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"Review on : Rhinorrhea"

[1]Miss. Telange – Patil P.V., [2]Mr. Kalel P.M., [3]Miss. Gadekar V.D., [4] Miss Zambare T.M., [5]Mr. Ambare R.H.,

[1]Assosiat Professor, [2]Student, [3]Student, [4] Student, [5] Student.

[1]Pharmaceutics Department,

[1]College of Pharmacy Paniv, Malshiras, Solapur, Maharashtra, INDIA.

1. Abstract:

Spontaneous cerebrospinal fluid leakage is usually caused by developmental abnormalities and is rare, accounting for approximately 5% of the cases cerebrospinal fluid (CSF) leakage. A cerebrospinal fluid (CSF) rhinorrhea occurs when there is fistula between the dura and the skull base and discharge of CSF from the nose. CSF rhinorrhea Or liquiorrhea commonly occurs following head trauma. (Fronto-basal skull fractures) as a result of intracranial surgery or destruction lesions. A Spinal Fluid leak from the intracranial space to the nasal respiratory tract is potentially very serious because of the risk of an ascending infection which could produce fulminant meningitis. The article reviewed the causes, diagnosis and treatment of CSF leakage. A PUBMED Search of the National library of medicine was conducted. Cerebrospinal Fluid leaks may have many etiologies the most common being trauma. The most common site of Dural lesion is the cribriform plate of ethmoid. Cerebrospinal fluid (CSF) rhinorrhea, when left untreated, can lead to meningitis and other serious complications. The objective of this study was to determine the frequently cited article in the field of cerebrospinal fluid rhinorrhea and otorrhea. An active surgical approach to closing CSF leaks may provide better long-term outcomes in some patients compared to more conservative management.

Keywords:-cerebrospinal fluid, Liquorrhoea, cerebrospinal Fluid, rhinorrhea, endoscopy.

2. Introduction:

Cerebrospinal fluid (CSF) leaks describe the discharge of CSF From the intracranial cavity through an osseous defect within the skull base. The underlying dura mater and adherent pia-arachnoid mater and are disrupted, resulting in a communication between the intracranial cavity, the

subarachnoid space and either the nasal or middle ear cavity.[1] CSF rhinorrhea can be clinically overt or insidious, and suspicion should merit further investigation due to an increased risk of recurrent bacterial meningitis.[2] Preoperative localization aids clinical decision making by facilitating the selection of approaches for repair, reducing adjuncts (i.e. intrathecal fluorescein postoperative lumbar drains) and identifying multiple leaks.[3] While CSF leaks may occur spontaneously, common etiologies of CSF rhinorrhea include trauma, neo-plasms and prior surgery, while CSF atorrhea is usually associated with craniocerebral trauma (e.g. Skull fracture involving the temporal bone), neurosurgical procedures or other conditions.[4]Patients with CSF leak can present with a variety of symptoms such as clear nasal discharge and headache or complications such as pneumocephalus, meningitis or brain abscess. As scientific knowledge has grown in biomedicine, it has also become necessary to develop tools to manage and understand the body of evidence.[5] The hourly production of CSF is approximately 20 ml with a daily production rate of 400-600 ml that can increases in response to chronic loss of CSF volume normal CSF volume averages 150 ml in adults with turnover 3-4 times daily. [6]CSF rhinorrhea commonly occurs following head trauma (front-basal skull fractures) or as a result of intracranial surgery. Others conditions include paranasal sinuses along with osteomyelitis of the adjacent bone, congenital anomalies of the brain and its coverings such as meningoceles or meningoencephaloceles, and destruction lesions long the skull base[7].Pituitary tumors cause erosion of the Sella turcica floor and are frequently associated with CSF rhinorrhea [8].

