

## Preface

This book was conceptualized to address the need for a pragmatic and complete overview of radiologic anatomy of the head and neck. Although some aspects of radiologic anatomy are described in extended handbooks of radiology, a step-by-step manual to aid recognition of the normal structures in the entire head and neck region has not been available before.

This book is an illustrated guide to radiologic anatomy of the head and neck as visualized on the most frequently used radiologic modalities, that is, conventional radiography, computed tomography (CT), and magnetic resonance imaging (MRI). Furthermore, radiologic features of the most commonly occurring and characteristic pathologies of the head and neck region are shown, with the aim of aiding recognition earlier in the diagnostic pathway. The differential diagnosis and possible points of interest are also discussed. For MRI, Chapter 1 provides an overview of the interpretation of findings.

For residents, knowledge of normal radiologic anatomy is a first step in recognizing pathology in this field, diagnosing diseases, and planning surgical procedures. For specialists, this book provides an opportunity to update their knowledge and refine their radiologic diagnostic skills in a time of rapidly progressing radiologic techniques.

Most radiologic books are mainly or exclusively written by radiologists. This guide has been designed from the perspective of the field of otorhinolaryngology and will be a vital diagnostic tool in clinical practice. It emphasizes the importance of the relation between clinical features and radiologic findings in the establishment of the correct diagnosis.

*Erwin A. Dunnebieer*

The author welcomes suggestions for improving the content of this book in future editions. If you have any comments, please send an email to [dunnebieer@zonnet.nl](mailto:dunnebieer@zonnet.nl).

## 3 Pathology of the Temporal Bone

### Pathology of the External Auditory Canal

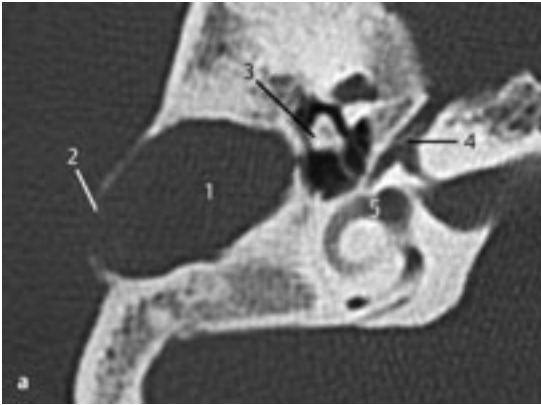
#### *Inclusion Cholesteatoma and Atresia of the External Auditory Canal*

#### Differential Diagnosis

- Any benign mass in the region of the external auditory canal, post-traumatic cholesteatoma of the external auditory canal, or cholesteatoma due to secondary stenosis of the external auditory canal as a result of chronic cicatrizing external otitis or bony stenosis due to fibrous dysplasia or exostosis in the lateral part of the external auditory canal.
- Aural atresia is often related to syndromes such as Treacher Collins, Crouzon, Nager, Goldenhar, Klippel–Feil, and Pierre Robin.

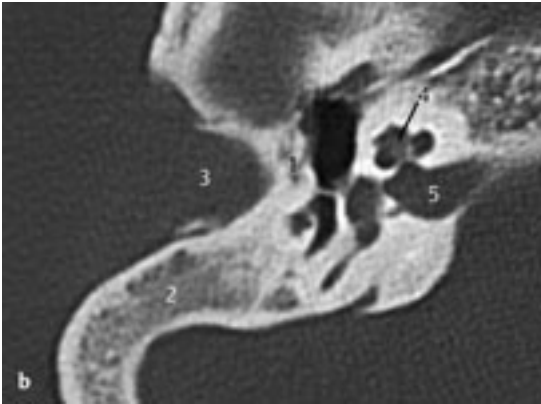
#### Points of Evaluation

- Expansion toward and/or destruction of the temporomandibular joint and toward the middle ear structures, abscess formation, and osteomyelitis and (intracranial) spread of infection.
- In case of aural atresia (first branchial groove anomaly), other dysmorphic features may be present too, especially in case of syndromal comorbidity.
- Particular attention needs to be paid to:
  - the appearance of the middle ear cavity and mastoid pneumatization
  - signs of ankylosis or malformation of the ossicular chain
  - presence of inner ear deformities, the round and oval windows and the vestibular aqueduct
  - aberrations in the anterior and/or lateral course of the facial nerve, which may complicate surgery.



**Fig. 3.1 a–c** Patient with Treacher Collins syndrome and purulent discharge from a pinpoint external auditory canal.

**a CT, axial.** Expanding, round, smooth-bordered lesion (1) in the cranial part of the mastoid with partial destruction of the cortex (2). The head of the malleus is possibly dysmorphic and ankylotic (3). Note the geniculate ganglion (4) with a clearly visible greater petrosal nerve canal anteriorly. The vestibule and horizontal semicircular canal (5) are normal.



**b CT, axial.** More caudally, osseous atresia of the external auditory canal is observed with osseous occlusion (1). The mastoid is not pneumatized (2). Lateral to the atresia is an expanding mass (3), suggestive of inclusion cholesteatoma, filling the meatus. The cochlea (4) and internal auditory canal (5) show normal features.

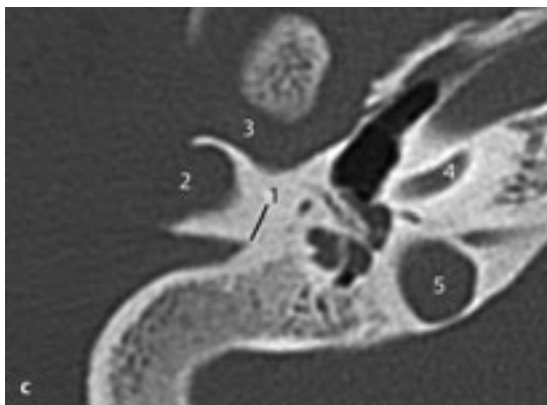


Fig. 3.1c

**c CT, axial.** On a lower slice, a narrowed and ending-obstructed meatus is observed (1), as well as an expansile mass (2) near the temporomandibular joint (3) without signs of destruction. The slice is taken at the level of the basal cochlear turn (4) and of the roof a high jugular bulb (5).

