



# MANAGEMENT OF SCALP HEMORRHAGE AND LACERATIONS

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## ABSTRACT

Scalp lacerations can vary in severity from a minor injury up to a complete degloving of the scalp. Severe scalp injuries can occur in a combat zone as a result of blunt trauma, penetrating trauma or blast-related mechanisms. More severe scalp wounds tend to cause a greater than expected blood loss and can contribute to patient destabilization relatively quickly. This article will discuss the source of blood supply to the scalp and concentrate on the management of scalp wounds with before and after pictures to demonstrate these techniques. The cases presented will exclude cranial fractures and concentrate more on the management of lacerations specifically.

## Anatomy of the Scalp

Prior to discussing the management of scalp injuries, it is important to understand the anatomy. Particular attention should be made to the blood supply and the flow/direction of its travel across the head as well as the surgical planes involved that contribute to the extent of the injury. In Figure 1 we see the layers of the scalp.

They can be remembered by the mnemonic:

S – Skin

C – Subcutaneous tissue

A – Aponeurosis and muscle

L – Loose areolar tissue/subgaleal fascia. This is the layer where traumatic separations occur most frequently.

P – Pericranium/periosteum

The skin and the subcutaneous tissues are relatively the same and cannot be easily divided. The sweat glands and hair follicles actually can be found in the fat layer below the dermis. The galea is more correctly known by the term Musculoaponeurotic Layer (ML). In this layer, we find the frontalis and occipital muscles as well as the superficial temporal artery. This is purposeful, as these muscles require a vibrant blood supply for their function. Laterally, the ML forms the temporoparietal fascia. The ML is a dense, fibrous tissue layer that shines when light is directed on it. This ML incorporates the frontalis and occipital muscles in a direct attachment to the overlying skin and subcutaneous tissue. This allows the eyebrows to be raised when this muscle contracts. The subgaleal fascia is also known as the loose areolar layer. Most traumatic lacerations, separations or avulsions occur in this layer. For the purposes of this article, a laceration is a violation of the organ/skin (in this case, the scalp) without missing pieces. An avulsion is a loss of scalp tissue that would require the rotation of flaps or free tissue transfer to reconstruct the resulting defect.

Management of Scalp Lacerations and Degloving  
Once we have a basic knowledge of the anatomy and blood flow to the scalp, we can logically determine how to stop frank blood loss from this area. One of the frequent questions concerns cut downs to the external or internal carotids to stop hemorrhaging from the oral/maxillofacial or scalp regions. There truly is no need for this surgical technique in most situations. This is secondary to a great deal of collateral circulation to these areas; an emergent, external carotid cut down is useless when trying to stop blood loss. Also, anatomically, the internal carotid does not supply the neck or the face as the primary blood source, the external carotid does.