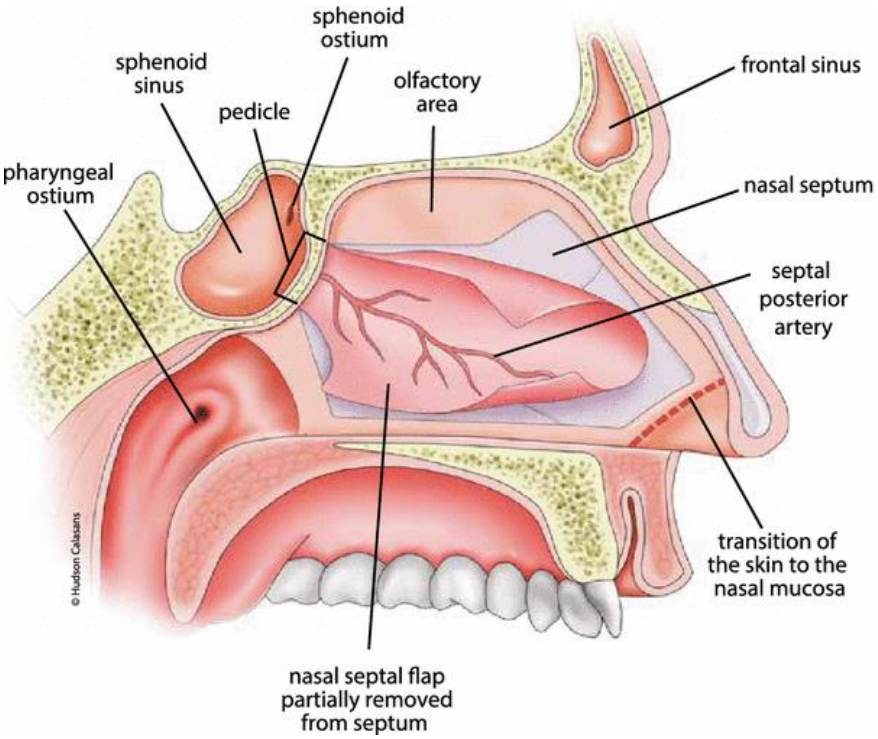
sphenoid ostium
sphenoid sinus
pedicle
olfactory area
frontal sinus
pharyngeal ostium
nasal septum
septal posterior artery
transition of the skin to the nasal mucosa
nasal septal flap partially removed from septum
© Hudson Calasans

Fig 1

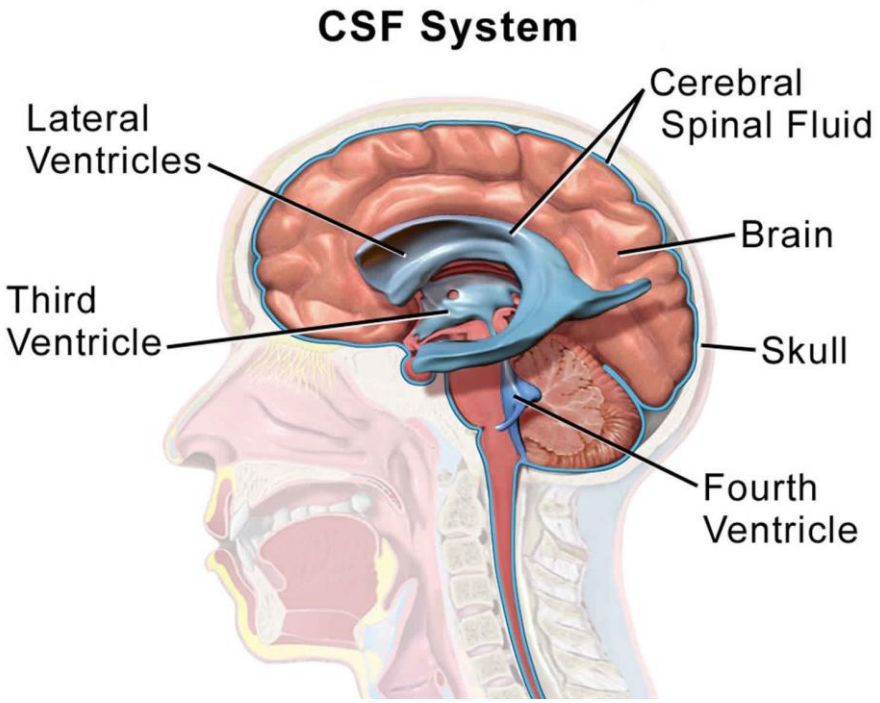
CSF System
Cerebral Spinal Fluid
Lateral Ventricles
Brain
Third Ventricle
Skull
Fourth Ventricle

