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Case Series

Autologous activated platelet-rich plasma gel as a sole adjunct in endoscopic repair of spontaneous cerebrospinal fluid rhinorrhea: a case series

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ABSTRACT

Cerebrospinal fluid (CSF) rhinorrhea results from an abnormal communication between the subarachnoid space and the nasal cavity, predisposing patients to potentially life-threatening meningitis if not promptly treated. Endoscopic endonasal repair has become the standard of care, with surgical success depending on precise localisation of the defect, secure multilayer closure, and the use of effective adjuncts. Platelet-rich plasma (PRP), when activated with calcium chloride to form a gel, provides a concentrated source of growth factors that enhance healing, promote rapid mucosal regeneration, and create an immediate watertight seal, offering an autologous, economical alternative to commercial fibrin sealants. This retrospective case series from a tertiary care centre in Pondicherry included five female patients aged 43-50 years who presented with spontaneous CSF rhinorrhea without any preceding trauma, surgery, or obvious precipitating factors. CT cisternography and MRI were used to localise defects, and two patients demonstrated features suggestive of idiopathic intracranial hypertension. All patients underwent endoscopic multilayer repair using fat and fascia lata grafts, with PRP gel-prepared by activating autologous PRP with calcium chloride-applied between graft layers and externally over the reconstruction site. Postoperative management included antibiotics, acetazolamide, and lumbar drainage when indicated. All five patients achieved complete resolution with no recurrence, meningitis, graft failure, or other complications during six months of follow-up. Activated PRP gel proved to be a safe, effective, and cost-efficient adjunct for reinforcing endoscopic anterior skull base CSF leak repair, although larger studies are required to validate long-term outcomes.

Keywords: CSF rhinorrhoea, Endoscopic trans nasal repair, Anterior skull base defect, Platelet rich plasma

INTRODUCTION

Cerebrospinal fluid (CSF) rhinorrhea is a condition resulting from an abnormal communication between the subarachnoid space and the nasal cavity, allowing the leakage of CSF through the nose. This condition may present either overtly with clear, watery nasal discharge, often unilateral and positional, or insidiously, where symptoms may be subtle or misattributed to allergic rhinitis or sinusitis.[1,2] Despite its varied presentation, timely identification of CSF rhinorrhea is critical, as untreated leaks pose significant risks such as low-pressure headaches, neck stiffness, tinnitus, anosmia, and, most seriously, recurrent bacterial meningitis.

The etiology of CSF rhinorrhea is diverse and can be broadly categorized into traumatic, iatrogenic, neoplastic, congenital, and spontaneous causes. Spontaneous leaks account for approximately 3% to 16% of all CSF rhinorrhea cases and occur in the absence of identifiable trauma, surgery, or pathology.[3,4] This subset is predominantly observed in middle-aged, obese females[5,6]

and is frequently associated with elevated intracranial pressure (ICP), often as a manifestation of idiopathic intracranial hypertension (IIH).[7] IIH is a condition characterized by elevated CSF pressure without an evident cause on neuroimaging or CSF analysis. In patients with spontaneous CSF rhinorrhea, IIH may either precede or coexist with the leak, and in some cases, the CSF leak may mask the classical symptoms of IIH by serving as a natural pressure release.[8]

The diagnostic criteria for IIH include the presence of papilledema, normal neurological examination aside from cranial nerve abnormalities, normal brain parenchyma on neuroimaging with exclusion of venous sinus thrombosis, normal CSF composition, and an elevated lumbar puncture opening pressure of ≥25 cm H_2O. MRI findings that may support the diagnosis of IIH include an empty sella, flattened posterior globe, and transverse sinus stenosis, optic nerve disc protrusion or tortuosity, Meckel cave enlargement and arachnoid pits. These radiological features, coupled with clinical findings, guide the diagnosis and management of spontaneous CSF leaks in the context of IIH.[9-11] Studies have demonstrated that meningitis may occur in 18.2% of patients with traumatic leaks and in up to one-third of patients undergoing certain surgical procedures involving the skull base. The risk remains significant in cases with persistent postoperative leaks, with rates approaching 19%. Therefore, accurate preoperative localization of the leak site is essential for surgical planning and risk mitigation. Advanced imaging modalities such as high-resolution computed tomography (CT) cisternography, magnetic resonance imaging (MRI), and intrathecal fluorescein-assisted endoscopy have facilitated more precise identification of the defect site(s), aiding in targeted surgical intervention.[12,13]

