Case Reviews in Head and Neck Vascular Lesion Management

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KEYWORDS

• Vascular lesions • Venous malformation • Cavernous hemangioma • Vascular malformation
• Bleomycin • Propranolol • Sirolimus • Beta-blocker

KEY POINTS

- Most vascular relations at some stage require surgical intervention status post-medical or interventional radiological therapy.
- Surgery has its challenges considering the location and access to most head and neck lesions.
- "Nidus" management by complete excision is the key to a high vascular lesion. The terminal feeders need to be occluded with litigation or deposition of any embolic material.
- Most of the tongue lesions present as low-flow lesions of a veno-lymphatic type and are rarely high-flow.
- Pericapsular dissection of a low-flow lesion is planned well with intralesional thrombotic agent injections and other interventional radiological techniques.

INTRODUCTION

This is a series of 6 cases representing the different management approaches to vascular lesions. The head and neck surgical subsites have been well represented with low flow and high flow and some distinct case theories that contribute to the presentation of the vascular lesion workup, approaches, and outcomes.[1–14]

Case 1

Low-flow vascular malformation of tongue

Presentation A 59-year-old man presented with an enormous swelling of the tongue for 25 years. The swelling had started causing difficulty in swallowing and speech. He reported occasional episodes of bleeding which were controlled with local measures (Fig. 1A–D).

Investigation MRI confirmed isolated involvement of tongue to determine the posterior extent of the lesion with little extension. Doppler and MRI confirmed low-flow vascular lesion.

Treatment The patient underwent anterior glossectomy with wide excision after collapsing the lesion with bilateral Satinsky vascular clamps applied on the tongue (see Fig. 1B) to compress the lesion thus aiding in limiting blood loss during surgery. Local oversewing and debulking of the lesion were carried out with monopolar cautery and usage of atraumatic resorbable sutures. He was on nasogastric feeds until swallowing, and

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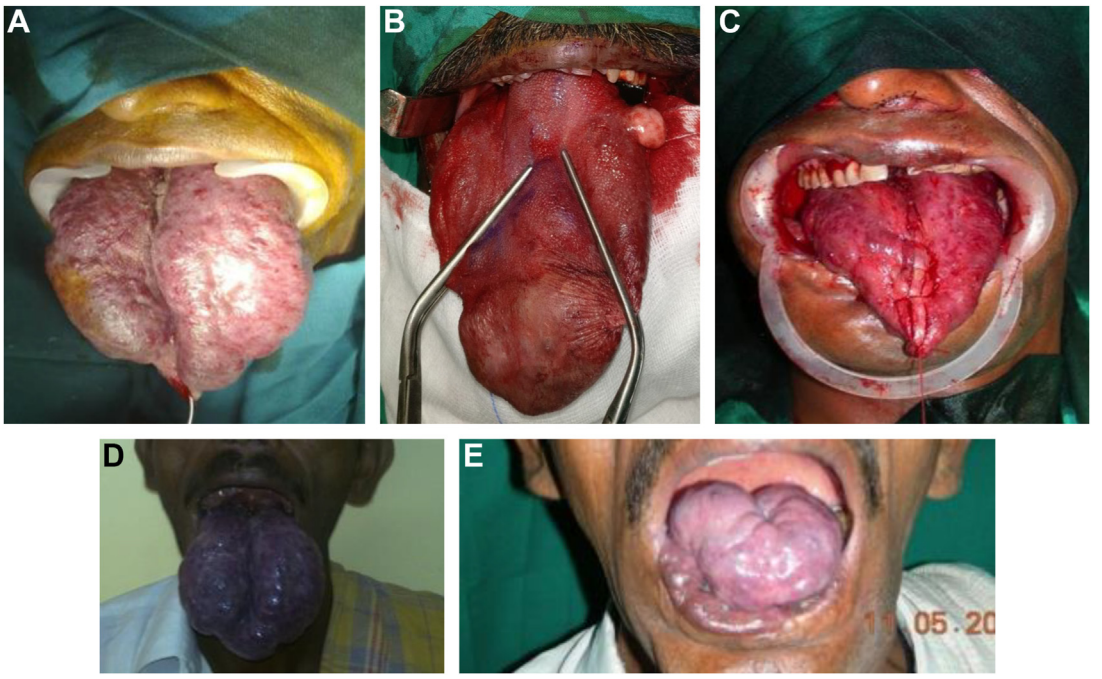


Fig. 1. Vascular control with 2 Satinsky clamps: This is an ideal method for transient vascular control. (*A*) Staged debulking of tongue with diffuse lesion discoloration. (*B*) Application of Satinsky clamps for vascular control and expeditious debulking. (*C*) Immediate postoperative appearance. Fig. 1D and E as described in patient case 1. (*D*) Preoperative illustration of rather large tongue lesion. (*E*) Postdebulking structural appearance of the tongue.

speech therapy was given. He was discharged and routine follow-up showed considerable improvement in his swallowing and speech.

This case illustrates how a lesion involving an isolated unit such as the tongue or lip can be managed with corseting and excision (Fig. 1A–E).

Learning points

- According to the authors' (Nair and colleagues) classification,[2,3] the aforementioned patient has a type I mucosal lesion.
- They are easy to diagnose as they frequently present with a bluish discoloration commonly seen with diffuse swelling.
- Most of these lesions can be completely excised in toto.
- Well-circumscribed tongue lesions are removed completely or debulked while trying to preserve the form and function of the tongue.
- Access through a V-shaped incision with the help of C or angled clamps not only helps in hemostasis but also enables primary closure.[14,15]

Case 2

Low-flow vascular malformation of the cheek

Presentation A 7-year-old child presented with swelling over the left side of his face. The swelling was soft, compressible, and non-pulsatile as a solitary mass (Fig. 2).

