CSF Leaks

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Etiology

CSF leaks occur if *dura is violated*:

1. ***surgery*** (esp. if CSF is contaminated with blood, bone dust, and necrotic debris → inflammatory & mechanical interference at arachnoid villi → CSF pressure↑).
2. ***tumor invasion*** (e.g. pituitary tumor erosion)
3. ***trauma*** (esp. basal skull fractures – thin & tightly adherent dura).

* fracture of ethmoid or sphenoid bone or orbital plate of frontal bone → **rhinorrhea (nasoliquorrhea)** - CSF leak through cribriform plate or adjacent sinus.
* fracture of temporal bone → **otorrhea (otoliquorrhea)**.

Predisposing factor - ICP↑.

Clinical Features

* ***watery discharge*** from nose, ear canal, wound.
* starts within 48 hours after dural breach.

N.B. after TBI, nasal mucosa may be swollen – rhinorrhea is delayed (do not confuse with posttraumatic rhinitis)

* rhinorrhea – salty taste in mouth.
* point of external leakage is poor guide to site of fistula (e.g. CSF may enter ear but leave nose via Eustachian tube).
* ***orthostatic*** ***headache***

Diagnosis

Differentiation from *local bleeding without CSF leak*:

1. **ring (halo) test** - drop of nasal discharge is placed on piece of filter paper\* – CSF (less dense than blood) migrates further on paper than blood – CSF is seen as large transparent ring surrounding central blood clot.

\*but may be seen spontaneously on pillow

1. pure bleeding usually ***stops*** in 1-2 days.

Differentiation from *nasal secretions*:

1. CSF rhinorrhea is ***clear fluid***, tends to be ***profuse*** (particularly when bending forward in morning)
2. ***glucose concentration***: inCSF ≥ 30 mg/dl(in lacrimal secretions / nasal mucus < 5 mg/dl); e.g. CSF tests positive for glucose using Dextrostix.
3. ***chloride concentration***: CSF > lacrimal secretions / nasal mucus.
4. ***β2-transferrin assay*** (present in CSF) - most accurate diagnostic test for CSF!
5. occult / intermittent CSF rhinorrhea – ENT may see ***nasal mucosal maceration***.
6. injection of ***radionuclide*** (e.g. 99mTc DTPA) into CSF → tampons are placed in each nostril → assessment of uptake by tampons - CSF rhinorrhea is diagnosed when tampon is impregnated with at least twice radioactivity of control tampon in opposite nostril (in presence of intact septum).

*Fistulės vietai nustatyti anksčiau buvo naudojamos dažo medžiagos į CSF (methylene blue\*, fluorescein, fenolsulfonftaleinas, indigokarminas), tačiau jos veikia toksiškai ir šiuo metu nebenaudojamos.*

\*may be lethal intrathecally!

**X-ray, CT bone window** – fluid in paranasal sinuses, skull fracture.

If there is CSF leak but *fracture site is not evident* (important before attempted surgical repair) → at time when patient is actively leaking fluid, perform:

* + 1. **overpressure radionuclide cisternography (with 99mTc DTPA)** - can demonstrate leak into nasal cavity or ear, but fails to delineate fistula site!

Radionuclide cisternogram - anterior fossa CSF fistula:



* + 1. **overpressure** **CT cisternography (with metrizamide)** - instillation (via LP) of water-soluble contrast into CSF → temporarily occlude both jugular veins for 4-5 min to encourage active leakage → **CT in coronal plane with patient placed prone**\* → contrast medium in sinuses or nasal cavity.

\*leaking is likely to be maximal in this position

N.B. site of intermittent leaks is rarely delineated, but most such leaks resolve spontaneously!

**MRI with intrathecal gadolinium** (CT is less sensitive – bone and intrathecal contrast look the same and obscure each other).

Complications

1. poor wound healing
2. severe headaches (intracranial hypotension)
3. recurrent bacterial meningitis!!! (esp. *Streptococcus pneumoniae*)

rhinorrhea > otorrhea

*Kai likvorėja išnyksta per 7 dienas meningito rizika – 11-20%, o tęsiantis ilgiau - net 88%.*

Prophylaxis

* + - 1. ***"oversew"*** - sew stitches closer together in tissues immediately overlying surgical site.
      2. **vascularized pericranial flaps** to repair holes in dura (e.g. temporalis muscle flaps, trapezius muscle flaps, free radial forearm flaps, free rectus abdominis muscle flaps).
      3. **dural sealants** – see [p. Op140 >>](../../Op.%20Operative%20Techniques/Op140.%20Surgical%20Instruments,%20Materials.pdf#Dural_sealants)
      4. **prophylactic** **temporary CSF diversion** (EVD, lumbar drain) – drain for 3 days, then clamp for 24 hrs (if no leak – D/C drain).

Treatment

* 1. Bed rest with **head elevation ≥ 45°, avoid Valsalva** (laxatives); if CSF leak is lumbar – keep patient **flat**.

N.B. leak may be only temporarily closed with brain and then recur!

* 1. **CSF production decreasing agents** (e.g. acetazolamide) - controversial
  2. **Pressure dressing** (does not work for posterior fossa) and **wound resuturing** if CSF leaks externally (but CSF may find alternate means of egress, e.g. via rhinorrhea).
  3. **Local antibiotics** (e.g. into ear canal); prophylactic **systemic antibiotics** are started after 7th day of CSF leak (many cases arrest spontaneously within 7 days).

N.B. routine prophylactic antibiotics lead to selection of resistant organisms → drug-resistant meningitis.

If CSF leak still persists for > 12-48 hours → **reduce CSF pressure** by:

1. ***multiple lumbar punctures***\*
2. continuous / intermittent drainage via ***lumbar drain***\* (at the end, clamp drain for 24 hrs – if no leak, remove drain).
3. ***permanent diversion*** by indwelling shunt (in case of coexisting hydrocephalus).

\*remove 50-400 mL in any given 24-hour period (e.g. 10 mL/h)

Progressive diminution of level of consciousness (during CSF drainage) - possibility of pneumocephalus!

rhinorrhea is less likely (80%) to arrest spontaneously than otorrhea (95%)

Some surgeons observe drainage for 2 days, others use as many as two 5-day trials of continuous lumbar drainage; if unsuccessful → **operation**: craniotomy with reapproximation of torn dura, suturing fascia / pericranium / muscle autografts to reinforce closure.

* + *skull base* dura is thin and difficult to repair (esp. dura overlying cribriform plate - olfactory nerves travel through it).

*Geriau yra užsiūti kietojo dangalo defektą* ***ekstraduraliai****, tačiau defektą lengviau surasti* ***intraduraliai****.*

If everything fails – place **VP shunt**.

* + if there is no external CSF leak, may **observe** CSFomas (pseudomeningoceles) – many disappear over several months.

Bibliography see [p. S50 >>](S50.%20GENERAL%20-%20Intracranial%20Hypertension.pdf#Bibliography)

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