Case Report

SAGE Open Medical Case Reports

Anaphylactic reaction to ethylene oxide in a hemodialysis patient

SAGE Open Medical Case Reports
Volume 7: 1–3

DOI: 10.1177/2050313X19838744
journals.sagepub.com/home/sco
SAGE

Bobak J Akhavan[1], Ugochi A Osborn[2] and Reeba Mathew[3]

Abstract

We present the case of a patient who developed a severe systemic allergic reaction during initiation of hemodialysis. The reaction completely resolved by switching the dialysis filter sterilized by ethylene oxide to a steam sterilized filter. Ethylene oxide is used to sterilize heat sensitive medical devices, and although allergic reactions related to ethylene oxide have been reported before, awareness is lacking among providers in the inpatient setting, specifically in the intensive care unit setting.

Keywords

Ethylene oxide, anaphylaxis, systemic allergy, hemodialysis filter, dialyzer

Date received: 11 October 2018; accepted: 27 February 2019

Introduction

We present an unusual case of an anaphylactic reaction during dialysis that resolved when the dialysis filter sterilized by ethylene oxide (EO) was changed. EO membranes are known to cause immunoglobulin E (IgE) anaphylactic sensitizations and reactions. It is important to know that dialysis filter reactions are not as common as in the earlier times due to recent innovations and enhancements in the production of said membranes as well as enhanced biochemical compatible membranes.[1] Due to the rarity of these reactions in recent times, it is important that awareness of these reactions by early identification and appropriate management be undertaken.

Case presentation

Our patient is a 73-year-old Chinese woman with history of hepatitis B, hypertension, insulin-dependent diabetes mellitus, chronic kidney disease (stage III), and hepatocellular carcinoma (HCC), who initially presented to the hospital for elective trans-arterial embolization of the HCC. She successfully underwent bland embolization of the right hepatic lobe for the HCC, but was admitted for monitoring due to concern for post-embolization syndrome with right upper quadrant pain, low grade fever, and elevation of transaminases and bilirubin. Over the next 48 h, she developed encephalopathy and oliguria with an upward trending creatinine to 4.36 mg/dL from a baseline value of 2.0 mg/dL, along with azotemia of 80 mg/dL. She was subsequently transferred to the medical intensive care unit (ICU) to receive urgent hemodialysis (HD) for contrast-induced acute tubular necrosis. The patient tolerated her initial dialysis session well; no fluid was removed. She underwent a repeat HD session on the second day. Approximately 20 min after starting HD, the patient became dyspneic and complained of back pain. She was noted to have tachycardia and hypotension with heart rate in the 140 beats/min range and blood pressure of 90/50 mm Hg, respectively. Her respiratory rate was 30 breaths/min and her oxygen saturation in the low 80s.

On physical examination, the patient was found to have audible inspiratory stridor and was given two doses of racemic epinephrine via nebulizer along with 10 mg dexamethasone intravenous injection. HD was stopped and her symptoms

[1]Department of Internal Medicine, McGovern Medical School, The University of Texas Health Science Center at Houston, Houston, TX, USA
[2]Department of Renal Diseases and Hypertension, McGovern Medical School, The University of Texas Health Science Center at Houston, Houston, TX, USA
[3]Divisions of Pulmonary, Critical Care, Sleep Medicine, McGovern Medical School, The University of Texas Health Science Center at Houston, Houston, TX, USA

Corresponding Author:
Bobak J Akhavan, Department of Internal Medicine, McGovern Medical School, The University of Texas Health Science Center at Houston, 6431 Fannin St, Houston, TX 77030, USA.
Email: Bobak.J.Akhavan@uth.tmc.edu

improved. The following day, another session of HD was attempted. She again developed dyspnea, tachycardia, and hypotension. Dialysis was stopped and the decision was made to change the HD filter from an EO sterilized filter to a polyethersulfone dialyzer which is steam sterilized. HD was re-initiated with the new filter. Patient symptoms improved and she tolerated the remainder and subsequent sessions of HD without any further complication. Sepsis was considered; this was, however, ruled out with chest imaging that did not reveal infiltrates suggestive of infection and negative blood and urine cultures. The post-embolization syndrome resolved during the ICU stay.

