中文題目：磁振照影顯影劑罕見副作用

英文題目：Acute Respiratory Distress Syndrome Following Gadolinium Administration

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Abstract

Gadolinium-based agent was applied in the contrast enhancement of magnetic resonance image (MRI) worldwide and it was considered as one of the safe agents in the world. It has extremely rare life-threatening systemic complications, which could lead to bronchospasm, cardiovascular arrest, and even death. However, gadolinium related hypersensitivity reactions with complication of acute respiratory distress syndrome were rarely reported in the past. We reported a case of a 51-year-old male patient who developed non-cardiogenic pulmonary edema and acute respiratory distress syndrome following intravenous injection of gadolinium.

Case Report

A 51-year-old man was relative robust in the past, and he had no prior history to contrast agent exposure and drug allergies. The patient visited our OPD presented with persistent cough for about 2 months, and the chest radiography disclosed a mass lesion over right upper lobe of lung, which lung cancer was highly suspected. Therefore, the patient was suggested to be admitted for tumor study and staging.

His blood test including complete blood cell count and electrolytes were within normal range when admission. Estimated glomeruli filtration rate was 111.25mL/min/1.73m^2. For tumor staging, the patient underwent brain MRI with injection of 8.5 mL (0.1 mL/kg body weight) of gadolinium. Two hours later after scanning of brain MRI, the patient developed rapidly progressive foamy sputum, dyspnea, desaturation and hypotension. The chest radiography demonstrated ground glass opacity and infiltration over bilateral lung fields. Under the impression of contrast medium causing anaphylactic shock complicated with acute pulmonary edema and acute respiratory distress syndrome, the patient underwent the endotracheal tube intubation with mechanical ventilator support, and he was transferred to intensive care unit for advanced monitoring. Transthoracic echocardiography showed the heart function was preserved without any wall motion defect, and the blood profiles revealed no abnormal serum data of cardiac enzymes. Therapy with intravenous steroids and large dose of diuretic agents with restricted

fluid infusion were arranged. The patient's clinical condition rapidly improved within 3 days, and he was extubated without any complications.

Discussion

Gadolinium-based MRI contrast agent was often preferred as it provided superior quality MRI conditions and low rates of adverse reactions. Adverse effects to contrast agents contained chemotoxic reactions and hypersensitivity reactions. Chemotoxic reactions, sometimes called physiologic reactions including flushing, nausea, or vomiting are related to dosage and infusion rate. Hypersensitivity reactions, also called anaphylactic reactions including angioedema, diffuse wheezing, hypotension, and even loss of consciousness are independent on dosage and infusion rate. An observational study enrolled 14,299 patients and the results revealed nausea was the most frequent side effect (0.25%), followed by urticaria (0.08%). Only one patient had severe hypersensitivity reactions. [1]. In another study, gadolinium-based MRI contrast agent related hypersensitivity reactions were seen in 0.079% of patients, and the recurrence rate of hypersensitivity reactions was 30% in patients with previous reactions. [2].

Similar reactions to gadolinium-based contrast media have been rarely described in the literature. Jihye Park and Il Hwan Byun described a 26-year-old female presented respiratory difficulty, edema of the lips, and diffuse wheezing upon auscultation after injection of gadobutrol. Severe acute respiratory distress syndrome was diagnosed based on PaO2/FiO2 ratio less than 100, and chest radiography disclosed bilateral central bat-wing consolidation. After mechanical ventilation support for 3 days, she was extubated and discharge under stable status. [3].

Anaphylaxis is defined as a severe, life-threatening generalized or systemic hypersensitivity reaction. In the past, anaphylaxis may be termed anaphylaxis reactions for IgE dependent events or anaphylactoid reactions for IgE independent events. The clinical presentations of the two reactions are usually indistinguishable. [4]. Activation of mast cell results in degranulation and release of histamine, leukotriene, prostaglandins and cytokines by IgE-mediated mechanisms or non IgE-mediated mechanisms is still controversial in immediate hypersensitivity to radiocontrast media.

Acute respiratory distress syndrome is described by the acute onset of clinically hypoxemia with presence of diffuse bilateral pulmonary infiltration. The acute

respiratory distress syndrome is characterized by the influx of water and proteins from the intravascular space to the interstitial space caused by increased permeability of the alveolar–capillary barrier. The consequences of endothelial injury and increased vascular permeability result in the pulmonary edema. [5]. The pathophysiology of acute respiratory distress syndrome caused by Gadolinium-based contrast media is not clear. It had been suggested that it was the result of widespread alveolar damage induced by more than one mechanism of chemical mediators and other inflammatory pathway.