Investigation One of the few lesions where computed tomography (CT) could be helpful for diagnosis, a CT angiogram suggested a low-flow lesion involving the subcutaneous tissue overlying the left parotid and angle of the mandible (see Fig. 2B, C). The presence of phleboliths and details of feeding arteries were reviewed; nidus and draining veins were ruled out.

Treatment Considering the risk of damage to the facial nerve, it was decided to attempt conservative management with bleomycin. Ultrasound-guided injection was done to confirm the intralesional deposition of the drug. A 3-way syringe with a low caliber hypodermic needle is introduced into the lesion under ultrasound guidance. An amount of blood equal to the amount of drug to be administered is aspirated, and the precalculated dose of bleomycin is administered intralesionally.

2 such injections were performed with a gap interval of 3 months into the lesion (see Fig. 2E).

In 6 months, the lesion was almost completely resolved.

A 5-year follow-up has shown no recurrence (see Fig. 2D).

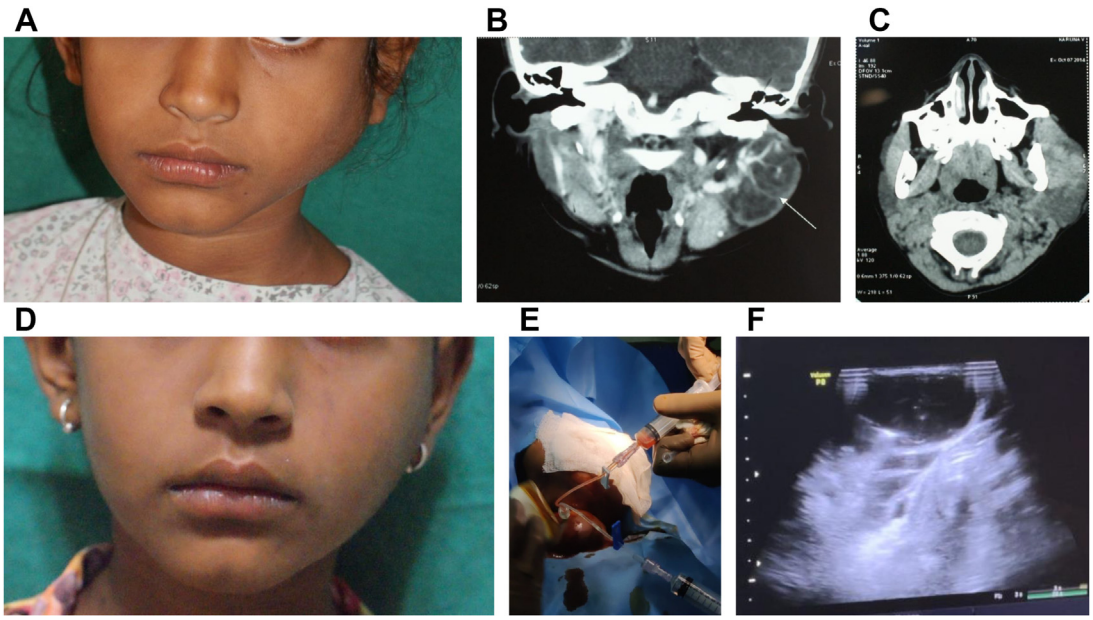


Fig. 2. Case 2: Low-flow malformation treated with ultrasound-guided intralesional bleomycin. (*A*) Left lower lateral facial mass with asymmetry. (*B*) Contrast enhanced computed tomography (CT) coronal section with the arrow depicting a left cystic parotid area lesion. (*C*) Contrast enhanced CT axial section with a left parotid lesion with mixed density after intralesional injections. (*D*) Left lower lateral facial mass resolved post therapy as noted in case 2 and injections demonstrated in Fig. 2E and F. (*E*) Intralesional injection with due aspiration and direct injection. (*F*) Ultrasound-guided injection of bleomycin.

In this case where the lesion is small, intralesional bleomycin using ultrasound was used for minimal morbidity and scarring.

Learning points

- Venous malformation usually presents as a symptomatic soft tissue mass.
- Though ultrasound is a useful tool in treating these lesions, a combination of ultrasound and CT angiography makes the dynamics of vascular malformations clearer.
- Bleomycin inhibits DNA synthesis and has a nonspecific inflammatory reaction on the endothelial cells.
- Though known to cause pulmonary fibrosis, the overall response is favorable.
- Intralesional injection of 15 IU bleomycin in 5 mL of fresh normal saline administered every 15 days for 3 to 4 sittings shows good result.[10,12,15]

Case 3

Low-flow vascular malformation of the face

Presentation A 50-year-old man presented with a diffuse swelling over the right side of his face, progressively getting larger and more painful (Fig. 3A).

Investigation A CT angiogram showed a low-flow lesion with multiple vascular channels involving the cheek, masseter, and parotid gland along with multiple phleboliths (Fig. 3B).

The presence of phleboliths within a soft tissue mass on CT is a characteristic of venous malformation. The serpiginous enhancement involving multiple compartments is suggestive of low-flow vascular malformation.[14,15]

Treatment A preauricular incision with a cervical extension was used to access the lesion. Wide excision and corseting to strangulate the deeper part of the lesion was done to reduce the bulk of the lesion. Placement of a bioresorbable suture (polydioxanone) in a continuous vertical looping fashion constricts the tumor thus obliterating the blood circulation. The excess skin was then excised to achieve closure (Fig. 3C–F).

