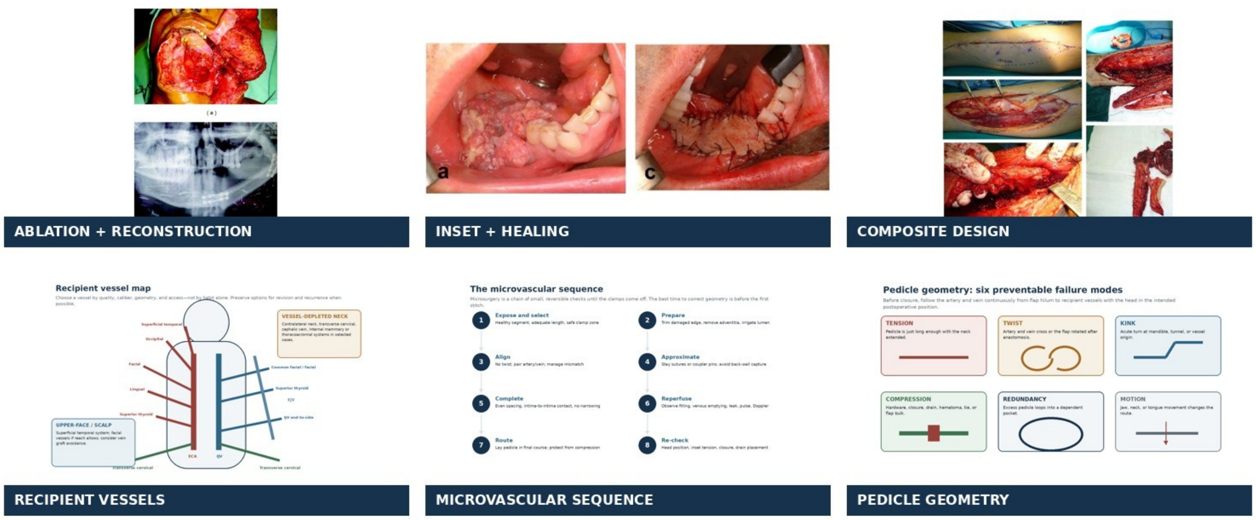
FREE-FLAP RECONSTRUCTION FOR HEAD AND NECK CANCER

VOLUME IV

Building the Reconstruction

Planning, workflow, recipient vessels, microvascular execution, inset, and perioperative care



Cover montage. Ablation, inset, composite reconstruction, recipient-vessel planning, microsurgical sequence, and pedicle geometry. Clinical panels are adapted from open-access web figures; full credits appear in Appendix F.

A resident-level guide to executing a safe reconstructive plan

Resident study guide • July 2026

CHAPTER 0

Orientation

The operation is a chain of interfaces, not a collection of isolated technical steps

Volumes I through III established the defect audit, donor-site toolkit, and defect-specific construct. Volume IV addresses the next question: how does a sound concept become a reliable operation? The answer is not simply “perform the anastomosis.” A free-flap reconstruction succeeds only when planning, ablation, harvest, geometry, recipient vessels, microvascular technique, inset, airway management, and perioperative physiology remain aligned.

Most preventable failures occur at interfaces. The ablative defect differs from the anticipated defect. The skin paddle is centered on the wrong perforator. The pedicle reaches the neck only after an unplanned tunnel is created. A plate or drain compresses the vein. A technically patent anastomosis is placed under tension after final inset. A generous crystalloid strategy produces edema that compromises both airway and flap. The resident’s central job is therefore to preserve continuity between the plan and the final construct.

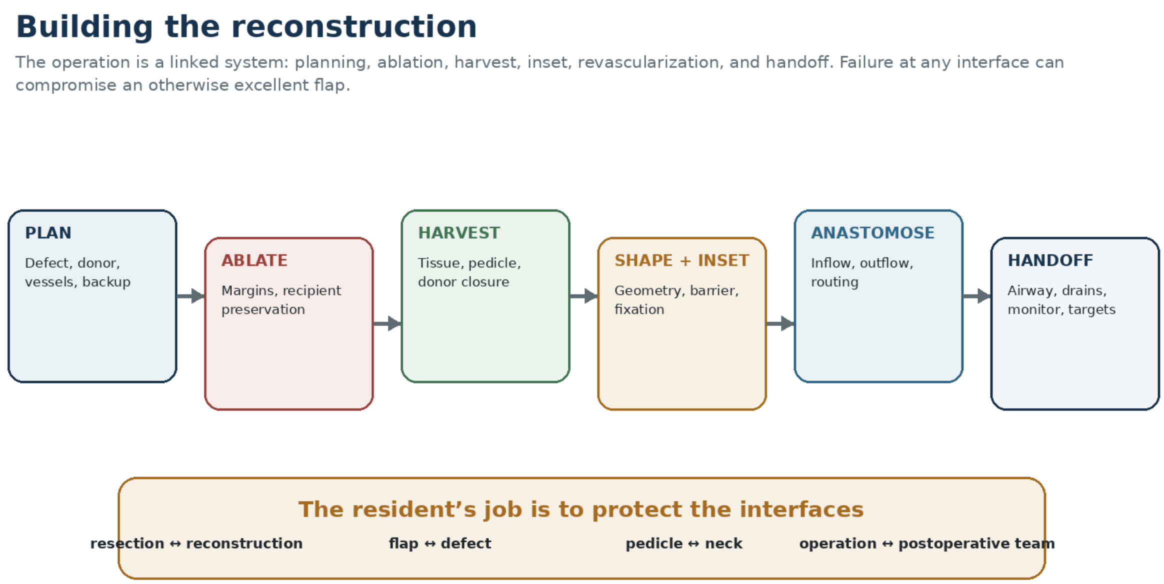


Figure 1. Building the reconstruction as a sequence of linked interfaces. Failure at one interface can propagate through the entire operation. Original synthesis diagram created for this guide.

Learning objectives

1. Convert an anticipated ablative defect into a primary reconstructive plan, a credible backup plan, and explicit intraoperative decision points.
2. Explain how virtual surgical planning, patient-specific guides, and conventional freehand judgment complement rather than replace one another.

3. Organize a two-team head and neck free-flap operation so that exposure, harvest, oncologic margins, ischemia time, and equipment flow remain coordinated.
4. Select recipient arteries and veins according to caliber, location, geometry, prior treatment, and pedicle requirements.
5. Describe the logic of end-to-end and end-to-side anastomosis, vessel preparation, size mismatch management, venous coupling, and flow assessment.
6. Identify preventable pedicle hazards during routing, inset, closure, drain placement, tracheostomy management, and postoperative positioning.
7. Use physiology-guided principles for fluids, vasopressors, transfusion, temperature, antithrombotics, antibiotics, and nutrition.
8. Perform a final intraoperative perfusion assessment and communicate a reconstructive handoff that allows the postoperative team to protect the construct.

> **SERIES BOUNDARY** This volume ends when the patient leaves the operating room with a documented baseline examination and a protected construct. Detailed postoperative monitoring, vascular compromise, return-to-OR exploration, fistula, infection, and late rehabilitation are addressed in Volume V.

CHAPTER 1

Preoperative Reconstructive Planning

Define the defect, the construct, the vascular route, and the bailout before incision

Good planning is not a prediction that the case will proceed exactly as expected. It is a structured method for remaining safe when the resection, margin, donor anatomy, or recipient vessels differ from expectation.

Read the oncologic operation as a reconstructive problem

The reconstructive surgeon should understand the tumor, planned access, neck dissection, possible margin extensions, prior treatment, and anticipated adjuvant therapy. The operative note from a prior neck dissection is often more useful than a generic statement that the patient had “neck surgery.” It may reveal which external carotid branches were divided, whether the internal jugular vein was sacrificed, where a previous pedicle was routed, and whether hardware or a prior flap occupies the expected inset plane.

Planning should explicitly separate what is known from what remains conditional. For example: “The current plan is a lateral segmental mandibulectomy with preserved symphysis. If the marrow margin is positive and the resection crosses the midline, the reconstructive priority changes from simple continuity to restoration of the anterior arch, tongue support, and chin projection.” This distinction prevents a detailed but brittle plan.

Build four linked plans

Table 1. The four linked preoperative plans.

Plan domain	Questions that must be answered
Defect plan	What tissues will be missing? Which compartments communicate? What native function remains? What margin extensions are plausible?
Construct plan	Which flap components, dimensions, skin-paddle orientation, bone segments, and monitoring strategy are required?
Vascular plan	Which artery and vein are preferred? Where will the pedicle run? What is the required length? What are the backup recipient systems?
Operational plan	How will the patient be positioned? Can two teams work simultaneously? When will the flap be divided? What equipment and consultants are required?

Preoperative imaging and donor evaluation

Imaging should answer a clinical question rather than satisfy a routine. CTA or MRA may be valuable when lower-extremity vascular disease, prior trauma, abnormal pulses, previous harvest, or vessel-depleted neck anatomy could change the plan. Dual-phase CTA can be particularly useful when both arterial inflow and venous outflow must be mapped. The absence of a palpable pulse is a reason to investigate, but a normal pulse does not exclude clinically meaningful variation or stenosis.

Donor-site assessment includes function, skin quality, scars, prior surgery, body habitus, vascular anatomy, mobility requirements, and the patient’s priorities. A patient who depends on a walker, has severe peripheral arterial disease, or has a dominant occupational need may not be best served by the institution’s default flap. The final choice should solve the head and neck problem without creating a disproportionate donor deficit.

> **RESIDENT HABIT** Before presenting a flap, state the anticipated defect, the required tissue components, the preferred recipient artery and vein, the expected pedicle route, and one reason the primary plan might fail.

CHAPTER 2

Contingency Planning and the Reconstructive Conference

A credible Plan B is part of Plan A

The most useful multidisciplinary discussion occurs before the patient is prepped, not after the team discovers that the resection or vascular anatomy has changed. The reconstructive conference should identify branch points and assign a response to each one.

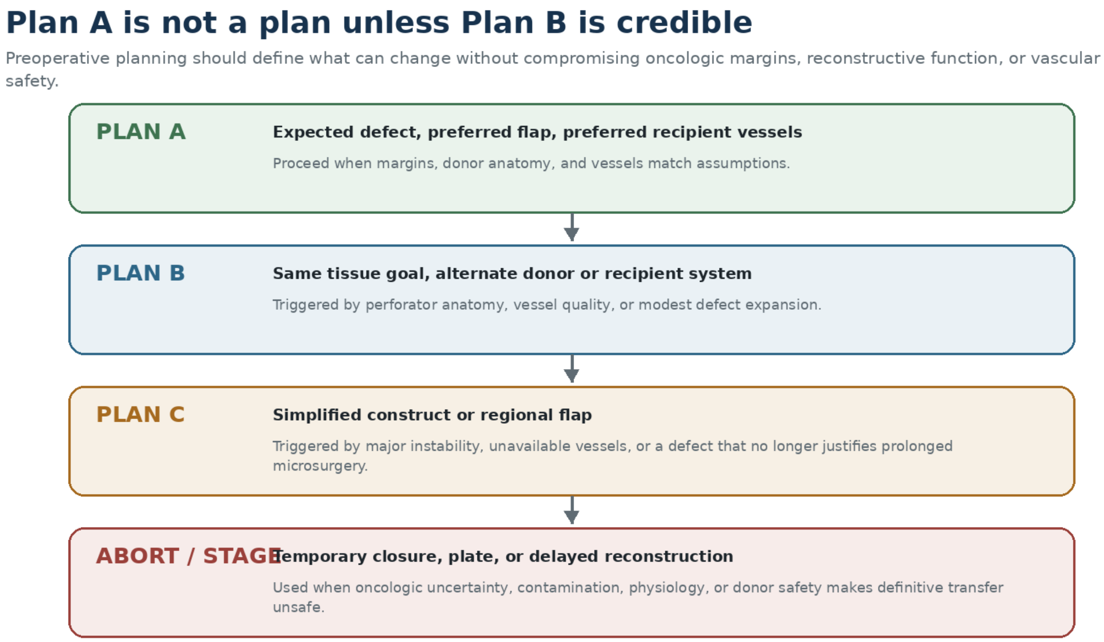


Figure 2. The contingency ladder. Plans should step down in complexity only when patient safety, oncologic clearance, reconstructive function, or vascular feasibility demands it. Original synthesis diagram created for this guide.

