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Risk factors for acute kidney injury after gynecological surgery in adult women: a systematic review and meta-analysis

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ADMINISTRATIVE INFORMATION**Support** - Self Fund.**Review Stage at time of this submission** - Preliminary searches.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202680085**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 24 August 2026 and was last updated on 24 August 2026.**INTRODUCTION**

Review question / Objective In adult women (≥ 18 years) undergoing gynecological surgery (benign or gynecological-oncology without systemic chemotherapy, analyzed as separate subgroups), what factors are independently (multivariable-adjusted) associated with postoperative acute kidney injury (AKI), defined using KDIGO, AKIN, or RIFLE criteria?

Rationale Acute kidney injury (AKI) remains an underexplored complication of gynecological surgery. Reza et al. (2023, Danish Medical Journal) pooled AKI incidence across 23 studies (7%) but did not examine independent predictors. Kengsakul et al. (2022, J Gynecol Oncol) looked at postoperative morbidity after cytoreductive surgery for ovarian cancer, without a specific focus on AKI. More recently, Liu et al. (2025, Annals of Medicine, PROSPERO CRD42022304083) conducted a much broader review of AKI after abdominal surgery (162 studies, 675,361 patients; pooled incidence 16%,

95% CI 14–17%). That review's risk-factor analysis was pooled across all abdominal surgery types rather than stratified by procedure, so no gynecology-specific, multivariable-adjusted risk factors have yet been reported. To our knowledge, no existing review has synthesized these factors specifically within a gynecological surgery population. Identifying which patient-level factors independently predict AKI in this setting could support more targeted perioperative risk stratification and prevention strategies in gynecological practice.

Condition being studied Acute kidney injury (AKI) occurring after gynecological surgery, staged using KDIGO, AKIN, or RIFLE criteria (harmonized — all three accepted as equivalent staging systems for eligibility purposes).

METHODS

Search strategy Electronic searches will be conducted in PubMed/MEDLINE, Scopus, and the Cochrane Library (Search Manager), covering the

period from January 2004 to present. Preliminary searches have been performed to test search string sensitivity; the formal search will be run and dated within August 2026, following protocol registration. The strategy combines controlled vocabulary (MeSH terms) and free-text keywords across two concept blocks: (1) gynecological surgical procedures and (2) acute kidney injury, joined with the Boolean operator AND. Filters will exclude case reports, letters, comments, editorials, and news items, as well as animal-only studies. No language restriction will be applied at the search stage.

The PubMed search strategy is:

("Gynecologic Surgical Procedures"[Mesh] OR "Hysterectomy"[Mesh] OR "Ovariectomy"[Mesh] OR "Uterine Myomectomy"[Mesh] OR "Endometriosis"[Mesh] OR gynecologic surgery[tiab] OR gynecological surgery[tiab] OR gynaecologic surgery[tiab] OR gynaecological surgery[tiab] OR hysterectom*[tiab] OR myomectom*[tiab] OR oophorectom*[tiab] OR salpingo-oophorectom*[tiab] OR salpingectom*[tiab] OR "ovarian cytoreductive surgery"[tiab] OR "ovarian debulking surgery"[tiab] OR "gynecologic cytoreductive surgery"[tiab] OR "gynecologic debulking surgery"[tiab] OR "primary debulking surgery"[tiab] OR "interval debulking surgery"[tiab] OR endometriosis surgery[tiab] OR ovarian surgery[tiab] OR gynecologic oncology surgery[tiab] OR gynecologic malignancy surgery[tiab]) AND ("Acute Kidney Injury"[Mesh] OR acute kidney injury[tiab] OR AKI[tiab] OR acute renal failure[tiab] OR acute renal injury[tiab] OR acute kidney failure[tiab] OR acute renal insufficiency[tiab] OR acute kidney insufficiency[tiab]) NOT ("Case Reports"[Publication Type] OR "Letter"[Publication Type] OR "Comment"[Publication Type] OR "Editorial"[Publication Type] OR "News"[Publication Type]) NOT ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) AND ("2004/01/01"[Date - Publication] : "3000/12/31"[Date - Publication])

Equivalent strategies, adapted to platform-specific syntax, will be applied in Scopus (TITLE-ABS-KEY, with document type exclusions for letters, editorials, and notes; PUBYEAR > 2003) and Cochrane Library Search Manager (MeSH descriptor "explode all trees" combined with title/abstract/keyword terms). Reference lists of included studies will be hand-searched to identify additional eligible articles not captured by the electronic search.

