

Case Report (presentation ID number: P-118)

Chin-sternum-heart syndrome type of injury observed in a pedestrian victim of car traffic accident

Junichi Furumiya, Hiroyuki Nishimura, Akinori Nakanishi, Yoshiaki Hashimoto

Department of Legal Medicine,
Kochi Medical School, Kochi University,
Kohasu, Oko-cho, Nankoku City,
Kochi 783-8505, Japan

Corresponding author: Junichi Furumiya

Department of Legal Medicine,
Kochi Medical School, Kochi University,
Kohasu, Oko-cho, Nankoku City,
Kochi 783-8505, Japan

TEL: +81 88 880 2419

FAX: +81 88 880 2420

E-mail address: furumiya@kochi-u.ac.jp

Abstract

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2 We report an autopsy case of a pedestrian victim of car traffic accident with the
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4 chin-sternum-heart syndrome type of injury. A drunken man who lay on the road was run over
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6 by a car. He died immediately at the scene. The autopsy findings were as follows: large scalp
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8 lacerations, abrasions in the chin and the sternal region, a transverse fracture of the sternum,
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10 ruptures of the heart, ruptures of the ascending and descending aortae, rupture and
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12 hemorrhage of the nuchal muscle, ring fracture of the base of the skull, subarachnoid
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14 hemorrhage at the base of the brain, multiple rib fractures, anterior compression fracture of
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16 the 11th thoracic vertebra, and small lacerations of the liver. Blood ethanol level was 2.92
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18 mg/g. These findings indicate that there was hyperflexion of the neck and then the victim's
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20 heart was strongly compressed and ruptured by the collision of the chin with the sternal
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22 region of the chest.
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31 *Keywords:* Chin-sternum-heart syndrome; Forensic pathology; Blunt cardiac injury;
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34 Hyperflexion of the neck; Pedestrian accident; Runover injury
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1. Introduction

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2 In 1971, Simson described the chin-sternum-heart syndrome that represented one of the
3 mechanisms of blunt cardiac injury [1]. This syndrome is known to occur in parachutists
4 wearing heavy protective helmets who strike the ground in the upright position because of
5 incomplete deployment or partial failure of a parachute. The mechanism of multiple
6 lacerations of the heart in this syndrome is associated with sternal compression by the chin. A
7 similar syndrome sometimes has occurred in individuals who have fallen down stairs,
8 sustaining hyperflexion injury to the neck [2]. However, to our knowledge, a similar
9 syndrome has not been described in a traffic accident. In this paper, we report an autopsy case
10 of a pedestrian victim of car traffic accident with the similar type of blunt cardiac injury.
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2. Case report

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28 A 53-year-old man was run over by a car on the road, and he died immediately at the scene.
29 The speed of the car was about 50 km/h at the accident.
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33 At autopsy, slight abrasions and bruises were mainly observed on his face, upper chest,
34 upper shoulders, hands and knees. Large scalp lacerations without calvarium fracture were
35 found in the left parietal region. Subarachnoid hemorrhage without brain contusion was seen
36 at the base of the brain, although ruptured aneurysm was not evident. Transverse transection
37 in the nuchal muscle with clotted blood was observed (Fig. 1). There was ring fracture of the
38 base of the skull (Fig. 2) without injuries to the cervical spine. Abrasions in the chin and
39 sternal region were observed, although the bleeding under the abrasions was obscure.
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41 Transverse fracture with slight hemorrhage was observed in the sternal body. Bilateral rib
42 fractures with sever hemorrhage were observed in the midclavicular line. The heart (400 g)
43 was extruded from the ruptured pericardial sac. Fig. 3 shows multiple injuries of the heart and
44 vessels. There were ruptures on the atriums, right ventricle, coronary arteries, the ascending
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1 and descending aortae, and the superior and inferior venae cavae. The contusions by the ends
2 of the fractured ribs were observed in posterior aspect of the lungs. Sever anterior
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4 compression fracture of the 11th thoracic vertebra was found. Small lacerations of the liver
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6 and the mesentery were present. There were décollements immediately beneath the brush
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8 abrasions in the left buttock and behind the left knee. No tire marks were recognized on the
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12 body.

