Peri-operative Lumbar Drains for Trans-Sphenoidal resection of Pituitary Adenomas
Ummey Hani, Saqib Kamran Bakhshi, Muhammad Shahzad Shamim

Abstract
Trans-sphenoidal approach for resection of pituitary adenomas is a safe and common neurosurgical procedure. It can be done both through microscopic or endoscopic methods, and both methods can be facilitated by a peri-operative lumbar drain insertion, that in theory improves tumour resection and reduces risk of post-operative cerebrospinal fluid leak. Herein we have reviewed the literature to find out the evidence in support of peri-operative lumbar drain insertion for trans-sphenoidal resections.

Keywords: Pituitary adenoma, trans-sphenoidal surgery, trans-sphenoidal resection, lumbar drains, cerebrospinal fluid drainage, cerebrospinal fluid leak.

Introduction
Pituitary adenoma resection via the transsphenoidal approach (TSS) is a safe and common neurosurgical procedure that can be done both through microscopic and endoscopic methods. It is generally an extra-arachnoid procedure but it is not infrequent to enter the subarachnoid space in the process. Hence, intra-operative, and subsequently, post-operative cerebrospinal fluid (CSF) leak, occurring in 1.5-12.7% of the cases, remains the commonest complication of this procedure. Over the past few years, lumbar drainage has been considered to be of particular importance in not only securing reconstruction material and optimizing tumour removal, but also to provide CSF drainage to reduce the risk of peri-operative CSF leakage. The latter is achieved by reduction in the intracranial pressure via continuous CSF drainage, which facilitates wound healing and obtains watertight closure of the wound site. However, the role of LDs in aiding with the aforesaid indices have become contentious in the present times, with only some surgeons advocating its usage over the others. Herein, we have reviewed the effectiveness of perioperative LD placement in improved post-surgical outcomes in patients undergoing trans-

Figure 1: a) Pre-operative MRI brain, T1 post-contrast, coronal section of a 63-year-old male with Pituitary Adenoma.
Figure 1: b) Post-operative MRI brain, T1 post-contrast, coronal section of the same patient showing resection cavity with peripheral enhancement.

The Aga Khan University Hospital, Karachi, Pakistan.
Correspondence: Muhammad Shahzad Shamim
 e-mail: shahzad.shamim@aku.edu
sphenoidal surgeries for pituitary adenoma resection.

**Review of Evidence**

We examined the PUBMED database for articles addressing the usefulness of peri- and post-operative lumbar drain placement in trans-sphenoidal surgeries for pituitary adenoma resection. No limit was set on the publication date and the review was completed in July 2019.

In a landmark study in 2006, Sade et al., analyzed their institutional data, emphasizing on the importance of lumbar drainage through their results. In their sample, 61 patients undergoing TSS for pituitary adenomas underwent LD insertion, 34 before the procedure, usually for adenomas with suprasellar extension, and 27 after the procedure, for those who did not have a pre-operative drain placed and thus, developed intra-operative leaks. They reported a lesser percentage of patients experiencing intra-operative leaks with pre-operative LD insertion, as compared to otherwise. Only two (1.6%) patients, with suprasellar adenoma extension, with LD placed, pre- or post-operatively, developed post-operative leaks, with 0% failure rates of lumbar drainage in patients who had no suprasellar extension of the tumour. Similar results were seen in the study by Rabadan et al., 2009, who deduced careful closure and post-operative external lumbar drainage to be efficacious prophylactic strategies for the prevention of post-operative CSF leaks. In their experience of 63 consecutive cases, only 20 patients suffered from intra-operative CSF leakage, and consequently underwent preventive treatment by fat graft closure and post-operative lumbar drainage for 2 to 4 days. Post-operative CSF leakage occurred only in one patient in this group documenting a failure rate of 5% only.

