preexisting cardiac disease and is due to intravascular volume expansion due to the osmotic effects of the contrast media (2). Non-cardiogenic pulmonary edema appears to be a rare occurrence following the administration of contrast media. In large clinical surveys on adverse reactions to contrast media the reported incidence of pulmonary edema ranges from .001% to .08% (1). In our case, pulmonary edema was considered to be non-cardiogenic in origin because of a lack of clinical findings that would suggest cardiac dysfunction.

The pathophysiology of non-cardiogenic pulmonary edema following the administration of contrast media is poorly understood. Proposed mechanisms producing disruption of the pulmonary-capillary barrier have included neurogenic and inflammatory processes (4, 5). In this case, a neurogenic origin is unlikely to be an important mechanism of non-cardiogenic pulmonary edema, because of the absence of clinical findings that would suggest cerebral dysfunction. Inflammatory mechanisms appear to play an important role, as other reactions to contrast media, such as bronchospasm, urticaria, and hypotension have long been thought to be mediated by inflammations.

Possible mediators of the pulmonary-capillary permeability defect include activation of the classic or alternative complement pathways, the formation of antibodies to contrast media, the direct effects of con-

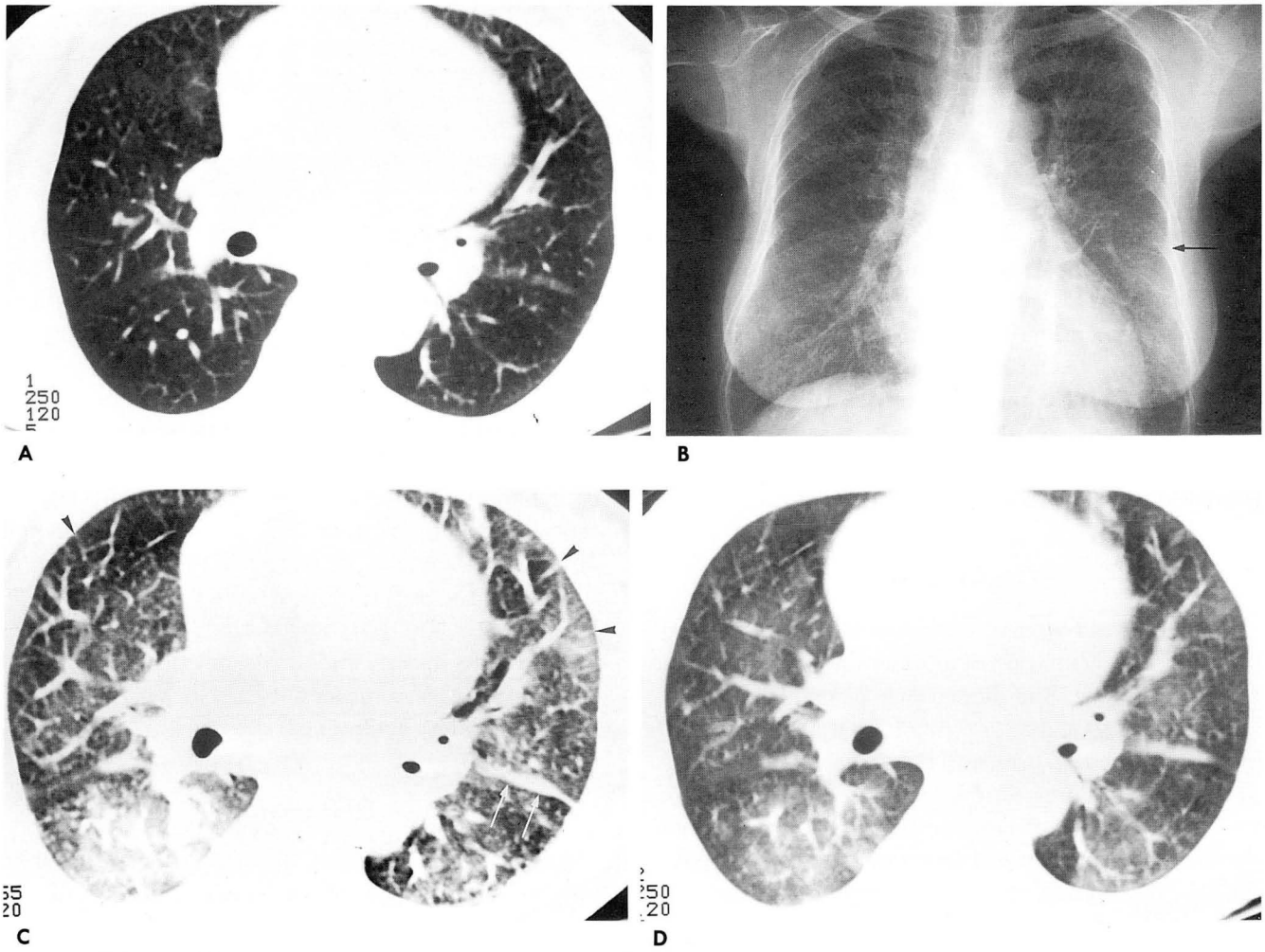

Fig. 1. A 53-year-old woman with intravenous contrast media induced pulmonary edema.
A. Precontrast CT scan at the level of bronchus intermedius shows no significant abnormality.
B. Chest radiograph obtained 60 minutes after the intravenous injection of the contrast media demonstrates multiple linear opacities including Kerley's-B lines (arrow) and peribronchovascular cuffing.
C. CT scan obtained right after the injection of contrast media shows areas of ground-glass opacification, focal air space consolidation, thickening of interlobular septae (arrowheads) and interlobar fissure (white arrows).
D. CT scan obtained 90 minutes after the injection of contrast media shows the ground-glass opacification and interlobular septal thickenings partly disappeared. Note also areas of focal air space consolidation in right lower lobe shown in (b) has been changed into areas of ground-glass opacity.

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Acute Pulmonary Edema after Intravenous Administration of Nonionic Contrast Media : A Case Report[1]

