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A 37 YEARS OLD MAN WITH SEVERE RESPIRATORY FAILURE POST-OPERATIVE OPEN ABDOMINAL AORTIC ANEURYSM REPAIR: LESSONS TO LEARN

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ABSTRACT
37 years old male, smoker underwent open aortic aneurysm repair with 10 hours of aortic clamping time, not reported previously. In the operative room, the patient required 10 units of blood. Post operatively, right leg faschiotomy was required. Ten hours post faschiotomy, he was extubated. In view of raising urea and creatinin and the fear of patient developing acute renal failure secondary to acute tubular necrosis and rhabdomiolysis secondary to prolonged aortic clamping time, the vascular surgeon had asked to over hydrate the patient (target CVP 16 cm H2O) with a maintenance IV fluids of 300 ml/hr. Seventy two hours post triple AAA repair, the patient went into respiratory failure requiring reintubation. Chest X-ray showed bilateral upper and lower zones infiltrates. He was afebrile with normal white cell count, ECG, cardiac enzymes, brain natriuretic peptide and procalcitonin. He was diagnosed to have Adult Respiratory Distress Syndrome secondary to ischemic reperfusion injury requiring reintubation and mechanical ventilation. He remained in the ICU for three weeks before being discharged alive. We think factors like positive fluid balance, lack of remote ischemic preconditioning as well as not practicing intraoperative auto-transfusion contributed to the complicated course of this patients. We therefore wanted to share this case with our colleagues.

INTRODUCTION

Prolonged aortic cross clamping time increases risk of complications post open abdominal aortic aneurysms (AAAs) repair secondary to Ischemic-Reperfusion (I-R) injuries. Best available evidence aids adopting a safe approaches to the care of such high risk patients in order to decrease complications. Different investigators have successfully demonstrated the beneficial effects of remote ischemic preconditioning (RIPC) in human studies. We think the potential role of this treatment modality was worth trying in the case to be presented in view of high risk for visceral I-R injuries secondary to long aortic cross clamping time which was 10 hours in our case (not reported previously). Moreover, studies have shown that excessive fluid administration (which was targeted in this case) contributed to the complicated course.

We think there are lessons to learn from this case and so thought to share it with our colleagues in the field.

Case History

37 year old, recently diagnosed to have a an infrarenal AAA, presented with acute onset of abdominal pain. He has past history of appendicectomy for perforated appendicitis 10 years ago. Abdomen was tender with pulsatile mass palpable over periumblical region. Ultrasound of the abdomen confirmed infra renal AAA with no leak.

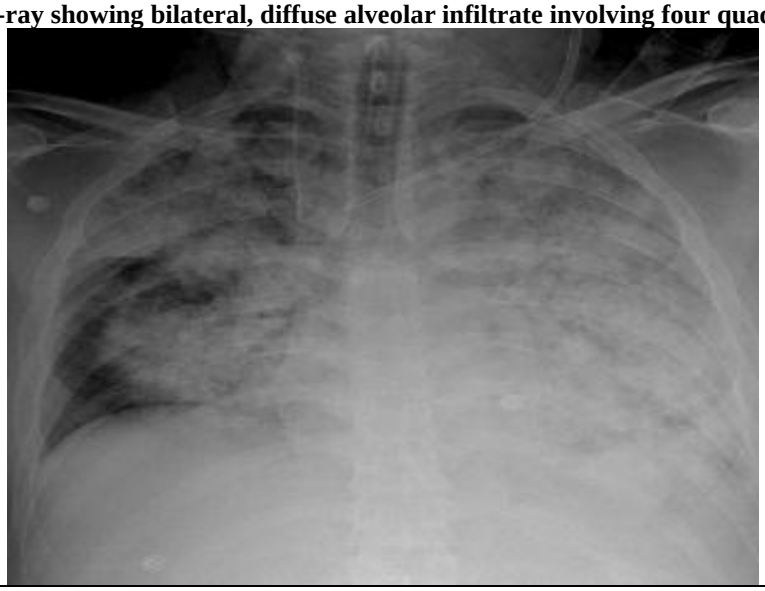
The treating vascular surgeon (an expert in endovascular surgeries) thought that the aneurysm was anatomically unsuitable for endovascular repair. Patient was booked for high risk emergency open AAA repair.

Intra-operatively, and because of the adhesions, the surgical repair was difficult to the extent that the cross clamping of the aorta and iliac vessels was prolonged for 10 hours. 10 units of blood were needed intraoperatively. Post operatively, the patient was shifted to the Intensive care Unit (ICU) intubated.

To avoid acute renal failure secondary to the prolonged cross clamping, the vascular surgeon aim was to keep his central venous pressure (CVP) at about 16 cm H2O with 300ml of intravenous fluid per hour. In the first 24 hours, patient course was complicated by evidence of right leg compartment syndrome requiring faschiotomy. Ten hours later. Patient was extubated. Despite a positive daily fluid balance of about 8-10 liters, the renal function deteriorated requiring renal replacement therapy.

