2.1 Eyelid Weights

2.1.1 Discussion

Facial nerve deficits can lead to keratitis secondary to lagophthalmos and decreased lacrimal gland secretions. The weights are available in different sizes and shapes, including thin profile. Eyelid weights are usually implanted subcutaneously and secured to the tarsus in the upper eyelid, enabling eye closure (Fig. 2.1). Gold eyelid weights are considered MRI compatible. Over 90% of patients experience improved visual acuity after this procedure. Complications related to eyelid implantation include infection, allergic reaction, migration, and extrusion. Closure of the orbicularis over the implant reduces the risk of extrusion.
2.2 Palpebral Spring

2.2.1 Discussion

Palpebral springs are used to treat patients with lagophthalmos secondary to facial nerve palsy. The device is implanted via orbitotomy and consists of a palpebral branch and an orbital branch connected by a spring mechanism. The positioning and function of the device can be readily assessed on radiographs obtained in the open and closed lid positions, whereby the palpebral branch is expected to descend with lid closure (Fig. 2.2).

Fig. 2.1 Eyelid weight. The patient has a history of left cranial nerve VII palsy. Frontal (a) and lateral (b) radiographs show a left eyelid weight (arrows). Axial (c) and sagittal (d) CT images show a left upper eyelid weight (arrows), which produces extensive streak artifact.
Fig. 2.2 Eyelid spring. Open (a) and closed (b) lid frontal and open (c) and closed (d) lid lateral radiographs show the spring device to be well-seated and functional. The palpebral branch (arrows) is noted to descend with respect to the orbital branch (arrowheads) during lid closure. There are also stigmata of Paget’s disease in the skull. Axial CT images (e, f) in a different patient show the lower limb (arrow) of the spring properly positioned along the inner surface of the upper eyelid and the upper limb (arrowhead) implanted in the orbital roof.

2.3 Blepharoplasty

2.3.1 Discussion

Blepharoplasty is the surgical reconstruction of the eyelids and can be performed for a variety of indications, such as ptosis, thyroid orbitopathy, and facial cosmesis. Many techniques have been developed, such as sling blepharoplasty, in which sutures of grafts are used to suspend the eyelid to the frontal bone; augmentation blepharoplasty, in which the eyelid tissues are built up using implants or via tissue repositioning; and reduction blepharoplasty, in which excess tissue is...
removed. In addition, blepharoplasty can be performed as an approach for browpexy, or brow lift. Often, there is no appreciable imaging correlate. However, many implants used for blepharoplasty are visible radiographically, including some materials used for augmentation and sling blepharoplasty anchors (Figs. 2.3 and 2.4). General complications of blepharoplasty include eyelid malposition, strabismus, corneal abrasion and exposure, scarring, and persistent edema.

2.4 Orbital Wall Reconstruction and Augmentation

2.4.1 Discussion

Traditionally, autologous cartilage or bone, silicone sheet implants (Fig. 2.5), and metal plates or mesh (Fig. 2.6) have been used for orbital wall fracture repair. More recent implant technology, including porous polyethylene materials...
2.4 Orbital Wall Reconstruction and Augmentation

(Fig. 2.7), has resulted in improved biocompatibility. The porous structure enables rapid ingrowth of vascular structures, soft tissues, and bone. Furthermore, endoscopic transantral approaches are increasingly used in order to avoid eyelid incisions. Wedge implants can be used to augment orbital volume in patients with enophthalmos (Fig. 2.8). Transnasal wires can also be inserted to stabilize the medial canthus in trauma patients (Fig. 2.9). The role of imaging after orbital fracture repair is mainly to assess for complications. For example, some of the
older alloplastic allograft materials used for reconstruction may incite foreign body reaction. In addition, these materials can serve as a nidus for orbital infection (Fig. 2.10), undergo extrusion (Fig. 2.11), deform (Fig. 2.12), subside (Fig. 2.13), impinge upon the rectus muscles (Fig. 2.14), result in optic nerve compression (Fig. 2.15), or obstruct the lacrimal sac leading to dacryocystitis if malpositioned.
Fig. 2.10  Implant infection. Axial (a) and coronal (b) CT images show extensive inflammatory changes in the right pre- and postseptal orbit following recent medial and inferior orbital floor fracture repair with mesh (arrows).

