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Research Article

Making Tacit Surgical Knowledge Explicit: A Structured Reflective Protocol for Teaching Local Perforator Flap Reconstruction, Supported by AI-Generated Imagery

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Abstract

Background: This paper presents a structured reflective protocol, the CIHSR Plastic Surgery Protocol, that enables experienced surgeons to document and externalise their practice knowledge systematically. We illustrate the protocol through a consecutive case series of 19 patients who underwent facial reconstruction after basal cell carcinoma (BCC) excision, and we describe the use of AI-generated imagery as a privacy-preserving documentation tool.

Methods: A retrospective case series of 19 patients (mean age 67.5–70 years) undergoing facial reconstruction between April 2023 and July 2025 was reviewed. Procedures included tailored paramedian forehead flaps, nasolabial perforator flaps, keystone perforator island flaps (KPIF), cheek perforator flaps, and glabellar flaps. The five-step CIHSR Protocol (understand anatomy, apply nuanced problem-solving, analyse technique, evaluate outcomes, create a reproducible lesson) was applied retrospectively to selected cases to generate structured teaching records. AI tools (ChatGPT, Perplexity) were used to produce synthetic visual representations of operative findings, removing the need for identifiable patient photographs.

Results: 100% flap survival was achieved across all 19 cases. At six-month follow-up, patient satisfaction exceeded 7 on a Likert scale in all cases. The synthetic imagery successfully illustrated anatomical concepts and operative steps without identifying individual patients.

Conclusion: The CIHSR Protocol provides a replicable method for converting clinical experience into structured, shareable teaching material. Its primary value lies in capturing the granular operative detail that experienced surgeons hold but rarely articulate. The present paper establishes the protocol and demonstrates its application.

Keywords: Facial Reconstruction; Local Flaps; Oncoplastic Surgery; Plastic Surgical Education; Aesthetic Subunits; Tacit Knowledge; Reflective Practice; AI-Generated Imagery; Patient Privacy; Surgical Documentation

Introduction

Facial oncological defects present complex reconstructive challenges [1] arising from the region's visibility, functional requirements, and the aesthetic sensitivity of facial subunits. Over the past four decades, advances in perforator flap surgery — from Mathes and Nahai's muscle flap classification [2] in 1981 to Koshima's perforator concept [3] in 1989 — have expanded the repertoire available to reconstructive surgeons considerably.

Explicit, reproducible documentation of operative decision-making — why one flap was chosen over another, how a complication was anticipated and managed, what width of pedicle proved sufficient — is uncommon in the published literature.

We describe the CIHSR Protocol, a five-step structured reflective framework that helps experienced surgeons externalise their practice knowledge into teaching records that other clinicians can use. We illustrate the protocol using a consecutive case series of 19 patients who underwent facial BCC reconstruction at CIHSR Nagaland between April 2023 and July 2025, and we show how AI-generated imagery [4] can support this documentation process while protecting patient privacy.

A structured method for making tacit surgical knowledge explicit is a legitimate and practically useful contribution to surgical education, and that AI-generated imagery solves a real practical problem for institutions without formal medical photography facilities.

Our experience with keystone perforator island flaps [5] (KPIF) over more than two years has been consistently reliable, with near-universal flap survival across a range of anatomical locations.

Materials and Methods

Study design

This is a retrospective case series combined with a descriptive account of an educational documentation protocol. The study took place in the Department of Aesthetic and Plastic Surgery, CIHSR Nagaland, covering the period April 2023 to July 2025. Ethical approval was not required for this type of observational case series.

Patient selection

Inclusion was limited to patients requiring perforator-based or axial facial flap reconstruction after surgical excision of histologically confirmed BCC. Of 21 patients with BCC assessed during the study period, two were excluded due to advanced disease rendering them unsuitable for surgery. One patient with squamous cell carcinoma and one with neurofibromatosis type 1 were excluded. The final series comprised 19 patients.

Patient Age, Sex	Diagnosis	Procedure	Outcome
59F	Recurrent BCC nasal dorsum	Wide excision and left forehead flap	100% flap survival
70M	BCC right perialar region	Wide excision and NLF perforator flap	100% flap survival
78M	BCC left perialar	Wide excision, perforator flap	100% flap survival
65F	Recurrent BCC left periorbita involving nasolacrimal duct	Wide excision and lacrimal sac bypass	100% flap survival; epiphora corrected post-op
75F	BCC left periorbital	Wide excision and perforator flap	100% flap survival
73M	BCC right alar	Wide excision and NLF perforator	100% flap survival; flap trimming after 3 weeks
70M	BCC left medial infraorbital	Wide excision and ipsilateral forehead flap	100% flap survival
67F	BCC right glabella	Wide excision and glabellar flap	100% flap survival
68F	BCC right upper scaphoid	Wide excision and perforator advancement	100% flap survival
59F	BCC right perialar	Wide excision and cheek perforator flap	100% flap survival; flap trimming after 1 month

