Postoperative hydrocephalus

Etiology

A cadaveric study shows that the blood supply of the arachnoid granulations of the superior sagittal sinus is via the middle meningeal artery. Additional cases of postoperative hydrocephalus following middle meningeal artery sacrifice are needed to support this hypothesis [1].

Epidemiology

Postoperative hydrocephalus is observed in approximately 30% of pediatric posterior fossa tumors. However, which patients will develop postresection hydrocephalus is not known.

The optimal management of hydrocephalus in pediatric posterior fossa tumors is a topic of debate [2].

Overall, close observation is recommended, with a preference for expectant management, rather than prophylactic surgery, and postresection definitive CSF diversion procedures undertaken only as clinically necessary [3].

Prevention

The question of whether to place an external ventricular drain (EVD), insert a ventriculoperitoneal shunt (VPS), perform an endoscopic third ventriculostomy (ETV), or defer cerebrospinal fluid diversion procedures before resective surgery depends on the clinical presentation and individual surgeon practice; there exists no class I evidence to guide management. In 2001, Sainte-Rose et al. reported that preoperative ETV was associated with a lower rate of postoperative hydrocephalus (27% vs. 6%) in a retrospective series of pediatric patients with posterior fossa tumors (n = 196) [4].

Only a portion of these patients would have gone on to develop postresection hydrocephalus, so performing a preresection ETV in every case potentially exposes over 70% of patients to unnecessary surgery [5] [6].

Purported benefits of permanent preresection CSF diverting surgery, such as ETV of VPS other than the reduced incidence of postresection hydrocephalus, include the following:

(1) Being able to delay resection surgery, thus avoiding resection under emergent conditions or allowing for preresection adjuvant therapy in certain circumstances

(2) reducing the likelihood of needing external CSF diversion, which may carry risk of infection

(3) potentially reducing risk of postresection CSF leak or pseudomeningocele.

Purported disadvantages of permanent preresection CSF diversion surgery include the following:

(1) Performance of a procedure that ultimately may not be clinically indicated, exposing patients to the risks of unnecessary surgery

(2) ETV may be less reliable in controlling intracranial pressure (ICP) and does not allow for ICP

monitoring

(3) no ability to externally drain spillage of blood products after the resection [7].

Prediction

See The Canadian Preoperative Prediction Rule for Hydrocephalus

Case series

2007

Due-Tønnessen and Helseth (n = 87, 1990–2003) found that patients with medulloblastoma and ependymoma had much higher rates of postoperative shunt requirement than astrocytomas [8].

2005

Morelli et al. (n = 160, 1989–2004) found medulloblastoma histology and severe preoperative hydrocephalus to be risk factors [9].

2003

Bognár et al. (n = 180, 1990–2000) found younger age, tumor histology, and presence of EVD to be predictive of postoperative need for CSF diversion, but they found that tumor location, extent of resection, and postoperative CSF leak or pseudomeningocele were not predictive [10]

2000

The incidence of postoperative hydrocephalus and factors relating to it were analyzed in 257 patients undergoing cranial base surgery for tumor resection. A total of 21 (8%) patients developed postoperative hydrocephalus, and all required shunting, Forty-two (17%) patients developed cerebrospinal fluid (CSF) leak that required placement of external drainage systems (ventriculostomy or lumbar drain, or both); 10 (23%) of these 42 patients eventually needed shunt placement to stop the leak because of hydrocephalus. Prior craniotomy, prior radiation therapy, and postoperative CSF infection were also associated with an increased risk of developing hydrocephalus (48% versus 6%, 19% versus 8%, and 14% versus 7%, respectively). Prior radiation and postoperative CSF infection increased the risk of CSF leak in patients with hydrocephalus (30% versus 18% and 30% versus 9%, respectively). CSF leak and hydrocephalus commonly occurred in patients who underwent resection of a glomus tumor. In conclusion, 8% of patients who underwent cranial base surgery for tumors developed de novo hydrocephalus; half of them also had CSF leak in addition to hydrocephalus; and all required shunt placement for CSF diversion [11].

1996

Kumar et al. (n = 175, 1983–1993) found age <3, ependymoma/medulloblastoma tumor histology, and subtotal resection to be risk factors [12].

1994

Culley et al. (n = 117, 1976–1990) found that age <3 years, midline tumor location, subtotal resection, prolonged EVD requirement, cadaveric (vs. autologous) dural grafts, pseudomeningocele formation, and CSF infections were statistically significant factors associated with the need for postoperative shunt placement [13]

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