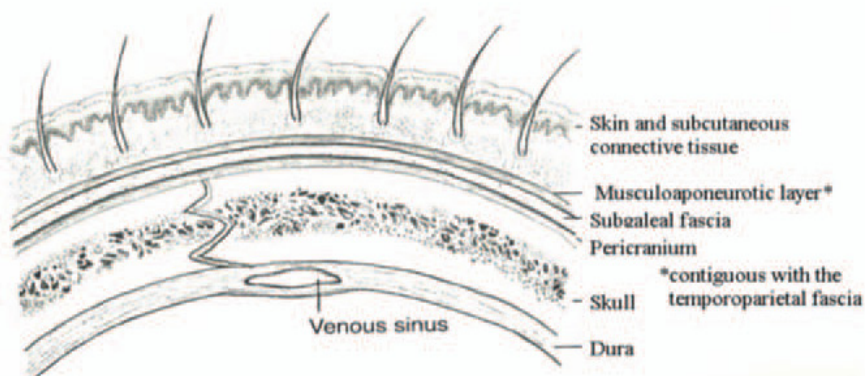


Figure 1 Layers of the Scalp

So attempting to ligate this great vessel for facial, head, or scalp bleeding is an outright mistake. In fourteen years of managing head and neck trauma, the author has witnessed one cut down to the external carotid successfully stop exsanguination from a lacerated lingual artery. This was performed as a final measure when interventional radiology was not available. While the reader might note that this situation is similar to what services are available on the front lines I would never advocate its use in the field or outside a high level trauma center. In addition, this technique should only be available to providers who have experience with head and neck cancer resections, and have seen or used it before. The reason being, the inexperienced provider may actually stop the hemorrhage but, leave a non-viable patient as a result. Therefore, all that has been accomplished is delaying the inevitable and perhaps sacrificing another that could possibly have been saved. In nearly every case regarding massive blood loss to the maxillofacial region and scalp, direct pressure (techniques described below) to the offending bleeder was sufficient to stop the loss of additional blood.

