A comprehensive preoperative decision-making tool for optimal surgical closure: CHAIRS

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Background
The process of excising and repairing skin cancers has the potential to be highly complex. This is especially the case on the head and neck or where a complex closure is required. To optimise decision making, it is important that at the planning stage all of the various, potentially competing, considerations are made explicit and appropriately ranked in relation to the four surgical hierarchical goals which are: (1) curing the cancer; (2) avoiding functional disturbance; (3) avoiding complications; and (4) achieving good cosmesis.

Objective
We wished to design an easily remembered formal process that would not only assist doctors ensure they had considered all the relevant variables but that would also help rank these in terms of surgical importance prior to making a surgical plan. An appropriate acronym is an efficient means of ensuring the most important considerations are made explicit first (establishing the hierarchy) and that all the relevant information is gathered. Only then does the solution phase proceed. This is the basis of 'CHAIRS' which stands for: **C**ure the Cancer; **H**ole; **A**rea/Alignment; **I**cebergs/Incidents; **R**eservoirs; **S**olution(s)/Salvage.

Discussion
CHAIRS enables structured, orderly preoperative planning crucial for achieving favourable outcomes in skin cancer surgery. It provides less experienced doctors a framework to work with, and more experienced ones with a back-up first principles approach. It is easy to learn, remember and teach.

SKIN CANCER SURGERY has four hierarchical goals: (1) curing the cancer; (2) avoiding functional disturbance; (3) avoiding complications; and (4) achieving good cosmesis. Structured, orderly preoperative planning is crucial for achieving favourable outcomes in relation to these goals and the current paper lays out a system for this using the aide-mémoire 'CHAIRS' (Table 1). This approach requires the doctor to have a sound pre-existing knowledge of relevant anatomy and surgical practice. This paper does not attempt to create a paradigm shift in the approach to surgical planning. Rather, it formalises the existing thought processes and considerations required in dermatologic surgical decision making by presenting an easy-to-use system that is logical, easy to learn, teach and recall when required. The use of CHAIRS preoperatively will allow consideration of all the variables so one does not miss a crucial step that might lead to an undesirable outcome. It is especially useful for doctors when learning to perform more complex repairs, particularly on the head and neck.

Existing literature on dermatological surgery underscores the importance of extirpating the cancer, assessing the defect and being mindful of Relaxed Skin Tension Line (RSTL) orientation and local anatomy. However, tools for integrating these components for pre-surgery decision making are lacking. Textbooks of surgical options at different anatomical locations are useful for generating ideas but do not invite the surgeon to deeply engage with the specifics of the defect at hand.

Current preoperative assessment tools typically assess factors such as the patient's medical history, health status, surgical complexity, potential risks and expected outcomes.[1] The goal is to ensure optimal patient preparation, minimise complications and enhance recovery. The focus is not on helping the surgeon choose the best surgical closure for a given surgical scenario.

The stated first goal in skin cancer surgery is 'cure the cancer'. In practical terms, this means creating a defect that is highly likely to prevent clinical recurrence. This should be done with reference to relevant local guidelines, which will allow the local epidemiology and available health resources to be taken into account.

The next step is to accurately describe the curative skin defect. Its relationship with surrounding skin lines and structures

Table 1. Quick reference table with the definition of CHAIRS

C	**Cure the cancer:** ensure treatment achieves cancer cure based on local guidelines
H	**Hole:** consider size, depth, anatomical level for planned reconstruction
A	**Area/Alignment:** contain in a single subunit, if possible, and align with natural lines
I	**Icebergs/Incidents:** identify hidden structures, at-risk free margins and potential complications
R	**Reservoirs:** identify the best skin reservoir(s)
S	**Solutions/Salvage:** plan surgical solutions in light of the above and have back-up plans in place

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needs to be considered. The main potential risks/problems are made explicit, and the best skin reservoir identified. Only after working through this process will the surgeon be in a good position to propose solutions. Less experienced operators jump to the solution stage too quickly. CHAIRS is a simple structured approach that is designed to guide doctors through these critical considerations in the correct order. A suitable clinical photo with the tumour margins marked might allow for the initial quick clinical decision making to be reviewed at a later time to ensure that each element has been thoroughly explored.

