

THE INFLUENCE OF TRAUMA UPON THE CERVICAL SPINE IN
FUNCTION OF AGE AND SEX

by

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ABSTRACT

Comparison of the mobility and the presence of pathological signs as osteophytosis, discopathia and olisthesis between two populations, one with traumatic history (traffic accident AIS=1) and one without traumatic antecedents. A radiological method is used. The influence of age is significant. The influence of sex upon mobility is clear. The used criteria made no significant difference between traumatic (AIS=1) and non traumatic population.

1. INTRODUCTION

The mobility of the cervical spine has already been studied by different authors using radiology as investigation method, (Bakke 1931, Nuemyer and Berning 1963, Moffat and Schulz 1979, De Seze et al. 1951).

Unfortunately, the examined sample is not always precisely described and in certain cases (Moffat et al. 1979) the sample is very small (N=11). In other instances, (Bakke 1931, De Seze et al 1951), there is a lack of information about the examined sample.

The problem was to have a more precise information about cervical spine mobility and the presence of certain pathological signs as osteophytosis, discopathia and olisthesis.

Owing to the origin of the studied population, it was possible to take into account the influence of trauma.

2. OBJECT OF THE STUDY

The first aim of this paper is to study the incidence of trauma on the cervical spine. The origin of the trauma is traffic accidents. The lesions are AIS=1. It became clear that this could not be achieved without taking into account age and sex.

The method used is based on radiology. All the radiological examinations were achieved by the same radiologist (M. Brombart) and the same technician. This is very important to avoid bias of the results through different radiological procedures.

3. THE RADIOLOGICAL INVESTIGATION METHOD

A radiological examination of the cervical spine needs a precise procedure to answer the clinical requirements.

So the following radiographic views have to be taken :

- a transbuccal view of the atlas-axis
- an antero-posterior or front view, the subject standing with his back next to the plate
- a sagittal or profile view, the subject standing looking horizontally
- two oblique views, the standing subject turning his head to the extreme left first and then to the extreme right
- a dynamic examination during which the cervical spine of the patient is radiographed in maximal flexion and extension. There is no problem to obtain a maximal extension from the examined person. On the contrary, the same is not true in the case of maximal flexion. The patient accomplishes a maximal flexion of the head upon the cervical spine, then pushes his head forward, making a maximal flexion of the spine itself, as the chin reaches the sternum. It is in this position that the view has to be taken.

The mobility of the different vertebral pairs is measured using the method proposed by Penning (Penning 1968). The radiologist made transferrings of the dynamic examination to determine the mobility and the presence of osteophytosis, discopathia and olistheasis.

The radiological examination gives the following information

- the mobility of vertebral pairs C2-C3, C3-C4, C4-C5, C5-C6, C6-C7
- presence or absence of osteophytosis which is the abnormal production of bone by subperiosteal ossification and endochondral ossification
- presence or absence of discopathy which is the structural deterioration of the intervertebral disc

- presence or absence of olisthesia which is an antero-posterior mobility of one vertebra on the one beneath. This sign when it appears only in anteflexion and retroflexion has no pathological meaning. When it appears in neutral position, it can have different pathological etiologies such as discopathia, etc.

4. THE POPULATION

The studied population (N=209) consisted of two groups. The first one is formed by persons who had no traumatic antecedents and underwent radiological examinations of the cervical spine for medical reasons not related with trauma. The persons are from both sexes and different ages.

The other group comes from the files of one of us (P. Tahon) and are cases of legal compensation for traffic accidents. These cases were examined one or two years after the concerned person incurred trauma by traffic accident. The type of lesion taken into account is cervical sprain and whiplash (AIS=1). Cases with cervical spine fractures were excluded (AIS=3).

The structure of the population by age, sex and etiology is summarized beneath :

Sex	N	Traumatic	Non-Traumatic
Men	75	54	21
Women	134	80	54
	209	134	75

Age	≤35 years	36-50 years	51 years and over
Men 75	20	32	23
Women 134	50	36	48
	70	68	71

The age groups are chosen to obtain balanced population numbers. The groups are noted as follows :

M = men, F = women, T = traumatic, NT = non-traumatic

A1 = < 35 years A2 = > 35 years and < 50 years A3 = > 50 years

Example : MT A3 = Group men, traumatic etiology and over 51 years of age

5. THE DATA

For each subject, the following data was taken :

- age
- sex
- presence or absence of trauma by traffic accident and then for each vertebral pair C2-C3, C3-C4, C4-C5, C5-C6 and C6-C7
- mobility in degrees
- presence of osteophytosis
discopathy
olisthesis

6. THE STATISTICAL TREATMENT OF THE DATA

The data of the vertebral mobility allow the calculation of the mean and standard deviation and to make inter-group comparisons of this means by the t Fisher Student test and the z Fisher test. The t Fisher Student test is used when N < 30 and the z Fisher test if N > 30.