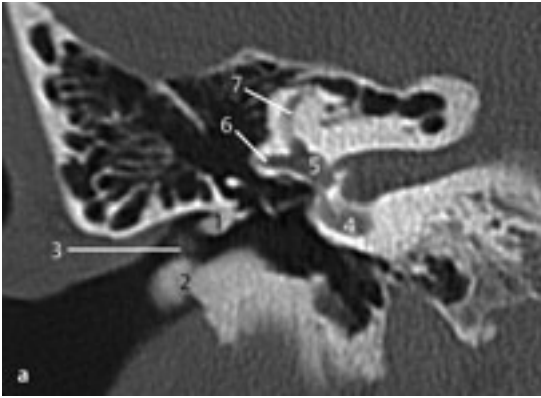
### ***Exostoses of the External Auditory Canal***

#### **Differential Diagnosis**

- Exostoses are frequently multiple and bilateral.
- An osteoma of the external auditory canal is most often unilateral, isolated, and round in shape.
- Fibrous dysplasia has a specific appearance on computed tomography (CT) and typically is not limited to the external auditory canal (see also “Fibrous Dysplasia” [1] and [2]).
- Clinically, exostoses can be easily differentiated from soft-tissue tumors by palpation.

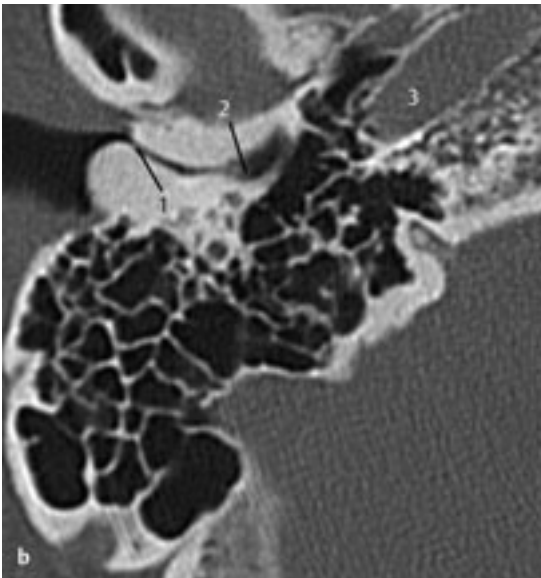
#### **Points of Evaluation**

- In patients with aural discharge, chronic otitis may be the result of infected epithelial stasis.
- In cases with a narrowed orifice and meatus, a meatoplasty might be considered for better aeration and cleaning options. Furthermore, CT might be reassuring, showing a normal aerated middle ear.



**a CT, axial.** Small exostoses are visualized in the roof of the external auditory canal near the annulus (1), and a larger one laterally on the floor of the meatus (2). Although some accumulation of cerumen (3) is present, hearing did not seem to be compromised, and there was no discharge. Also clearly seen are the basal cochlear turn (4), vestibule (5), and horizontal (6) and anterior (7) semicircular canals.

**Fig. 3.2a** Patient referred by his general practitioner because of abnormalities in the outer ear canal.



**Fig. 3.2b** Another patient with more extensive exostoses.

**b CT, axial.** Only a small lumen remains (1), with accumulation of cerumen or epithelium more medially (2) with a high risk of impaction and development of an inclusion cholesteatoma. Note the internal carotid artery (3), indicating the caudal orientation of this slice.

## 4 Radiologic Anatomy of the Skull Base

The skull base can be evaluated by computed tomography (CT), which will demonstrate the bony structures of the skull base with its foramina and fissures for vessels and cranial nerves, the temporal bone, and sinonasal cavities. Magnetic resonance imaging (MRI) will demonstrate the contents of the foramina and fissures as well as the intracranial soft tissues. CT or MRI may provide enough information individually to demonstrate and classify the pathology in this area, however, when used together these modalities can be complementary and define even better the invasion and destruction of (bony) structures of the skull base by soft-tissue masses.

### Radiologic Evaluation Points of the Skull Base

#### *Computed Tomography*

- Bony outline of the outer skull.
- Bony outline of the intracranial skull base.
- Temporal bone structures: internal auditory canal, vestibular and cochlear aqueduct, apex.
- Foramina: ovale, spinosum, jugular, rotundum.
- Large vessels: carotid artery, sigmoid sinus, jugular bulb.
- Supraorbital fissure and orbital structures.
- Infratemporal fossa, sphenoidal bone, clivus.
- Clinoid processes, sella and pituitary fossa.
- Features of the pathology: expanding or invasive growth pattern.

#### *Magnetic Resonance Imaging*

- Intracranial brain structures: cerebrum, cerebellum, pons and brainstem, ventricles, dural outlines.
- Vascular structures: transverse sinus, sigmoid sinus and jugular bulb, superior petrosal sinus, carotid artery, vertebrobasilar system, anterior and posterior inferior cerebellar arteries (AICA and PICA).
- Temporal bone: fluid contents (T2-weighted MR image) of inner ear structures and internal auditory canal, appearance of the cochlear, vestibular (inferior and superior), and facial nerves.