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We describe high-resolution CT findings of pulmonary edema following the administration of intravenous nonionic contrast media in a patient who had no previous history of cardiovascular disease ; areas of ground glass opacity and interlobular septal thickenings which partly disappeared on scans obtained 90 minutes after the initial scans. The proposed mechanisms of pulmonary edema are briefly discussed.

Index Words : Contrast media, toxicity
Lung, CT
Lung, edema

Pulmonary edema following the administration of contrast media is an uncommon but life-threatening complication (1). Chest radiographic findings of pulmonary edema induced by intravenous contrast media have already been documented (2-4), but such findings on CT have not been well described (5). We recently observed on CT scan a patient with acute pulmonary edema occurring after the intravenous administration of nonionic contrast media.

Case report

A 53-year-old woman underwent chest CT angiography for the evaluation of unilateral weak pulse in the upper extremity. She denied any prior history of allergic reaction, cardiac or pulmonary disease. To determined scan level, pre-contrast scans (Fig. 1A) were obtained. A total of 120mL iopromide (Ultravist, 370 mg/mL ; Schering, Erlangen, Germany) was adminisiteed with a mechanical injector at a flow rate of 3 mL/sec. Within several minutes of this intravenous bolus injection of contrast media, the patient complained of dyspnea and a sensation of fullness in the neck, and then, began to produce frothy sputum. Immediate physical examination revealed a rapid and faintly palpable carotid pulse. Blood pressure was 90/70mmHg, pulse rate was 120/min and respiration rate was 32/min. No wheezes were audible. During continuous positive airway pressure (CPAP) at 5 cm H_2O of oxygen by face mask, clinical symptoms were markedly improved. A CT scan obtained 15 minutes later showed area of ground-glass opacity, and interlobular septal thickening (Fig. 1C). A chest radiograph obtained 60 minutes later revealed multiple interlobular septal thickening in both lungs (Fig. 1B). She did not, however, complain of dyspnea or a sensation of fullness in the neck. A follow-up CT scan obtained 90 minutes later (Fig. 1D) showed a decrease in the area of ground-glass opacity and degree of interlobular septal thickening. After a futher CT scan, she was discharged without residual symptoms.

Discussion

Adverse reactions have been reported to occur in approximately 13% of the ionic and 3% of the nonionic intravenous contrast media examinations (6). Major life threatening complications of intravenous contrast media injection include a drop in blood pressure, ventricular fibrillation, circulatory collapse, angina, cardiac arrest, laryngeal edema and pulmonary edema (7).

