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Massive intra-cardiac emboli during cementless hemiarthroplasty of the hip: a mortality case report.

Authors:

Pai-Ching Huang, Kuen-Bao Chen, Yu-Cheng Liu, Albert Wai-Cheung Lau, Rick Sai-Chuen Wu*

(* Corresponding Author)

Institution:

Dept of Anesthesia, Pain Service & Critical Care Medicine, China Medical University & Hospital, #2 Yuh-Der Road, Taichung City 40447, Taiwan, ROC.

Case report:

The 95-year-old female with history of hypertension was admitted for further management of subcapital right femoral neck fracture, Garden type IV. Pre-operative transthoracic echocardiography (TTE) showed LV abnormal relaxation and moderate pulmonary hypertension with moderate PR, TR. Other lab data revealed nothing particular except anemia. Chest X-ray showed cardiomegaly with prominent bilateral pulmonary vascularity, and decreased height of L2/3 vertebral body.

The patient was scheduled for right hip cementless bipolar hemiarthroplasty. In the operating room, with initial vital sign of BP 163/92 mmHg, HR 84/min, and SpO₂ 96%, the patient was anesthetized with induction agents of IV fentanyl 50µg, etomidate 16mg, cisatracurium 4mg, and then maintained by inhaled sevoflurane. A-line and CVC were set up. Baseline ABG showed pH: 7.45, PaCO₂: 25.5, PaO₂: 123.5, SaO₂: 99.1%. The patient's vital sign was stable until sudden onset of hypotension (60/30 mmHg), bradycardia (50/min), low ETCO₂ (12mmHg), and desaturation (82%) one minute after the insertion of femoral stem. IV ephedrine, atropine, and epinephrine were given at once. ABG was then followed: pH: 7.28, PaCO₂: 58.3, PaO₂: 58.2, SaO₂: 92.3%. Prominent dilated RA and RV, both filled with massive "snow flurry", and interatrial septum bulged toward LA were noted in the subsequent transesophageal echocardiography (TEE) (Fig. 1). Massive air bubbles were noted when collecting blood from the CVC. Pulseless electrical activity (PEA) ensued 30 seconds later and CPR was initiated immediately. Under the impression of acute air embolism complicated with obstructive shock, the patient was placed in the Trendelenburg and left decubitus position. After 10-minute CPR, acid-base and electrolyte correction, and adequate fluid challenge with inotropic agents use, the patient's ECG returned to sinus tachycardia (152/min) with BP 125/90 mmHg. Unfortunately, another episode of bradycardia and progression to PEA recurred just before transferring the patient to the SICU. The last ABG in the operating room showed pH: 7.25, PaCO₂: 42.1, PaO₂: 80.5, SaO₂: 96.6%. CPR was lasted 12 minutes this time before the patient's arrival at SICU, where the patient's BP 102/80 mmHg, HR 159/min, and SpO₂ 77%. The patient passed away 8 hours later in the SICU despite subsequent supportive treatment.

Discussion:

Intra-operative mortality of cementless and cemented hemiarthroplasty of the hip were reported 0% (n=4400) and 0.43% (n=2814) respectively.¹ The other study showed that none of the patients scheduled for cementless hemiarthroplasty of the hip died during hospitalization (n=48, with a mean age of 88 y/o).² We present a very rare mortality case of cementless hemiarthroplasty due to a fatal intra-operative pulmonary embolic event.

The morbidity and mortality of hemiarthroplasty of the hip is mainly caused by bone cement implantation

syndrome (BCIS), which is now believed to be an embolic event during femoral reaming, cementation, prosthesis insertion, or reduction of the joint.³ Several kinds of emboli have been proven as cement particles,¹ fat,⁴ bone marrow,⁵ bone particles,⁶ air,⁷ and blood clot.⁸ BCIS has a broad spectrum of severity which is ranged from transient reduction of SaO₂ or BP⁹ to profound shock or cardiac arrest.¹ Intra-medullary pressure of femur during cementless hemiarthroplasty is much lower and thus with lower incidence and lesser severity of BCIS when compared with cemented hemiarthroplasty.^{5, 10}

Several risk factors in the genesis of BCIS have been identified: old age,¹ poor physical reserve,¹¹ impaired cardiopulmonary function,¹¹ long-stem femoral component,¹¹ and pre-existing pulmonary hypertension.¹² In patients with high risk of BCIS, avoidance of nitrous oxide which could exacerbate air embolism, avoidance of intravascular volume depletion,³ high level of peri-operative monitoring such as TEE or pulmonary artery catheter¹, and increase inspired oxygen concentration during stem insertion¹³ were recommended to minimize the risk.

Conclusion:

Although femoral cementless hemiarthroplasty is safer than cemented hemiarthroplasty in terms of BCIS, it still occurs. We report a very rare case of cementless hemiarthroplasty complicated with fatal intra-operative BCIS. We suggest that identifying the risk factors of BCIS and minimizing the risk by increased vigilance and aggressive peri-operative monitoring, must be considered in patients with advanced age, poor physical reserve, impaired cardiopulmonary function, long-stem femoral component, and pre-existing pulmonary hypertension, regardless of a very low reported incidence of fatal BCIS during the cementless hemiarthroplasty of the hip.



Fig. 1 ME AV SAX view: Enlarged RA and RV filled with massive “snow flurry”, and interatrial septum bulged toward LA. (AV, aortic valve; LA, left atrium; ME, midesophageal; RA, right atrium; RV, right ventricle; RVOT, right ventricular outflow tract; SAX, short axis.)

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