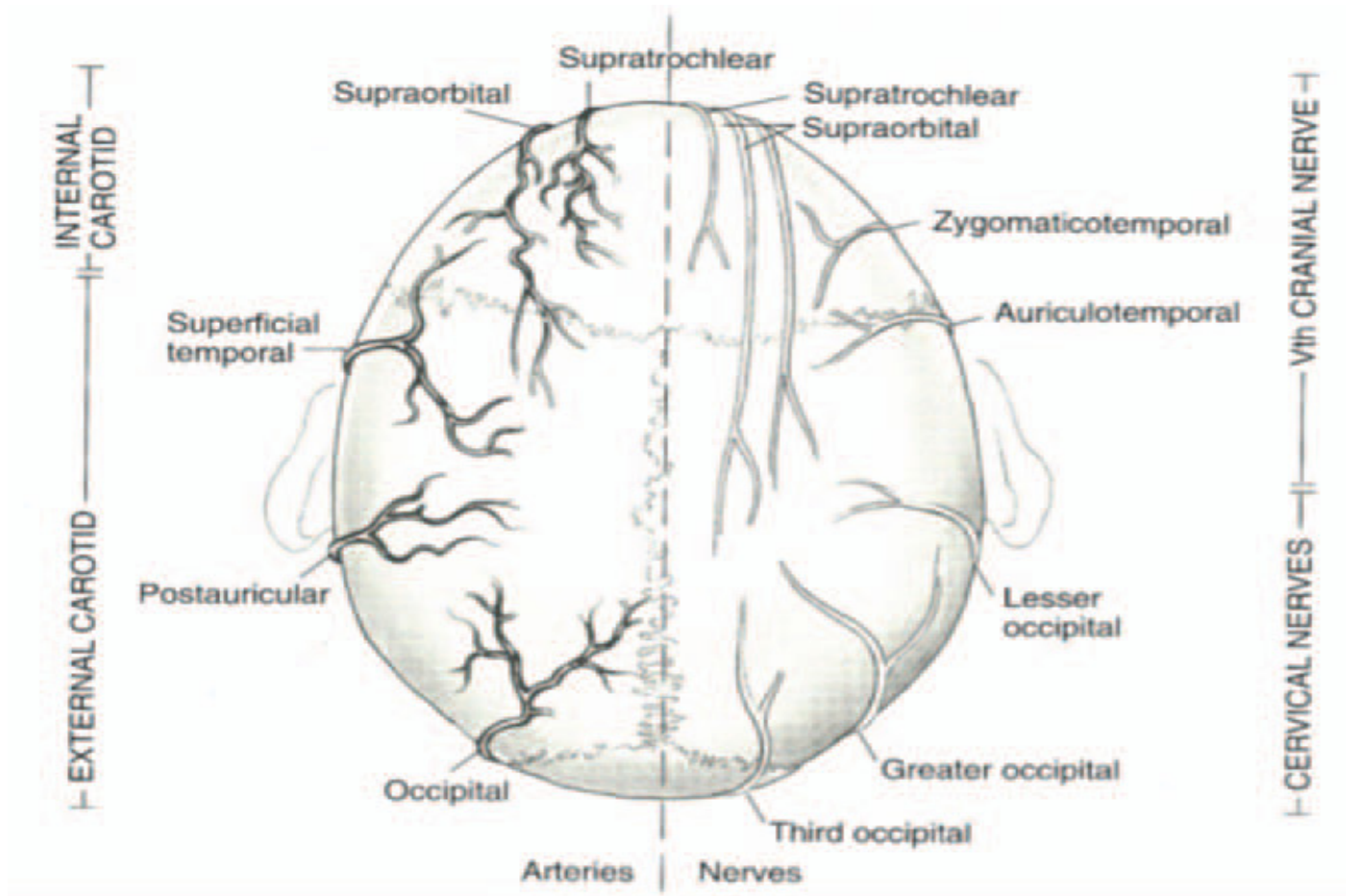


Figure 2 Blood and Innervation to the Scalp

While in the field, if the tactical medical provider (medic, EMT-P, 18D, Corpsman, or physician) is presented with a scalp laceration and concomitant cranial fractures, applying too much pressure may lead to brain injury. Therefore, it is important to quickly and correctly assess the presence of a mobile or a displaced cranial fracture. Simply feeling for crepitus or a step off, palpation of the skull within the laceration with a finger, or direct visualization is sufficient in providing a quick diagnosis. If a cranial fracture is found, care must be taken to avoid further injury to the patient while attempting to stop bleeding from the scalp. As stated above, direct pressure will usually provide adequate cessation of blood loss. However, it is sometimes very difficult to apply direct pressure to the head while attempting to treat other patients or other injured areas on the same individual. Using Hemostats (as pictured above) is one way to stop bleeding but, if there are multiple bleeders or multiple patients, you will eventually run out of instruments. Placing a 2-0 suture (resorbable or non-resorbable) parallel to and approximately 1/2 inch from the edge of the laceration will also stem the flow of blood. Picturing the origin and the direction of the arterial supply to the area will allow the provider to place the suture into the scalp in a full thickness throw (the needle should enter the scalp approximately one inch from where it exits.) and successfully “lasso” the artery.

Tying the suture tight will ligate the vessel. Direct pressure in the same area where you would place a suture will usually be enough to stop any bleeding. However, if you need your hands to be free, placing a suture is much more efficient and appropriate than providing inadequate pressure or ignoring the wound altogether to address other issues. Unfortunately, this is where the provider must decide to apply the M.A.R.C.H.E principles (massive bleeding, airway, respirations, circulation, hypothermia, everything else/evacuation) instead of the ABCD's.

The use of haemostatic agents or powders in the treatment of scalp lacerations is not necessary nor is it advisable. Scalp lacerations can truly go from severe hemorrhage to having the patient walk out the door in a day or so. Therefore, being mindful of tissue defects as a result of our efforts to stop the bleeding must be taken into account. Haemostatic agents have been cited numerous times in trauma and medical journals for causing thermal injuries and potential thrombosis. This author cannot remember having seen a long-term, prospective study that has evaluated hair loss or scalp damage after the use of haemostatic agents on the scalp. However, logic dictates that if use of these products in the femoral area can cause tissue damage, use of these products on the scalp would cause localized hair loss at the least and loss of viable tissue to cover the cranium at the worst. This author completely understands the decision between stopping bleeding and the ghastly effects of possible alopecia, but advances in battlefield medicine have moved us past having to cauterize wounds with gunpowder or a red-hot piece of iron. It is not thought that simply settling for haemostasis in this matter is much different. The reader should note that the above paragraph has elicited much discussion from the editors. The author is aware that some civilian agencies are using products that generate heat as a byproduct of their clotting mechanism. The reader is most likely aware that the DOD has stepped away from use of the heat generating clotting agents. Regardless, for all of the lacerations that are shown in this article, haemostatic clotting agents were not used. Also of note, the author has not used haemostatic products in scalp lacerations for any of my patients. Using the techniques described in this article has been sufficient to stop scalp hemorrhaging in any patient that was treated. The author would advise the reader to follow the protocols used by their agency or branch of service. There has also been much discussion concerning hair length and scalp lacerations and the possible effects of allowing bacteria to wick into a wound.



These photos demonstrate the blood loss that can come from a scalp laceration.

