

THE TYPICAL TRAFFIC ACCIDENTS IN ADOLESCENTS: THE MOTORCYCLE ACCIDENT- SOME EPIDEMIOLOGIC FEATURES AND THE EFFECTIVENESS OF SAFETY HELMETS AND CLOTHING.

G.FELDKAMP, K.JUNGHANNS, Department of Surgery, University of Heidelberg, HEIDELBERG (w.-Germany)

The daily confrontation with the growing number of motorcycle accidents has increased the number of severely injured adolescents and causes growing concern in all traumatologic units. How can we prevent this?

Classification of motorcycles.

In Germany motorcycles are grouped in the following categories: There are 2 types of motorbikes: the motorized bicycles (up to 25 km/h) and the mopeds (up to 40 km/h) and 2 groups of motorcycles: light motorcycles (up to 50 cc) and large motorcycles (more than 50 cc).

The number of motorcycles in Germany increases rapidly:(Tab.1) The overall number of motorcycles increased between 1969 to 1974 from 1.27 to 1.97 millions. These numbers include also all two-wheeled motorized vehicles with a maximum speed up to 40 km/h, which increased from 1 mill. to 1.7 mill. in about the same time period. Thus the smaller vehicles represent 78 % of all motorcycles. This category is almost exclusively used by adolescents from 15 to 21 years. Within this time period the motorized bicycles increased up to 1.1 mill, representing a 12 fold rise. The sale cards of the motorcycle industry show that 100 000 of 270 000 motorized bicycles were bought by 15 years olds.

Risks of injury (FRG):

The number of injured and killed motorcyclists increased constantly. In 1965 there were 1433 killed and 54750 injured and in 1974 1684 killed and 63496 injured. The individual risk of the motor-rider can be evaluated by relating the number of dead and injured to the overall number of motorcycles. There is practically no increase of the individual risk. The probability of death has risen from 0.07 % to 0.08 % between 1965 and 1974 and the probability of injury increased from 2.85 % to 3.22 % in the same time period.

How much more dangerous is it to ride a motorcycle compared to the risks of driving? In 1974 the risks seems to be a 110 % higher for the cyclists including all kinds of motorcycles. The difference is most impressive for the larger motorcycles, where the risk of death is 6 times and the risk of injury is 5 times higher than for cars. Clearly less dangerous is the driving of a moped or a motorized bicycle (Tab.2).

The percentage of killed and injured adolescents in the FRG is alarming. The 15 to 21 year olds represent 61 % of all dead and injured. Among the drivers of motorbikes this group shows 46,5 % dead or injured and among the motorcycles they represent 72 %.

Material:

From 1968 - 1974 467 in-patients were treated after motorcycle accidents. We saw the following injuries: 285 fractures of the lower extremity, 234 head injuries, 133 fractures of the upper extremity, 48 abdominal injuries, 40 thoracic injuries, 31 lesions of vessels and nerves, 13 fractures of the spine, 10 pelvic fractures. The examination of the age distribution showed that the 16 to 25 years olds were the largest group with 64 % with increasing tendency. In 1968 they represented 58 % and in 1974 78.5 %. Within this group the 16-17 years old predominated in 1974. In 1968 10 % of the patients had larger motorcycles and between 1972 and 1974 31 %. The remaining 69 % constitute 32 % small motorcycles, 25 % mopeds and 12 % motorized bicycles.

A prospective study of 124 patients between 1972 and 74 tried to give an insight into several special questions concerning: type of motorcycle, circumstances of trauma, driving experience and the amount of personal protection including helmets and clothing.

The larger the motorcycles the more frequently it is used as a hobby. Motorcycles are used to go to work in 31 %, mopeds and motorized bicycles in nearly 70 %.

Location of accident:

Most accidents happened in urban areas = 46 %, on country roads = 31.5 %, on larger roads = 19 % and on highways = 2.6 %.

The monthly distribution showed two peaks, one in June-July with 23.2 % and the second in September-October with 22.4 %.

The time of accident was 68 % during daylight hours (6 to 19 h) and 31.5 % during the evening (19-24 h) and 0.5 % between midnight and 6 h.

According to the general driving experience with car drivers we see more accidents in the unexperienced rider. 40 % had their licence for less than one year and 58 % owned their motorcycle less than 12 months.

Questioning the patients as to the causes of accidents they felt themselves responsible in 61 %, in 13 % they were partially responsible and 23 % were caused by others. Similar percentages are seen in the Heidelberg Police traffic report: between 62.4 - 74.4 % are caused by the drivers themselves.

Causes of accidents were collisions with another vehicle in 41.2 %, fall or running against an obstacle in 27.6 %, racing activities in 2.1 % and uncertain causes in 29.1 %.

