CQ15 Is it useful to use postmortem images to determine rib fractures with cardiopulmonary resuscitation?

Grade of recommendations: C1

When cardiopulmonary resuscitation is performed in cases of cardiopulmonary arrest without trauma, postmortem CT can identify the presence of rib fractures. Rib fractures due to cardiopulmonary resuscitation should not be misinterpreted as antemortem injury.

Explanation----------

Background

Cardiopulmonary resuscitation for out-of-hospital cardiopulmonary arrest involves placing the victim in a supine position and manually compressing the precordial chest. Recently, automatic chest compression devices have been developed and their usefulness was reported. Complications have also been reported, and rib fractures are considered to be a relatively frequent complication of cardiopulmonary resuscitation.

Image findings

Postmortem CT findings characteristic of rib fractures due to chest compression are buckle rib fractures, which are often observed with only medial or rare lateral cortical bone fractures, with other continuities maintained. Reference [1] shows the shape of an incomplete fracture. A study based on autopsy findings has reported that there are differences in the sites of rib fracture occurrences depending on whether the precordial compression method was manual or mechanical. With manual precordial compression, about 66% of the fractures were found in the anterior part and about 26% in the parasternal (costal cartilage) part. Mechanical precordial compression (LUCUS®) showed fractures in approximately 47% of the anterior and parasternal regions [2]. In particular, the frequency of rib fractures in the paravertebral region was reported to be 0.01% for manual and 0.60% for mechanical stress induced fractures [2]. A posterior rib fracture was also identified in a report using a different automatic chest compression device (AutoPulse®) [3].

As a complication of the anterior chest compression method, rib fractures as well as sternum fractures have been reported [2-5], and in a retrospective study of 614 cases, about 27% were manual and about 48% were mechanical [2]. Of the rib/sternal fractures, few were identified by postmortem CT alone than by an autopsy [5].

Literature search formula and literature selection (2019/ 6 /28)

PubMed

#	Search formula	Number of documents
1	Search (((((("postmortem CT") OR "postmortem MRI") OR "postmortem imaging") OR "post-mortem CT") OR "post-mortem MRI") OR "postmortem imaging"	827
2	Search (#1) AND CPR	16

Ichushi（Medical Journal）

#	Search formula	Number of documents
1	(死後 mri/AL) and (PT=原著論文,会議録除く)	15
2	(死後 ct/AL) and (PT=原著論文,会議録除く)	191
3	((心肺蘇生法/TH or 心肺心肺蘇生術/AL)) and (PT=原著論文,解説,総説,図説,Q＆A,講義,会議録除く)	6,281
4	#1 and #3	0
5	#2 and #3	16

From other than search formula

[2, 4- 6]

References

[1] Yang KM et al：“Buckle” rib fracture：an artifact following cardio-pulmonary resuscitation detected on postmortem CT. Leg Med 2011; 13: 233-239 (Level 4b)

[2] Ondruschka B et al: Chest compression-associated injuries in cardiac arrest patients treated with manual chest compressions versus automated chest compression devices (LUCAS II): a forensic autopsy-based comparison. Forensic Sci Med Pathol 2018; 14: 515-525 (Level 4b)

[3] Pinto DC et al: Manual and automated cardiopulmonary resuscitation (CPR): a comparison of associated injury patterns. J Forensic Sci 2013; 58: 904-909 (Level 4b)

[4] Kashiwagi Y et al: Computed tomography findings of complications resulting from cardiopulmonary resuscitation. Resuscitation 2015; 88: 86-91 (Level 4b)

[5] Yamaguchi R et al: Frequency and influencing factors of cardiopulmonary resuscitation-related injuries during implementation of the American Heart Association 2010 Guidelines: a retrospective study based on autopsy and postmortem computed tomography. Int J Legal Med 2017; 131: 1655-1663 (Level 4b)

[6] Koga Y et al: Effects of mechanical chest compression device with a load-distributing band on postresuscitation injuries identified by post-mortem computed tomography. Resuscitation 2015; 96: 226-231 (Level 4b)