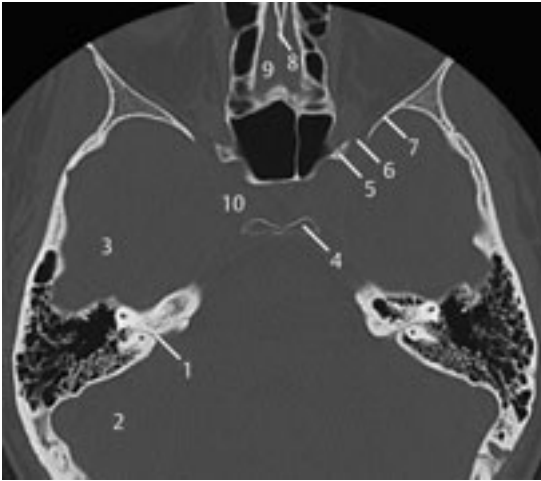
- Other cranial nerves: olfactory region, optic nerve, supraorbital fissure, abducens and trigeminal nerves, Meckel cave.
- Intensities on T1-weighted and T2-weighted MR images, with contrast, and possible asymmetry.

### Evaluation of the Skull Base on Axial CT Slices in a Craniocaudal Sequence



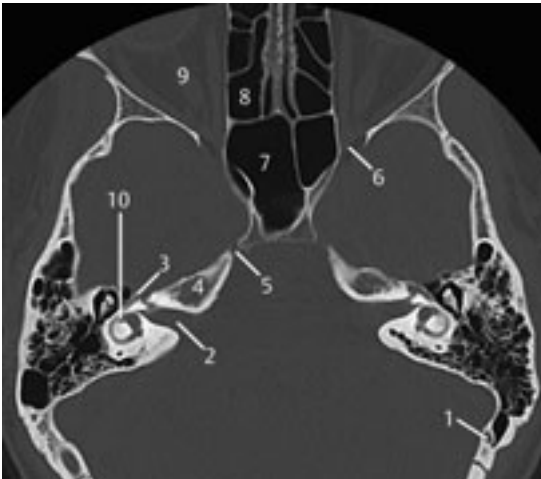
**Fig. 4.1** CT slice.

- 1 Temporal bone
- 2 Anterior semicircular canal
- 3 Posterior clinoid
- 4 Anterior clinoid
- 5 Dorsum sellae
- 6 Pituitary fossa
- 7 Tuberculum sellae
- 8 Fovea ethmoidalis (cranial nerve I in anterior cranial fossa)
- 9 Superior orbital fissure



**Fig. 4.2 Axial CT slice.**

- 1 Subarcuate canal and artery
- 2 Posterior cranial fossa
- 3 Middle cranial fossa
- 4 Posterior clinoid process
- 5 Anterior clinoid process
- 6 Superior orbital fissure (cranial nerves III, IV, VI, and a part of V)
- 7 Sphenoid bone
- 8 Crista galli
- 9 Fovea ethmoidalis
- 10 Region of the cavernous sinus and internal carotid artery



**Fig. 4.3 Axial CT slice.**

- 1 Emissary vein
- 2 Internal auditory canal (cranial nerves VII and VIII)
- 3 Geniculate ganglion
- 4 Petrous apex
- 5 Foramen for the ophthalmic nerve (part of the trigeminal nerve)
- 6 Superior orbital fissure
- 7 Sphenoid sinus
- 8 Ethmoid sinus
- 9 Optic nerve (cranial nerve II)
- 10 Horizontal semicircular canal and vestibule



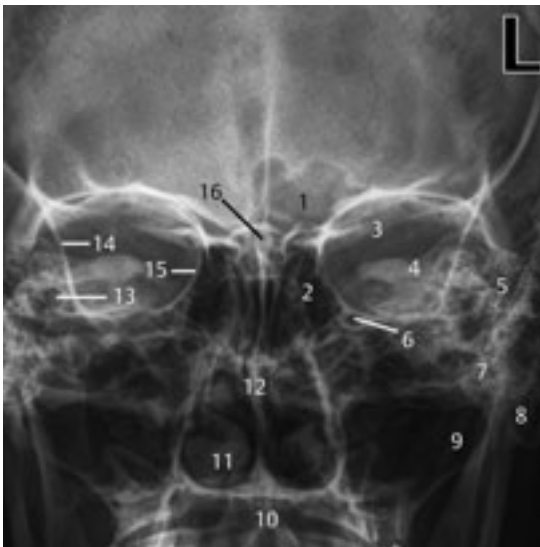
## 6 Radiologic Anatomy of the Nasal Cavity and Paranasal Sinuses

Conventional radiography (plain film) of the paranasal system and other parts of the skull is frequently used as a screening tool in the diagnosis of sinusitis, but has limited value for detailed evaluation due to superimposition of structures.

For more accurate preoperative evaluation and use during surgery, computed tomography (CT) is the preferred tool to visualize anatomic borders and to detect pathology in the paranasal system. Although CT does not always clearly differentiate between soft-tissue processes and secretions, it provides crucial information about disease localization and integrity of the osseous structures.

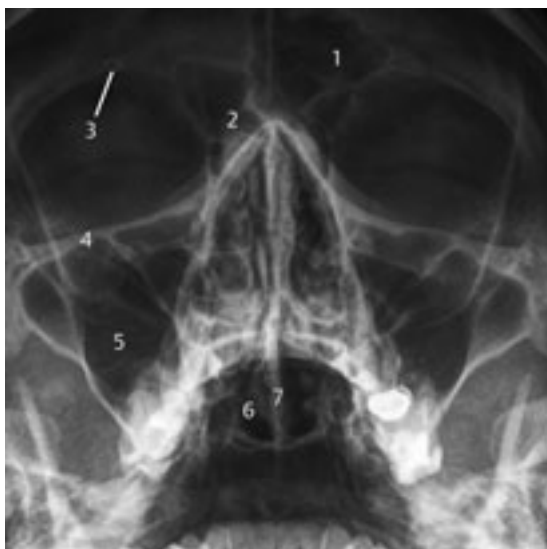
Magnetic resonance imaging (MRI) enables better discernment of the characteristics of soft-tissue disease and the relation to other anatomic structures, as well as spread to and invasion into these structures. Detailed information is provided about the intracranial compartments as well as the intraorbital structures. Examples of MRI are shown and discussed in Chapter 5.