Outcome The lesion reduced in size considerably in 3 months.

There was transient facial palsy which resolved in 6 months.

Learning points

- Low-flow lesions involving more diffuse areas where complete excision is not possible can be managed with a combination of excision and corseting sutures to reduce morbidity.

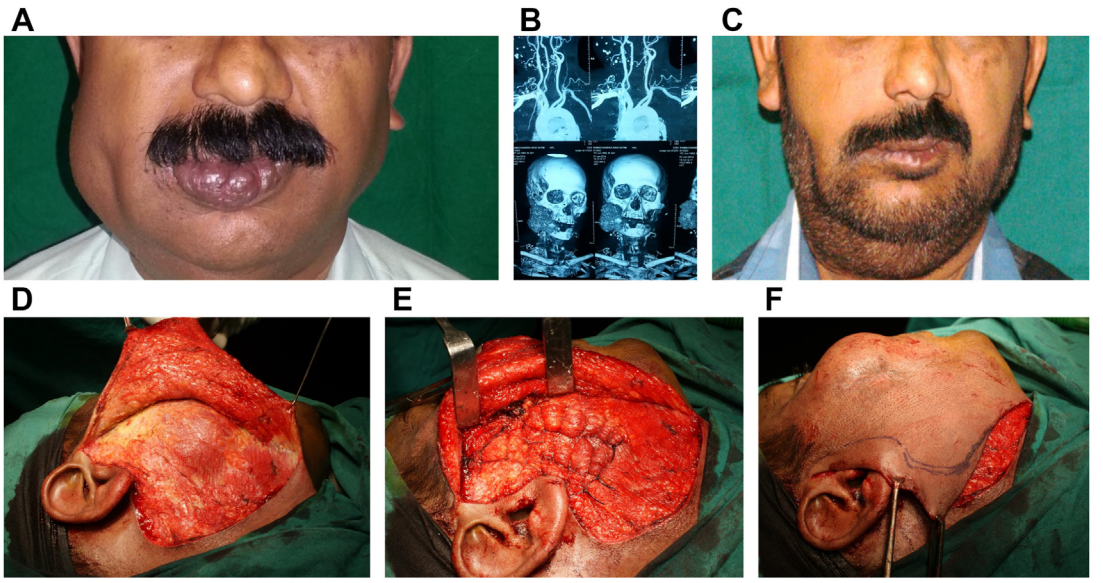


Fig. 3. (*A*, *B*) Low-flow venous vascular malformation of the face. (*A*) Right lateral masseteric area facial mass. (*B*) Computed tomography (CT) angiogram depicting in the top row with representations of the pleboliths in the left facial region noted as white satellite clusters; Images at the bottom row of the CT angiogram depict the large venous malformation with circuitous channels and pleboliths. (*C*) Postsurgical intervention with staged corsetting and resection of the lesion. Please note transient right facial weakness. (*D*) Case 3: a preauricular incision with flap elevation for a low-flow venous vascular malformation of the face. (*E*) Case 3: low-flow venous vascular malformation of the face, with placement of 'corset sutures' to obliterate the lesion. (*F*) Case 3: low-flow venous vascular malformation of the face with removal of excess skin status post resection of expansile venous malformation in the right parotid area.

- Corset suturing is a proven technique, especially where important structures like the facial nerve are involved.[3,14]
- Large lesions require further excision and debulking as age advances and lesions linger.
- Large low-flow lesions have a potential to be completely removed at a second stage once shrinkage is achieved by corseting.
- Noncapsulated lesions are then rarely excised completely but improve the quality of life and reduce the risk of mortality due to pressure symptoms on the airway and hemorrhage.

Case 4

High-flow lesion of lip

Presentation A 60-year-old man presented with a pulsatile swelling of the lower lip with occasional bleeding for which he had to get emergency surgical treatment (Fig. 4).

On examination, there was a soft, compressible swelling involving the lower lip, left commissure, and chin region. There was a palpable bruit.

A handheld Doppler ultrasound confirmed high-flow lesion of the face.

Investigation CT angiogram showed isolated feeder vessels coming from the left facial artery. Compression of the facial artery at the mandible angle reduced the Doppler signal in the lesion (see Fig. 4B).

An MRI also confirmed the anatomic extent of the lesion. It was infiltrating the subcutaneous tissues but showed to extension into the underlying bone.

Treatment The common carotid and external carotid artery (ECA) were identified, and the branches of the ECA were dissected but preserved. A vascular clamp (No 1 bulldog) was placed on the facial artery trunk, and simultaneously Doppler signal in the lip lesion was evaluated. There was a reduction in signal intensity of the Doppler, confirming arterial supply mainly from the facial artery. Wide excision of the lesion under carotid artery control was done.

The remaining lip commissure was recreated using the redundant lip tissue and rotation to close. The excess skin was closed using a rotation advancement flap of the neck skin (see Fig. 4I).

Outcome Lesion healed uneventfully. In 6 months, the commissure function was almost back to normal with very little drooling of saliva following treatment.

