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A Study of CSF Leak after Cranial Surgery: A Prospective Study

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Abstract: ***Introduction: Cerebrospinal fluid (CSF) leaks are well-known and frequent complications of intracranial procedures. The duramater closure is important to prevent CSF leak, subgaleal collection and future infection. Dural closure done by approximation of the dural edges with suture i.e. primary closure of dura or by inserting a graft material between the dural defect i.e. K/a duraplasty. Watertight dural closure is often not possible. Therefore, numerous techniques and materials developed to obtain the "perfect" closure, which should result in the reduction of CSF. It is important to study the incidence, risk factors, treatment, complications and various method of closure of dura as CSF leakage leads to increased morbidity, prolongation of hospital stay, surgical revision, and enhanced cost of treatment. Aim and objective: To Study incidence, risk factors, treatment and complications of CSF leak after Cranial Surgery. Methods: Total 332 patients who underwent craniotomy for various indications at Hamidia Hospital, Bhopal for one and half year. On admission patient's history, neurological examination, indication of craniotomy & relevant investigations, incision and method of dural closure were recorded. Each patient was clinically assessed for 2 weeks post-op period for any CSF collection, leak & other complications. Results: Incidence of post op CSF leak is 11.14 %(37 patients). Risk factor for CSF leak are middle age group, female, diabetes, long duration of procedure, steroid for longer duration, infratentorial pathology and craniotomy done for tumor pathology. Maximum CSF leak incidence reported in which dural closure was not done and loose approximation than use of various graft, but minimum incidence with water tight dural closure. No significant difference in various treatment methods reported in Compressive dressing, Re-suturing of the wound, lumber drain, and v-p shunt. Common Complication of CSF leak is surgical site infection, meningitis, pseudomeningocele, and Epidural empyema, CSF hygroma etc. Conclusion: water tight dural closure or graft or sealant should be used to decreases CSF leak incidence. Initially conservative method like compressive dressing and resuturing of wound with higher antibiotic and later stage lumber tapping/drain or v-p shunt should be used.***

1. Introduction

Cerebrospinal fluid (CSF) leaks are well-known and frequent complications of intracranial procedures. Dural closure is done by reapproximation of the dural edges with suture i.e. primary closure of Duramater or by inserting a graft material between the dural defect i.e. K/a duraplasty.

Watertight dural closure is often not possible due to various reasons. Therefore, numerous techniques and materials have been developed to obtain the "perfect" closure, which should result in the reduction of CSF leaks in post op patients.

Cerebrospinal fluid (CSF) leakage leads to prolongation of hospital stay, surgical revision, and enhanced costs of treatment, increased morbidities and mortalities.

Incidence of CSF leakage depends-
Location of surgery (supratentorial / infratentorial)
Size of the craniotomy
Dural opening
Underlying pathological process

Patient-related factors
Immune status
Age
Nutritional status

The addition of haemostatic agents such as fibrin glue, cellulose collections eg PMMA, cyanoacrylate can also be used for dural closure. Fascia temporalis, fascia lata or artificial dural graft was also used for closure of dura.

After CSF leakage many complications can develop like surgical site infection, pseudomeningocele, Meningitis, Epidural empyema,

For treatment of CSF leak initially conservative measures like antibiotics, compressive dressing, re-suturing of the wound are used.

If CSF leak persist then following procedure can be used:
a) Intermittent lumber drainage
b) Continuous lumber drain
c) Lumber peritoneal drainage
d) Ventriculo-peritoneal shunt.

And then finally reexploration of wound should be done.

Aims and Objectives

Primary Objectives
1) To Study incidence and risk factors for CSF leak after Cranial Surgery.
2) To Study Treatment and complications of CSF leak.

Secondary Objectives
To analyze CSF Leak in various methods of dural closure.

2. Material and Method

Prospective, observational study

This study comprised all patients who underwent craniotomy for various indications at department of surgery, Gandhi Medical College, Bhopal.

