

CSF Leaks

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ETIOLOGY

CSF leaks occur if *dura is violated*:

- surgery** (esp. if CSF is contaminated with blood, bone dust, and necrotic debris → inflammatory & mechanical interference at arachnoid villi → CSF pressure↑).
- tumor invasion**
- 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:

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

Differentiation from nasal secretions:

- CSF rhinorrhea is **clear fluid**, tends to be **profuse** (particularly when bending forward in morning)
- glucose concentration**: in CSF ≥ 30 mg/dl (in lacrimal secretions / nasal mucus < 5 mg/dl); e.g. CSF tests positive for glucose using Dextrostix.
- chloride concentration**: CSF $>$ lacrimal secretions / nasal mucus.
- $\beta 2$ -transferrin assay** (present in CSF) - most accurate diagnostic test for CSF!
- occult / intermittent CSF rhinorrhea – ENT may see **nasal mucosal maceration**.
- injection of **radionuclide** (e.g. ^{99m}Tc 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 (metileno mėlis, fluoresceinas, 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:

- a) **overpressure radionuclide cisternography (with ^{99m}Tc DTPA)** - can demonstrate leak into nasal cavity or ear, but fails to delineate fistula site!

Radionuclide cisternogram - anterior fossa CSF fistula:



- b) **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!

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) **synthetic absorbable sealant** - **"DURASEAL" DURAL SEALANT SYSTEM** (*polyethylene glycol ester* solution + *trilycine amine* solution - when mixed together, solutions combine to form sealant gel);
 - FDA approved for surgery involving dura mater - applied over sutures to prevent CSF leaking out of incision site.

- sealant is absorbed in \approx 4-8 weeks.

TREATMENT

1. Bed rest with **head elevation $\geq 45^\circ$, avoid Valsalva** (laxatives).
N.B. leak may be only temporarily closed with brain and then recur!
2. **CSF production decreasing agents** (e.g. **ACETAZOLAMIDE**) - controversial
3. **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).
4. **Local antibiotics** (e.g. **LEVOMICETINO** milteliai į ausį); prophylactic antibiotics are started after 7th day of rhinorrhea (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:

- a) **multiple lumbar punctures***
- b) continuous / intermittent drainage via **lumbar drain*** (at the end, clamp drain for 24 hrs – if no leak, remove drain)
- c) **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