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Safety and Clinical Outcomes of Perforator Free Flaps in Elderly Patients: A Systematic Review Protocol

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ADMINISTRATIVE INFORMATION

Support - No support.

Review Stage at time of this submission - Title and abstract screening has been completed. Full-text assessment of the retrieved reports has been completed, while 13 reports could not be retrieved or lacked an accessible English-language full text. The data extraction form has been piloted using three eligible studies. Full data extraction, risk-of-bias assessment, and data analysis have not yet commenced.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202680069

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 17 August 2026 and was last updated on 17 August 2026.

INTRODUCTION

Review question / Objective To systematically evaluate the technical, systemic, donor-site, and patient-centered outcomes of perforator free-flap reconstruction in elderly patients and to identify patient-related and perioperative factors associated with adverse outcomes. The review will also explore whether flap type, particularly the anterolateral thigh flap, recipient site, and age threshold influence clinical outcomes.

Rationale Advanced age is often considered a potential risk factor for prolonged microsurgical reconstruction because elderly patients may have reduced physiological reserve, multiple comorbidities, frailty, and an increased risk of perioperative medical complications. However, chronological age alone may not accurately predict free-flap failure or postoperative morbidity. Perforator free flaps preserve the underlying muscle and may reduce donor-site morbidity, but evidence specifically addressing their safety and clinical benefits in elderly patients remains limited and heterogeneous. This review aims to clarify the available evidence, distinguish technical flap outcomes from systemic patient outcomes, and identify objective factors that may support patient selection and perioperative risk reduction.

Condition being studied Elderly patients undergoing microsurgical reconstruction using perforator-based free flaps for defects resulting from cancer resection, trauma, chronic wounds, or other reconstructive indications. The review will assess flap viability, surgical and medical complications, donor-site morbidity, mortality, functional recovery, quality of life, and perioperative risk factors.

METHODS

Search strategy PubMed/MEDLINE, Embase, and Web of Science were searched from database inception to August 2026. The search combined terms related to older age with terms related to perforator-based free-flap reconstruction.

The main search concepts included: aged, elderly, older patient, older adult, geriatric, advanced age, octogenarian, nonagenarian, perforator flap, perforator free flap, free tissue transfer, anterolateral thigh flap, ALT flap, deep inferior epigastric perforator flap, DIEP flap, superficial circumflex iliac artery perforator flap, SCIP flap, thoracodorsal artery perforator flap, TDAP flap, profunda artery perforator flap, PAP flap, and medial sural artery perforator flap.

Controlled vocabulary terms, including MeSH and Emtree terms, and free-text terms were adapted for each database. The reference lists of included studies and relevant reviews were also examined to identify additional eligible reports. Search results were imported into EndNote, and duplicate records were removed before screening.

Participant or population Adult patients undergoing microsurgical reconstruction with a perforator-based free flap who were classified as elderly or older according to the age threshold used by each individual study. Studies using thresholds such as 60, 65, 70, or 75 years will be eligible. The exact age definition will be extracted from each study. Mixed-age cohorts will be eligible when outcomes for the elderly group or the association between age and outcomes can be extracted separately.

Intervention Microsurgical reconstruction using a perforator-based free flap, including anterolateral thigh (ALT), deep inferior epigastric perforator (DIEP), superficial circumflex iliac artery perforator (SCIP), thoracodorsal artery perforator (TDAP), profunda artery perforator (PAP), medial sural artery perforator (MSAP), and other flaps explicitly described as perforator-based free flaps. Mixed-flap studies will be included only when data for eligible perforator free flaps can be extracted separately.

Comparator The primary comparator, when available, will be younger or non-elderly patients undergoing comparable perforator free-flap reconstruction. Comparisons between different elderly age thresholds, flap types, recipient sites, or perioperative risk groups will also be considered. Studies without a comparator group will remain eligible for narrative synthesis if they provide extractable outcomes for at least three elderly patients.

Study designs to be included Prospective or retrospective comparative cohort studies, case-control studies, non-comparative observational cohorts, and case series including at least three eligible elderly patients will be included. Single case reports, reviews, meta-analyses, editorials, letters without original patient data, technical notes without clinical outcomes, and animal or cadaveric studies will be excluded.