Study period: March 2016 to August 2018.

Sample Size- total 332 patients

Complete history, neurological examination, intraop findings, post op complication etc note down according to performa.

Follow up patients
Each patient was clinically assessed in postoperative period for two weeks for occurrence of any CSF collection & CSF leak (Each CSF collection was measured clinically as number of gauze piece soaked USG report and with computed tomography images). Any other type of complication was also recorded.

Inclusion Criteria- All Patient Admitted in Hamidia Hospital, Bhopal from March 2017 to august 2018 and underwent craniotomy for various indications.

Exclusion criteria - previous surgery at the same site and transnasal-trans sphenoidal surgery and craniotomy for various infections.

3. Results

Table 1: CSF leak according to pathology and site of operation

Site of operations	Pathology	Total patients	CSF leak	Percentage of CSF leak
Supratentorial	Trauma (head injury)	170	8	4.7%
	Chronic SDH	20	2	10%
	Intraprenchymal Bleed	30	4	13.3%
	Meningioma	14	2	14.28%
	Glioma	28	4	14.28%
	Arachnoid Cyst	2	0	0%
Infratentorial	Trauma (head injury)	10	2	20%
	Intraprenchymal Bleed	10	2	20%
	Meningioma	8	2	25%
	Medulloblastoma	13	2	15.38%
	CP Angle Tumor (Acoustic schwannoma)	14	4	28.57%
	Glioma	13	3	23.07%

Table 2: CSF leak in different Pathology

Pathology	Total number of patients	CSF leak	Percentage of CSF leak
Trauma (head injury)	180	10	5.5%
Chronic SDH	20	2	10%
Intraprenchymal Bleed	40	6	15%
Meningioma	22	4	18.18%
Medulloblastoma	13	4	30.76%
CP Angle Tumor (Acoustic scwannoma)	14	4	28.57%
Glioma	41	7	17.07%
Arachnoid Cyst	2	0	0%

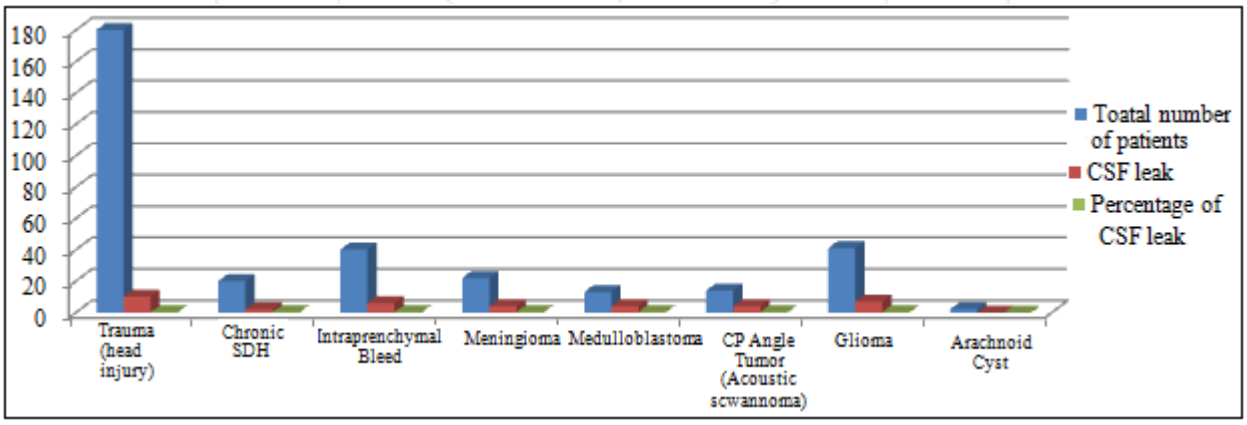


Figure 1: CSF leak in different Pathology

Table 3: Risk Factors Affecting Csf Leak

Risk factors		Patient numbers	CSF leak	Percentage of CSF leak
Location of surgery	Supratentorial	264	20	7.5
	Infratentorial	68	15	22.05
Indication of surgery	Tumor	90	19	21.11
	Trauma	180	10	5.55
	Intracerebral bleed	40	6	15
	Beningn lesion	2	0	0
	Chronic SDH	20	2	10
Age	50 or >50 yr	118	13	11.01
	<50yr	214	24	11.21
Sex	Male	229	20	8.73
	Female	103	17	16.50

