

Perefral vascular trauma

-Introduction: vascular injury has two main consequences: Hemorrhage and ischemia, un recognized and un controlled hemorrhage can rapidly lead to the death of the trauma patient unrecognized and un treated ischemia can lead to limb lose, stroke, bowel necrosis and multiple organ failure.

-pathophysiology: hemorrhage is the prime consequence of vascular injury. Bleeding may be obvious with visible arterial hemorrhage or it may be concealed. Classically concealed arterial hemorrhage may be in the chest, abdomen and pelvis. Ischemia results from an acute interruption of flow of blood to a limb or organ. Oxygen supply is inadequate to meet demand and anaerobic metabolism takes over. Producing lactic acidosis and activating cellular and humoral inflammatory pathways. If arterial supply is not re established in time cell death occurs

-patterns of vascular injury:

-laceration: with either complete or incomplete transection of the vessel. Is the most common form of vascular injury? Hemorrhage tends to be more severe in partially transected vessel, as complete transection results in retraction and vasoconstriction of the vessel, limiting or even arresting arterial hemorrhage

-Blunt trauma : results in contusion to the vessel an intimal flap may be formed which will lead to thrombosis or dissection and subsequent rupture. Arterial hemorrhage may continue within a contained hematoma leading to pulsatile mass of clot. Called pseudo aneurysm commonly distal flow is preserved with false aneurysm formation and diagnosis may be difficult. These are at risk of rupture if undiagnosed. If there is injury to an adjacent vein and artery, an arterio-venous fistula may form which may lead to subsequent rupture or cardiovascular compromise.

-diagnosis: the diagnosis of significant vascular injury rests almost entirely in the physical examination. An absence of hard signs of vascular injury virtually excludes the presence of vascular trauma. In contrast the presence of hard signs mandates immediate action.

-hard sign of vascular injury:

- *pulsatile bleeding*
- *expanding hematoma*
- *absent distal pulses*
- *cold, pale limb*
- *palpable thrill*
- *audible bruit*

the presence of hard signs of vascular injury mandates immediate operative intervention. Usually the site of injury is obvious and angiography is unnecessary. Unnecessary intervention and investigation should be avoided to minimize the delay to definitive care.

-diagnostic tests

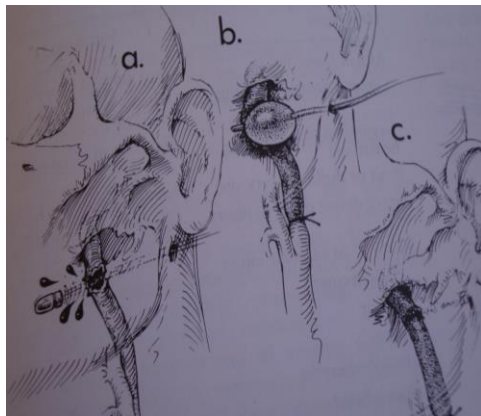
1- Doppler (duplex Doppler U S) : can detect intimal tear , thrombosis, false aneurysm and arterio venous fistula.

2-angiography : remains the gold standard investigation for delineation of vascular injury.

-Management:

the priorities of vascular injury are arrest of hemorrhage and restoration of normal circulation. Airway control and respiratory assessment take priority over management of the circulation, but these can be achieved in the same time when there is trauma team in attendance.