Fig. 2.11  Implant extrusion. Coronal CT image shows medial displacement of the plastic orbital floor reconstruction plate into the right ethmoid sinuses (arrow).

Fig. 2.12  Mesh deformity. Coronal CT image shows an acute angulation deformity of the orbital floor mesh (arrow), which impinges slightly upon the inferior aspect on the posterior globe.
Fig. 2.13  Subsided mesh. The patient presented with enophthalmos after left inferior orbital wall repair with titanium mesh. Coronal (a) and sagittal (b) CT images show inferior displacement of the left orbital mesh (arrows).

Fig. 2.14  Rectus muscle impingement. Axial (a) and coronal (b) CT images show lateral angulation of the posterior left medial orbital wall titanium mesh, which impinges upon the medial rectus muscle (arrow).
Orbital decompression for dysthyroid orbitopathy serves to reduce proptosis and improve visual acuity and intraocular pressure. A variety of orbital decompression techniques can be implemented, such as resection of the medial, lateral, or inferior orbital walls or a combination of these (Fig. 2.16). The enlarged orbital fat and rectus muscles can bulge through these defects. A transnasal endoscopic approach is commonly implemented for inferior and medial wall decompression. As a result, resection of portion of the

**Fig. 2.15** Optic nerve impingement. Axial CT image shows a portion of the mesh used to repair the medial orbital wall fracture positioned far posteriorly and laterally towards the orbital apex where it impinges upon the optic nerve (arrow). The mesh was subsequently repositioned

**Fig. 2.16** Medial and lateral orbital wall decompression. Axial (a) and coronal (b) CT image shows surgical defects in the bilateral medial and inferior orbital walls and right lateral bony orbital wall (arrows). Note the enlarged rectus muscles
paranasal sinuses may also be observed on follow-up imaging. Serious complications related to orbital decompression occur in 3–5 % of cases depending on the particular technique and include diplopia and globe displacement, chronic sinusitis, cerebrospinal fluid leak (Fig. 2.17), meningitis, optic neuropathy, orbital cellulitis, hemorrhage, nasolacrimal duct obstruction, and inadequate proptosis reduction. In addition, excess herniation of orbital contents through the surgical defects can result in obstructed paranasal sinus secretions (Fig. 2.18).

Fig. 2.17  Cerebrospinal fluid leak complicating orbital decompression. The patient has a history of thyroid orbitopathy and marked proptosis. Right medial and lateral bony orbital decompression was attempted. During reduction of the superior lateral orbital wall, clear fluid was encountered and there was a suspicion for a rent in the dura, causing a CSF leak, confirmed by positive beta-2-transferrin. Postoperative axial (a) and sagittal (b) CT images demonstrate an osseous defect in the superior lateral orbital (arrow). There is also evidence of medial decompression with herniation of fat and a portion of the medial rectus (arrowhead). Subsequent MR cisternogram (c) shows a fluid collection in the superior right orbit (arrow) that extends beneath the temporalis muscle (arrowhead). The corresponding coronal post-contrast T1 MRI (d) shows enhancement of the intraorbital contents, overlying dura, and right frontal lobe (arrow)
2.6 Dacryocystorhinostomy and Nasolacrimal Duct Stents

2.6.1 Discussion

Dacryocystorhinostomy can be performed to relieve lacrimal obstruction. Both external and endonasal approaches can be used to remove bone in the region of the medial canthus in order to create a fistula between the nasolacrimal duct and the nasal cavity. Silicone tubes are sometimes temporarily inserted in the opened nasolacrimal ducts. Postoperative complications occur in about 6% of cases and most commonly includes restenosis. Patency of the dacryocystorhinostomy can be evaluated via a dacryocystogram (Fig. 2.19).

