Posttraumatic leptomeningeal cyst

- Leptomeningeal Cyst
- Secondary nummular headache: Are they more common than we thought?
- Post-craniotomy leptomeningeal cyst: a new presentation of an old problem
- Does long segment subarachnoido-subarachnoid shunt prevent posttraumatic and postinfectious spinal arachnoid cyst recurrence?: technical note and case series
- Recurrent Meningitis After a Post-Traumatic Intradiploic Arachnoid Cyst: A Case Report
- Ruptured Sylvian arachnoid cysts: an update on a real problem
- What provokes a disappearing arachnoid cyst? - Case study and literature review
- Imaging Spectrum of Calvarial Abnormalities

Posttraumatic leptomeningeal cysts (PTLMC) (sometimes just traumatic leptomeningeal cysts), AKA growing skull fractures consists of a fracture line that widens with time.

The term cyst is actually a misnomer, as it is not a cyst, but an extension of the encephalomalacia [1].

Posttraumatic leptomeningeal cysts were first described in 1816, [2].

Epidemiology

Posttraumatic leptomeningeal cyst epidemiology

Pathophysiology

The pathophysiology and some aspects of its management are still controversial.

It is thought they occur secondary to skull fractures causing dural tears allowing the leptomeninges and/or cerebral parenchyma to herniate into it

Pulsations from CSF erode the fracture margin, resulting in eventual expansion and non-union.

It occurs due to a wide skull defect with underlying dural defect and changes in pressure gradients within the skull cavity. Neglected cases may develop progressive neurological deficits and complications after second head trauma [3].

Clinical features

Enlarging scalp mass

Seizures

Focal neurological deficit

Headache

Most often presents as scalp mass (usually subgaleal), although there are reports of presentation with head pain alone [4].

Kitumba and Mascarenhas presented a rare case of an adult with excruciating headache secondary to a post-traumatic fronto-orbital leptomeningeal cyst [5]

PTLMCs rarely occur > 6 mos out from the injury. Some children may develop a skull fracture that seems to grow during the initial few weeks that is not accompanied by a subgaleal mass, and that heals spontaneously within several months; the term “pseudogrowing fracture” has been suggested for these [6].

They can rupture and cause diffuse subgaleal CSF collection [7].

Diagnosis

Radiographic findings: progressive widening of fracture and scalloping (or saucering) of edges.

Plain radiograph

round or oval lucency with smooth margins

CT

CT scan is the modality of choice for the evaluation of leptomeningeal cyst. It consists of a lytic calvarial lesion with scalloped edges, in which encephalomalacia invaginates. The following features may also be present

extracranial brain herniation

hydrocephalus

unilateral ventricular dilatation

porencephalic cyst.

Guler I, Buyukterzi M, Oner O, Tolu I. Post-traumatic leptomeningeal cyst in a child: computed tomography and magnetic resonance imaging findings. J Emerg Med. 2015 May;48(5):e121-2. doi: 10.1016/j.jemermed.2014.12.042. Epub 2015 Feb 3. PMID: 25662419.

Differential diagnosis

Not to be confused with arachnoid cysts (AKA leptomeningeal cysts, which are not posttraumatic).

Posttraumatic intradiploic leptomeningeal cyst.

Skull tumor [8].

eosinophilic granuloma

calvarial metastases

epidermoid cyst

osteomyelitis

congenital calvarial defect

Complications

Although usually asymptomatic, the cyst may cause a mass effect with neurologic deficit.

Distal cortical artery aneurysms: often associated with an overlying s skull fracture, sometimes a growing skull fracture

---

Neglected GSF can rupture and cause diffuse subgaleal CSF collection [9].

Management

Screening

If early growth of a fracture line with no subgaleal mass is noted, repeat skull films in 1–2 months before operating (to rule out pseudogrowing fracture). In young patients with separated skull fractures (the width of the initial fracture is rarely mentioned), consider obtaining follow-up skull film 6–12 mos post-trauma. However, since most PTLMCs are brought to medical attention when the palpable mass is noticed, routine follow-up X-rays may not be cost-effective.

Treatment

Treatment of true PTLMC is surgical, with dural closure mandatory. Since the dural defect is usually larger than the bony defect, it may be advantageous to perform a craniotomy around the fracture site, repair the dural defect, and replace the bone [10].

