

The utility of pre-operative imaging and intrathecal fluorescein in the operative management of cerebrospinal fluid rhinorrhea



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INTRODUCTION

A cerebrospinal fluid (CSF) leak occurs when there is a communication between the subarachnoid space and the upper aerodigestive tract. Symptoms of CSF leak include clear nasal drainage, headache, pneumocephalus, meningitis, and brain abscess. In order to avoid these complications, CSF leak must be closed by either conservative measures or surgical procedures.¹

- Endoscopic repair of CSF leaks has become the standard of care with success rates of greater than 90%.²
- CSF leak localization can be accomplished via computed tomography imaging (CT) and/or with intrathecal fluorescein (IF) administration
- CT imaging has increased in resolution with thinner sliced cuts, bone window algorithms and reformatting in multiple planes. Despite being frequently utilized, IF lacks FDA approval and requires additional consent for off-label usage. This poses a theoretical risk to patients and, medicolegally, to surgeons.³

The purpose of this study is to determine diagnostic ability of CT versus IF for localization of CSF leak. We also attempted to identify patient populations in which IF may have added diagnostic yield in successful CSF leak localization.

METHODS

- This study was reviewed by the University of Kansas Institutional Review Board and deemed exempt from review.
- Patients admitted for CSF rhinorrhea between 2003 and 2016 were identified using the Healthcare Enterprise Repository for Ontological Narration (HERON). The records of these patients were retrospectively analyzed and the demographics, location of leak, and complications were collected.
- Diagnostic yield of pre-operative imaging and intrathecal fluorescein for identification of leak site was analyzed.

RESULTS

102 patients underwent CSF leak repair. 16 patients had multiple sites of CSF leakage, for a total of 121 CSF fistulas.

- The most common CSF leak etiologies and leak sites were identified in Table 1.
- Surgical repair was most frequently completed with abdominal fat graft, followed by nasoseptal flap. Nasoseptal flap became more frequently used during the duration of the study (Table 1)
- CT identified leak site in 67% of patients while IF was used in 56 cases and useful for intraoperative localization in 73%.
- **IF was more helpful for leak localization in cases of multiple defects vs. single, 9/9 vs 27/47, p=.019 (Table 2).**
- 6 patients receiving lumbar drain experienced a complication: spinal headache (50%) and other neurologic issues (50%). 1 patient required a blood patch.

Table 1
Patient Demographics and Leak Characteristics

Factor	n=102 (%)
Patient Characteristics	
Mean age	49.5
Female	75 (73.5)
Male	27 (26.5)
Etiology of CSF Leak	
Iatrogenic	27 (26.5)
ESS, n=27	15 (55.6)
Previous SBS, n=27	12 (44.4)
Encephalocele	22 (21.6)
Idiopathic	16 (17.7)
Skull Base Tumor	13 (12.7)
Traumatic	9 (8.8)
Unknown	9 (12.7)
Location of Leak	
Right	50 (51.2)
Left	50 (48.8)
Sphenoid Sinus	46 (38)
Cribiform	29 (23.9)
Posterior Ethmoid	23 (19)
Anterior Ethmoid	15 (12.3)
Sella	4 (3.4)
Other	4 (3.4)
Repair Type	
Abdominal Fat Graft	60 (58.8)
Nasoseptal Flap	14 (13.7)
Free Mucosal Graft	10 (9.8)
Other	18 (17.6)

CSF, Cerebrospinal Fluid; ESS, Endoscopic Sinus Surgery; SBS, Skull Base Surgery

Table 2
Localization of CT and IF

Localization Modality	Single Leak Site, n (%)	Multiple Leak Sites, n (%)
Pre-Operative CT imaging	58 (67.4)	13 (81)
Peri-Operative Intrathecal Fluorescein	63 (73.2)	9 (100)

CT, Computed Tomography; IF, intrathecal fluorescein

DISCUSSION

Because of improved CT imaging resolution, increased sub-specialized training, the potential complications associated with LD placement and off-labeled usage of IF, this study determined diagnostic utility of CT versus IF.

- The most common etiology of multi-site CSF leak was skull base tumor and encephalocele
- Successful CSF leak identification was equivocal between CT and IF when a single leak was present. IF had better diagnostic yield than CT in the presence of multiple leak sites.
- IF may have added utility during CSF repair for skull base tumor or encephalocele as these commonly present as multi-site leaks.

CONCLUSION

The diagnostic yield of intrathecal fluorescein and pre-operative imaging were equivalent, with each modality localizing leak site approximately two-thirds of the time. Fluorescein may be of increased utility in instances of multiple leak sites.

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