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14 Ethanol was detected by headspace gas chromatography [3]. Ethanol levels in the blood,
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16 urine and stomach contents were 2.92 mg/g, 3.85 mg/g and 3.40 mg/g, respectively.
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22 **3. Discussion**

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24 Pedestrians are most often struck by the front of a vehicle. In a typical situation, the person
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26 will initially be struck by the bumper of the car which injures the lower legs [4-6]. In our
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28 case, there were no findings of the leg injuries struck by the front bumper, and the surface of
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30 the car except for the underside had no damage. In addition, ethanol level at autopsy was 2.92
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32 mg/g in blood. Therefore, those facts suggested that the pattern of injuries in our case were
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34 derived from being run over by the car when he was lying on the road in drunkenness.
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39 The common mechanism of cardiac injury, when the body is run over by a car, is a
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41 compression of the chest by a wheel [4, 5]. However, there were no findings of chest
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43 compression by a wheel in the present case. Meanwhile, there were ring fracture and
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45 transection of the nuchal muscle which strongly suggested hyperflexion of the head and neck
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47 at the accident. Furthermore, the anterior compression fracture of 11th thoracic vertebra
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49 indicated that he was in a supine position at the event and the upper half of the body was
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51 severely flexed forward by the compression of the undersurface of the car. Therefore, it was
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53 indicated that the chin hit and compressed the sternal region of the chest. It seems that this
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55 pattern of pedestrian injuries is similar to the chin-sternum-heart syndrome type of injury.
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1 Slight external injuries of the chin and sternal region may be associated with his immediate
2 death [6].
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4 In our autopsy case, we confirmed that this syndrome type of injury was useful finding for
5 reconstructing the mechanism of blunt cardiac injury. Forensic pathologists should remind the
6 chin-sternum-heart syndrome when they perform an autopsy of the victims in the traffic
7 accidents.
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17 **Conflict of interest:** None
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References

- 1
2 [1] Simson LR Jr. "Chin-sternum-heart syndrome": cardiac injury associated with
3
4 parachuting mishaps. *Aerosp Med* 1971; 42: 1214-1217.
5
6
7 [2] DiMaio VJ, DiMaio D. *Forensic Pathology*, 2nd ed. Boca Raton: CRC press, 2001. pp.
8
9 117-130.
10
11 [3] Moriya F, Ishizu H. Can microorganisms produce alcohol in body cavities of a living
12
13 person? : a case report. *J Forensic Sci* 1994; 39: 883-888.
14
15
16 [4] Saukko P, Knight B. *Knight's Forensic Pathology*, 3rd ed. London: Arnold, 2004. pp.
17
18 181-189.
19
20
21 [5] Spitz WU. The road traffic victim. In: Spitz WU, ed. *Spitz and Fisher's Medicolegal*
22
23 *Investigation of Death: Guidelines for the Application of Pathology to Crime*
24
25 *Investigation*, Illinois: Charles C Thomas, 1993, pp. 528-566.
26
27
28 [6] Clark JC, Milroy CM. Pedestrian injuries and death. In: Mason JK, ed. *The Pathology*
29
30 *of Trauma*, Boston: Edward Arnold, 1993, pp. 17-29.
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Legends to figures

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5 Fig. 1. The photograph shows the occipital region. Arrows show a transverse transection in
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7 the nuchal muscle due to hyperflexion of the neck, which accompanied by clotted blood.
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12 Fig. 2. Arrows show a ring fracture of the base of the skull due to hyperflexion of the neck,
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14 which accompanied by subarachnoid hemorrhage at the base of the brain.
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19 Fig. 3. Arrows show multiple ruptures of the heart and vessels due to sternal compression by
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21 the chin, which accompanied by sternal fracture and multiple rib fractures.
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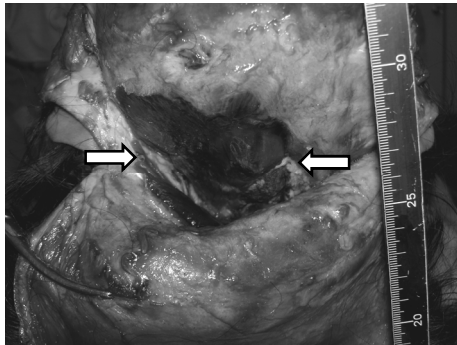


Fig. 1

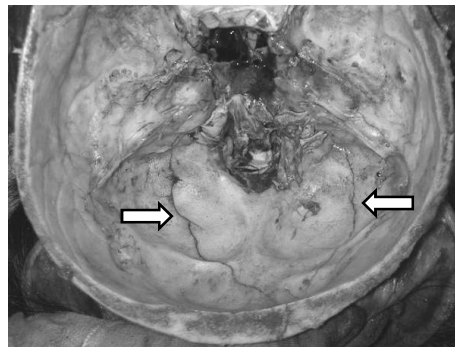


Fig. 2

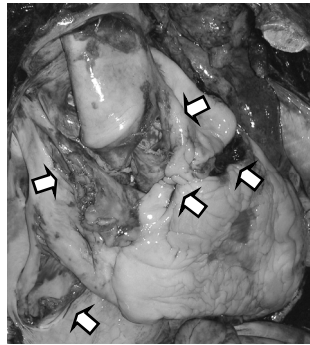


Fig. 3