EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 8
Issue: 9
226-228
Year: 2021

POSTMORTEM COMPUTED TOMOGRAPHY SHOWED MASSIVE GASES IN THE BRAIN, HEART, LIVER, AND KIDNEY: A CASE REPORT

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Article Received on 15/07/2021 **Article Revised on 04/08/2021** **Article Accepted on 24/08/2021**

ABSTRACT
We experienced a case whose postmortem computed tomography (PMCT) showed massive gases detected in the brain, heart, liver, and kidney. An 85-year-old man, who had emphysema and dementia, was taken in the ambulance under cardiopulmonary resuscitation(CPR), manual ventilation with mask, chest compression, intravenous adrenaline administration by paramedics. When he arrived at our hospital, jaw rigidity was found, and electrocardiogram showed asystole. Therefore, we abandoned CPR which continued about 40 minutes. About 2 hours might have passed since cardiac arrest. PMCT was performed immediately. Massive gases were observed in the brain, heart, liver, and kidney. No clear cause of death was observed in PMCT other than obstructed bilateral bronchi, which might induce asphyxia, and/or increase intra-alveolar pressure to induce barotrauma and gas embolism. Mask ventilation and/or chest compression might also break the alveoli in emphysema to induce gas embolism. We should keep in mind that PMCT might show massive gases in many organs even with a short duration of CPR, though whether these were cause of death or results of CPR was not clear.

KEYWORDS: PMCT, CPR.

INTRODUCTION
We do not perform autopsy so often in Japan. Therefore, postmortem computed tomography (PMCT) is important to know the cause of the death.

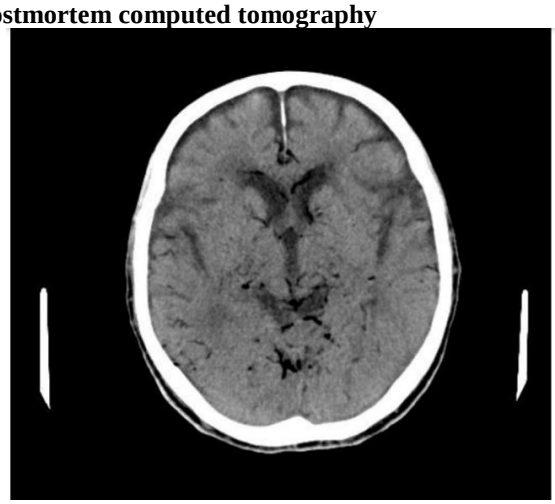
Kawanishi et al.[1] showed that PMCT revealed cause of death in 54% of cases. If PMCT was performed in 6 hours from death and cardiopulmonary resuscitation (CPR) or artificial ventilation was not performed, gas in the brain or liver might be air embolism as a cause of death.[2] However, when CPR was performed, chest compression or positive pressure ventilation causes the gas in the organ.[3] We report a case with massive gases in the brain, heart, liver, and kidney in PMCT after CPR.

CASE REPORT
An 85-year-old man, who had emphysema and dementia, was emergency transported to our hospital. His family found him in a cardiac arrest at 13:30 and they confirmed that he was alive at 12:30.

An ambulance arrived at his home at 13:42. A venous route was secured with acetated Ringer's solution, and chest compression and mask ventilation were started by paramedics at 13:52. Epinephrine 1 mg was administered intravenously.

He arrived at our hospital at 14:27. His pupils were dilated (diameter 6mm, no difference between right and left), without a light reflex. An electrocardiogram (ECG) showed asystole. His lower jaw rigidity was observed. We stopped CPR and confirmed his death at 14:36. PMCT was performed at 14:40, and showed obstruction of the bilateral bronchi, massive gases in the brain, heart, liver, and kidney (Fig.1). No autopsy was performed.

