

# Autologous Blood Patch — The New Ray of Hope in Cases of Post-Operative CSF Leak

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## Abstract

**Introduction:** When we discuss post-operative neurosurgical complications, cerebrospinal fluid leak (CSF leak) is a very well-known complication among all, especially in the trans-nasal approach and trans-cranial posterior fossa approach, if not identified and treated on time, the outcome can be fatal (1,2).

**Materials and Methods:** Our original research was an outlook study (prospective study), which included 11 patients in 4 years from 2015 to 2019. Dural opening was a common criterion among all the study patients. Informed consent was taken from each individual before the procedure and before documentation.

**Results:** In our study, a total of 11 CSF leakage cases were enlisted with proper informed consent undertakings. The total duration of the research was 4 years from 2015 to 2019. After obtaining proper informed consent, all 11 patients were taken for radiological imaging, blood investigations, and blood patching (Autologous blood) applied at the CSF leakage site. Out of 11 patients, 9 patients' CSF leakage stopped after the blood patch procedure. In 2 patients first attempt of epidural blood patching procedure failed. We did re-application of the same procedure for these 2 patients with epidural blood patch (Autologous blood) with Fibrin glue this time, this time CSF leakage stopped completely.

**Conclusion:** Blood patch with or without Fibrin glue is a minimally invasive, cost-effective (Autologous blood), painless effective, and safe procedure. With imaging guidance, this procedure becomes safer, quicker, and simpler. The outcome of this procedure is also remarkable after 3-6 months of follow-up.

**Key words:** Autologous, Epidural, Blood patch, CSF leak, Fibrin glue

## INTRODUCTION

When we discuss post-operative neurosurgical complications, cerebrospinal fluid leak (CSF leak) is a very well-known complication among all, especially in the trans-nasal approach and trans-cranial posterior fossa approach, if not identified and treated on time, the outcome can be fatal.<sup>[1,2]</sup> As per various studies, CSF leaks were reported in 3.8% of post-operative neurosurgical cases. 6.2% CSF leakage cases found in skull base surgery, anterior skull base procedures 5.9%, 6.4% during middle cranial fossa surgeries, followed by trans-petrosal surgeries

5.2%.<sup>[1,2]</sup> CSF leak produces the risk of infection like meningitis, encephalitis, and cerebral abscess and that causing fatal outcome in last.<sup>[3,4,5,6]</sup> Treatment of CSF leakage increases total treatment cost too much due to higher antibiotics and long stay in hospital. Due to financial overburden, patients left treatment in between and the outcome becomes fatal.<sup>[2,3]</sup> Most of the CSF leakage are low-pressure leaks, that can be controlled with medical treatment like Diamox tablets i.e. acetazolamide (carbonic anhydrase inhibitor - reduces CSF production), mannitol, or furosemide.<sup>[6]</sup> Since the old era, various modalities have been used for secondary CSF leakage site closer by suturing<sup>[7,8]</sup>, muscle patch closer, watertight closer of Dura,<sup>[8,9]</sup> application of Glues or adhesive, sealing agents, fascia application with suturing, or placing a subarachnoid space catheter as a lumbar drain,<sup>[7]</sup> But no one can produce promising results till date.

This Original study aims to share a simple, safe, effective, and minimally invasive but less popular and unrecognized

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technique that can be helpful to close the post-operative very minimum pressure CSF leakage complication.

## MATERIALS AND METHODS

Our original research was an outlook study (prospective study), which included 11 patients in 4 years from 2015 to 2019. Dural opening was common criteria among all the study patients.

All cranial surgery and spinal surgery patients were included in this original study except those operated outside our hospital, old unknown CSF leak patients, and post-traumatic CSF leaks.

All age groups and all genders were included in the study. From the institutional ethics committee, ethical clearance was taken as per the standard institutional policy. Informed consent was taken from each individual patient before procedure and before documentation with a detailed explanation of complications during the procedure or redo of the invasive procedure if required. Later all blood investigations and radiological imaging were sent, reports collected and procedures completed.

### Procedure

During primary surgery, we did a dural opening in all the study patients which was primarily closed after surgery with the watertight dural closure (WTDC) technique or with the help of autologous graft, the help of pericranium, using fascia lata or using artificial dura, which was clearly explained in informed consent undertaken by patient or patient's relatives. Same procedure followed in both cranial surgeries and spinal surgeries. Whenever possible or required, the bone flap was replaced in the anatomical place, the drain was applied, and closer done layer by layer with the standard technique. The patient was shifted to the ICU or post-operative intensive unit and kept under observation.

### Follow-Up

On daily IPD rounds, patients were under daily observation; surgical wounds were examined and found healthy without complications. Initially when a CSF leak is noted, first managed with medical treatment like Diamox tablets i.e. acetazolamide (carbonic anhydrase inhibitor - reduce CSF production) and furosemide, conservatively, and if conservative treatment failed, after detailed counseling and informed consent, patients were taken for a blood patch procedure.

Systematic radiological examination was done with ultrasonography CT and MRI Brain to find out the exact site of the CSF leakage track.

