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A Meta-Analysis of Open Globe Injury and the Choice of Surgical Timing

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ADMINISTRATIVE INFORMATION

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 22 July 2026 and was last updated on 22 July 2026.

INTRODUCTION

Review question / Objective To systematically evaluate the effects of early versus delayed vitrectomy on visual acuity improvement, globe survival rate, complications and the incidence of proliferative vitreoretinopathy (PVR) in patients with open globe injury(OGI).

Condition being studied Open globe injury (OGI) represents one of the most devastating forms of ocular trauma, defined as a full-thickness wound of the eyewall resulting from either laceration or rupture. Globally, OGI is a leading cause of monocular blindness, particularly affecting young working-age adults and children, thereby imposing substantial socioeconomic burdens.

METHODS

Participant or population Included patients had clinically confirmed OGI, defined according to the internationally accepted Birmingham Eye Trauma Terminology System as a full-thickness wound of the eyewall, including all mechanical OGI subtypes, such as globe rupture, penetrating injury and perforating injury, with or without an intraocular foreign body. All included patients had undergone primary wound exploration and suturing of the OGI to restore the integrity of the eyewall and were scheduled to undergo or had undergone secondary PPV. There were no special restrictions regarding patient age, sex, race or cause of injury.

Intervention Patients in the experimental group underwent early PPV after primary suturing of the OGI. The time threshold for early PPV was based on the original definition used in each included study, with the most commonly used threshold being surgery performed within 7 days after primary suturing.

Comparator Patients in the control group underwent delayed PPV after primary suturing of the OGI. The time threshold for delayed PPV was based on the original definition used in each

included study, with the most commonly used threshold being surgery performed more than 7 days after primary suturing.

Study designs to be included Eligible studies comprised published controlled clinical studies, including randomised controlled trials (RCTs), prospective cohort studies and retrospective cohort studies, with no language restrictions.

Eligibility criteria Inclusion Criteria
1) Participants: Included patients had clinically confirmed OGI, defined according to the internationally accepted Birmingham Eye Trauma Terminology System as a full-thickness wound of the eyewall, including all mechanical OGI subtypes, such as globe rupture, penetrating injury and perforating injury, with or without an intraocular foreign body [19].
All included patients had undergone primary wound exploration and suturing of the OGI to restore the integrity of the eyewall and were scheduled to undergo or had undergone secondary PPV. There were no special restrictions regarding patient age, sex, race or cause of injury.
2) Interventions: Patients in the experimental group underwent early PPV after primary suturing of the OGI. The time threshold for early PPV was based on the original definition used in each included study, with the most commonly used threshold being surgery performed within 7 days after primary suturing.
3) Controls: Patients in the control group underwent delayed PPV after primary suturing of the OGI. The time threshold for delayed PPV was based on the original definition used in each included study, with the most commonly used threshold being surgery performed more than 7 days after primary suturing.
4) Outcomes: The study reported at least one of the pre-specified core outcomes of this review, including visual acuity improvement, globe survival, the total incidence of postoperative complications and the incidence of PVR.
5) Study design: Eligible studies comprised published controlled clinical studies, including randomised controlled trials (RCTs), prospective cohort studies and retrospective cohort studies, with no language restrictions.
Exclusion Criteria
Literature meeting any of the following criteria was excluded:
1) Single-arm clinical studies that did not clearly define the time threshold for early versus delayed PPV or did not include a concurrent control group;
2) Studies with incomplete data from which valid data for the pre-specified core outcomes of this review could not be extracted and for which complete and valid data could not be obtained after contacting the original authors by email or other means;
3) Duplicate publications, including multiple studies published by the same research team based on the same study population;
4) Studies involving patients with infectious endophthalmitis requiring emergency PPV or prophylactic chorioretinectomy;
5) Studies for which the full text could not be obtained through formal channels, such as database retrieval, library services or contact with the authors.
For studies reporting on the same patient population, only the study with the most complete data, the longest follow-up duration and the highest methodological quality was retained, and the remaining studies were excluded. Two investigators independently screened the literature, and any disagreements were resolved through discussion or by consultation with a third investigator.

Information sources Six academic databases, including PubMed, Web of Science Core Collection, the Cochrane Library, Embase, Scopus and China National Knowledge Infrastructure (CNKI), were systematically searched from the inception of each database to 1 March 2026. A manual backward search of the reference lists of the included studies was also performed.

Main outcome(s) The outcomes of this review include visual acuity improvement, globe survival, the total incidence of postoperative complications and the incidence of proliferative vitreoretinopathy (PVR). Globe survival was defined as preservation of the anatomical eyeball without enucleation, evisceration or progression to phthisis bulbi at the final follow-up. Postoperative complications were defined as any adverse event occurring after the initial vitrectomy that required medical or surgical intervention or adversely affected visual or anatomical outcomes. The pooled effect measure was odds ratio (OR) with its 95% confidence interval (CI).

Quality assessment / Risk of bias analysis For the included RCTs, the Cochrane-recommended Risk of Bias tool was used for assessment, whereas the Risk of Bias in Non-Randomized Studies of Interventions (ROBINS-I) tool was used for the included prospective and retrospective cohort studies. The assessment covered seven domains: (1) random sequence generation (selection bias), (2) allocation concealment (selection bias), (3) blinding of participants and personnel (performance bias), (4) blinding of

outcome assessment (detection bias), (5) incomplete outcome data (attrition bias), (6) selective reporting (reporting bias), (7) other bias. Each domain was judged as 'low risk of bias', 'high risk of bias' or 'unclear risk of bias'. Two independent reviewers assessed the certainty of evidence for each outcome using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework, the certainty of evidence was rated as high, moderate, low or very low based on five domains: risk of bias, inconsistency, indirectness, imprecision and publication bias.

Strategy of data synthesis Meta-analysis was performed using Stata software (version 17.0; StataCorp LLC, College Station, TX, USA). The odds ratio (OR) with its 95% confidence interval (CI) was used as the pooled effect measure. Heterogeneity across studies was assessed using the Q test and I^2 statistic. An I^2 value of 75% high heterogeneity. The two-tailed significance level of $\alpha = 0.05$ was adopted for all analyses.

Subgroup analysis Due to the limited number of included studies (less than 10 studies per outcome), the statistical power was insufficient to perform subgroup analyses based on different time thresholds for vitrectomy, cause of injury, injury severity (Ocular Trauma Score), patient age, follow-up duration and different definitions of visual improvement.

Sensitivity analysis Sensitivity analysis was performed using the leave-one-out method to assess the robustness of the pooled results. The results showed that sequential exclusion of any single study did not substantially alter the pooled effect estimate, 95% CI or statistical significance, indicating that the meta-analysis results for all outcomes were stable and robust and were not driven by any single study.

Country(ies) involved the United States and China.

Keywords eye injuries, penetrating; vitrectomy; time factors; visual acuity; vitreoretinopathy, proliferative.

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