The dural substitutes used are either autografts (which may not be enough) or artificial grafts (which are foreign-body implantations and which also may be too expensive in a low-resource practice).

Adeleye presented the surgical description of the use of the cyst capsule as a cost-free autologous graft in the surgical repair of the dural defects of two cases of traumatic leptomeningeal cyst [11].

Pseudogrowing fractures should be followed with X- rays and operated only if expansion persists beyond several months or if a subgaleal mass is present.

Retrospective cohort studies

A study aims to identify the factors associated with growing skull fracture development to determine which children require follow-up.

Materials and methods: This was a single-center retrospective study examining the referral data from all patients under one year old referred with head trauma between 2013 and 2023 (n = 246). Of these patients 189 sustained skull fractures, with two requiring surgery for a growing skull fracture. Referral data for all head injuries between 2008 and 2013 was unavailable but surgical records were accessed for the only case of a child who developed a growing skull fracture in this period. Each fracture was analyzed using the computed tomography (CT) head for its characteristics, including fracture splay distance and fracture elevation/depression.

Results: A total of 190 cases were reviewed, which showed a male-to-female ratio of 1.6:1. The majority of patients presented before one month of age and the most common mechanism of injury was a fall (80%). The most common fracture sustained was a linear fracture (87.4%). Of all fractures, the most common bone affected was the parietal bone (88.4%). Of those who developed a growing skull fracture, there was a significant difference in both the fracture splay distance ($p < .05$) and fracture elevation/depression distance ($p < .05$). All three patients who had growing skull fractures had a fracture splay distance above 5 mm at presentation and an elevation/depression of over 4 mm. 32% of children (n = 61) who had fractures had follow-up, with only nine having a fracture diastasis over 4mm.

Conclusion: Resources and investigations should focus on children with fracture displacement over 4mm and/or elevation/depression distance of over 3mm, as they are at significantly greater risk of growing skull fracture development [12].

Case series

Liu et al. performed a retrospective review of 27 patients with GSF, who were grouped according to 3 different GSF stages.

27 patients with GSF (16 males and 11 females) were treated in the authors' department. The mean follow-up period was 26.5 months. Six patients were in the pre-phase of GSF (Stage 1), 10 patients in the early phase (Stage 2), and 11 in the late phase (Stage 3). All patients underwent duraplasty. All 6 patients at Stage 1 and 5 patients at Stage 2 underwent craniotomy without cranioplasty. Five patients at Stage 2 and all of the patients at Stage 3 underwent cranioplasty with autologous bone and alloplastic materials, respectively. Among all patients, 5 underwent ventriculoperitoneal shunt placement. Symptoms in all patients at Stages 1 and 2 were alleviated or disappeared, and the cranial bones developed without deformity during follow-up. Among patients with Stage 3 GSF, no obvious improvement in neurological deficits was observed. Three patients underwent additional

operations because of cranial deformation or infection.

The authors identify the stages of GSF according to a new hypothesis. They conclude that accurately diagnosing and treating GSF during Stages 1 and 2 leads to a better prognosis [13)]

Case reports

2021

Kulkarni et al. presented a 14-year-old child who developed sudden-onset, diffuse, soft, fluctuant, circumferential swelling of the head after a road traffic accident. He had sustained a head injury at the age of 3-months leading to an asymptomatic soft swelling over the skull which was left untreated. The present CT scan of the brain showed a bony defect with ragged edges and cerebrospinal fluid (CSF) collection in subgaleal space circumferentially. He underwent exploration, duroplasty, and cranioplasty and had a good outcome.

Neglected GSF can rupture and cause diffuse subgaleal CSF collection. It should be managed with dural repair and cranioplasty [14)].

2020

Kitumba D, Mascarenhas L. Rare case of an adult with excruciating headache secondary to post-traumatic fronto-orbital leptomeningeal cyst. Neurochirurgie. 2020 Nov;66(5):410-411. doi: 10.1016/j.neuchi.2020.06.126. Epub 2020 Aug 7. PMID: 32777233 [15)].