CHAIRS: Components and significance

Cure the cancer

The curative defect is made following appropriate guidelines with reference to tumour size, location, subtype and tumour margin definition. It should be remembered that the first surgical approach to a skin cancer has the best chance of curing it. Salvage procedures and surgery for recurrent tumours can be very difficult, so unless the chance of cure is high, refer onward.

Hole

Depth, anatomical level and diameter of the resultant hole/defect relative to the relevant cosmetic subunit(s) informs the complexity of reconstruction and choice of closure techniques. For example:

- A small shallow defect might be suitable for second intention healing.
- A deep defect might require a thick flap.
- A defect with a bare cartilage base will not support a graft.
- A 1-cm diameter defect on the nasal ala will require complex closure techniques whereas the same defect on the larger cheek subunit will probably close primarily.

Area/Alignment

The cosmetic boundaries and RSTLs relevant to the defect are made explicit. This increases the chances of keeping the repair in a single cosmetic unit and allows incisions to be optimally oriented with respect to RSTLs and cosmetic boundaries. Drawing on the patient's skin or using a computer-based drawing tool to annotate clinical photos aids this process.

Icebergs/Incidents (potential problems)

'Icebergs' refers both to hidden (often neurovascular) structures that might be injured intraoperatively and also to structures (often free margins) at risk of detrimental functional or cosmetic effects of surgery. Underlying anatomical structures that are at risk need to be considered. Palpable arteries can be marked onto the patient's skin, as can the approximate position of superficial nerves. At-risk free margins (notably the eyelids, alar rims and lips) need to be identified, as do less visible functionally important structures such as the internal nasal valve. Icebergs relating to complications or functional consequences are prioritised over those associated with cosmesis. Knowledge of these icebergs preoperatively will lead to prevention of their associated incidents/complications intraoperatively and postoperatively (eg intraoperative bleeding, postoperative haematoma formation, regional parasthaesiae and paralysis, ectropion formation, eclabium formation, nasal airway obstruction from internal nasal valve collapse).

Reservoirs

The best skin reservoir(s) should be identified. It is non-negotiable that any proposed solution must effectively access this, otherwise the risk of complications rises steeply.

Solutions/Salvage

A tailored closure solution based on defect characteristics and anatomical considerations will ensure an optimal functional and aesthetic outcome. In general, the simplest approach that will work well is used. It is good practice to have a formalised 'plan B' in case difficulties are encountered. This might be as simple as anticipating the possibility of a Burow's graft (excising the lesion as a circle so that the Burow's triangles can go into saline rather than formalin in case they are needed later for grafting). Plan B can also be a stepwise solution; for example, converting an O to Z into an H flap to achieve extra advancement.

The concept of salvage is important for practitioners working in environments with limited access to intraoperative margin assessment techniques. These techniques, such as Mohs Micrographic Surgery (MMS), intraoperative frozen sections or staged excisions, allow for assessment of tumour clearance prior to defect closure but are more resource intensive and are not universally available. Salvage in the context of CHAIRS means thinking ahead to the postoperative period when the histology report comes back, and considering how an inadequately cleared tumour is going to be remedied. Reflection on this point might result in the selection of a less cosmetic but simpler technique (eg full thickness skin graft) or onward referral of the patient.

The approach is summarised in Table 1.

Practical application: Case study

The following case represents an advanced case for primary care management. It has been selected to highlight the many decision points that a systematic approach such as CHAIRS allows to be made explicit. It should be noted that a CHAIRS analysis applied to simpler situations, such as an ellipse on the face or on a distal limb, might be equally useful for less-experienced practitioners.

