even eight digits at a time. This is not a very demanding activity as it relies largely on an automatic kind of processing that typically can only be disrupted by a great amount of brain damage. But if mildly injured patients receive more information than can be immediately grasped—as is contained, for instance, in a sentence of 20 or 22 syllables in length (the average intact adult ought to be able to handle sentences of 24 to 28 syllables in length without too much effort)—then they find it difficult to understand what was said as they can grasp part but not all of the sentence. Much of what they hear is



incomplete. This problem can create unpleasant kinds of situations in the family as there will be constant bickering over who said what. Patients who have reasonably good marital relationships and reasonably strong egos can deal with this problem in about five minutes. I simply tell my patients that if they are continually involved in disagreements about what somebody said, they are probably wrong. Most patients are willing to accept this as a trade-off for increased peace at home. In addition, both spouses need to learn techniques to improve communication given the patient's limitations.

Another subtle problem is divided attention or the inability to do two things at once. A young man who had had a severe injury taught me about the serious implications of this problem. Ten years post-injury he was living semi-independently. I saw him for about a half-an-hour every third week for support and counseling as needed. I always had a great deal of difficulty stopping him from talking when I wanted to say something or I wanted to close the session. I gave all the usual cues—I'd clear my throat, put away my pencils, and sometimes even stand up and start talking, but Buddy would just keep going. I finally asked him why he kept on talking despite what I did. I felt foolish when he explained: "When I'm thinking about something that I'm trying to talk to you about, I can't watch you at the same time." There it was. He cannot do two thing at once.

There are also secondary emotional consequences of diffuse damage. Irritability, for many of these patients, is a reaction to fatigue and also a reaction to the constant experience of frustration. When persons who are accustomed to running their mental machinery effectively and running the machinery in the world around them appropriately and efficiently suddenly feel as though anything they put their hands to goes wrong, their world is experienced as out of control. They are frustrated. They feel demeaned. Many react with irritability if not outright anger.

Anxiety is a natural consequence of feelings of being out of control. When the ground changes and one no longer feels on solid footing, whether it be metaphorically or physically, this is anxiety producing. Unexpected change, inability to control the environment—these experiences are very anxiety producing. Most mild head trauma patients experience so much anxiety and so much irritability within the first three to four months after the injury, that they fear they are going crazy. A depressive reaction heightens these fears. Now, these are people whose personalities are essentially intact, who are still in touch with reality, and are, basically, competent people yet they feel as though they are going crazy. A depressive reaction almost always complicates the problem. It is rare for a person to experience a mild head injury with these kinds of sequelae without going through a period of depression.

One other characteristic of these patients is a tendency to obsessive/compulsive traits such as checking and rechecking what they do, not trusting their thoughts, feeling "blocked" in their thinking, etc. My guess is that obsessive/compulsive features creep up in the course of the first nine months or year post injury. If you see this behavior immediately after the injury, chances are the patient was like that before the injury.

All of this leads to what I call the "coping hypothesis," that is, the personality changes that occur in mild head trauma victims, their new quirks and altered emotional and social reactions come about in the course of their efforts to cope with mental inefficiency due to diffuse brain damage. The patient starts with the primary upsets of the head injury: the posttraumatic syndrome with the attentional problems, the perplexity and distractibility, plus headache and dizziness, which leads to chronic fatigue and inefficiency and give rise to irritability, anxiety, and social withdrawal. Social withdrawal is a very important piece of the whole picture. Almost all of these patients withdraw socially to one degree or another. That is, they have reduced their social contacts and their social activity. This continues for at least two, three or more years and, I suspect, it often becomes a lifetime characteristic. Because they can only keep their minds on one thing at a time, they cannot handle groups very well: the noise and clatter and bustle of a cocktail party drives them out of their mind; noisy restaurants are torture. Even a quiet dinner party for eight is too noisy for them. This pattern of social withdrawal for people who were previously outgoing makes a great deal of difference in their lifestyle. Many of these patients do go through major lifestyle changes. Does this give rise to depression? Of course. (Here is a fool-proof recipe for depression: to fatigue add a situation of high stress, anxiety, and social withdrawal. Few can withstand it.) The attentional problems with the attendant stress, anxiety, and fatigue exacerbate the headache, dizziness, and certainly the other concussion symptoms. The patient feels unable to cope effectively and withdraws, adding loneliness and boredom to all the other stress factors, and fueling a vicious circle of distress.

