ORIGINAL RESEARCH PAPER

Volume-8 | Issue-8 | August - 2019 | PRINT ISSN No. 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

POSTERIOR-FOSSA EXTRADURAL HAEMATOMA-DIAGNOSTIC DILEMMA AND MANAGEMENT DIFFICULTIES

Neurosurgery

Dr. Sanghmitra Sarkar Assistant Professor,Department of Neurosurgery, CNMCH Kolkata

Dr. Payoz Pandey* Post Doctoral Trainee,Department of Neurosurgery,CNMCH Kolkata *Corresponding Author

ABSTRACT

Extradural hemorrhage (EDH) results from collection of blood between the dura and the calvaria as a consequences of head injury. Extradural haematoma occurs in approximately 2-% of all patient with head injury.Though posterior fossa extradural hematoma(PFEDH) is much less frequent than it's supratentorial counterpart it is the most common traumatic space occupying lesion in this location. It accounts for approximately 0.3% of all craniocerebral injuries and constitutes 2.7-11% of all intracranial epidural hematomas (EDH).It is a potentially lethal sequelae of head injury, as it may be silent or slow to develop, but deterioration may be sudden and rapid, becoming fatal, if not promptly treated. Mortality is high in PFEDH is due to the small volume of the posterior fossa and contained important structures. A high index of suspicion is needed for proper intervention for prevention of morbidity and mortality.

AIMS AND OBJECTIVES: The aim of the present study was to share the experience of 27 cases and review the literature concerning PFEDH for earlier diagnosis and better management of PFEDH

MATERIALS AND METHODS: Our study is a prospective analysisof patients who had presented to us with Posterior fossa Epidural Hematoma from Sep 2017- March 2019(30 months).in the Department of Neurosurgery, Calcutta National Medical College and Hospital (CNMC &H).

RESULT ANALSIS: This prospective study of 27 patients with PFEDH during a period of30 months has revealed the following facts: EDH accounts for 2.27% of Neurosurgical admissions. PFEDH constitutes 19.6% of EDH. Male: Female ratio is 1.69:1(M17;F10).55.5%,(15) of patients were below 15 yrs of age. Frequently the cause was fall from a height n= 15 (55.5%) followed by road traffic accident n=5 (18.5%)and trauma over back of skull n=4 (14.8%). Patients present mostly with features of raised I.C.P such as headache vomiting papilloedema n=17 (62.96%). 22.2% of patients(n=6) were asymptomatic at presentation. X-ray skull detected fracture of occipital bone in 74.08% of cases(20cases) which had frequent association with PFEDH . At follow up, the outcome was evaluated using the Glasgow outcome scale (GOS). The patients were classified into five groups according to the GOS : Good recovery n= 16(59.25%) . Moderate disability n= 5 (18.51%). Severe disability n= 3 (11.11%). Persistent vegetative state n=1 (3.70%). Death n=1 (3.70%).

CONCLUSION: PFEDH is a potentially lethal complication of head injury.Children and Young and active males are the usual victims. High degree of suspicion and awareness of its occurrence isneeded in any case of head injury which might be asymptomatic withG.C.S score of 15, and /or with evidence of local trauma overposterior aspect of skull.C.T scan of brain should be requisitioned in any case of headinjury, so that a prompt diagnosis can be made and managementinstituted. With proper evaluation and management a fair number of patientsrespond to conservative treatment. Overall prognosis of PFEDH is good, if there is no concomitant brainstem injury.

KEYWORDS

INTRODUCTION:

Extradural hemorrhage (EDH) results from collection of blood between the dura and the calvaria as a consequences of head injury. Extradural haematoma occurs in approximately 2-% of all patient with head injury[1].

Though posterior fossa extradural hematoma(PFEDH) is much less frequent than it's supratentorial counterpart it is the most common traumatic space occupying lesion in this location. It accounts for approximately 0.3% of all craniocerebral injuries[1] and constitutes 2.7-11% of all intracranial epidural hematomas (EDH)[5]

It is a potentially lethal sequelae of head injury, as it may be silent or slow to develop, but deterioration may be sudden and rapid, becoming fatal, if not promptly treated. Mortality is high in PFEDH is due to the small volume of the posterior fossa and contained important structures. A high index of suspicion is needed for proper intervention for prevention of morbidity and mortality.[2] Main factors contributing to mortality in PFEDH's is due to its rapid clinical deterioration in form of respiratory depression occuring without any change in pupillary size and motor deficit[1]. Change in GCS or severe headache with vomiting and new onset cerebellar signs are associated features that help to clinch the diagnosis. Hydrocephalus may be observed in as high as 30 percent of cases on the CT scan[2,5]

