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Management of Blood Loss in Maxillofacial Trauma

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Running Title: Management of blood loss in Maxillofacial Trauma

Abstract: ***Resuscitation of a severely traumatised patient with the administration of crystalloids, or colloids along with blood products is a common transfusion practice in trauma patients. The determination of this review article is to update on current transfusion practices in trauma. Exsanguination is an underestimated cause of treatment failures in patients with severe trauma or undergoing surgery. Trauma induced consumption and dilution of clotting factors, acidosis and hypothermia in a severely injured patient commonly causes trauma-induced coagulopathy. Early infusion of blood products and early control of bleeding decreases trauma-induced coagulopathy. Early recognition that the patient will need massive blood transfusion will limit the use of crystalloids. Massive transfusion protocols improve survival in severely injured patients.In a trauma patient with life threatening injuries, treating it in 1:1:1 ratio, with thawed plasma, PRBCs, and platelets, limited use of crystalloids and rapid haemorrhage control will improve management.***

Keywords: blood loss, hemorrhage, trauma

1. Introduction

Maxillofacial injuries can be complex and multi-specialty involvement in their management may be needed. Injury can involve the skin and soft tissues as well as resulting in fractures. Acute and long-term psychological problems can result from maxillofacial trauma and disfigurement.(1)(2)Crown fractures and luxation are the most commonly occurring of all dental injuries. Proper diagnosis, treatment planning and follow up are important for improving a favourable outcome. Resuscitation of a severely traumatised patient with the administration of crystalloids, or colloids along with blood products is a common transfusion practice in trauma patients.(3) The determination of this review article is to update on current transfusion practices in trauma. Trauma induced consumption and dilution of clotting factors, acidosis and hypothermia in a severely injured patient commonly causes trauma-induced coagulopathy.(4) Early infusion of blood products and early control of bleeding decreases trauma-induced coagulopathy. Early recognition that the patient will need massive blood transfusion will limit the use of crystalloids. Massive transfusion protocols improve survival in severely injured patients.

Initial Assessment

The strategy of look, listen, and feel helps to figure out airway obstruction and anticipated airway complications. The airway management approach, particularly in unconscious trauma patients should be complimented with the protection of C-spine.(5,6) In high-velocity trauma which involves the mandible, swallowing mechanism is altered due to pain and ineffective protective reflex modulation, results in difficulty to keep the airway clear(7). Strictly speaking, irrespective of the injury, maxillofacial trauma patients should be given adequate oxygenation with uninterrupted saturation monitoring. Hence, the strategy is a systematic analysis of the airway as delayed airway compromise may occur due to the displacement of tissue, bleeding, and swelling. (8,9)High-volume suction should be available to clear the mouth and oropharynx from blood and secretions. In patients with a patent airway and absent spontaneous breathing, bag-mask ventilation is the procedure of choice. A tightly fitted mask with concurrent jaw thrust is often enough to maintain ventilation.

Circulation and Heamorrhage

After the acquisition of airway and addressing breathing problems, attention must be given to circulation. Maxillofacial injuries are very prone to massive haemorrhages, and life-threatening haemorrhage can vary from 1.4% to 11%.One out of every ten complicated facial fractures bleeds significantly. The main vessels involved are an ethmoid artery, ophthalmic, vidian branch of internal carotid, and maxillary artery. In most cases, bleeding can be are easily controlled, but rarely severe epistasis that ranges from 2% to 4% of all facial trauma arises from the maxillary artery, creating difficulty in haemorrhage control. (10,11,12) Control of hemorrhage can be achieved by pressure packing, manual reduction of fractures, balloon tamponade, and in severe cases with angiography followed by trans-arterial embolization or in some cases with direct external carotid artery (ECA) ligation.(13,14) Two large bore IV lines should be placed for replacing fluid loss; similarly, exclude other concealed bleeding from the thorax, abdomen, and vascular injury of other vital organs.

Different Transfusion Material

A blood transfusion is a common procedure in which you receive blood through an intravenous (IV) line that goes into one of your blood vessels. Blood transfusions are used to replace blood lost during surgery or a serious injury. (15,16) A transfusion also might be done if your body can't make blood properly because of an illness. Crystalloids and colloids are different transfusion materials.