Nasolacrimal duct stents or Jones tubes and other lacrimal drainage bypass devices have been used to treat dacryostenosis and epiphora. These devices are usually composed of polyurethane or nitinol in the form of tubular structures with a “mushroom” that secures the stent at the orifice of the nasolacrimal duct or dacryocystorhinostomy (Fig. 2.20). Technical success rates are as high as 96%. These stents are composed of metal or plastic and are readily depicted on CT, which
can be used effectively to assess for complications, such as stent malposition or migration and inflammation of surrounding tissues, such as episcleritis. A peculiar complication of nasolacrimal duct stents is pneumorbit after sneezing, which can cause proptosis if a significant amount of air is forced through the stent (Fig. 2.21). Long-term patency is poor, as up to 65% of stents eventually become occluded by the presence of granulation tissue or mucoid debris. Dacryocystorhinostomy remains the preferred treatment for nasolacrimal duct obstruction when feasible.
2.7 Strabismus Surgery

2.7.1 Discussion

Strabismus secondary to cranial nerve palsy can be treated by rectus muscle transposition. Several techniques can be performed, including repositioning portions of the rectus muscle bellies onto the sclera, with or without tenotomy. Medial rectus recession is sometimes performed in conjunction with transposition (Fig. 2.22).

Changes related to rectus transposition can be appreciated on imaging, such as changes in size as morphology of the rectus muscles and signal

Fig. 2.22 Rectus transposition. Preoperative axial CT (a) and T2-weighted MR (b) images demonstrate right medial strabismus and right lateral rectus atrophy (arrow). Postoperative axial CT (e) and T2-weighted MR (d) images show interval normalization of the right globe alignment. The coronal CT (e) and T2-weighted MR (f) images show truncation of the lateral aspects of the right superior and inferior rectus muscles (arrows), which also display mildly increased signal. There is a lesion in the right cavernous sinus.
changes on MRI. Although improved ocular alignment can also be noted on imaging, this is readily assessed on clinical exam. Nevertheless, imaging can be useful for evaluating postoperative complications, such as rectus muscle rupture (Fig. 2.23), rectus muscle slippage (Fig. 2.24), and infection (Fig. 2.25).

**Fig. 2.23** Postoperative rectus muscle rupture. The patient presented with recurrent right lateral strabismus after bilateral partial medial rectus resection and advancement. The right medial rectus muscle was noted to be rather friable during the surgery. Axial T2 (a) and T1 (b) MR images show an abrupt caliber change and signal abnormality in the belly of the right medial rectus muscle (arrow). The distal portion of the right medial rectus is lax, and there is lateral rotation of the globe. Bilateral lens implants are also present.

**Fig. 2.24** Postoperative slipped medial rectus. Longitudinal B-scan shows a thick, irregularly shaped muscle belly (arrows) in the orbit posterior to the equator. Note the absent tendon insertion.
2.8 Glaucoma Surgery

2.8.1 Discussion

Glaucoma shunts and valves are surgically implanted devices that reduce intraocular pressure by decompression of aqueous humor. Several types of implants are commercially available, including the Ahmed, Baerveldt, Krupin, and Molteno. The Molteno and Baerveldt devices are non-valved devices (Figs. 2.26), while the Krupin and Ahmed devices include valves (Figs. 2.27). The basic design of a valved shunt consists of a tube drain, valve, and endplate (Fig. 2.28). The one-way valve closes below a certain intraocular pressure, thereby preventing hypotonia of the globe. Endplates with larger surface area have greater ability to dissipate the aqueous humor. The devices are usually implanted superotemporal to the globe, with endplate positioned against the scleral surface and the fine tube drain inserted into the anterior chamber. However, the valve can also function in the inferotemporal or superomedial quadrant and can drain into the paranasal

Fig. 2.25 Postoperative infection. The patient presented with cellulitis and swelling around the left eye after strabismus surgery. Axial (a) and coronal (b) CT images show a left periorbital rim-enhancing fluid collection (arrows).

Fig. 2.26 Baerveldt shunt. Axial (a) and coronal (b) CT images demonstrate the hyperdense device (arrows) positioned superolateral to the globe. Several Ahmed valves are also present within the bilateral orbits.
A fibrous capsule forms around the aqueous humor, eventually forming a so-called reservoir or bleb. The fluid is normally resorbed by the surrounding tissues, such that there is no significant accumulation. Glaucoma valve shunts often contain radiopaque barium impregnated silicone. Alternatively, these devices can be composed of polypropylene, which is of intermediate density on CT. Glaucoma valve implants are MRI compatible and appear as low signal on both T1- and T2-weighted sequences surrounded by a small amount of fluid in the reservoir. Complications include hypotonia, malposition, tube obstruction, and giant bleb formation (Fig. 2.30), secondary to adhesions between Tenon’s capsule and the episcleral space, obstruction (Fig. 2.31), infection (Figs. 2.32 and 2.33), and various types of choroidal detachment (Figs. 2.34, 2.35, and 2.36). Newer non-tube implants, such as the Express shunt, do not require iridotomy and result in less postoperative inflammation. The Express shunt is a non-valved stainless steel implant that is inserted under a scleral flap in a paralimbal site (Fig. 2.37).
**Fig. 2.29** Glaucoma valves drainage into maxillary sinus. Coronal CT image shows a radiopaque Ahmed valve positioned inferior to the left globe (arrow), where it drains into the maxillary sinus. There are also superolateral and superomedial radiolucent Ahmed valves (arrowheads).

