Quantitative Study of Optico-Carotid and Carotid-Oculomotor Window Before and After ICA Mobilization and P-COM Division

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Introduction

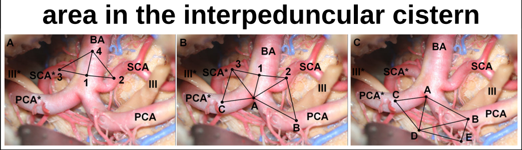
We quantified the surgical exposure of the basilar apex through the optico-carotid window (OCW) and the carotid-oculomotor window (COW), before and after mobilization of the internal carotid artery (ICA) and division of the posterior communicating artery (PCoA).

Methods

Eleven silicone-injected cadaveric heads were dissected bilaterally. The surgical dissection was divided into four major steps: 1) supraorbital modified orbitozygomatic craniotomy; 2) mobilization of the ICA after drilling out the anterior clinoid process intradurally and, cutting the distal dural ring 3) drilling out the posterior clinoid process and dorsum sellae; 4) dividing the PCoA at the posterior third of the PCoA. A frameless navigational system was used to quantify the surgical exposure area of the basilar apex through the OCW and COW.

Measurements were taken of the surgical areas of exposure with regard to: the temporary occlusion (TO) of the basilar trunk, permanent clip application (pCA), and the area between the superior cerebellar artery (SCA) and posterior cerebral artery (PCA) (Fig. 1).

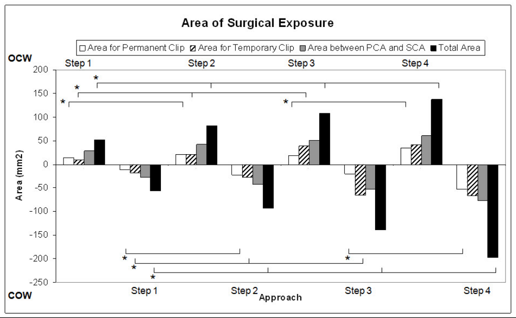
Fig. 1.Reference points for the surgical area in the interpeduncular cistern



Result 1

The total area increased between steps: 1-4 through both the OCW and COW groups ($p < 0.05$)*. Area for the permanent clip application (pCA) through both windows, increased ($p < 0.05$)* between steps 1-2, and 3-4; however no significant increase ($p > 0.05$) was observed between steps 2-3. The area for the temporary occlusion (TO), through either window, increased between steps: 1-2 and 2-3 ($p < 0.05$)*, however no significant increase was observed between steps 3-4 ($p > 0.05$) (Table1).

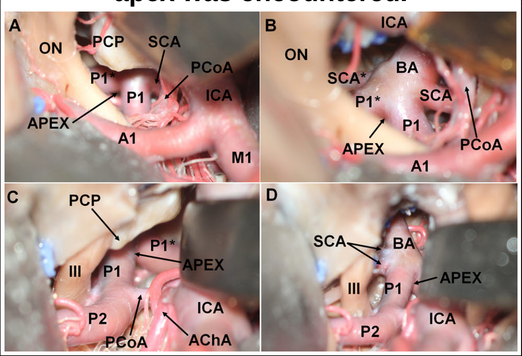
Table 1.



Result 2

In the low lying basilar apex(BX) group, the total ($p = 0.006$) and permanent clip ($p = 0.003$) area increased through the COW after step 3. Again, after step 3, the COW had a more significant gain in the area for pCA when low lying BX was encountered ($p = 0.031$) compared to the OCW (Fig.2).

Fig. 2. The effect PCP removal on the OCW and COW when a low lying basilar apex was encountered.



Result 3

Mean area for pCA through the OCW in the high lying BX group (19.7±18.0 mm2)(Fig.3 C-D) seemed to be smaller than in the low lying BX group (37.2±26.5 mm2)(Fig.3 A-B). Mean area for pCA through the COW in the high lying group (41.6±33.8 mm2)(Fig.4 C-D) seemed to also be smaller than in the low lying group (68.6±30.0mm2) (Fig.4 A-B)). However, no significant difference was found.