In conventional radiography, the Caldwell view and Waters view are the most commonly used projections; these are complementary to each other.

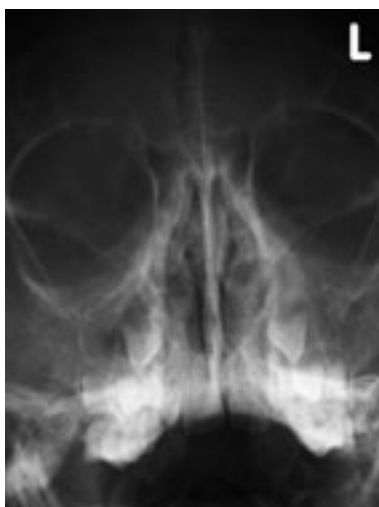


**Fig. 6.1 Caldwell view**

- 1 Left frontal sinus, right side aplasia
- 2 Ethmoid sinus
- 3 Planum sphenoidale
- 4 Superior aspect of the petrous bone
- 5 Pneumatized and aerated mastoid cells
- 6 Foramen rotundum (infraorbital canal)
- 7 Zygomatic arch (better seen on Waters view)
- 8 Mastoid apex
- 9 Maxillary sinus
- 10 Maxilla
- 11 Inferior turbinate
- 12 Nasal septum
- 13 Cochlea
- 14 Innominate line of the greater wing of the sphenoid
- 15 Lamina papyracea
- 16 Crista galli

**Fig. 6.2 Waters view**

- 1 Frontal sinus
- 2 Frontal recess
- 3 Supraorbital nerve canal
- 4 Orbital floor
- 5 Maxillary sinus
- 6 Sphenoid sinus
- 7 Intersphenoidal septum

**Fig. 6.3 Waters view.** Waters view of a 7-year-old child. The frontal sinuses are not yet pneumatized. In the region of the maxillary sinus, several unerupted teeth are present, which limit the surgical procedures that can be carried out in this area.

## Evaluation Points for CT of the Nasal Cavity and Paranasal Sinuses

Although most of the below-mentioned points of evaluation might also be evaluated on plain films, CT will demonstrate much more detail on bony outlines and contents. Systematic evaluation is best done in an anteroposterior sequence, starting with the coronal slices followed by a craniocaudal sequence of axial slices. In both sequences, the evaluation starts with the less complex slices. The paranasal sinuses as well as the remaining structures are systematically and bilaterally screened according to the points mentioned below. Although a clinical description will end up being longer, it is always worth looking at both sides in the evaluation, even in cases without pathology.

### *Frontal Sinus*

- Presence, extension, and degree of pneumatization, bony outlines.
- Contents: septal structures, aeration or opacification of the sinus.
- In case of opacification: characteristics such as calcifications.
- Frontal recess: patency and opacification.

### *Ethmoid Sinus*

- Degree of pneumatization, bony outlines.
- Opacification: diffuse, localization (anterior/posterior).
- Ethmoid roof: appearance, height, and left/right differences.
- Ethmoid bulla: morphology, degree of caudal extension.
- Lamina papyracea.

### *Infundibulum*

- Patency, morphology of the uncinate process.
- Obstruction by a caudally extended ethmoid bulla, opacities.

### *Maxillary Sinus*

- Degree of pneumatization, bony outlines, tooth elements, any fistulas from the maxilla.
- Morphology of the bony canal containing the infraorbital nerve.
- Presence of retention cysts and their relation to the natural ostium, degree of obstruction, opacifications and their characteristics.

# Index

## A

- abducens nerve
  - in Gradenigo syndrome 164
  - MRI 114
- aberrant carotid artery 43
- abscess
  - intracranial
    - from otologic focus 181
    - from sinonasal focus 182
  - MRI presentation 2, 7
  - neck 286
  - orbital 9, 239
    - from ethmoiditis 2
  - parapharyngeal 287
  - tonsillar 278–279
- acinic cell carcinoma, parotid 322–323
- acoustic canal/meatus *see* auditory meatus
- acoustic neuroma (vestibular schwannoma)
  - 124, 126, 128, 141
- adenoid cystic carcinoma 7, 319, 320–321
- adenoid hypertrophy 206
- adenoma
  - hypophyseal/pituitary 8, 117, 178
  - middle ear 47
  - pleomorphic *see* pleomorphic adenoma
  - submandibular gland 311
- Albright syndrome (polyostotic fibrous dysplasia) 59, 168, 170, 224–225
- amyloidosis, orbital 248
- aneurysm 116
  - MRI presentation 7
- angiofibroma, juvenile 8, 259–261
- anteroposterior sequences
  - conventional radiography of swallowing disorders 276–277
- CT
  - sinonasal region 191–195
  - skull base 101
- arachnoid cyst 7, 117, 132–133
  - differential diagnosis 132
  - schwannoma 128, 139
- arteriovenous malformation
  - cerebellopontine angle 116
  - dural, MRI presentation 7
- aspiration 324–325
- astrocytoma 116, 150–151
- atresia
  - choanal 230–231
  - external auditory canal 23, 24
- auditory (acoustic) meatus/canal
  - external
    - CT 14
    - pathology 23–31
  - internal 13
    - enlarged 78–79
    - schwannoma 124–125
- autoimmune disease, pachymeningitis in 154
- axial slices
  - CT
    - neck 265–270
    - sinonasal region 196–198
    - skull base 97–100
    - temporal bone 14–19
  - MRI, skull base 102–115

## B

- barium swallow 324–325
  - esophageal passage disorders 326–327
  - Zenker diverticulum 328, 329, 330, 331
- blow-out fracture of orbit 251
- bone
  - destruction
    - anterior skull base with meningioma 170–171
    - temporal bone 148–169
  - Paget disease of 168
  - radiation necrosis bone 64
- bone marrow, MRI characteristics 7
- branchial cleft cyst 7, 294–295, 332

