CERVICAL SPINE INJURIES

EPIDEMIOLOGICAL INVESTIGATION. MEDICAL AND SOCIAL CONSEQUENCES.

by
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Abstract
According to data from the registry maintained by the Danish National Health Service (Sundhedsstyrelsen) a little more than 2oo persons are hospitalized annually in Denmark because of cervical spine injuries sustained in road traffic accidents. Experiences from the Odense University Hospital show that not all injuries are reported to the national registry. According to the hospital registrations an estimate of 385 road traffic accident victims with cervical spine lesions should be hospitalized in Denmark annually and another 1o5o should be treated as outpatients. 67.1% of the victims were front-seat car riders. The role of the classical whiplash injury is stressed by the fact that 46.5% of the patients with cervical spine lesions had been involved in rear-end collisions in opposition to 5.2% of the persons injured in all registered car collisions in Denmark in 1979.

Although most injuries to the neck were graded as AIS 1 a follow-up investigation showed that even patients with this lesion only had long lasting complaints.

Introduction

The purpose of this paper is to give a picture of the medical and social consequences and the epidemiology of life-threatening as well as minor cervical spine injuries in an effort to provide a basis for a future cost-benefit analysis of mandatory automobile headrests in Denmark.

Material and methods

In this material a cervical spine injury is defined as a fracture, a dislocation, a medullary or cervical nerve-root lesion as well as an acute strain. The material corresponds to the description of cervical spine lesions in the 198o edition of the Abbreviated Injury Scale (AIS) page 49 (1) except that lesions to the trunk or brachial plexus are not included.

The Danish National Health Service maintains a register of all patients admitted to hospital in the country. From this register information concerning the time and place of admission as well as diagnosis (N- and E-diagnosis) have been collected for all patients with a cervical spine lesion hospitalized in 1978 and 1979.

At the Odense University Hospital all lesions acquired in traffic accidents are categorized according to the AIS scale,and a special registration form is filled in for every person injured in a road traffic accident.These special forms as well as the patient case papers for each patient with an AIS-score for neck lesion acquired in a road traffic accident in 1978-198o have

been analyzed. Each of the 183 patients still alive received a questionnaire in April 1981 in order to obtain information concerning medical and social consequences of the injury as well as further information concerning the accident, in particular the direction of impact and the use of headrest. 151 (82.5%) responded to the questionnaire.

Results

Epidemiology

In Denmark (5.1 million inhabitants) a cervical spine lesion has been registered in 1465 patients hospitalized after 1469 accidents in the two-year periode 1978-1979 according to data from the national health registry.

E-diagnoses have been registered for 1207 out of 1469 (82.2%) and 631 had been classified as traffic accidents, 11 of which happened away from public roads. 19 hospitalizations were due to sequelae. The material comprises the remaining 601 road traffic accidents, where 3 persons have been injured twice.

Table 1 shows the distribution of the injured according to mode of transportation. Almost 50% of the injured were car drivers and 25% car passengers. The data does not separate front- and back-seat passengers.

For car riders and passengers the injuries sustained can be subdivided as shown in table 2. 267 patients had been hospitalized because of their cervical spine lesion alone and 167 patients may have been hospitalized because of other lesions. Apart from 28 patients with acute strain all patients had more serious cervical spine lesions which needed hospital treatment.

In the Odense University Hospital approximately 3.000 persons injured in road traffic accidents were treated per year in 1978-1980 (3.225, 3.095 and 3.008 respectively).

An AIS-score for the neck region was registered in 228 patients in the same period of time, 194 of these had a cervical spine lesion.

The distribution of road traffic accident victims with lesions to the cervical spine according to mode of transportation is shown in table 1, and table 3 shows the age and sex distribution. In the age group 10 - 19 years the majority of patients were between 15 and 19 years old (26 men and 10 women).

Headrests are seldom used on the rearseat. Information on direction of impact and use of headrest was therefore analyzed only for 130 front seat riders in cars (table 4).

Most impacts have been from the rear-end (46.1% of the cases where the direction of impact is known) and approximately 32% of the total number of injured used a headrest.

According to police registrations of car accidents in Denmark in 1979 (2) only 6.2% were rear-end collisions. In the same year the police registrations show that only 5.2% of the total number of injured were injured in this type of collision.