Fig 2

3. PATHOPHISIOLOGY:

Cerebrospinal fluid is made of water, electrolytes (Na, K, Mg2+, Ca2+, Cl and HCO,), glucose (60-80% of blood glucose), amino-acids and different proteins (22-38 mg/dL). It has no colour, it is clear, with polymorphonuclear cells and mononuclear cells (<5/µL).[9]

The main site of cerebrospinal fluid production is represented by the choroid plexus, responsible for producing 50-80% of the daily volume. Other production sites are the ependymal superficial layer (almost 30%) and the capillary ultrafiltration (almost 20%).[10]

Cerebrospinal fluid is the final product of the plasma ultrafiltration of the epithelial cells in the choroid plexus, which lines the cerebral ventricles, process catalyzed by Na+/K+ATP-ases.[11]

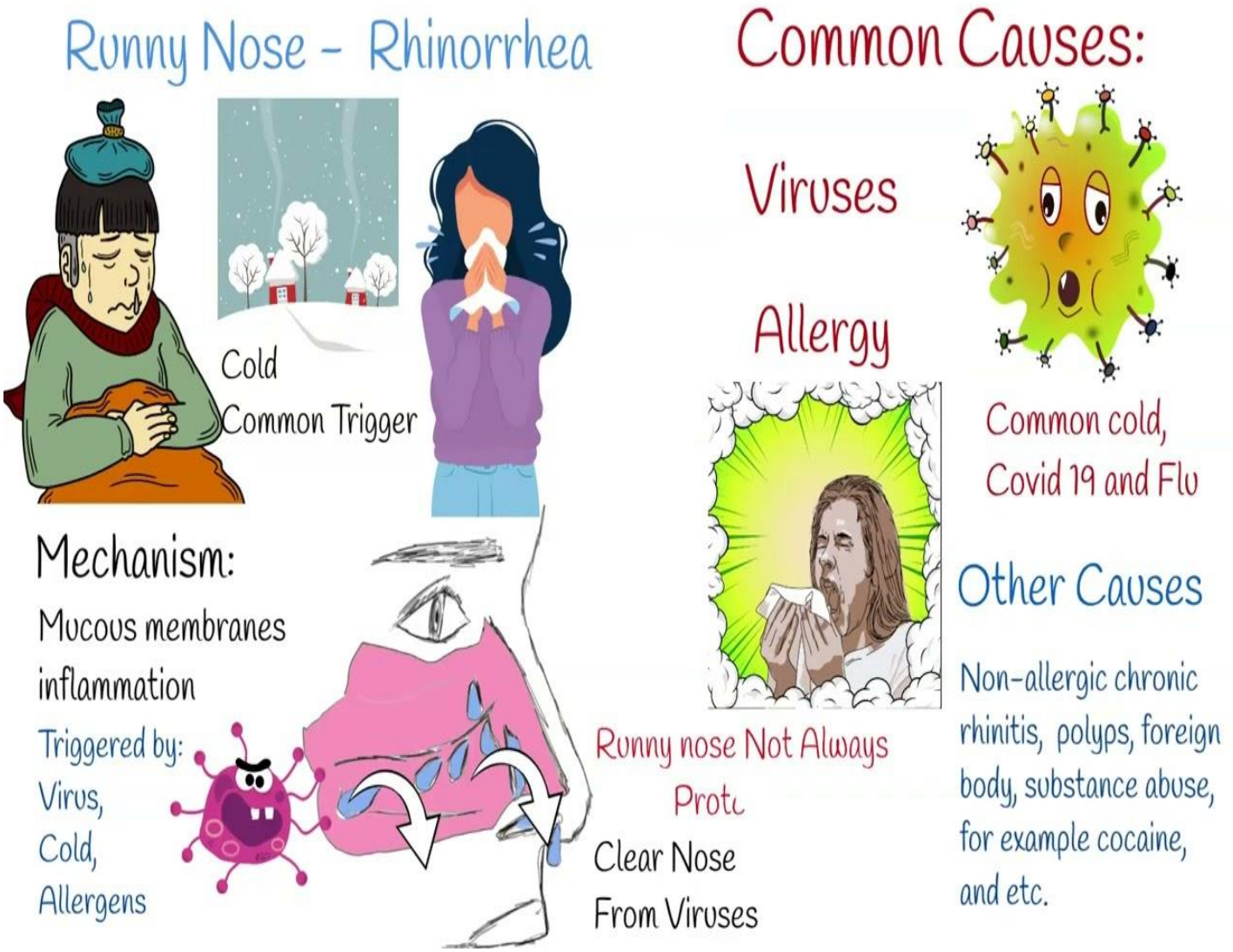

Fig 3

Hydrostatic differences between the production rate and the absorption rate are responsible for maintaining the level of circulating cerebrospinal A pressure of 10-15 mmHg is considered as a normal value for CSF, while elevated pressures (>20 mmHg) determine high intracranial pressure (ICP)[12].CSF leak is a relatively rare, but potentially severe condition, in case of treatment absence. The underlying condition that leads to CSF discharge into the nasal cavities is the disruption of the limits between the rhinosinusal cavities and the anterior and middle cerebral fossae. The communication with the central nervous system may determine multiple infectious complications, with high morbidity and potentially severe patient outcome.[13] CSF rhinorrhea after intracranial or intranasal surgery is a known potential complication with significant morbidity and mortality. Accurate identification of the site of CSF leakage is necessary for a successful surgical repair. The most reliable methods of distinguishing between a traumatic or neoplastic lesion and a spontaneous CSF rhinorrhea are high-resolution computed tomography (CT) and magnetic resonance (MR) tomography [14].MR imaging is reserved for defining the nature of soft tissue i.e. inflammatory tissue, meningoencephaloceles or tumor [15].In MR images we can find brain herniation into the ethmoid or frontal sinuses [16].CT with or without intrathecal contrast and preoperative nasal endoscopy are frequently used to preoperatively localize the site of the leak [17].CSF rhinorrhea have significantly greater incidence of periorbital haematoma. This suggests that patients with head injuries and features of periorbital haematoma are at greater risk of unobserved dural tear and delayed CSF leakage [18].Radiographic exams like simple skull X-rays are quite ineffective. However it can demonstrate indirect