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EXPERIENCE DOES MATTER FOR PULMONARY ENDARTERECTOMY SURGERY

To the Editor:

I have read the article entitled “Is Subdural Hemorrhage After Pulmonary Endarterectomy Underrecognized?” by Yap and colleagues.¹ I want to congratulate the authors for this article and starting a pulmonary endarterectomy (PEA) program in Singapore, and make some contributions.

In the article, it has been reported that 6 of 10 patients had subdural hemorrhage (SDH) after PEA for chronic thromboembolic pulmonary hypertension. The authors concluded that in their small cohort of patients, a higher incidence of SDH was encountered. As one of the reasons for this high incidence of SDH, the authors claimed that Asians are known to be at a higher risk of intracranial hemorrhage compared with their Western counterparts.

PEA is a complex procedure that can be safely performed only in expert centers based on a high level of experience of an interdisciplinary team.² It is also well established that a major prognostic factor for PEA surgery is the experience of the surgeon and the institution. A PEA center is defined as an institution that performs 20 or more PEA surgeries per year with a mortality rate less than 10%.² At the Sixth World Symposium on Pulmonary Hypertension in Nice, February 27 to March 1, 2018, an expert center was defined as a center that performs more than 50 PEA cases per year. Increasing surgical experience, technical refinements, and better patient selection probably explain the improvements in perioperative mortality during the past 20 years.

It is well known that deep hypothermic circulatory arrest (DHCA) is the optimum modality for patients undergoing PEA surgery. In our early PEA experience, mean DHCA time was 21.4 ± 7.2 minutes for PEA surgery³; however, Yap and colleagues¹ reported their DHCA time as 46 ± 15 minutes. I think this time is too long for an initial

experience of PEA surgery, and it may contribute to this higher incidence of SDH. Ever since we started our PEA program with acceptable results,³ more than 500 operations have been performed over 7 years (80 cases last year), with increased institutional and surgical experience resulting in our center becoming the only expert PEA center in Turkey. With this experience, we did not encounter any SDH or other serious neurologic complications regarding to PEA surgery, although our center is aware of postoperative neurologic complications of cardiothoracic surgery.⁴

Although I could not read the editorial comment about the article, this early experience of Yap and colleagues¹ highlights the importance of an expert chronic thromboembolic pulmonary hypertension team within a high-volume center to overcome intraoperative and early postoperative complications.

Bedrettin Yıldızeli, MD

Department of Thoracic Surgery

Marmara University School of Medicine and Kartal

Koşuyolu Teaching and Education Hospital Istanbul

Istanbul, Turkey

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LOOK BEFORE YOU LEAP

Reply to the Editor:

In Zen teachings, the term *mushin* reflects a state of mind that is undisturbed by thought, emotion, or judgment. This state of mind allows one to act in a fashion that is free of obstructive thought processes and emotions. It is challenging to achieve *mushin*, but doing so allows one to be more reflective and to be less prone to jumping to conclusions.

In the commentary in the *Journal* entitled, “Experience Does Matter for Pulmonary Endarterectomy Surgery,” Yıldızeli¹ suggests that the increased incidence of subdural hemorrhage (SDH) found in the cohort of patients undergoing pulmonary endarterectomy (PEA) for chronic

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thromboembolic pulmonary hypertension (CTEPH) reported on by Yap and colleagues² is likely due to early experience. Yıldızeli¹ argues that the prognosis for patients undergoing PEA for CTEPH is highly dependent on surgeon and institutional volume and experience, suggesting that the cohort of Yap and colleagues² may have encountered a disproportionately increased incidence of SDH as a result of increased circulatory arrest time (46 ± 15 minutes; $n = 10$).

Yıldızeli¹ cites his own group's experience with a mean circulatory arrest time of 21.4 ± 7.2 minutes ($n = 49$) and an in-hospital mortality of 14.2%. He does not report the incidence of SDH or intracranial hemorrhage in his group's cohort. It is unclear, however, how many of his group's patients underwent cranial computed tomography to investigate for such a complication. Data from the University of California San Diego group, our own center, an international prospective registry, and Denmark's national referral center all cite mean circulatory arrest times ranging from 35 minutes to 39 minutes.³⁻⁶ Furthermore, many of these studies report longer circulatory arrest times during their early experiences, with decreasing mean circulatory arrest duration in their later cohorts. In reviewing these data, it can be seen that Yap and colleagues² do indeed report a slightly higher mean circulatory arrest time; however, it is not much higher than other experienced groups reporting limited mortality.

Yap and colleagues² also cite a study from the Papworth group, in which the incidence of SDH as a complication of PEA was 14.3%.⁷ This is one of the only known studies to report on the incidence of SDH in a PEA for CTEPH cohort. None of their SDH complications required intervention. This group previously reported a mean time of circulatory arrest of 35 ± 8.5 minutes,⁸ which is not far off from the mean circulatory arrest time reported by Yap and colleagues.² Similar to previous reports on PEA for CTEPH, however, patients were not routinely screened with cranial computed tomography for detection of SDH.

There is no doubt that PEA for CTEPH is a challenging procedure, requiring high volume and experience to achieve excellent outcomes. The circulatory arrest times reported by Yap and colleagues² are not disproportionately higher than those of many other experienced centers around the world, yet their incidence of SDH is certainly out of keeping with what would be expected. Furthermore, these cases were supervised and guided by a highly experienced PEA surgeon, and we can safely presume that the surgical steps were consistent with the best standard of practice. Yap

and colleagues² suggest that perhaps increased screening for SDH led to increased detection, which is certainly conceivable. They also make several other suggestions on the basis of the literature, including damage to the bridging veins secondary to minor head trauma in the setting of anticoagulation and alterations in cerebral volume as a result of fluid shifts during surgery.^{2,9} Interestingly, they cite another study that found increased incidence of SDH in aortic surgery to be associated with decreased administration of platelet volume.¹⁰ There are likely other reasons of which we may be unaware. We would caution against jumping to conclusions and preemptively attributing the increased incidence of SDH to inexperience, because there is no evidence that the duration of circulatory arrest is a consistent metric for this. It would be prudent for future studies to investigate this phenomenon further to ensure that we are not missing an opportunity to characterize and possibly prevent a potentially devastating complication.

Thin Xuan Vo, MD, MSc
Fraser Rubens, MD, MSc, FACS, FRCSC
Division of Cardiac Surgery
University of Ottawa Heart Institute
Ottawa, Ontario, Canada

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