**Fig. 2.30** Glaucoma blebs. Axial (a) and coronal (b) CT images show a large fluid collection (arrows) around the radiolucent inferolateral Ahmed valve. Axial T2 (c) and coronal T1 (d) MRI sequences show bilateral linear low-signal Ahmed valves surrounded by minimal fluid on the right (arrowheads) and a larger amount fluid on the left (arrows), which indents the globe. Transverse B-scan (e) shows Molteno® glaucoma filtering plate (arrow) and large surrounding fluid bleb (arrowheads).
**Fig. 2.30** (continued)

**Fig. 2.31** Obstructed Molteno® glaucoma valve. Transverse B-scan shows glaucoma filtering plate (*arrow*). Note the lack of surrounding fluid bleb

**Fig. 2.32** Endophthalmitis after glaucoma valve implantation. Longitudinal B-scan shows marked membrane formation and an inflammatory mass (*arrow*) adherent to the posterior fundus and optic disc

**Fig. 2.33** Orbital cellulitis after Ahmed valve implantation. Axial (a) and coronal (b) CT images show pre- and postseptal inflammatory changes surrounding the device in the left orbit

**Fig. 2.34** Serous ciliochoroidal detachments following glaucoma valve implantation. Transverse B-scan shows shallow and 360° anterior choroidal detachments (*arrows*)
Fig. 2.35  Kissing choroidal detachment following glaucoma valve implantation. Longitudinal B-scan shows choroidal detachments touching centrally (arrows).

Fig. 2.36  Hemorrhagic choroidal detachments following glaucoma valve implantation. Axial CT (a) shows a 360° choroidal hemorrhage within the left globe. A radiolucent Ahmed valve is present (arrow), and there is preseptal edema. Longitudinal B-scan (b) shows a choroidal detachment with very dense subchoroidal hemorrhage (*). A Molteno® glaucoma implant is present (arrows).

Fig. 2.37  Express glaucoma shunt. Axial (a) and coronal (b) CT images show a metallic-density material in the region of the anterior chamber of the left globe (arrow).
## 2.9 Scleral Buckles

### 2.9.1 Discussion

Scleral buckles or bands are circular devices positioned around the globe for treatment of retinal detachment. The buckles exert pressure to appose the layers of the retina together. These devices are composed of either hydrophilic hydrogel polymers or silicone, which in turn are available in the form of solid rubber bands or sponges, or a combination of these (Figs. 2.38, 2.39, and 2.40). On CT, silicone rubber bands are of high density, while the sponges are nearly air attenuation. On MRI, the silicone scleral buckles are of low signal intensity on both T1- and T2-weighted sequences. Mild circumferential indentation of the globe is an expected finding. In the past, small clips composed of tantalum were used to secure the free ends of the buckles (Fig. 2.41). The tantalum clips are MRI compatible. Scleral buckles should not be confused with calcifications, hemorrhage, or masses.

Complications related to scleral implantation occur between 1.3 and 24.4% of cases and mainly include infection, scleral invasion, and extrusion (Figs. 2.42, 2.43, 2.44, and 2.45). Although less stiff and prone to causing scleral erosion than silicone implants, hydrogel implants are permeable to water and therefore can gradually swell. On MRI, the fluid consistency of the hydrated implant is evident as high T2 signal and low T1 signal. There may be rim enhancement, as a fibrous capsule often forms around the scleral buckles. Dystrophic calcifications can appear as curvilinear or punctate densities along the edges of the implant. Thus, the imaging appearances of this process may mimic orbital mass or infection. However, available surgical history, the tubular configuration of the implant encircling the globe, and lack of restricted diffusion should lead to the proper diagnosis. Hydrated scleral buckles are friable and can be difficult to extract.