Over the past two decades, endoscopic endonasal approaches have become the gold standard for the repair of anterior skull base CSF leaks.[14] The success of endoscopic skull base repair depends not only on meticulous technique but also on the choice of reconstructive materials. Several options have been explored, including non-vascularized grafts (such as fascia lata, fat, and cartilage), vascularized pedicled flaps (e.g., the nasoseptal flap), middle turbinate and synthetic biomaterials like gelfoam, fibrin glue and polymethylmethacrylate. Each of these materials has its own advantages and limitations, and the choice is often influenced by the location, size, and etiology of the defect, as well as surgeon preference and experience.[15]

In recent years, PRP activated with calcium chloride to form a gel has gained attention as a promising adjunct in skull base reconstruction, particularly in cases of spontaneous CSF rhinorrhea. PRP is an autologous concentration of platelets rich in growth factors such as transforming growth factor-beta (TGF-β), platelet-derived growth factor (PDGF), insulin-like growth factor-1 (IGF-1), and vascular endothelial growth factor (VEGF), which accelerate tissue repair, angiogenesis, and wound healing. When activated with calcium chloride, PRP forms a gel that provides an immediate watertight seal at the leak site and promotes rapid mucosalization and healing, reducing the need for multiple grafting layers and improving surgical outcomes.[16,17]

CASE SERIES

This is a retrospective study conducted in the department of ENT at a tertiary care hospital in Pondicherry after obtaining appropriate consent from the patient and attenders.

We had five female patients with CSF leak in the last 6 months who came to our outpatient department with complaints of incessant watery nasal discharge that could not be sniffed back. There was no previous history of trauma. All patients were admitted and received injection ceftriaxone 1 g twice a day for 7 days and was evaluated for CSF leak. Nasal discharge was sent for CSF analysis which came back positive for CSF. Thyroid function test was done for all and one patient was diagnosed with hypothyroidism and was started on Eltroxin and surgery was deferred until it was optimised. They also underwent CT cisternogram and MRI which showed the site of leak and ruled out any intracranial space occupying lesions. All five patients had anterior skull base defects-cribriform plate of ethmoid, and in two cases, imaging confirmed an empty sella, a classical radiological sign of IIH.

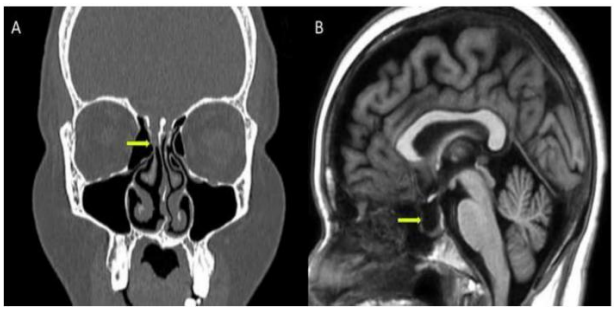

Figure 1 (A and B): Radiological findings: A) CT cisternogram, yellow arrow showing defect in the right cribriform plate of approx. size 4-5 mm, B) MRI: yellow arrow showing empty sella.

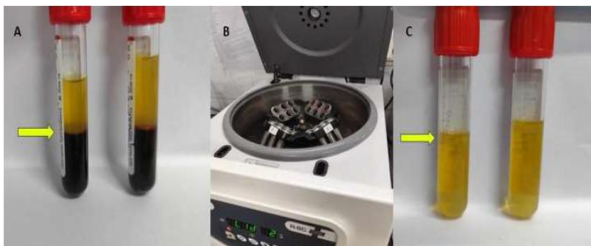

Figure 2 (A-C): Preparation of platelet rich plasma in our hospital: A) Sedimentation after checking for lysis in blood sample, B) Centrifugation apparatus used to separate PRP from whole blood C) Platelet rich plasma production after centrifugation.