Common branch points

Margin expansion is the most common reason an elegant preoperative design becomes inaccurate. Other branch points include sacrifice of a recipient vessel during neck dissection, loss of a planned perforator, unexpected donor vessel disease, inadequate pedicle length, excessive skin-paddle thickness, need for external skin, change in airway plan, or hemodynamic instability that makes a prolonged construct unsafe.

Each branch point should have an operational response. “Use another flap” is not a sufficient backup. The team should know which alternative donor site is available, whether it requires different positioning, whether a tourniquet or bowel preparation is needed, whether the recipient-vessel strategy changes, and whether the alternative still meets the critical functional goals.

When simplification is correct

Complexity should be justified by a meaningful outcome. A patient with limited prognosis, severe frailty, or unstable physiology may benefit from a shorter operation, a regional flap, a reconstruction plate with soft-tissue coverage, or delayed skeletal reconstruction. This is not failure if the simplified plan reliably separates compartments, protects vital structures, and matches the patient’s goals. It is failure only when simplification is improvised without understanding what function is being surrendered.

Table 2. Converting common threats into explicit backup actions.

Threat to primary plan	Reasonable response
Defect larger than anticipated	Enlarge or redesign the paddle, add an independent component, change donor site, or use a second flap when a single construct cannot safely replace all surfaces.
Preferred recipient artery unavailable	Move to another ipsilateral branch, an end-to-side external carotid configuration, the contralateral neck, or a remote system according to geometry and pedicle length.
Preferred recipient vein unavailable	Use another internal jugular branch, end-to-side internal jugular vein, external jugular system, contralateral vein, or cephalic transposition; avoid casual long vein grafts.
Critical perforator absent or injured	Recenter the design on a reliable perforator, convert the tissue components, choose another donor site, or abort harvest before creating an unreconstructable donor defect.
Patient cannot tolerate planned duration	Prioritize barrier, vessel protection, and wound closure; simplify bone or dental objectives and consider staged rehabilitation.

CHAPTER 3

Virtual Surgical Planning and Skeletal Execution

Use digital planning to transfer geometry - not to outsource judgment

Virtual surgical planning (VSP) is most valuable when the reconstruction depends on precise skeletal geometry, occlusion, orbital support, or reproducible transfer of a complex plan. It is a communication and manufacturing workflow, not a guarantee that the intraoperative anatomy will match the model.

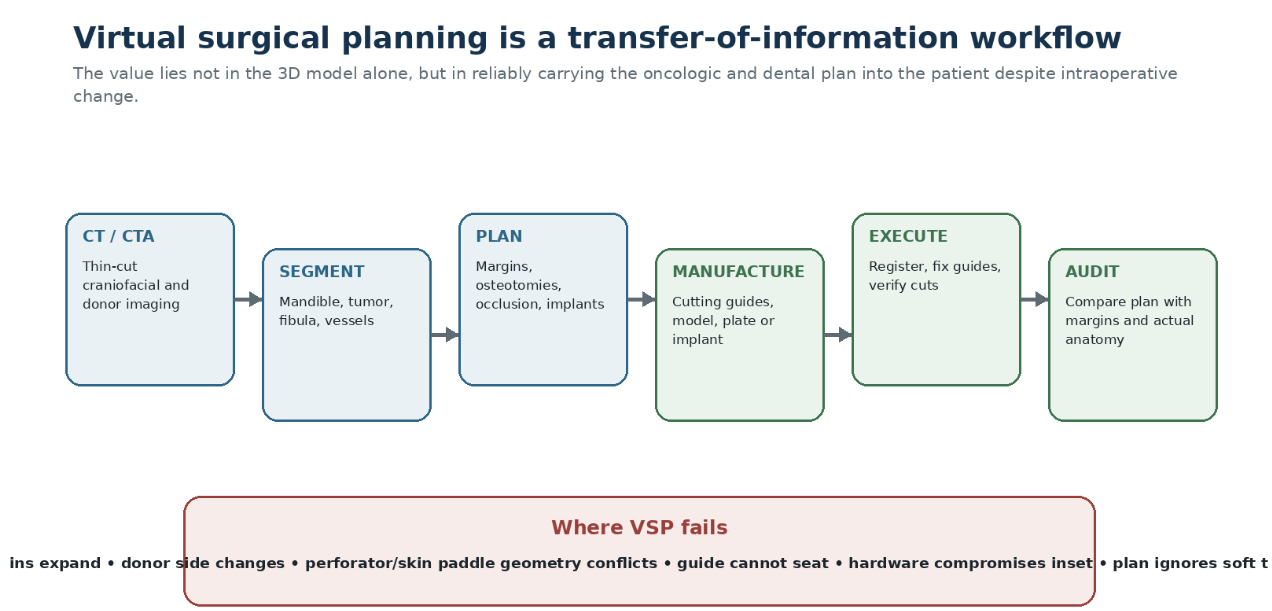


Figure 3. Virtual surgical planning as a transfer-of-information workflow. The model is useful only when the diagnostic and operative plan remain aligned. Original synthesis diagram created for this guide.

What VSP can improve

For mandibular reconstruction, VSP can define osteotomy locations, segment lengths, mandibular contour, plate shape, fibular orientation, and the relationship of bone to future dental implants. In maxillary reconstruction, it can help restore alveolar position, midfacial buttresses, orbital volume, and projection. Patient-specific plates and cutting guides may reduce intraoperative contouring and improve reproducibility, particularly when the desired geometry is difficult to reconstruct by eye.

VSP also improves communication. The ablative surgeon, reconstructive surgeon, engineer, and prosthodontic team can see the same proposed margins, osteotomies, hardware, and dental endpoint. The process forces decisions that are otherwise deferred until the operation, such as whether the reconstruction is optimizing inferior mandibular border, alveolar position, or implant trajectory when all three cannot be perfectly reproduced.

Where VSP fails

A guide can be internally accurate and clinically wrong. Tumor progression, changed margins, dental extractions, guide-seating interference, limited exposure, poor bone quality, or altered donor anatomy can invalidate the plan. Soft-tissue requirements may also dominate the case even when the skeletal model is beautiful. A fibular segment that restores mandibular contour but leaves the skin paddle unable to line the oral cavity is not a successful transfer of the plan.

The reconstructive team must therefore retain freehand landmarks and bailout skills. Confirm occlusion, condylar seating, mandibular width, chin projection, orbital position, and pedicle geometry on the patient. If the guide does not seat unambiguously, stop and identify why rather than forcing the guide to make the anatomy fit the model.

BOARDS PEARL VSP improves planning and reproducibility, but oncologic margins take precedence. When the resection changes, the reconstruction must adapt to the actual defect rather than preserve the digital plan.

CHAPTER 4

Operating Room Setup and the Two-Team Workflow

Design the room so that the operation can proceed without contaminating fields or competing for access

The two-team approach can shorten operative time, but only when the teams can work independently. Poor setup creates repeated interruptions, compromised sterility, unsafe line placement, and unnecessary ischemia.

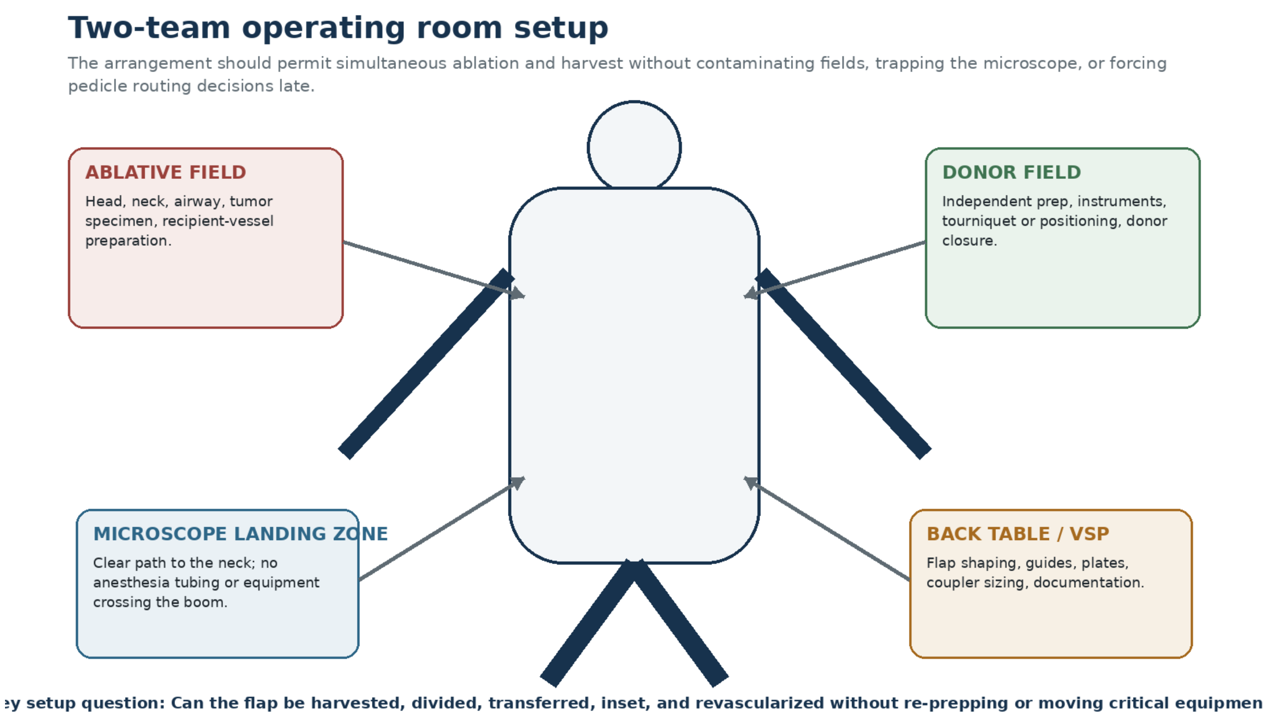


Figure 4. A conceptual two-team operating room setup. The exact arrangement varies by flap and institution, but competing access should be anticipated before positioning. Original synthesis diagram created for this guide.

Positioning begins with all teams

The airway, neck, donor site, pressure points, and possible backup donor sites should all be accessible. The anesthesia circuit and central access must not occupy the recipient-vessel field. A fibula harvest requires attention to hip position, knee flexion, padding of the contralateral limb, and access for tourniquet placement. A subscapular-system flap may require lateral positioning or repositioning that changes the sequence of ablation and harvest. An ALT can often be harvested supine, but the skin paddle and pedicle orientation should be marked with the final inset in mind.

The patient should be positioned for the longest and most constrained portion of the operation, not merely for the first incision. A minor ergonomic inconvenience early is preferable to an inaccessible neck or compressed pedicle during microsurgery.

Equipment and communication

Before incision, confirm the microscope, coupler system, microinstruments, vessel clamps, Doppler, implantable monitor if used, heparinized irrigation, warming strategy, plates and guides, tourniquet, dermatome or skin-graft supplies, and backup flap instruments. Missing equipment discovered after pedicle division converts a solvable logistics problem into ischemia.

The operative briefing should name the expected defect, flap, laterality, recipient vessels, monitor location, airway plan, and backup options. During the case, the ablative team should announce when margins are likely to delay division, when a recipient vessel is being preserved or sacrificed, and when the defect has changed. The reconstructive team should announce perforator findings, flap dimensions, expected pedicle length, and the earliest safe time for division.