## C

- calculus, submandibular gland (sialolith) 310
- Caldwell view 188
- frontal sinusitis 213
  - maxillary sinusitis 203, 204
  - osteoma 228
- cancer (malignancy)
- external ear 28, 30
  - laryngeal 6, 301
  - MRI presentation 7, 8, 9
  - oropharyngeal/tongue base 282
  - parotid gland 318–323
  - sinonasal 2, 7, 260–262
  - thyroid 294, 304
  - tonsillar 280–281
  - see also* metastasis
- carcinoma
- adenoid cystic 7, 319, 320–321
  - laryngeal, interventional radiology 6
  - nasopharyngeal 260–261
  - parotid gland 318, 319, 320–323
  - sinonasal 2, 260–261
  - MRI presentation 7
  - squamous cell, external meatus 30
  - tonsillar 280–281
- carotid body paraganglioma 292–293
- cavernous hemangioma 116
- MRI presentation 8
- cellulitis, orbital 9, 237–238
- cerebellopontine angle lesions 116–157
- differential diagnosis 116–120
- cerebral infarction, MRI presentation 7
- cerebral lymphoma, MRI presentation 8
- cerebrospinal fluid leakage 65
- see also* otorrhea; rhinorrhea
- chest cavity 324–337
- choanal atresia 230–231
- cholesteatoma 48–53, 136–138
- congenital 52–53
  - differential diagnosis 48, 50, 52, 136
  - endolymphatic sac tumor 52, 136
  - lymphangioma 162
  - pseudotumors of petrous apex 122
  - intracranial involvement 136–138
  - mastoid 48–53
  - middle ear 46
  - MRI presentation 7
  - parotid gland region 315
- cholesterol granuloma/cyst 7, 119
- differential diagnosis
    - lymphangioma 162
    - pseudotumor of petrous apex 122
- chondrosarcoma 7, 117
- chordoma 7, 117
- cochlea 13
- implant 90–94
  - malformations 72, 74
- cochlear (nerve) schwannoma 127
- computed tomography (CT)
- differentiating characteristics 2–6
  - neck 264, 265–273
  - sinonasal region 188, 190–202
  - evaluation points 190–191
  - skull base 96, 97–101
  - temporal bone 12, 13–20
- conductive hearing loss 32, 33, 35, 36, 38, 39, 41
- osteogenesis imperfecta 38, 40
  - Treacher Collins syndrome 57
- congenital cholesteatoma 52–53
- congenital malformations *see* malformations
- coronal CT slices
- neck 271–273
  - sinonasal region 191–195
  - temporal bone 19–22
- cranial base *see* skull base
- cranial fossa
- middle
    - intracranial haemorrhage due to approach via 184
    - MRI 102–115
    - posterior, MRI 102–115
- craniocaudal sequences
- CT
- neck 265–270
  - sinonasal region 196–198
  - skull base 97–100
  - MRI, skull base 102–115
- craniometaphyseal dysplasia 168
- cyst
- arachnoid *see* arachnoid cyst
  - branchial cleft 7, 294–295, 332
  - cholesterol *see* cholesterol granuloma
  - dermoid *see* dermoid
  - epidermoid *see* epidermoid cyst
  - retention 9, 207–209
  - Thornwaldt 235
  - thyroglossal duct 302–303, 332
- cystic carcinoma, adenoid 7, 319, 320–321

cystic degeneration, cerebellopontine angle  
 schwannoma 139–140  
 cystic fibrosis 218–219  
 cystic hygroma (hygroma colli)  
 8, 296–297  
 cysticercosis  
 arachnoid cyst vs 132  
 (epi)dermoid cyst vs 134

## D

deafness *see* hearing loss  
 decompression of orbit in Graves  
 disease 252–253  
 demyelination, MRI presentation 7  
 dermoid (cyst) 119, 134–135  
 differential diagnosis 134  
 lymphangioma 162  
 MRI presentation 7  
 developmental malformations  
*see* malformations  
 diffusion-weighted imaging 135  
 diverticulum, Zenker 328–331, 332  
 dura mater (pachymeninx)  
 arteriovenous malformation,  
 MRI presentation 7  
 inflammation (pachymeningitis)  
 116, 154  
 prolapse 65  
 sinonasal surgery-associated defect 185  
 dural sinus thrombosis 180

## E

ear, in intracranial abscess etiology 181  
*see also* inner ear; middle ear; outer ear  
*and entries under* ot-  
 eardrum (tympanic membrane),  
 glomus tumor 44, 160  
 effusion (serous) 7  
 electrode malposition, cochlea implant  
 93–94  
 embolization (technique) 6  
 juvenile angiofibroma 257, 259  
 empty cochlea 72  
 empty sella 179  
 encephalomeningocele  
*see* meningo(encephalo)cele

endolymphatic sac tumor 70–71, 119,  
 158–159  
 differential diagnosis 70, 158  
 cholesteatomas 52, 136  
 MRI presentation 7  
 endonasal sinonasal surgery, dural defect  
 after 185  
 ependymoma 118  
 epidermoid cyst 7, 117, 134–135  
 differential diagnosis 134  
 arachnoid cyst 132  
 cholesteatoma 136  
 pseudotumor of petrous apex 122  
 schwannoma 128  
 esophagus 324–337  
 esthesioneuroblastoma 176–177  
 MRI presentation 7  
 ethmoidal infundibulum 190  
 ethmoidal sinus, CT 190  
 ethmoiditis 2  
 exostoses, external auditory canal  
 25–26  
 external ear *see* outer ear