Ophthalmology opinion was sought to rule out papilledema which may occur due to raised intracranial pressure. Pre-operatively their blood was sent for centrifuge to prepare PRP that was used intraoperatively. After obtaining anaesthetic fitness, all patients underwent CSF leak repair via trans nasal endoscopic approach under hypotensive general anaesthesia and were given intravenous antibiotic prophylaxis with ceftriaxone and supportive treatment with acetazolamide. Lumbar drain was placed postoperatively for the patients with IIH alone and removed on post operative day 3 (Table 1).

Table 1: Five patients with their comorbidities, site, size and type of CSF leak and the minimum follow up period of 3 months.

Age (in years)	Gender	Comorbidities	Site of CSF leak	Size of defect	Type of CSF leak	Idiopathic intracranial hypertension	Follow up period
49	F	Hypothyroid, obesity	Cribriform plate of ethmoid	2 mm	Spontaneous	Absent	6 months
50	F	Hypertensive, obesity	Cribriform plate of ethmoid	1.2 mm	Spontaneous	Present	6 months
47	F	Coronary artery disease, obesity	Cribriform plate of ethmoid	2-3 mm	Spontaneous	Absent	5 months
44	F	Rheumatoid arthritis, Obesity	Cribriform plate of ethmoid	4 mm	Spontaneous	Absent	4 months
43	F	Coronary artery disease, obesity	Cribriform plate of ethmoid	4-5 mm	Spontaneous	Present	3 months

PRP

PRP is an autologous concentration of platelets suspended in a small volume of plasma, rich in various growth factors and cytokines that promote tissue repair, angiogenesis, and regeneration. The preparation of PRP begins with drawing about 20-60 ml of peripheral blood from the patient, collected into tubes containing an anticoagulant, such as acid citrate dextrose (ACD), to prevent clotting. The blood is then subjected to centrifugation, which separates the components into three layers: red blood cells at the bottom, a middle layer (the buffy coat) rich in white blood cells and platelets, and platelet-poor plasma (PPP) at the top. The buffy coat and part of the plasma are collected to create the PRP. There are two main methods for centrifugation: the single spin method, where a soft spin separates the components, and the double spin method, which involves a second, harder spin to concentrate the platelets even further. After centrifugation, PRP may be activated with substances such as calcium chloride to release growth factors from platelets, enhancing its healing properties. Commercial systems are also available that offer standardized, closed systems to reduce contamination and ensure consistency (Figure 2).

Endoscopic CSF leak repair

Under general anesthesia, the patients were positioned supine with the head slightly elevated and turned towards the operating surgeon, to optimize access to the nasal cavity. Using a rigid nasal endoscope, the surgeon entered the nasal cavity and performed a careful inspection of the skull base to locate the defect. All five patients had CSF leak from the cribriform plate and was easily visualised after removal of the middle turbinate.

Once the defect was identified the meningocele was cauterised with bipolar and the bony margins were skeletonised. The repair begun with the preparation of the recipient site. The margins of the defect are cleaned and freshened to encourage graft adherence. Depending on the size and location of the defect, a multilayered closure technique is employed. All patients' fascia lata was harvested from the thigh along with fat intraoperatively.

The defects were closed in multiple layers starting with a layer of fat followed by fascia lata. Between the layers, PRP activated with calcium chloride (forming a platelet gel) was placed to enhance sealing and healing. At the end, an additional layer of activated PRP gel was applied directly over the repair site to provide immediate hemostasis and watertight closure.

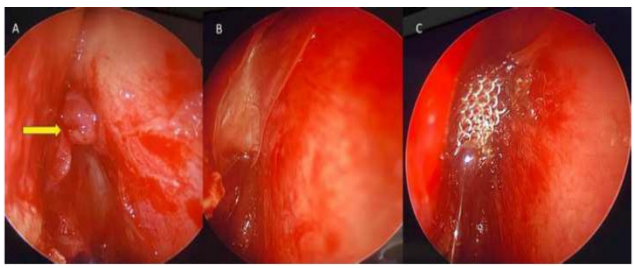

Figure 3: Intraoperative images showing: (A) Meningocoele herniating at the site of defect, (B) Fascia Lata graft placement, (C) Surgicel applied over PRP placement.

