Seizures after posterior fossa surgery: Exploring the unknown, a systematic review-

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Research

Keywords: posterior cranial fossa, seizures, anticonvulsants

DOI: https://doi.org/10.21203/rs.3.rs-25132/v1

Abstract

Background

Seizures due to posterior fossa lesions is an uncommon phenomenon. In this study systemic literature review was done to i) study the incidence of seizures in posterior fossa lesions ii) determine factors associated with high risk for seizures and iii) ascertain role of prophylactic AEDs in such cases.

Methods

Systemic literature review was done, for the MeSH terms “posterior cranial fossa” AND “seizures” AND “anticonvulsants”. All original research articles, case reports and systematic reviews pertaining to seizures or use of anticonvulsants in posterior fossa lesions were considered for inclusion.

Results

A total of 79 cases of posterior fossa lesions, identified from 8 studies, were included for analysis. Incidence of seizures in posterior fossa lesions ranged from 1.8–5% in various studies. The highest incidence for seizures was reported with medulloblastoma, cerebellar haemorrhage and during microvascular decompression for cases of neurovascular conflict. The most significant risk factor for seizures in post-operative period was use to ventricular shunt or ventriculostomy. AEDs were administered symptomatically after the occurrence of seizures in 78 cases except for the use of prophylactic AEDs in a single case of posterior cranial fossa lipoma.

Conclusion

Seizures in association with posterior fossa lesions are rare and associated with a poor prognosis. Clinical detection can often be difficult and EEG helps in early diagnosis and treatment. Further studies are needed to confirm the role of prophylactic AEDs in high-risk cases.

Background

The occurrence of seizures in association with supra-tentorial lesions is well reported and prophylactic antiepileptic drugs (AEDs) are frequently used to reduce seizure recurrence [1–5]. There is no clear indication that these drugs reduce the incidence of seizures and long-term use is not recommended by most authors [1–5]. However, seizures due to posterior fossa lesions is an uncommon phenomenon and there is dearth of literature with regards to this [6]. The importance of addressing the issue of seizures in posterior fossa lesions, is due to the anatomical configuration where in the posterior fossa being a tight compartment resists even a mild increase in intracranial pressure and can lead to cerebral herniation and threaten life.

In this paper, we did a literature review to i) study the incidence of seizures in posterior fossa lesions ii) determine factors associated with high risk for seizures and ii) ascertain role of prophylactic AEDs in such cases.

Methods

We searched various databases including PubMed, Cochrane and the grey literature, including relevant organisational websites, for the MeSH terms “posterior cranial fossa” AND “seizures” AND “anticonvulsants”. All original research articles, case reports and systematic reviews pertaining to seizures or use of anticonvulsants in posterior fossa lesions were considered for inclusion. Excluded were cases having i) multiple intracranial lesions ii) lesions situated in other areas of brain but were approached via posterior cranial fossa iii) posterior fossa lesions which neither had seizures nor AEDs were used prophylactically.

Results

A total of 79 cases of posterior fossa lesions, identified from 8 studies; who either presented with seizures or in whom AEDs were prophylactically used; were included for analysis. Seizures occurred pre-operatively in 15 cases and post-operatively in 63 cases. The various studies dealing with seizures in posterior fossa lesions are summarised in Table 1.

Table 1
Summary of literature data on seizures in posterior fossa lesions

Study group	Timing of seizure	Number of cases and type of lesion	Risk factors for post-operative seizures	AED administered prophylactically or symptomatically	Outcome
Lee et al.[6] (1990)	Post-operative	Posterior fossa lesions (13) Medulloblastoma (4), Microvascular decompression (3) Haemorrhage (2) Acoustic neuroma (2), Astrocytoma (1), Meningioma (1),	Metabolic acidosis (4), Hyponatremia (1), Meningitis (2) Ventriculostomy or shunt (9)	Symptomatic	-
Patir and Banarjee [7] (1990)	Post-operative	Posterior fossa tumors (13) Medulloblastoma (6), Acoustic neuroma (3), Astrocytoma (2), Meningioma (2),	Shunt (11)	Symptomatic	Poor
Bazowski et al. [8] (1994)	Nil	Posterior fossa lipoma (1)	-	Prophylactic	-

Study group	Timing of seizure	Number of cases and type of lesion	Risk factors for post-operative seizures	AED administered prophylactically or symptomatically	Outcome
Suri et al. [9] (1997)	Post-operative	Posterior fossa lesions (36),	Operation in sitting position, intraoperative air embolism, postoperative pneumocephalus, hyponatraemia, metabolic acidosis, meningitis	Symptomatic	-
Mclone [10] (1998)	Pre-operative	Cerebellar hamartoma (1)	-	Symptomatic	Good
Brown and Verheyden [11] (2009)	Post-operative	Posterior fossa infarction (1)	-	Symptomatic	Poor
Grill et al. [12] (2009)	Pre-operative	Number of patients (13), Aneurysms (4), Cavernous malformations (3), Cerebellar haemorrhage (3), Posterior fossa tumors (2), PRES (1)	Sepsis (3), Use of drugs: cephalosporins (6), levofloxacin (3), bupropion (1)	Symptomatic	Poor
Triana-Perez et al. [13] (2011)	Pre-operative	Rosai-Dorfman disease (1)	-	Symptomatic	-

Risk of seizures associated the various posterior fossa lesions

A. Tumors

The most common posterior fossa tumors associated with seizures were medulloblastoma (n = 10, 47%) followed by acoustic neuroma (n = 5, 23.8%). The other tumors less frequently associated with seizures were astrocytoma, meningioma, as well as a rare case of Rossai-Dorfman disease.