In 2012, Mehta et al., suggested a different preventive strategy than Rabadan et al., concluding that pre-operative LD insertion for TSS in pituitary adenomas obviated the need for both post-operative CSF drainage and surgical repair for intra-operative CSF leaks. In their retrospective analysis of 114 patients with no pre-operative LDs compared to 44 patients with LDs placed before surgery, they reported a statistically significant reduction in the percentage of intra-operative leaks in tumours with suprasellar extension, from 57% in the former procedure, to 5% subsequently. While the rate of post-operative CSF leakage remained similar in both cases, 5% in each to be precise, the need for operative repair decreased significantly from 32% to 5%, documenting pre-operative lumbar drainage as a more rational prophylactic measure. Conflicting results were seen in a study by Zhan et al., in 2015, reporting no significant differences in the outcome of post-operative CSF leaks managed conservatively versus via LD placement. In the 33 out of 384 patients who had low flow CSF leaks and no intra-operative LD placement, 94.4% in the LD group responded well to lumbar drainage, while 93.3% in the control group were successfully cured conservatively. A patient each in both groups had to undergo endoscopic surgery for the leak repair. The gross total resection rate of the tumour was in fact greater in the control group (86.7% vs 83.8% in the LD group), although the difference was not statistically significant.

Thawani et al., evaluated the factors for increased length of stay in hospitals after pituitary adenoma resection via TSS in 2017, reporting a statistically significant association of longer hospital stays with peri-operative lumbar drainage (6.89 vs 4.32 days without lumbar drain placement, p <0.001) in their post hoc analyses. They also did not recognize any significant association of post-operative leaks with intra- or post-operative lumbar drainage, thus concluding it to be of limited value in reducing their risks. In their comprehensive study in 2018, Caggiano et al., concluded outcomes similar to the aforementioned study, documenting that pre-operative lumbar drainage did not prevent the risk of intra-operative CSF leak in either high- or low-risk patients. In their assessment of 811 patients having undergone trans-sphenoidal resection of pituitary adenoma, the length of hospital stay was found to be significantly associated with intra-operative LD that was placed in 38 patients, averaging to 6.16 days, versus 2.13 days in patients without LD placement (p <0.0001). In reality, they reported a higher rate of intra- and post-operative leaks in patients having LD placed compared to otherwise. This difference, however, was not significant.

**Complications of Lumbar Drainage**

As an invasive procedure, the placement of lumbar drains can entail a number of complications, which, though usually minor, can cause the patient significant distress. In 2011, Ransom and colleagues explored the complications caused by lumbar drain placements in 65 patients from their center, concluding them to be more frequent and morbid than post-operative leaks. They
reported a complication rate of 12.3% with a total of 10 additional days of hospital stay including readmissions and a prolonged in-patient course. While persistent CSF leakage causing spinal headache was the commonest amongst all, other complications included accidental over-drainage, retained catheter tip prompting open removal of the fragments, and worsening pneumocephalus due to inappropriate opening of the drain. In the study by Zhan et al.,\textsuperscript{8} investigating the management of outcomes of postoperative leaks with lumbar drain placement, 2 patients in the LD group developed meningitis, compared to one in the control group, thus leading to an overall statistically insignificant difference between the two management strategies.

In a comprehensive study evaluating risk factors for meningitis with three kinds of cerebrospinal fluid drains, Hussein et al.,\textsuperscript{11} documented the incidence of meningitis to be 12%. Out of the 437 drains placed, 92 were LDs, with CSF leak forming 3.9% of the total indications for CSF drainage. Persistent CSF leakage present before catheter insertion was a statistically significant risk factor (p<0.029), others being diabetes mellitus, drain days, and drain opening. Significant association of infection was also seen with the type of drain (p<0.007), where lumbar drains had a lower rate of infections than external ventricular drains, but a higher risk than ICP catheter.

**Conclusion**

While findings in the earlier works suggest otherwise, recent studies have not shown encouraging results with the use of peri-operative LDs in TSS for pituitary adenomas, in preventing CSF leaks or improving tumour removal. With multiple studies reporting potential patient indisposition and subsequently increased healthcare costs with its use, we advise judicious use of lumbar drains restricted to the most high-risk patients.

**References**