80M	BCC upper left perioral	Wide excision and NLF perforator flap	100% flap survival
72M	BCC nasal tip	Excision and local flap	100% flap survival
77F	BCC left perialar	Wide excision and perforator from cheek	100% flap survival
71F	BCC left nasal dorsum	Excision and contralateral forehead flap	100% flap survival
57F	BCC right mandibular angle	Excision and local perforator flap	100% flap survival
52M	BCC left perialar	Wide excision and nasolabial perforator flap	100% flap survival
70F	BCC right medial periorbit	Glabella flap	100% flap survival
70F	BCC left periorbit	Excision and forehead flap	100% flap survival; initial venous congestion resolved
72F	BCC dorsum of nose	Excision and forehead flap	100% flap survival

Table A: Patient List and Procedures.

There were 12 female patients (age range 57–75 years, mean 67.5 years) and 7 male patients (age range 52–80 years, mean 70 years).

The CIHSR Protocol: A five-step reflective framework

The CIHSR Protocol provides a structured sequence for converting operative experience into explicit teaching material. It was applied retrospectively to selected cases from this series to generate lesson records. The five steps are:

- **Understand the anatomical concept:** Document the vascular basis, relevant anatomy, and tissue relationships that govern flap behavior in this case.
- **Apply nuanced problem-solving:** Record the clinical reasoning that led to the choice of this flap for this defect — size, location, tissue availability, aesthetic subunit, patient factors.
- **Analyse the technique:** Document the operative steps in sufficient detail to be reproducible — incision lines, tissue planes, pedicle width, timing of division, modifications made.
- **Evaluate outcomes:** Record functional and aesthetic results and patient-reported satisfaction. Note any complications and how they were managed.
- **Create a reproducible lesson:** Synthesize the above into a structured teaching record that a colleague or trainee could use to plan a similar case.

AI-Generated imagery

Teaching material was illustrated using synthetic visual representations generated with ChatGPT and Perplexity AI (2025 versions). These images represent operative anatomy, flap design, and tissue relationships without using identifiable patient photographs. Synthetic imagery removes this barrier entirely. This privacy-preserving function, is the principal educational argument for using AI-generated visuals.

Clinical Material: Flap techniques [6] used

Nasolabial perforator flap

Indications: Alar, columella, medial cheek defects. Design: Superiorly or inferiorly based; random-pattern or perforator-based keystone variant. Advantages: Excellent color and texture match, user-friendly, low risk of necrosis.

Cheek perforator flap

Indications: Moderate-sized cheek and perialar defects. Design: Perforator-based, using a reverse face-lift vector.

Paramedian forehead flap

Indications: Moderate and large nasal defects; periorbital defects. Design: Axial flap based on the supratrochlear and supraorbital arteries. Key teaching points: two-stage planning; tailoring the flap width to balance perfusion and donor-site closure; subperiosteal elevation in the distal segment.

Glabellar flap

Indications: Medial canthal and glabellar defects. Design: Perforator-based advancement or rotation.

V-Y advancement perforator flap

Indications: Perinasal and perioral defects. Design: Perforator-based V-Y advancement.

Illustrative Lessons: Applying the CIHSR protocol

The following two lessons demonstrate how the five-step protocol was applied to cases from this series.

Lesson 1: Keystone Perforator Nasolabial Flap for Alar Reconstruction

Case summary: A 69-year-old female presented with a 2 × 2.5 cm ulcerated BCC of the left alar region. Wide excision with 5 mm margins was performed; resection margins were clear on histopathology. The defect was reconstructed using a keystone perforator nasolabial flap. The patient recovered without complication and patient satisfaction was high.

- **Step 1 – Anatomical concept:** The nasolabial flap relies on perforating branches of the facial artery. The keystone configuration uses an island design for easy closure.
- **Step 2 – Problem-solving:** The alar region is an aesthetically demanding subunit. The nasolabial fold provides a natural scar line and a reliable donor territory.
- **Step 3 – Technique:** Flap dimensions were designed to slightly exceed the defect dimensions to allow tension-free inset. Elevation proceeded in the subcutaneous plane, preserving the perforators.
- **Step 4 – Outcome evaluation**: Flap survival was 100%. The Likert satisfaction score at six months was above 7.
- **Step 5 – Reproducible lesson:** For alar defects of 2–3 cm, a keystone perforator nasolabial flap is reliable, user-friendly, and produces consistent color match.

Figure 1: AI-generated illustration of keystone perforator nasolabial flap design for alar reconstruction (synthetic image; no patient photographs used).

