

## STEROIDS IN CARDIAC SURGERY: A SYSTEMATIC REVIEW

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### **Abstract**

*Since there has been considerable research on the prophylactic administration of corticosteroids in adult patients undergoing cardiac surgery with cardiopulmonary bypass (CPB), there is limited evidence to suggest that steroid therapy substantially affects patient outcomes.*

**Objective:** *This study aims to investigate the effects of administering steroids during cardiac surgery.*

**Aim:** *This study complied with the PRISMA 2020 guidelines for systematic review and meta-analysis. The researchers verified the study's similarity to become feasible. Publications from 2015 to 2023 were searched using online reference databases, including Pubmed and SagePub. Review articles, previously published works, and incomplete articles were dismissed.*

**Methods:** *The search identified 9,316 articles in PubMed and 7,654 articles in SagePub. In 2015, a search on PubMed identified 238 articles, and a search on SagePub yielded 121 articles. At last, 27 papers were selected, with 15 sourced from PubMed and 12 from SagePub. We included five studies that met the criteria.*

**Conclusion:** *The relationship between prescribing steroids and surgical site infections is still debated. Corticosteroid therapy has been found to reduce the incidence of postoperative delirium.*

**Keyword:** *Cardiac surgery; Dellirium; Infection; Steroids*

**INTRODUCTION**

Atherosclerosis in the coronary arteries is the characteristic of coronary heart disease (CHD), which may present without noticeable symptoms. Stable angina pectoris, unstable angina pectoris, and myocardial infarction with or without ST-segment elevation are all forms of coronary heart disease (CHD) or ischemic heart disease.<sup>1-3</sup>

The WHO confirms that non-communicable diseases (NCDs) are primarily caused by cardiovascular disease, which causes mortality. It contributes to 17.5 million mortality, representing 46% of all non-communicable disease-related deaths. Coronary heart disease occurs more frequently in countries with lower middle incomes, accounting for 80% of cases. Estimating the prevalence of CHD in the population is challenging due to lacking information from several countries.<sup>4</sup>

The administration of corticosteroids to adult patients undergoing heart surgery with CPB lacks substantial empirical support and shows significant variability in practice among institutions and practitioners. The limited effect of steroid medication on patient outcomes persists despite extensive research, indicating a need for more data.<sup>5-7</sup>

Meta-analyses evaluating the initial 35-40 years of clinical practice indicate a potential decrease in mortality rates and additional adverse effects such as postoperative atrial fibrillation and intensive care unit admissions.<sup>6</sup> These findings suggest that these trends may persist. The meta-analysis was limited by the small sample size and low quality of most trials, eliminating definitive evidence of a significant decrease in mortality.<sup>8,9</sup>

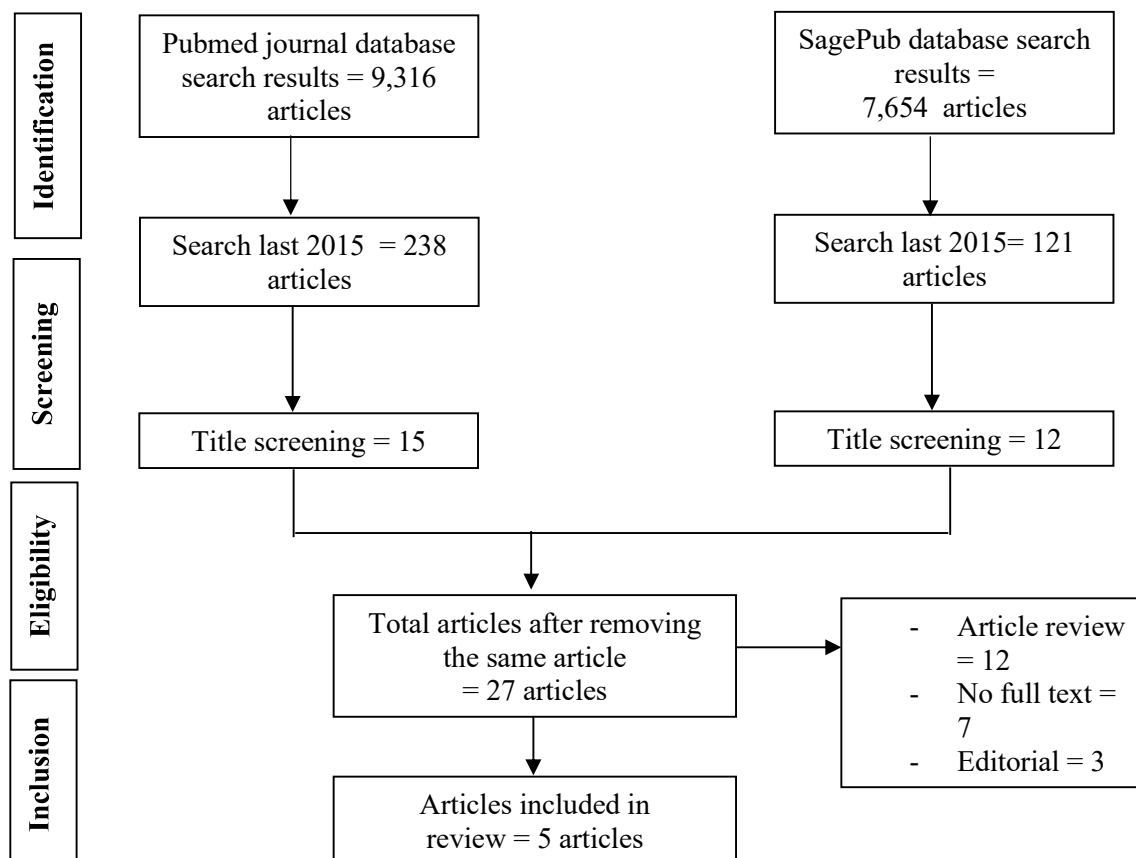
The publishing of two prominent and essential studies, the Dexamethasone for Cardiac Surgery (DECS) experiment and the Steroids in Cardiac Surgery (SIRS) study, has significantly contributed to an increase in our current level of understanding regarding this contentious subject. Corticosteroids impact on mortality and significant morbidity in adults following cardiac surgery was investigated in both studies. Secondary outcomes, such as delirium rates and recovery quality, were also analyzed in these trials.<sup>8,9</sup>

