

Fixed Site Theme Park Rides and Neurological Injuries

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Background

Because of recent public interest in theme park ride related neurological injuries, Six Flags, Inc. commissioned NEURO-KNOWLEDGE™, a program of the AANS and Outcome Sciences Inc. to evaluate whether fixed site theme park rides pose a risk of neurological injury to riders.

A panel composed of experts in the fields of cerebrovascular disease, neurological trauma, medical neurology, emergency medicine, clinical epidemiology, biostatistics, roller coaster engineering and astronautics met to review the available literature bearing on this issue. Data presented to and reviewed by the panel included g-force data on theme park rides, injury statistics of the Consumer Product Safety Commission, literature on the physiology of acceleration, background literature on the types of neurological injuries that have been reported to be associated with theme park rides and all published cases of neurological injuries associated with such rides.

The panel evaluated the issues of causality (i.e. do theme park rides cause neurological injuries and if so by what mechanism), degree of health risk (i.e. is the incidence of theme park related neurological injury such that it is a public health concern) and commented on potential areas of additional research or surveillance. A detailed consensus statement based on the deliberations of the panel was generated and given to Six Flags, Inc. The following key points are identified from this paper. We believe that the paper demonstrates the importance of careful and credible review of the data in questions of neurological health and safety.

Incidence rates and public health concerns

In 2002 it is estimated that there will be 320-350 million visits to fixed site (fixed site describes parks that are permanently situated at one physical location) theme parks in the United States. As the number of rides delivered per year at these parks is more than three billion and the number of injuries reported is low the absolute risk that any individual will suffer a neurological injury while riding a fixed site theme park ride is extremely low. Published medical literature on specific neurological injuries thought to be associated with fixed site theme park rides is limited to 22 cases. After a meticulous review of these cases the panel concluded that in the majority of the reported cases it was implausible that the ride was causally related to the reported injury. The incidence of theme park ride related neurological injury is so low that it would seem to be of negligible concern from a public health standpoint.

The panel also concluded that there are no reliable data to describe what is occurring in terms of case numbers over time. None of the available data sources from the parks or the consumer products safety commission have a good methodology for capturing neurological injuries in a reliable fashion. Without better data collection there is no way to determine the true incidence rate for a given year or trends over time.

Effects of g-forces and causality

The panel investigated the question of whether or not increasing height and speed of theme park rides has resulted in riders being exposed to increased g-forces. Data from the 128 roller coasters at Six Flags Theme Parks built over the last two decades did not show a pattern of increasing g-forces in vertical or lateral axes over time. Although the rides are taller and faster, the g-forces to which riders are exposed are not greater now than they were 20 years ago.

The question of g-forces on theme park rides and neurological injury was discussed at length. Aeronautic and astronautic research was reviewed. This research has generated an extensive literature on human responses to increasing g-forces. The literature demonstrates that increasing g-forces lead to a loss of visual function (grey-out) progressing to a loss of consciousness (black-out). These responses are not reported in relation to theme park rides. Furthermore, the aeronautic and astronautic literature on human responses to extreme g-forces documents no cases of the kind of neurological injuries that have been reported to occur on theme park rides. The panel concluded that there were no data available to establish a causal link between g-forces on amusement park rides and neurological injury. A recent paper, published since the expert panel review, confirms the perceptions of the panel that the g-forces generated on theme park rides are inadequate to cause neurological injury (1).

Whether or not there is another causal mechanism linking theme park rides to neurological injury in susceptible individuals is impossible to determine based on the existing data. The panel considered the possibility that human physiological responses to riding, as for any exciting activity, might lead to neurological injury in susceptible individuals. Panelists also noted that the types of neurological injuries that have been reported as being related to theme park rides are all known to occur spontaneously without recognized cerebral trauma. Therefore, the occurrence of such an event temporally related to riding would not, in itself, establish a causal relationship.

Further Investigation

The panel recommended that additional efforts be made to prospectively identify and verify cases of neurological injury associated with theme park rides as a prospective data collection and surveillance system would generate ride-specific data of much greater reliability than are presently available. Six Flags and the American Association of Neurological Surgeons are pleased to announce that a prospective, ongoing research effort is being developed for Six Flags to report all neurological injury data from Six Flags properties to a monitoring board assembled by Neuro-Knowledge™.

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References:

1. Smith DH, Meaney DF. Roller coasters, g forces and brain trauma: On the wrong track? *J Neurotrauma* 19 (10): 1117-1120, 2002.