Table 3. Communication checkpoints in a two-team operation.

Moment	Minimum communication
Pre-incision	Defect, flap, side, recipient vessels, airway, positioning, backup donor and vessel plan.
Before irreversible harvest step	Perforator reliability, required tissue components, donor vascular anatomy, and whether the actual defect remains compatible.
Before flap division	Margins acceptable or expected delay understood; recipient vessels prepared; microscope and inset field ready.
Before anastomosis	Pedicle route, orientation, sequence, anticoagulation/irrigation preference, and anticipated size mismatch.
Before closure	Baseline signal, pedicle position, drains, hardware coverage, airway security, and postoperative restrictions.

CHAPTER 5

The Ablative-Reconstructive Interface

The final defect is a three-dimensional specimen, not an operative label

The most consequential reconstructive assessment often occurs after the specimen is removed and before the flap is divided. The team should pause and repeat the defect audit using the actual anatomy.

Reassess the defect

Measure mucosal and cutaneous surfaces without excessive traction. Identify whether the defect is a patch, a folded surface, a tube, or a true through-and-through cavity. Determine which tissue edges are viable, which structures need coverage, and whether a potential leak would contact the pedicle, carotid, hardware, or skull base. Confirm the residual tongue, pharynx, palate, lip, orbit, and mandible in functional terms.

For composite defects, identify the relationship between bone and soft tissue before finalizing osteotomies or paddle orientation. Bone segment order, perforator position, pedicle exit, and mucosal inset are coupled. A segment can be geometrically correct yet rotate the skin paddle away from the oral defect or place the pedicle beneath a plate.

Prepare the recipient field early

Recipient-vessel exposure should be performed before flap division whenever feasible. The artery and vein must be not only present but usable: adequate caliber, healthy wall, suitable length, favorable orientation, and freedom from adjacent scar, clips, tumor, or radiation injury. A vessel that can be reached only under tension after a sharp turn is not an acceptable recipient simply because it has flow.

The ablative team should preserve vessel length when oncologically safe and avoid unnecessary cautery, crush, or skeletonization. Veins are especially vulnerable to traction and desiccation. The reconstructive team should participate in selection before branches are ligated, particularly in the previously treated neck.

> **PAUSE POINT** Before pedicle division: confirm final defect dimensions, required components, recipient artery and vein, pedicle route, skin-paddle orientation, monitoring surface, and whether the construct still matches the oncologic defect.

CHAPTER 6

Flap Design, Harvest, Division Timing, and Ischemia

Harvest for the inset, not for the donor-site photograph

The flap should be designed backward from the defect. Surface dimensions, fold lines, bone segments, perforator location, pedicle exit, and monitoring paddle all need to function together after transfer.

Design principles

A skin paddle should include a reliable perforator and enough tissue for tension-free closure, but excessive size creates bulk, redundant folds, and donor morbidity. For folded or multiple-surface defects, mark orientation before division and use reference sutures to distinguish mucosal from external surfaces. When a flap includes bone, the pedicle and perforators must remain protected through osteotomy and fixation. Chimeric components should have sufficient independent mobility without placing traction at branch points.

The distal-most skin is not automatically the best monitoring surface. The monitor should reflect the component at risk and remain visible after swelling. A tiny paddle tucked deep in the oral cavity may be technically viable but clinically difficult to assess. Conversely, a large external paddle added only for monitoring may distort contour or compromise closure.

When to divide the pedicle

Pedicle division should occur only when the recipient field is ready and the flap can move promptly toward inset or revascularization. The priorities are not identical for every case. In a straightforward soft-tissue defect, rapid transfer to the microscope may minimize warm ischemia. In a complex mandibular reconstruction, partial fixation or inset before anastomosis can establish geometry and protect the pedicle, but excessive pre-anastomotic manipulation prolongs ischemia. The team should select a sequence deliberately rather than follow habit.

Ischemia time is a modifiable risk, but it should not be reduced by rushing vessel preparation or accepting poor geometry. The most effective strategy is organizational: recipient vessels prepared before division, equipment ready, roles assigned, and no avoidable delay between harvest completion and reperfusion.

Table 4. Common sequencing strategies.

Sequence	Advantages	Tradeoffs
Anastomosis first	Early reperfusion; useful when inset will be prolonged or difficult.	Perfused flap may be cumbersome; final inset can alter pedicle geometry.
Partial inset/fixation first	Establishes orientation and pedicle route; useful for bone or deep defects.	Longer ischemia; risk of discovering that the planned vessels or pedicle length are inadequate.
Hybrid sequence	Critical fixation or deep sutures first, then anastomosis, then final inset.	Requires clear choreography and protection of both the pedicle and the partially completed inset.

CHAPTER 7

Recipient Arteries

Choose a healthy vessel that creates a straight, tension-free construct

Recipient selection is a geometric decision as much as an anatomic one. The best artery is not necessarily the largest or closest; it is the vessel that provides reliable inflow with a healthy wall and allows the pedicle to lie without tension, twist, or compression.

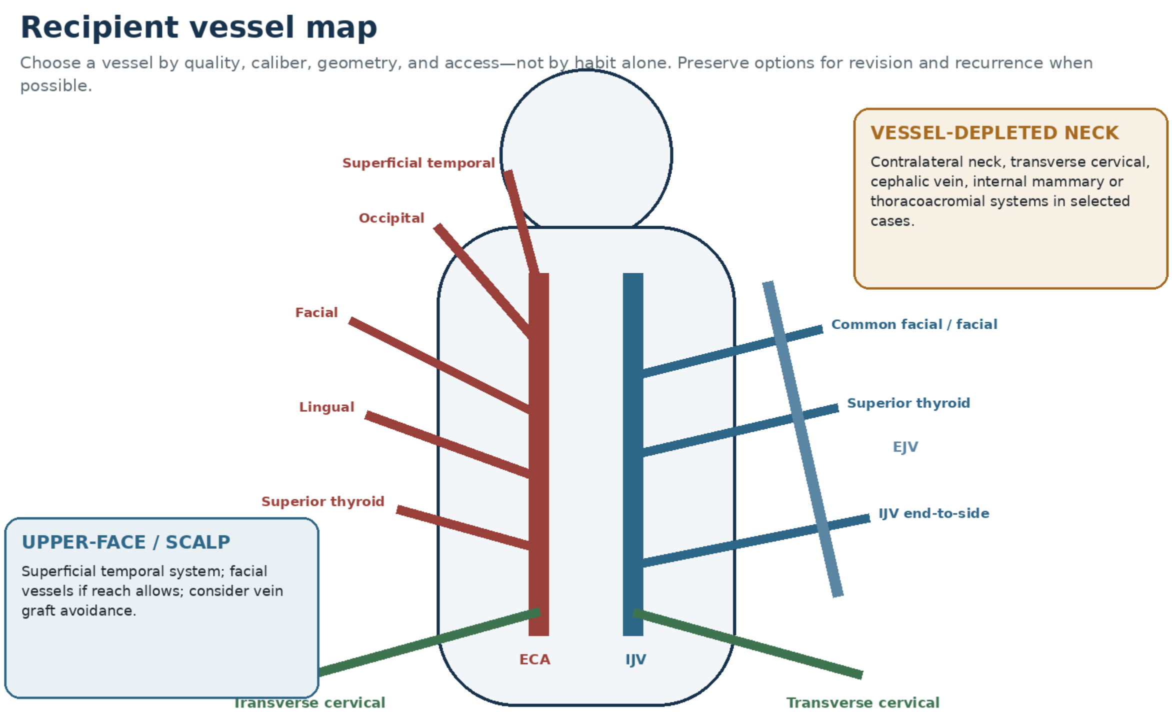


Figure 5. Conceptual recipient-vessel map. Common external carotid branches serve most primary necks; upper-face, scalp, and vessel-depleted defects may require alternative systems. Original synthesis diagram created for this guide.

Common external carotid branches

The facial, superior thyroid, and lingual arteries are common recipient choices in the neck. The facial artery often offers useful caliber and length for oral and midfacial defects. The superior thyroid artery is frequently available in the lower neck and has favorable proximity for many oral cavity reconstructions, although its caliber may be smaller. The lingual artery can be useful but may lie deep, particularly after neck dissection or radiation. The superficial temporal artery provides access for scalp, upper-face, and selected skull-base defects.

No universal hierarchy applies to every case. Published recipient-vessel algorithms provide useful anatomy, but individual caliber varies, and prior surgery can make a nominally “first-choice” branch inferior to a healthy alternative. The resident should describe the vessel’s wall quality, pulse, length, orientation, and relationship to the pedicle rather than defend a branch name in isolation.

End-to-end versus end-to-side

End-to-end anastomosis is technically familiar and isolates the flap from downstream resistance in the divided recipient branch. It requires sacrificing that branch and usually demands reasonable caliber matching. End-to-side anastomosis to the external carotid artery or another larger vessel preserves distal continuity and can solve severe size mismatch, but it requires careful arteriotomy, favorable access, and a geometry that avoids a sharp takeoff angle.

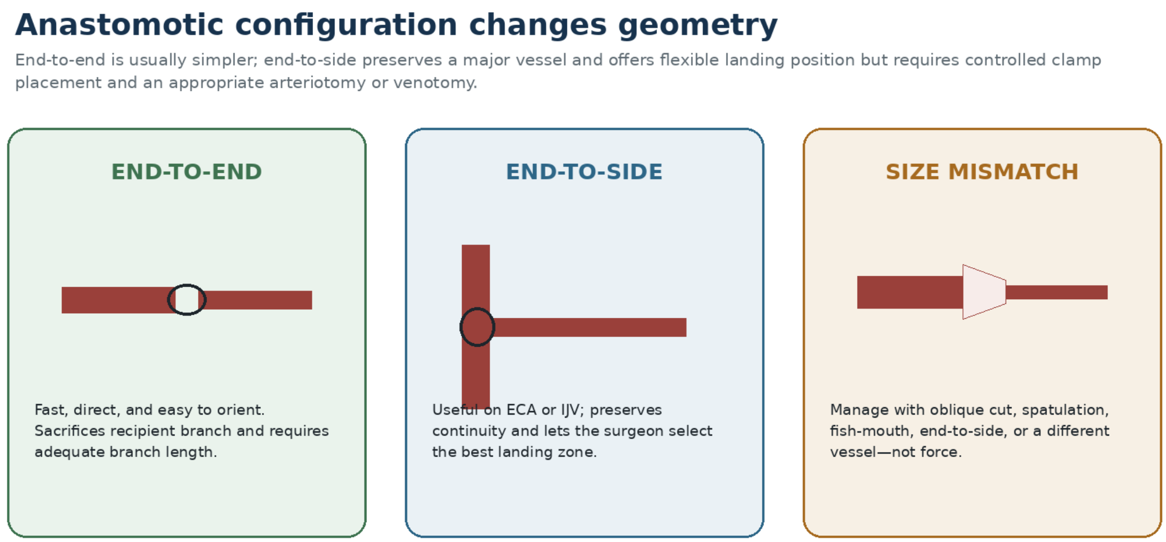


Figure 6. End-to-end, end-to-side, and size-mismatch configurations. The configuration should reduce tension and turbulence rather than merely satisfy convention. Original synthesis diagram created for this guide.

BOARDS PEARL The preferred recipient artery is a healthy, accessible vessel with adequate caliber and length that permits a tension-free, non-kinked pedicle. Prior radiation or surgery changes the hierarchy.

CHAPTER 8

Recipient Veins and Venous Outflow

A low-pressure system has little tolerance for compression or poor geometry

Venous problems are a major cause of early flap compromise because outflow depends on a compliant, low-pressure pathway. A vein may look generous under the microscope yet collapse after closure, neck rotation, edema, or drain suction.