Lesson 2: Tailored Paramedian Forehead Flap for Nasal Dorsum Reconstruction

Case summary: A 67-year-old patient presented with recurrent BCC of the nasal dorsum following incomplete excision at another center six months previously. A wide excision was planned and the resultant defect covered with a modified tailored paramedian forehead flap with primary closure of the donor defect. Postoperatively there was venous congestion of the flap over days 3–4, attributed to a pedicle base of approximately 1.5 cm. The congestion resolved within one week. The patient recovered fully.

- **Step 1 – Anatomical concept:** The paramedian forehead flap is an axial flap based principally on the supratrochlear vessels, with additional supply from supraorbital branches. Its arc of rotation reaches the nasal dorsum and periorbital areas with consistent reliability. Elevation in the loose areolar tissue plane beneath frontalis in the mid-forehead, transitioning to a subperiosteal plane approximately 2 cm above the supraorbital rim, is the critical technical sequence.
- **Step 2 – Problem-solving:** Recurrent BCC on the nasal dorsum, in a previously operated field, required a wide excision margin. The resulting defect was too large for a local perforator flap. The forehead flap was the most reliable option for a defect of this complexity.
- **Step 3 – Technique:** In our series of 9 forehead flaps, the flap width has consistently been maintained at approximately 2 cm. This provides adequate perfusion while permitting

primary donor closure in most patients. The defect after tumor excision is tailored slightly smaller than the native defect to allow the flap to sit without tension. Division of the flap pedicle is performed at 21 days.

- **Complication – venous congestion:** Early venous congestion occurred in one case where the pedicle base measured 1.5 cm rather than our standard 2 cm; the congestion resolved within one week.
- **Step 4 – Outcome:** In all 9 forehead flap cases in this series, there was no flap loss, infection, or tip necrosis. The one episode of venous congestion resolved completely. Patient satisfaction at six months exceeded 7 on the Likert scale in all cases.
- **Step 5 – Reproducible lesson:** A pedicle base of 2 cm is recommended for tailored paramedian forehead flaps in this patient population. Division at 21 days has proved reliable. The transition from areolar to subperiosteal elevation at 2 cm above the supraorbital rim protects the vascular pedicle and reduces donor-site morbidity.

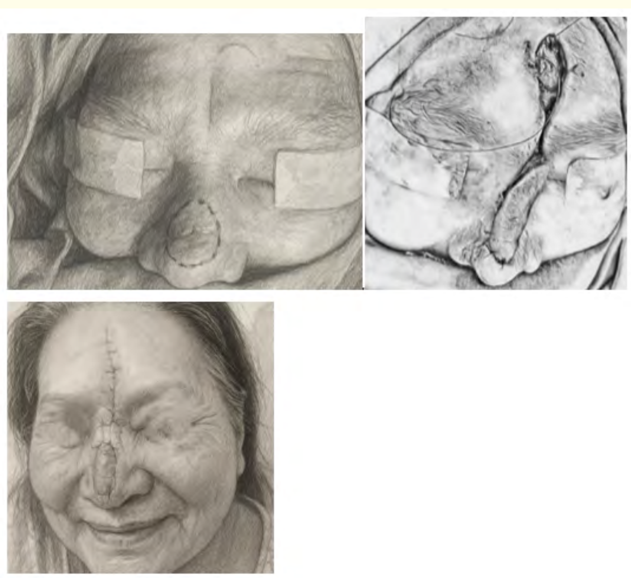

Figure 2: AI-generated illustration of tailored paramedian forehead flap design and elevation planes (synthetic image).

Results

Clinical outcomes

100% flap survival was achieved across all 19 cases. No patient experienced flap loss, infection, or tip necrosis. One episode of early venous congestion resolved with conservative management (loosening of sutures). Two cases required flap trimming at three to four weeks due to minor bulkiness; this is an expected step in nasolabial and cheek perforator flap reconstruction and does not constitute a complication. At six-month follow-up, patient satisfaction exceeded 7 on a Likert scale in all cases.

Flap Type	Variant	Aesthetic Result	Reliability
Paramedian forehead flap	Tailored axial	Good	Excellent vascularity; 9/9 cases
Nasolabial flap	Perforator-based	Good	Reliable; consistent color match
Cheek perforator (KPIF)	Keystone island	Very good	Robust; low complication rate
Glabellar flap	Perforator	Good	Reliable blood supply
NLF and cheek combination	Perforator	Good; minor bulkiness	Reliable; trimming required in 2 cases

Table B: Summary of Perforator Flap [8] Outcomes.