## F

facial nerve involvement/pathology  
 68–71  
 otitis externa 29  
 facial sensory deficits, trigeminal nerve  
 schwannoma 148  
 false/fausse route (via falsa), intracranial  
 haemorrhage due to 183  
 fenestration procedure 60–61  
 fibrous dysplasia 58–59, 88–89, 168–169,  
 224–227  
 differential diagnosis 168  
 exostoses 25  
 meningioma 58, 88, 170  
 monostotic 88, 226–227  
 MRI presentation 8  
 polyostotic (McCune–Albright syndrome)  
 59, 168, 170, 224–225  
 skull base 168–169, 170  
 fistula, labyrinthine 50, 60  
 fixation of ossicular chain 32–33  
 food, esophageal obstruction 327  
 foreign body, swallowed 326, 336–337  
 food 327

- fractures  
 nasal bone 207–209  
 orbital blow-out 251  
 skull  
 anterior 249–251  
 base 34, 54–55
- frontal recess mucocele 172–173
- frontal sinus  
 CT 190  
 in cystic fibrosis 218  
 mucocele 244, 245
- frontal sinusitis 213–215
- fungal sinusitis 220–221  
 invasive 240–241  
 MRI presentation 9  
 noninvasive 220–221
- G**
- Gardner Syndrome, osteoma 242
- geniculate ganglion, hemangioma 66–67
- glioblastoma, MRI presentation 8
- glomus tumor (paraganglioma)  
 carotid body 292–293  
 cerebellopontine angle 118  
 intravagal 292  
 jugular 160–161  
 jugulotympanic region 44, 160, 161  
 MRI presentation 9  
 tympanic membrane 44, 160
- glottic tumor 301
- goiter 294
- Gradenigo syndrome 164
- granulations, MRI presentation 8
- granuloma, cholesterol *see* cholesterol granuloma
- granulomatosis, Wegener 210, 218, 222–223, 247
- Graves disease, orbital decompression 252–253
- gusher phenomenon 41
- H**
- haemorrhage, intracranial, iatrogenic 183–184
- head and neck pathology, MRI  
 characteristics, *see also* neck 6–9
- head trauma  
 cochlear implant dysfunction after 90  
 skull base fracture 54–55
- hearing loss (deafness) 92  
 conductive *see* conductive hearing loss  
 sensorineural 124  
 sudden 82, 127, 146, 152, 155  
 unilateral 82, 146, 152  
 unexplained 70
- hemangioblastoma 8, 118, 159  
 cerebellopontine angle schwannoma (with cystic degeneration) vs 139
- hemangioma 66–67  
 cavernous *see* cavernous hemangioma  
 differential diagnosis 66, 122, 162  
 geniculate ganglion 66–67  
 MRI presentation 8
- hemangiopericytoma,  
 MRI presentation 8
- hematoma  
 cerebellopontine angle 120  
 MRI presentation 8
- high jugular bulb 25
- HIV lymphadenopathy 289
- hygroma colli (cystic hygroma)  
 8, 296–297
- hypophysis *see* pituitary gland
- I**
- iatrogenic intracranial damage 183–185
- immunosuppressed patients, fungal sinusitis 220
- infarction, cerebral, MRI presentation 7
- infections  
 pachymeningeal 154  
 radical cavity 62, 181  
 skull base 164–165  
*see also specific pathogens and infectious diseases*
- infrahyoid neck pathology 298–306
- infundibulum (ethmoidal) 190
- injury, head *see* fractures; trauma
- inner (internal) ear  
 CT 13  
 MRI, sagittal 115  
 pathology 72–94
- internal ear *see* inner ear
- interventional radiology 6

intracranial involvement and complications  
 180–185  
 cholesteatoma 136–138  
 otosyphilis 154–157  
 intravagal glomus tumor 292

## J

jugular glomus 160–161  
 jugulotympanic region, glomus tumor  
 44, 160, 161  
 juvenile angiofibroma 8, 259–261

## L

labyrinth  
 fistula involving 50, 60  
 hematoma, MRI presentation 8  
 ossification after meningitis 80–81  
*see also* labyrinthitis ossificans  
 labyrinthitis 119  
 MRI presentation 8  
 subclinical meningitis combined  
 with 152–153  
 labyrinthitis ossificans 8  
 lacrimal sac, dilated 234  
 laryngeal nerve, recurrent, paralysis 335  
 laryngocele 332–333  
 larynx  
 cancer 6, 301  
 trauma 306  
 lateral to medial sequences of sinonasal  
 region on CT 199–200  
 lipoma 8, 119  
 arachnoid cyst vs 132  
 (epi)dermoid cyst vs 134  
 parotid 314  
 luxation, ossicular chain 34–35  
 lymph node metastases, interventional  
 radiology 6  
 lymphadenitis  
 MRI presentation 8  
 neck (lymphadenitis colli) 288  
 lymphadenopathy, HIV 289  
 lymphangioma 162–163  
 cystic (hygroma colli) 8, 296–297  
 lymphoma (non-Hodgkin or unspeci-  
 fied) 290–291

cerebral, MRI presentation 8  
 neck 282, 284, 290–291, 298  
 skull base 118

## M

McCune–Albright syndrome (polyostotic  
 fibrous dysplasia) 59, 168, 170, 224–225  
 magnetic resonance imaging (MRI)  
 characteristics of head and neck  
 pathology 6–9  
 differentiating characteristics 2–6  
 neck 264  
 sinonasal region 188  
 skull base 96  
 temporal bone 12, 96  
 malformations and structural deficits  
 (congenital/developmental)  
 inner ear 72–73  
 and ossicular chain 74–75  
 mastoid 56–57  
 sinonasal region 230–236  
 malignancy *see* cancer  
 malignant otitis externa 28, 164  
 mastoid bone/process  
 CT in region of 13  
 pathology 48–65  
 mastoidectomy, intracranial  
 haemorrhage 183  
 mastoiditis, cochlear implant in 92  
 maxillary sinus 190  
 in cystic fibrosis 219  
 maxillary sinusitis 203–205  
 fungal 220  
 odontogenic 216  
 medulloblastoma 118  
 melanoma 119  
 meningioma  
 differential diagnosis 146  
 fibrous dysplasia 58, 88, 170  
 schwannoma 124, 128  
 MRI presentation 8  
 skull base/cerebellopontine angle  
 120, 146–147  
 bone destruction 170–171  
 meningitis  
 cochlear implant and history of 91  
 labyrinthine ossification after 80–81  
 lymphangioma presenting with 162



