

## Ethylene Oxide(EO) Induced Cutaneous Hypersensitivity in a Patient on Hemodialysis

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A 46-year-old male patient had recurrent episodes of generalized pruritic wheals during hemodialysis. He has experienced urticaria during hemodialysis whenever he used a capillary dialyser sterilized by ethylene oxide(EO, Polysulfone®) gas which is used to sterilize hemodialysers and other medical equipment. On the other hand, capillary dialyser sterilized by Gamma ray (Hemophan®) has not evoked urticaria. Although the presence of EO-specific antibodies was not detected, urticarial rash never developed when the equipment was switched to a gamma-sterilized one.

We herein report a case referred to ethylene oxide induced cutaneous hypersensitivity during hemodialysis.

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*Key Words* : Hemodialysis, Ethylene oxide(EO), Hypersensitivity.

Hypersensitivity reactions have been described due to a variety of substances. But the possible association of ethylene oxide(EO) hypersensitivity during hemodialysis was first reported by Dolovich and Bell in 1978<sup>1</sup>. EO is the most commonly used agent to sterilize dialysers and other medical equipment that can not withstand heat sterilization.

During hemodialysis, there may be complex interactions between the patient and all the components of the extracorporeal circuit. These interactions may cause specific immunological response such as formation of antibody or sensitized T cells that specifically recognize a given substance or

antigen. In a hemodialyser the blood and dialysis fluid flow countercurrently.

We describe a patient with ethylene oxide(EO) gas induced cutaneous hypersensitivity during hemodialysis.

### CASE REPORT

A 46-year-old male patient had received hemodialysis because of chronic renal failure since Feb. 2000. He had no past history of hypersensitivity reactions. In the beginning of hemodialysis he had few complaints although he was noted to have pruritus during hemodialysis. In the course of subsequent sessions, however, generalized wheals were developed(Figure) and then disappeared 2 hours after hemodialysis. During these episodes there were no changes in blood pressure and pulse nor any other signs of respiratory distress. In the laboratory findings, mild anemia and elevated serum BUN and creatinine level were noted. LFT, urinalysis, chest PA, EKG were within normal limit. The predialysis rinsing of the system was carried out with a larger amount of physiological saline. However, his symptoms did not diminish. He has ex-

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## Laboratory findings Laboratory findings

	Before dialysis	2hrs after dialysis	4hrs after dialysis
WBC ( $\times 10^3/\mu\text{l}$ )	4.17	7.12	7.04
Eosinophil ( $/\mu\text{l}$ )	124	170	177
Total IgE (KU/L)	1,827	1,921	1,903

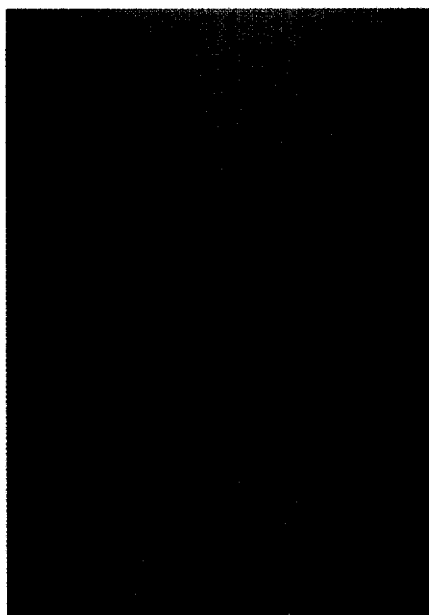


Fig. Erythematous pruritic wheals on the arm.

periened urticaria during hemodialysis using a capillary dialyser sterilized by EO (Polysulfone®). To rule out the possibility of adverse reaction to sterilizing agent, we changed the capillary dialyser sterilized by Gamma ray (Hemophan®). His symptoms were not developed. Although serum anti-EO IgE antibodies were not detected by RAST, the patient's WBC, eosinophil count and total IgE level were found to be elevated (table). He has not suffered from urticaria after changing the dialyser for 5 months. And there was no difference in the levels of uremic substances such as creatinine, urea, phosphate, reflecting the efficiency of the dialysis. Although EO-specific IgE was not detected, the sterilizing gas, EO, was considered to be a most likely causative agent.

We herein report a case referred to ethylene oxide hypersensitivity and suggest that change of dialyser should be considered in patients showing signs of hypersensitivity during hemodialysis.

## DISCUSSION

During hemodialysis there is a complex interaction between the patient and all the components of the extracorporeal circuit. In literature, the incidence of severe, non-fatal hypersensitivity reaction is estimated to be 4.2/100,000 dialysis<sup>2</sup>. Hemodialysis associated hypersensitivity reaction is characterized by a rapid onset of symptoms immediately after the return of blood.

Ethylene oxide(EO) gas has been used to sterilize disposable dialyser, blood tubing and other medical equipment that can not withstand heat sterilization. In order to be recognized by the human immunological system, a substance generally is a molecular weight greater than 3-5kDa. Thus, these proteins can act as complete antigens and cause hypersensitivity reaction. Low-molecular-weight agents, less than 1-3kDa such as EO cannot act as complete antigens. Instead, they act as haptens by combining with carrier protein. There is significant scientific evidence<sup>3</sup> that EO can haptenize human proteins such as human serum albumin(HSA), thus rendering the allergen EO-HSA. This is then recognized as foreign substance and induces formation of specific IgE antibody against EO-HSA. In our case, EO that resides on the extracorporeal capillary membrane would react with blood proteins forming allergen and then cross-link specific IgE on basophils and mast cells resulting in hypersensitivity, although predialysis rinsing of the system was carried out with a large amount of physiological saline. However, even the minimum quantity that

remains in the tubing system may be sufficient to provoke hypersensitivity reaction in certain patients<sup>4</sup>.

Bommer and co workers<sup>5</sup> detected the presence of EO-specific antibodies in 42% of hemodialysed patients. Caruana *et al.*<sup>6</sup> confirmed increased EO-specific antibody level of 70% of dialysed patients who displayed hypersensitivity reaction and in 10% of those without symptoms, indicating 30% of dialysed patients who had the same skin lesion showed negative EO-specific antibody findings. According to Lemke's examinations, there is a close correlation between the EO-specific IgE level and severity of hypersensitivity reaction<sup>7</sup>.

In our case, although serum anti-EO IgE antibodies were not detected by RAST, the clinical picture referred to EO hypersensitivity. The IgE level, however, was found to be elevated. EO-hypersensitivity was supported by the fact that hypersensitivity reactions stopped with the change of steam-sterilized dialysers. As the basic material of the two dialysers was identical, the difference may be explained by the different agents used in two different methods.

We recommend that, in patients showing signs of

hypersensitivity, steam-sterilized dialysers should be preferred.

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