**Fig. 2.38** Solid silicone rubber band. Axial (a) and coronal (b) CT images show a high-density band (arrows) surrounding the right globe. The scleral band (arrows) is of very low signal intensity on MRI (c). There is expected indentation of the globe.
Fig. 2.39  Silicone sponge scleral buckle. Axial (a) and coronal (b) CT in another patient show a low-density scleral buckle surrounding the left globe (arrows). There is also silicone oil in the left globe.

Fig. 2.40  Combined silicone rubber band and sponge. Axial (a) and coronal (b) CT images show radiodense and radiolucent components of the left scleral buckle.

Fig. 2.41  Scleral buckle with tantalum clip. Axial (a) and coronal (b) CT images show a small metallic clip (arrows) adjacent to the globe.
Fig. 2.42 Hydrogel scleral buckle hydration and expansion. Axial CT image (a) shows circumferential enlargement of the right hydrogel scleral buckle (arrows), which has fluid attenuation. There are also partial rim calcifications. Axial T2 (b) and axial T1 (c) MRI sequences show that the enlarged right scleral buckle contains fluid signal (arrows). ADC map (d) shows no significant restricted diffusion within the device compared to brain parenchyma (arrows).

Fig. 2.43 Hydrogel scleral buckle hydration, fragmentation, and migration. Axial (a) and sagittal (b) CT images show that the unraveled, hydrated, and partially calcified scleral buckle (arrows) has migrated into the superotemporal quadrant of the left orbit, where it indents the orbit.
Keratoprostheses are artificial corneal substitution devices. These devices can be either completely synthetic, such as the Boston KPro, or completely biological tissue-engineered artificial cornea. Furthermore, osteo-odonto keratoprostheses combine a synthetic optic with a biological haptic. The Boston KPro consists of a muffin-shaped front plate, a back plate, and a titanium ring. The metallic and plastic components of keratoprostheses can be identified on CT (Fig. 2.46). Complications related to keratoprostheses include retroprosthetic membranes and glaucoma progression in about 25% of cases each.
2.11 Intraocular Lens Implants

2.11.1 Discussion

Cataracts are common causes of vision loss and can be treated via cataract extraction and intraocular lens replacement when symptomatic. Intraocular lens implants consist of two main components: the optic and two haptics. These lens implants can be composed of polymethylmethacrylate, silicone, hydrogel, polyethylene, polypropylene, or a combination of these. The lens implants can be positioned posterior or anterior with respect to the plane of the iris. Unlike native lenses, lens prostheses are very thin structures in profile, as seen on an axial image. The optic appears as radiodense on CT and is of low signal intensity on both T1- and T2-weighted MRI sequences (Fig. 2.47). The haptic portions are not readily visible at 1.5T or on thin-section CT. Intraocular lens prostheses do not normally enhance. Silicone bands are sometimes also implanted during lens replacement surgery, which appear as hyperdense structures adjacent to the lens on CT.

Complications of intraocular lens implants include retained lens fragments, displacement, dislocation, and less commonly dystrophic calcifications (Figs. 2.48, 2.49, 2.50, 2.51, 2.52, and 2.53). Implant displacement/dislocation can result from inadequate capsular or zonular support or following traumatic injury. This complication is usually apparent on clinical exam or ophthalmic ultrasound, but can be incidentally encountered on CT or MRI. Dystrophic calcifications may form on the surface of lens prostheses and can impair vision. When extensive calcifications form, these can be visible on CT. This complication does not necessarily indicate an underlying disturbance in calcium metabolism and may be attributable to phosphorus containing solutions used intraoperatively.

Fig. 2.46 Keratoprosthesis. Axial (a) and sagittal (b) CT images show a Boston Keratoprosthesis (KPro) device in the right cornea, which consists of an intermediate-density front plate and metallic-density ring (arrows)
2.11 Intraocular Lens Implants

**Fig. 2.47** Posterior chamber intraocular lens (IOL) following cataract surgery. Axial CT (a) and T2 MR (b) images show a posterior chamber left prosthetic lens implant (arrow) and a native lens on the right (arrowhead). Radial ultrasound biomicroscopy (UBM) scan in a different patient (c) shows normal position of the haptic (in the capsular bag) and the optic (center of the pupil). An incidental cyst of the iris pigment epithelium is noted. Illustration of an intraocular lens implant showing the optic and two haptics (d).