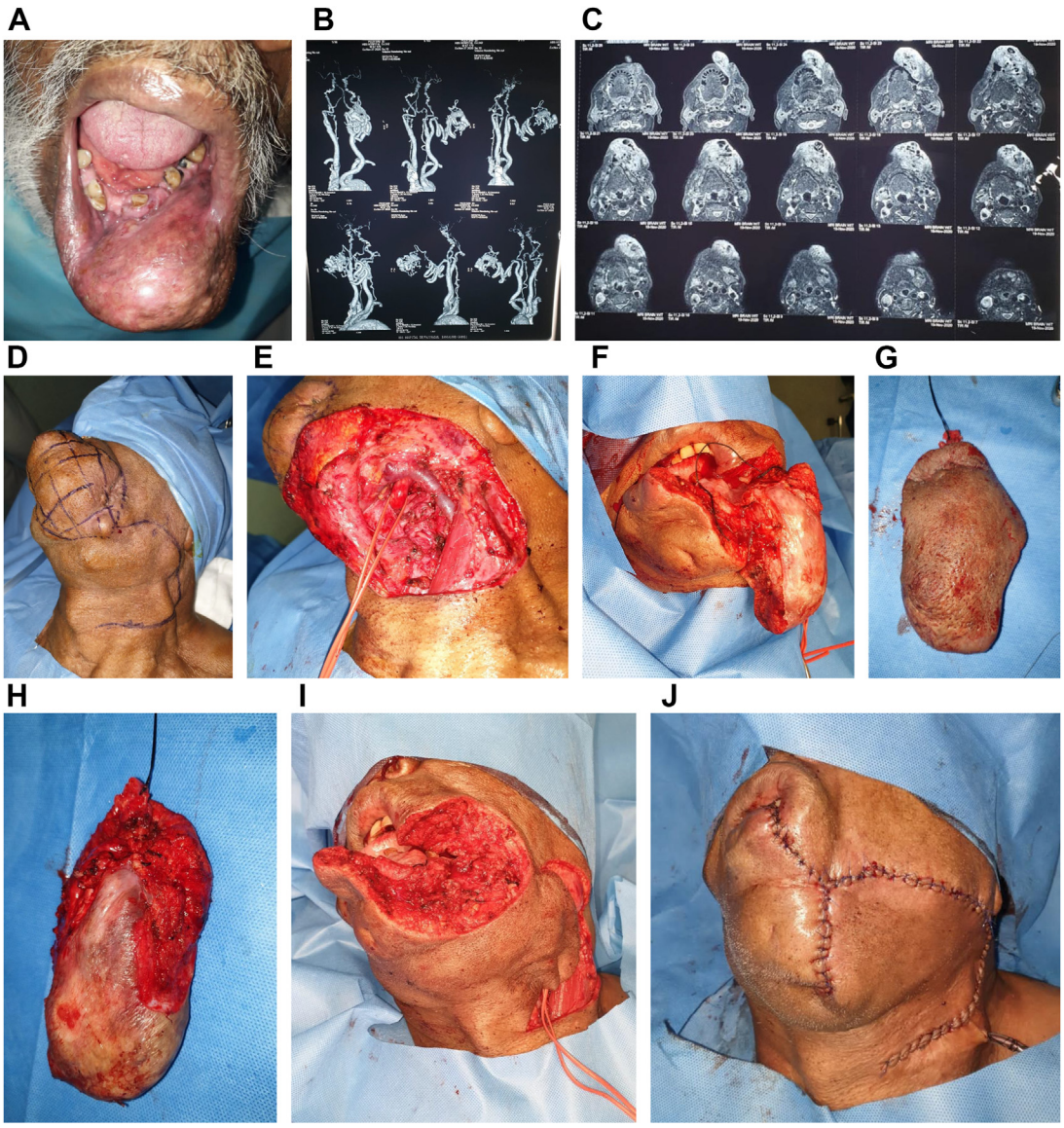


Fig. 4. Case 4: (*A*) High-flow vascular malformation of lower lip with asymmetry. Fig. 4B of case 4: Preoperative CT angiogram showing isolated feeders from ECA. Fig. 4C of Case 4: Preoperative contrasted MRI scan axial views demonstrating the intense vascular perfusion, flow voids, and lip deformation. Fig. 4D of Case 4: planned surgical incision and area of the lesion cross hatched for excision; (*E*) High-flow vascular malformation of lower lip with asymmetry. External carotid artery identification and control with vascular loop. (*F–H*) High-flow vascular malformation of lower lip excision. (*F*) Intraoperative picture with ECA control and post excision; (*G*, *H*) cutaneous and mucosal surface. Case 4: (*I*) High-flow vascular malformation of lower lip excision defect; (*J*) Neck and lower lip immediate closure post excision.

No recurrence of the lesion has been seen on follow-up of 2 years (see Fig. 4).

Learning points

1. This case illustrates in a high-flow lesion, if the vascular territory shows isolated feeders, how vascular ECA control and excision can be done to treat such lesions.
2. It is important to note that this type of treatment is possible when a well demarcated, isolated high-flow lesion is identified. MRI is the most useful tool for determining the extent of the lesion.
3. Complete excision of the 'nidus' or vascular shunted tissue gives the best chance of cure. In the head and neck region this is difficult as several vital structures are present, and excision can cause significant deformity.
4. A local flap as illustrated provides the best result for lip function, as no distant flap can

reconstruct the muscle function of the lip. Preservation of lip function was the main goal of reconstruction in this case.

Case 5

High-flow lesion scalp

Presentation A 45-year-old lady presented with a pulsatile swelling of her right scalp. The lesion occasionally bled while combing her hair (Fig. 5A).

Investigation A CT angiogram showed multiple high-flow channels in the scalp fed by branches of the terminal ECA. No intracranial involvement was noted (Fig. 5B, C).