Participant or population Adult women (≥ 18 years) undergoing gynecological surgery, comprising two pre-specified subgroups analyzed separately: (1) benign indications (e.g. hysterectomy, ovarian surgery, myomectomy, endometriosis surgery) and (2) gynecological oncology surgery without systemic chemotherapy (e.g. radical hysterectomy, ovarian cytoreductive/debulking surgery). Excluded populations: cytoreductive surgery with hyperthermic intraperitoneal chemotherapy (CRS-HIPEC, including AKI attributable to intraperitoneal chemotherapy itself), non-gynecological surgical procedures, and pediatric/adolescent populations (<18 years).

Intervention Not applicable in the traditional sense (this is a prognostic factor review, not an intervention review). The "exposure" of interest is any patient-level factor reported as an independent predictor of AKI in a multivariable-adjusted analysis (e.g. age, BMI, diabetes mellitus, hypertension, baseline renal function/CKD, operative duration, blood loss/transfusion, ASA class, surgical approach [open vs. laparoscopic/robotic]). Structural/system-level exposures (e.g. hospital or surgeon annual procedure volume) are excluded from the primary synthesis, as they are not patient-level, individually assessable risk factors.

Comparator For each candidate predictor, the reference/comparator group is the corresponding group without that risk factor, as defined by each study's own multivariable model (e.g. non-exposed vs exposed, below vs above a cut-off).

Study designs to be included Observational studies (retrospective or prospective cohort, case-control, cross-sectional) reporting multivariable/adjusted analysis of predictors for the outcome(s) of interest. Randomized controlled trials are also eligible if they report the outcome(s) of interest. Case reports, case series (<10 patients), conference abstracts without extractable data, letters, editorials, comments, and news items are excluded, as are animal/non-human studies.

Eligibility criteria Inclusion: adult women (≥ 18 y) undergoing gynecological surgery as defined above; multivariable/adjusted analysis reported; AKI (KDIGO/AKIN/RIFLE) reported as an outcome; observational or RCT design; any language at screening stage; published 2004–present.

Exclusion: CRS-HIPEC for non-gynecological cancers; AKI attributable to intraperitoneal chemotherapy during HIPEC; pediatric/adolescent-

only populations; gynecological oncology with systemic chemotherapy as the primary exposure under study; studies reporting AKI incidence without any multivariable factor analysis, or reporting factor analysis without AKI as an outcome (both required together); other systematic reviews/meta-analyses (retained separately for citation-mining only, not extracted as primary data); studies where the only adjusted exposure is a structural/system-level variable (e.g. hospital/surgeon volume).

Information sources MEDLINE/PubMed, Scopus, and Cochrane Library (CENTRAL/CDSR) — three electronic databases, searched from 2004 to present (2004 corresponds to the publication of the RIFLE criteria, the first standardized AKI staging system).

No trial registry or grey-literature search beyond this is currently planned.

Main outcome(s) Postoperative acute kidney injury (AKI), diagnosed according to KDIGO, AKIN, or RIFLE criteria (any of the three accepted).

Additional outcome(s) None — mortality (in-hospital and other timepoints) is covered exclusively by a companion review (see item 27, "Other relevant information") to keep this review's outcome set poolable and internally consistent.