MRI presentation 8  
 subclinical, labyrinthitis combined  
 with 152–153  
 meningo(encephalo)cele 174–175  
 differential diagnosis 174  
 cholesteatoma 136  
 mucocele 172  
 metastasis  
 lymph node, interventional radiology 6  
 MRI presentation 9  
 skull base 118  
 middle ear  
 CT 13  
 pathology 23–47  
 mucocele 172–173, 244–246  
 differential diagnosis 172  
 schwannoma (with cystic  
 degeneration) of cerebellopontine  
 angle 139  
 frontal recess 172–173  
 MRI presentation 9  
 nasolacrimal 234  
 sublingual gland (= ranula) 312–313  
 mucoepidermoid carcinoma, parotid  
 319, 320  
 multiple synchronous malignancies,  
 neck 284–285  
 mumps 309  
 myxoma, paranasal 236

## N

nasal bone fracture 207–209  
 nasal cavity 187–262  
 pathology 203–262  
 radiologic anatomy 188–202  
 nasolacrimal mucocele 234  
 nasopharyngeal carcinoma 260–261  
 neck 263–337  
 pathology 278–377  
 infrahyoid 298–306  
 MRI characteristics 6–9  
 suprahyoid 278–297  
 radiologic anatomy 264–277  
 necrotizing (malignant) otitis externa  
 28, 164  
 neoplasms *see* tumors  
 neurinoma *see* schwannoma  
 neurofibromatosis II (NF II) 142–145  
 neurosarcoïdosis 9, 120  
 non-Hodgkin lymphoma *see* lymphoma  
 nose *see* nasal cavity

## O

obstruction  
 esophageal, after dinner 327  
 nasal  
 juvenile angiofibroma 257  
 polyps 210, 212  
*see also* atresia; stenosis  
 odontogenic sinusitis 216–217  
 olfactory bulb 202  
 orbit 237–253  
 abscess *see* abscess  
 cellulitis 9, 237–238  
 oropharyngeal tumour 282–283  
 osseous destruction *see* bone  
 ossicular chain  
 fixation 32–33  
 luxation 34–35  
 malformations of inner ear and 74–75  
 ossification of labyrinth *see* labyrinth;  
 labyrinthitis ossificans  
 osteogenesis imperfecta 40–41,  
 86–87, 92  
 cochlear implant 92  
 otosclerosis vs 38  
 osteoma, sinonasal 228–229, 242–243  
 osteomyelitis, MRI presentation 9  
 osteoradionecrosis 64  
 otitis externa, malignant/necrotizing  
 28, 164  
 otitis media, chronic 27, 136–138  
 cholesteatoma vs 46  
 purulent 136, 166  
 otorrhea, purulent 180  
 otosclerosis 38–39, 42, 84–85  
 fenestration procedure 60–61  
 retrofenestral 84–85  
 otosyphilis 82, 154–157  
 outer (external) ear  
 CT 13  
 pathology 23–32  
 oval (window) niche, otosclerosis 38

## P

- pachymeninx *see* dura mater  
 Paget disease 168  
 papillary thyroid carcinoma 294  
 papilloma  
   of paranasal sinuses, inverted 254–256  
   of skull base 118  
 paraganglioma *see* glomus tumor  
 paranasal sinuses *see* sinonasal region;  
   sinuses; sinusitis  
 parapharyngeal abscess 287  
 parotid gland  
   cholesteatoma near to 315  
   lipoma 314  
   pleomorphic adenoma 316–317, 318  
   Warthin tumor, MRI presentation 9  
 parotitis  
   acute bilateral 309  
   chronic, MRI presentation 9  
 petrous bone (incl. apex)  
   CT 13–14  
   inflammation (petrositis) 118, 166–167  
     cochlear implant in 92  
     MRI presentation 9  
   pseudotumors 120–122, 162  
 pharyngeal bursa (Thornwaldt cyst) 235  
 pharyngeal tumors 298–301  
 pharyngocele 332  
 pharyngoesophageal (Zenker) diverticu-  
   lum 328–331, 332  
 piriform aperture malformation 232–233  
 piston stapedectomy 36–37  
 pituitary gland (hypophysis) 178–179  
   adenoma 8, 117, 178  
 plain films (conventional radiography)  
   anterior skull fractures 250  
   dental bur 337  
   pneumothorax 334  
   recurrent laryngeal nerve compression  
   by heart 335  
   sinonasal region 188, 189, 204  
     adenoid hypertrophy 206  
     anterior skull fracture 250  
     frontal sinusitis 213  
     maxillary sinusitis 203, 204, 205  
     nasal bone fracture and retention  
     cysts 207  
     odontogenic sinusitis 216  
     osteoma 228  
     swallowed foreign bodies 336, 337  
     swallowing disorders 264, 274–277  
     temporal bone 12  
     Zenker diverticulum 331  
 pleomorphic adenoma  
   MRI presentation 9  
   parotid gland 316–317, 318  
   submandibular gland 311  
 pneumatization  
   frontal sinuses 213  
   turbinates 201  
 pneumothorax 334  
 polyostotic fibrous dysplasia (McCune–  
   Albright syndrome) 59, 168, 170,  
   224–225  
 polyp(s), nasal 210–212  
 polyposis, MRI presentation 9  
 preseptal orbital cellulitis 237  
 prolapse, dural 65  
 pseudotumors, petrous apex 120–122, 162  
 pterygopalatine fossa malignancy 262  
 pulse sequences, MRI 3

