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Manipulation of lower cranial nerves and jugular bulb during in subtotal temporal bone resection for advanced squamous cell carcinoma of the external auditory canal: anatomical consideration and surgical strategies.

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Background and Objectives

Both lateral temporal bone resection (LTBR) and subtotal temporal bone resection (STBR) are standard methods of en bloc resection for squamous cell carcinoma of the external auditory canal (EACSCC). Though en bloc subtotal temporal bone resection is a highly challenging procedure, en bloc resection aiming for negative margins is considered the most reliable treatment strategy for advanced EACSCC.(Fig.1) Literature indicates that STBR resection carries a high perioperative risk. (Fig.2) This report retrospectively examines 5 cases of en bloc STBR performed at our department, considering the manipulating of the lower cranial nerves, especially glossopharyngeal nerve, and the jugular bulb from a microsurgical anatomical perspective.

Result 2

A three-dimensional analysis of the jugular foramen revealed a high jugular bulb in one case (Case 2). All five cases exhibited a groove-type glossopharyngeal meatus; no semicanal or canal types were observed.(Fig. 3) In all cases, the nerves were identified caudal to C1 and preserved as they were traced toward the skull base and jugular foramen. Despite all cases exhibiting a groove-type glossopharyngeal meatus, careful dissection from the underside of the temporal bone, with sharp cutting of the surrounding tissues, preserved the nerves, preventing traction injuries. Regarding the jugular bulb, venous wall separation from the jugular fossa was possible in all cases. (Video)

Video. The video illustrates the surgical procedures performed after the separation of the temporal bone has been completed.



Case1 Case2 Case3

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Temporo-occipital craniotomy

