

Clinical reports

Repeated shock after suspected anaphylactic reaction to a pulmonary artery catheter

YOSHIHIRO SHIBATA, TOMOKO BABA, TOMOKO GOTO, and KENICHI OGATA

Department of Anesthesiology, Kumamoto Chuo Hospital, 96 Tainoshima, Tamukae-machi, Kumamoto 862, Japan

Key words: Anaphylactic shock, Pulmonary artery catheter, Latex

Introduction

Anaphylaxis is one of the most serious events in medical practice [1]. Agents responsible for anaphylaxis include both administered drugs and non-drugs, such as latex. We describe a case of repeated anaphylactic reactions immediately after pulmonary artery (PA) catheter positioning.

Case report

The patient was a 54-year-old male farmer. He had been suffering from hypertension but had no history of allergy or asthma. Two years earlier he had undergone surgery for entry closure of a dissecting thoracic aortic aneurysm (DeBakey IIIa). At surgery he was anesthetized with fentanyl, diazepam, vecuronium, and inhaled enflurane. A PA catheter (Swan-Ganz Thermodilution Catheter 7.5F, Baxter, Irvine, CA, USA) was inserted. Although his recovery was uneventful, an enlarged aneurysm was noted, and resection and replacement of the aneurysm was scheduled.

Anesthesia for the resection was induced by 5 mg diazepam, 0.9 mg fentanyl, and 12 mg vecuronium, and the trachea was intubated. The patient's blood pressure

and pulse rate were stable during induction of general anesthesia. After induction, a PA catheter (Swan-Ganz Thermodilution Catheter 7.5F, Baxter) was inserted via his right jugular vein. Before insertion, chlorhexidine was applied for disinfection. Immediately after the latex balloon was inflated and the PA catheter was positioned, his systolic blood pressure suddenly decreased from 110 to 30 mmHg, and a diffuse skin rash appeared. Although his arterial blood pressure was low, his cardiac output was $6.0 \text{ l} \cdot \text{min}^{-1}$. On auscultation his respiratory sound was weak, especially in his right lung, and peak inspiratory airway pressure was increased from 10 to 40 cmH₂O. He received closed cardiac massage, 3600 ml of volume expansion (crystalloids, hydroxyethyl starch, and human albumin), one shot of 1.0 mg norepinephrine, and continuous administration of epinephrine, norepinephrine, and dopamine (total dose 0.8 mg, 1.9 mg, and 72 mg, respectively) in the operating room. Thirty minutes later his arterial blood pressure was restored to 80/40 mmHg and his cardiac output was $11.0 \text{ l} \cdot \text{min}^{-1}$. His serum histamine level was found to be $8.0 \text{ ng} \cdot \text{ml}^{-1}$. The operation was postponed and the endotracheal tube was removed in the ICU. The PA catheter was removed the next day.

Skin-prick tests and intradermal skin tests to fentanyl, diazepam, vecuronium, and chlorhexidine were performed. No drugs revealed hypersensitivity, and the agent that provoked the anaphylactic reaction remained uncertain.

Three months later his operation was rescheduled. Anesthesia was induced with 10 mg midazolam, inhaled isoflurane, and 6 mg pancuronium, and his trachea was intubated. The duration from drug administration to endotracheal intubation was 30 min, much longer than for the first anesthetic induction. After induction of anesthesia, the same PA catheter as that used at previous shock was inserted. For disinfection, povidone iodine was applied. When the PA catheter reached his pulmonary artery, his systolic blood pressure decreased

Address correspondence to: Y. Shibata

Received for publication on April 4, 1997; accepted on September 11, 1997

abruptly from 120 to 50 mmHg, and the skin rash reappeared. He received volume expansion, epinephrine (total dose 1.0 mg), and dopamine (total dose 30 mg). One hour later, his blood pressure was restored to a normal level without administration of catecholamines, and the skin rash disappeared. Anesthesia was maintained with inhaled isoflurane, and cardiopulmonary bypass was established during aortic clamping. Heparin and protamine were used as usual in vascular surgery, and a 7800 ml blood transfusion was performed. The surgery was carried out uneventfully with the PA catheter in situ. The PA catheter was removed on the second postoperative day.

Postoperative lymphocyte proliferation tests were performed on midazolam, vecuronium, and the PA catheter rinse solution. The results were all negative. For latex, a skin-prick test and intradermal test were also performed. The latex extracts were not obtained from the latex balloon of the PA catheter. Instead, a 10-cm² high-ammonia latex sheet consisting of latex obtained from *Hevea brasiliensis* (Toray, Tokyo, Japan) was cut into small pieces, agitated in 5 ml physiological saline for 30 min, filtered through a 0.22- μ m filter, and diluted 10- and 100-fold with physiological saline. The results were negative. Neither radioallergosorbent test (RAST) nor radioimmunosorbent test (RIST) was performed.