New Advances in Transfusion Products

Perfluorocarbon emulsions are being clinically evaluated as artificial oxygen carriers to reduce allogeneic blood transfusions or to improve tissue oxygenation (17)

Role of Blood in Oxygen Delivery

Role of blood in oxygen delivery — Blood delivers oxygen to the tissues, and the vast majority of oxygen delivered is bound to haemoglobin in RBCs. Thus, anaemia has the potential to reduce oxygen delivery. However, most patients are able to increase tissue oxygen delivery by increasing cardiac output over a range of haemoglobin concentrations.(18) The major physiologic considerations relevant to anemic patients are the degree to which oxygen delivery to the tissues is adequate and whether compensatory mechanisms for maintaining oxygen delivery will become overwhelmed or deleterious.(19)

Oxygen delivery (DO2) is determined by the formula:

DO2 = cardiac output x arterial oxygen content

In healthy patients, DO2 can be raised by increasing cardiac output (increased heart rate in conscious patients and increased stroke volume in anesthetized patients). In critically ill patients, DO2 may become more dependent on arterial oxygen content, and oxygen utilization may become pathologically dependent upon DO2. This pathologic dependence may be due to elevated arterial lactate concentrations and a change in the slope of the oxygen extraction ratio. Determining what haemoglobin level is adequate in individual clinical scenarios has been the goal of a large number of clinical studies and randomized trials.

At rest, there is a large reserve in oxygen delivery, since the rate of delivery normally exceeds consumption by a factor of four. Thus, if intravascular volume is maintained during bleeding and cardiovascular status is not impaired, oxygen delivery theoretically will be adequate until the hematocrit falls below 10 percent because greater cardiac output, rightward shift of the oxygen-haemoglobin dissociation curve, and increased oxygen extraction can compensate for the decrease in arterial oxygen content.

These predictions were confirmed in a study in which healthy resting individuals underwent acute isovolemic reduction of their hemoglobin to 5 g/dL (equivalent to a hematocrit of approximately 15 percent) [20]. Though some individuals did develop electrocardiogram (ECG) changes consistent with myocardial ischemia, there was little evidence of inadequate oxygen delivery, and the fall in hemoglobin was associated with progressive increases in stroke volume and heart rate (and therefore cardiac output), and a progressive reduction in the systemic vascular resistance. Heart rate was found to increase linearly in response to the acute isovolemic anemia [21]. Of note, cognitive function measured by reaction time and immediate memory was impaired when the hemoglobin concentration was reduced to 5 to 6 g/dL.

The preceding considerations represent the optimal clinical response in healthy adults. However, blood transfusion is usually administered to patients who are ill with underlying comorbidities, and there is concern that compensatory mechanisms may be impaired in critically ill patients, particularly in patients with underlying cardiovascular disease. It has been argued in the past that this might justify prophylactic transfusion to maintain hemoglobin of 10 g/dL. However, data in favour of this hemoglobin target level are sparse. To the contrary, multicentre randomized controlled trials indicate that compared with a target hemoglobin of 10 g/dL, target hemoglobin values of 7 to 8 g/dL are associated with equivalent or better outcomes in many patient populations.

Complication of Transfusion

The risks and potential long term complications of RBC transfusion, and strategies to minimize these risks and complications, are discussed separately. These include the following:

- Infection is a risk of transfusion since transfusion-transmitted pathogens (eg, viruses, bacteria, and parasites) can be transmitted if they are present in donor blood and if they escape detection by screening assays. In addition, some studies have reported that transfusion-mediated immunosuppression may lead to increased risk of postoperative bacterial infection, although a 2016 meta-analysis of randomized trials did not find an increased risk of infection
- Allergic and immune transfusion reactions can occur in any patient, and are more common in multiply-transfused patients
- Volume overload is typically a concern in the elderly, small children, and those with compromised cardiac function.
- Hyperkalaemia from potassium released from RBCs during blood bank storage is primarily a concern in massive transfusion, impaired renal function, and infants/newborns.
- Iron overload becomes a concern after a large number of transfusions for chronic anemia.

2. Conclusion

The administration of supplemental oxygen is an essential element of appropriate management for a wide range of clinical conditions, crossing different medical and surgical specialities. The present review summarizes the role of supportive oxygen therapy in various clinical condition encountered in our day to day practice in the speciality of oral and maxillofacial surgery.

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