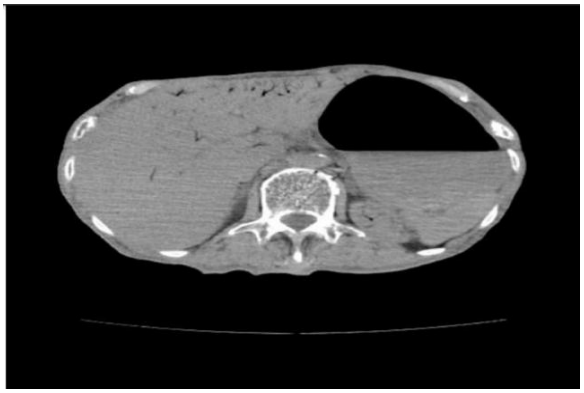
Postmortem computed tomography



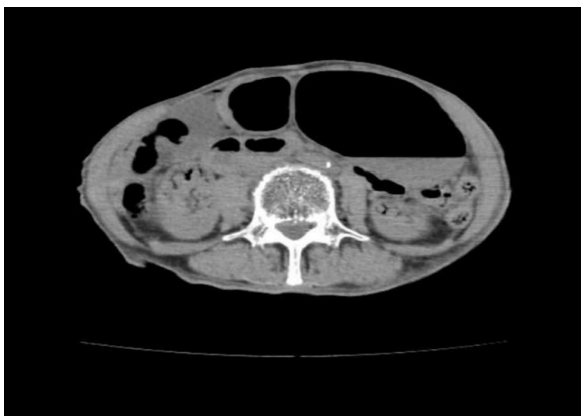
1. Gases were observed in the brain.

2. Bilateral bronchi was obstructed. Pleural effusion was observed.

3. Gases were observed in the right and left heart.



4. Gases were observed in the liver.



5. Gases were observed in the kidney. Intestine was dilated by gases.

DISCUSSION

This case had already lower jaw rigidity when he arrived at our hospital. Therefore, 2-3 hours might have passed after his death. He arrived at the hospital at 14:27, and he was alive at 12:30, which suggested his heart was arrested just after 12:30. It might be about 2 hours from his death to the PMCT.

Shiotani et al.[4] observed gas in the cardiovascular system in 71% of 228 cases who received CPR, but no gas in 9 cases without CPR. Our case received CPR, therefore, we could not decide that the gases in the organs were air embolisms as the cause of his death.

The PMCT showed gas in the heart,[4] in the brain and heart,[5] and portal vein[6] at 2 hours from death、in the brain and liver at 4 hours from death,[2] and in the liver, spleen, pancreas, and kidney at 80 to 1200 minutes from death.[7] However, there is only one case with massive gases in the brain, heart, liver and kidney by PMCT reported by Zenda et al.[3] Their case had received CPR for more than one hour and PMCT was performed at 5.5 hours after the death. Our case received CPR for 40 minutes and PMCT was performed at 2 hours from his death, but massive gases were observed.

There was no difference in the duration of the CPR between the cases with chest injury and gas in the heart and aorta, and the cases without chest injury and gas.[1] Therefore, there is no relation between the time after death and gas in the organs by PMCT.[7]

Enterobacteria produces putrefactive gas after death of the host. It occurs 24 to 48 hours after the death,[8] therefore, our case did not have this kind of gas.

Two kinds of the gases were observed in PMCT; one is seen in the superior and inferior vena cava and right ventricle, which comes from intravenous catheter, another is observed in the left ventricle, liver, and brain, which comes from injured lung or dissolved gas,[9] Dissolved gas was vaporized by chest compression.[10] Chest compression and/or positive pressure ventilation injured pulmonary blood vessels and alveoli.,[4,11] then gases went into the vessels. Shiotani et al.[5] told that gas embolism in the brain artery was induced by barotrauma of the lung and venous gas embolism was produced by chest compression and positive pressure ventilation. Mask ventilation dilates intestine by gas insertion, and it induces gas in the portal vein,[6] Our case did not have rib fractures, but had emphysema, therefore, chest compression and positive pressure ventilation might induce lung injury and gas went into the vessels. In addition, mask ventilation puts the gas into the intestine, which dilates intestine and induces gas into the portal vein.

The obstruction of bilateral bronchi in the PMCT was only the one which could suggest the cause of his death. Aspiration might induce the obstruction of bilateral

bronchi. The obstruction increased intra-alveolar pressure to break alveoli, and gas embolism might happen to cause death. Therefore, we could not confirm the gases in multiple organs were the cause of death or results of CPR in this case.

We should keep in mind that PMCT might show massive gases in many organs even with a short duration of CPR, though these were cause of death or results of CPR.

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