A man aged 72 years had a well-defined, infraorbital nodular basal cell carcinoma (BCC) (Figure 1). The patient was uninsured and MMS was beyond his means. MMS is not offered at his local public hospital. The turnaround time for urgent histology at the only available pathology service is 2 weeks, making staged excisions impractical. Given these circumstances, a single-stage surgical excision and repair was planned.

Cure the cancer: A 4-mm radial margin is highly likely to be sufficient for this small, non-aggressive well-defined tumour, particularly with dermoscopic mark out of the tumoral extent.[2] Likewise, it was judged that a deep margin down to and including the orbicularis fascia was highly likely to be curative. This approach is consistent with current Australian guidelines.[3]

Hole: The defect was 12 mm diameter with the deep margin being orbicularis oculi muscle.

Area/Alignment: The defect straddles the infraorbital crease fairly evenly, making it a two-subunit defect (eyelid/central cheek). Rhytids on the lid are horizontal and RSTLs on the cheek are oblique, falling inferolaterally in a similar direction to the nasojugal line. This analysis implies a two-subunit repair might be required.

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Icebergs: Ectropion of the lower lid with its attendant functional implications is the primary iceberg (despite the patient having good lid tone). Given the central face location, suboptimal cosmesis is a significant (albeit lower level) iceberg. As the two involved subunits have quite different skin, the principle of replacing like-with-like is important. Had the defect been more medial, then lacrimal apparatus injury would have been relevant.

Reservoirs: Prime reservoirs are cheek/eyelid laterally and to a lesser extent medially. The inferior central cheek is also a reservoir. The ipsilateral upper lid is a distant reservoir.

Solutions/Salvage: The defect is too large for vertical primary closure and even oblique primary closure would invite ectropion. Second-intention healing and full thickness skin graft would have a high risk of hitting both of the main icebergs – contracture/cicatricial scarring leading to ectropion and poor cosmesis. Horizontally oriented advancement flaps access the prime lateral reservoir and also allow for the synchronous movement of skin from both involved subunits (eyelid and cheek), thus facilitating the replacement of like-with-like. Similarly, a rotation from the lateral cheek would work well but it is a large procedure for a small defect. A laterally oriented island pedicle flap would also replace like-with-like but invariably one scar line is not exactly in RSTLs, affecting cosmesis. Transposition flaps in general have simultaneous tension vectors at various angles, meaning it would be difficult to completely isolate the lower lid from tension. Finally, a formal separate subunit repair (eg a pexed vertical cheek advancement to close the cheek component and a full thickness skin graft from the ipsilateral upper lid for the lid component) would work well but is technically demanding and complex.

Salvage is easiest where there is no tissue movement as in a graft (which has already been ruled out) or where the tissue movements are simple such as advancement and rotation flaps.

From this analysis, horizontally oriented advancement flaps would appear to be the best option; for example, a superiorly based A–L flap, a Burow's exchange flap or an O–Z flap (Figure 2). All of these flaps have a built-in plan B (the A–L and Burow's exchange can be converted into an A–T and the O–Z into an H flap).

The A–L/T option was selected on the basis that there was a good chance that only the lateral side of the flap would need to be developed, thus limiting undermining of the eyelid; in fact, this turned out to be the case (Figure 3). Note no tension on the lower lid and adequate cosmesis for this central face repair.

Conclusion

The CHAIRS aide-mémoire ensures an orderly and formal approach is taken to defect creation and repair, integrating relevant local guidelines with knowledge of physical and functional anatomy. This then allows for the optimal closure strategy to be selected.

Key points

- A structured and hierarchical approach is crucial to complex surgical decision making.
- CHAIRS considers local skin cancer guidelines and consideration of local medical resources available.
- CHAIRS ensures existing surgical knowledge and experience is brought to bear at the correct time.
- CHAIRS considers the four skin cancer surgical goals occur, especially with respect to the curative goal.
- CHAIRS enables selection of appropriate surgical closure options with consideration of potential intra-operative and postoperative complications requiring salvage options.