Data management Search results from all databases will be exported in a compatible citation format (e.g., .nbib, RIS) and imported into Rayyan (Rayyan Systems Inc.) for reference management and screening. Duplicate records will be identified and removed within Rayyan prior to screening. Title and abstract screening will be performed independently by two reviewers (Ade Yonata, MD and Nurul Islamy, MD) against the pre-specified eligibility criteria, with conflicts resolved by discussion or adjudication by a third reviewer if consensus cannot be reached. Full-text articles of potentially eligible studies will be retrieved and independently assessed by the same two reviewers for final inclusion. Reasons for exclusion at the full-text stage will be recorded. The study selection process will be documented and reported using a PRISMA 2020 flow diagram. Data extracted from included studies will be recorded in a standardized, piloted extraction form and stored in a password-protected electronic spreadsheet accessible only to the review team.

Quality assessment / Risk of bias analysis Risk of bias will be assessed using the Newcastle-Ottawa Scale (NOS), cohort version (8 items across 3 domains: Selection [max 4 stars],

Comparability [max 2 stars], Outcome [max 3 stars]; total max 9 stars), applied uniformly to all included observational studies, including those with a cross-sectional/single-encounter administrative-database design, since exposure ascertainment still precedes outcome ascertainment in this literature. Quality categories (Good/Fair/Poor) follow conventional NOS thresholds.

Strategy of data synthesis Random-effects meta-analysis (no additional subgroup/sensitivity models beyond those specified above) will be used to pool adjusted effect estimates (odds ratio or hazard ratio, as reported) for factors reported by ≥ 3 studies with sufficiently comparable adjustment sets. Factors reported by fewer studies, or with substantially divergent adjustment sets, will be synthesized narratively rather than pooled. Statistical analysis software: RevMan.

Subgroup analysis Pre-specified subgroup analysis by surgical indication: benign gynecological surgery vs. gynecological-oncology surgery (without systemic chemotherapy). Where feasible, sensitivity analysis restricted to studies with the lowest risk of bias (NOS "Good") is also planned.

Sensitivity analysis Sensitivity analysis excluding studies judged at higher risk of bias (NOS "Fair"/"Poor"), where a sufficient number of studies per pooled factor allows. Anticipated heterogeneity (moderate-to-high, given variation in covariate adjustment sets and setting) will be assessed using I^2 and explored narratively where quantitative subgroup/meta-regression is not feasible given the number of studies per factor.

Language restriction English. No language restriction was applied during the electronic database search (in line with the Cochrane Handbook, to avoid language bias); non-English full texts identified as potentially eligible will be.

Country(ies) involved Indonesia.

Other relevant information This systematic review does not involve primary data collection from human participants and therefore does not require formal ethical approval. A preliminary search of PROSPERO and INPLASY confirmed no currently registered or published systematic review with an identical focus. A related review (PROSPERO CRD42022304083) examined AKI incidence and risk factors across abdominal surgery broadly, including gynecological procedures as one of several surgical subgroups;

however, no review to date has specifically and comprehensively addressed risk factors for AKI following gynecological surgery as its primary focus. This review aims to fill that gap. Findings are intended to inform risk stratification and perioperative management strategies for gynecological surgery patients, and will be submitted for publication in a peer-reviewed journal upon completion.

Keywords acute kidney injury; mortality; gynecological surgery; gynecologic oncology; risk factors; prognostic factors; systematic review.

Dissemination plans The results of this systematic review and meta-analysis will be submitted for publication in a peer-reviewed, PubMed-indexed journal in the field of nephrology, anesthesiology, or gynecological surgery. Findings will also be presented at relevant national or international scientific conferences in nephrology or perioperative medicine. The completed protocol and results will be made publicly accessible via the INPLASY registry to support transparency and reduce the risk of unnecessary duplication by other research groups.

Contributions of each author

Author 1 - Ade Yonata - Conceived and designed the study; developed the eligibility criteria and search strategy; will conduct screening, data extraction, statistical analysis, and risk of bias assessment; drafted the manuscript.

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Author 2 - Nurul Islamy - Provided clinical expertise in obstetrics and gynecology to refine eligibility criteria; will independently conduct screening and data extraction; critically reviewed the manuscript.

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