As head injury, affecting mostly the younger adults, it becomes all the more imperative to suspect and diagnose PFEDH at the earliest, evaluate both clinically and radiologically and take remedial measures urgently, so that mortality can be brought down as near to zero level as possible

AIMS AND OBJECTIVES:

The aim of the present study was to share the experience of 27 cases and review the literature concerning PFEDH for earlier diagnosis and better management of PFEDH

MATERIALS AND METHODS:

Our study is a prospective analysisof patients who had presented to us with Posterior fossa Epidural Hematoma from Sep 2017- March 2019(30 months).in the Department of Neurosurgery, Calcutta National Medical College and Hospital (CNMC &H). Ethical Committee clearance was taken and an informed consent was taken from the patients at the time of admission.

All patients of traumatic head injury with Posterior fossa Epidural Hematoma from Sep 2017- March 2019(30 months).in the Department of Neurosurgery, Calcutta National Medical College and Hospital (CNMC &H) were included in this study.Non-traumatic PFEDH's were excluded from this study.

The decision for surgical or expectant treatment primarily depended on the CT findings and the clinical condition of the patients.

- The criteria for surgical intervention included a clot volume ≥15 ml(with or without the presence of fourth ventricle compression or displacement and/or obstructive ventriculomegaly.
- Patients with small haematomas (volume<10) without mass effects and no associated intracranial lesions or midline shift were conservatively treated.
- Patients with a haematoma volume ranging from 10 to 15 ml-treatment was individualized based on the clinical condition of the patients.

Data were obtained from the patients at admission to neurosurgery department at Calcutta National Medical College.Data were entered into a master chart containing proforma that included demographic information ,GCS Score at admission ,one week after admission and at 1 month

After admission, a rapid and accurate examination of all patients were done which included an assessment of the level of consciousness, External trauma over head and pupillary reactivity. Further medical treatment included treatment of fluid resuscitation, treatment of haemorrhage and associated substantial extra cranial injury .

Respiratory support with mechanical ventilation, and shifting patients in the neuro I.T.U when needed. All patients were initially admitted in Neurosurgical ward at CNMCH and were shifted to Neurosurgical ICU depending on the Neurological status and CT scans. Each patient underwent a CT Brain(plain).Details on CT Scan(hematoma thickness, volume and ventricular dilatation) at admission, repeat CT scan at 6 hours &72 hours/as per need, 6 hours after operation in patients managed surgically and at 1 month follow up were noted. Surgical/conservative management are decided depending on the CT findings and the clinical condition of the patients with PFEDH., Patients requiring close observation were admitted to Neuro I.T.U and neurological monitoring was performed, with hourly GCS and pupillary examinations. Consecutive follow-up CT scans were routinely performed after injury, particularly within the first 72 hours of hospital admission. For patients with surgical indications, the standard surgery, suboccipital craniectomy, performed. During the postoperative period, all patients routinely underwent a CT scan within 6 hours to assess the completeness of evacuation and/or resolution of the fourth ventricle compression. At Discharge ,all patients were asked to Follow-up after a duration of 1 month/SOS(in case of Seizures,LOC,IncreasingHeadache,Vomitting,Neurological deterioration).after 3 months and after 1 yr.

Statistical evaluation was performed. Clinical data for participants was presented as Mean for Continuous Variables and Absolute numbers and Percentages for categorical variables

RESULTANALSIS:

Between Sep 2017- March 2019(30 months)5598 patients with head injury were admitted and treated in Calcutta National Medical College and Hospital, out of which 127 patients were admitted with EDH (2.27% of total head injury). 27 patients of these were admitted with an established diagnosis of PFEDH (19.6%) of total no of EDH admitted which were analysed in our series .

This prospective study of 27 patients with PFEDH during a period of30 months has revealed the following facts:

- EDH accounts for 2.27% of Neurosurgical admissions
- PFEDH constitutes 19.6% of EDH
- Male: Female ratio is 1.69:1(M17;F10)
- 55.5%,(15) of patients were below 15 yrs of age.
- Frequently the cause was fall from a height n= 15 (55.5%) followed by road traffic accident n=5 (18.5%)and trauma over back of skull n=4 (14.8%)
- Patients present mostly with features of raised I.C.P such as headache vomiting papilloedema n=17 (62.96%).