Treatment Using direct vascular access from the neck, the ECA was exposed. The carotid artery is first identified, and then the ECA is identified by the presence of branches in the neck. A vascular clamp (No 1 bulldog) was placed on the terminal ECA, above the facial and lingual trunk. A handheld Doppler is used to confirm that the flow signal in the lesion shuts down on clamping these vessels. The vascular clamp is left in place to prevent retrograde flow, and then cyanoacrylate glue was injected into the vascular channels. This was allowed to set, and then the lesion was excised, and corset sutures placed (Fig. 5D–M).

Outcome The surgical site healed uneventfully. The patient followed up for 1 year and showed no recurrence of the lesion.

Learning points

1. As the lesion was overlying the cranium, a CT angiogram was the most appropriate investigation to rule out intracranial communications of the lesion. The CT angiogram also helps map out the vascular tree of the lesion, assisting in the approach to access the vessels.
2. Excision of such an extensive lesion would have resulted in a very large defect which would require microvascular free tissue transfer. It was therefore decided to use a more conservative approach. Transfemoral catheterization and embolization of terminal branches is a technically challenging procedure, and possible retrograde flow risks the embolic glue to enter the internal carotid artery with disastrous consequences, such as stroke.
3. This case illustrates how in a high-flow lesion, which is more extensive and where embolization would involve multiple catheterizations, local embolization with glue into the lesion itself may shut down feeders before excision.
4. The cyanoacrylate glue if left in the tissues can sometimes cause a foreign body reaction and necessitate further excision.

Case 6

High-flow lesions: lip and chin subunits

Presentation A 26-year-old patient presented with a swelling of the lower lip and chin with skin color changes (Fig. 6). There was a marked bruit over the chin. Previous ligation of the facial artery had not significantly reduced size of lesion (see Fig. 6A).

Investigation CT angiogram showed multiple feeders from branches of the ECA. No intra-osseous extension of the vascular channels noted (see Fig. 6B).

Treatment

Surgery 1 The ECA was exposed to identify feeding vessels. It was noted that a large 'facial artery like' vessel had developed since previous facial artery ligation. A vascular clamp (No 1 bulldog) was applied to the vessel, and reduced signal intensity was noted in the facial lesion. The bulk of the lesion was excised, and the remaining part of the lesion was strangulated with corseting.

A significant reduction in size of the lesion was noted and lip function was returned to near normal.

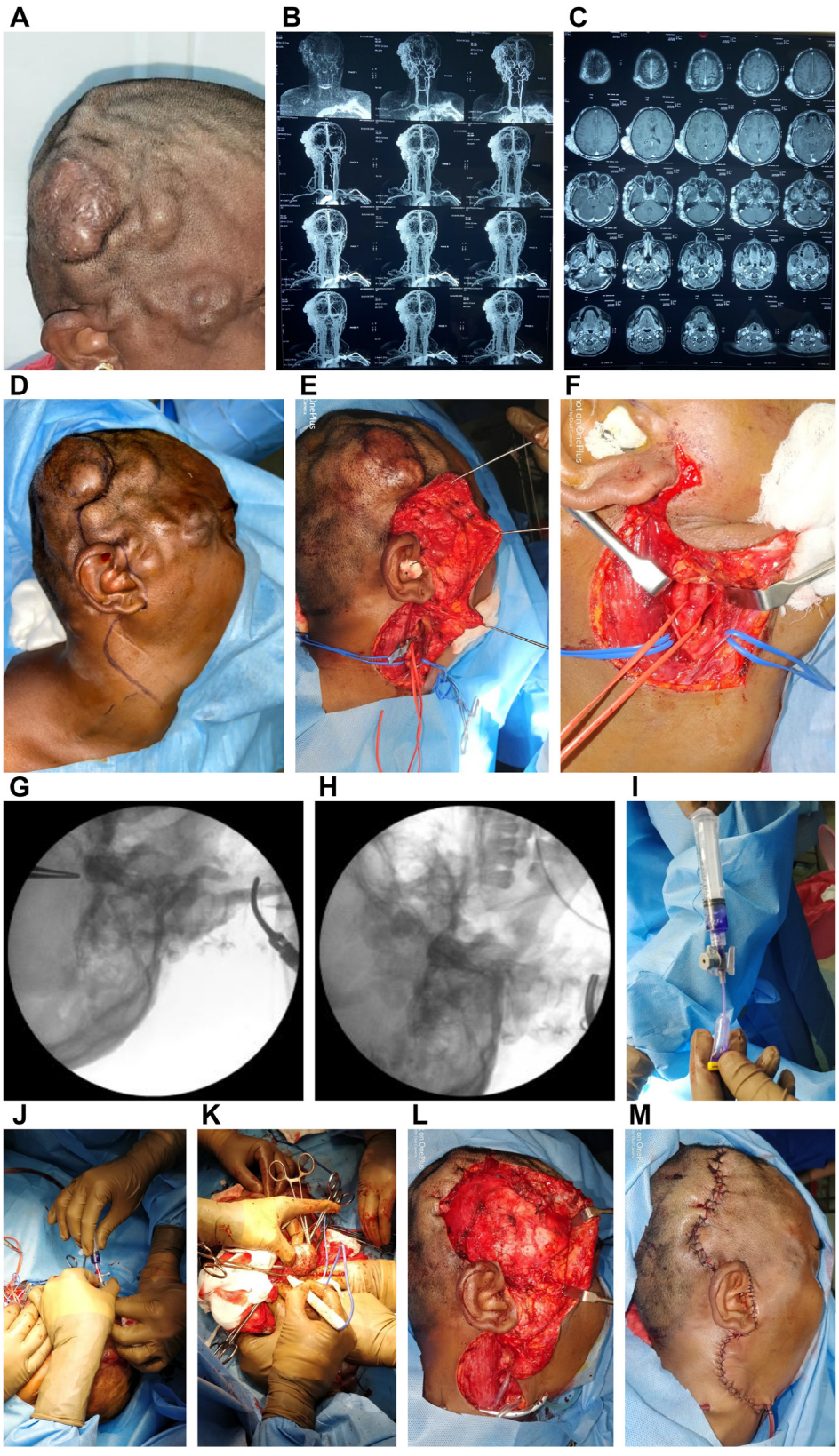
A follow-up 3 years later however, showed a recurrence of a pulsatile lesion in the chin area in cutaneous regions. A CT angiogram scan revealed that the lip component of the lesion had regressed, but a large high-flow lesion in the skin of the chin persisted. No intra-bony extension was noted.

