

Author's Accepted Manuscript

Transient pressure changes in the vertebral canal during whiplash motion – a hydrodynamic modeling approach

Hua-Dong Yao, Mats Y. Svensson, Håkan Nilsson



PII: S0021-9290(16)00014-2
DOI: <http://dx.doi.org/10.1016/j.jbiomech.2016.01.005>
Reference: BM7524

To appear in: *Journal of Biomechanics*

Received date: 30 September 2015
Revised date: 30 December 2015
Accepted date: 4 January 2016

Cite this article as: Hua-Dong Yao, Mats Y. Svensson and Håkan Nilsson, Transient pressure changes in the vertebral canal during whiplash motion – a hydrodynamic modeling approach, *Journal of Biomechanics* <http://dx.doi.org/10.1016/j.jbiomech.2016.01.005>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

1 Transient pressure changes in the vertebral canal during
2 whiplash motion – a hydrodynamic modeling approach

3 Hua-Dong Yao^{a,*}, Mats Y. Svensson^a, Håkan Nilsson^a

4 ^a*Chalmers University of Technology, SE-412 96 Gothenburg, Sweden*

Word count: 3676 (from Introduction through Discussion)

5 **Abstract**

6 In vehicle collisions, the occupant's torso is accelerated in a given direction
7 while the unsupported head tends to lag behind. This mechanism results in
8 whiplash motion to the neck. In whiplash experiments conducted for animals,
9 pressure transients have been recorded in the spinal canal. It was hypoth-
10 esized that the transients caused dorsal root ganglion dysfunction. Neck
11 motion introduces volume changes inside the vertebral canal. The changes
12 require an adaptation which is likely achieved by redistribution of blood
13 volume in the internal vertebral venous plexus (IVVP). Pressure transients
14 then arise from the rapid redistribution. The present study aimed to explore
15 the hypothesis theoretically and analytically. Further, the objectives were
16 to quantify the effect of the neck motion on the pressure generation and to
17 identify the physical factors involved. We developed a hydrodynamic system
18 of tubes that represent the IVVP and its lateral intervertebral vein connec-
19 tions. An analytical model was developed for an anatomical geometrical
20 relation that the venous blood volume changes with respect to the vertebral
21 angular displacement. This model was adopted in the hydrodynamic tube
22 system so that the system can predict the pressure transients on the basis of

**Email address:* huadong@chalmers.se

Download English Version:

<https://daneshyari.com/en/article/10431141>

Download Persian Version:

<https://daneshyari.com/article/10431141>

[Daneshyari.com](https://daneshyari.com)