## R

- radiation necrosis of bone 64  
 radical cavity  
   infection 62, 181  
   modified 62–63  
 radiography, conventional *see* plain films  
 radiotherapy effects, cerebellopontine angle  
   schwannoma 141  
 ranula, sublingual gland 312–313  
 recurrent laryngeal nerve paralysis 335  
 retention cyst 9, 207–209  
 rhabdomyosarcoma, MRI presentation 9  
 rhinorrhea 210  
 rhinosinusitis, chronic 210

## S

- sagittal views  
   CT, sinonasal region 199–200  
   MRI  
     inner ear 115  
     skull overview 113  
 salivary glands 307–323  
 sarcoidosis 9, 120, 307

- schwannoma (neurinoma) 124–131, 139–141
- cerebellopontine angle 117, 124, 128–131, 139–141
- cystic degeneration 139–140
- radiotherapy effects 141
- cochlear 127
- facial nerve 68–69
- internal auditory canal 124–125
- MRI presentation 9
- trigeminal *see* trigeminal nerve
- vestibular 124, 126, 128, 141
- sella, empty 179
- sensorineural hearing loss 124
- serous effusion 7
- Shrapnell retraction pocket 48, 49, 52
- sialadenitis 307
- sialadenosis, MRI presentation 9
- sialolith, submandibular 310
- siderosis 120
- sinonasal region 187–262
- pathology 203–262
- carcinoma *see* carcinoma
- dural defect after endonasal surgery 185
- in intracranial abscess etiology 182
- radiologic anatomy 188–202
- sinuses, paranasal 187–262
- pathology 203–262
- radiologic anatomy 188–202
- normal variations 201–202
- see also* sinonasal region; sinusitis
- sinusitis 203–205, 213–217, 220–221, 240–241
- frontal 213–215
- fungal *see* fungal sinusitis
- maxillary *see* maxillary sinusitis
- MRI presentation 9
- odontogenic 216–217
- see also* rhinosinusitis
- Sjögren syndrome 9, 307
- skull
- anterior, fractures 249–251
- sagittal overview on MRI 113
- skull base 95–185
- pathology 116–185
- anterior skull base 170–179
- fractures 34, 54–55
- middle skull base 116–157
- radiologic anatomy 96–115
- sphenoid sinus 191
- squamous cell carcinoma, external meatus 30
- stapedectomy 36–37
- stapedial artery, persistent 42–43
- stenosis, external auditory canal 27
- Stenvers projection 12
- stone, submandibular gland (sialolith) 310
- sublingual gland ranula 312–313
- submandibular gland
- pleomorphic adenoma 311
- sialolith 310
- subperiosteal orbital abscess 239
- supraglottic tumors 298–301
- suprahyoid neck pathology 278–297
- surgery, iatrogenic complications 183–185
- swallowing
- disorders 264, 274–277, 324–325
- foreign body *see* foreign body
- see also* barium swallow
- synchronous malignancies, neck 284–285
- syphilis, otologic 82, 154–157
- T**
- temporal bone 12–94
- mastoid process *see* mastoid bone
- pathology 23–94
- osseous destruction 148–169
- petrous *see* petrous bone
- radiologic anatomy 12–22, 96
- teratoma 119
- thoracic cavity 324–337
- Thornwaldt cyst 235
- thrombophlebitis, MRI presentation 9
- thrombosis
- dural sinus 180
- MRI presentation 9
- thyroglossal duct cyst 302–303, 332
- thyroid gland
- cancer 294, 304
- hypertrophy 304–305
- tinnitus
- arachnoid cysts 132
- glomus jugulare tumor 160
- petrous apex pseudotumor 120
- tissue differentiation, CT vs MRI 2–3

tongue, tumour at base of 282–283  
 tonsillar abscess 278–279  
 tonsillar carcinoma 280–281  
 Tornwaldt (Thornwaldt) cyst 235  
 trauma  
   head *see* head trauma  
   iatrogenic intracranial 183–185  
   laryngeal 306  
   *see also* fractures  
 Treacher Collins syndrome 24, 56–57  
 trigeminal nerve  
   MRI 114  
   schwannoma/neurinoma 148–149  
     cerebellopontine angle schwannoma  
       vs 128  
 tuberculoma, MRI presentation 9  
 tumors  
   cerebellopontine angle/skull base  
     116–120, 124–131, 146–151, 176–177,  
     178  
   endolymphatic sac *see* endolymphatic sac  
   tumor  
     facial nerve 68–69  
     malignant *see* cancer  
     middle ear 47  
     MRI presentation 7, 8, 9  
     neck 280–285, 298–301  
     pharyngeal and supraglottic 298–301  
     salivary gland 9, 311, 316–323  
     salivary gland area 314  
     sinonasal 228–229, 236, 242–243,  
     245–262  
 turbinates, pneumatized 201  
 tympanic membrane, glomus tumor 44,  
 160

## V

vagal glomus tumor 292  
 vascular anatomy in skull base, MRI 96  
 vertigo, cholesteatoma-related labyrinthine  
   fistula 50  
 vestibular aqueduct enlargement 76–77  
 vestibular (nerve) schwannoma 124, 126,  
 128, 141  
 via falsa, intracranial haemorrhage due  
   to 183  
 Von Hippel–Lindau disease 70, 142, 158,  
 159

## W

Warthin tumor, MRI presentation 9  
 Waters view 189  
   maxillary sinusitis 203, 205  
 Wegener granulomatosis 210, 218, 222–  
 223, 247

## X

X-ray radiograph *see* plain films

## Z

Zenker diverticulum 328–331, 332  
 zygomatic arch fractures 249–250