Imaging in Endoscopic Cranial Skull Base and Pituitary Surgery

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KEYWORDS

• Endoscopic skull base surgery • CT • MRI • Nasoseptal flap • Skull base

KEY POINTS

- The feasibility of endoscopic endonasal approaches, the potential surgical risk, and tumor resectability depend on critical anatomic structures in the surgical corridors that can be assessed by preoperative imaging studies.
- Computed tomography scan yields the best overall evaluation of the bony architecture of the skull base.
- MRI is the best imaging modality to evaluate the soft tissues and to demonstrate the location of a lesion and its relationship to adjacent neurovascular structures.
- Neoplastic recurrences typically occur at the interface of the flap recipient bed and reconstructive tissue and appear as new or growing infiltrative enhancing tissue similar to the resected tumor.

INTRODUCTION

Although traditional open techniques still play an important role in skull base surgery, they continue to carry significant perioperative risks and morbidity with prolonged recovery times, in part because they require some degree of brain retraction and

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Abbreviations	
ASB	Anterior skull base
CN	Cranial nerve
CSB	Central skull base
CSF	Cerebrospinal fluid
CT	Computed tomography
CTA	Computed tomography angiography
DWI	Diffusion-weighted imaging
EEA	Endoscopic endonasal approaches
ESBR	Endoscopic skull base reconstructions
FDG-PET	F18-fluorodeoxyglucose positron emission tomography
FLAIR	Fluid-attenuated inversion recovery
ICA	Internal carotid artery
IOF	Inferior orbital fissure
ITAC	Intestinal type adenocarcinomas
MRA	Magnetic resonance angiography
MRI	Magnetic resonance imaging
NPL	Nasopalatine line
NSF	Nasoseptal flap
PPF	Pterygopalatine fossa
SOF	Superior orbital fissure
STIR	Short-tau inversion recovery
T1WI	T1-weighted image
T2WI	T2-weighted image

neurovascular manipulation to access the skull base. In an attempt to address some of the shortcomings of open skull base surgery, less invasive endoscopic endonasal approaches (EEAs) to the skull base have been developed and have become increasingly accepted and widely adopted.[1]

In recent years, EEAs have become standard for the treatment of a variety of sinonasal and central skull base diseases. Important factors leading to the popularization of these techniques include an improved understanding of the anatomy of the skull base anatomy; imaging advances that allow easy acquisition and reconstruction of high-resolution, multiplanar images of the skull base; and the rapid development of imaging-based operative navigation systems. In modern practice, the preoperative radiographic evaluation is not only useful for diagnosis but is also invaluable for surgical mapping to ensure safe and optimal surgical outcomes.[2] These techniques were initially developed for paranasal sinus surgery, but their indications have been gradually extended to include endoscopic resection of pituitary tumors, as well as lesions of the clivus, olfactory cleft, planum sphenoidale, petrous apex, and infratemporal fossa. The EEA provides access to almost all regions of the skull base situated anterior to the foramen magnum.[3]

Principles of endoscopic endonasal skull base surgery involve selecting a surgical corridor with an optimal visual field, thus minimizing the need for neurovascular manipulation. If these preconditions are met, the outcomes after an EEA compare favorably with conventional techniques, while providing the advantages of a lack of external incisions or scars, decreased trauma to soft tissue and bone, less disturbance of craniofacial growth in pediatric patients, fewer complications, reduced risk of neurologic damage, improved postoperative quality of life, decreased lengths of hospital stays, and faster recovery times.[4]

A major criticism of endoscopic techniques is that they do not allow en bloc resection of tumors. However, the tumors are also often fragmented in the course of open surgery, and the most important aspect is not en bloc resection, but complete resection of the tumor margins. Tumors of the skull base often demonstrate exophytic growth into