Discussion

Surgical education has long relied on apprenticeship: the trainee watches the expert, assisted in progressively more complex cases, and gradually internalizes an operative repertoire that the expert cannot fully articulate because they have never needed to. This model works when expert supervision is available and consistent, and when a trainee has access to enough cases over enough time. Both conditions are increasingly difficult to guarantee in contemporary training environments.

The result is that a large body of operative knowledge — specific, practical, and hard-won — exists in the expertise of practicing surgeons and is not systematically recorded. It is transmitted, when it is transmitted at all, through informal commentary during an operation, or is lost when a surgeon retires. The CIHSR Protocol is one response to this problem.

The protocol is a tool for experienced surgeons, not a curriculum for trainees. Its five steps describe how a surgeon who already knows how to perform an operation should reflect on a specific case to extract its teaching content. This is a different activity from teaching a trainee, and conflating the two would misrepresent what the protocol achieves.

Our more modest claim is that the protocol reliably produces teaching records of a quality and specificity that is uncommon in the published literature, and that this is a useful contribution in itself.

The most defensible and practically significant claim for AI-generated imagery in this context is the privacy-preservation argument [7]. AI-generated imagery solves this problem directly [8]: it produces illustrations of adequate quality for teaching purposes without using any identifiable patient material. However, for teaching the full complexity of operative surgery, real cases remain essential.

Limitations

This is a retrospective case series from a single institution. The 19 patients were managed by two experienced surgeons whose accumulated expertise is itself an uncontrolled variable: the excellent clinical outcomes reflect the surgeons' skill as much as the protocols described. The CIHSR educational protocol has not been tested in a prospective educational study and its effect on trainee learning is unknown. The patient satisfaction data (Likert scale) were self-reported and not independently validated.

The five-step protocol draws heavily on Bloom's Taxonomy [9] without adding substantially to it from an educational theory perspective. Its contribution is practical rather than theoretical: it operationalizes a well-established educational sequence in the specific context of operative surgical documentation.

Conclusion

Experienced surgeons hold operative knowledge that is specific, granular, and practical, and that is rarely made explicit in publishable form. The CIHSR Protocol provides a five-step method for doing so, structured around the sequence: understand anatomy, apply nuanced problem-solving, analyse technique, evaluate outcomes, and create a reproducible lesson.

Applied to a consecutive case series of 19 facial BCC reconstructions at CIHSR Nagaland, the protocol produced structured teaching records documenting flap selection rationale, specific operative decisions, and complication management — material that does not appear in standard textbook descriptions of these techniques. All 19 cases achieved 100% flap survival with high patient satisfaction at six months. There were no deformities associated with the procedures.

AI-generated imagery enabled this material to be illustrated without using identifiable patient photographs, The primary contribution of this paper is methodological: it describes and demonstrates a replicable approach to converting clinical experience into structured surgical teaching records. Prospective evaluation of whether such records improve trainee learning outcomes is a natural and necessary next step.

Conflicts of Interest

None declared.

Funding

None.

Ethical Approval

Not required for this type of retrospective observational case series.

Image Disclosure

All images are AI-generated synthetic illustrations. No identifiable patient photographs are included. AI tools used: Perplexity AI (mobile subscription), ChatGPT (latest versions, 2025).

Bibliography

1. Marco Marcasciano., *et al*. "Surgical Treatment with Loco regional Flap for the Nose". *Biomed Research International* (2017): Article ID 9750135.
2. Mathes S and Nahai F. "Classification of the vascular anatomy of muscles: experimental and clinical correlation". *Plastic and Reconstructive Surgery* 67 (1981): 177-187.

3. Koshima I., *et al*. "The anterolateral thigh flap; variations in its vascular pedicle". *British Journal of Plastic Surgery* 42.3 (1989): 260-262.

4. Virve Koljonen. "What could we make of AI in plastic surgery education?" *Journal of Plastic, Reconstructive and Aesthetic Surgery* 81 (2023) 94-96.

5. Gomez., *et al*. "Keystone Flap: Overcoming Paradigms". *Plastic and Reconstructive Surgery – Global Open* 7 (2019): e2126.

6. Azeem., *et al*. "Perforator-based local flaps for cutaneous facial reconstruction". *Maxillofacial Plastic and Reconstructive Surgery* 46 (2024): 30.

7. Arian Arjomandi Rad., *et al*. "The ethical considerations of integrating artificial intelligence into surgery: a review". *Interdisciplinary CardioVascular and Thoracic Surgery* 40.3 (2025): ivae192.

8. Yadav., *et al*. "Data Privacy in Healthcare: In the Era of Artificial Intelligence". *Indian Dermatology Online Journal* 14 (2023): 788-792.

9. Nancy E Adams. "Bloom's taxonomy of cognitive learning objectives". *Journal of the Medical Library Association* 103.3 (2015).