Common venous options

Internal jugular branches, the common facial vein, the external jugular vein, and direct end-to-side internal jugular anastomosis are widely used. The internal jugular system offers high-capacity central drainage and is often preferred when available. The external jugular vein can be convenient and superficial but may be more exposed to positional compression or prior ligation. The best choice depends on wall quality, length, valve position, geometry, and what the final closure will do to the vessel.

One vein or two?

A single technically sound venous anastomosis is sufficient for many flaps. A second vein may provide redundancy or improve drainage when the flap has distinct venous territories, questionable crossover, a large volume, or an especially high consequence of congestion. However, a second anastomosis is not automatically protective. It adds operative time and another opportunity for thrombosis, and one compromised pathway can sometimes transmit misleading flow signals. The decision should reflect flap anatomy and risk rather than ritual.

Venous couplers

Mechanical couplers can provide rapid, reproducible intima-to-intima venous approximation when the vessel walls are healthy and the size is appropriate. The largest device that fits without overstretching is generally preferred because small diameter increases resistance and makes minor technical irregularities more consequential. Couplers do not eliminate the need to inspect for twist, tension, valve interference, wall injury, or poor outflow beyond the anastomosis.

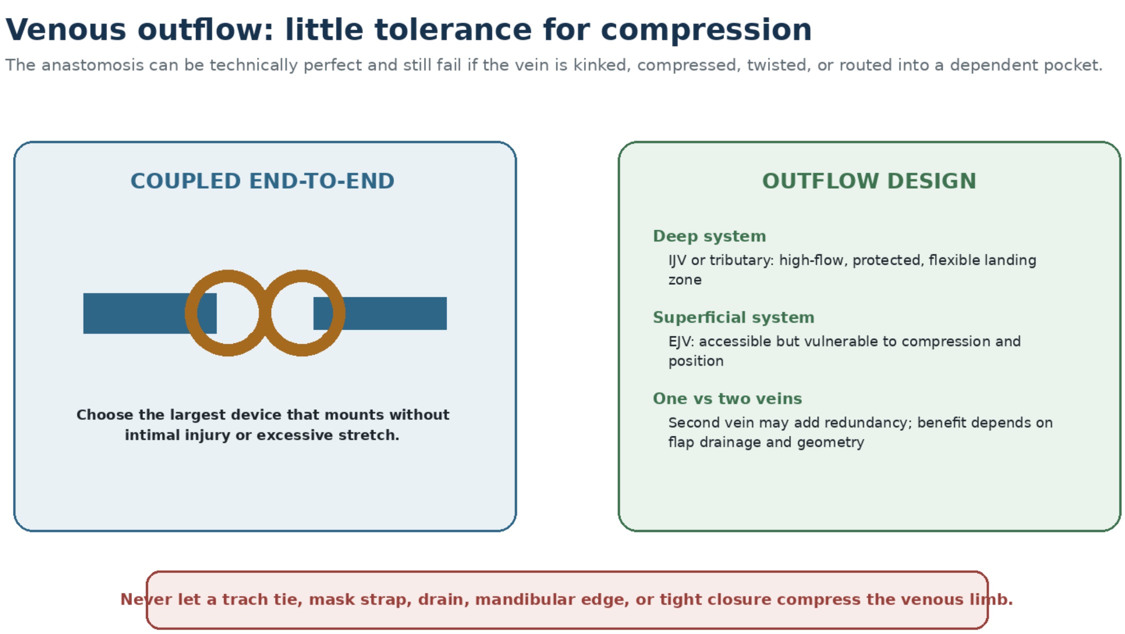


Figure 7. Venous outflow design. Coupling simplifies approximation, but final success depends on the entire low-pressure pathway. Original synthesis diagram created for this guide.

Table 5. Venous outflow strategies.

Venous strategy	When it is attractive	Major concern
Branch of internal jugular system	Primary neck with healthy branch and favorable orientation.	Short branch, clip injury, or tension after inset.
End-to-side internal jugular vein	Large caliber mismatch, limited branches, or vessel-depleted neck.	Requires exposure and careful venotomy; geometry must avoid a flat or kinked takeoff.
External jugular vein	Superficial access, useful length, or preservation during neck dissection.	Compression, positional change, and prior ligation or scarring.
Second venous anastomosis	Independent venous territories, large flap, limited crossover, or high-risk outflow.	Added time and complexity without guaranteed benefit.
Vein graft or transposition	No local vein reaches without tension.	Additional anastomoses, thrombosis risk, and another potential compression point.

CHAPTER 9

The Vessel-Depleted Neck

Replace improvisation with a preoperative hierarchy of alternative systems

A vessel-depleted neck is not defined merely by prior radiation. It is a neck in which conventional recipient vessels are absent, injured, scarred, unreliable, or geometrically unusable because of previous surgery, radiation, infection, thrombosis, tumor, or prior reconstruction.

Preoperative strategy

Review prior operative reports and imaging, identify the previous flap pedicle, and examine both sides of the neck. CTA can define arterial continuity and may identify venous patency, although operative exploration remains definitive. Plan the donor flap around the recipient problem: a long-pedicle ALT, radial forearm, or latissimus construct may avoid a graft that a shorter-pedicle flap would require.

The safest progression is usually from a healthy local branch to another ipsilateral system, then the contralateral neck, then remote recipient vessels or transposition. The sequence depends on defect location. Transverse cervical vessels can be valuable below a previously dissected or irradiated field. Superficial temporal vessels may serve upper-face and scalp defects. The thoracoacromial system and cephalic vein can provide rescue options. Direct external carotid or internal jugular end-to-side anastomosis may use central vessels that remain patent when smaller branches are unavailable.

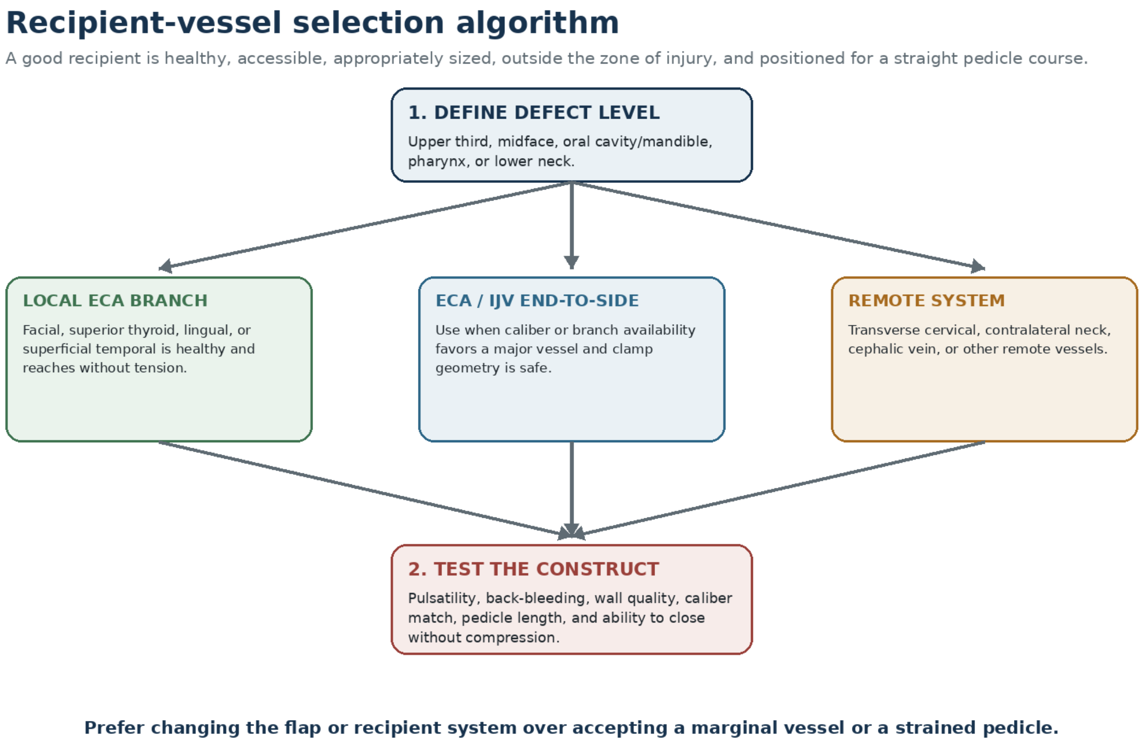


Figure 8. Recipient-vessel selection algorithm. Test both the vessel and the completed geometry before accepting the plan. Original synthesis diagram created for this guide.

Vein grafts and arteriovenous loops

Interposition grafts solve distance but create additional anastomoses and a longer conduit vulnerable to twist, compression, and thrombosis. They should not be used simply because a poorly planned flap is short. First consider a longer-pedicle flap, pedicle repositioning, contralateral vessels, vessel transposition, or a different recipient system. When a graft is necessary, the route should be short, protected, and marked so that orientation is preserved.

Staged arteriovenous loops and other complex constructs can be lifesaving in selected cases, but they belong to deliberate high-risk planning. Their use should prompt discussion of the patient’s prognosis, available alternatives, donor morbidity, and the consequence of failure.

> **ORAL BOARDS** For a previously irradiated, bilateral neck-dissection patient, do not answer with one “magic” vessel. Describe review of imaging and prior operative notes, a hierarchy of ipsilateral/contralateral/remote vessels, preference for a long-pedicle flap, and a backup that avoids unnecessary grafts.

CHAPTER 10

Microvascular Anastomosis: First Principles

The goal is a smooth endothelial conduit that remains stable after reperfusion and closure

The technical details vary by surgeon, but the physiologic requirements are constant: healthy intima, adequate lumen, minimal tension, no twist, no leak that compromises flow, and no external condition that later collapses the construct.

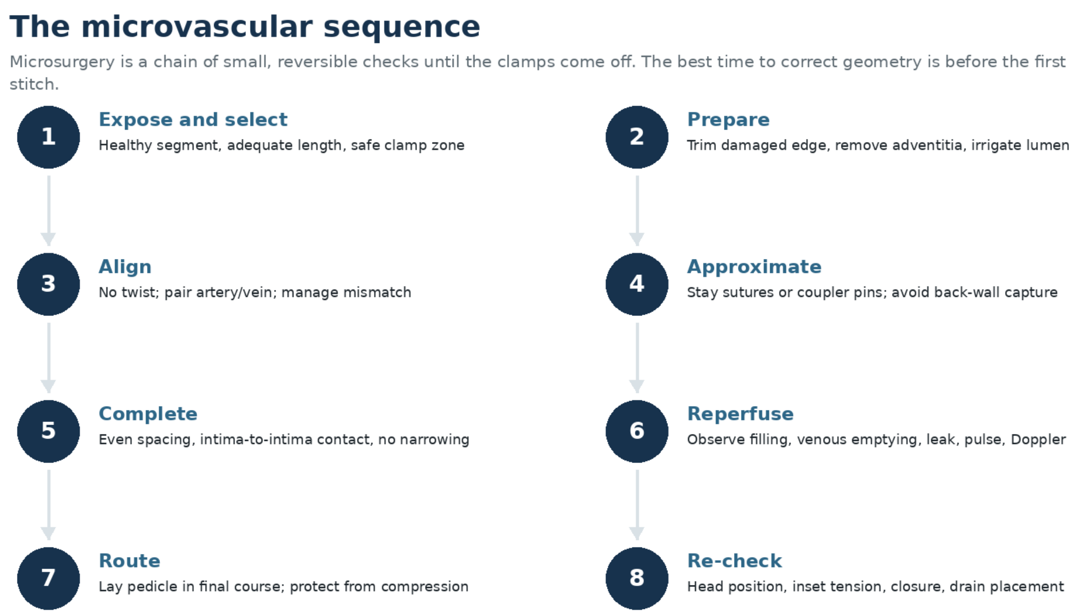


Figure 9. The microvascular sequence from exposure through final recheck. Original synthesis diagram created for this guide.