After CSF leak defect confirmation only, patients were taken for a blood patch or epidural blood patch procedure.

### Blood Patch Procedure

With all aseptic precautions, cleaning and draping done. The patient's blood was drawn with the help of a 20cc syringe from the femoral vein. After localization of the CSF leakage defect, the freshly drawn 20 ml autologous blood is injected slowly (in 30-60 seconds) at the exact defect site, epidural space (below the scalp flap and above the dural layer at the defect site) to form a blood clot patch. After this gentle compression was applied for 5 minutes, and finally compression bandage was applied. The whole procedure usually takes 30 minutes and the patient is kept under observation for a couple of hours.

## RESULTS

In our study, a total of 11 post-operative CSF leak patients were enlisted. The total duration of this original study was 4 years from 2015 to 2019.

2 patients underwent fronto-temporoparietal craniotomy, developed CSF leak post-operatively, 3 were operated on for posterior fossa hematoma underwent suboccipital craniectomy, developed CSF leak post-operatively, 1 underwent frontal craniotomy, developed CSF leak post-operatively, 3 was post cervical laminectomy, and 2 was post-operative traumatic spinal fixation [Table 1].

We used medical therapy with Diamox tablets i.e. acetazolamide (carbonic anhydrase inhibitor - reduce CSF production) and furosemide for 4 days when CSF leakage started but persisted in having CSF leak with the same flow. After this medical treatment failure, patients underwent a blood patch procedure.

After proper informed consent and important documentation with complete investigations, underwent blood patch/epidural blood patch procedure. After the procedure, CSF leak stopped in 9 patients (81.81%), the remaining 2 patients underwent re-investigation and another blood patch (Autologous blood) was applied with Fibrin glue this time, after this second attempt CSF leakage stopped completely in both patients.

**Table 1: Causes of postoperative CSF leak**

Procedure	Number of patients
Post fronto-temporoparietal craniotomy	2
Post suboccipital craniectomy	3
Post frontal craniotomy	1
Post cervical laminectomy	3
Post-operative traumatic spinal injury - spinal fixation	2

All the patients became CSF leakage-free at the last. After 3-6 months of follow-up, no further complications were noted.

## DISCUSSION

Our study based on the blood patch procedure produces very bright results and fabulous outcomes in all CSF leak patients. Fortunately, Medical therapy cured most of the other patients of mild or low-pressure post-operative CSF leak cases, but on the other side, we got a very small number of patients for our study. With our study, we enlighten the unique lee known procedure which is quite safe, simple, effective, minimally invasive, and low cost. Before any other major invasive procedure like cranial fossa carpeting, endoscopic intervention, or lumbar drain catheter application, anyone can consider this procedure, to reduce the risk and total cost of treatment.<sup>[1,2]</sup> Brain infections like meningitis, encephalitis, or brain abscess are more common with long-term CSF leak and this converts morbidity into mortality.<sup>[3,4]</sup> CSF leak-related complications increase the total cost of treatment, ICU stay, ICU-acquired infection, psychiatric illness, various other revision cranial surgeries, shunt surgery, etc.<sup>[10-12]</sup> Intracranial hypotension is another entity that gets a positive result with blood patch procedure.<sup>[13]</sup>

A systematic study by Gottschalk on blood patch procedure in CSF leak noticed that this procedure is completely safe, simple, technically easy, and with fantastic outcomes.<sup>[14]</sup> He also added that with the good and bright outcome of this technique, there may be a need for repetition with the blood patch procedure twice or thrice in a single case is also safe and easy.

Magnus *et al* published a postoperatively CSF leak case series of 32 patients and with medical management, 10 patients became seizure-free. The remaining 22 patients underwent lumbar drain insertion. After lumbar drain insertion 12 out of 22 patients got satisfactory results and the CSF leak stopped. The rest of the 10 patients went through open surgical correction repair and closer of CSF leakage defect. The author mentioned that there were no recurrences of CSF leaks appearing in any of the follow-up cases.<sup>[6,7]</sup> They shared their experience with these techniques and projected their steps and techniques safest and best way to treat post-operative CSF leak.<sup>[6]</sup> Bayazit *et al* also found the same results as Magnus *et al*, in their article.<sup>[6]</sup>

As we mentioned earlier in this study the blood patch procedure for post-operative CSF leak closer is lesser-known, unrecognized, and unacknowledged, due to a lack

of research studies on this topic. CSF leak is related to the bad outcomes if remains untreated or uncontrolled. With our proposed blood patch procedure, CSF leak patients can get new hope even in primary or secondary healthcare centers with minimum expenditure and in limited infrastructure.

## CONCLUSION

With this original article, we conclude that the blood patch procedure is an effective, easy, safe, less expensive, and minimally invasive technique with attractive outcomes in cases of CSF leak. In this method, we use the patient's blood (auto-graft blood), which is very safe, and with this, we can repeat the procedure 2 or 3 times if required with no cost. With sterile precautions, chances of infection during the procedure are very low. Multicentric clinical trials with big study numbers on this procedure are need of hour to prevent bad outcomes of post-operative CSF leak complications.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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### Conflicts of interest

There are no conflicts of interest.

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