

Bone Cement Implantation Syndrome – A Survival Story

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Abstract

Introduction: Bone Cement Implantation Syndrome (BCIS) is a poorly understood complex entity with very high mortality in clinically significant cases. We are reporting a case of suspected BCIS in a patient with pathological fracture of femur who underwent modified Total Knee replacement. Interestingly in spite of a full-blown intraoperative complication of BCIS, the patient survived. Data regarding such cases is sporadic, so the reporting to make everybody aware of this life threatening complication in Orthopaedic anaesthesia practice.

Conclusion: Early suspicion, prompt recognition and aggressive management according to standard resuscitation protocols can improve outcome in patients with BCIS.

Keywords: Bone cement implantation syndrome, total hip arthroplasty, embolism.

Introduction

Bone Cement Implantation syndrome (BCIS) is a potentially life threatening intraoperative complication in cemented Arthroplasty cases [1]. It is most commonly described in association with hip arthroplasty but can happen in any cemented procedure. There is no standard consensus on definition of BCIS but it includes hypoxia, hypotension, cardiac arrhythmias, altered sensorium, unconsciousness, pulmonary hypertension and cardiac arrest [1]. Earlier the etiology was thought to be secondary to release of cement monomer in blood circulation causing various chemical interaction leading to symptoms. However recent research shows that the emboli of fat released into circulation, due to forceful pressurisation of bone canal by cement and prosthesis, are the main culprit for BCIS [2]. We present a case of BCIS in a patient of pathological fracture secondary to plasmacytoma undergoing reconstruction

with cemented megaprosthesis.

Case report

A 50 year old lady presented with pathological fracture of lower end femur with suspected malignancy (Plasmacytoma). She was posted for Tumour excision and Reconstruction with Total Knee Replacement megaprosthesis. There were no significant co morbidities. Pre-operative investigations showed anaemia with haemoglobin of 8.5g/dl, serum creatinine 1.2 mg/dl and hypoalbuminaemia. Rest other investigations were within normal limits. Electrocardiogram showed sinus tachycardia but 2D echocardiogram showed preserved left ventricular ejection fraction with diastolic dysfunction. Combined spinal- epidural anaesthesia was planned for the patient. Routine monitoring devices like electrocardiogram, non-invasive blood pressure, pulse oximetry were applied. Two wide bore

intravenous access were achieved with 18 G intracaths. Epidural space was identified with loss of resistance technique under all aseptic precautions. Epidural catheter was inserted and fixed at 10 cm. Spinal anaesthesia was given with 25 G Quincke needle, dose given was Inj. Bupivacaine (heavy) 0.5% 12.5 mg. Urinary catheter was inserted. Surgery was done in supine position. Resection of lower end of femur along with tumour tissue was done for about length of 15cm. Since the surgery was started without tourniquet, blood loss till this stage was about 400 -500 ml. One packed cell red blood cell transfusion was already transfused due to low preoperative haemoglobin along with adequate crystalloids. The femoral prosthesis-component had a long stem and 60 gm of bone cement (CMW Simplex) was used. As soon as the femoral component was inserted, patient developed bradycardia for which Inj. Atropine 0.6 mg intravenously was given. This quickly progressed to

asystole and patient became unresponsive. Cardiopulmonary resuscitation was started, endotracheal intubation was done and 100% Oxygen was given. Inj Adrenaline 1 gm intravenously was given. 5 cycles of CPR were given before sinus rhythm was seen on

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monitor. Crystalloids and packed cell RBC's were infused rapidly. Suddenly patient developed ventricular tachycardia which was promptly treated with DC shock of 200 J from a biphasic defibrillator. Patient reverted back to sinus rhythm. Hypotension persisted for which noradrenaline infusion was started. Right internal jugular venous cannulation was done. CVP was 20 cm of H₂O. Left radial artery cannulation was also done for invasive monitoring of BP. Arterial blood gas analysis showed metabolic acidosis. This was corrected with Inj sodabarbonate (8.4%) 50 ml. Patient started showing signs of spontaneous respiratory efforts. Surgery was finished. She was shifted to Intensive care unit and put on mechanical ventilation on SIMV with PS mode. Inotropes continued. After two hours patient started responding to deep painful stimuli. During this episode, urine output had dropped. As CVP was still high inj frusemide 40 mg intravenously. Urine output improved after initial haematuria. After 4 hours, there was spontaneous eye opening. She was transfused total 4 units of PCV and 3 Units of fresh frozen plasma. Noradrenaline was stopped after 4 hours and blood pressure was maintained without any support. Low dose Epidural infusion was started with bupivacaine 0.1 % at the rate of 5ml/hour. After 8 hours, patient started obeying commands. Six hours later she was fully conscious and was extubated after a short trial of CPAP and T-piece. Patient had complete amnesia of the whole episode. Further course in the hospital was uneventful.