Surgery 2 Embolization of multiple vascular feeding channels was done with polyvinyl alcohol particles. 2 days post embolization, the patient had wide excision of the subcutaneous component of the lesion (see Fig. 6D).

Outcome Significant reduction in the size of the lesion was observed in 3 months. The patient had erbium-YAG laser for treatment of the superficial lesions of the skin.

Learning points

1. The treatment for a high-flow lesion in the head and neck region is not ligation of the facial artery. Ligations prevent the possibility of insertion of a catheter for embolization if necessary in the future.
2. Excision of the 'nidus' is the treatment of choice for high-flow vascular malformation.
3. Allowing the arterial branches to remain patent after excision of the lesions provides embolization access if required for these patients.
4. This case illustrates how for large, diffuse high-flow lesions, combined approach with embolization and excision can be used to reduce morbidity.



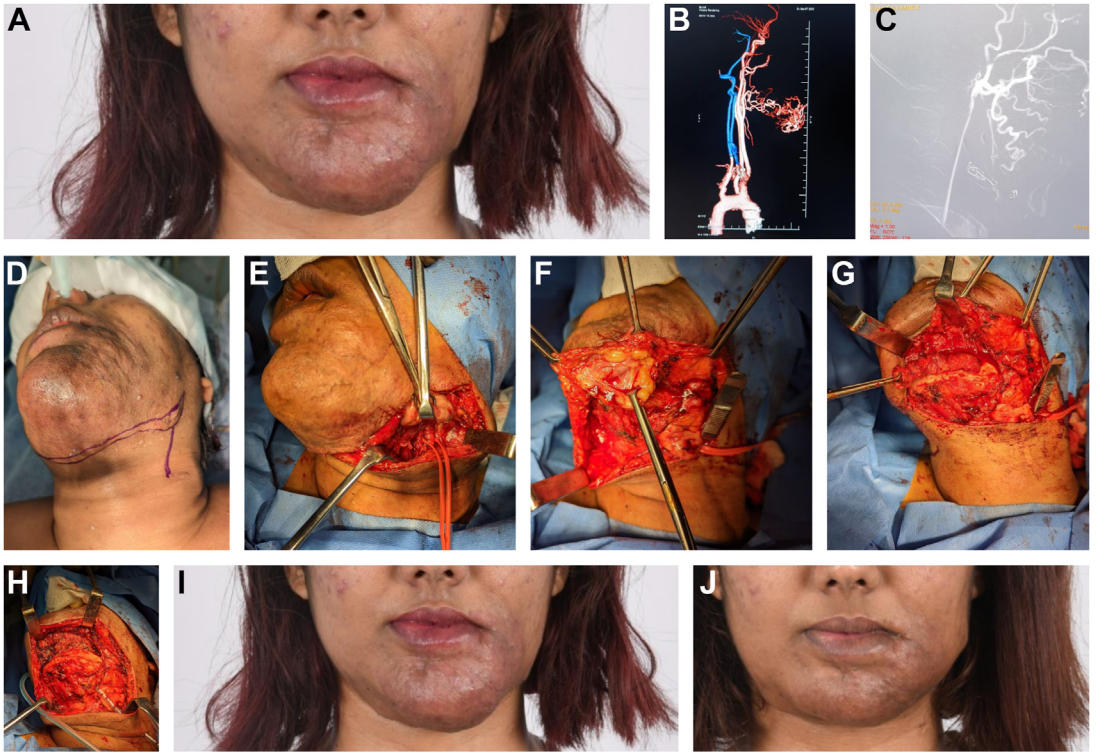


Fig. 6. Case 6: (*A*) High-flow vascular malformation involving chin and lip. (*B*) computed tomography (CT) angiogram showed multiple feeders from branches of the external carotid artery (ECA). No intra-osseous extension of the vascular channels noted. (*C*) Embolization of multiple vascular feeding channels was done with polyvinyl alcohol (PVA) particles. (*D*) Surgical incision marking 2 days post embolization. (*E*) Exposure of carotid control prior to debulking and wide excision of the subcutaneous vascular lesion. (*F*) Exposure of external carotid artery and control prior to debulking and wide excision of the subcutaneous vascular lesion. (*G*) Excision and corseting of residual lesion. (*H*) Completion of excision and debulking of the vascular lesion. Case 6: (*I*) Preoperative lip and chin area vascular lesion. (*J*) Postsurgical excision of the facial subunit regions with ongoing laser therapy for pigment reduction caused by vascular lesion of the subcutaneous areas.