The obsessive/compulsive character-

istics are useful because they enable these patients to handle more efficiently their attentional and other problems of the posttraumatic syndrome. These patients begin to cope better as they learn techniques for keeping track of what they are doing, to check and recheck their work, to avoid overstimulation, to take fewer risks (and fewer challenges). Then their stress level goes down because they feel a little more in control.

The effects of temporal lobe damage

The most common "memory" problem of mildly damaged head trauma patients is not a learning problem *per se*, but a difficulty in retrieving stored information. This difficulty tends to show up in at least two different ways. One is just simply in poor memory retrieval; the other is in mixed associations. For example, when hearing a list of words to learn that includes the words "parents" and "school," many think that they had heard "children" too. They may also confuse the words that they heard in a first list with the words that they heard later. Retrieval problems are often associated with a communication disorder as many of these patients have difficulty with confrontation naming—pulling up words they do know on demand. They can tell you what kind of object or person or idea they want to identify by name but they cannot give you the name in a reliable manner. However, a phonetic or other cue can often help them retrieve the name they are searching for.

Among the common but subtle memory problems of these patients is the effect of stimulus overload. After head injury many people can process what they hear quite well, so long as they do not hear too much at once. This has implications for communicating with people with head injuries. The speaker must slow down, use relatively few words at a time, and leave a few moments between important messages.

Visuospatial memory may be affected and will sometimes not show up identifiably on the examination. Visuospatial memory is often examined by having the patient draw. If the patient has some difficulty with drawing *per se* the visuospatial problem may not become apparent. It is important for any kind of memory assessment, including visuospatial as well as verbal, that the patient be given a delayed recall or recognition trial to see if learning has actually occurred.

The effects of frontal damage

Damage to the dorsolateral frontal cortex tends to compromise cognitive effectiveness. Patients may think more concretely. This does not mean that they can no longer make formal abstractions or generalizations. Many patients who tend to be rather concrete and literal-minded in real life still get good scores on formal tests of abstract reasoning. Patients with mild frontal damage may be more rigid in their personalities and have some difficulty integrating their thinking with what they do. They may have an idea in their minds but have difficulty initiating a response to that thought.

In addition, diminished self-monitoring and quality control are important and relatively common problems referable to frontal lobe damage.

The patient with significant damage to the medial frontal cortex will have markedly reduced drive, initiation, and spontaneity. A patient who is mildly damaged may be very competent about continuing all familiar, usual activities but unable to undertake new or very complex ones. I recently examined a railroad brakeman who continues to be a brakeman for one of the big railroads in the west after sustaining a head injury. Because he was very familiar with his work and did it well, he continues on the same job he held before the accident. He confessed that he has had a few accidents that he has been able to cover up. He is considered mildly brain injured, having experienced a very brief loss of consciousness. His memory is excellent. The major changes, however, were very significant and do certainly implicate frontal lobe damage. He used to be very active with his two younger children; he now ignores them. He used to do all of his home chores with great detail. He has lost all his "verve," and now his wife has to push him to do chores. He is 35 years old and physically very vigorous. He has lost all sexual appetite and will now "perform," he estimates, about 12 times a year. This is not normal for a 35-year-old man. And this does not bother him in the least. He *can* perform; there's no performance problem, he just doesn't have any drive. The most telling of all, I think, is that he spends his spare time in the basement of his home with a video machine and about 30 game programs. He plays only the same game over and over again. Any time that he is left alone to his own devices, this once very sociable man now plays his video machine. This is a good example of someone who is defined as having a mild head trauma but is more than mildly damaged from a psychosocial point of view.

The basal frontal cortex seems to be deeply involved in the regulation of ongoing behavior and that includes such capacities as impulse control, the ability to inhibit oneself or, on the