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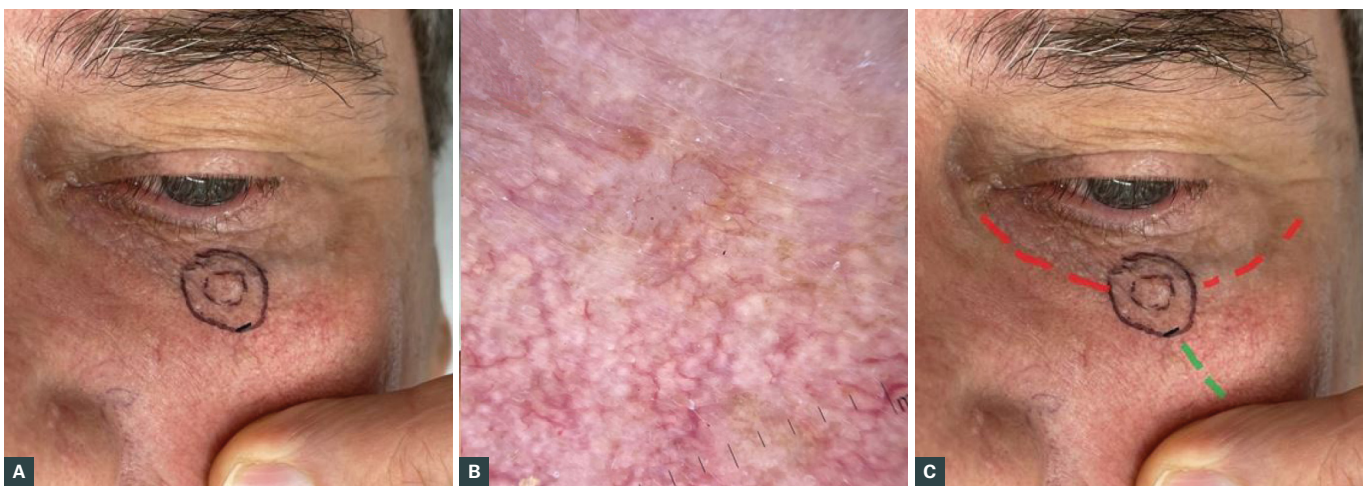

Figure 1. Case photos. **A.** Clinical photo of nodular BCC with 4-mm margins marked; **B.** Dermoscopy of nodular BCC; **C.** Margins with RSTLs and orbital lines marked.

BCC, basal cell carcinoma; RSTLs, relaxed skin tension lines.

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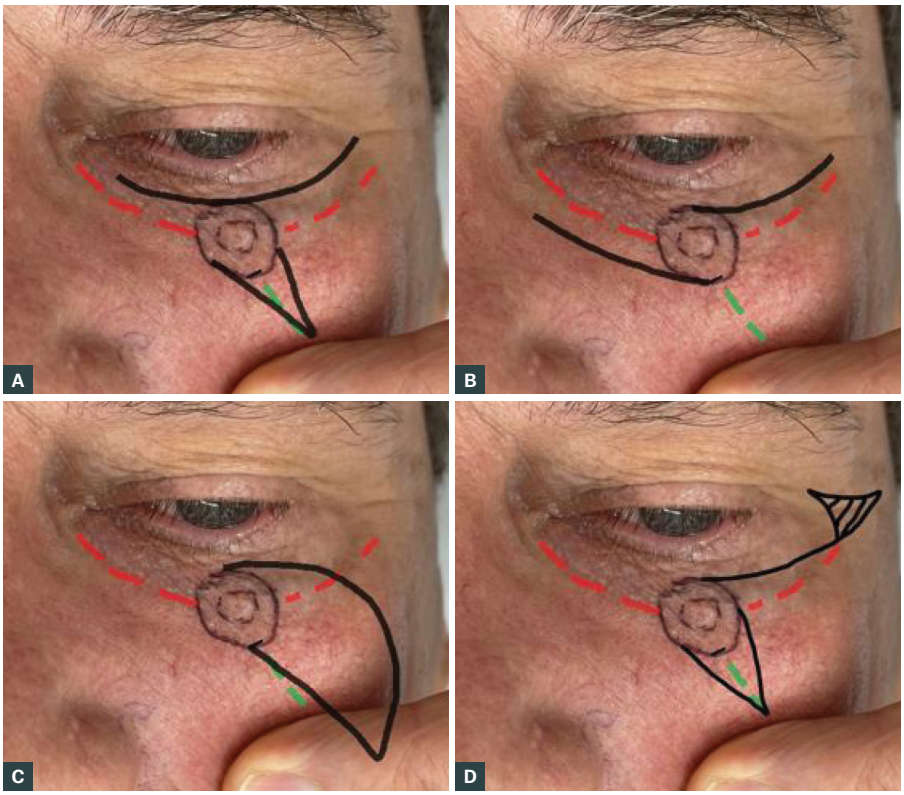