Medical and social consequences

Table 5 shows, that 52 out of 194 injured registered at the Odense University Hospital were admitted for treatment. Eleven out of the 52 had a cervical spine lesion only. 41 had other lesions as well - in 32 cases lesions that were considered more serious than the cervical spine lesion, whereas the cervical spine lesion was the most serious lesion in 2 cases. Nine were dead on arrival and another 2 died in hospital during the first two days.

Far the most cervical spine lesions were graded as AIS 1 (table 1). In table 7 the AIS-score for cervical spine lesions as well as the highest AIS-score for any other lesion is shown. The table shows that no victim with an AIS of 5 or 6 survived the accident. Out of 11 fatalities the cervical spine lesion was the leading cause of death in one case and contributory cause in two cases. The first case was an old man on a bicycle hit by a car. He was the only victim with a tetra- or paraplegia, and he died a few hours after the accident.

72 out of 151 who responded to the questionnaire had to go on sick-leave after the accident (table 8) and of these 3 were still unable to work at the time of the follow-up investigation 9, 18 and 3o months after the accident. In 65 cases the incapacitation was due to or partly due to the cervical spine lesion. 3 had to change occupation because of the injuries they sustained, 2 because of a cervical root avulsion acquired in a motorcykle accident and one because of sequelae after a head injury.

Before the accident 13 had complaints from the neck. After the accident 4o complained of tendencies to neck-pain and 22 complained of reduced movement of the neck. 18 complained of light paraestesia in the extremities.

The extend of time from the accident until the patients were free of symptoms is shown in table 9.

87 patients had a cervical spine lesion only (81 with AIS 1, 4 with AIS 2 and 2 with AIS 3). 15 patients with AIS 1 did not respond to the questionnaire. The extend of abscense from work for the remaining 72 is shown in table 8, and the extend of time from the accident until the patients were free of symptoms in table 9. Although only 13 stated they still were not free of symptoms, another 13 having had a period without symptoms stated to have one or more neck-complaints at the follow-up. Only 1o out of the 72 had complaints before the accident.

Discussion

Among others serious spine injuries have been analyzed by Kraus et al. (3). Cloward (4) states that even minor injury to the cervical spine may result in long-lasting symptoms, and this is in accordance with our results.

Tsuchihashi et al.(5) found that the body region most frequently injured in automobile accidents was the neck, but that 99.1% of the neck injuries were graded AIS 1. In our material 87.1% of the neck injuries from the total amount of traffic accidents were graded as AIS 1, and 81.2% of those acquired in automobile acci-

dents were graded as AIS 1.

Our proportion of victims of rear-end car collisions (46.5%) stress the role of the classical whip-lash injury.

Investigations based on autopsies of persons killed in accidents show a high proportion of fatal as well as non-fatal cervical spine injuries (6). Autopsies are not done in all cases (only 6 out of 11 fatalities were autopsied in our study), and some cervical spine injuries will not be registered.

According to data from the national registry a little more than 2oo persons out of a population of 5.1 million are hospitalized each year with cervical spine injuries sustained in a road traffic accident. However of 52 cervical lesions registered by the Odense University Hospital only 17 were retrieved from the national health registry presumably because they have been considered unimportant in the normal procedures of classification based on the hospital patients forms.

The Odense University Hospital serves 4.5% of the total Danish population. Assuming the area is representative for the country an annual number of approximately 385 cervical spine injuries acquired in road traffic accidents can be estimated to be hospitalized in Denmark, and another approximately 1o5o can be estimated as outpatients, -67.1% of these will be either drivers or front-seat passengers in cars.

References

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Table 1. Distribution according to mode of transportation of road traffic accident victims who suffered lesions to the cervical spine and who were admitted to hospital in Denmark 1978-1979 or treated at the Odense University Hospital 1978-198o.

Mode of transportation	Admitted to hospital in Denmark		Treated at the Odense University Hospital	
	Number	in %	Number	in %
Car driver (trucks and buses included)	275	45.7	93	48.o
Car passenger (trucks and buses included)	159	26.4	47	24.2
MC/moped driver	57	9.5	14	7.2
MC/moped passenger	15	2.5	1	o.5
Person on tractor	2	o.3	1	o.5
Bicyclist	37	6.2	33	17.o
Pedestrian	28	4.7	3	1.6
Other	28	4.7	2	1.o
Total	6o1	loo.o	194	loo.o

Table 2. Cervical injuries sustained by 434 cardrivers and passengers admitted to hospital in Denmark 1978-1979 with a cervical spine injury after a road traffic accident.

