All terrain vehicle (ATV) accidents in Germany
A medical and technical analysis

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Abstract
Although ATV accidents account for numerous deaths in the US and Australia, the role in traffic accidents and hospital admissions in Germany is unknown. At a level I trauma centre, hospital and crash charts were analysed for medical and technical parameters of ATV accidents. ATV drivers were 0.1% of emergency trauma patients. The mean total hospital stay was 15 days; there were 1.5 stays per patients with 2.0 surgical procedures needed. One patient died, only two recovered fully. 14 cases of ATV accidents out of 18990 (0.1%) were documented within 10 years. The mean impact velocity was 35 km/h. Car collisions were predominant. The upper extremity was the predominant injured region (AIS 0.7), Mean maximum AIS was 1.4. ATV accidents in Germany are rare but pose high risk for severe injuries. Possible reasons are low active and passive security, limited experience and risky driving behaviour. Preventive measures are discussed.

INTRODUCTION

All terrain vehicles (ATV, quad) do not seem to play a major role both in traffic accidents and hospital admissions in Germany. Yet, the usage of ATVs has become more and more frequent in Germany during recent years, and reports about spectacular ATV crashes in the press are not that infrequent. In contrast, no scientific survey or study regarding the issue of ATV crashes in Germany has been published so far. Thus, this study aims to evaluate the present incidence of ATV crashes, accidents circumstances and resulting injury patterns, and to discuss possible consequences.

METHODS AND MATERIALS

Two data sources were explored. At first, all trauma emergency admissions at a level I trauma centre during a 5 year period from 2005 to 2009 were scanned for trauma histories of ATV involvement. Then hospital charts were retrieved and examined for diagnoses and types of injuries, treatment, length of stay, number of procedures and outcome as well as age and sex of the patients.
Secondly, the data bank of an accident research unit was used to explore ATV accidents. Since 1972, this unit has collected prospective data in regard to all reported traffic crashes within Germany. Specially trained documentation personnel are notified by police dispatchers and arrive on scene, often simultaneously with the rescue personnel. Thus, investigation of the crash (measurements by photography, stereophotography, three dimensional (3D)-laser technique), and clinical injury documentation is performed on site. This case report is then completed at the hospital, where all of the injured victims are taken, with proper documentation of X-ray examination, injury type, and severity. Among the technical measurement techniques, the modern 3D-laser technique, especially, is a quick and exact method to document the exact position of all objects at the crash site. A 3D-data cube with a maximum size of 50 m3 is generated from the data obtained by the 3D-laser scanner. This data allows an exactly scaled reconstruction of the crash site for later technical analysis of the crash. Slide and skid marks of vehicles, objects, and victims and any kind of deformation of involved vehicles or objects are also measured, and this data are included in the crash analysis. Furthermore, data from a database containing technical features of involved vehicles (size, weight, and detailed structural data comparable to finite element analysis data) are included in the analysis. The inclusion of the described data in a software based calculation allows an exact estimation of parameters as delta-v or collision speed. In total, the monitoring of the crash research unit includes demographic data, type of road user (car/truck occupant, motorcyclist, cyclist, pedestrian), delta-v (km/h) for motorized vehicle user; vehicle collision speed (km/h) for bicyclists/pedestrians, Abbreviated Injury Scale (AIS) score,

Maximum AIS (MAIS) score, Injury Severity Score (ISS), incidence of serious and/or severe multiple injuries (ISS>16), incidence of serious injuries (MAIS 2–4) or severe injuries (MAIS 5 of 6), and mortality.[1] [2]
For this study, traffic crash reports from 2000 to 2009 from the local accident research unit, as described above, were analyzed for the involvement of ATV as well as for demographic data, AIS score, MAIS score, ISS, incidence of multiple injuries, incidence of serious or severe injuries, incidence of death, collision speed, collision opponent, and collision type. Comparisons to motorcycle accidents were performed.

RESULTS

Hospital admissions

During a five year period from 2005 to 2009, there were ten admissions of ATV drivers out of around 11.000 emergency trauma patients (0.1%). Five accidents had happened off-road, four were traffic accidents. Eight patients were male; the mean age was 30 years. The mean total hospital stay was 15 days; there was a mean of 1.5 stays per patients with 2.0 surgical procedures needed. One patient died only two recovered fully. Figure 1 shows the frequency of injuries, figure 2 shows the outcome.