Eligibility criteria Original human studies will be included when they: (1) evaluate adult patients classified as elderly or analyze age as a predictor; (2) involve microsurgical perforator-based free-flap reconstruction; and (3) report extractable technical, surgical, medical, donor-site, functional, quality-of-life, perfusion, or mortality outcomes.

Mixed-flap studies will be eligible only when data for perforator free flaps can be separated from conventional muscle, axial-pattern, pedicled, or local flaps. Studies reporting only local or pedicled perforator flaps will be excluded. Studies with insufficient or non-separable perforator free-flap data will also be excluded.

When multiple reports describe the same or overlapping cohort, they will be linked, and patients will not be counted more than once. Case series must include at least three eligible elderly patients. Single case reports, reviews, meta-analyses, editorials, technical reports without relevant clinical outcomes, and non-human studies will be excluded.

Only reports with a full text available in English will be included. Reports available exclusively in languages other than English will be excluded because resources for reliable translation and verification are unavailable.

Information sources The primary electronic information sources will be PubMed/MEDLINE, Embase, and Web of Science, searched from inception to August 2026. Reference lists of included articles and relevant reviews will be manually examined for additional eligible studies. When an English-language full text or essential outcome data cannot be obtained, institutional library services, interlibrary loan, and direct contact with corresponding authors will be attempted. Reports for which an English-language full text cannot be obtained will not be included.

Main outcome(s) The primary outcomes will be: (1) total flap loss, defined as complete flap necrosis or failure requiring removal or replacement of the flap; (2) major systemic or medical complications, using the definitions provided by each study and including serious pulmonary, cardiovascular, thromboembolic, renal, infectious, neurologic, or other perioperative medical events; and (3) perioperative mortality, preferably within 30 days after surgery or during the index hospitalization.

For dichotomous outcomes, event numbers, proportions, risk ratios, odds ratios, and 95% confidence intervals will be extracted when available. Outcomes will be analyzed at the reported postoperative time point, with 30-day or in-hospital outcomes prioritized when multiple time points are available.

Additional outcome(s) The primary outcomes will be: (1) total flap loss, defined as complete flap necrosis or failure requiring removal or replacement of the flap; (2) major systemic or medical complications, using the definitions provided by each study and including serious pulmonary, cardiovascular, thromboembolic, renal, infectious, neurologic, or other perioperative medical events; and (3) perioperative mortality, preferably within 30 days after surgery or during the index hospitalization.

For dichotomous outcomes, event numbers, proportions, risk ratios, odds ratios, and 95% confidence intervals will be extracted when available. Outcomes will be analyzed at the reported postoperative time point, with 30-day or in-hospital outcomes prioritized when multiple time points are available.

Data management Search records will be imported into EndNote, organized by source database, and deduplicated before screening. Each report will receive a unique report identifier. Reports arising from the same or overlapping patient cohort will additionally receive a shared study-cluster identifier to prevent double counting.

Data will be extracted into a prespecified standardized spreadsheet containing separate sections for study characteristics, patient groups, outcomes, risk-factor analyses, and risk-of-bias judgments. Total patient numbers, eligible perforator-flap patient numbers, and flap numbers will be recorded separately. Outcome-specific denominators and units of analysis will be retained. NR will indicate not reported, NA will indicate not applicable, and calculated values will be clearly identified. Exact page, table, or figure sources will be recorded. Extracted data will be checked against the original reports, and ambiguities will be resolved through discussion among the review authors. Authors will be contacted when essential information is missing or unclear.

Quality assessment / Risk of bias analysis Risk of bias will be assessed using the Joanna Briggs Institute critical appraisal tools appropriate to each study design. Comparative cohort studies will be evaluated using the JBI Checklist for Cohort Studies, case-control studies using the JBI Checklist for Case Control Studies, and non-comparative case series using the JBI Checklist for Case Series.

