CASE REPORTS

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Anaphylaxis To Penicillin on Reperfusion during Liver Transplantation  
Sylvia Xi-Moy, M.D., Ph.D.,* Nancy K. Thorvilson, M.D.,† Charles E. Edmiston, Ph.D.,‡ Harvey J. Woehlck, M.D.§

PENICILLIN and its derivatives are the most common causes of drug-induced anaphylaxis, accounting for approximately 500 deaths/yr in the United States. Anaphylaxis in the recipient of a liver transplanted during reperfusion caused by penicillin administered only to the donor organ has not been reported previously. Although the clinical manifestations and management of anaphylaxis are well-established, anaphylaxis may be difficult to identify during liver transplantation because many signs of anaphylaxis and postreperfusion syndrome overlap. We present a case of anaphylaxis and severe reperfusion syndrome that occurred in a patient with a documented penicillin allergy and a previous episode of anaphylaxis who was exposed to penicillin that was administered only to the donor organ.

Case Report  
The patient was a 62-yr-old, 85-kg, 147-cm woman with end-stage liver disease secondary to autoimmune hepatitis. She was fully aware but previously had hepatic encephalopathy. Transvenous intrahepatic port-systemic shunting was performed before transplantation for variceal bleeding. Preoperative cardiac function evaluated via dobutamine stress echocardiography was normal. The patient was allergic to penicillin and had previously had an anaphylactic reaction to penicillin characterized by urticaria, dyspnea, and airway edema, which necessitated endotracheal intubation.

The patient underwent orthotopic liver transplantation with use of venous bypass. Monitoring included radial and pulmonary arterial catheters. Baseline hemodynamics included blood pressure, 150/70 mmHg; pulse, 80; pulmonary arterial pressure, 56/25; central venous pressure, 12, cardiac output, 6.7 L/min. Anesthetization was performed with fentanyl, ketamine, and succinylcholine and maintained with isoflurane, pancuronium, and fentanyl. At the beginning of the operation, airway pressure of 30 cm H_2O resulted in a 700-ml tidal volume (∗12 breaths/min). Approximately 30 min before reperfusion, 500 mg methylprednisolone was administered for immunosuppression. The overall prehepatic and anhepatic phases were unremarkable. The donor liver was flushed with approximately 1,000 ml of Ringer's lactate, and the liver was reperfused after completion of vascular anastomoses.

Severe bronchospasm developed within 2 or 3 min after reperfusion; simultaneously, pulmonary arterial pressure increased to 50/39 mmHg, central venous pressure increased to 22 mmHg, and arterial blood pressure progressively decreased to 30 mmHg, after which no pulse pressure could be detected and pulse oximetry registered no pulse. Ventilation became difficult as pulmonary compliance markedly decreased. With use of the integral ventilator of a Draeger Narkomed anesthesia machine (Telford, PA), an intended tidal volume of 700 ml produced airway pressures greater than 50 cm H_2O. Actual tidal volumes of only 100-200 ml resulted because of the high-pressure limiting feature of the ventilator. Because of limited access under the drapes, it was not possible to thoroughly examine the patient for cutaneous manifestations of anaphylaxis, such as urticaria. Treatment with a 1-mg bolus of epinephrine was initiated for combined hypotension and bronchospasm. During this time, electrocardiography showed sinus bradycardia, first-degree atrioventricular block, and junctional rhythms.

Treatment with chest compressions and 100% inspired oxygen was instituted, and isoflurane was discontinued to facilitate resuscitation. The patient required a total of five doses of epinephrine (1 mg) at intervals of 2-4 min, followed by a continuous infusion to maintain blood pressure and relieve bronchospasm. During the first 30 min, bronchospasm and hypotension recurred when attempts were made to reduce or discontinue the epinephrine infusion. An additional 500 mg methylprednisolone was administered. By 30 min after reperfusion, hemodynamic stability was restored and the pulmonary artery pressure remained slightly above baseline. Postoperatively, the patient had an uneventful recovery and was discharged to her home.

Discussion  
Because the recipient was allergic to penicillin and demonstrated anaphylaxis in the past, no penicillin was
administered preoperatively. At the time of this case, our pharmacy routinely added antibiotics to the UW solution (ViaSpan [Belzer UW], DuPont Merck Pharmaceutical Co., Wilmington, DE) used in organ harvesting. This antibiotic usually was penicillin G, as recommended by the manufacturers of UW solution and stated on the package insert, but if the donor or recipient was known to be allergic to penicillin, vancomycin was substituted according to protocol. Expecting that vancomycin had been added to the UW solution and not knowing that penicillin had been administered to the donor organ, we initially considered the possibility of an anaphylactoid reaction from rapid release of vancomycin into the circulation during reperfusion. We subsequently discovered that, at the time of the organ procurement, the identity of the recipient was not known, and penicillin G was added to the UW solution as recommended in the package insert. Unintentional administration of penicillin through solid organ transplantation appeared to result in an anaphylactic reaction in this patient. Because recipient identity may not be known when organs are harvested, unintentional administration of penicillin also may occur when organs are shared among institutions if these antibiotic protocols are followed.

In this patient, the diagnosis of anaphylaxis depended on the identification of signs and symptoms of anaphylaxis that have no counterpart in reperfusion syndrome.1-3 The hemodynamic signs of anaphylaxis also are present during reperfusion syndrome and, therefore, cannot be used to distinguish between these two conditions. Flushing and urticaria are cutaneous manifestations of anaphylaxis that are difficult to identify during anesthesia and surgery because of draping of the patient.4 Pulmonary hypertension may accompany not only anaphylaxis, but also postreperfusion syndrome.5-7 The clinical sign that most strongly identified anaphylaxis in this patient was the presence of severe bronchospasm, which has not been reported as a component of reperfusion syndrome and is the second most commonly identified manifestation of anaphylaxis during anesthesia.8

References