How to Spare the Inner Ear Structures during the Posterior IAM Wall Opening: Literature Review

A. MIKHALKOVA¹, MD, N. ALSHAFAI¹, MD FRCS(C) EBNS
¹ Alshafai Neurosurgical Academy, Toronto, ON, Canada

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Disclosure

• We don’t have any disclosure and any conflict of interest to declare.
Introduction

• Resection of the tumors invading the internal acoustic meatus (IAM) though the retrosigmoid approach requires the drilling of its posterior wall. During this step, the damage of the inner ear structures is possible with consecutive postoperative hearing loss. That is why it is important to develop an operative strategy in order to keep these structures intact.
Methods

• Review of the literature published between 2000 and 2016 was performed in the PubMed database using the search terms “internal acoustic meatus/canal” and “anatomy”. Additional articles were selected secondary from the reference list. In total, twenty-nine articles were found and reviewed.
Results

• Following methods of sparing the inner ear structures could be distinguished:
  • measurement of the average distances between relevant anatomical structures;
  • measurement of the individual distances between anatomical structures based on the preoperative CT-scan;
  • usage of the intraoperative navigation and endoscopy.

• The critical structures endangered during the IAM posterior wall resection include posterior semicircular canal, common crus, endolymphatic duct, sac and perilymphatic duct.

• No reliable superficial landmarks for the inner ear structures could be found due to the high interspecimen variability.
Results

• However, the position of the inner ear structures can be evaluated preoperatively using a thin-sliced skull base CT-scan with only slight difference between the distances measured radiologically and anatomically (fig. 1).

Figure 1. Bone window skull base CT-scan (slice thickness 0.6 mm, from caudal to cranial) depicting inner ear structures. Blue continuous line – cochlear aqueduct; blue dotted line – vestibular aqueduct; blue arrowhead – posterior semicircular canal; blue star – vestibule; red arrow – internal acoustic meatus; red arrowhead – lateral semicircular canal
Results

• The location of relevant anatomical structures can be then intraoperatively estimated with a ruler/ instrument or accurately localized by electromagnetic or optical navigation.

• For example, in the study of Sceratti et al the average length of the exposed IAM with the assistance of the optical navigation was 88.95% in contrast to 40-70% described in the literature. However, the use of the intraoperative navigation for this purpose remains mostly experimental so far.
Discussion

• According to current literature, the relationships between superficial anatomical structures and inner ear shows high interspecimen variability. Since, no reliable surgical anatomical landmarks for the inner ear structures could be established.

• An individualized surgical planning based on the preoperative CT-scan provides most reliable information so far to define intraoperatively the “safe drilling zone” of the posterior meatal wall.

• Intraoperative navigation for localization of the inner ear structures was shown to be feasible in few experimental studies. However, its applicability in the daily practice still has to be evaluated.
Summary points

• “Safe drilling zone” of the posterior meatal wall can estimated well based on the preoperative CT-scan

• Due to the reported promising results, further evaluation of the intraoperative navigation for localization of the inner ear structures should be performed in larger surgical series.