Vessel preparation

Expose enough vessel to permit comfortable clamp placement and approximation, but avoid unnecessary skeletonization. Remove adventitia from the cut edge so it does not enter the lumen, while preserving the media and avoiding thermal or crush injury. Irrigate and inspect the lumen for thrombus, intimal flap, plaque, dissection, or a damaged segment. A questionable recipient edge should be revised before suturing rather than explained away after poor flow.

The pedicle should reach the recipient without traction. If the vessels pull apart when the clamps are released, the problem is geometry, not suture strength. Conversely, excessive redundancy can create a loop that twists after neck rotation. Marking the vessel surface before transfer can help maintain orientation.

Approximation and suture placement

Sutures should approximate the full thickness of the vessel wall without incorporating the back wall or leaving exposed adventitia in the lumen. Bite size and spacing should be proportional to vessel caliber. Unequal spacing can create purse-string narrowing; overly large bites invert or bunch the wall. Before completing the anastomosis, inspect the posterior wall and irrigate the lumen according to institutional practice.

Size mismatch

Mild mismatch can be managed by distributing sutures asymmetrically, beveling the smaller vessel, fish-mouthing, or selecting a more compatible recipient. Severe mismatch may favor end-to-side anastomosis or a different recipient vessel. The correct response is the one that creates a smooth lumen without forcing the smaller wall to pucker around a larger circumference.

Reperfusion

After clamp release, observe arterial filling, venous drainage, flap color, capillary refill, and bleeding from a controlled edge when appropriate. A pulse in the artery does not prove tissue perfusion, and an audible Doppler does not prove adequate venous outflow. The entire flap should warm and change in a coherent way. Persistent pallor, progressive congestion, poor venous filling, or a weak signal should be investigated before closure.

> **TECHNICAL PRINCIPLE** Never use a final stitch, heparin dose, or prolonged observation to compensate for unresolved tension, twist, poor vessel wall, or an inadequate recipient. Correct the mechanical problem.

CHAPTER 11

Pedicle Routing and Protection

A patent anastomosis can still fail if the route is wrong

Pedicle geometry changes during inset, fixation, closure, drain placement, tracheostomy positioning, and patient movement. The route should be designed for the final postoperative configuration, not merely for the open operative field.

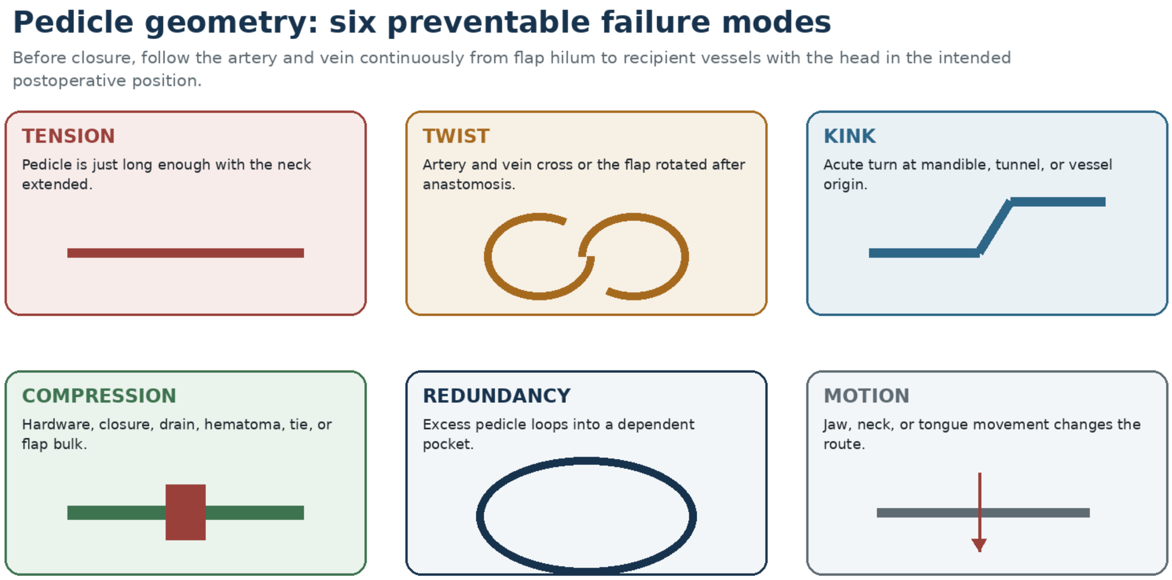


Figure 10. Six preventable pedicle failure modes: tension, twist, kink, compression, excessive redundancy, and motion. Original synthesis diagram created for this guide.

Tunnels and turns

A pedicle tunnel should be wide, smooth, and direct. Sharp fascial edges, residual digastric or stylohyoid bands, a narrow mandibular tunnel, or a constricting skin bridge can become fixed compression points when edema develops. Passing the pedicle before the flap is fully committed allows the team to feel resistance and enlarge the route.

Turns should be broad. A vessel may tolerate a curve but not a hinge. The vein deserves special attention because it can flatten against a plate, mandibular edge, hyoid, tracheostomy flange, or tight fascial closure. The pedicle should not cross a suction drain or lie where a drain can migrate onto it.

Redundancy and fixation

Some slack is needed to tolerate swelling and movement, but an overly long pedicle can loop and twist. Redundancy should be arranged in a single visible curve rather than packed into a small cavity. Strategic soft-tissue support or loose fixation can prevent migration, but circumferential sutures around the pedicle are dangerous.

Position testing

Before closure, place the head and neck through the range likely to occur postoperatively. Confirm that neutral position is safe, then test gentle rotation and extension according to the defect and airway. The postoperative restriction should be based on observed geometry: “avoid left rotation because it tensions the pedicle” is more useful than a generic “keep head midline.”

CHAPTER 12

Inset, Dead Space, Hardware, and Watertight Closure

Inset is layered reconstruction, not skin closure

The inset should be planned as a sequence of barriers, volume replacement, structural support, pedicle protection, and monitoring. A cosmetically neat skin closure cannot rescue a dead space, exposed plate, or salivary leak onto the pedicle.

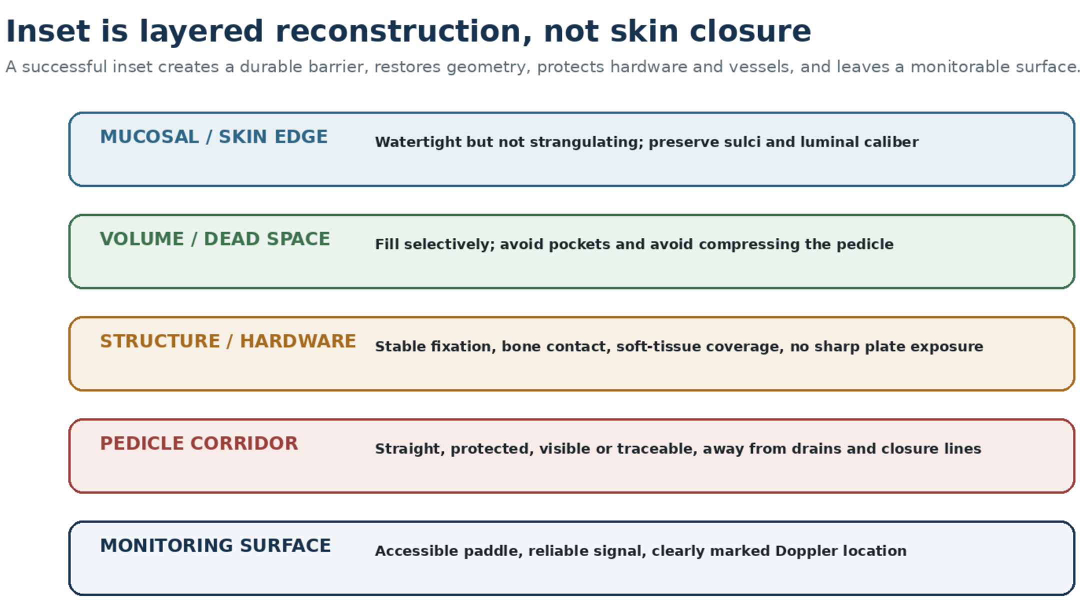


Figure 11. The layers of inset: epithelial barrier, volume, structure, pedicle corridor, and monitoring surface. Original synthesis diagram created for this guide.

Deep and inaccessible sutures first

Deep pharyngeal, palatal, skull-base, or posterior oral sutures should be placed before access is lost. The suture line should include viable tissue without strangulating the flap. In mucosal reconstruction, a watertight closure is desirable, but the deeper principle is a durable barrier that does not place excessive tension on friable irradiated edges.

Quilting can eliminate dead space and shape a flap, but it must not compress perforators or the main pedicle. Muscle may be used to fill irregular cavities and cover hardware, while a skin paddle provides lining or external cover. The components should be assigned distinct jobs rather than packed indiscriminately into the defect.

Dead space and salivary contamination

Dead space invites hematoma, seroma, infection, and dependent fluid around the pedicle. In the oral cavity and pharynx, the reconstruction should direct saliva away from major vessels and hardware.

A small leak over well-vascularized tissue may heal; the same leak onto a plate or carotid can become catastrophic.

Hardware coverage

Plates and mesh require stable fixation and durable soft-tissue coverage. The flap should cover sharp edges and screw heads without creating a thin, high-pressure interface under irradiated skin. When hardware lies near the pedicle, confirm that swelling cannot trap the vein between the plate and a rigid structure.

Table 6. Final inset tests.

Inset goal	Practical test before closure
Watertight barrier	Inspect the entire suture line under direct vision; probe corners and junctions that will be inaccessible after closure.
Dead-space control	Look for dependent cavities; confirm that the flap fills rather than roofs over the space.
Hardware protection	Verify vascularized tissue over plates, mesh, bone edges, and screw heads.
Pedicle corridor	Trace artery and vein continuously from flap to recipient; identify every turn and potential compression point.
Functional geometry	Check tongue mobility, sulcus depth, oral aperture, occlusion, pharyngeal caliber, orbital position, or facial contour as relevant.
Monitoring access	Confirm the surface and signal remain accessible after swelling and dressings.

CHAPTER 13

Osseous Fixation, Occlusion, and Dental Planning

Bone must restore a functional coordinate system, not merely bridge a gap

In mandibular and maxillary reconstruction, the bone segments define the position of soft tissue, dentition, tongue, orbit, and facial contour. Small errors at fixation can produce large functional consequences.

Mandibular fixation

Re-establish occlusion and condylar seating before final plate fixation whenever the native dentition and temporomandibular joints allow it. The native mandibular segments should be reduced to their pre-resection relationship; the flap then fills the planned gap. An apparently smooth inferior border can conceal a widened arch, rotated ramus, shortened projection, or lingual displacement of the neomandible.

Bone contact should be broad enough for healing, with viable periosteal and segmental blood supply preserved. Osteotomies should not crush the pedicle or perforators. Plate position must anticipate soft-tissue coverage, future radiation, and possible dental implants. Excessive stripping to make the bone look tidy undermines the biologic advantage of vascularized bone.

Maxillary and orbital fixation

The maxilla is a three-dimensional buttress system. Reconstructive priorities may include alveolar position, palatal separation, zygomatic projection, nasal support, and orbital floor. The chosen bony endpoint should reflect which functions matter most. Globe position should be assessed before edema obscures the anatomy, and orbital reconstruction should avoid overpacking that elevates the globe or under-support that causes hypoglobus and enophthalmos.

Dental rehabilitation

Dental planning should occur before osteotomy when meaningful rehabilitation is a goal. The bone can be positioned to recreate the inferior facial contour or to place the alveolar segment for implants; these targets are not always identical. Immediate implants may reduce treatment stages in selected patients, but oncologic timing, radiation, bone geometry, hygiene, and prosthodontic resources matter. The resident should recognize dental rehabilitation as part of the initial coordinate system rather than an afterthought.