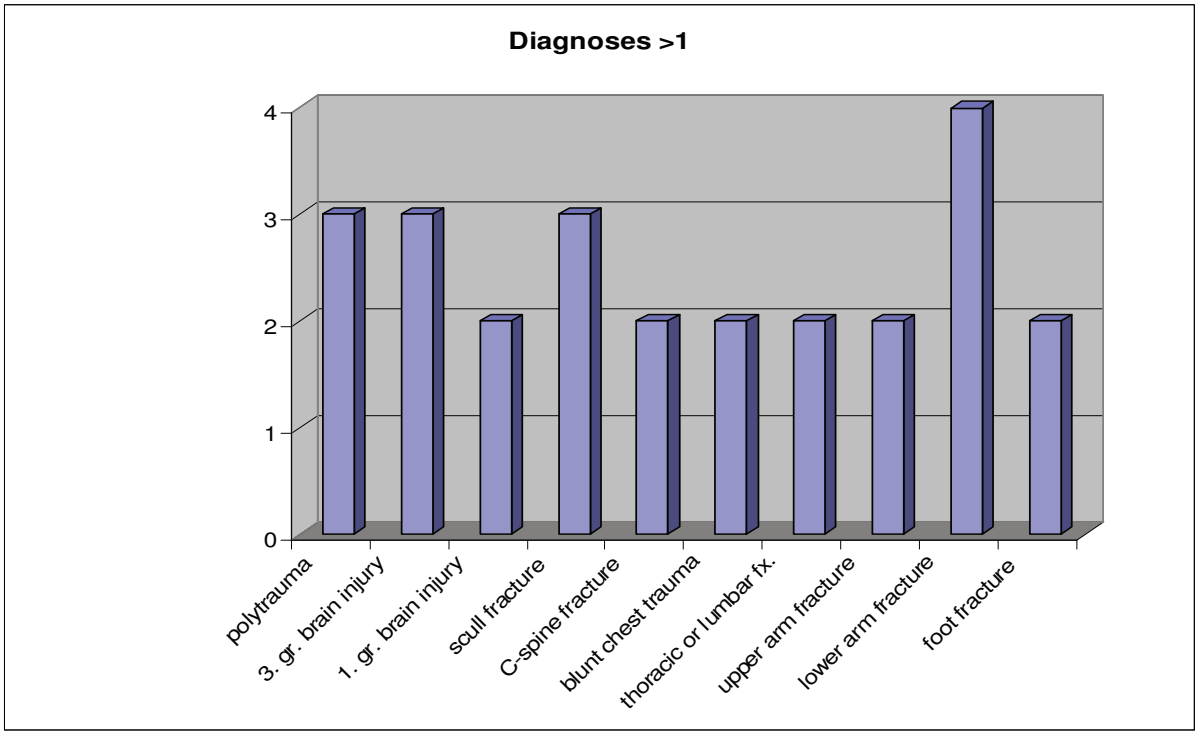

Figure 1: Frequency of diagnoses

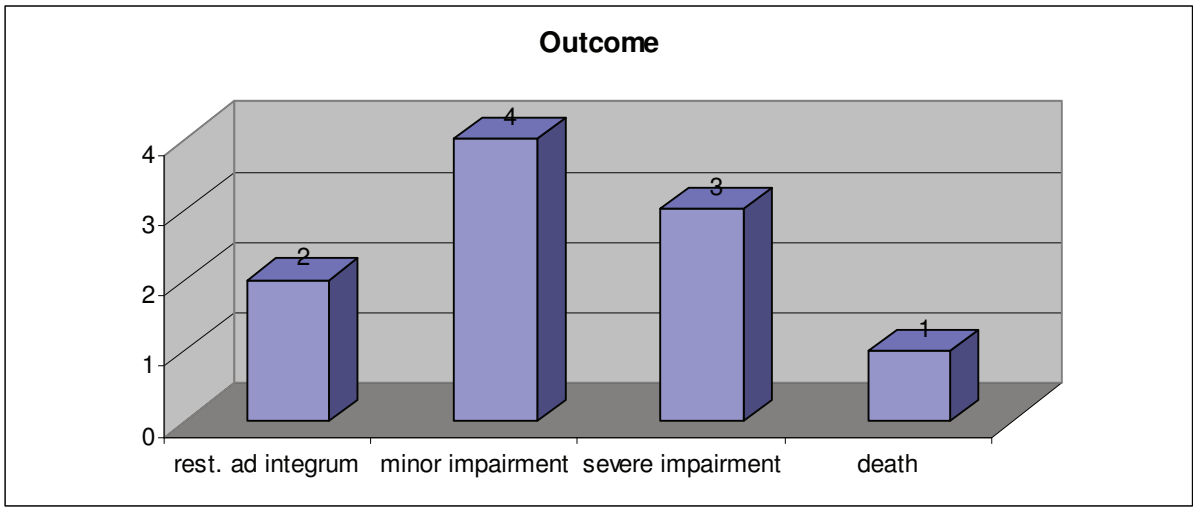

Figure 2: Outcome

Traffic accidents

The accident research data bank revealed 14 cases of ATV accidents out of 18990 (0.1%) with the first at all in 2003. From 2004 to 2009 the incidence per year varied between one and five. The cohort of motorcyclists which served as control group, comprised 2966 patients. The mean age of ATV drivers was 32 years [16-74}, the mean age of motoryclists was 33.6 years [14-89]. 13 out 14 ATV drivers were male, eleven were wearing safety helmets.

The mean impact velocity was 35 km/h (motorcyclists 40.0 km/h). The most frequent injury mechanism was a collision with a car. Half of the collision opponents in ATV crashed were cars, another four were stationary objects. Figure 3 shows an example of an injury situation as recorded by the accident research unit.

Figure 3: Injury situation

Injury patterns

Injuries to the upper extremities were the most common and the most severe (AIS 0.7), while it was the lower extremity in motorcyclists (AIS 0.91). The maximum AIS were 1.4 in ATV drivers and 1.49 in motorcyclists. Figure 4 shows the distribution of injuries according to anatomic regions. Because of the low number of ATV drivers in our sample statistic evaluation was not applicable.

