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# Commentary to: External Ventricular Drainage before Endovascular Treatment in Patients with Aneurysmal Subarachnoid Hemorrhage in Acute Period: Its Relation to Hemorrhagic Complications

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We read with extreme interest the article by Lim et al.[1] on the use of "external ventricular drainage before endovascular treatment in patients with aneurysmal subarachnoid hemorrhage in acute period and its relation to hemorrhagic complications." The authors[1] report external ventricular drainage (EVD) before endovascular treatment (EVT) in patients with subarachnoid hemorrhage (SAH) in the acute period did not increase the rate of rebleeding or EVD-related hemorrhagic complications in a sample of 122 patients. There are certain sections in the manuscript that seem conflicting: "rebleeding before EVT seemed more common in the pre-embo EVD group (28.4%) than in the post-embo EVD group (41.8%), but the difference was not statistically significant (P=0.120)." In addition to this, the authors state: "no rebleeding occurred due to pre-embo EVD in our series, suggesting that pre-embo EVD did not increase hemorrhagic complications, such as rebleeding or EVD-related hemorrhage." If the rebleeding in the "pre-embo EVD" group was more common, then, how is it possible no rebleeding occurred due to pre-embo EVD? Moreover, the real meaning of "embo" here is unclear. For their EVT, "coils and stents were chosen according to the surgeon's preference." If that is the case, there was no embolization involved. The word "embo" has been used multiple times in the abstract, and for the first time in the patient selection group: "included patients were sorted into 2 groups: a pre-embo EVD group (n=67) comprising patients who underwent EVD before EVT and a post-embo EVD group (n=55) comprising those who underwent EVD after EVT." Does "embo" mean the placement of EVT? If so, why do the authors use two different terminologies?

EVD placement is a routine technique in neurosurgery, as it helps in the management of neurocritical patients. On a few occasions, the use of EVD has been associated with vascular injury.[2] It should be clearly stated that the goal of any aneurysm intervention is preventing rebleeding. Incidence of aneurysmal rebleeding is high within the first few hours after the aneurysm rupture, being associated with

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a mortality rate of up to 50%. While EVD reduces intracranial pressure after ventricular cerebrospinal fluid (CSF) drainage, this has been reported to increase aneurysmal transmural pressure, resulting in the displacement of the formatted clot with a higher risk of rerupture before aneurysm treatment.[3-6] In a recent meta-analysis including 6,804 patients with SAH, 8.7% of patients rebled. External ventricular drainage was peformed in 19% of patients with SAH.[3] Among this group, rebleeding occurred in 241 patients (18.4%). In the remaining 5,498 patients without EVD, rebleeding occurred in 354 patients (6.4%) (P<0.0001).[3] Despite the authors stating that EVD time is of certain relevance, the results of their study also showed that the mean time between initial SAH and EVD placement was 50 hours, whereas the mean time between SAH and aneurysm treatment was 81.4 hours. This goes directly against the present conclusion that EVD before EVT in patients with acute SAH in the acute period did not increase the rate of rebleeding as well as EVD-related hemorrhagic complications. Thus, the series is either powered to a lesser degree to draw such conclusions or the timing of rebleeding has been coincidentally mistaken for bleeding after EVD. Also if EVT had been done, why was there a need for EVD in the case of hydrocephalus? It seems that a shunt placement in such situations would result in better outcomes. The time of rebleeding in the meta-analysis was available for 366 patients and occurred within 24 hours for 225 patients (61.5; 95% confidence interval,56–66%). However, this series included operated cases as well as intervention cases. Also, based on the analysis, hemorrhage occurred very early after EVD (1 hour), and in 17% of cases occurred immediately after the procedure.[4]

The rebleeding rate after EVD placement was 18.8% in the meta-analysis, and in the present series it was seen in 18 patients (14.8%): 6 (8.9%) in the pre-embo EVD group and 12 (21.8%) in the post-embo EVD group.[3] While it may seem less, the chance of rebleeding in ruptured untreated aneurysms is 8 to 23% during the first 72 hours after SAH.[6] Thus, the practice of indiscriminately performing EVD in all SAH cases might not be right, and certain other factors should be considered. The size of the aneurysms that underwent rebleeding was roughly 1.3 times greater than aneurysms without rebleeding.[5] However, in the present series, the difference did not regard aneurysm size (P=0.553), which again reiterates the need for a larger sample.[5] Again, Lim et al.[1] showed that lower Fisher grades (I–II) were more common among non-rebleeding patients (39% vs. 25%) (P<0.0001), whereas higher Fisher grades (III–IV) were more common among the rebleeding group (75% vs. 60%) (P<0.0001). However, the present study has a non-significant difference of P=0.108. Sadly in most cases, poor grade SAHs are the ones that need EVD.[3]

There has also been speculation, and it has been proved to some extent, that CSF drainage leads to improvement in brain compliance and consequently brain perfusion. This is especially evident in traumatic brain injury cases where typically younger patients improve better than their older counterparts as atrophic brains may not benefit from decompression. In a study of 49 such traumatic brain injury (TBI) cases, Akbik et al.[6] showed a statistically significant increase in brain tissue oxygenation ($PbtO_2$) level by an average of 1.15 mmHg. While this small change in itself may not be clinically relevant, 12% of cases showed a change of 5 mmHg or more, which may subtend a better prognosis. The larger the decrease in CSF pressure, the more the improvement in $PbtO_2$ levels. However, these cases of TBI do not have an aneurysm that may rupture with the release of the tamponade, and thus a subset of cases who will benefit most from CSF release needs to be identified in future studies.

Thus, while EVD serves as a measure to gain time for the patient and surgeon, it should be judiciously used considering the size of the aneurysm and the amount of initial bleeding. If possible, ultra-early surgery of the aneurysm with intraoperative tapping of the ventricle using Paine's point might be a better alternative to prevent rebleeding and possible infection. After the aneurysm has been secured and the patient develops hydrocephalus, a shunt should always be the better alternative.

## REFERENCES


1. Lim YC, Shim YS, Oh SY, Kim MJ, Park KY, Chung J. External ventricular drainage before endovascular treatment in patients with aneurysmal subarachnoid hemorrhage in acute period: its relation to hemorrhagic complications. *Neurointervention* 2019;14:35-42
2. Choudhri O, Gupta M, Feroze AH, Heit JJ, Do HM. Endovascular management of external ventricular drain-associated cerebrovascular injuries. *Surg Neurol Int* 2014;5:167
3. Cagnazzo F, Gambacciani C, Morganti R, Perrini P. Aneurysm rebleeding after placement of external ventricular drainage: a systematic review and meta-analysis. *Acta Neurochir* 2017;159:695-704
4. Beck J, Raabe A, Szelenyi A, Berkefeld J, Gerlach R, Setzer M, et al. Sentinel headache and the risk of rebleeding after aneurysmal subarachnoid hemorrhage. *Stroke* 2006;37:2733-2737
5. Boogaarts HD, van Lieshout JH, van Amerongen MJ, de Vries J,

Verbeek AL, Grotenhuis JA, et al. Aneurysm diameter as a risk factor for pretreatment rebleeding: a meta-analysis. *J Neurosurg* 2015;122:921-928

6. Akbik OS, Krasberg M, Nemoto EM, Yonas H. Effect of cerebrospinal fluid drainage on brain tissue oxygenation in traumatic brain injury. *J Neurotrauma* 2017;34:3153-3157