Occipital, sub-occipital and retro mastoid swelling n=17 (62.96%)
Brain stem features n=15 (55.5%) and other associated features.
Most importantly 22.2% of patients(n=6) were asymptomatic atpresentation.

- The GCS score was used to assess the level of consciousness in all patients. Acording to the Glasgow Coma Scale (GCS) at presentation patients were stratified into 3 tiers,
- G.C.S >13 n=9 (33.33%)
- G.C.S-8-13 n=16(59.25%)
- G.C.S < 8 n=2(7.40%)

- X-ray skull detected fracture of occipital bone in 74.08% of cases(20cases) which had frequent association with PFEDH .

- Upon admission, CT scans were obtained for all suspicious patients with a history of head injury. We evaluated the CT findings, including the volume of the haematoma, the presence of fourth ventricle compression(33.33%), the hydrocephalus (29.62%) and obliteration of the perimesencephalic cistern(29.62%), the presence and pattern of the skull fracture, and the associated intracranial lesions like contusion(22.22%) and Supratentorial EDH(11.11%).Supratentorial SDH(7.40%)

We operated on 19 patients : 14 patients underwent immediate surgery after diagnosis, and Five patients, initially planned for conservative management, deteriorated in consciousness during hospitalisation. At surgery, 11 patients bled from the fracture lines, and no evidence of the source of bleeding was observed in 8 patients . There were no cases of mortality among the surgically treated patients except One patient with G.C.S score 3 initially expired postoperatively in spite of I.T.U management. PFEDH patients with GCS>13 (9 patients) initially managed conservatively undergoing close observation of their neurological status and serial CT scanning (at 24, 48, and 72 hours after admission). 8 patients responded to conservative management and discharged home after 10 days .1 patient in this group deteriorated clinically after 48 hours and treated by surgical evacuation. .Except for two cases, all patients had good recovery after a mean hospital stay of 5.4 days. The mean follow-up duration was 14.3 months (ranging from 3 to 24 months).

The clinical course of traumatic PFEDH was classified according to the proposal of Hooper as

- acute - onset of symptoms within the first 24 hours of trauma,
- sub-acute with the, onset of symptoms within from the 2nd to the 7th day after trauma, and
- chronic, with the, onset of symptoms later, respectively

Most of our patients were presented with the acute form of disease n= 18(66.66%)

8 Patients(29.62%) were presented with subacute form of disease and 1 patient (3.71%) had chronic symptoms.

At follow up, the outcome was evaluated using the Glasgow outcome scale (GOS). The patients were classified into five groups according to the GOS :

- Good recovery n= 16(59.25%)
- Moderate disability n= 5 (18.51%)
- Severe disability n= 3 (11.11%)
- Persistent vegetative state n=1 (3.70%)
- Death n=1 (3.70%)

Demographics data

Table 1
SEX PREDILICTION

Sex M:F - 1.6:1	Number of patients	Percentage
Male	17	62.9
Female	10	37.1

Table 2
AGE DISTRIBUTION
Average age-33.25

Age	Number of patients	Percentage
0- 4years	4	14.810%
5-14 years	11	40.74%
15-24years	5	18.51%
25-34 years	3	11.11%
35-44 years	2	7.40%
45-54 years	1	3.70%
55-65 years	1	3.70%
>65	0	0%

Table 3
Mode of Injury

Mode of injury	Number of patients	Percentage
Fall from height	15	55.55%
Motor Vehicular accident	5	18.51%
Physical Assault	3	11.11%
Fall of heavy object on head	4	14.81%

Table 4
Clinical Features

Chief complaints	Number of patients	Percentage
Asymptomatic	6	22.22%
Severe headache	10	37.03%
Loss of consciousness	1	3.70%
Vomiting	16	59.25%
Seizures	3	11.11%
Occipital, sub-occipital and retro mastoid swelling	17	62.96%

features of raised ICP	17	62.96%
brain stem features	15	55.5%

Table 5
Glasgow coma scale on admission

Glasgow coma scale	Number of patients	Percentage
15-13	9	33.33%
13-8	16	59.25%
<8	2	7.40%