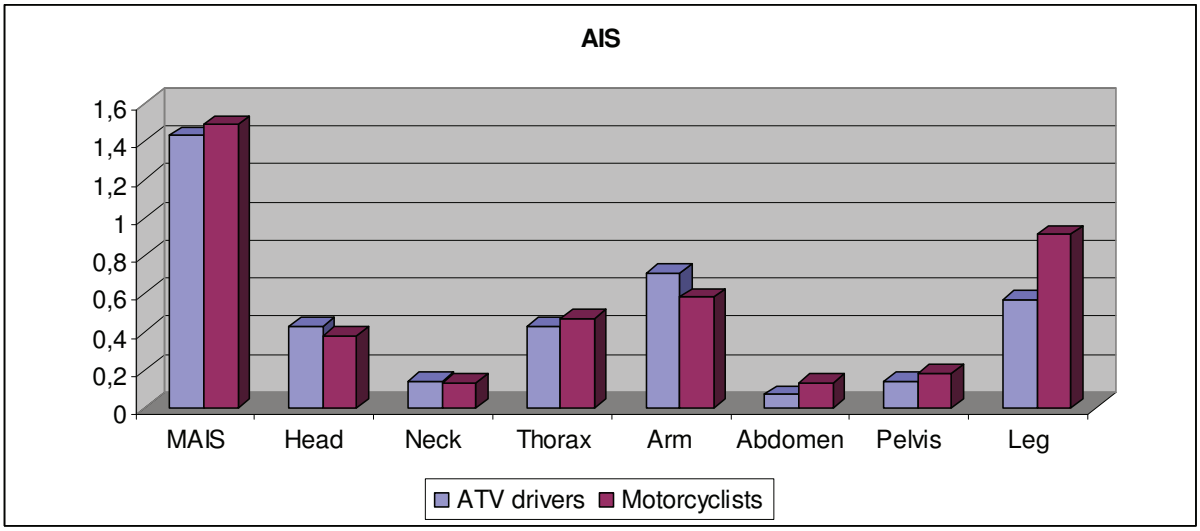

Figure 4: AIS

DISCUSSION

Although the absolute number of ATV accidents in our study is very low, they pose a relatively high risk for severe injuries. While in Germany ATV accidents consequently are still rare, in the US the number of killed ATV drivers and passengers even exceeds those of byciclists: According to data from the National Highway Traffic Safety Administration, between 2000 and 2005, 694 adults and 174 children were killed in ATV accidents (bicycle accidents: 666 adults and 155 children annually). [3, 4]

Possible reasons are the comparatively low active and passive security of ATVs as well as limited experience with ATV driving and the “fun” aspect which might provoke risky driving behaviour. [5] Larger series from the US report high incidences of drug abuse among ATV casualties as well as very limited use of helmets. [6-10] In Germany, helmet usage is mandatory since 2006. Possible additional measures to prevent a rise in ATV accidents could be the total prohibition of alcohol consumption for ATV drivers as well as special courses or driving licenses or the increase of the legal age for driving ATVs.[11, 12]

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