Case 7

Arteriovenous malformation

Presentation A 37-year-old male presented with 4 × 4 cm compressible, pulsatile swelling in left cheek for 10 years duration, warm to palpate with distinct bruit. No discolorations on the skin over the swelling were obvious. Otherwise, the patient was asymptomatic.

Investigation: US Doppler identified the high-flow arterial supply into the lesion with cavernous sac. Magnetic resonance anigiography and digital subtraction angiography demonstrated a sizable venous sac lateral to the pterygo-maxillary region with feeders from the facial and internal maxillary (Fig. 7). Decision was made to gain intraoperative control on the ECA and excise the venous sac[9–14] (see Fig. 7B).

Treatment: Using a preauricular access with cervical and temporal extension the facial flap was raised at the superficial musculoaponeurotic

Fig. 5. (*A*) High-flow vascular malformation of right scalp, with scarring from prior ulcerations and bleeds. (*B*) With a collage of the computed tomography angiogram (CTA) with vascular lesions in the tempero-parietal area. (*C*) CTA showing no intracranial feeders noted on the axial section of the CTA. (*D*) Right scalp lesion surgical marking of planned incision and excision areas; (*E*) External carotid artery (ECA) isolated and feeder vessels injected with cyanoacrylate glue for embolization and placement of corset sutures in the right parotid bed area; (*F*) Intraoperative external carotid control with vessel loops. Case 5: (*G*, *H*) Intraoperative fluoroscopic images utilizing a C arm reviewing the embolization after ECA access. Case 5: (*I*) Cyanoacrylate glue obtained into a syringe with flow valve, (*J*) Accessing the vascular lesion for injection of cyanoacrylate to 'dam' the outflow; (*K*) excision of the scalp lesion post vascular control and injection of tissue glue; (*L*) Right scalp to neck exposure with resection of the vascular lesion; (*M*) Esthetic closure of the excision defect with placement of drain.