Each item will be judged as Yes, No, Unclear, or Not applicable, with supporting evidence and source pages recorded. The assessment will consider participant selection, exposure and outcome measurement, identification and control of confounding, completeness of follow-up, appropriateness of statistical analysis, and consecutive or complete inclusion of cases. Domain-level judgments will be retained rather than converted into an unvalidated numerical quality score. One review author will conduct the initial assessment, which will be checked by another review author; disagreements will be resolved by discussion and consensus.

Strategy of data synthesis A structured narrative synthesis will be the primary method because heterogeneity is anticipated in elderly age thresholds, flap types, recipient sites, study designs, outcome definitions, and follow-up periods. Study characteristics, patient risk profiles, operative variables, technical outcomes, systemic complications, donor-site outcomes, and patient-centered outcomes will be summarized in tables.

Comparative and non-comparative evidence will be presented separately. Patient-level and flap-level denominators will not be combined. Reports from overlapping cohorts will be linked, and only the most complete or appropriate dataset will contribute to each analysis.

Meta-analysis will be considered only when at least three clinically comparable studies report the same outcome using sufficiently similar definitions, populations, and time points. Dichotomous outcomes will be summarized using risk ratios or odds ratios with 95% confidence intervals. Continuous outcomes will be summarized using

mean differences or standardized mean differences, as appropriate. A random-effects model will be preferred because clinical heterogeneity is expected. Statistical heterogeneity will be assessed using the I^2 statistic and interpreted together with clinical and methodological differences. When quantitative pooling is inappropriate, effect estimates and event rates will be reported without generating a pooled estimate.

Subgroup analysis When sufficient data are available, subgroup analyses will be conducted according to: (1) perforator flap type, with particular attention to the anterolateral thigh flap; (2) recipient site, including head and neck, breast, and extremity reconstruction; (3) the elderly age threshold used by each study, such as 60, 65, 70, or 75 years; (4) comparative versus non-comparative study design; and (5) major clinical indications, including oncologic, traumatic, and chronic-wound reconstruction.

Additional exploratory analyses may consider ASA class, frailty, comorbidity burden, and operative duration when sufficiently and consistently reported. Subgroup findings will be interpreted cautiously and will not be used to claim superiority of one flap unless supported by direct comparative evidence.

Sensitivity analysis If meta-analysis is feasible, sensitivity analyses will be performed by excluding: (1) case series and non-comparative studies; (2) studies with important risk-of-bias concerns; (3) studies in which perforator-flap data required calculation or were incompletely separated from mixed-flap cohorts; and (4) potentially overlapping cohorts.

Analyses will also be examined according to the unit of analysis, distinguishing patient-based from flap-based outcomes, and according to different elderly age thresholds when sufficient data are available. The influence of individual studies will be explored using leave-one-out analyses when appropriate. If fewer than three comparable studies are available for an outcome, no quantitative sensitivity analysis will be performed, and uncertainty will instead be addressed in the narrative synthesis.

Language restriction Searches were not restricted by language; however, only reports with an English-language full text will be included.

Country(ies) involved Republic of Korea.

Other relevant information Full-text assessment of retrieved reports and pilot extraction of three studies were completed. Thirteen reports lacked an accessible English-language full text or could not be retrieved. Full extraction, risk-of-bias assessment, and analysis have not commenced.

Keywords elderly; perforator free flap; microsurgery; free tissue transfer; anterolateral thigh flap; donor-site morbidity; postoperative complications; systematic review.

Dissemination plans The findings will be submitted for publication in a peer-reviewed journal in plastic, reconstructive, or microsurgical surgery. The results may also be presented at relevant national or international scientific meetings. The completed review will be reported in accordance with the PRISMA statement, and the INPLASY registration number will be included in the manuscript.

Contributions of each author

Author 1 - Junghyun Lee - Literature searching, study screening, data extraction, risk-of-bias assessment, data organization, and preparation of the initial manuscript draft.
Email: jhyun5221@gmail.com
Author 2 - Deokhyeon Ryu - Conceptualization, methodology, clinical interpretation, supervision, data verification, risk-of-bias verification, and critical review and revision of the manuscript. Corresponding author and guarantor of the review.
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