Table 6
C.T scan features

C.T scan features	No of patients	Percentage
Posterior fossa EDH	27	100%
Fracture in occipital bone	20	
4thventricular compression	9	33.33%
Hydrocephalous	8	29.62%
Obliteration of perimesencephalic cistern	8	29.62%
Contusions	6	22.22%
Supratentorial EDH	3	11.11%
Supratentorial SDH	2	7.40%

Table 7
Thickness of Posterior fossa EDH on C.T scan

Thickness of Posterior fossa EDH	Number of patients	Percentage
<10 mm	7	25.92%
>10-15 mm	17	62.96%
>15 mm	3	11.11%

Table 8

Management	No of patients	Percentage
Conservative management	8	29.62%
Surgical managemebt	19	70.37%

Table 9
Glassgow outcome scale

Glassgow outcome scale	No of patients	Percentage
Good recovery	16	59.25%
Moderate disability	5	18.51%
Severe disability	3	11.11%
Persistent vegetative state	1	3.70%
Death	1	3.70%

DISCUSSIONS:

EDH, as a whole comprises 1% to 2% of admission for all acute head injuries, and the incidence of PFEDH accounts for 4%–12.9% of all acute EDH.[1] In our study EDH accounts for 2.27% of Neurosurgical admissions and PFEDH constitutes (19.6%) of total no of EDH admitted. This is probably due to the fact that our hospital is a tertiary referral centre and there might be bias in referring the patients with significant radiological findings

In our study the incidence of PFEDH is 55.5%in Children (Age < 15 yrs) in comparison to the 44.44% in adults (Age>15 yrs). This is similar to findings of study by Suyama et al where they found the incidence of PFEDH more in children is than in adults—23.3% versus 12.7%. PFEDH is encountered most commonly in children as reported by Kinomonoto et al[8](21.2% children versus5.2% in adults) and Shin - ichiotsuka et al [10](17.5% children versus7.5% in adults) Higher incidence in children has been explained by colemon et al due to the ease with which dura and sinuses are damaged in the event of skull fracture, owing to strong adhesion of the dura to the inner table of skull in children.[15]

In our study more than 50% patients n=16(59.62%)had G.C.S score between 8-13 . number of patients presenting with G.C.S 13 – 15 was 9(33.33%).only 2 patients(7.40%) had G.C.S score was below 8.The mean GCS score upon admission in a study by Chaoguo, You et al[29]was 13 (ranging from 4 to 15).

In our study 22.2% of patients(n=6) were asymptomatic at presentation. Patients present with features of raised I.C.P such as headache vomiting papilloedema n=17 (62.96%). Occipital, sub-occipital and retro mastoid swelling were present in n=17 (62.96%). PFEDH has no characteristic clinical features specific of Ikeda[13] et al reported that acute cases often presented with disturbances of consciousness, where as in sub-acute cases symptoms of raised I.C.P such as headache vomiting papilloedema, as well as cerebellar signs were the presenting features. Shin-ichi OTSUKA et al,[10] reported headache & vomiting is the most frequent symptoms, impairment of consciousness and cerebellar signs are rare presenting symptoms. Scalp hematoma or subgaleal hematoma in the occipital region is highly suggestive of underlying PFEDH[10].

In our study X-ray skull and C.T scan of Brain detected fracture of occipital bone in 74.08% of cases(20cases) which had frequent association with PFEDH , as compared to patients n=7(25.92%)without fracture..Mahapatraet al[33] in a retrospective analysis of 22 patients found that 73% had occipital fracture & 72.7% as reported by Shin-ichiotsuka et al who demonstrated that a occipital fracture is of paramount importance in PFEDH, serious complications developing in 33% of patients as compared with 7% of patients without fractures[10].

In our study on admission, CT scans were obtained for all suspicious patients with a history of head injury. We evaluated the CT findings, including the volume of the haematoma, the presence of fourth ventricle compression(33.33%), the hydrocephalus(29.62%) and obliteration of the perimesencephalic cistern(29.62%), the presence and pattern of the skull fracture, and the associated intracranial lesions like contusion(22.22%) and Supratentorial EDH (11.11%) and Supratentorial SDH(7.40%). CT is the most essential element of the diagnostic work-up and should be performed routinely in all cases of head injury as some patients with PFEDH are asymptomatic with G.C.S 15. Because the CT findings are generally found earlier than the clinical manifestations, the diagnosis rate increases[2]. If the initial CT scan is negative but new symptoms appear or initial symptoms worsen or fail to improve because of slower course of PFEDH in a delayed haematoma formation, a repeat CT scan should be performed especially in the presence of occipital bone fracture [3]. Associated intracranial pathology detected in C.Tscan having a bearing on prognosis in patients with PFEDH are supratentorial extension of hematoma as reported by Zuccarello etal[19] Brain contusion and SAH as reported by Taskin Yrstswinet al[14] and brain contusion and post-traumatic hydrocephalus reported byEdson Bor-Seng-Shu et AL10[20] Most of our patients were presented with the acute form of disease n=18(66.66%)8 Patients(29.62%) were presented with subacute form of disease and 1 patient (3.71%) had chronic symptoms