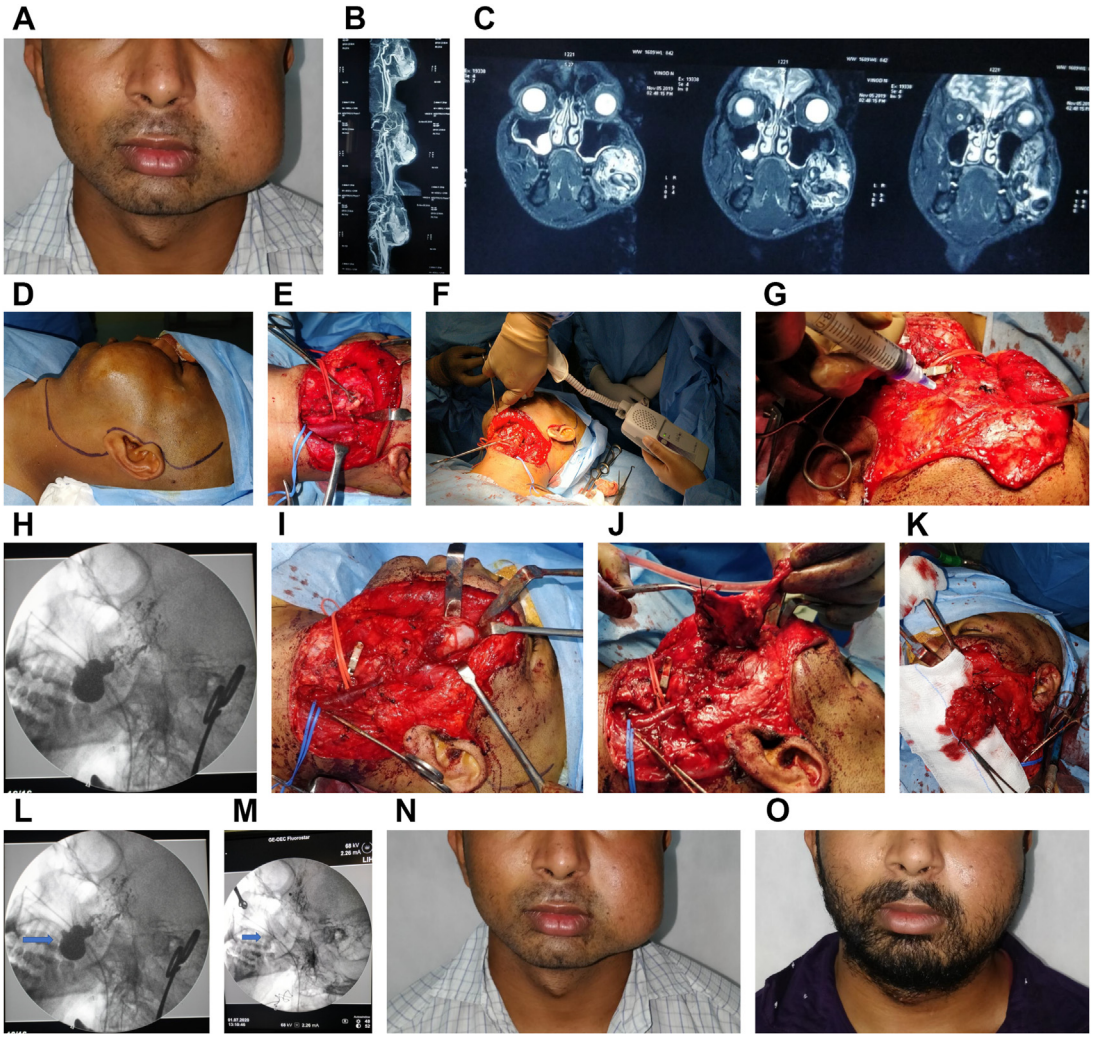


Fig. 7. Case 7: (*A–C*) Clockwise. (*A*) Arteriovenous malformation (AVM) of the left cheek. (*B*) Magnetic resonance angiography (MRA) and digital subtractiob angiography (DSA) demonstrated the size of the venous sac lateral to the pterygo-maxillary region with feeders from the facial and internal maxillary. (*C*) Coronal section of the MRA with large multiloculated sac of the vascular AVM. Case 7: (*D*) Extended planned incision into the neck for external carotid artery (ECA) access. (*E*) Intraoperative control the ECA and excise the venous sac. Case 7: (*F*) Intraoperative Doppler to identify changes in flow with ECA control and gradual embolization techniques. (*G*) Intraoperative ECA control and gradual embolization technique. (*H*) Vascular AVM embolized as demonstrated with the intraoperative fluoroscopic C arm technique. (*I*) ECA control, intermittent bull dog clamping, and dissection with identification of facial nerve branches allowed complete access. (*J, K*) Demonstration and excision of the large vascular AVM sac after ligating the vascular pedicle was done. (*L*) Preoperative AVM sac: (pointed by the *thick blue arrow* after cyanoacrylate injection). (*M*) Post excision of the sac (pointed by the *thick blue arrow* after cyanoacrylate injection). (*N*) Preoperative facial photograph of the left facial mass. (*O*) Postoperative facial picture of the area with residual edema.

system layer. The ECA was identified and controlled with vascular clamps. Intraoperatively contrast was injected into the feeders to identify the venous sac using a C arm image (see Fig. 7G, H). Cyanoacrylate glue was injected into the sac to solidify the lesion. Blunt dissection with identification of facial nerve branches allowed complete excision after ligating the vascular pedicle was done. Good cosmetic and functional result was achieved.

Case 8

Lymphatic malformation or lymphovenous malformation

Presentation Female, 25 years of age, with swelling in the preauricular region, which was

present from birth and showed progressive increase in size. The swelling had the shape of an enlarged parotid gland clinically indicating its presence within the capsule of the parotid gland. It was previously operated during childhood with unsuccessful attempt at removal.

Investigation CT angiograph demonstrated macrocystic spaces within the parotid gland limited to the inside of the capsule. Diagnosis of macrocystic lymphatic malformation was arrived at.

Treatment Surgical excision of the lesion with the superficial parotid was planned. Through a parotid incision a facial flap along the parotid fascia was raised. The gland with its enclosed lesion was exposed. Facial nerve was identified tracing the upper border of the posterior belly of digastric muscle. The lesion could be peeled off of the branches of the facial nerve with ease. The preauricular soft tissue defect was filled by swinging the upper layer of the sternocleidomastoid muscle (Fig. 8). Total excision with good cosmetic result was achieved.[3,9,13]

Fig. 8. (*A–D*) Left facial vascular lesion of *lymphatic malformation or lymphovenous malformation type.* (*E*) CT scan of the axial image depicting the large multicystic lesion (macrocystic spaces within the parotid gland). (*F–J*) (*Left top*: Clockwise). (*F*) Intraoperative pictures of incision; (*G*) flap elevation; (*H*) identification of the facial nerve; (*I*) cystic sac of the mass with multilocation excision; (*J*) Postexcision left parotid bed with adequate hemostasis; Case 8: (*K–M*) Postoperative frontal, lateral, and left posterior facial area and neck incision areas.

Learning points

1. Arteriovenous malformations (AVMs) are treated as 2 separate entities; hence, controlling the arterial flow and excision of the venous sac gives satisfactory outcome.
2. Use of ECA control over transosseous-alveolar embolization can prove to be effective in AVMs especially considering that a lot of embolic particles may disappear into the venous system.
3. Preauricular or buccal lesions need careful identification and isolation of facial nerve branches.
4. Incisions to the lesion require meticulous planning for complete access and ablation of the lesion.
5. Glandular lesions would require excision with the gland rather than dissecting the vascular lesion from within the parenchyma of the gland.

SUMMARY

Vascular lesions of the head and neck are reviewed for surgical excision and management based on our departmental publications and protocols led by Nair and colleagues.[3,4,9,13] This classification of 5 types is based on the location from skin subcutaneous tissue, muscular or subcutaneous, glandular, intra-osseous, and deep visceral areas of anatomy. This simple anatomic and surgical classification proposes a management as represented in the cases earlier.

CLINICS CARE POINTS

- In high-flow lesions, where more extensive need embolization, multiple catheterizations, local embolization with glue direct into the lesion may shut down small feeders before excision.
- The treatment for a high-flow lesion in the head and neck region is not ligation of the facial artery or similar major branches. Ligations prevent the possibility of insertion of a catheter for embolization if necessary in the future.
- Arteriovenous malformations (AVMs) are treated as 2 separate entities; hence, controlling the arterial flow and excision of the venous sac gives satisfactory outcome.
- Glandular lesions would require excision with the gland rather than dissecting the vascular lesion from within the parenchyma of the gland.
- Cyanoacrylate glue if left in the tissues can sometimes cause a foreign body reaction and necessitate further excision.

DISCLOSURE

No disclosures are reported for any of the authors.

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