Table 4: Risk Factors Affecting CSF Leak

Risk Factors		Patient Numbers	CSF leak	Percentage of CSF leak
Hypertension	Present	82	9	10.97
	Absent	250	28	11.2
Diabetes mellitus	Present	52	11	21.15
	Absent	280	26	9.28
Length of operation (time)	<120 min	229	24	10.62
	>120 min	103	13	12.62
Extended duration of corticosteroid (>7days)	Received	119	17	14.28
	Not Received	213	20	9.38

Table 5: CSF leak according to age groups

Age group	Total number of patients	CSF leak	Percentage of CSF leak
<20	22	1	4.54
21-30	50	3	6
31-40	75	11	14.66
41-50	76	13	17.10
51-60	42	4	9.52
61-70	55	4	7.27
71-80	12	1	8.33

Table 6: Incidence CSF leak depend upon craniotomy size

Craniotomy size	Total patients	CSF leak	Percentage of CSF leak
<5 cm	107	11	10.28
5 to <10 cm	120	13	10.83
Equal or >10 cm	106	13	12.14

Table 7: CSF leak depend on various closure method

Methods of dural closure	Total patients	CSF leak	Percentage of CSF leak
Water Tight Suturing	17	1	5.88
Duroplasty using temporal fascia	31	3	9.67
Duroplasty using fascia lata	34	3	8.82
Duroplasty using Artificial dural patch	23	2	8.69
Use of glue	32	3	9.37
Loose Approximation	88	11	12.5
Not done	107	14	13.08

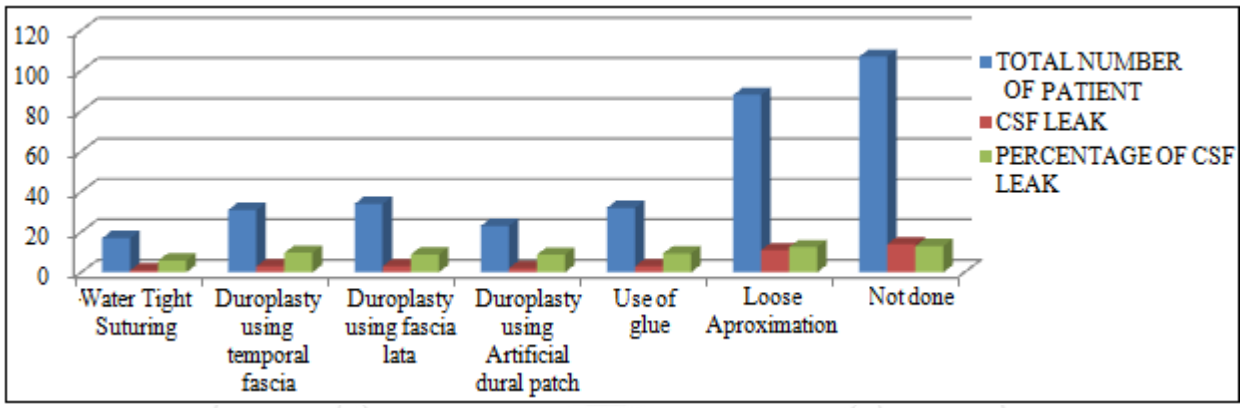


Figure 2: CSF leak depend on various closure methods

Table 8: Persistence of CSF leak after various treatment methods

Treatment methods	Total patients of CSF leak	Patients in which CSF leak persist despite treatment methods
Compression dressing + antibiotic	11	2
Resuturing of wound + antibiotic	10	2
Lumbar puncture + antibiotic	14	3
V-P shunt + antibiotic	2	0f