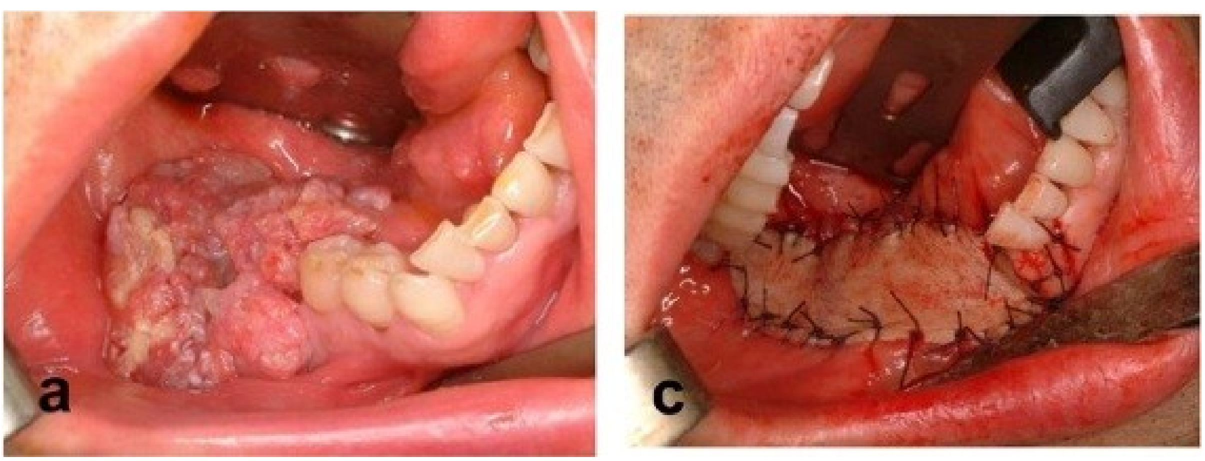


Figure 12. Fibula osteocutaneous reconstruction of an oromandibular defect, demonstrating the linked relationship among bone, plate, skin paddle, and oral lining. Kim et al., 2020; CC BY 4.0.

CHAPTER 14

Airway, Drains, Monitoring Paddle, and Donor-Site Closure

The final closure must protect both the reconstruction and the patient

The last hour of the operation can undo the previous ten. Airway devices, drains, tight skin, dressings, splints, and donor-site closure all change pressure around the flap and determine what the postoperative team can safely examine.

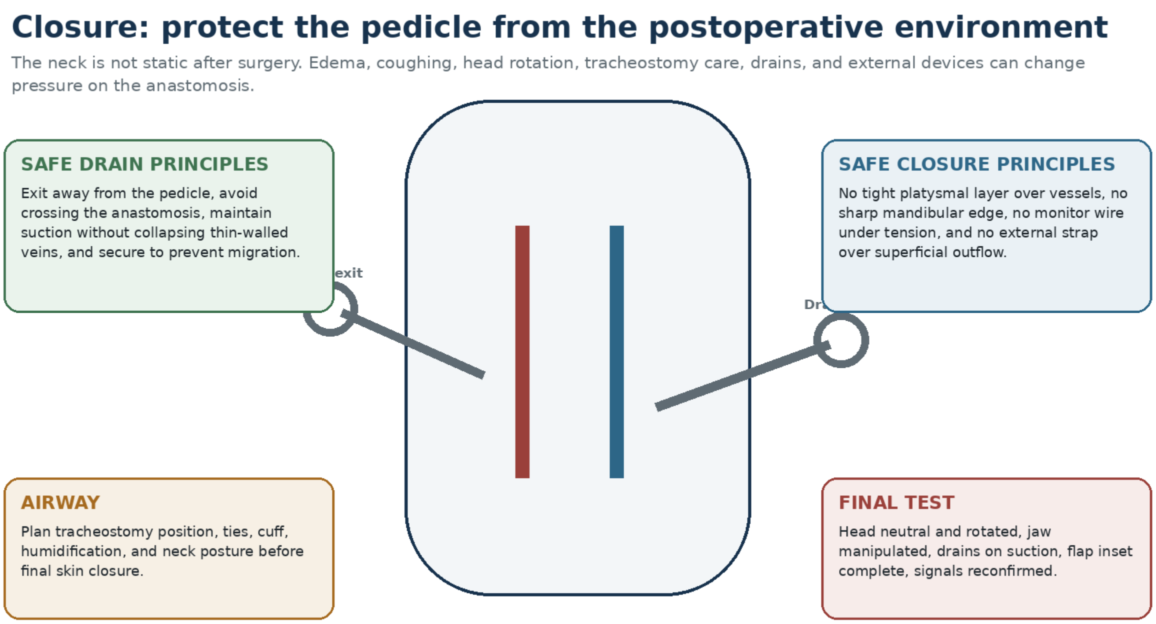


Figure 13. Closure principles: protect the pedicle, choose safe drain trajectories, secure the airway, and reproduce the final head and neck position before leaving the room. Original synthesis diagram created for this guide.

Airway strategy

Tracheostomy decisions depend on defect size, tongue or floor-of-mouth edema, bilateral neck dissection, prior radiation, expected bleeding, pulmonary reserve, and access for urgent reintubation. A tracheostomy can provide a controlled airway but introduces a flange, ties, secretions, and neck motion near the pedicle. The tube and securing method must not compress the recipient field. When extubation is planned, the team should anticipate progressive edema and have a clear rescue pathway.

Drains

Drains should evacuate dependent spaces without crossing, suctioning, or abrading the pedicle. The fenestrated segment should not lie directly on the anastomosis. Drains should exit away from the monitoring site and be secured against migration. Excessive suction can collapse a vein when the drain lies in a confined space; the risk is geometric, not simply determined by the drain brand or pressure setting.

Monitoring paddle and baseline

The monitor should be visible, reachable, and interpretable. Before dressings are applied, document color, temperature, capillary refill, tissue turgor, pinprick response if used, and Doppler location and quality. Mark the signal with a stitch or skin mark according to local practice. A postoperative team cannot recognize change without a reproducible baseline.

Donor-site closure

Primary closure should not be forced under tension. Skin grafts require a stable bed, hemostasis, and a bolster that does not compress underlying nerves or vessels. Splints should protect the graft while avoiding pressure injury. For fibula harvest, confirm distal perfusion, protect the common peroneal nerve, maintain ankle position, and document the postoperative weight-bearing plan. For ALT or forearm harvest, document motor and sensory expectations, drain location, and graft care.

CHAPTER 15

Hemodynamics, Fluids, Vasopressors, Transfusion, and Temperature

Flap perfusion is a whole-patient problem

The flap has no autoregulatory reserve beyond its vascular construct. Perfusion depends on cardiac output, perfusion pressure, vascular resistance, venous pressure, oxygen delivery, temperature, and the absence of mechanical obstruction.

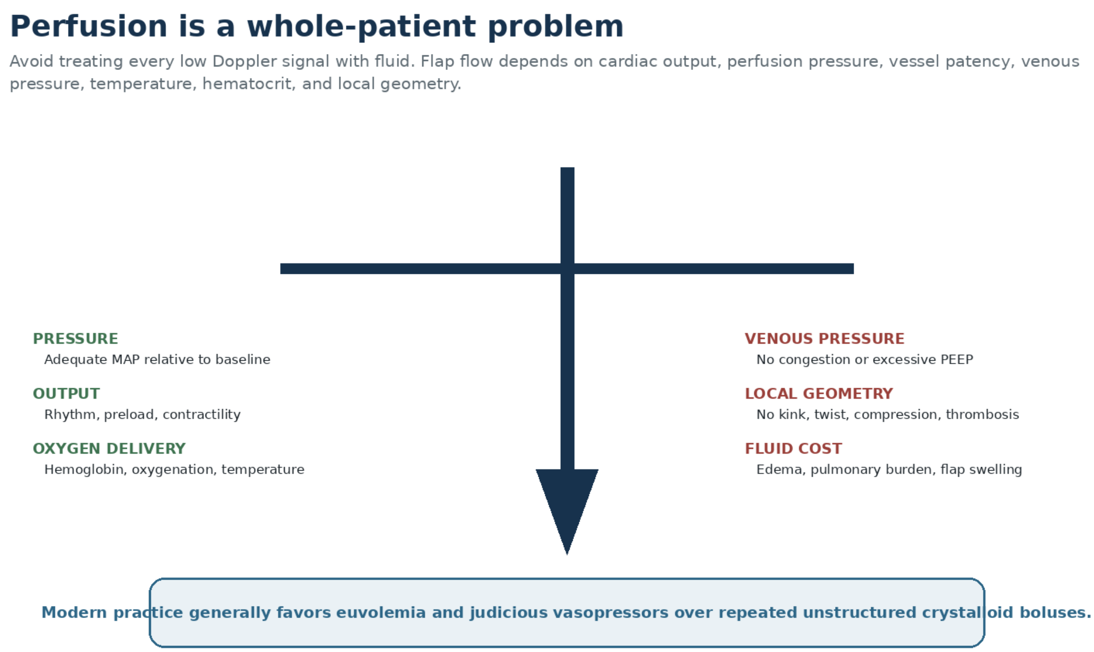


Figure 14. Flap perfusion as a balance of systemic pressure, venous pressure, oxygen delivery, and fluid cost. Original synthesis diagram created for this guide.

Blood pressure and vasopressors

Hypotension should be evaluated rather than reflexively treated with liters of crystalloid. Determine whether the cause is vasodilation, bleeding, low preload, myocardial dysfunction, anesthetic depth, or mechanical impairment of venous return. Modern evidence does not support an absolute prohibition on vasopressors in head and neck free-flap surgery. Judicious, physiology-guided vasopressor use can maintain perfusion pressure and may be safer than repeated unstructured fluid boluses.

There is no universal mean arterial pressure target for every patient. The goal is adequate organ and flap perfusion near the patient’s physiologic baseline while avoiding severe hypertension that promotes bleeding and hematoma. A low Doppler signal in a hypotensive patient may improve with systemic correction, but a persistent abnormal flap examination still requires mechanical evaluation.

Fluids

Both hypovolemia and fluid overload are harmful. Excess crystalloid contributes to flap edema, airway edema, venous congestion, cardiopulmonary complications, and prolonged recovery. Goal-directed or restrictive strategies use clinical examination, blood loss, urine output in context, hemodynamic trends, and dynamic indices when appropriate rather than a fixed volume formula. Colloid choice and use remain institution-specific.

Transfusion and oxygen delivery

Anemia reduces oxygen-carrying capacity, but transfusion increases viscosity, volume, and exposure to transfusion-related complications. A restrictive, patient-specific strategy is generally favored rather than transfusion to an arbitrary high hematocrit. Active bleeding, myocardial ischemia, symptomatic anemia, poor oxygen delivery, or hemodynamic instability may justify transfusion at a higher value than an otherwise stable patient. Institutional protocols and the complete clinical context should guide the decision.

Temperature

Hypothermia causes vasoconstriction, coagulopathy, altered drug metabolism, and discomfort. Use active warming, warmed fluids, and efficient exposure management. A cold flap immediately after reperfusion may simply be equilibrating, but persistent coolness with pallor and poor refill is not explained by room temperature alone.

> **MODERN PRINCIPLE** Vasopressors are not inherently forbidden. The safer question is whether perfusion pressure is being restored with an appropriate amount of fluid and whether a mechanical cause of poor flap flow has been excluded.

CHAPTER 16

Antithrombotics, Antibiotics, Nutrition, and ERAS

Separate evidence-based supportive care from institutional ritual

Perioperative protocols vary widely because many interventions have limited or conflicting flap-specific evidence. The resident should understand the physiologic rationale, distinguish venous thromboembolism prophylaxis from microvascular thrombosis prophylaxis, and follow local pathways without presenting them as universal truths.

