Research Paper

Volume : 4 | Issue : 6 | June 2015 • ISSN No 2277 - 8179

A Rare Incidence of Severe Anaphylaxis and Cardiac Arrest Following Bone Cement Implantation

Medical Science

KEYWORDS : Bone cement implantation, hypoxia, cardiac arrest, resuscitative measures

Dr. Prof (Col) V. R. R CHARI	(Professor) Department Of Anaesthesia, Dr. D. Y. Patil Medical College College, Pimpri, Pune 18,
Dr ARNAB PAUL	(Resident) Department Of Anaesthesia, Dr. D. Y. Patil Medical College College, Pimpri, Pune 18,

ABSTRACT

Bone cement implantation syndrome (BCIS) is a known cause of intra operative morbidity and mortality in patients undergoing cemented arthroplasty.Majority of these patients undergoing this surgery are > 65years old with female/male ratio 2:1 and there has been an increase in the number of ASA grade III/IV patients undergoing hip joint surgery in recent years because of increased longevity. The anaesthetic challenges faced by the anaesthetist are hypoxia, hypotension, cardiac arrhythmias, unexpected loss of consciousness and cardiac arrest or a combination of these features leading to death in 0.6 to 1% of patients. Cardiac arrest is a rare but potentially fatal complication.We report a rare case of BCIS in an elderly patient, which occurred during hemiarthroplasty under spinal anaesthesia.Within a few minutes of cementation patient developed severe hemodynamic compromise leading to shock and to cardiac arrest. Aggressive and early resuscitative measures led to desired outcome. Risk factors, etio-pathogenesis and management of this condition are discussed in brief.

INTRODUCTION

Bone cement implantation syndrome (BCIS) is a rare and a potentially fatal intraoperative complication occurring in patient undergoing cemented bone surgery.[1] It is an acute catastrophic intraoperative event and is characterized by hypoxia, hypotension, cardiac arrhythmias, unexpected loss of consciousness, cardiac arrest or a combination of these features leading to death. [2]It may occur at one of the five stages in the surgical procedure-femoral reaming, acetabular or femoral cement implantation, insertion of the prosthesis or joint reduction.Can also occur around the time of limb tourniquet deflation following total knee replacement surgery.

CASE REPORT

A 75 year old female patient was admitted with inter trochanteric fracture right femur following accidental fall in the bathroom on the previous day. She was posted for hemiarthroplasty of right hip. Her pre-anesthetic evaluation was unremarkable except that she was detected to have hypertension. All relevant investigations including hemoglobin (Hb%) of 10.6 gm.%, Electrocardiogram (ECG) and echocardiography (2 D ECHO) were normal . Hypertension was controlled preoperatively with tab amlodipine 5 mg and she was then accepted for surgery under spinal anesthesia (SA) in American Society of Anesthesiologists (ASA) grade III. On the operation table ringer lactate, intravenous (i.v) infusion was started and she was given spinal anaesthesia with 3 ml 0.5% hyperbaric bupivacaine.

On achieving adequate sensory and motor block surgery was conducted in left lateral position. Intra operatively her pulse rate, SpO_2, non-invasive blood pressure(NIBP) and electrocardiogram(ECG) were monitored . Oxygen supplement with a venturi mask was administered. During surgery her hemodynamic parameters were stable with PR varying between 68-84beats/min., systolic blood pressure (SBP) 110-130 mmHg, diastolic BP (DBP) 72-90mmHg and SpO2 100%. Hydrocortisone 100 mg i.v was administered prior to cement implantation to prevent anaphylactic reaction on introduction of bone cement.

Liquid methyl methacrylate 20 gm. was injected into the medullary canal using cement gun and long stem femoral prosthesis was inserted.After approximately 3-4 min. of cementation the patient became pulseless, BP and SpO2 were not recordable and she was unresponsive to verbal communication. ECG showed severe bradycardia (heart rate 15-20/min) and irregular QRS complexes. So immediately surgery was stopped, patient was turned supine, intubated and ventilated manually using 100% oxygen and external cardiac compressions were initiated and EtCo2 was monitored. The rate of i.v infusion was increased, inj. Atropine 0.6mg was administered iv followed by a bolus dose of epinephrine 1 mg iv and both the drugs were repeated 2 min later. Epinephrine 1mg diluted in 10ml normal saline was administered iv and hydrocortisone 100 mg i.v. was repeated. Her ECG was taken which showed normal sinus rhythm after 3min.of initiation of resuscitation. Subsequently surgery was allowed to complete. Patient was then shifted to intensive care unit (ICU) and managed on ventilator support with FiO2 0.6(60% oxygen) and other supportive measures.Post operatively her ECG was normal, other vital parameters were stable and urine output was adequate. Arterial blood gas analysis done at 2 hourly interval showed metabolic acidosis despite good oxygenation and ventilation. Sodium bicarbonate was administered as per requirement to correct metabolic acidosis. Patient regained consciousness after about 2 hours and showed improvement in cardiopulmonary and higher mental function. Norepinephrine infusion was gradually tapered off over next 4 hours and patient was weaned off the ventilator over next 8 hours. Subsequent postoperative course was uneventful.