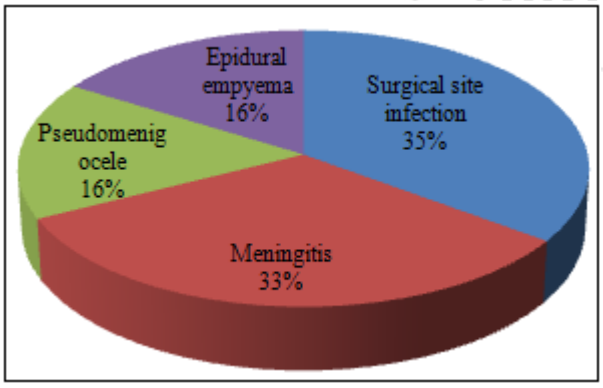
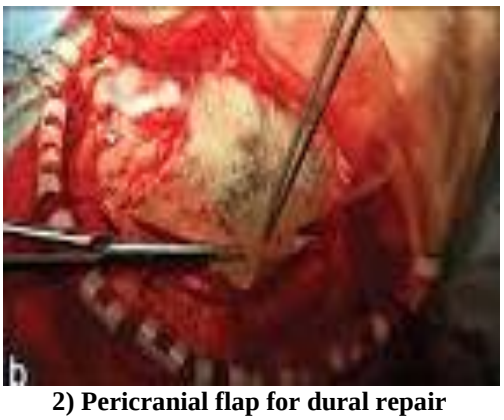