**Fig. 2.48** Retained lens fragments. Transverse B-scan shows mild vitreous opacities with several highly reflective, retained lens fragments (arrows) and a posterior vitreous detachment (arrowheads).

**Fig. 2.49** Displaced intraocular lens implant. Radial ultrasound biomicroscopy (UBM) scan shows the haptic of the posterior chamber lens implant (arrow) embedded in the peripheral iris.
Fig. 2.50 Displaced intraocular lens implant. Radial ultrasound biomicroscopy (UBM) scan shows the haptic portion of the posterior chamber intraocular lens implant (arrow) floating in the anterior vitreous space.

Fig. 2.51 Intraocular lens implant dislocation. Axial CT (a) and T2 MR (b) images show the left lens implant positioned in the center of the globe (arrow).
Fig. 2.52 Dislocated intraocular lens implant. Longitudinal B-scan shows the implant (arrow) adherent to the retina. Note the mild vitreous opacities consistent with vitreous hemorrhage (*) and shadowing of the orbital structures (arrowheads).

Fig. 2.53 Intraocular lens implant dystrophic calcification. Axial CT image shows irregular clumps of calcifications deposited on the surface of the left lens implant (arrow). The native lens is present in the right globe.
2.12 Lensectomy

2.12.1 Discussion

Lensectomy consists of resection of the crystalline lens through a transscleral retrociliary incision. At least a portion of the vitreous gel is also removed. The procedure is mainly performed for treatment of pediatric cataracts. On imaging, there is no apparent separation between the anterior chamber and the rest of the globe (Fig. 2.54).

Fig. 2.54 Lensectomy. Axial CT (a) and axial T2 MRI (b) show absence of the left lens.
2.13 Pneumatic Retinopexy

2.13.1 Discussion

Intraocular gas injection is a technique used to tamponade the retina during retinal detachment surgery until chorioretinal adhesions form (pneumatic retinopexy). The procedure is effective for treating retinal detachment in up to 80% of cases. Intraocular gas injection can also be used to restore intraocular volume during scleral banding. A variety of gases can be used, including air, hexafluoride, and perfluoropropane. On CT, air lucency is present antidependently in the vitreous body, creating an air-fluid level (Fig. 2.55). Complications of intraocular air injection include secondary glaucoma, subretinal gas or anterior chamber migration (Fig. 2.56), vitreous hemorrhage, new retinal breaks, endophthalmitis, proliferative vitreoretinopathy, and delayed reabsorption of subretinal fluid.

Fig. 2.55 Pneumatic retinopexy. Axial CT image demonstrates intravitreal gas (arrow).

Fig. 2.56 Axial CT image shows gas within the right anterior chamber following fluid-air exchange (arrow). A scleral band is also present.
2.14 Intraocular Silicone Injection

2.14.1 Discussion

Intraocular gas injection is a technique used to tamponade the retina during retinal detachment surgery until chorioretinal adhesions form (pneumatic retinopexy). CT and MR are the imaging modalities of choice to evaluate ocular anatomy following silicone oil tamponade (Fig. 2.57). On CT, silicone oil is hyperdense and globular, measuring up to 120 HU. The hyperdense material can sometimes be confused with blood, but retinal hemorrhage typically layers dependently and is not as dense as the silicone oil. On MRI, silicone oil tends to be hyperintense to water on T1 and hypointense to water on T2, again sometimes mimicking hemorrhage. Chemical shift artifact at the interface between the silicone oil and vitreous can be used to distinguish the two entities. Fat saturation pulses can also cause some degree of signal suppression, also differentiating it from hemorrhage. The silicone oil used for tamponade is usually removed after 8 weeks, but may remain permanently, depending on the risk of recurrent detachment. Complications of silicone oil instillation include choroidal detachment, scarring, cataracts, and optic nerve atrophy. In very rare instances, intracranial migration of silicone oil can occur via the optic nerve and into the ventricular system.