A lumbar drain was inserted postoperatively in two patients who had IIH to reduce intracranial pressure and minimize the risk of graft displacement during the critical early healing phase. The patients were then monitored closely for signs of recurrence, meningitis, or CSF rhinorrhea. Antibiotics and absolute bed rest with head elevation was employed during the recovery period of 5 days. Patient was mobilised after 5 days. Follow-up endoscopy was performed at 3 months and 6 months post operatively to assess the healing status and graft integrity was ensured.

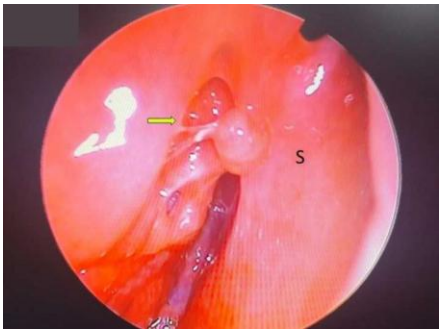

Figure 4: Postoperative endoscopy image showing healed defect site (yellow arrow), S denotes the nasal septum.

No recurrence of rhinorrhoea was observed during the follow-up period. Patients reported significant symptomatic relief. No significant postoperative complications, infections, or delayed healing were noted, suggesting PRP's potential as a safe and effective alternative for dural repair. These findings support its role in skull base reconstruction, though larger studies with longer follow-ups are needed to confirm its long-term efficacy and durability.

DISCUSSION

Spontaneous CSF rhinorrhea represents a diagnostic and therapeutic challenge, particularly in the context of increasing prevalence among obese individuals and its association with IIH.[18] In our case series of five patients, all presented with spontaneous CSF rhinorrhea without a preceding history of trauma, surgery, or malignancy. Notably, all five patients were obese, and two had definitive radiological evidence of IIH, emphasizing the growing recognition of obesity as well as IIH as significant risk factors in the pathogenesis of the spontaneous CSF leaks.

The predominance of obesity among our patients mirror findings in existing literature, where elevated body mass index (BMI) has been consistently identified as a predisposing factor. Obesity is believed to contribute to raised intracranial pressure via multiple mechanisms, including increased intra-abdominal and thoracic pressure, reduced cerebrospinal fluid absorption, and impaired venous return.[19,20] Chronic elevation in intracranial pressure leads to focal weaknesses at anatomically thin areas of the anterior skull base, particularly the cribriform plate and ethmoid roof, predisposing these patients to spontaneous CSF leak. This pathophysiological model is strongly supported by our findings, where all five patients had anterior skull base defects-cribriform plate of ethmoid, and in two cases, imaging confirmed an empty sella, a classical radiological sign of IIH.

Among the two patients with confirmed IIH, papilledema was not present after ophthalmic examination, reaffirming that papilledema, while a hallmark of IIH, may not be present in all cases. It is crucial to maintain a high index of suspicion for IIH in patients presenting with spontaneous CSF leaks, especially those with risk factors such as obesity and female gender.[21-24] Recognizing and managing IIH is essential not only for treating the CSF leak but also for preventing recurrence and addressing associated symptoms such as headache, visual disturbances, and pulsatile tinnitus.

Importantly, we employed PRP activated with calcium chloride to form a gel as an adjunctive material in reconstruction.[26] The activated PRP gel offered several benefits: rapid clot formation, promotion of mucosal healing, and immediate watertight closure, even in cases of high-flow leaks or challenging defects[27]. Its autologous nature, cost-effectiveness, and ready availability make it an excellent alternative to commercial sealants such as fibrin glue.

The biological properties of PRP, including its reservoir of growth factors and cytokines, are believed to accelerate tissue regeneration and epithelialization of the repair site. In our experience no recurrences were observed during a follow-up period of 3-6 months. These results reinforce the growing body of evidence supporting the use of PRP as a cost-effective, autologous, and efficacious material in skull base reconstruction. Although Fibrin glue is more commonly used, it is more expensive and not easily available, especially in a tertiary care setup such as our hospital, where there is an influx of patients from poor socio-economic backgrounds.