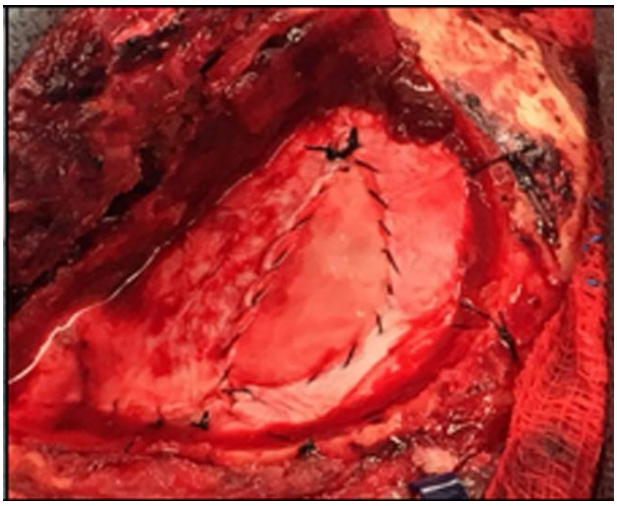
Figure 3: Complications of CSF leak

Methods of Closure of Dura Closure

1) Temporal base pericranial flap for closure of dural defect

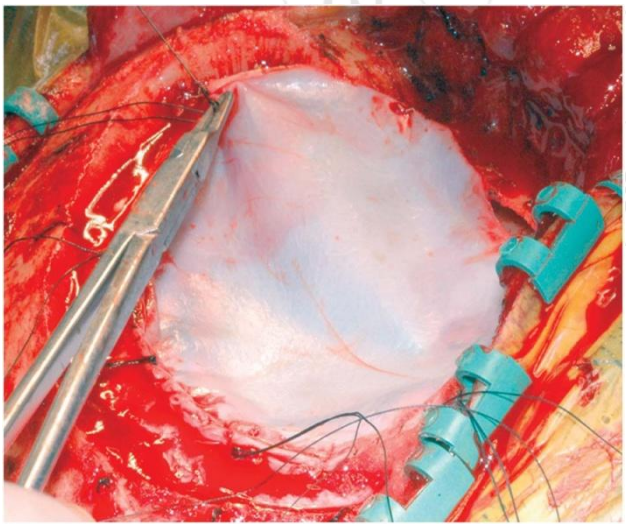


2) Pericranial flap for dural repair



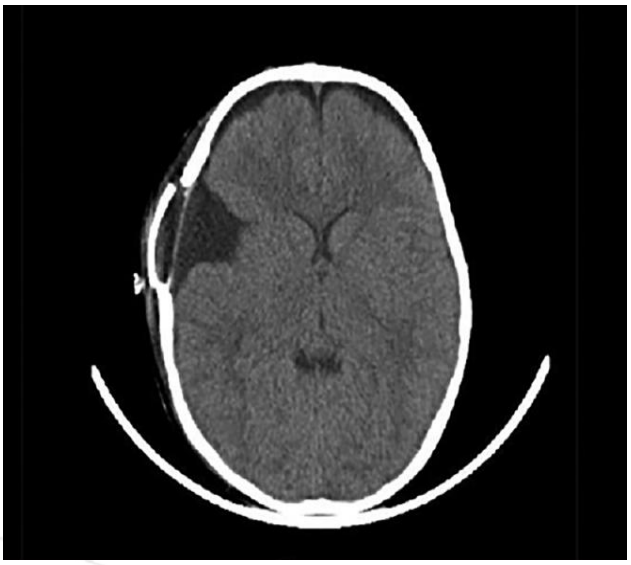
3) Dural repair by Fascia lata

4) Polypropylene mesh for closure of dura



5) Dural Repair by Biosynthetic cellulose graft

COMPLICATIONS OF CSF LEAK



1) Post-operative CSF hygroma

2) Post craniotomy Subdural Empyma

3) Post craniotomy wound infection

4. Conclusion

In our study incidence of post op CSF leak is **11.14** %.

Incidence of CSF leak higher in infratentorial procedure **(17.09%)** than supratentorial procedure **(7.5%).**

Incidence of CSF leak most commonly reported from tumor pathology **(21.11%)** i.e. much higher than other trauma **(5.5%)**, Benign disease (0%), Intraparenchymal bleed **(15%)** and chronic SDH **(10%)**.

In neoplastic pathology CSF leak develops in medulloblastoma (**30.7%**), meningioma (**18.18%**), acoustic schwannoma (**28.57%)**, Glioma (**17.07%**).

CSF leak incidence almost same in both hypertensive as well non- hypertensive patients. Incidence of CSF leak higher in diabetic (22.91%) than non diabetic (9.28%). diabetes also considered as important risk factor and 3 times higher chances of CSF leak.

As length of operation increases chances of CSF leak higher.

CSF leak chances higher in those patients who take steroid for longer times.

Most commonly affected age group 41-50 from CSF leak (17.10%). Second most common affected age group is 31 to 40 yr (14.66%). CSF leak decreases in both higher and lower age group extremities.

CSF leak is almost equal in >50 yr age group and <50 yr.

Size of craniotomy has no significant effect in CSF leak. But slightly higher if craniotomy size equal >10cm size.

Loose approximation type dural closure method has higher csf leak incidence (12.5%),as compare to duroplaty with fascia temporalis (9.67%), duroplaty with fascia lata (8.82%), duroplaty with artificial Dural grafts develop csf leak (8.69%). On use of glue post op develop CSF leak (9.37%).

Minimum chances of CSF leak with water tight dural closure method that developed in only single patient (5.88%).

Graft or glue has similar result in post-op CSF leak. Addition of these graft material or glue or application of water tight suture individually has significant protective role in development of post op csf leak (8.76%) as compare to individually no dural closure or loose approximation of suture (12.82%).

As duration of operation increases post-op CSF leak risk is higher.

Treatment of CSF leak included

- Conservative measures – in our study no significant difference in various treatment methods reported.
- Common Complication of CSF leak in our study is surgical site infection/wound infection (37.83%), meningitis (32.4%), pseudo-meningocele(16.2%), and Epidural empyema(16.2%), CSF hygroma.
- Morbidity and mortality rate is higher with infectious complication of CSF leak than non-infectious complication.

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