Discussion

EO is a highly reactive potent alkylating gas frequently used for sterilization of heat sensitive medical devices such as leukocyte filters, infusion sets, ventriculo-peritoneal shunts, and so on and dialysis filters as in our patient's case.[2] Exposure to microparticles of EO that remain on the filters sensitize the patients, placing them at higher risk for a subsequent immediate type 1 hypersensitivity reaction mediated by IgE, mast cells, and basophils.[3–5] Systemic allergic reactions to EO are uncommon, with most reports of development of type 1 hypersensitivity reaction noted in the nephrology literature.[2,5] Our patient had her initial HD session that used EO sterilized filter without complications; however, her subsequent two episodes of HD resulted in similar presentations of respiratory distress and hemodynamic instability. Both episodes resolved upon termination of the HD session and administration of racemic epinephrine and steroids. Of note, blood was not returned to the patient on termination of HD. HD was re-attempted after replacing the filter with a steam sterilized filter (polyethersulfone) after which she had no further episodes.

The differential diagnosis of respiratory distress and hemodynamic instability during dialysis is wide and would include sepsis, reactions to drugs or product transfusions received simultaneously in the ICU, reaction to non-biocompatible or even biocompatible filters, and volume depletion. Allergic reactions to the dialysis filter, including EO-related allergic reactions, are often not thought of and consideration of the same is important in the management of a patient decompensating during HD. EO-related type 1 hypersensitivity reactions are rare, but potentially fatal.[2,5] They occur approximately 4/100,000 dialysis treatments.[4] This was first described in 1975 by Poothullil et al. in a HD patient and is also known to occur with peritoneal dialysis.[3] Symptoms include dyspnea, burning/heat sensation at the access site or throughout the body, angioedema, urticaria, rhinorrhea/lacrimation, abdominal cramping, and chest/back pain with symptom reproducibility when the same type or brand of dialyzer is used.[2,5] Typical features include a prior period of sensitization, occurrence in minutes after initiation of dialysis specifically after venous blood from the dialyzer circuit is returned to the patient and resolution with cessation of HD and use of non-EO sterilized filters.[2,6] Some of the methods to prevent allergic reaction to EO include double rinsing filters prior to use and use of gamma radiation or steam for sterilization of heat sensitive medical devices.[2,3,5] Testing may include radioallergosorbent test (RAST) against EO, skin testing, IgE levels including EO specific IgE levels, and eosinophil count.[2,6]

Conclusion

We present this case to raise awareness regarding the risk of developing a type 1 hypersensitivity reaction to EO sterilized dialysis filter. A high index of suspicion and timely intervention is required, and this includes immediate cessation of dialysis, discarding circuit blood to avoid patient exposure to additional allergen load and treatment of anaphylaxis with epinephrine, steroids, and diphenhydramine in addition to airway and hemodynamic support.[6] Inability to recognize the possibility of this adverse reaction may lead to unnecessary diagnostic and therapeutic management and potentially cause the patient additional harm. Future dialysis sessions should be undertaken using EO free dialyzers such as a steam sterilized filter. Provider education and awareness regarding the risk of developing a type 1 hypersensitivity reaction to EO sterilized dialysis filter is essential.

Acknowledgements

All authors have seen and approved the manuscript, contributed significantly to the work, and certified that the manuscript has not been previously published nor is not being considered for publication elsewhere. There are no patient identifying factors in the manuscript. Our institution does not require ethical approval for reporting individual cases or case series.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Informed consent

Written informed consent was obtained from a legally authorized representative(s) for anonymized patient information to be published in this article.

ORCID iD

Bobak J Akhavan https://orcid.org/0000-0002-0090-1293

References

1. Alvarez-de Lara MA and Martin Malo A. Hypersensitivity reactions to synthetic haemodialysis membranes-an emerging issue? *Nefrologia* 2014; 34(6): 698–702.
2. Rockel A, Klinke B, Hertel J, et al. Allergy to dialysis materials. *Nephrol Dial Transplant* 1989; 4(7): 646–652.
3. Poothullil J, Shimizu A, Day RP, et al. Anaphylaxis from the products of ethylene oxide gas. *Ann Intern Med* 1975; 82(1): 58–60.
4. Daugirdas JT and Ing TS. First-use reactions during hemodialysis: a definition of subtypes. *Kidney Int Suppl* 1988; 24: S37–S43.
5. Lemke HD, Heidland A and Schaefer RM. Hypersensitivity reactions during haemodialysis: role of complement fragments and ethylene oxide antibodies. *Nephrol Dial Transplant* 1990; 5(4): 264–269.
6. Kraske GK, Shinaberger JH and Klaustermeyer WB. Severe hypersensitivity reaction during hemodialysis. *Ann Allergy Asthma Immunol* 1997; 78(2): 217–220.