Int. J. Oral Maxillofac. Surg. 2008; 37: 405–414
doi:10.1016/j.ijom.2007.11.005, available online at http://www.sciencedirect.com

International Journal of
Oral & Maxillofacial Surgery

Invited Review Paper
Trauma

Advanced Trauma Life Support (ATLS) and facial trauma: can one size fit all? Part 3: Hypovolaemia and facial injuries in the multiply injured patient

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M. Perry, J. O'Hare, G. Porter: Advanced Trauma Life Support (ATLS) and facial trauma: can one size fit all? Part 3: Hypovolaemia and facial injuries in the multiply injured patient. Int. J. Oral Maxillofac. Surg. 2008; 37: 405–414.

Abstract. Hypovolaemic shock is a common cause of morbidity and mortality following trauma, accounting for approximately 30% to 40% of trauma deaths. Life-threatening blood loss from the maxillofacial region is uncommon, but represents one of a number of possible sites which must be rapidly identified and controlled. Bleeding from the face may not be obvious especially in awake, supine patients and it poses an obvious threat to the unprotected airway. Identification requires careful assessment. Control of bleeding in the maxillofacial region requires a number of correctly sequenced techniques. Computerized tomographic imaging is now playing an increasingly important role in identifying blood loss, especially in the chest, abdomen and pelvis. This need may potentially result in the transfer of patients, with unrecognised facial injuries, outside the relative safety of the emergency department. The concepts of the 'lethal triad' and 'biologic first hit' have resulted in new strategies in managing the profoundly shocked patient, although some of these remain controversial. Debate continues over the optimal blood pressure, fluid administration and role of surgical intervention in the actively bleeding patient. These may have an impact on the timing and extent of any proposed maxillofacial repairs, and are discussed.

Keywords: ATLS; craniofacial; trauma; shock; hypovolaemia; resuscitation; angiography; damage control.

Accepted for publication 6 November 2007
Available online 11 February 2008

0901-5027/050405 + 10 $30.00/0

Hypovolaemic shock is a common cause of morbidity and mortality following trauma. In the multiply injured patient there may be several sites of significant blood loss, of which the maxillofacial region (including the scalp) may be one. Although life-threatening hypovolaemia arising from scalp and facial injuries is relatively uncommon, timely recognition and appropriate intervention is still necessary. Unfortunately facial bleeding may not always be obvious, and it therefore needs to be actively considered and sought after in all facial injuries. This is particularly so in awake or hypotensive patients, where recognition of bleeding can be significantly delayed. As previously discussed in Part 2 of this review series[59], ongoing facial bleeding in supine patients may pose a threat to the unprotected airway, and this can result in major complications, especially outside the relatively safe environment of the resuscitation room or during interhospital transfers.

The optimal management of injured patients in shock is still controversial, and debate continues over the precise role of fluid resuscitation and the timing of repair of coexisting injuries. This latter point can have an impact on the timing and extent of any proposed maxillofacial repair. It is therefore essential that oral and maxillofacial surgeons are involved in the management of the multiply injured patient with coexisting facial injuries at an early stage. Immediate intervention may be required during the ATLS (Advance Trauma Life Support) primary survey ('C – circulation with control of haemorrhage'), and this may involve surgery or interventional radiology. The timing of any definitive repairs also needs to be carefully planned, taking into account all other known (or potential) injuries, all investigations and interventions required, and the general condition of the patient. On occasion, our ideal treatment plan may need to be modified and therefore close early liaison with other specialties is paramount.

Hypovolaemia and facial injuries in the multiply injured patient

Advances in trauma care continue to improve outcomes in patients following injury[2]. Yet, despite even the best efforts, major or multisystem trauma still carries significant morbidity and mortality. One of the commonest causes of mortality in the severely injured patient is hypovolaemic shock, which is often treatable if recognised early. Haemorrhage is responsible for 30%–40% of trauma mortality[31,88] Life-threatening facial haemorrhage is relatively uncommon[86] in the multiply injured patient, but when present requires timely intervention[3,65]. In some circumstances it can be overlooked and in the presence of injuries elsewhere management becomes complicated. A number of unresolved issues still exist in the management of hypovolaemic shock, whether the face is involved or not. 'How much fluid?' and 'what type of fluid?' to give are two areas of ongoing controversy in the literature. 'Permissive hypotension'[39], 'crystalloid versus colloid'[16] and 'damage control'[11,71] are also areas of current debate which can impact on the early management of craniofacial trauma.

What is shock?

Shock is defined as ''a profound haemodynamic and metabolic disturbance, characterized by failure of the circulatory system to maintain adequate perfusion of the vital organs''[22]. In trauma this is usually as a result of acute blood loss, although other causes exist (or may coexist).

Research has now shown that a 'lethal triad' of acidosis, hypothermia and coagulopathy combine to produce the so-called 'biologic first hit', the magnitude of which is directly related to mortality[34,85] This triad arises not only as a result of the primary injuring event itself, but also of any subsequent episodes of hypotension. All three components of the biologic first hit arise particularly as a result of blood loss and inadequate tissue perfusion. Therefore, one of the main goals of management is to *rapidly* prevent further blood loss and restore tissue perfusion as soon as possible. A number of strategies have evolved over the years, but the best way to attain this goal is still controversial in some areas. Research has so far identified some factors which may predict the magnitude of the biologic first hit (for example lactate and interleukins). These may have a significant impact on how trauma is managed in the future. Nevertheless the early detection and control of bleeding is still essential in the management of the injured patient – the patient's own circulating warm blood is considerably better than any substitute. Depending on the magnitude of the first biologic hit, lengthy surgery to carry out any definitive repair, including facial injuries, may adversely affect prognosis.

Initial considerations during evaluation

Patients can rapidly lose significant amounts of circulating blood into their abdomen, pelvis, chest, retroperitoneal space and around fracture sites in the limbs. They can also lose significant amounts externally, through open wounds. Loss of blood sufficient to result in *life-threatening* shock can potentially occur into just one of these sites following penetrating injuries, or it can occur at multiple sites following high-velocity blunt trauma. In some cases the site of blood loss may be obvious, such as in open wounds or long-bone fractures. In other cases bleeding may be occult and needs to be actively sought. Injuries to the chest, abdomen, retroperitoneum and pelvis may all cause bleeding which is concealed. This can result in patients with apparently minor injuries quickly deteriorating in the emergency department. The only initial clues to the underlying severe injuries may be just the mechanism of injury or superficial markings such as bruising and abrasions.

This situation becomes more complicated in agitated, poorly responsive or unresponsive patients who have sustained multiple injuries. Clinical examination in these circumstances is even more unreliable. In all patients time is of the essence, and not only must bleeding be identified and controlled as soon as possible, but concurrent resuscitation must also be appropriate to each case. In the hypotensive patient, active bleeding may be minimal when the patient first arrives in the emergency department – it is only when the blood pressure improves with ongoing resuscitation that bleeding, both obvious and occult, recommences. In the UK, this is sometimes referred to as the 'pop the clot' phenomenon. From a maxillofacial point of view, it is therefore important to remember that an injured face, which is not bleeding during the early stages of resuscitation, may not always remain that way. This has important implications when considering interhospital transfers.

Where is the patient bleeding?

Once 'A' (airway) and 'B' (breathing) have been addressed, the next step is 'C' – circulation and control of haemorrhage. Priorities at this stage of the primary survey are to stop any obvious and significant blood loss and establish wide-bore intravenous access. The statement ''any cold and tachycardic patient should be considered to be in hypovolaemic shock until proven otherwise''[2] is helpful