The significance levels are noted as follows :

p = 0.05	is noted as	"+"
p = 0.01		"++"
p = 0.001		"+++"

The frequency of subjects suffering from osteophytosis, discopathy and olisthesis are noted for each vertebral pair for each group.

The comparison of the groups is not made by using the khi square but the Fisher test because the computer allowed it. This method was suggested by the "Centre de Calcul", Université Libre de Bruxelles. The significance levels are noted above.

7. THE GROUPS AND THEIR POPULATION

The populations of the groups are :

<u>Désign.</u>	<u>N</u>	<u>Désign.</u>	<u>N</u>
1.M.	75	19.T.A2	48
2.F.	134	20.T.A3	33
3.T.	134	21.NT.A1	17
4.NT.	75	22.NT.A2	80
5.A1	70	23.NT.A3	38
6.A2	68	24.M.T.A1	17
7.A3	71	25.M.NT.A1	3
8.M.T.	54	26.M.T.A2	25
9.F.T.	80	27.M.NT.A2	7
10.M.NT.	21	28.M.T.A3	12
11.F.NT.	54	29.M.NT.A3	11
12.M.A1	20	30.F.T.A1	36
13.M.A2	32	31.F.NT.A1	14
14.M.A3.	23	32.F.T.A2	23
15.F.A1	50	33.F.NT.A2	13
16.F.A2	36	34.F.T.A3	21
17.F.A3	48	35.F.NT.A3	27
18.T.A1	53	36.PG.	209

8. THE RESULTS

Only the most interesting and significant results are presented due to lack of space. When tests are not mentioned, it means that no level of significance is obtained by the used tests.

8.1. The influence of age upon mobility

	A1	A2	test	A2	A3	test
C2 - C3	9,9	10,6		10,6	9,1	+
C3 - C4	15,4	14,7		14,7	12,1	+++
C4 - C5	18,7	17,1	+	17,1	15,2	+
C5 - C6	20,0	16,6	+++	16,6	12,6	+++
C6 - C7	17,3	15,1	+	15,1	12,3	++

Mobility of the vertebral pairs in degrees.

8.2. The influence of age upon the presence of osteophytosis

	A1	A2	test	A2	A3	test
effectifs	70	68		68	71	
C2 - C3	0 (0%)	4 (5,9%)		4 (5,9%)	1 (1,4%)	
C3 - C4	5 (7,1%)	12 (18%)	+	12 (17,7%)	8 (11,3%)	
C4 - C5	3 (4,3%)	12 (18%)	++	12 (17,7%)	22 (31%)	+
C5 - C6	6 (8,6%)	22 (32%)	+++	22 (32,4%)	53 (75%)	+++
C6 - C7	3 (4,3%)	20 (30%)	+++	20 (29,4%)	40 (56,3%)	

N° of cases of osteophytosis with percentages in brackets.

813. The influence of age upon discopathia

	A1	A2	test	A2	A3	test
effectifs	70	68		68	71	
C2 - C3	1 (1,4%)	1 (1,5%)		1 (1,5%)	0 (0%)	
C3 - C4	0 (0%)	1 (1,5%)		1 (1,5%)	4 (5,6%)	
C4 - C5	0 (0%)	4 (5,9%)		4 (5,9%)	11 (15,5%)	+
C5 - C6	2 (2,9%)	12 (17,7%)	++	12 (17,7%)	34 (48%)	+++
C6 - C7	0 (0%)	14 (20,6%)	+++	14 (20,6%)	22 (31%)	++

Number of cases of discopathia with percentages in brackets.

814. The influence of age upon olisthesis

	A1	A2	test	A2	A3	test
effectifs	70	68		68	71	
C2 - C3	43 (61,4%)	28 (41,2%)	++	28	28 (39,4%)	
C3 - C4	44 (62,8%)	32 (47%)	+	32	36 (50,7%)	
C4 - C5	43 (61,4%)	31 (45,6%)	+	31	43 (60,5%)	+
C5 - C6	30 (42,8%)	18 (26,5%)	+	18	20 (28,2%)	
C6 - C7	7 (10%)	4 (5,8%)		4	6 (8,4%)	

Number of cases of olisthesis with percentages in brackets.