Our findings also highlight the importance of comprehensive management in cases of spontaneous CSF rhinorrhea. In addition to surgical repair, patients with spontaneous CSF leaks require long-term follow-up and adjunctive medical therapy, such as acetazolamide, to manage intracranial pressure, which was done pre operatively in our case series. Weight reduction remains a cornerstone in the management of IIH and spontaneous CSF leaks in obese patients, with potential to prevent recurrence and alleviate associated symptoms. While none of the patients in our cohort required cerebrospinal fluid diversion procedures, this remains a consideration in patients with recurrent leaks or refractory IIH.

While our results are encouraging, the limited sample size and relatively short follow-up period restrict the

generalizability of these findings. Larger prospective studies are needed to evaluate the long-term outcomes and recurrence rates, especially in patients with uncontrolled IIH or poor adherence to medical therapy. Additionally, standardized protocols for the use of PRP and other autologous materials could further enhance reproducibility and outcomes in diverse clinical settings.[28-30]

CONCLUSION

Spontaneous CSF rhinorrhea is increasingly seen in the context of obesity and IIH. Our case series highlights that endoscopic repair, supported by autologous platelet-rich plasma activated with calcium chloride to form a gel, offers a safe, effective, and economical treatment modality with low recurrence rates. Successful management requires a multidisciplinary approach addressing both the anatomical defect and the underlying contributors such as elevated intracranial pressure and obesity. The adjunctive use of PRP gel has the potential to improve outcomes and represents a valuable tool in modern skull base surgery.

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REFERENCES

1. Xie M, Zhou K, Kachra S, McHugh T, Sommer DD. Diagnosis and Localization of Cerebrospinal Fluid Rhinorrhea: A Systematic Review. Am J Rhinol Allergy. 2022;36(3):397-406.
2. McFadyen K, Whymark A. Spontaneous cerebrospinal rhinorrhoea: a guide for primary care. Br J Gen Pract. 2021;71(703):90-1.
3. Bhavana K, Kumar R, Keshri A, Aggarwal S. Minimally Invasive Technique for Repairing CSF Leaks Due to Defects of Posterior Table of Frontal Sinus. J Neurol Surg B. 2014;75(03):183-6.
4. McFadyen K, Whymark A. Spontaneous cerebrospinal rhinorrhoea: a guide for primary care. Br J Gen Pract. 2021;71(703):90-1.
5. Badia L, Loughran S, Lund V. Primary Spontaneous Cerebrospinal Fluid Rhinorrhea and Obesity. Am J Rhinol. 2001;15(2):117-20.
6. Soin P, Afzaal UM, Sharma P, Kochar PS. Isolated spontaneous cerebrospinal fluid rhinorrhoea as a rare presentation of idiopathic intracranial hypertension: Case reports with comprehensive review of literature. Indian J Radiol Imaging. 2018;28(04):406-11.
7. Pavithran A, Menon A, Govind B, Jacob AJ. Spontaneous Cerebrospinal fluid Rhinorrhea: An enigma. IOSR J Dental Med Sci. 2020;19(12):13-5.
8. Alkhotani A. Cerebrospinal Fluid Rhinorrhea Secondary to Idiopathic Intracranial Hypertension. Case Rep Neurol. 2019;11(3):295-8.
9. Elshanawany A, Mohammad F. Spontaneous cerebrospinal fluid rhinorrhea as a primary presentation of idiopathic intracranial hypertension, management strategies, and clinical outcome. Surgical Neurol Int. 2024;15:458.
10. Berhanu AE, Pauli NP. More than just a 'runny nose': a rare diagnosis of spontaneous CSF rhinorrhoea for a common symptom. BMJ Case Rep. 2014;2014:bcr2014206133.
11. Anstead AS, J. Liu J. Cerebral spinal fluid leak repair. Operat Techn Otolaryngol Head Neck Surg. 2014;25(2):187-93.
12. Ibrahim AA, Yoneis A, Elsakka A, Elwany S. Fat enhanced leukocyte-platelet-rich fibrin versus fascia lata in endoscopic reconstruction of CSF leaks. Eur Arch Otorhinolaryngol. 2023;280(9):4141-7.
13. Sundararaju U, Rajakumar HK, Ashok Siva S, Prateep A. Spontaneous cerebrospinal fluid rhinorrhoea: a case report and literature review. J Med Case Rep. 2024;18(1):533.
14. Sanghvi S, Sarna B, Alam E, Pasol J, Levine C, Casiano RR. Role of Adjunct Treatments for Idiopathic CSF Leaks After Endoscopic Repair. The Laryngoscope. 2021;131(1):41-7.
15. Martín-Martín C, Martínez-Capoccioni G, Serramito-García R, Espinosa-Restrepo F. Surgical challenge: endoscopic repair of cerebrospinal fluid leak. BMC Res Notes. 2012;5(1):459.
16. Kaplan N. A Study of Platelet Rich Plasma Commonly Used in Neurosurgery Practice. 2019. Available at: https://zenodo.org/record/2550812. Accessed on 25 October 2025.
17. Kaplan N. A Study of Platelet Rich Plasma Commonly Used in Neurosurgery Practice. 2019. Available at: https://zenodo.org/record/2550812. Accessed on 25 October 2025.
18. Kim-Orden N, Shen J, Or M, Hur K, Zada G, Wrobel B. Endoscopic Endonasal Repair of Spontaneous Cerebrospinal Fluid Leaks Using Multilayer Composite Graft and Vascularized Pedicled Nasoseptal Flap Technique. Allergy Rhinol (Providence). 2019;10:2152656719888622.
19. Noori FA, Hamdan DM, Alaqsam YI, Almutairi DA. The Etiology, Diagnosis, and Management of Cerebrospinal Fluid Rhinorrhea: A Tertiary Center Experience. Cureus. 2023;15(7):e42661.
20. Sumaily I. Current Approach to Cerebrospinal Fluid Rhinorrhea Diagnosis and Management. JOENTR. 2017;7(1):00191.
21. Majhi S, Sharma A. Outcome of Endoscopic Cerebrospinal Fluid Rhinorrhoea Repair: An Institutional Study. Indian J Otolaryngol Head Neck Surg. 2019;71(1):76-80.
22. Galli J, Morelli F, Rigante M, Paludetti G. Management of cerebrospinal fluid leak: the importance of multidisciplinary approach. Acta Otorhinolaryngol Ital. 2021;41(1):S18-29.
23. Lobo BC, Baumanis MM, Nelson RF. Surgical repair of spontaneous cerebrospinal fluid (CSF) leaks: A