A 4-year-old boy was brought to the emergency department after suffering from head trauma caused by a fall from a rooftop where he was treated conservatively at a local hospital. Later, he developed swelling in the occipital region and was brought to the department of neurosurgery where he was operated on. After the first surgery, recurrence of swelling was seen after a postoperative period of 2 months, and a computed tomography scan reported persistent epidural hygroma with extension into the subcutaneous space. The second surgery was performed, and a 12-month follow-up did not show any recurrence of swelling in the patient [16)].

2013

Post-Traumatic Leptomeningeal Cyst in Child: A Case Report and Review of Literature [17)]

2007

A full-term infant born after a nontraumatic, forceps-assisted spontaneous delivery, who developed an increasing cystic swelling over the left frontoparietal area that crossed over coronal and sagittal sutures. The lesion was initially misinterpreted as cephalhematoma. Clinical and radiological follow-up established the correct diagnosis of leptomeningeal cyst.

The collection was initially tapped. Surgical treatment was undertaken thereafter, consisting of decompression and resection of the cyst and dural repair. Two months after follow-up, the patient remains asymptomatic and the porencephalic cavity remains isolated from the extradural space, with no evidence of new fluid collections [18].

2004

A 53-year-old female presented with a post-traumatic leptomeningeal cyst manifesting as bulging of the scalp, dizziness, and tinnitus. She had known of the bulging of her forehead for about 20 years. She had suffered an injury to the head in childhood. Brain CT revealed a bone cyst associated with a round bone defect in the left frontal bone, bulging of the very thin outer layer, and the defective inner layer. She was treated surgically with a diagnosis of a skull tumor, but only gray cystic membranous tissue was found. The dural defect was repaired with fascia and the bone defect with bone cement. Bulging of the skull in adults can be caused by a bone cyst originating from a skull fracture [19].

2003

12 patients diagnosed and treated between 1980 and 2002. 11 patients were under the age of 3 years and one patient was 5 years old at the moment of HI. The most common cause of injury was a fall from height. In the initial plain x-rayfilms, 11 patients showed a diastatic skull fracture and one patient only had a linear fracture. At this time, CT scan showed cortical contussion underlying the fracture in every case. The mean time between injury and presentation of GSF was 11.6 weeks. Diagnosis was made by palpation of the cranial defect and confirmed with skull x-rayfilms. The most frecuent location of GSF was in the parietal region. Associated lesions like hydrocephalus, encephalomalacia, leptomenigeal cysts, brain tissue herniation and ipsilateral ventricular dilatation, were found in the preoperative CT or MRI. All patients underwent a dural repair with pericranium or fascia lata. The cranial defect was covered with local calvarial bone fragments in every case. Only one patient needed a cranioplasty with titanium mesh. Every child with a skull fracture must be followed until the fracture heals. Patients under the age of 3 years with a diastatic fracture and a dural tear, demostrated by TC or MRI, are more prone to develop GSF. In these cases, early repair must be adviced in order to prevent progressive brain damage [20].

2000

A growing skull fracture associated with cerebrospinal fluid rhinorrhoea following trauma sustained in adult life. The natural history of its development, diagnosis, and the results of surgery are discussed. The literature is reviewed with regard to aetiology, incidence, imaging characteristics and management of this rare post-traumatic complication [21].

1998

A lump in the right parietal region of this 53-year-old man prompted a computed tomography (CT) scan. The patient denied any symptoms and was in good health. The examination confirmed a firm, non-tender, non-pulsatile mass in the right parietal region of the skull. The CT scan demonstrated a 4 x 3 cm area of irregular bone destruction involving both the inner and outer table of the skull. At

operation a distinctly raised paper-thin outer table was noted, and underneath was a soft, tan-colored mass, which measured approximately 2 x 2 cm and was connected to the underlying brain through a 1 cm dural defect. The extradural portion of the mass was amputated, the dura repaired with a pericranium patch, the skull defect was repaired with a split-thickness bone graft, and the final pathology was congruent with a gliotic brain [22].

1967

Meloche BR, Sansregret A, Grégoire H, Gagnon J, Massicotte P. Un cas de kyste leptoméningé post-traumatique [A case of post-traumatic leptomeningeal cyst]. Union Med Can. 1967 Oct;96(10):1214-9. French. PMID: 5601803.

1957

PEYSER E, WEISSBERG D. Post-traumatic arachnoidal cyst. Report of an unusual case. J Neurosurg. 1961 Jul;18:551-3. doi: 10.3171/jns.1961.18.4.0551. PMID: 13735101.