Pulmonary edema is an uncommon complication associated with the intravenous administration of contrast media. It usually occurs in patients with

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trast media on the endothelial surface due to their osmolarity, and their effects on mast cells and basophils, resulting in the release of histamine (8-9).

Our case raises another potential cause of non-cardiogenic pulmonary edema. Upper airway obstruction is a well-recognized cause of this condition; edema of the larynx, epiglottis, or surrounding tissues can occur following contrast media exposure leading to upper airway obstruction. The main mechanism proposed for the development of pulmonary edema is the generation of negative intrathoracic pressures from attempted inspiration against an obstructed upper airway (Müller's maneuver). This results in an increase in pulmonary blood volume and decreases pulmonary capillary perivascular pressures, both of which favor the formation of pulmonary edema (10). In most patients with pulmonary edema caused by upper airway obstruction, the pulmonary edema resolves rapidly, usually within 24 hours. The rapid resolution of respiratory symptoms and hypotension over several hours reduces the risk of significant pulmonary capillary injury and supports a transient hydrostatic process for the formation of this patients pulmonary edema, the occurrece of which following upper airway obstructions, has been described.

In summary, we report a case of non-cardiogenic pulmonary edema following intravenous injection of contrast media. Inflammatory or osmotic injury to the pulmonary-capillary membrane appears to be the main mechanism leading to this form of pulmonary edema. Occult upper airway obstruction should also be considered since its presentation may be subtle and it represents a potentially preventable and reversible cause of non-cardiogenic pulmonary edema.

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비이온성 조영제의 정맥 투여후 발생된 급성 폐부종:1예보고[1]

[1]서울대학교 의과대학 진단방사선과학교실

천정은 · 임정기 · 정진욱 · 박재형 · 한만청

저자들은 심폐질환의 과거력이 없었던 환자에서 비이온성 경정맥 조영제 주입후 발생한 폐부종 1예를 경험하였기에 고찰과 함께 CT 소견을 보고하는 바이다. 병변은 조영제 주입직후 젖빛 유리음영과 소엽간 중격의 비후를 보였으며 이는 90분뒤 시행한 CT 스캔에서 부분적으로 소실되었다.

1997년 연세의대 진단방사선과학교실 연수교육

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   연수교육 책임교수 : 유형식
   연수교육 담당교수 : 서진석

MRI update 1997

MRI update Hand-on　　1997년 3월 22일 (토요일)

14:00－15:00	MRI Basic Hardware 소개 및 Clinical & Research Mode 설명	정 은 기
15:10－16:00	Brain Imaging, EPI & Diffusion, Functional Imaging	윤 평 호
16:00－17:00	Brain, Spectroscopy	전 평
17:00－18:00	Abdomen & Pelvis & Torso Coil Image	김 명 진
18:00－19:00	Musculoskeletal Imaging, T1-T2 Map & Tumor Perfusion	서 진 석
	(실기강의록 별도＋Chosing with Dinner)	

MRI update 강의　　1997년 3월 23일 (일요일)

9:00－ 9:30	Overview of MR Hardware	정 은 기
9:30－10:10	MR Physics, Advanced : EPI and Technical Applications	정 은 기
10:10－10:40	Brain, Diffusion, Perfusion, Functional Imaging of CSF Flow	윤 평 호
10:40－11:00	휴 식	
11:00－11:30	MR Angiography : Clinical Application	정 태 섭
11:30－12:00	Congenital Spinal Anomaly	윤 춘 식
12:00－12:20	질의 및 토의	
12:20－13:30	점 심	
13:30－14:00	Heart, Myocardial Infract, Perfusion, Wall Motion Study	최 규 옥
14:00－14:30	Breast	오 기 근
14:30－15:00	Abdomen, Fast imaging (Dynamic, Breath-hold, MRCP)	유 정 식
15:00－15:20	Coffee Break	
15:20－15:50	Genitourinary System, Recent Trends	김 명 진
15:50－16:20	Musculoskeletal System, Tumor & Cartilage Imaging	서 진 석
16:20－16:30	종합 질의 및 토의	전 체 연 자

	3월 22일 실기 (Hand-on)	3월 23일 강좌
수강신청 :	20명 선착순 (사전등록만 가능) (단, 병원 사정에 의해 변동가능함)	250명 선착순 (사전, 현장등록 가능)
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