As per C.T lesions can be classified as pure PFEDH, when the haematoma is located within the boundaries of foramen magnum and the transverse and sigmoid sinuses as mixed PFEDH, when itextends beyond the sinuses to the occipital area

In our study n=17(62.96%) diagnosed as pure PFEDH and rest of the patients n=10(37.03%) was as mixed PFEDH, as it extends beyond the sinuses to the occipital area.

In our study Plain C.T scan of brain is very useful in measuring the volume of PFEDH which is a major deciding factor for the mode of management. In our study we had 3 patients (11.11%) with clot volume >15 ml. The criteria for surgical intervention included a clot volume ≥15 ml with or without the presence of fourth ventricle compression or displacement and/or obstructive ventriculomegaly. Patients n=7(25.92%) with small haematomas (volume<10) without mass effects and no associated intracranial lesions or midline shift were conservatively treated.

Patients with a haematoma volume ranging from 10 to 15 ml n=17(62.96%) - treatment was individualised based on the clinical condition of the patients.

Deciding between conservative and surgical management of PFEDH is controversial, selection of surgical candidates being of paramount importance [4,5]. A G.C.S score of 15 and exclusion of both mass effect and associated lesion are usually the criterion for conservative treatment.

In our study We operated on 19 patients : 14 patients underwent immediate surgery after diagnosis, and Five patients, initially planned for conservative management, deteriorated in consciousness during hospitalization. PFEDH patients with GCS>13 n=9(33.33%) initially managed conservatively undergoing close observation of their neurological status and serial CT scanning (at 24, 48, and 72 hours after

admission)..8 patients (29.62%)responded to conservative management and discharged home after 10 days .1 patient(3.70%) in this group deteriorated clinically after 48 hours and treated by surgical evacuation.

Coleman and Thompson were the first to report successful operation for removal of PFEDH in 1941[12]. Tabuse et al have recommended surgery in PFEDH when the hematoma is more than 10 mm of thickness in maximum thickness[23].Sakurai et al here advocated emergency surgery whenever there is poor visualization of quadrigenimal and ambient cisterns on C.T. As this suggests ascending transtentorial herniation[24]. Nagamine Y. et al have stated that compression and displacement of the fourth ventricle, obstructive hydrocephalus and absence of posterior fossa cisterns on C.T especially quadrigeminal and ambient cisterns are important consideration while deciding on surgery although clinical symptoms and signs of haematoma are also important[25]. TaskinYurtseven et al , recommended immediate surgery for patients of PFEDH of more than 10 ml of haematoma volume[14]. If haematoma is less than 10 ml close observation with repeat CT scan at 6 and 24 hours are recommended

Prognosis for children with PFEDH is good[21,41,33 42,28,37]. For instance, Prasad et al[28].in a series of 22 children with PFEDH, reported that all patients had good outcomes, except one case of moderate disability. Sencer et al [37]reported 40 cases of patients with good outcomes. Gupta et al[33]reported one case of severe disability and two cases of moderate disability among the 19 children PFEDH examined in their study. Berkeret al[41]reported a single case of mortality and one case of moderate disability among 16 children with PFEDH.

In our study ,the outcome was evaluated using the Glasgow outcome scale (GOS). The patients were classified into five groups according to the GOS :

- Good recovery n= 16(59.25%)
- Moderate disability n= 5 (18.51%)
- Severe disability n= 3 (11.11%)
- Persistent vegetative state n=1 (3.70%)
- Death n=1 (3.70%)

Prognosis of PFEDH depends on proper diagnosis and management and is good if diagnosis and surgery are done urgently. Delay in diagnosis poor. G.C.S at the time of admission and associated other intra-cranial lesionsare main factors affecting mortality. Higher mortality rates also found in patients with mixed type of PFEDH / associated damage to the brainstem &/or basal ganglia. The mortality rate was higher in pre C.T era, as is evident from the figures of Hopper et al (50%in 1954)[6]. With the use of C.T which enables earlier diagnosis and treatment, mortality rate as reported by Lui et al [17] and Shinichi Otsuka et al has come down to 18.2.[10]