![Fig. 2.57 Intraocular silicone injection. Axial CT image (a) shows globular high-attenuation material in the posterior chamber of the left globe. T1-weighted MRI (b) shows that the intraocular silicone is isointense to muscle and hyperintense to fluid, while the T2-weighted MRI (c) shows that the intraocular silicone is hypointense. Chemical shift artifact is present at the interface between the silicone and the vitreous (arrows).](image-url)
2.15 Enucleation, Evisceration, and Globe Prostheses

2.15.1 Discussion

Evisceration consists of removing the globe contents while preserving the sclera and extraocular muscles, while enucleation consists removing the globe entirely along with the anterior portion of the optic nerve. These procedures are mainly performed for intraocular malignancies and irreparable globe rupture. Following enucleation, globe implants are often used to provide orbital volume and cosmetic effect. Although a wide variety of globe implant designs are available, the typical globe implant has two components: a deep spherical orbital implant, which can be placed within the remaining scleral, and an anterior scleral cover shell prosthesis, somewhat analogous to a large contact lens in terms of shape and location. In the past, a wide variety of metallic implants were used in globe prostheses (Fig. 2.58). Currently, hydroxyapatite, solid silicone, and Medpor prostheses are most commonly used. These prostheses have distinct features on imaging (Figs. 2.59, 2.60, and 2.61). Diffuse linear enhancement surrounding the implant components is frequently present on MRI and is of no clinical significance. Occasionally, the scleral cover shell prosthesis is used alone if orbital volume is adequate (Fig. 2.62). In patients who underwent enucleation for neoplasm, tantalum rings are sometimes implanted into the orbit for guiding additional stereotactic radiotherapy (Fig. 2.63). Complications are uncommon, but include rotation (Fig. 2.63), infection, inflammation, and exposure, even many years after implantation. (Figs. 2.64 and 2.65). Imaging is complimentary to physical examination for evaluating some of these complications.

![Fig. 2.58 Metallic globe prosthesis. Axial CT images (a, b) show two varieties of metal ring implants](image-url)
**Fig. 2.59** Hydroxyapatite prosthesis. Axial CT image shows a hyperdense left globe implant with a characteristic cobblestone pattern.

**Fig. 2.60** Silicone prosthesis. Axial CT image (a) shows a homogeneously hyperdense implant in the left orbit. Axial pre- (b) and post-contrast (c) T1 MR images in a different patient show diffuse linear enhancement surrounding the right globe implant components, which likely represents scar tissue.
Fig. 2.61 Medpor prosthesis. Axial CT image (a) shows that the left globe prosthesis has a density between that of fluid and fat. Axial T2 (b), T1 (c), and post-contrast T1 (d) MR images in a different patient show that the left globe implant has relatively low T1 and T2 signal, but enhances due to fibrovascular ingrowth.

Fig. 2.62 Scleral cover shell prosthesis. Axial CT image shows a right scleral cover shell prosthesis used without orbital augmentation following enucleation.
Fig. 2.63 Tantalum rings. Axial (a) and coronal (b) CT images show three metal density markers (arrows) in the left orbit adjacent to a globe prosthesis.

Fig. 2.64 Globe implant rotation. Axial CT image (a) shows a gap between the rectus muscles and the implant, which is rotated 90°, such that the metal mesh (arrow) is oriented medially, compared with the normal configuration of the implant in a different patient (b).

Fig. 2.65 Globe implant exposure. The patient had a history of enucleation approximately 40 years prior to presentation with discomfort and discharge from the left orbit. Physical examination revealed an extruding orbital implant, but no evidence of infection. Axial (a) and sagittal (b) CT images show infiltration of the left orbital fat and soft tissue surrounding the prosthesis, which proved to be granulation and scar tissue at subsequent surgery. The inferior portion of the implant is angled anteriorly, and the scleral cover shell prosthesis is absent.
2.16 Orbital Tissue Expanders

2.16.1 Discussion

Orbital tissue expanders are temporarily implanted devices used for enlarging the orbital cavity in patients with congenital anophthalmia and microophthalmia and can obviate more extensive surgery. The main types of orbital expanders include hydrophilic osmotic hydrogel devices or inflatable saline globes. The volume of the expanders can be evaluated via CT or MRI. Hydrogel expanders appear as either spherical or hemispherical structures with nearly fluid density on CT and low T1, high T2 MRI signal intensity, and do not enhance (Fig. 2.66). Saline expanders appear as spherical fluid-density structures on CT adjacent to the metal-density T-plate. The saline expanders have similar imaging characteristics as the aqueous on CT and MRI and are attached to metallic T-plate.