Fig. 3.Effect of division of the PCoA on the OCW according to height of the basilar apex (A-D; the OCW through step 3-4, Right side).

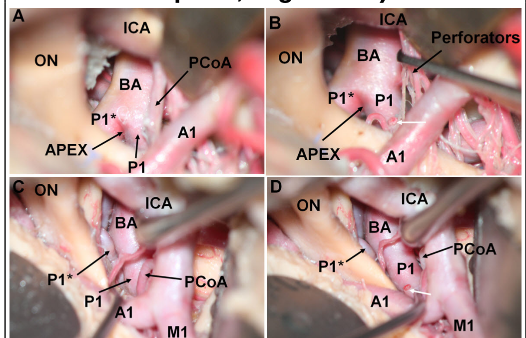
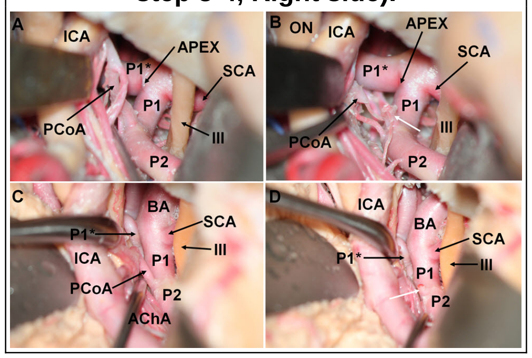


Fig.4. The effect of dividing the PCoA on the COW according to height of the basilar apex (A-D; the COW through step 3-4, Right side).



Result 4

Where a short adult PCoA was concerned, there was only a significant increase in the total area ($p = 0.040$) and the area for pCA ($p = 0.028$), through the COW (Fig.5 C-D). When an adult type PCoA was divided, regardless of it being short/long, the area for pCA only increased within the COW.

When a long hypoplastic PCoA was encountered (Fig.6), there was no change in area after the division of this vessel, either within or between the two windows ($p > 0.05$). A long hypoplastic PCoA may therefore be mobilized by gentle retraction rather than being sacrificed.

Fig. 5. The effect of dividing the PCoA, on the OCW and COW in the case of a short and adult type PCoA (Left side approach).

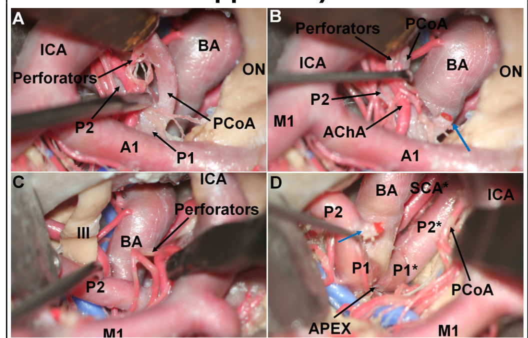
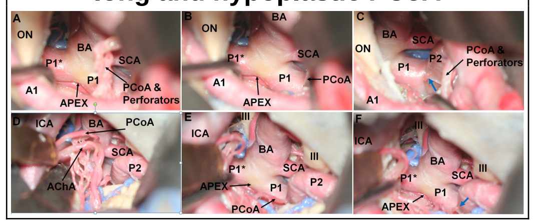


Fig.6. The effect of dividing the PCoA on the OCW and COW, in the case of a long and hypoplastic PCoA



Conclusions

The COW was a more favorable route for applying a permanent clip than the OCW; due to the COW's larger surgical exposure. In terms of the division of short hypoplastic PCoAs, the area for pCA significantly increased through both windows, and there was a greater change in area through the COW compared to the OCW. When approaching the basilar apex via the pterion route, the appropriate surgical step and window may be selected according to characteristics of the PCoA and height of the basilar apex.

Reference

Krayenbuhl N, Krisht AF: Dividing the posterior communicating artery in approaches to the interpeduncular fossa: technical aspects and safety. Neurosurgery 61:392-396; discussion 396-397, 2007.

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