signs like fractures and pneumocephalus [19]. Various combinations of planar tomography and CT, contrast-enhanced CT stereography, and radionuclide cisternography, and, more recently, MR Cisternography have been used in the diagnosis of CSF leak. Radionuclide cisternography and contrast enhanced CT cisternography techniques require injections into the intrathecal space, most often via lumbar puncture. Although cisternography has minimal inherent risks, such as infection and lumbar CSF leak, it significantly increases expense and adds patient discomfort. Radionuclide studies do

not provide precise anatomic localization of CSF leaks. Stone et al [20] suggest that high-resolution CT is a useful screening examination for the initial workup of CSF rhinorrhea or otorrhea. When the clinical and imaging findings coincide, further evaluation using CT cisternography and radionuclide cisternography is often unnecessary. Computerized cisternography and radionuclide cisternography should be used if MR imaging is contraindicated or if a clinically and biologically proven CSF fistulae is not visualized by CT or MR imaging [21].

4. EPIDEMIOLOGY:

CSF rhinorrhea can be divided in traumatic and non-traumatic: the traumatic group can be divided in accidental and iatrogenic. The non-traumatic group is associated to brain tumors (intracranial and extracranial tumors, cholesteatoma, or tuberculoma are known to erode the bone directly)[22] skull base congenital defects and meningoceles or meningoencephaloceles [23].CSF leak most commonly occurs following trauma (80-90 % of cases) and the majority of cases presenting within the first three months. Other etiologies include: postoperative defect (10%), spontaneous leak (3-4 %), tumor, and inflammation [24].The general classification includes traumatic, iatrogenic and spontaneous/idiopathic causes for CSF leaks .This category is usually divided into iatrogenic and non-surgical causes.

Traumatic causes (penetrating and blunt craniofacial lesions) represent approximately 80% of all CSF leaks, being most common in young males. Basilar skull fractures are involved in 12-30% of cases, more common in the anterior cranial fossa. At this level, the dura has a high adherence to the skull base and it can easily be affected by injuries. When examining the cases with major head trauma, only 2-3% of them determine a CSF leak [25].

4.1. Spontaneous CSF leaks:

Spontaneous CSF leak appears in patients without any antecedent causes, but as a consequence of an intracranial process, elevated intracranial pressure (ICP). High-pressure leaks appear to be involved in 45% of the non-traumatic cases of CSF leaks [26].