Cervical spine lesion	Drivers	Passengers	Total
Fracture	175	113	288
Dislocation	42	2o	62
Disk rupture	1	1	2
Acute strain	54	23	77
Medullary lesion	41	31	72
Nerve root lesion	2	4	6
Number of lesions	315	192	5o7
Number of patients	275	159	434

Table 3. Distribution according to age and sex of 194 patients treated at the Odense University Hospital for cervical spine injuries after road traffic accidents in 1978-1980.

Age	Men	Women	Total
0 - 9	3	2	5
10-19	32	14	46
20-29	21	30	51
30-39	16	22	38
40-49	9	11	20
50-59	5	10	15
60-69	12	2	14
70-79	2	3	5
Mean	29.5	32.8	31.1
Range	4-72	5-78	

Table 4. Direction of impact and use of headrest for drivers and front-seat passengers injured in cars.

Direction of impact	Use of headrest			Total number of injured
	yes	no	unknown	
Frontal	9	17	8	34
Rear end	10	35	8	53
From side	12	12	0	24
Other	0	3	1	4
Unknown	1	3	11	15
Total	32	70	28	130

Table 5. Course of treatment for 194 patients treated at the Odense University Hospital for cervical spine lesions after road traffic accidents in 1978-198o.

Course of treatment	Number	In %
Dead on arrival	9	4.6
Admitted	52.	26.8
Referred to ambulatory treatment	3	1.6
Referred to family physician	8	4.1
Discharged	122	62.9
Total	194	loo.o

Table 6. Distribution of AIS in 194 patients treated for cervical spine lesions.

AIS-score	Number of patients	Percentage of patients
1	169	87.2
2	9	4.6
3	9	4.6
4	1	o.5
5	4	2.1
6	2	1.o
Total	194	loo.o

Table 7. Distribution of AIS-score for cervical spine lesions and highest AIS-score for other lesions compared to the distribution according to mode of transportation in 194 patients treated at the Odense University Hospital for injury in the cervical spine after road traffic accident in 1978-198o.

AIS-score cervical spine	AIS-score other lesion	Front seat car riders	Other	Total number
1	⁄.	69	12	81
1	1	37	24	61
1	2	7	13	2o
1	3	1	2	3
1	4	o	1	1
1	5	o	(2)	(2)
2	⁄.	3	1	4
2	1	3	o	3
2	2	2	o	2
2	5	o	(1)	(1)
3	⁄.	2	o	2
3	1	2	1	3
3	2	1	1	2
3	3	o	1	1
3	6	o	(1)	(1)
4	6	(1)	o	(1)
5	2	o	(1)	(1)
5	5	o	(1)	(1)
5	6	o	(2)	(2)
6	3	(1)	o	(1)
6	5	(1)	o	(1)
Total number		13o	64	194
Number of fatalities		3	8	11

Fatalities shown with ( ).

Table 8. Distribution of duration of abscense from work for patients treated at the Odense University Hospital 1978-198o for cervical spine injuries acquired in road traffic accidents.

Period of abscense from work	All 194 patients	87 patients with a cervical spine lesion only		
		AIS 1	AIS 2	AIS 3
No abscense	35	27	o	o
1-7 days	29	13	1	
-2 weeks	15	4		
-3 weeks	11	3		
-4 weeks	4	2		
-2 months	4	1		
-3 months	3		1	
-4 months	o			
-5 months	1		1	
-6 months	1			
6- months	4			
Unemployed	4o	16	1	2
No answer (11 dead)	47	15	o	o
Total	194	81	4	2

Table 9. Distribution of duration of time from the accident until the patient was free of symptom in patients treated at the Odense University Hospital 1978-198o for cervical spine lesions acquired in road traffic accidents.

Extend of time	All 194 patients	87 patients with a cervical spine lesion only AIS 1	AIS 2	AIS 3
1-7 days	47	27	1	
- 2 weeks	19	11		
- 3 weeks	8	5		
- 4 weeks	1o	4		
- 2 months	8	5		
- 3 months	5	2		
- 4 months	4	o		1
- 5 months	1	1		
- 6 months	3	o	1	
6- months	4	1		
Symptoms still remaining	36	11	1	1
No answer	49	14	1	o
Total	194	81	4	2