Seventy two hours later, the patient had an acute onset of rapidly progressing severe respiratory distress, refractory to oxygen therapy and none invasive positive pressure ventilation with diffuse abnormalities on chest radiographs (Figure 1). ECG, cardiac enzymes, brain natriuretic peptide and procalcitonin were all normal. He was a febrile with normal daily white cell count. These lab works excluded acute myocardial Infarction with pulmonary oedema and ventilator/hospital acquired pneumonia with secondary Adult Respiratory Distress Syndrome (ARDS). Transfusion Related Acute Lung Injury (TRALI) was unlikely in view of late onset after the transfused blood in the operating Theatre (OR). ARDS secondary to ischemic reperfusion injury was the most likely diagnosis with typical onset of 48-72 hours post operative triple AAA repair. Patient was reintubated and mechanically ventilated with difficulties maintaining his oxygenation in the first 24 hours. He remained in the ICU for three weeks before being discharged alive.

Figure 1. Chest X-ray showing bilateral, diffuse alveolar infiltrate involving four quadrants of the lung.



DISCUSSION AND CONCLUSION

Abdominal aortic aneurysms (AAAs) are usually asymptomatic but expand over time with risk of rupture [1]. Symptomatic aneurysms presenting with abdominal pain have a higher rupture risk than asymptomatic aneurysms. Management involves urgent surgical repair, preferentially with endovascular aneurysm repair (EVAR) in centres with sufficient experience of elective open AAA repair [2]. Most infrarenal AAAs are now treated using EVAR approach, resulting in a significant decrease in postoperative morbidity and mortality [3]. Unfortunately, anatomic exclusions, like paravisceral AAAs' (PAAA) as in our case, remain problematic [4]. These are usually treated with open surgery with risk of prolonged aortic cross clamp leading to high incidence of perioperative complications [5]. Significant stress is placed on visceral organs when the aorta is clamped is greater than 30 min.

A multicenter, clinical, prospective study has recently elicited preoperative risk factors associated with increased postoperative 30-day mortality after open repair of PAAA. Major complications included reintubation, return to operating room, new dialysis requirement and myocardial infarction. Multivariate analyses identified clamp duration (> 110 min), volume of blood transfusion (> 1,280 mL), and emergency operation as predictors of postoperative mortality [6]. In a prospective, randomized single center study, open aortic procedures have recently been performed under the intraoperative cell saving with auto-transfusion with an associated significant decrease in the number of peri-operatively and post- operatively transfused allogeneic blood units in these patients and the overall mortality [7].

Ischemic-Reperfusion (I-R) post release of aortic cross clamp results in both a local and a systemic inflammatory response that may result in widespread microvascular dysfunction. If severe enough, this could result in the systemic inflammatory response syndrome

(SIRS) or the multiple organ dysfunction syndrome (MODS) including respiratory failure, which account for up to 30–40% of intensive care unit mortality [8,9]. Understanding consequences of ischemia and reperfusion lead to innovative therapeutic strategies for treating patients with I-R associated SIRS and MODS [10].

These approaches render organs more resistant to I-R injuries. They could be used in a preventive manner during major surgery associated with ischemia and reperfusion. Remote ischemic preconditioning (RIPC) is a phenomenon whereby brief periods of ischemia followed by reperfusion in one organ. This provides systemic protection from prolonged ischemia. In a randomized trial, RIPC was found to reduce the incidence of myocardial and renal injury in patients undergoing elective open abdominal aortic aneurysm repair [11]. In this study, eighty-two patients were randomized to abdominal aortic aneurysm repair with RIPC or conventional abdominal aortic aneurysm repair (control). Two cycles of intermittent cross clamping of the common iliac artery with 10 minutes ischemia followed by 10 minutes reperfusion served as the RIPC stimulus [11]. Multivariable analysis revealed protective effect of RIPC on heart and kidney. More recently, a meta-analysis of randomized controlled trials of RIPC showed decrease in incidence of myocardial infarction [12]. RIPC constitutes an attractive means of ameliorating the adverse consequences of I-R injuries. It is easily performed, requires little additional equipment and may be highly cost effective. RIPC has great potential to improve patient outcomes and could have made differences in our case. For patients undergoing elective OR for AAA, there are no established guidelines on perioperative fluid management. Significant variation among physicians exists in respect to the types of and volumes of fluid administered. SIRS resulting from I-R, combined with massive intravenous fluid administration makes patients particularly vulnerable to harmful extra vascular fluid accumulation. In a retrospective cohort study of 100 consecutive patients, positive fluid balance after elective open AAA repair was found to be predictive of major adverse events (cardiac and pulmonary complications); increased ICU and overall hospital stay [13]. Whilst it is not possible to support a causal link between excessive intravenous fluid administration alone and the complications in our case, it is clear that over hydration may have contributed to deleterious effects on this high-risk surgical patient.

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