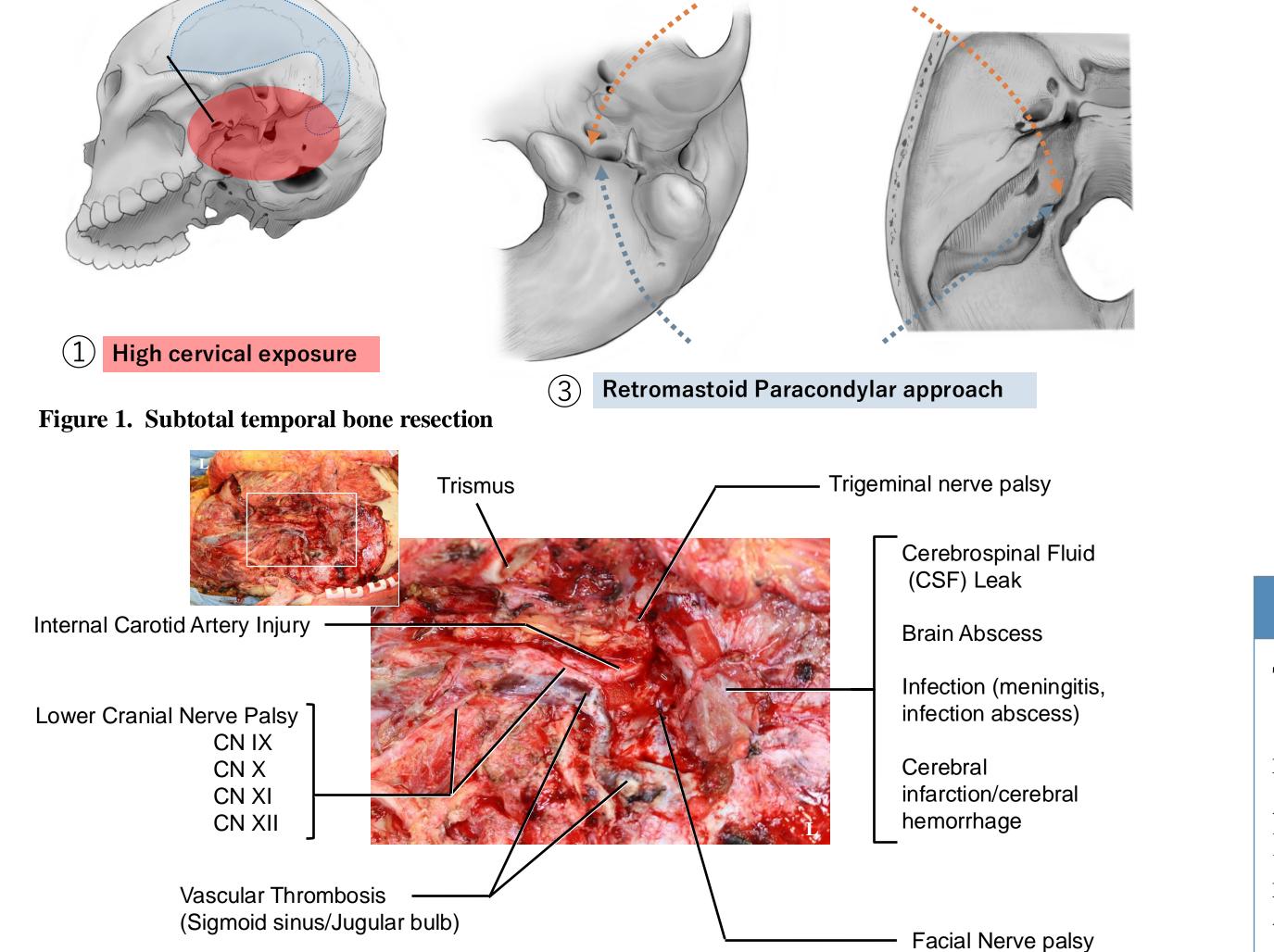


Figure 2. Complications of subtotal temporal bone resection. Surgical view on left side is shown.

Materials and Methods

Retrospective observational study. This study includes 5 cases of STBR performed at our department between August 2018 and December 2023. The clinical factors were examined from patient charts and surgical videos. The manipulation of the lower cranial nerves and the jugular bulb was reviewed from surgical videos. Three-dimensional reconstructions of preoperative CT were used to evaluate the presence of a high jugular bulb and classify the glossopharyngeal meatus.

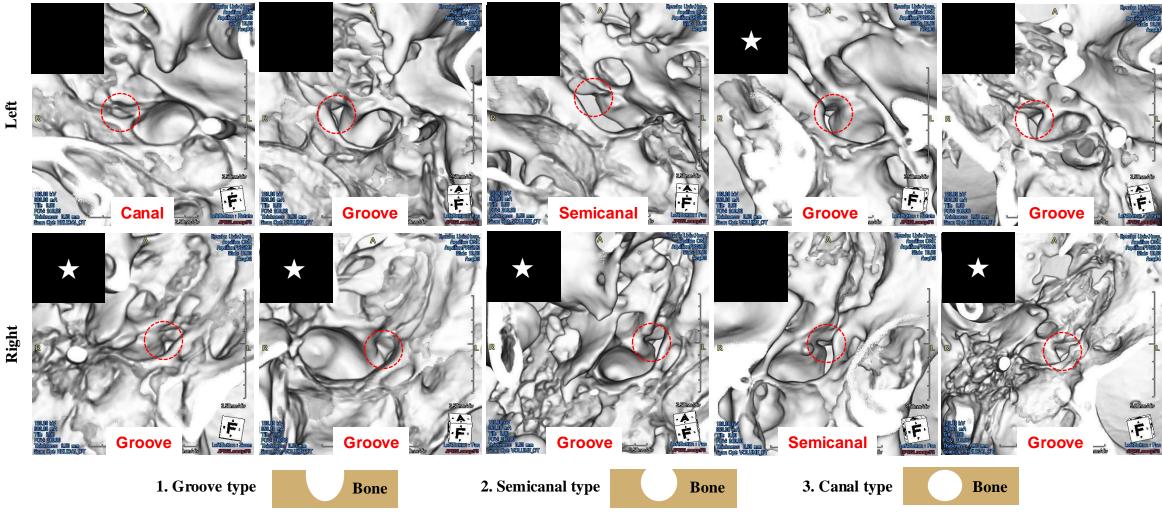


Figure 3. Glossopharyngeal meatuses in 5 cases. Bone canal formation was classified into three types. A Star indicates surgical side of each case. A red circle shows the glossopharyngeal meatus.

Discussion

The glossopharyngeal meatus has historically been referred to by various names, such as the triangular depression, cochlear groove, and glossopharyngeal recess.(Ref 2-5) which occasionally forms a canal-like structure. (Ref 3-6) Among the lower cranial nerves, the glossopharyngeal nerve travels most laterally just below the cranial base as it exits from the skull base to the cervical region. (Fig. 4) As demonstrated in the video (Video), we recommend carefully tracing and exposing the glossopharyngeal nerve from its peripheral portion in the neck to just beneath the cranial base when managing the soft tissues at the cranial base after temporal bone osteotomy. In the five cases we examined, none exhibited a tubular structure; however, for cases where the glossopharyngeal meatus formed a deep groove, careful dissection and separation of the nerve from the bony surface allowed us to prevent glossopharyngeal nerve injury effectively. Regarding the jugular bulb, venous wall separation from the jugular fossa can be safely performed.