systematic review. Laryngoscope Investig Oto. 2017;2(5):215-24.
24. David H, Corina W. Obesity as a Risk Factor for Primary Spontaneous Rhinoliquorrhea. Arch Otolaryngol Head Neck Surg. 2003;129(3):324-6.
25. Bej A, Lenka S, Mishra S. Management of CSF Rhinorrhea: A Review. Int J Dental Med Sci Res. 2022;4(4):346-8.
26. Nakayama N, Yano H, Egashira Y, Enomoto Y, Ohe N, Kanemura N, et al. Efficacy, Reliability, and Safety of Completely Autologous Fibrin Glue in Neurosurgical Procedures: Single-Center Retrospective Large-Number Case Study. World Neurosurg. 2018;109:e819-28.
27. Gupta S, Paliczak A, Delgado D. Evidence-based indications of platelet-rich plasma therapy. Expert Rev Hematol. 2021;14(1):97-108.
28. Aziz HF, Yaqoob U, Tariq R, Shamim MS. Platelet-Rich Plasma-A Safe and Cost-effective Dural Sealant in Spinal Surgeries-A Systematic Review. Researchsquare. 2024;1-12.
29. Theys T, Van Hoylandt A, Broeckx CE, Van Gerven L, Jonkergouw J, Quirynen M, et al. Plasma-rich fibrin in neurosurgery: a feasibility study. Acta Neurochir. 2018;160(8):1497-503.
30. Das G, Roy C, Dutta D, Pathak L. Platelet-rich Plasma: A Recent Review. J Recent Adv Pain. 2020;6(1):20-3.

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