Fig. 2.66 Hemispheric hydrogel expander. Axial T2 (a), T1 (b), and post-contrast T1 (c) MR images show bilateral orbital implants with similar signal characteristics as fluid and no internal enhancement (arrows)
2.17 Orbital Exenteration

2.17.1 Discussion

Orbital exenteration is performed for treatment of primary orbital malignancies and periorbital malignancies that invade the orbit. Several types of orbital exenteration procedures can be performed with various degrees of dissection, ranging from extended enucleation, subtotal exenteration with sparing of the eyelid, total exenteration with removal of the eyelid in addition to orbital contents, and radical exenteration with removal of structures surrounding the orbit, such as paranasal sinuses and skull base (Figs. 2.67, 2.68, 2.69, and 2.70). The socket created by more extensive exenteration procedures can either heal by granulation or lined with skin graft or tissue.

Fig. 2.67 Orbital exenteration and facial implant. The patient had a remote history of retinoblastoma treated with orbital exenteration and radiation. Axial CT image shows resection of the left orbit and reconstruction via silicone implant (arrow), which has rim calcifications.

Fig. 2.68 Orbital exenteration with maxillectomy and flap reconstruction. The patient has a history of stage IV recurrent post-chemoradiated skull-base squamous cell carcinoma of the frontal, ethmoid, maxillary, and sphenoid sinus, status post-radical exenteration with myocutaneous flap reconstruction. Axial CT image (a) shows the normal-appearing muscle (M) and fat (F) components of the myocutaneous thigh flap within the left orbit and maxillectomy defect. The vascular supply to the graft is derived from the left facial artery and vein. There is also evidence of left maxillectomy. Sagittal (b) T1, axial T2 (c), and fat-suppressed coronal contrast-enhanced T1-weighted (d) MRI sequences show the high-signal T1-weighted subcutaneous fat (F) portion of the graft, which loses signal with fat suppression. There is normal enhancement of the muscle component of the graft (M), which suggests viability.
flap. An orbital implant can be used in patients with cavities lined by granulation tissue or skin grafts. Complications occur in up to 25% of exenterations and include fistulae, tissue necrosis and dehiscence (Fig. 2.71), exposed bone, infection, and tumor recurrence (Fig. 2.72).

Fig. 2.69 Radical orbital exenteration. The patient has a history of squamous cell carcinoma involving the left orbit, status post-radical orbital exenteration. Recent postoperative axial CT image (a) shows left radical orbital exenteration with bone flap reconstruction of the orbital floor and surgical packing (P). Coronal CT (b) and postcontrast T1 MRI (c) show bifrontal craniotomies, an air-filled left orbit that communicates with the nasal cavity (*), and a denuded orbital roof (arrows), which was allowed to heal via granulation.
Fig. 2.70 Orbital exenteration with orbital prosthesis. The patient has a history of left ocular melanoma with episcleral involvement. Axial (a) and coronal (b) contrast-enhanced T1 MR images demonstrate left orbital exenteration and reconstruction using an orbital implant inserted into the lateral orbital rim.

Fig. 2.71 Graft necrosis and dehiscence. Axial CT image shows right orbital exenteration. Sheets of gas (arrows) dissect through the residual myocutaneous flap.

Fig. 2.72 Tumor recurrence. The patient has a history of exenteration of the left orbit for squamous cell carcinoma. Axial (a) and coronal (b) CT images show a nodular lesion in the medial aspect of the left orbit (arrows). There is suggestion of central necrosis within the lesion.
Further Reading

Eyelid Weights


Palpebral Spring


Blepharoplasty


Orbital Decompression for Dysthyroid Orbitopathy


Dacryocystorhinostomy and Nasolacrimal Duct Stents


Strabismus Surgery


### Glaucoma Surgery


### Scleral Buckles


### Keratoprostheses


### Intraocular Lens Implants


### Lensectomy


Pneumatic Retinopexy


Intraocular Silicone Injection


Enucleation, Evisceration, and Globe Prostheses


Orbital Tissue Expanders


Orbital Exenteration


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