References

1) https://radiopaedia.org/articles/leptomeningeal-cyst

2), 22) Britz GW, Kim DK, Mayberg MR. Traumatic leptomeningeal cyst in an adult: a case report and review of the literature. Surg Neurol. 1998 Nov;50(5):465-9. doi: 10.1016/s0090-3019(97)00233-4. PMID: 9842874.

3) Drapkin AJ. Growing skull fracture: a posttraumatic neosuture. Childs Nerv Syst. 2006 Apr;22(4):394-7. doi: 10.1007/s00381-005-1158-9. Epub 2005 Apr 22. PMID: 15856258.

4) Halliday AL, Chapman PH, Heros RC. Leptomeningeal Cyst Resulting from Adulthood Trauma: Case Report. Neurosurgery. 1990; 26:150–153

5), 15) Kitumba D, Mascarenhas L. Rare case of an adult with excruciating headache secondary to post-traumatic fronto-orbital leptomeningeal cyst. Neurochirurgie. 2020 Nov;66(5):410-411. doi: 10.1016/j.neuchi.2020.06.126. Epub 2020 Aug 7. PMID: 32777233.

6) Sekhar LN, Scarff TB. Pseudogrowth in Skull Fractures of Childhood. Neurosurgery. 1980; 6:285–289

7), 9), 14) Kulkarni AV, Dikshit P, Devi BI, Sadashiva N, Shukla D, Bhat DI. Unusual Complication of a Neglected Growing Skull Fracture. Pediatr Neurosurg. 2021 Feb 24:1-5. doi: 10.1159/000513102. Epub ahead of print. PMID: 33626526.

8), 19) Kurosu A, Fujii T, Ono G. Post-traumatic leptomeningeal cyst mimicking a skull tumour in an adult. Br J Neurosurg. 2004 Feb;18(1):62-4. doi: 10.1080/02688690410001660463. PMID: 15040717.

10) Iplikciglu AC, Kokes F, Bayar A, et al. Leptomeningeal Cyst. Neurosurgery. 1990; 27: 1027–1028

11) Adeleye AO. Posttraumatic leptomeningeal cyst capsule as a cost-free autograft for its repair: case

illustrated technical reports. Neurosurg Rev. 2020 Aug 8. doi: 10.1007/s10143-020-01364-6. Epub ahead of print. PMID: 32772295.
12)

John W, Lowes D, Leach P. Follow up of infants with skull fractures by neurosurgeons due to the risk of growing fractures; is it needed? Br J Neurosurg. 2024 Nov 7:1-5. doi: 10.1080/02688697.2024.2421832. Epub ahead of print. PMID: 39508080.
13)

Liu XS, You C, Lu M, Liu JG. Growing skull fracture stages and treatment strategy. J Neurosurg Pediatr. 2012 Jun;9(6):670-5. doi: 10.3171/2012.2.PEDS11538. PMID: 22656261.
16)

Harsh V, Gond PK, Kumar A. Post-Traumatic Diploic Leptomeningeal Cyst with Bilateral Posterior Cranial Fossa Epidural Hygroma: A Management Dilemma? World Neurosurg. 2020 Aug;140:258-261. doi: 10.1016/j.wneu.2020.05.129. Epub 2020 May 21. PMID: 32445897.
17)

https://ibimapublishing.com/articles/IJCRM/2013/533543/
18)

Miranda P, Vila M, Alvarez-Garijo JA, Perez-Nunez A. Birth trauma and development of growing fracture after coronal suture disruption. Childs Nerv Syst. 2007 Mar;23(3):355-8. Epub 2006 Oct 5. PubMed PMID: 17021730.
20)

Mierez R, Guillén A, Brell M, Cardona E, Claramunt E, Costa JM. [Growing skull fracture in childhood. Presentation of 12 cases]. Neurocirugia (Astur). 2003 Jun;14(3):228-33; discussion 234. Spanish. PubMed PMID: 12872172.
21)

Gupta V, Sinha S, Singh AK, Kumar S, Singh D. Growing skull fracture of ethmoid: a report of two cases. J Craniomaxillofac Surg. 2000 Aug;28(4):224-8. doi: 10.1054/jcms.2000.0141. PMID: 11110154.