Antithrombotic therapy

Meticulous technique and correction of mechanical problems remain the primary prevention for anastomotic thrombosis. Aspirin, unfractionated heparin, low-molecular-weight heparin, dextran, and other regimens have all been used, but no single postoperative regimen has demonstrated universal superiority across head and neck free-flap populations. More aggressive anticoagulation can increase hematoma, which itself can compress the pedicle.

Standard venous thromboembolism prophylaxis addresses a different risk and is generally indicated according to patient and institutional protocols. The presence of a free flap does not eliminate the need for VTE prevention, nor does VTE prophylaxis prove that the microvascular anastomosis is protected.

Antibiotics

Most oncologic oral cavity and pharyngeal free-flap cases are clean-contaminated. Perioperative antibiotic choice should cover expected upper aerodigestive flora and follow institutional stewardship guidance. Prolonged antibiotics do not compensate for a salivary leak, devitalized tissue, unfilled dead space, or exposed hardware. Duration should be protocol-driven and reconsidered when the clinical situation changes.

Nutrition and glycemic control

Malnutrition is common in head and neck cancer and is associated with poor healing and complications. Enteral access and the feeding plan should be established before the operation. Early enteral nutrition is a common ERAS component when the reconstruction and local protocol permit it. Severe hyperglycemia should be avoided, but overly aggressive insulin therapy that produces hypoglycemia is also harmful.

Enhanced recovery

ERAS pathways integrate preoperative counseling, nutrition, multimodal analgesia, nausea prevention, fluid strategy, airway care, mobilization, tube management, and discharge planning. Their value is not a single medication but reduced variation and earlier return of function. Deviations should be deliberate and documented rather than accidental.

Table 7. ERAS domains and appropriate uncertainty.

Domain	High-level principle	What is not universal
Antithrombotics	Meticulous technique; correct mechanical causes; provide VTE prophylaxis according to risk.	Aspirin dose, heparin regimen, dextran use, or duration of flap-specific therapy.
Antibiotics	Appropriate clean-contaminated prophylaxis and stewardship.	Exact agent and duration across institutions or allergy patterns.
Nutrition	Identify malnutrition, secure enteral access when needed, and feed early when safe.	Feeding route and postoperative day for every defect.
Analgesia	Multimodal opioid-sparing strategy while maintaining respiratory safety.	Exact medication bundle in renal, hepatic, bleeding, or airway risk.
Mobilization	Early mobilization with donor-site and pedicle precautions.	Weight-bearing and range-of-motion rules for every donor site.

CHAPTER 17

Intraoperative Troubleshooting Before Leaving the OR

A marginal flap is an indication to reopen the problem, not to transfer it to the ICU

Poor perfusion before closure may arise from the patient, the pedicle route, or the anastomosis. The diagnosis should be systematic and the final test should occur after the reconstruction is fully positioned and closed enough to reproduce postoperative conditions.

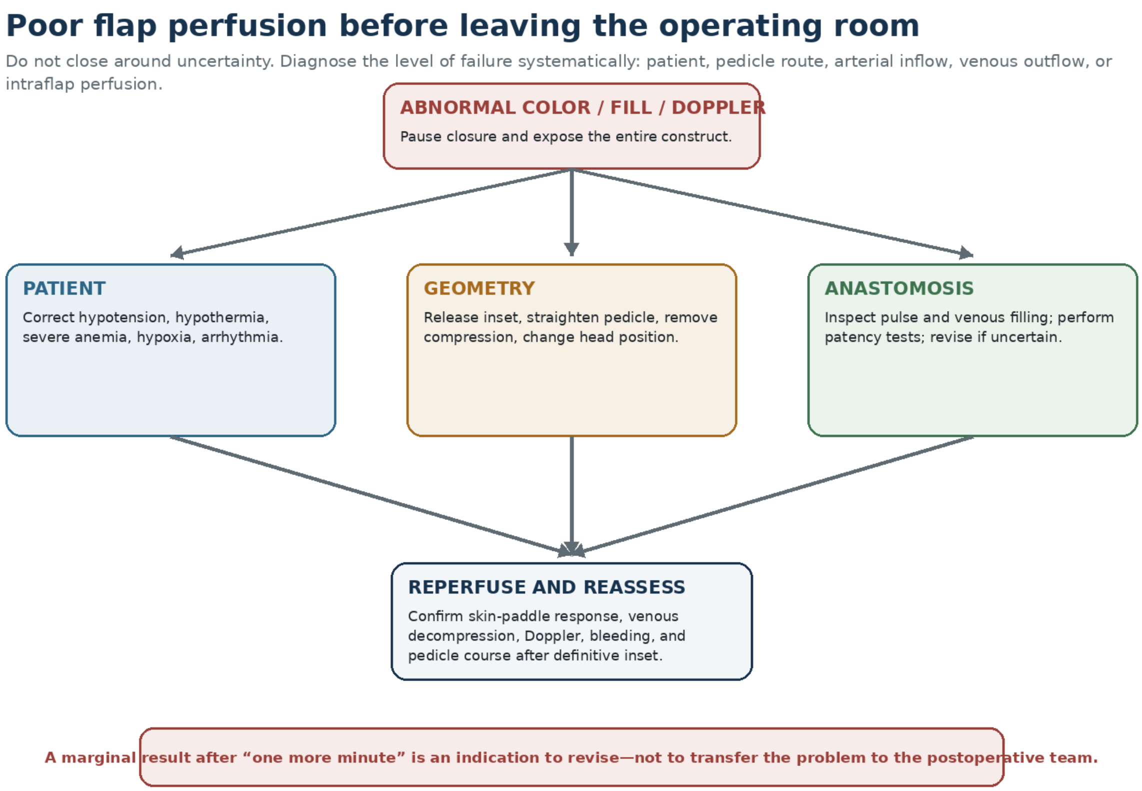


Figure 15. A structured approach to poor flap perfusion before leaving the operating room. Original synthesis diagram created for this guide.

Step 1: examine the whole patient

Correct severe hypotension, hypoxemia, hypothermia, anemia with impaired oxygen delivery, arrhythmia, or major acid-base disturbance. Confirm that the neck is not hyperextended and that external equipment is not compressing venous return. Systemic correction should occur in parallel with direct flap assessment, not instead of it.

Step 2: inspect the geometry

Open the closure as needed and trace the pedicle. Look for a tight tunnel, twisted vein, sharp turn, plate compression, drain contact, hematoma, redundant loop, or tension created by final inset.

Reposition the head and determine whether the signal changes. A positional signal is a mechanical diagnosis until proven otherwise.

Step 3: interrogate the anastomoses

Inspect arterial inflow and venous outflow directly. Evaluate pulsation, refill, venous filling, Doppler, and bleeding characteristics. If thrombosis or a technical defect is suspected, revise promptly. Repeated observation of an abnormal flap consumes salvage time without creating new information.

Step 4: recheck after the final environment is recreated

After correction, return the flap to its final position, replace drains and dressings, secure the airway, and repeat the baseline examination. A signal obtained only while the neck is open or the flap is lifted from the defect is not an acceptable endpoint.

> **NO TRANSFER OF UNCERTAINTY** A flap that remains pale, congested, cool, poorly refilling, or dependent on a nonphysiologic head position should not be sent to the postoperative unit for "close observation." Resolve the problem in the operating room.

CHAPTER 18

Documentation and Handoff

Transfer the vascular construct, not merely the operation name

The postoperative team must know what was built, where the pedicle lies, how the flap is monitored, what position is safe, and what change requires immediate escalation. A generic "free flap checks per protocol" order is not a reconstructive handoff.

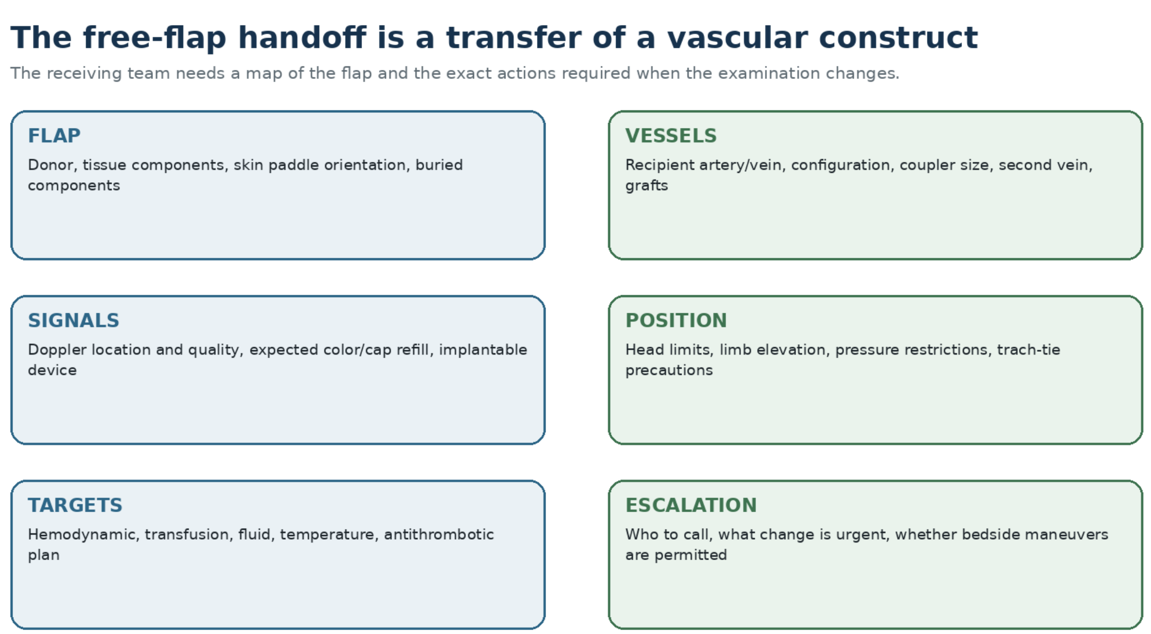


Figure 16. The free-flap handoff as transfer of a vascular construct. Original synthesis diagram created for this guide.

Operative documentation

Document the defect, flap type and laterality, tissue components, perforators, bone segments and osteotomies, hardware, recipient artery and vein, anastomotic configuration, coupler size if used, ischemia time, pedicle route, monitoring method and location, baseline examination, drains, airway, donor-site closure, and any intraoperative concern or revision. If the flap was salvaged intraoperatively, state what failed and what was corrected.

Postoperative restrictions

Position restrictions should be specific to the construct. Describe head rotation, flexion, extension, tracheostomy tie placement, blood-pressure goals or acceptable range per local protocol, fluid concerns, weight-bearing, splinting, and whether oral suctioning or manipulation is restricted. State which team should be called and whether any bedside maneuver is permitted before the reconstructive surgeon arrives.

The receiving examination

The receiving nurse and resident should examine the flap with the operative team when feasible. Agree on the Doppler location and quality, color, capillary refill, temperature, turgor, and expected pinprick response if that technique is used. This shared baseline reduces false alarms and, more importantly, prevents true change from being normalized as “probably how it looked in the OR.”

> **HANDOFF SENTENCE** “This is a left ALT flap with one skin paddle lining the tongue and floor of mouth. The artery is end-to-end to the superior thyroid artery and the vein is coupled to a common facial branch. The pedicle exits posteriorly and is tensioned by rightward head rotation. The marked Doppler is strong and triphasic; the paddle is warm, pink, and refills in 2 seconds. Any signal loss, progressive duskiness, or neck swelling is an immediate call.”

CHAPTER 19

Integrated Clinical Cases and Oral-Boards Reasoning

Explain the plan, execute the branch points, and protect the final geometry

The strongest oral-boards answer is organized around the patient, defect, construct, recipient vessels, execution sequence, and contingency plan. The following cases emphasize decisions rather than memorized flap names.

Case 1: primary oral cavity composite defect

A 58-year-old with lateral tongue, floor-of-mouth, and mandibular body squamous cell carcinoma undergoes ipsilateral neck dissection and segmental mandibulectomy. CTA shows suitable lower-extremity runoff. Describe your reconstructive execution.

