Summary:

The brachial plexus is a complex network of nerves between the neck & shoulders that control muscle function in the chest, shoulder, arms and hands, as well as sensibility in the upper limbs. The brachial plexus is a somatic plexus formed by the anterior rami of C5 to C8, and most of the anterior ramus of T1. It originates in the neck, passes laterally and inferiorly over the 1st rib, and enters the axilla.

Brachial plexus injury is a serious & tragic cause of severe disability. The most frequent victims are young men who may be fallen from motor cycles or other trauma and may become unemployable, causing socio-economic consequence. Obstetric brachial plexus injury sustained by neonate during difficult delivery is also a great problem with great effect on the patient parents and health care authorities. Although its incidence is generally decreasing over the last few decades because of modern births, but continue to be seen with relative frequency in our country compared with western world.

Closed injuries, such as those caused by vehicular or industrial accidents, and sports-related trauma are the most common causes of stretch or contusion injury. Violent torsion of the upper limb, either upward or downward, may damage the plexus. Penetrating injuries as Gunshot wounds and knife injuries to the neck or axilla, shrapnel and blast injuries can all result in brachial plexus lesions. Iatrogenic injuries occur during surgery, particularly in procedures involving neck, shoulder or chest, regional anesthetic blocks and placement of cannulas. Non traumatic lesions causing BPI were tumors, infection, radiation & thoracic outlet syndrome.

For many years, blame has been placed on the obstetrician when a neonate is diagnosed with BPI. The assumption has been that the method of delivery & traction applied to the head & neck during the birthing process caused the injury but many risk factors also contribute in developing OBPI including, birth Wight, breech presentation, multiparity, maternal diabetes, shoulder dystocia & using forceps or vacum extraction.

Brachial plexus injury is accompanied with many pathological changes on the peripheral nerves of the plexus itself, central nervous system, muscles & bone. The severity of the lesion & its extent are determined by the severity of trauma & time of injury, which consequently determines the ultimate prognosis of the condition. Associated injuries are quite common in this patient population such as vascular injury, bony fractures, chest injuries, brain & spinal cord injuries.

Brachial plexus injuries classified according to many factors. It can be classified according to the component of the plexus injured, severity of the lesion, the clinical presentation & the operative finding. These classifications allow comparison of prognosis, treatment & outcomes.

History taking should include the mechanism of injury, as well as a description of patient symptoms. Common mechanisms of injury involve cervical extension, rotation, lateral bending & depression or hyperabduction of the shoulder. Patients should be queried about weakness, sensory loss, paresthesias, dysesthesias & the location of symptoms in the arm. The physician should examine the cervical spine, shoulder, clavicle, scapula, and related joints for range of motion, alignment & tender points. Neurological examination of the upper extremity should include manual muscle testing, sensory examination & evaluation of deep tendon reflexes. In OBPI careful review of the delivery history for maternal diabetes, fetal macrosomia, abnormal labor patterns, malpresentation, mode of delivery, difficult extraction & use of instrumentation should be noted. Arm weakness or paralysis is usually readily apparent. A weak or limp arm or hand, asymmetric movements, or incomplete reflexes indicate a possible BPI. If a completely limp arm with hand weakness is noted, eye on the affected side shows eyelid drooping & unequal pupils. These are signs that may be indicative of Horner's syndrome, Pale cool dry skin may also indicate impaired sympathetic tone.

Radiographs of the injury site help in identifying fractures or foreign bodies. Also Plain CT scanning is very helpful in the evaluation of any cervical fractures. Also CT myelography was the standard method for evaluating the integrity of the brachial plexus. MRI is the only technique that can be used to visualize the postganglionic brachial plexus. also MRN can depict both normal and abnormal peripheral nerves in various regions of the body. Electrodiagnostic tests providing physiologic data about the continuity of pathways and of lesion type and severity. Serial testing is helpful to determine prognosis. These tests like Sensory and motor nerve action potential conduction velocity, Spinal somatosensory evoked potentials, The f response, Electrical tinnel sign & Galvanic skin response.

BPI are often associated with other injuries that take precedence. Trauma resuscitation ***(ABC)***, with management of other life threating injuries like repair of visceral damage, reconstruction of vascular flow & stabilization of fractures requires immediate treatment & dominated the initial post injury period. Non-operative treatment of BPI is complex and may be best addressed by a multidisciplinary team that integrates a skilled orthotist, occupational therapists, physical therapists, and physicians. Bracing often plays a role in preventing contractures while waiting for recovery in a neuropraxia or after

surgery. Also daily range of motion exercises help to keep the muscles and joints moving normally and prevent contracture. The few studies of pain following BPI show that this type of pain is very difficult to treat. Most patients are initially treated with various narcotics, tricyclic antidepressants, antipsychotic drugs, and sympathetic blockers. It has been shown that there is a statistical correlation & temporal relationship between the reduction in pain & returning of motor function.

The purpose of primary surgery or micro neural reconstruction is to correct the injury in the plexus and help the reinnervation of muscles and The techniques used depend on the severity of the lesion. Like neurolysis which is removal of the constrictive scar tissue surrounding the nerve, neuroma excision should be done When the neuroma is large and the nerve reattached either with end-to-end sutures or by fibrin glue, even with nerve grafting When the gap between the nerve ends is so large that it is not possible to have a tension free repair using end-to-end technique, The most popular harvesting sites for autogenous nonvascularised nerve grafts are the sural nerve, the lateral and medial antebrachial cutaneous nerves and the terminal sensory branch of the posterior interosseus nerve.

Neurotization of the nerves of the brachial plexus is used generally in those cases where there is an avulsion of the nerve root from the spinal cord. The nerves that can be used as a donor nerve include the hypoglossal nerve, spinal accessory nerve, phrenic nerve, intercostal nerve, long thoracic nerve and ipsilateral C7 nerve. In addition, intraplexual neurotizationcan be used. The parts of the roots still attached to the spinal cord can be used as donors for avulsed nerves.

Root repair & re-implantation has recently been described as a new technique. The spinal cord is exposed by performing multiple laminectomies & a graft inserted into a slit in the spinal cord & connected distally to the avulsed roots. In some cases it has proved possible to place the avulsed root directly into the spinal cord. It is too early to say whether this technique will become standard practice, but it has been stated that the clinical benefits reported in the original series are only minor.

Secondary surgery aims to improve the overall function of the affected limb. Depending on which nerves are affected, functional deficit can vary from minor clumsiness to a totally flail and anesthetic arm. It may include; tendon transfers, pedicled muscle transfers, free muscle transfers, joint fusions and rotational, wedge or sliding osteotomies. Operations to restore sensory functions can also be done.