As the patient developed dyspnea after gadolinium administration, it needed to keep airway patent with adequate oxygen support. If the patient was going to reveal respiratory failure, even acute respiratory distress syndrome, emergent endotracheal intubation with mechanical ventilator support was required. Administration of diuretics should be begun and monitoring of patient's renal function, electrolytes and fluid status was needed. Emergent hemodialysis might be playing a role of management of fluid overloading with acute pulmonary edema but it could not replace the gadolinium agents out of bodies.

Conclusion

Gadolinium-based contrast agents could induce life-threatening adverse effects, including acute pulmonary edema and acute respiratory distress syndrome. Anaphylaxis is a critical condition, and it might happen within minutes to several hours after administration of gadolinium-based contrast agent. Maintenance of airway and breathing with advanced life support was needed, and consideration to this seriously adverse effect was requested rapidly to make the differential diagnosis for adequate approaching the complication. We would like to report this case that reminded clinical physicians to keep in mind the rare complication while patients undergoing gadolinium administration.

References

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Figures to legend

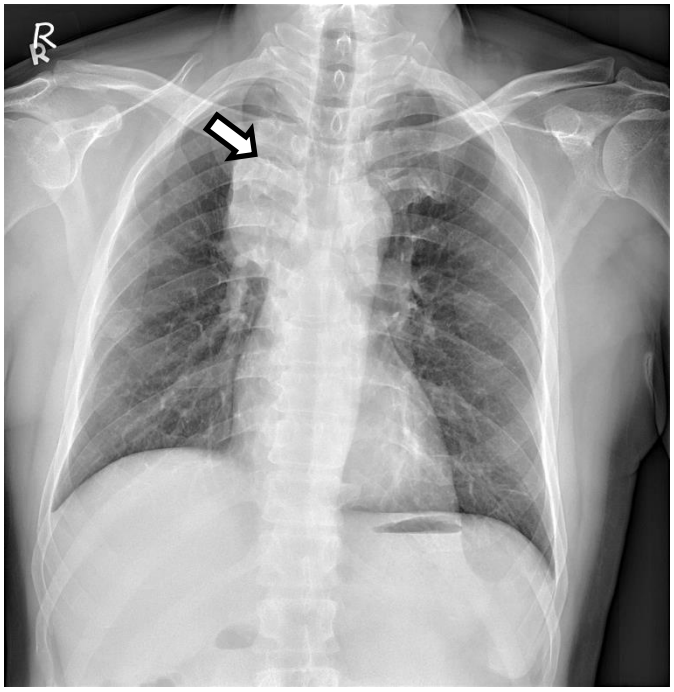

Figure 1. A mass lesion (arrow) over right upper lobe adjacent to mediastinum before admission

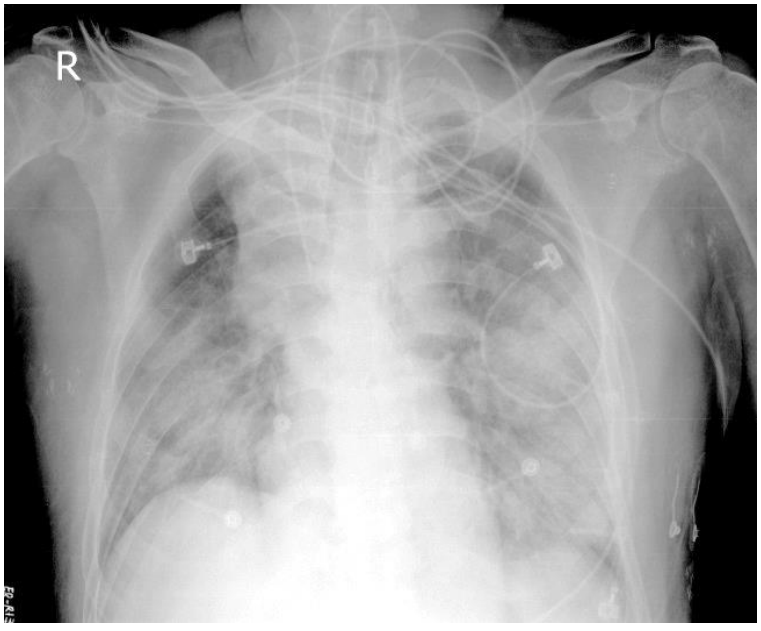

Figure 2. Pulmonary edema two hours later after administration of gadolinium, complicated with acute respiratory distress syndrome and respiratory failure.