CONCLUSION:

PFEDH is a potentially lethal complication of head injury.Children and Young and active males are the usual victims. High degree of suspicion and awareness of its occurrence isneeded in any case of head injury which might be asymptomatic withG.C.S score of 15, and /or with evidence of local trauma overposterior aspect of skull.C.T scan of brain should be requisitioned in any case of headinjury, so that a prompt diagnosis can be made and managementinstituted. With proper evaluation and management a fair number of patientsrespond to conservative treatment. Overall prognosis of PFEDH is good, if there is no concomitant brainstem injury.

REFERENCES:

1. Rammurthy and tendon bibliography-Ramamurthi R and PN tendon.Ramamurthi and Tandon'stextboom of Neurosurgery.3rded,Vol 1,Jaypee ,2012
2. Bozbuğa M, Izgi N, Polat G, Gürel I. Posterior fossa epidural hematomas:observations on a series of 73 cases. Neurosurg Rev. 1999;22(1):34-40.
3. Songara A et al. IntSurg J. 2016 Feb;3(1):369-371
4. GallagherJP.Brower EJ Extradural haematoma. J Neurosurgery29:1.1968
5. Balasubramanian V. Ramesh V G.A case of coup and contrecoup extradural hematoma of the posterior fossa Br J surgery 1954. 42:19-26(Midline)
6. Hooper RS: Extradural hemorrhages of theposterior fossa. Brit J Surg 42: 19261954
7. Kalyanraman S. Ramamurthi k, Ramamurthi B: An analysis of twothousand cases of head injury Neurol(India) 18(suppl):3.1970
8. Meredith JM.EDH in post-fossa diagnosis and treatment with areport of two suegically treated patients.Am J Surg 1966:102:524-31
9. Brambilla G, Rainoldi F. Crippano D, Padletto P: extradural hematoma of the posterior fossa: A report of eight cases and a review of the literature. ActaNeurochir (Wien) 80: 24291986
10. Shin-ichi OTSUKA, Shoji NAKATSU, Shigeo MATSUMOTO, Shinichi SATO- Study on Cases with Posterior Fossa Epidural HematomaClinical Features and Indications for Operation Neurol Med Chir(TOKYO) 3024281990
11. Kinomoto T Itoh Y. Yokoe T. Banno T: Posteriorfossa epidural hematoma in children. Neurotrauma matology 8: 1771831985
12. Coleman CC, Thomson JL: Extradural hemorrhagein the posterior fossa. Surgery 109859901941
13. Ikeda Y, Nakazawa S, Yamakawa K, Kobayashi STsuji Y, Nishimura N: Traumatic posterior fossa epidural hematoma. Especially the value of CT scan.NoShinkeiGeka 9: 4014061981 in Japanese).
14. TaskinYurtseven, Series Islekel,et al successful management ofadult traumatic Post fossa haematoma with zero mortality Journal ofneurological sciences(Turkish)
15. Fisher RG, Kim JK, SachsEJr Complication inposterior fossa due to occipital trauma, their operability JAMA 167. 176-182, 1958
16. Bor-Seng-Shu E. Aguiar PH, Matushita H, et al: Actual asymptomatic epidural hematomas in childhood Report of threecases Childs NervSyst 136056071997
17. LUI TN Lee ST, Chang CN et al Epidural hematomas in theposterior cranial fossa. J Trauma 342112151993
18. Wong CWN The CT criteria for conservative treatment but underclose clinical observation of posterior fossa epidural haematomasActaNeurochir 126 124-127, 1994
19. Zuccarello M, Pardatscher K. Andrioli GC, et al Epiduralhematomas of posterior cranial fossa Neurosurgery 84344371981
20. Edson Bor-Seng-Shu, Paulo Henrique Aguiar et al Epiduralhaematomas of posterior cranial fossa Neurosurg Focus/vol 16/Feb2004
21. Ammirate M. Tomita T Posterior Fossa epidural haematomaduring childhood. Neurosurgery 145415461984
22. Boiten J Epidural haematoma of Posterior Fossa good resultafter prompt diagnosis with C.J.J NeurolNeurosurg Psychiatry.529149151989
