

## Supplementary File S2

### Prevention and Management of Post-operative Complications

#### Venous air embolism

It is a common and feared complication seen in patients being operated in the sitting position. During resection of the tumor, placing a gelfoam or a patty along the aqueduct also helps in preventing a large influx of air into the ventricular system. Transesophageal echocardiography (TEE) with continuous monitoring is the most sensitive technique that can detect even 0.02 ml/kg of air and air bubbles of 5-10micron diameter. In case venous air embolism is evident on TEE or is indirectly indicated by the sudden drop in end-tidal carbon dioxide concentration, further surgical resection should be halted. The potential sites of air embolism should be obliterated and if the volume of air in the right atrium is significant, aspiration of air embolus from the central line should be started. Meanwhile, the surgical bed should be packed and filled with normal saline solution and bone edges should be waxed adequately, as it is usually the venous lacunae in bones that are the sites for air entry. Once the patient has been stabilised, the head should be raised slowly and surgery resumed.

#### Vascular injury

Excessive bleeding can result due to vertebral artery injury during dissection of the C1 arch. Due care should, therefore, be taken to avoid injuring the vertebral artery by performing a sub-periosteal dissection near the C1 arch and avoiding being in the submuscular plane. However, if vertebral artery injury has occurred then the primary aim of the neurosurgeon should be primary repair by suturing the rent. In case primary repair is not possible, the artery can be ligated or coagulated. The posterior inferior cerebellar artery and the transverse sinus are also at risk during medulloblastoma surgery. One should ensure that the occipital sinus is adequately obliterated when encountered, as it can gently bleed during surgery, making the blood loss significant in a small child. Another variant of the intra-operative haemorrhage is attributed to venous congestion that manifests as massive cerebellar swelling on opening the dura. The likely cause of this cerebellar swelling may be the ligation of the occipital sinus, which was draining the tumour. Some tumors with thin walled vessels often undergo intra-tumoral haemorrhage, which also manifests as a massive cerebellar swelling. In such cases, it is advisable to perform a pre-operative magnetic resonance venography, which provides a fair idea of the venous drainage of the tumor. In case, tumoral venous drainage is considered at risk then dural opening should be made without sacrificing the occipital sinus. If faced with such an adversity intra-operatively, the craniotomy should be enlarged along with widening of the dural opening followed by a rapid debulking of the tumor and evacuation of the hematoma. Post-operative hematoma is an emergency specially in children who have been operated without placing a ventricular drain, as acute hydrocephalus can occur in a very short period leading to trans-tentorial/ tonsillar herniation. In patients deteriorating acutely, the ventricles should be decompressed before shifting the patient for imaging, if a pre-operative ventricular drain had not been placed earlier. All significant hematomas should be re-explored

and evacuated immediately. To avoid the development of post-operative hematoma, complete resection of the tumor should be attempted (except when the tumor is adherent to the brainstem). If the tumor tissue is adherent to vital structures, then adequate haemostasis should be done before the dural closure. A waiting period of 15-20 minutes, followed by filling the cavity with saline to check for any persistent bleeding, will usually avoid later explorations to handle post-operative hematomas in the posterior fossa.

#### Wound dehiscence and CSF leak

Performing a craniotomy for exposure, with fixation of the bone flap using titanium mini-plate and screws, provides for better anatomic closure than a craniectomy. Though the midline incision is safe in terms of preserving skin vascularity, the application of self-retaining retractors during surgery for a long duration may lead to necrosis of edges of the skin incision, which may not be immediately apparent. Also, monopolar cautery should be used after insulation of its shaft to avoid an inadvertent burning of the scalp skin. To avoid CSF leak, a water-tight dural closure should be achieved. Pericranium which is harvested at the beginning of procedure can be used later for a water-tight dural closure. The surgical wound closure should be done in layers and should not be too tight to prevent necrosis. The subcutaneous layer should be closed meticulously with burying of the knots. The skin closure should be gentle and one should avoid tying the knot too tight as it can lead to necrosis of wound edge. The closure should be just tight enough to keep the skin apposed with mattress sutures lying 5-7mm apart. If wound dehiscence and/or CSF leak occurs, re-exploration and appropriate re-closure may be needed.

#### Brainstem dysfunction

This occurs invariably after an aggressive attempt at radical removal of the tumor from the floor of the fourth ventricle. As stated previously, whenever the tumor is adherent to either the brainstem or the floor of fourth ventricle, it is advisable to leave a sliver of tumor behind rather than attempt an aggressive surgical resection, as the latter may lead to significant morbidity. Diplopia and multiple cranial nerve palsies in immediate post-operative period are an indicator of brainstem injury. During extubation, any vocal cord palsy should be looked for; in case vocal cord palsy has occurred, the patient should be re-assessed after 7-10 days for the need of an elective temporary tracheostomy for avoiding recurrent chest infections.

#### Cerebellar mutism

Also known as posterior fossa syndrome, cerebellar mutism occurs in 10-15% of children undergoing surgery for any posterior fossa tumor. Damage to the dentate nuclei during surgical handling affecting the dentato-thalamo-cortical pathway is the postulated mechanism. It typically presents between the 1<sup>st</sup> to 6<sup>th</sup> post-operative days, (more than 50% will present within 2 days), and is characterised by decreased or absent speech, irritability, hypotonia, swallowing apraxia and ataxia. Most patients recover within 1-4 weeks with return of functional speech; however, some amount of dysarthria can persist thereafter. Since there is no specific management for mutism, excepting for watchful waiting, careful attention should be paid to the judicious use of retractors for cerebellar retraction to minimize the incidence of mutism

### Infections

The commonest infective complication in the immediate post-operative period is meningitis, characterized by fever, headache, vomiting, and meningism. The diagnosis of acute bacterial meningitis is confirmed by CSF biochemistry that shows typically low sugars and elevated proteins with abundant neutrophils. Early institution of intravenous broad-spectrum antibiotics is recommended for suspected acute bacterial meningitis that can subsequently may be tailored based on the results of the CSF culture-sensitivity report. In a subset of patients (aseptic meningitis), there is evidence of CSF pleocytosis only, with unaffected CSF biochemistry and sterile cultures. This condition responds to a short course of steroids. Occasionally, some children may develop aspiration pneumonia due to poor brainstem reflexes or prolonged recumbence.