Postoperatively, the patient recovered uneventfully and was discharged 62 days after surgery. Four months after discharge, he died of massive bleeding from a fistula between the aorta and esophagus.

Discussion

In the current case, the diagnosis of anaphylaxis was based on the presence of severe cardiovascular collapse, diffuse skin rash, bronchospasm, and increased serum histamine level. The anaphylactic shock occurred on two occasions immediately after the insertion of a PA catheter during general anesthesia. The materials suspected of provoking anaphylactic shock were anesthetic drugs and the materials related to the PA catheter insertion, such as disinfectant and latex. Skin tests were performed on the anesthetic drugs, but the results were all negative.

At the rescheduled surgery, all the anesthetic drugs were changed. In addition, the duration from anesthetic induction to PA catheter insertion was 30 min, which was much longer than the first anesthetic induction. This successfully excluded the possibility of anesthetics. Chlorhexidine, which was used as a disinfectant at the first scheduled surgery, has been reported to be a material that provokes anaphylaxis [2]. In this case, shock

was not prevented, though the disinfectant was changed from chlorhexidine to povidone iodine. So we strongly suspected that the latex balloon of the PA catheter was the causative material.

Attention is being increasingly focused on anaphylactic reactions provoked by latex [3]. It has been reported that anaphylactic reactions to latex have increased and are a leading cause of anaphylactic reactions during anesthesia in children [4]. Patients with spina bifida or those exposed to latex as a result of multiple operative procedures are at risk of anaphylaxis provoked by latex [5]. Health-care workers and hospital employees are also at risk for progressive sensitization to latex [3]. In addition, a case in which a severe anaphylactic reaction was provoked by a PA catheter balloon has been reported [6].

In the current case, the patient had no history of allergy, including latex allergy. He had never experienced anaphylactic shock previously. He was not in any group at high risk for latex allergy, such as health-care workers. But he had undergone vascular surgery and at that time a PA catheter was inserted.

To diagnose anaphylaxis to latex, it would be necessary to have a positive skin test or immunological test. In the current case, a skin test was performed but the result was negative. Latex contains several different proteins [7]. Thus if the sensitizing latex product contained different materials from those in the assay, a false-negative result could occur [7]. It might be problematic that the latex extracts were obtained from a separate latex sample rather than the same PA catheter.

It might also be a problem whether skin testing was performed at the most suitable time. It is recommended that skin testing should be performed 1 month after a reaction [1,8]. We tested less than 1 month after the reaction, and at that time a false-negative response due to mediator depletion may have occurred. In the case described here, sophisticated immunological tests such as RAST or RIST were not performed. These immunological tests might have been beneficial, but are not as sensitive as a skin test [3].

Though concrete evidence that the anaphylactic shock was due to the latex balloon was lacking, the shock occurred immediately after the PA catheter insertion. At least some agent related to the PA catheter insertion should be the most suspect material, because the repeated shock immediately after the PA catheter insertion was effectively, though unintentionally, evaluated by a "use test."

In summary, we present a case of repeated anaphylactic shock which may be related to PA catheter insertion. Anesthesiologists should recognize the possibility of anaphylactic reaction caused by non-drugs.

References

1. Levy JH (1992) Anaphylactic reactions in anesthesia and intensive care, 2nd edn. Butterworth-Heinemann, Stoneham, MA
2. Harukuni I, Ishizawa Y, Nishikawa T, Takeshima R, Dohi S, Naito H (1992) Anaphylactic shock with ventricular fibrillation induced by chlorhexidine (in Japanese with English abstract). *Masui (Jpn J Anesthesiol)* 41:455–459
3. Holzman RS (1993) Latex allergy: an emerging operating room problem. *Anesth Analg* 76:635–641
4. Murat I (1993) Anaphylactic reactions during paediatric anaesthesia; results of the survey of the French Society of Paediatric Anaesthetists (ADARPEF) 1991–1992. *Paediatr Anaesth* 3:339–343
5. Gold M, Swartz JS, Braude BM, Dolovich J, Shandling B, Gilmour RF (1991) Intraoperative anaphylaxis: an association with latex sensitivity. *J Allergy Clin Immunol* 87:662–666
6. Gosgnach M, Bourel LM, Ducart A, Barre E, Viars P (1995) Pulmonary artery catheter balloon: an unusual cause of severe anaphylactic reaction. *Anesthesiology* 83:220–221
7. Kelly KJ, Kurup VP, Rejjula KE, Fink JN (1994) The diagnosis of natural rubber latex allergy. *J Allergy Clin Immunol* 93:813–816
8. Fisher M (1984) Intradermal testing after anaphylactoid reaction to anaesthetic drugs: practical aspects of performance and interpretation. *Anaesth Intens Care* 12:115–120