Figure 2. Solutions: various local flap options for closure of this lower eyelid nodular basal cell carcinoma (BCC) excision defect. **A.** A–T flap. **B.** O–Z flap. **C.** Lenticular island pedicle advancement flap. **D.** Burow's exchange advancement flap.

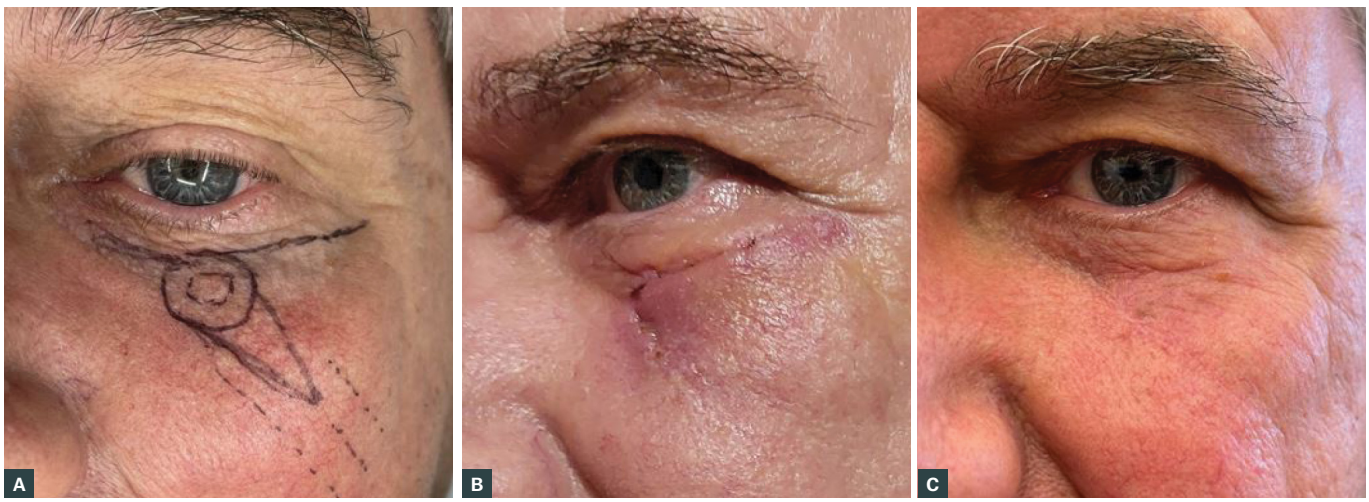

Figure 3. Chosen solution: A–T/A–L advancement flap – chosen with respect to cosmetic boundaries with tension of closure perpendicular to the eyelid margin to avoid ectropion formation. Only the lateral arm of the flap was needed to close the defect (A–L flap). **A.** A–T pre-operative mark-up. Dotted lines showing the orientation of the relaxed skin tension lines (RSTLs) to emphasise the oblique orientation of the closure to improve the final cosmetic outcome. **B.** Five days postoperative showing only the lateral arm used (A–L). **C.** Eight weeks post-operative result.

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