B. Vascular lesions

The most common vascular lesions in the posterior fossa associated with seizures were cerebellar haemorrhage (n = 6, 62.5%), followed by aneurysm (n = 4, 33%). Other lesions were one case each of cerebellar hamartoma and posterior fossa infarction respectively.

C. Miscellaneous

Other causes of seizures related to posterior fossa lesions were three cases of neurovascular conflict in whom microvascular decompression was attempted and one case of posterior reversible encephalopathy syndrome (PRES).

Risk factors for post-operative seizures

The most significant risk factor for seizures in post-operative period was use to ventricular shunt or ventriculostomy (n = 20,50%). The other risk factors were metabolic acidosis, hyponatremia, sepsis, meningitis, use of drugs which predispose to seizures such as cephalosporins, levofloxacin or bupropion and operation in sitting position which predisposed to air embolism and pneumocephalus.

Role of prophylactic AEDs

AEDs were administered symptomatically after the occurrence of seizures in 78 cases and prophylactic AEDs were only used in a single case of posterior cranial fossa lipoma.

Outcomes of patients having seizures in posterior fossa lesions

Amongst the four studies, which looked at patient outcomes in posterior fossa lesions presenting with seizures; poor outcomes were reported in three studies and a single case of cerebellar hamartoma had good outcome after seizures were controlled.

Discussion

Posterior cranial fossa contains several structures which are pertinent for maintaining normal level of consciousness. Structural lesion involving the posterior cranial fossa may cause impairment of consciousness commonly by virtue of mass effect leading to raised intracranial pressure and brainstem compression. An important differential diagnosis for sudden deterioration in sensorium of patients having posterior fossa lesions is seizure; which may be convulsive or non-convulsive. Seizures may cause altered consciousness or post-ictal weakness which may mimic clinical deterioration from other

causes. Unlike supratentorial lesions which are commonly associated with seizures, the incidence of seizures in posterior fossa lesions is rare ranging from 1.8–5% in various series [6, 7, 12].

The mechanism of seizures in posterior fossa lesions, especially the role played by cerebellum in controlling epilepsy is a matter of dispute. Dysfunctional cerebellum has been found to be linked with disinhibition of epileptic activity in the cerebral cortex [14–16]. Pathologic cerebellar alterations lead to decrease in inhibitory purkinje cell output to the dentate nucleus and can result in seizures via the excitatory dentatothalamocortical tracts.

The incidence of seizures either pre or post-operatively is largely dependant upon the type of lesion [6–13] and use of ventricular shunt or ventriculostomy [6, 7]. The highest incidence for seizures was reported with medulloblastoma, cerebellar haemorrhage and during microvascular decompression for cases of neurovascular conflict. The high risk for seizures associated with this entities is plausibly due breach of the blood-brain barrier and intracranial deposition of hemosiderin, which is considered highly epileptogenic.

Majority of patients with seizures in posterior fossa lesions tend to have poor outcome [7, 11, 12]. Early detection and prompt administration of AEDs is necessary as seizures can cause cerebral hypoxia, metabolic acidosis and a further increase in intracranial pressure. However, clinical detection of seizures in posterior fossa lesions is difficult, as convulsive seizures need to be differentiated from decerebrate or decorticate posturing secondary to raised intracranial pressure. Similarly altered sensorium due to non-convulsive status epilepticus (NCSE) needs to be differentiated from coma due to structural lesion. EEG is a vital tool to facilitate seizure diagnosis and initiate prompt treatment. It is mandatory to order continuous EEG monitoring in all patients with a posterior fossa lesions who develop altered mental status before or after surgery.

There is no literature evidence regarding use prophylactic AEDs or choice of particular AEDs for seizure management [6, 7, 9–13]. However, in certain cases associated with high risk of seizures as discussed earlier, it is worth considering the possible use of prophylactic AEDs. Prevention of seizures could result in an improved prognosis for such patients. In addition, the use of prophylactic AEDs may also be cost-effective given the increased morbidity and mortality in those patients who do develop seizures and NCSE. Further studies and possibly large scale multi-centric trials are warranted to investigate whether the use of prophylactic AEDs can be recommended in high-risk posterior fossa lesions.

Conclusion

Seizures in association with sub-tentorial posterior fossa lesions are rare and are associated with a poor prognosis. Clinical detection can often be difficult and EEG helps in early diagnosis and treatment. Further studies are needed to confirm the role of prophylactic AEDs in high-risk cases.

Abbreviations

AED-anti-epileptic drugs,

NCSE-non-convulsive status epilepticus,

PRES-posterior reversible encephalopathy syndrome

Declarations

Availability of data and materials

The data that support the findings of this study are available from the corresponding author, [Dr.Agarwal] upon reasonable request.

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