This study aims to evaluate the efficacy of administering steroids during cardiac surgery.

**METHODS**

The study's author fulfilled the PRISMA 2020 criteria to ensure it was currently accepted to relevant regulations. This stage is essential as it preserves the reliability of the investigation's findings. The study found that administering steroids during cardiac surgery affects patients. To achieve this objective promptly, assess prior research on this specific issue. This section will demonstrate the raised issues' significance in reaching the essay's goal.

Researchers had to demonstrate that they met the criteria to be authorized to participate in the inquiry. For publication consideration, the paper must focus primarily on administering steroids in cardiac surgery and be written in English. Publications between 2015 and the evaluation period will be included in this evaluation. Unpublishable research includes editorials, non-DOI applications, previously published reviews, and entries resembling published journal articles.



**Figure 1. Article search flowchart**

We used “steroids” and “cardiac surgery” as keywords. The search for studies to be included in the systematic review was carried out from June, 9<sup>th</sup> 2023 using the PubMed and SagePub databases by inputting the words: (*"steroidal"[All Fields] OR "steroidals"[All Fields] OR "steroidic"[All Fields] OR "steroids"[MeSH Terms] OR "steroids"[All Fields] OR "steroid"[All Fields]*) AND (*"thoracic surgery"[MeSH Terms] OR ("thoracic"[All Fields] AND "surgery"[All Fields]) OR "thoracic surgery"[All Fields] OR ("cardiac"[All Fields] AND "surgery"[All Fields]) OR "cardiac surgery"[All Fields] OR "cardiac surgical procedures"[MeSH Terms] OR ("cardiac"[All Fields] AND "surgical"[All Fields] AND "procedures"[All Fields]) OR "cardiac surgical procedures"[All Fields] OR ("cardiac"[All Fields] AND "surgery"[All Fields])*) used in searching the literature.

The text emphasizes that the credibility of the articles was determined by two evaluators who analyzed their titles and abstracts. The researchers evaluated each study's credibility by exploring its abstract and title, followed by a review of relevant historical documents. The systematic review only included unpublished English comments that met specific criteria. The paper details the authors, publication date, study location, subject characteristics, research topic, and study parameters. Endnote removed multiple entries from the results list.

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**RESULT**

In the PubMed database, the results of our search brought up 9,316 articles, whereas the results of our investigation on SagePub brought up 7,654 articles. The search results for the last year of 2015 yielded 238 articles for PubMed and 121 articles for SagePub. In the end, we compiled 27 papers, 15 of which came from PubMed and 12 from SagePub. We included five research that met the criteria.

McClure et al. (2019)<sup>10</sup> A study revealed that surgical site infections were observed in 180 individuals who received a placebo and 184 who received steroids. The study found significant risk factors ( $P < 0.05$ ) for postoperative acute kidney injury. These included diabetes managed with insulin, oral hypoglycemics, or diet, female sex, renal failure with and without dialysis, and CPB duration exceeding 96 minutes.

Alghamdi et al. (2022)<sup>11</sup> identified diabetes, hypertension, smoking, renal failure, and repeat surgery as the primary risk factors for post-cardiac surgery infections in Saudi Arabia, with a higher incidence in males. The leading causes were diabetes, hypertension, smoking, renal failure, and re-operation.