It is much easier to visualize the laceration if there isn't bloodied, matted hair over and inside the wound. It is the author's opinion, running a razor or shears over the area either before or after stopping the bleeding makes closure and wound care easier. The author is not advocating stopping emergent treatment for a complete head shave, but is simply stating that if you cannot see a portion of the wound due to dirt or matted hair, it is very difficult to treat it. This area can be easily addressed with the razor or the shears and then attention can be directed back to haemostasis. Prior to obtaining primary closure, the scalp wound should be copiously irrigated with normal saline (NS). Using a 16 or 18 gauge angiocath and puncturing the lid of a one liter plastic bottle multiple times will give the user a nice water source that can be placed under pressure to sufficiently wash out the wound. This can be repeated as necessary until gross debris (hair, dirt, etc) has been removed. At this point, the author uses a chlorhexidine scrub brush or swab (or betadine/iodine) and goes over the wound an additional time, then follows with another rinse of NS.



Please note that IV fluids can be used for the wash out but, the author recommends only using NS or lactated Ringers and not whatever was available (e.g., Hextend). Regarding closure of scalp lacerations and avulsions, the use of skin-level sutures within the hairline (for closure of the wound) is not recommended. Re-approximation of the scalp at the sub galeal fascia layer can be accomplished with resorbable or non-resorbable sutures. The use of these sutures for skin closure has anecdotally led to hair loss along the closure line due to strangulation of the blood supply to the hair follicles. It is simply easier and quicker to use skin staples within the hairline to obtain primary closure. Closure of lacerations that extend beyond the hairline can be closed in a more traditional manner with removable sutures (adults) or resorbable sutures or skin glue for children. Post-closure pressure dressings should be left in place for 12 to 24 hours to prevent hematoma or seroma formation. The use of Jackson Pratt drains or vacuum sealed blood collecting tubes connected to a large bore angiocath have been successful in limiting hematoma and seroma formation after closure. If a drain is deemed necessary, then a pressure dressing should also be placed. Placement of the drain should not be along the laceration but through a small stab incision closest to the area where dependent drainage will occur. These drains should be discontinued when the collection of fluid is approximately less than 20cc per day. If a collection of fluid arises after the pressure bandages have been removed, the hematoma/seroma can easily be managed by inserting a large gauge angiocath, attached to a 10–20cc syringe, into the fluid or portion of the scalp where the separation occurred and simply draw out the fluid. Pressure dressings will have to be reapplied for another 24 to 48 hours. In summary, successful management of scalp hemorrhaging and avulsions depends on knowledge of the anatomy of the scalp and the judicious use of pressure and sutures where warranted. The use of Raney clips is also very effective in providing haemostasis but having these readily available in the field or in an austere environment may not be likely. Therefore, thinking outside the box and using items that are usually available is more prudent. Also, patients with severe lacerations will most always have an IV placed at some point during their transport and giving IV antibiotics certainly cannot hurt. If IV antibiotics are not available then the patient should be placed on oral antibiotics that will cover the microbes endemic to the area of operation (AO). Antibiotics should cover both Gram (+) and Gram (-) organisms and sometimes pseudomonas depending on the geographic location and the mechanism of injury. Post operative infections generally will not occur prior to 48 hours from the time of closure. Staples can be removed in approximately 10 days and skin-level sutures on the face should be removed in seven days. Return to duty is dependent on the AO and the specialty or vocation of the patient. Concerning scalp laceration management but not related to hemorrhage control, scalp lacerations and avulsions should be closed within 12 hours of the incident. If a patient presents outside of this window of opportunity, the margins of the laceration must be freshened to the point of bleeding and then the wound can be closed as described above. I would highly recommend antibiotic coverage with IV being preferred over oral administration until it can be determined if the wound will abscess. Placement of a drain in these cases would be prudent not for removal of a hematoma but more for access to the deep parts of the wound for irrigation. The patients with severe lacerations that have been successfully re-approximated can literally be discharged within 24 hours if they are hemodynamically stable, are without infection, and any drains that were placed have been pulled or discontinued.

#### **Note**

The views expressed in this paper are those of the author and do not necessarily reflect the views of the DOD, or the North Carolina Rapid Assessment Team

#### **References**

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Illustrations were taken (with permission) and modified from:

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