The analysis of the sustained injuries shows:

1. Head injuries: We differentiate between concussion, contusion and complex injuries meaning one of the first two in association with fractures of the skull or face, intracranial bleeding or perforating injuries. The concussion cases increased from 32 % (1970) to 69.7 % (1974). Contusions are diminishing from 68 % (1970) to 27.3 % (1974). Complex injuries decreased from 52 % (1970) to 18.2 % (1974).

2. Fractures of extremities: The number of fractures increased from 42 % (1968) to 76.8 % (1974). At the upper extremity the shaft fractures are leading with 42.5 %. The forearm is 3 x more involved than the humerus. At the lower limb shaft fractures are predominant with 73 % of which 60 % involve the lower leg. The relation of arm to leg injury is 1 : 2.

Compound fractures were seen of the femur in 14.6 % (1972-74) and of the lower leg in 52.5 %. That means that more than half of the lower extremity fractures are compound.

Degree of injury: An average of 34.5 % had to be admitted to intensive care showing the severity of the injuries. The dangerous lesions increased during the time period 1968 (39 %) and 1974 (46 %). Every second patient nowadays shows dangerous injuries.

Fatalities: Between 1968 and 1974 39 patients died subsequent to their injuries, that means 8 %. All of them had head injuries. As a cause of death this injury could be accused in 82 %. 63.3 % of the dead were between 16 and 25 years old. The mean age of the dead patients was 17 years.

Our special interest in the prospective study concerned the amount and effectiveness of protective measures used by the drivers: In the following we give some of the most interesting facts:

1. From 124 drivers 73 = 59 % had no helmets and 68.5 % had no protective clothes.
2. The severity of injury is independent of the speed at the time of accident.
3. Severe injuries were seen in large motorcycle patients in 43 %, in small motorcycles in 42 %, with mopeds in 48 % and with motorized bicycles in 50 %.
4. Head injury happened in 53.7 % in large motorcycle accidents,

small motorcycles 55 %, mopeds in 55 % and motorized bicycles in 64.4 %.

5. Protective measures were used most by drivers of large motorcycles: 73.2 % used helmets, 58.5 % protective clothing. The drivers of small motorcycles used them in 35 % and 25 % respectively. Moped riders used helmets in 24.2 % and protective clothes in 14 % and the drivers of motorized bicycles never used any of them.
6. The users of helmets sustained head injuries in 45 % compared to 60 % among the unprotected riders.
7. The use of a helmet does not prevent light injuries of the head which we saw in 78.2 %. But we only saw 21.8 % severe head injuries. Unprotected riders had 41 % severe head injuries and 59 % light injuries.
8. Different protective effectivity between jet- and integral-helmet could not be seen in our investigation because of the small numbers.
9. Severe injuries are diminished by the use of protective clothes from 52.9 to 28.1 %.
10. Compound fractures were seen in riders who did not use protective clothes 3 times more frequently than in protected riders (25.9 % and 7.7 %).
11. In our prospective study between 1972 and 1974 9 died from the sustained head injury. Only 2 of these used helmets.
12. The legal measures since 1.1.1976 only order the use of helmets for motorcycles leaving the mopeds and motorized bicycles unprotected. That constitute more than 50 % of the overall number of the two-wheeled motorized vehicles. From our investigation it is clearly shown, that the use of protective clothes as well as helmets should be legally instituted for all motorized two-wheeled vehicle riders.

TABLE 1

Two-wheeled motorized vehicles (FRG)

	<u>Motor bikes</u>		<u>Motorcycles</u>		<u>Total</u>
	<u>Mot.bicycles</u>	<u>Mopeds</u>	<u>Light M.</u>	<u>Large M.</u>	
1960	----	2.213.133	-----	1.892.479	4.105.612
1968	93.848	906.655	-----	311.604	1.312.107
1969	162.342	852.680	-----	263.486	1.273.508
1970	260.487	793.716	-----	228.604	1.432.807
1971	395.717	706.808	150.000	201.452	1.463.977
1972	569.158	677.102	160.000	198.221	1.614.481
1973	743.249	650.332	170.000	212.706	1.794.631
1974	902.679	637.295	188.344	230.364	1.972.635
1975	1.116.439	602.568	202.297	249.832	2.188.839
			220.000		

TABLE 2

Risks of fatal and non-fatal injury 1974 (German Federal Bureau
of Statistics)

<u>Fatal</u>			<u>Non-fatal</u>		
Two-wheeled mot.bicycle (Total)	1 : 1169 vehicles		1 : 31 vehicles		
Motorcar	1 : 2605	"	1 : 66	"	
=====					
Motorcycles	1 : 454	"	1 : 12	"	
Mopeds	1 : 1970	"	1 : 58	"	
Mot.bicycles	1 : 2196	"	1 : 51	"	