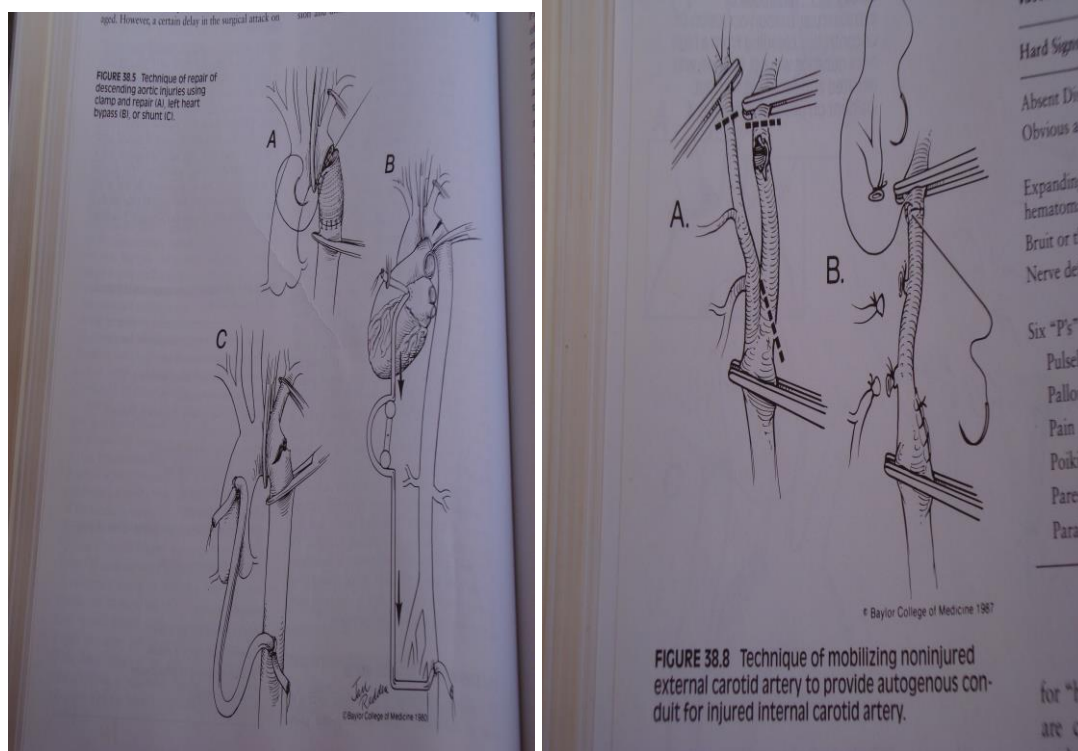
-immediat hemorrhage control : is usually achieved by direct pressure over the site of injury . when hemorrhage is welling up from deep knif or gun shot track control may be temporary achieved by passing a urinary catheter into the track as far as possible , inflating ballon and then applying traction to the catheter.



-volume resuscitation: prior to hemorrhage control, minimal fluid should administered. Because rising blood pressure will increase bleeding from vessel injury and dislodge any clot that has already formed.

Large bore venous access is necessary. Once hemorrhage control is achieved, warm fluid, crystalloid, blood or clotting factor as necessary are administered to correct hypothermia, acidosis and coagulopathy and restore perfusion to shut down organ system. This should help to prevent the subsequent development of a systemic inflammatory response and its consequences such as multiple organ dysfunction and failure.

- Operative strategy: The basic principle of vascular repair is to gain proximal and distal control of the relevant vessel before investigating the site of injury. Exploration the site of injury and once the vessel injury is identified we should do debridement of devitalized tissue. The next step is assessment of inflow and outflow, if inadequate a balloon (fogarty) catheter is passed proximally and distally to extract thrombus then heparinized saline is instilled proximally and distally to locally anti coagulate the vessel after that vascular repair is achieved either by direct end to end anastomosis if possible. If there is big gap between proximal and distal end venous or synthetic arterial graft can be used and we prefer vein graft because have longer patency rate.



- **Compartment syndrome:** prolonged interruption of blood flow to limb leads to cellular ischemia activation of cellular and humoral inflammatory responses and alteration in vascular permeability. Subsequent reperfusion of the limb leads to generalized tissue edema. When this occurs in a limited enclosed space such as the fascial compartments of the lower limb, the pressure in the compartment may rise above the capillary and venous pressure and cause vascular stasis, cellular ischemia and death. Patient presented with intense pain in the limb worsen by passive flexion of the muscle groups. If compartment syndrome suspected measurement of compartment pressure should be done if possible. Values over 30 mm Hg are diagnostic of compartment syndrome. This treated by fasciotomy and is best performed at the time of initial surgery rather than as subsequent procedure.

Fasciotomy

Fasciotomy is the most important adjunct to the surgical repair of extremity arterial trauma. An elusive diagnosis even under optimal circumstances, compartment syndrome is even more difficult to diagnose in a vasoconstricted, edematous, and hypothermic patient. A host of local and systemic factors such as extensive soft tissue trauma, prolonged hypotension, and substantial delays between injury and revascularization all combine to create a set of circumstances favoring the rapid development of increased compartment pressures (66).

Arbitrary definitions of ischemic times (6 or 8 hours) are poor guidelines for the need for a fasciotomy. Pressure measurement, although occasionally useful in borderline cases, provides information about one point in time, and in the labile, severely traumatized patient, this is clearly not enough. Maintaining a very low threshold for fasciotomy in injured limbs is always in the patient's best interest. Fasciotomy should precede revascularization in patients with preoperative signs of compartment syndrome. Patients with several hours' delay between injury and arterial repair, those with compromised venous outflow, and those with extensive soft tissue destruction should have a fasciotomy even in the presence of normal compartmental pressure because the risk of developing a compartment syndrome far exceeds the added morbidity of the procedure.