MODEL ANSWER Confirm final margins and defect, design a fibula osteocutaneous flap around the oral lining and bone requirements, and preserve a monitorable skin surface. Prepare the recipient artery and vein before division. Establish mandibular geometry and occlusion, route the pedicle in a broad protected curve, perform a tension-free anastomosis, complete watertight oral inset and hardware coverage, then test the construct after drains, airway, and final head position. A scapular-system flap is a reasonable backup if the leg or skin-paddle anatomy is unsuitable.

Case 2: prior bilateral neck treatment

A patient requires salvage total laryngopharyngectomy after prior radiation, bilateral neck dissections, and a previous radial forearm flap. CTA shows patent transverse cervical vessels and internal carotid systems but few conventional external carotid branches.

MODEL ANSWER Review prior operative reports, choose a long-pedicle flap that provides the required conduit, and plan recipient vessels before incision. Transverse cervical vessels, contralateral or central end-to-side configurations, cephalic transposition, or other remote systems are considered according to geometry. Avoid an interposition graft if a longer pedicle or alternative system can provide a direct route. Prepare a regional-flap or staged backup if microvascular options fail.

Case 3: weak signal after closure

A radial forearm flap is warm and pink with a strong signal before closure. After the skin is closed and the head is turned neutral, the signal becomes intermittent and the paddle darkens.

MODEL ANSWER Treat the change as mechanical. Reopen the closure, return the head to the position with good flow, inspect the vein and pedicle route, remove compression from tunnel, drain, plate, or soft tissue, and correct twist or tension. Recheck after recreating the final position. Do not transfer the patient with a position-dependent signal.

Case 4: hypotension during anastomosis

During a prolonged free-flap case, the patient becomes hypotensive after receiving a large crystalloid volume. The flap is edematous but has a patent arterial anastomosis.

MODEL ANSWER Evaluate cause and volume responsiveness rather than continuing reflexive crystalloid. Correct bleeding, anesthetic depth, cardiac dysfunction, vasodilation, temperature, and oxygen delivery. Judicious vasopressor support is acceptable when indicated and may avoid worsening edema. Assess venous outflow and pedicle geometry because systemic treatment does not exclude a mechanical problem.

Case 5: VSP no longer matches the margin

A patient-specific mandibular cutting guide was designed for a lateral defect. Frozen section requires extension across the symphysis.

MODEL ANSWER Oncologic clearance supersedes the digital plan. Re-audit the defect, determine the new functional requirement for anterior arch and tongue support, and revise the construct freehand or with available backup guides and plate options. Confirm occlusion, projection, skin-paddle reach, and pedicle geometry. Do not force the planned segments to bridge an unplanned defect.

CHAPTER A

Operative Planning Checklist

A compact preoperative and intraoperative checklist

Table A1. Free-flap operative planning checklist.

Domain	Checklist
Patient	Goals, prognosis, frailty, nutrition, tobacco, vascular disease, prior radiation/surgery, donor-site function, airway risk.
Defect	Subsite, lining, external cover, volume, bone, dead space, vital structures, plausible margin extensions.
Flap	Primary and backup donor, laterality, tissue components, dimensions, perforator plan, monitoring surface, donor closure.
Vessels	Primary artery/vein, configuration, pedicle length and route, imaging, backup systems, graft avoidance strategy.
Logistics	Position, two-team access, microscope, couplers, plates/guides, tourniquet, warming, graft/bolster supplies.
Before division	Final defect confirmed, recipient vessels prepared, equipment ready, orientation marked, margins understood.
Before closure	Perfusion baseline, pedicle traced, dead space filled, hardware covered, drains safe, airway secured, position tested.
Handoff	Construct, vessels, route, signal, position, targets, donor restrictions, escalation trigger, responsible team.

CHAPTER B

Recipient Vessel Quick Reference

Common systems and the problem each can solve

Table B1. Recipient vessel systems.

System	Typical role	Key caution
Facial artery / common facial vein	Oral cavity, midface, and many primary neck reconstructions.	Prior ligation, short length, or tension across the mandible.
Superior thyroid artery	Reliable lower-neck recipient in many primary cases.	Smaller caliber and deep orientation in scarred neck.
Lingual artery	Useful caliber and proximity for oral/pharyngeal defects.	Deep dissection and proximity to hypoglossal nerve.
Internal jugular branches	High-capacity venous drainage.	Branch injury, clip damage, or limited mobility.
External carotid / internal jugular end-to-side	Central solution for size mismatch or branch-depleted neck.	Higher technical demand and need for safe central-vessel exposure.
External jugular vein	Superficial and accessible alternative.	Compression and positional vulnerability.
Transverse cervical system	Often outside prior neck-dissection field; useful in vessel-depleted neck.	Distance and pedicle route across lower neck.
Superficial temporal system	Scalp, upper face, and selected skull-base defects.	Small caliber, tortuosity, and temporal-branch anatomy.
Thoracoacromial / cephalic transposition	Remote rescue inflow or outflow.	Long route, additional dissection, and compression points.
Contralateral neck	Healthy conventional vessels when pedicle length permits.	Cross-neck route, tension, and future treatment implications.

CHAPTER C

Free-Flap Handoff Template

A structured transfer for the postoperative team

- Flap: donor site, side, tissue components, inset location, buried components, monitoring paddle.
- Vessels: recipient artery and vein, end-to-end or end-to-side, coupler size, second vein, revisions.
- Pedicle: route, exit from flap, known tight spaces, relationship to plate, tracheostomy, and drains.
- Baseline: color, temperature, refill, turgor, Doppler location and quality, pinprick response if used.
- Position: permitted head and neck position, movements to avoid, tracheostomy tie and pillow precautions.
- Targets: hemodynamic range per protocol, temperature, transfusion considerations, antithrombotics, antibiotics, feeding.
- Donor: splint, graft or bolster, drain, distal perfusion, neurologic examination, weight-bearing and mobility.
- Escalation: exact findings that require immediate call, who to contact, and what bedside actions are or are not permitted.

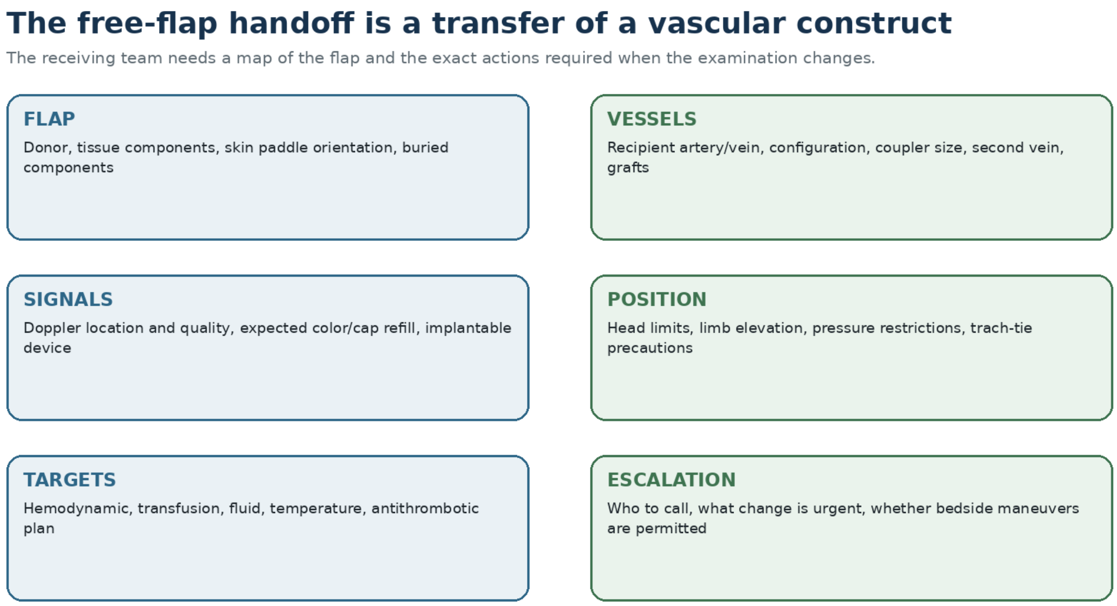


Figure C1. The handoff domains at a glance. Original synthesis diagram created for this guide.

CHAPTER D

Last-Minute Boards Pearls

High-yield distinctions for rapid review

- The best recipient vessel is healthy and geometrically favorable, not merely the largest named branch.
- Prepare recipient vessels before pedicle division whenever feasible.
- Oncologic margins override VSP, cutting guides, and the preferred flap design.
- End-to-end is familiar and simple; end-to-side preserves continuity and can solve major size mismatch.
- Venous outflow is vulnerable to compression, head position, drains, and closure even when the anastomosis is technically perfect.
- A second vein is selective redundancy, not a universal requirement.
- Couplers simplify venous approximation but do not correct twist, tension, poor wall quality, or downstream obstruction.
- In the vessel-depleted neck, use prior operative notes and imaging, plan a hierarchy, and prefer a long pedicle over an avoidable graft.
- A wide smooth tunnel is safer than a tight “anatomic” tunnel.
- Inset should create a barrier, fill dead space, cover hardware, protect the pedicle, and preserve functional geometry.
- Judicious vasopressors are acceptable; avoid treating every hypotensive episode with unstructured crystalloid.
- No universal antithrombotic regimen substitutes for meticulous technique and mechanical correction.
- Recheck the signal after final closure, drains, airway, dressings, and head position.
- A marginal flap should be corrected in the operating room, not sent for observation.
- The postoperative team needs the construct, pedicle route, baseline, position, and escalation trigger - not just the flap name.

CHAPTER E

Glossary

Operative terms used throughout this volume

Table E1. Glossary.

Term	Definition
Arteriotomy / venotomy	An opening created in the side of a recipient vessel for an end-to-side anastomosis.
Chimeric flap	Multiple tissue components supplied by branches of a common source pedicle, allowing relative independent positioning.
Coupler	Mechanical ring-and-pin device used most commonly for venous anastomosis.
End-to-end	Anastomosis between divided ends of donor and recipient vessels.
End-to-side	Donor vessel connected to an opening in the side of a recipient vessel that remains continuous.
Ischemia time	Interval during which the transferred tissue lacks perfusion after pedicle division until reperfusion.
Pedicle	The flap artery, vein or veins, and associated tissues connecting the flap to recipient circulation.
Recipient vessel	Native vessel used to provide inflow or outflow to the flap.
Vessel-depleted neck	Previously treated or diseased neck in which conventional recipient vessels are absent, damaged, or unusable.
Virtual surgical planning	Digital workflow using imaging, segmentation, modeling, guides, and/or patient-specific implants to transfer a skeletal plan.
Warm ischemia	Ischemia at body or room temperature after flap division; clinically influenced by transfer and anastomosis workflow.
Watertight closure	A continuous epithelial barrier intended to prevent salivary or other contaminated leakage into the neck or deep spaces.

CHAPTER F

References and Figure Credits

Selected evidence, consensus guidance, and open-access teaching figures

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16. Verified local institutional protocols should guide specific blood-pressure targets, antithrombotic regimens, antibiotic duration, flap-check cadence, feeding, airway management, and donor-site mobilization.

Figure credits

- Cover montage: clinical panels from Zhang et al. (2011), Kim et al. (2020), and Wang et al. (2020), open-access publications; synthesis panels created for this guide.
- Figure 12: Kim et al. Reconstruction with locoregional and free flaps in the head and neck. Arch Craniofac Surg. 2020; CC BY 4.0.
- Figures 1-11 and 13-16, plus Appendix C: original synthesis diagrams created for this guide.
- All clinical images are used for resident education with source attribution. No image is intended to prescribe a single institutional technique.

EDUCATIONAL USE This guide synthesizes published evidence and common reconstructive principles. It is not a substitute for direct supervision, local protocols, patient-specific judgment, or the operating surgeon's technique.