815. The results of the significance tests for the influence of age upon mobility

A1/A2	A2/A3	M.A1/ M.A2	M.A2/ M.A3	F.A1/ F.A2	F.A2/ F.A3	T.A1/ T.A2	T.A2/ T.A3
	+++				+++		
+	+				+		
+++	+++	++	+	+	+++	++	++
+	++						
NT.A1/ NT.A2	NT.A2/ NT.A3	M.T.A1/ M.T.A2	M.NTA2/ M.NT.A3	F.T.A2/ F.T.A3	F.NT.A1 F.NT.A2	F.NT.A2/ F.NT.A3	
	++			+		++	
+++	+++	+	+	++	++	++	
++	+				+		

8.16. The results of the significance test for the influence of age upon olisthesis

	A1/A2	F.A1/ F.A2	NT.A1/ NT.A2	F.NT.A1/ F.NT.A2
C2 - C3	++	++	+++	+++
C3 - C4	+	++	++	++
C4 - C5	+		+	
C5 - C6	+		+	+

8.21. The influence of sex upon mobility

	M.	F.	test
effectifs	75	134	
C2-C3	9,5°	10,1°	
C3-C4	13,1°	14,5°	+
C4-C5	16,1°	17,5°	+
C5-C6	14,7°	17,3°	+++
C6-C7	14,4°	15,1°	

Mobility of the vertebral pairs in degrees.

8.22. The influence of sex upon the presence of osteophytosis

	M.	F.	test
effectifs	75	134	
C2-C3	2 (2,6%)	3 (2%)	
C3-C4	12 (16%)	13 (8%)	
C4-C5	13 (17%)	24 (18%)	
C5-C6	33 (44%)	48 (36%)	
C6-C7	26 (34,5%)	37 (27%)	

Number of cases of osteophytosis with percentages mentioned between brackets.

823. The influence of sex upon the presence of discopathia

	M.	F.
effectifs	75	134
C2-C3	2 (2,6%)	0
C3-C4	5 (6,6%)	0
C4-C5	3 (4%)	12 (9%)
C5-C6	16 (21%)	32 (24%)
C6-C7	18 (24%)	24 (18%)

Number of cases of discopathia with percentages in brackets.

824. The influence of sex upon the presence of olisthesis.

	M.	F.
effectifs	75	134
C2-C3	29 (40%)	70 (52,5%)
C3-C4	32 (43%)	80 (60%)
C4-C5	36 (48%)	81 (60,5%)
C5-C6	17 (24%)	51 (39%)
C6-C7	3 (4%)	14 (10,5%)

Number of cases of olisthesis with percentages in brackets.

825. The results of the significance tests for the influence of sex upon mobility

	M.A1 / F.A1	M.A2 / F.A2	M.T./ F.T.	M.NT/ F.NT	M.T.A1/ F.T.A2	M.NT.A1/ F.NT.A1	M.NT.A2/ F.NT.A2
C3-C4		++			++	+	+
C4-C5				+			
C5-C6	+	+++	+	++	+	++	
C6-C7							

831. The influence of trauma upon mobility

	T.	NT.	test
effectifs	134	75	
C2-C3	10,2	9,1	+
C3-C4	14,2	13,7	
C4-C5	17,2	16,7	
C5-C6	16,5	16,1	
C6-C7	15,1	14,5	
MG	73,2	70,247	

Mobility of the vertebral pairs in degrees

832. The influence of trauma upon presence of osteophytosis

	T.	NT.
C2-C3	4 (3%)	1 (1,4%)
C3-C4	21 (15,5%)	4 (5%)
C4-C5	25 (18,5%)	12 (16%)
C5-C6	43 (33%)	38 (50,5%)
C6-C7	31 (24%)	32 (43%)

Number of cases of osteophytosis with percentages in brackets

833. The influence of trauma upon the presence of discopathia

	T.	NT.
C2-C3	2 (1,5%)	0
C3-C4	3 (2,2%)	2 (2,5%)
C4-C5	9 (6,5%)	6 (8%)
C5-C6	24 (18%)	24 (32%)
C6-C7	19 (15%)	23 (32%)

Number of cases of discopathia with percentages in brackets.

834. The influence of trauma upon the presence of olisthesis

	T.	NT.
C2-C3	60 (45%)	39 (52%)
C3-C4	66 (50%)	46 (60%)
C4-C5	62 (47%)	55 (72%)
C5-C6	35 (26%)	33 (44%)
C6-C7	11 (8,5%)	6 (8%)

Number of cases of olisthesis with percentages in brackets.

835. The results of the significance test for the influence of trauma upon mobility

	T.A1 / NT.A1	M.T./M.NT.	F.T.A1 / F.NT.A1
C2-C3			
C3-C4	+		+++
C4-C5			
C5-C6	++	+	++
C6-C7			
MG	+	+	++

CONCLUSION

Mobility decreases with increase of age. The frequency of osteophytosis and discopathia also increases with age.

Mobility, osteophytosis and discopathia evolve together. This is most noticeable at C5-C6 and C6-C7.

Sex has an influence upon mobility which is greater in women. The differences of frequency in osteophytosis and discopathia are slight.

It was not possible to put in evidence an influence of trauma (AIS=1) between the two populations using mobility, osteophytosis, discopathia and clisthesis as criteria.

There is a need for epidemiological studies of the phenomena upon samples of different ages and sex but without any pathological history.

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