Discussion

The incidence of BCIS is quite rare. Intraoperative mortality secondary to cardiopulmonary changes during cemented arthroplasty is quoted to be 0.02% to 6.6% [3,4]. Parvizi et al reported the incidence of intraoperative deaths during arthroplasties

as 0.06% [5]. Transcranial and transoesophageal doppler have showed that almost all cases with cemented femoral prosthesis especially in hip arthroplasty surgery will have embolic showers and BCIS. The severity maybe different and most of the patients escape with minor changes in blood pressure or oxygenation [3,4,6,7]. When full blown, mortality is extremely high.

Several cases and studies are reported on mortality in these cases. In 2004 a case was reported of a women who developed BCIS while undergoing hemiarthroplasty for femoral neck fracture. She was resuscitated but remained in a noresponsive comatose state. Serial magnetic resonance imaging (MRI) scans showed multiple cerebral fat emboli [8].

In another case of total hip arthroplasty there was no event during surgery but patient developed severe BCIS after surgery. MRI scans suggested cerebral fat emboli [9]. In India 4 cases were reported from one centre out of which 3 survived and one died [10]. Another case was reported from Andhra Pradesh, where despite initial revival, patient succumbed after 8 hours postoperative [11]. An interesting case was reported where Bone Cement Implantation Syndrome occurred during spinal surgery with cement augmented screw fixation requiring cardiac surgery for removal of emboli from pulmonary artery [12]. The patient survived in this case. A recent report from National Health Services (NHS) UK, reported 62 cases, of which 41 (66%) died. Thus the casualty rates are quite high once patient develops BCIS [13] although at times patient do survive and have good recovery. What determines these outcomes is still unclear but clinical expertise and preparedness of the anaesthesia team and also patient factors that predisposed to BCIS play a definite role.

Various predisposing factors are implicated with high incidence of BCIS. Advanced age,

associated comorbidities, osteoporosis and replacement secondary to fractures have higher predisposition toward BCIS [6,7]. Parvizi et al noted higher rate of cardiovascular complication in cases with pathological fractures [5]. Our case was also of pathological fracture secondary to plasmacytoma. Tumors may cause secondary changes in vascular architecture leading to higher chances of vascular embolization [6]. Also in our case there was preexisting diastolic dysfunction. Thus our case had higher chance of BCIS. We could initiate appropriate resuscitative protocols and the patient survived. Retrospectively, we thought that in such cases, we should have started with Intra-arterial BP monitoring and a CVP line. The readiness to handle such complication appears to be the single most factor for a favourable outcome. Thus in cases where the risk factors are identified, high index of suspicion for intraoperative events should be maintained and the anaesthesia team should be ready for such eventuality. Although current literature still does not have enough evidence to accurately calculate the risk and benefits in such cases [13] we should be aware of the eventuality and be prepared for the same.

Clinical Message

The whole purpose of this Case report was to make everybody aware that this can actually happen in patients with any of the risk factors. We are going to see more and more comorbid cases coming for cemented surgeries, apart from Total Hip Replacements. Proper understanding of the syndrome, early recognition and prompt management as per the standard resuscitation protocols will improve survival in such life threatening complication.

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Conflict of Interest: Nil
Source of Support: None

How to Cite this Article

Adhye B, Bhong G, Panchwagh Y, Shyam A, Sancheti P. Bone Cement Implantation Syndrome – a Survival Story. *Journal of Anaesthesia and Critical Care Case Reports* July-Sep 2015; 1(1): 24-26.