Result 1

The series included three females and two males, with a median age of 66 (57-78). There were four cases on the right side and one on the left. One patient died from the current illness eight months postoperatively, while the remaining four survived without recurrence (follow-up period: 19-40 months). There were no instances of intraoperative lower cranial nerve injury. (Table 1) One case with severe intraoperative venous wall injury showed no postoperative blood flow but had no symptoms postoperatively. In the other case, asymptomatic transverse to sigmoid sinuses occlusion on the operative side was detected postoperatively. No postoperative glossopharyngeal or vagus nerve paralysis was observed in any case. (Table 1)

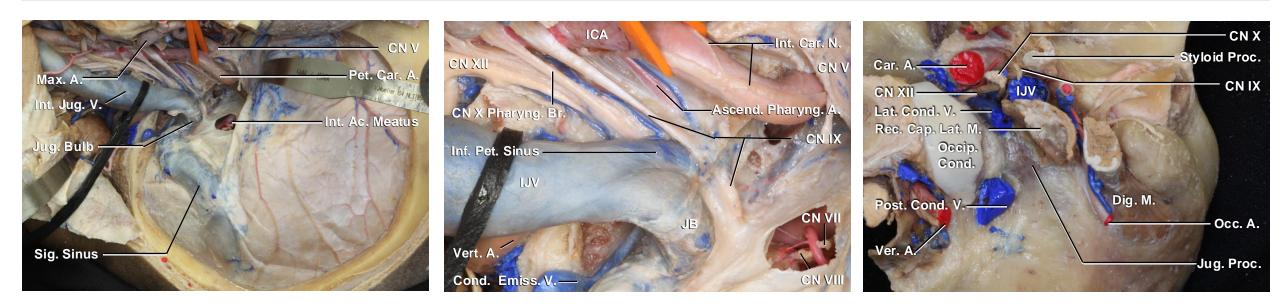


Figure 4. Microsurgical anatomy of lower cranial nerves. A. Lateral view. B. Enlarged view of A. C. Inferior view

Conclusion

In subtotal temporal bone resection, the glossopharyngeal nerve is considered the most vulnerable structure for paralysis when considering the anatomical course of the nerves. If the glossopharyngeal nerve is not adequately dissected from the temporal bone, forced traction of the resected temporal bone might increase the risk of avulsion injuries. During STBR, venous wall separation of jugular bulb from the jugular fossa can be safely performed.

Са		Sov	A	Side	cT/N/M	Primary tumor extent of disease	Fluid in Mastoid	Histology	Margin status	Reconstruction	Treatment	Follow-up		Lower cranial nerve damage			Postoperative	Postoperative	e Venous Flow
	Case	Sex	Age	Side								(N	/Ionth)	IX	X	XI	dysphagia	SS	JB
	1	F	57	R	4/0/0	Mast, ME,FC, GF, MC, SP, JP, Ossicles, PPS	+	w SCC	Positive	ALT	Surgery*	8	DOD		PIRLNP		—	Thrombosis	Thrombosis
	2	Μ	78	R	4/0/0	Mst, ME, GF, SP, PG, PM, MF, Ossicles	+	w SCC	Negative	ALT	Surgery*	40	NED			—	_	Patent	Patent
	3	F	70	R	4/1/0	Mast, ME, FC, GF, MF, JP, Ossicles	+	w-m SCC	Negative	ALT	IC→Surgery*	21	NED					Patent	Occluded
	4	F	62	L	3/0/0	Mast, ME, MF, Ossicles	+	w SCC	Negative	ALT	IC→Surgery	21	NED					Patent	Patent
	5	Μ	66	R	3/2b/0	Mast, ME, FC, GF, SP, PG,	+	w-m SCC	Negative	ALT	Surgery*	19	NED		_	During ND	_	Patent	Patent

 Table 1. Case profile od subtotal temporal bone resection

ME, middle ear; FC, facial(fallopian) canal, GF, glenoid fossa; Mast, mastoid cavity; MC, mandibular condyle; SP, styloid process, PG, parotid gland; PM, pterygoid muscle; MF, middle fossa; JP, jugular process; PPS, parapharyngeal space, PIRLNP, postintubation recurrent nerve palsy, ND, neck dissection, Asterisk indicates the addition of the postoperative chemoradiotherapy.



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