23. Tabuse J. Kajikawa H, Mori M. Hirota N. Tanaka H: Acute epiduralhematoma of fossa. Nippon GekaHokan 55: 3781986 inJapanese
24. Sakurai M, Yamamoto Y, Asari S: Computedtomography in diagnosis of acute traumatic epidural hematoma in posterior fossa. RinshoHoshasen 261055-1058, 1981 (in Japanese)
25. Nagamine Y. Sonobe M, Takahashi S: Investigationof epidural hematomas of the posterior fossa according to CT findings. No ShinkeiGeka 9: 3573631981(in Japanese)f
26. Suyama Y, Kajikawa H, Yamamura K, Sumioka S, Kajikawa M. [Acute epidural hematoma of posterior fossa: comparative analysis between 20 cases in adults and 10 cases in children] No ShinkeiGeka. 1996;24:6214.
27. Ciurea AV, Nuteanu L, Simionescu N, Georgescu S. Posterior fossa extradural hematomas in children: report of nine cases. Childs NervSyst 1993;9:224-8
28. Prasad GL, Gupta DK, Sharma BS, Mahapatra AK. Traumatic pediatric posterior fossa extradural hematomas: a tertiary-care trauma center experience from India. PediatrNeurosurg 2015;50:250-6.
29. Chaoguo, You &Xiu, Long &Liuxun, Hu &Hansong, Sheng & Nu, Zhang. (2019). Traumatic Posterior Fossa Epidural Hematomas in Children : Experience with 48 Cases and a Review of the Literature. Journal of Korean Neurosurgical Society. 62. 225-231. 10.3340/jkns.2016.0506.007.
30. Campbell E, Whitfield Rd, Greenwood R.Extradural hematomas of the posterior fossa. AnnSurg. 1953;138(4):509-20
31. Bor-Seng-Shu E, Aguiar PH, de Almeida Leme RJ, Mandel M, Andrade AF, Marino R Jr : Epidural hematomas of the posterior cranial fossa. Neurosurg Focus 16 : ECP1, 2004
32. Ersahin Y, MutluerS : Posterior fossa extradural hematomas in children. PediatrNeurosurg19 : 31-33,
33. Gupta PK, Mahapatra AK, Lad SD : Posterior fossa extradural hematoma. Indian J Pediatr69 : 489-494, 2002
34. Malik NK, Makhdoomi R, Indira B, Shankar S, Sastry K : Posterior fossa extradural hematoma: our experience and review of the literature. SurgNeurol68 : 155-158; discussion 158, 2007
35. Otsuka S, Nakatsu S, Matsumoto S, Sato S, Motozaki T, Ban S, et al. : Study on cases with posterior fossa epidural hematoma--clinical features and indications for operation. Neurol Med Chir (Tokyo) 30 : 24-28, 1990
36. Pozzati E, Tognetti F, Cavallo M, Acciarri N : Extradural hematomas of the posterior cranial fossa. Observations on a series of 32 consecutive cases treated after the introduction of computed tomography scanning. SurgNeurol32 : 300-303, 1989
37. Sencer A, Aras Y, Akcakaya MO, Goker B, Kiris T, Canbolat AT : Posterior fossa epidural hematomas in children: clinical experience with 40 cases. J NeurosurgPediatr9 : 139-143, 2012
38. Altay Sencer, M.D., Yavuz Aras, M.D., Mehmet Osman Akcakaya, M.D., BurcuGoker, M.D., TalatKırıs, M.D., and Ali TuncayCanbolat, M.D. Department of Neurosurgery, Istanbul School of Medicine, Istanbul University, Istanbul, Turkey
39. Peter JC, Domingo Z: Subacute traumatic extradural haematomas of the posterior fossa: a clinicopathological entity of the 5- to 10-year-old child. Childs NervSyst 6:135–138, 1990
40. Ciurea AV, Nuteanu L, Simionescu N, Georgescu S: Posterior fossa extradural hematomas in children: report of nine cases. Childs NervSyst 9:224–228, 1993
41. Berker M, Cataltepe O, Ozcan OE : Traumatic epidural haematoma of the posterior fossa in childhood: 16 new cases and a review of the literature. Br J Neurosurg17 : 226-229, 2003
42. Jung SW, Kim DW : Our experience with surgically treated epidural hematomas in children. J Korean NeurosurgSoc51 : 215-218, 2012