4.2. Tumoral CSF leaks:

In case of benign tumors, their rhythm of growth does not usually determine CSF rhinorrhea. There are also cases of locally

aggressive tumors, like inverted papilloma and neoplasms (nasopharyngeal carcinoma, osteomas), that may erode the bone in the anterior cranial fossa. The bony destruction by mass effect may lead to local inflammation and potential Dural disruption [27].A study conducted by Lieberman et al on patients with spontaneous CSF rhinorrhea proved that they had multiple simultaneous bony defects in the skull base. The researchers found that intracranial hyper- tension represents a determining factor for the appearance of these defects [28].

5. DIAGNOSIS:

Differentiating CSF rhinorrhea from other types of nasal secretions is the cornerstone in diagnosing the CSF fistula. In patients with profuse posttraumatic CSF leak- age, the diagnosis is obvious and needs only to be confirmed [29].Chemical Diagnosis. Chemical analysis of the dis- charge is the oldest method of diagnosing CSF leaks. Chemical examination of the nasal fluid became the standard of care after Sir St. Clair Thomson published his book The Cerebrospinal Fluid in 1899. In it he described in detail the chemical and physical characteristics that distinguish CSF fluid and nasal secretions based on differences in glucose concentrations [30] .The concentration of glucose in CSF exceeds 50% of the serum concentration except during meningitis, subarachnoid hemorrhage, or some other unusual circumstance [31].Cisternography with intrathecal radioactive isotope is a well-established method of confirming and localizing CSF fistulas when clinical suspicion of CSF rhinorrhea is present, but the leak has not been localized on CT or MRI [32].Magnetic resonance cisternography uses T2-weighted images with fat suppression and image reversal to highlight CSF [33].Imaging Diagnosis. After confirming the presence of CSF rhinorrhea, the next step in its management is localization of the leakage site. Localizing this site assists in surgical planning and increases the chance for a successful repair. Imaging studies play a very important role in this step [34].The first step of the diagnosis of CSF leak should be based on the patient's detailed anamnesis, followed, after clinically suspicion, by laboratory tests for CSF markers. Diagnosis is easier to be made in the case of the patients with recent surgeries or trauma than in other patients. In case of delayed fistulas, there are some difficulties of diagnosis and the CSF leak may appear also years after the trauma. In these cases, it is possible to misdiagnose the

leak as a vasomotor or allergic rhinitis [35].Laboratory tests are very important for diagnosing CSF leak. From all the tests that have been proposed over the years, only one managed to remain the gold standard in determining the presence of cerebrospinal fluid and that is the test for beta-2-transferrin[36].

6. SIGN AND SYMPTOMS:

Rhinorrhea is characterized by an excess amount of mucus produced by the mucous membranes that line the nasal cavities. The membranes create mucus Faster than it can be processed, causing a backup of mucus in the nasal cavity. As the cavity flips up, it blocks off the air passageway, causing difficulty breathing through the nose. Air caught in nasal cavities, namely the sinus cavities, cannot be released & the resulting pressure may cause headache or facial pain. Headache, facial pain, pressure of a dull constant or aching sort over the affected sinuses in common with both acute & chronic stages of sinusitis. This pain is usually localized to the involved sinus & may worsen when the affected Person bends over or lies down. Pain often starts on one side of head & progresses to both sides [37].If the mucus backs up through the Eustachian tube; it may result in ear pain or an ear infection. Excess mucus accumulating in the throat or back of the nose may cause a post-nasal drip, resulting in a sore throat or coughing. Additional Symptoms include sneezing nosebleeds and nasal discharge.

Symptoms associated with Rhinorrhea may include:

1. Clear discharge
2. Thick discharge
3. Nasal Congestion
4. Itchy eyes or nose.
5. sneezing
6. Cough
7. Fever

7. TREATMENT:

7.1 The treatment of CSF leak can be divided into conservative & surgical management usually, Posttraumatic CSF leak resolves only with conservative treatment, but in the case of spontaneous CSF leaks, surgical therapy is recommended.