DISCUSSION:

The aim of reporting of this case is to show a rare and fulminant intraoperative catastrophic event occuring in a susceptible patient following use of cement in a patient undergoing hemiarthroplasty .Severe anaphylaxis and cardiovascular collapse following cement implantation is a known complication of this procedure although fatality is rare.[3,4] Our patient was an elderly female who was detected to have hypertension on admission and was therefore accepted for surgery under SA in ASA grade III after thorough evaluation. It is known that geriatric patients, with impaired cardio-pulmonary function, osteoporosis and pre-existing pulmonary hypertension are at a higher risk of developing BCIS.[5]Our patient was a likely candidate to have these risk factors because of her age and pre-existing hypertension.

A combination of various processes is involved in development of BCIS. Earlier it was believed that release of methyl methacrylate (MMA) cement monomer into circulation causing sudden severe systemic vasodilation and cardiovascular collapse was considered to be the cause of this catastrophic event.[6] Recently additional hypothesis has been propounded that the concentration of the MMA released in to circulation is much less

than required to cause cardiopulmonary effects.[1] During arthroplasty high intramedullary pressure develops (> 300 mmHg) during cementation and prosthesis insertion.[6] Expansion of this cement in the space between the prosthesis and bone as a result of exothermic reaction traps air and medullary contents (fat, marrow, cement particles, air, bone particles, aggregates of platelets and fibrin) in this space under pressure which are forced into circulation as emboli.[6]The embolic load may cause life threatening anaphylaxis,systemic hypotension, mechanical obstruction of pulmonary circulation, increase in pulmonary vascular resistance (PVR) and pulmonary hypertension, increased central venous pressure (CVP), pulmonary edema and bronchospasm resulting in hypoxemia.[6-8] Certain precautions need to be observed in elderly patients posted for hip arthroplasty.These patients must be subjected to thorough pre anesthetic evaluation including investigations and pre-optimization of co-morbid conditions. Anaesthetic technique must be tailored to individual patient. Use of volatile anesthetics is associated with greater hemodynamic changes for the same embolic load than high dose fentanyl-diazepam anesthesia which is therefore preferred for general anaesthesia(GA).[1] High concentration of oxygen must be given throughout intra-operative period.

High level of hemodynamic monitoring is required especially in high risk patients such as CVP and use of transesophageal echocardiography (TEE). Et CO_2 monitoring is also essential for surgery under GA as sudden drop in Et CO_2 is the earliest indicator of BCIS.[1] In the event of occurrence of this complication, the patient should be treated aggressively.

Management is essentially supportive, that is, administration of 100% oxygen, control of airway, invasive hemodynamic monitoring, aggressive volume replacement therapy if there is insufficient pre-load and use of vasopressors (alpha-1 agonists) to raise systemic BP.[1]

We used SA in this case and calculatedly did not administer any i.v sedation to avoid cardio-respiratory depression in the elderly patient and also to enable us to detect this complication promptly in a conscious patient if it occurs in form of dysponea and altered sensorium which are the early signs of BCIS.

REFERENCE

1. Donaldson AJ, Thomson HE, Harper NJ, Kenny NW. Bone cement implantation syndrome. Br J Anaesth 2009; 102 (1) : 12-22. | 2. Razuin R, Effat O, Shahidan MN, Shama DV, Miswan MF. Malays J Pathol 2013; 35 (1) : 87-90. | 3. Mudgalkar N, Ramesh KV. Bone cement implantation syndrome : a rare catastrophe. Anesth Essays Res. 2011; 5(2) : 240-2. | 4. Govil P, Kakar PN, Arora D, et al. Bone cement implantation syndrome : a report of four cases. Indian J Anaesth 2009; 53 (2) : 214-8. | 5. Herrenbruck T, Erickson EW, Damron TA, Heiner J. Adverse clinical events during cemented long- stem femoral arthroplasty. Clin orthop Relat Res 2002; 395 : 154-63. | 6. Orcini EC, Byrick RJ, Mullen JBM, KAY JC, Waddell JP. Cardiopulmonary function and pulmonary micro emboli during arthoplasty using cemented or non-cemented components the role of intra medullar pressure. J bone Joint Surg 1987; 69: 822-32el. | 7. Jenkins K, Wake PJ, Cement implantation syndrome. Anaesthesia 2002; 57: 416. | 8. Parry G. Sudden deaths during hip hemi-arthroplasty. Anaesthesia 2003; 58: 922-3.