7.2 Case of refractory CSF leaks, we must apply complex therapeutic methods, which consist of observation, CSF reduction and surgery (intracranial OR extracranial procedure). Negative

prognostic factors in the management are loss of consciousness on admission and the Coexistence of intracranial lesions within posttraumatic CSF leaks [38].practicians must decide carefully the optimal time & the way of treating this condition. Conservative treatment is efficient in posttraumatic leaks, taking into consideration that they have a great odd of spontaneous resolution. Basically conservative management consists of bed rest [39]. The patient must stay in bed for 7-10 days keeping the head of the bed elevated at 15-30 degree, in order to reduce CSF pressure at the level OF the basal cisterns .stool softners must be used for reducing the strain & the level of intracranial pressure. The patient must not strain, cough, and blow his nose, neither to perform heavy lifting. It has been shown that, using this management 75-80% of all traumatic CSF rhinorrhea: may spontaneously resolve seven days. Antibiotherapy in case of CSF leak still remains Controversial. It is used for preventing the appearance of intracranial infections, like meningitis [40]. Many studies have noticed no difference in the prevention of the cerebral complications with or without antibiotics. The administration of antibiotics during FESS is acceptable because due to the intracranial invasion meningitis may occur. when there is an an increased ICP diuretic use showed be considered. For example acetazolamide, a diuretic that inhibits the conversion of water and CO2 to bicarbonate & H+, can lower ICP by reducing .the activity OF Na+ /K+ ATP -ases responsible For CSF production. Thus aceta zolamide can be useful adjust in the treatment of patient with spontaneous CSF rhinorrhea associated with elevated intracranial Pressure [41]. But care should be taken to the side effects (e.g. Diarrhea, nausea, metabolic acidosis, polyuria, paresthesia) An adjunctive method is also the lumbar drain and it should be taken into consideration after the failure of 5-7 days of the previous management. Continuous drainage is preferred over intermittent drainage, because it prevents CSF pressure spikes. The recommended tate for CSF drainage must be about 10-15 cc/hr, in order to prevent adverse effects like nausea, headaches and emesis [42].It should be noted that lumbar drain is not Recommended for initial management Following skull base surgery or large bony defect. Noticed that, in patients with closed head trauma and CSF rhinorrhea, leakage time may be diminished by the early placement of a lumbar drainage.[43]

7.3 In Selected cases surgical intervention remains the only valuable method in the management of CSF Leak.

This treatment is only contraindicated in the patient medically unstable for a general anesthesia. The surgical management of CSF rhinorrhea Depends on the cause, location & severity of the leak.

7.4 General principles applicable in the management of CSF leaks are the following:

(1) To treat meningitis & hydrocephalus, before performing any surgical procedure.

(2) To identify the Dural defect site and Extension.

(3) To dissect the bone & dural defect;

(4) To directly repair the dura, when possible;

(5) To close by grafts, when the direct dura repair impossible.

7.5 Preoperative CT scans should be performed. If available, the stereotactic image guided technique valuable in identifying the dural defect. A multidisciplinary team formed of otolaryngologist, anesthesiologist & neurosurgeon is essential for a favorable outcome. In cases of iatrogenic CSF leaks the movement of repair should be at the same time as the principal surgery. The Surgical treatment of CSF leak is divided into intracranial & extracranial intervention. Intracranial approaches are used in case comminuted or extended skull fractures & hemorrhages in cranial Fractures or Contusion, which require craniotomy [44].The main advantage of this technique is the direct visualization of the dural defect and cortical injuries, which allows a better Patching of the disruption. The disadvantages (high-morbidity, increased hospitalization, anosmia, cerebral injuries with seizures and behavior disorders) are important and must be minimized as much a possible [45].

8. CONCLUSION:

Cerebrospinal fluid leaks represent a serious, potentially severe condition, which requires immediate diagnosis and appropriate treatment, because, in its absence, the risk of meningitis increases by 10 fold. The most frequent etiology remains the traumatic lesions, either from iatrogenic or surgical causes. The therapeutic results depend on the cause, size of the dural defect, and timing of applying the treatment and patient comorbidities. In 7-10 days, under conservative treatment of the most post– traumatic CSF leaks, complete

resolution in expected, while spontaneous CSF leaks usually require surgical intervention. This study also shows that the major specialties contributing to the field of CSF leak were otorhinolaryngology and neurosurgery, which were almost equally represented among the most cited documents.

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