**Table 1. The literature included in this study**

Author	Origin	Method	Sample	Result
McClure, 2019 <sup>10</sup>	Canada	Multi-centre randomized-controlled trial	7,406 adult patients underwent cardiac surgery y	Patients having CABG surgery, requiring more prolonged CPB, having a higher BMI, or having diabetes have an increased chance of developing an infection at the surgical site. Research needs to be done to investigate potential risk-reduction strategies better.
Alghamdi, 2022 <sup>11</sup>	Saudi Arabia	Retrospective study	2,366 adult patients underwent cardiac surgery	Post-cardiac surgery infections are associated with risk factors such as smoking, diabetes, multiple procedures during a single hospital stay, and gender. Further research must identify additional factors and optimal strategies for mitigating post-cardiac surgery infections.
Whitlock, 2015 <sup>8</sup>	Canada	Randomized-controlled trial	7,507 adult patients underwent cardiac surgery	Methylprednisolone administration following cardiac surgery with cardiopulmonary bypass did not significantly affect mortality or significant morbidity rates. The SIRS trial findings do not support the routine use of methylprednisolone in cardiopulmonary bypass patients.
Royse, 2017 <sup>12</sup>	Australia	Randomized-controlled trial	Four hundred eighty-two participants for recovery and 498 participants for delirium were available for analysis	Methylprednisolone used intraoperatively at high doses does not improve the quality of recovery in high-risk cardiac surgery patients, nor does it lower the incidence of delirium.
Cotogni, 2017 <sup>13</sup>	Italy	Prospective cohort study	1,020 consecutive adult patients underwent cardiac surgery	According to the findings of this study, a violation of the timing of prophylactic vancomycin administration significantly increased the likelihood of surgical site infections (SSIs) and mortality due to infectious causes in patients undergoing heart surgery.

Whitlock et al. (2015)<sup>8</sup> enrolled 7,507 patients from June 21, 2007, to Dec 19, 2013, and designated them randomly between methylprednisolone (n = 3,755) and placebo (n = 3,755). Methylprednisolone did not demonstrate a significant decrease in mortality or major morbidity, nor did it reduce the risk of death at 30 days compared to placebo. The incidence of infection, surgical site infection, and delirium were similar in both groups.

Royse et al. (2017)<sup>12</sup> demonstrated that the quality of recovery improved over time. Still, no significant differences were observed between groups regarding the primary endpoint of overall recovery or individual recovery domains. The control group had a 10% incidence of delirium, while the methylprednisolone group had an 8% incidence. No significant differences were observed in the subdomains of delirium. No significant differences were observed in any cognitive domain preferred methylprednisolone among participants with standard (51%) and low (49%) cognition at baseline. Postoperative delirium was associated with poorer recovery in patients.

## DISCUSSION

CABG is a significant surgical intervention involving a grafted vein or artery to eliminate atheromatous blockages from the patient's coronary arteries. Revascularization is conducted to reactivate blood flow to the ischemic myocardium, reinstating function and viability and reducing angina symptoms. The yearly prevalence of CABG procedures has decreased due to the rise of alternative treatments such as medical therapy and PCI.<sup>14,15</sup>

The patient's aorta and heart were centrally cannulated and connected to the cardiopulmonary bypass circuit via a tube. Following the initiation of CPB, the heart is operated on with high-potassium cardioplegia to allow for the anastomosis of the drain to the coronary artery located distal to the obstruction. Following the surgeon's starting of the distal anastomosis, the canal is connected to the newly formed ostia in the proximal aorta. After the removal of cardioplegia, the heart initiates contraction, enabling the surgeon to examine the graft's blood flow and competence and inspect for bleeding at the anastomosis site. Afterward, sternal cables were used to close the chest, and the patient was moved to the intensive care unit for hemodynamic stability monitoring and extubation.<sup>16</sup>

Complications of CABG might include stroke, wound infection, graft failure, renal failure, postoperative atrial fibrillation, and mortality. The incidence of stroke ranges from 1-2% based on patient-specific and risk factors, whereas the sternal wound infection rate is 1%. Obesity, diabetes, chronic obstructive pulmonary disease, and prolonged surgical duration are risk factors.<sup>16,17</sup>

Postoperative delirium is common among cardiac surgery patients and is associated with elevated morbidity and mortality rates. Pharmacological interventions to decrease its occurrence are appealing. Intraoperative administration of high-dose methylprednisolone before cardiopulmonary bypass did not improve postoperative quality of recovery or reduce the incidence of delirium. Steroids did not reduce delirium incidence. The results are consistent with the SIRS and DECS studies, which demonstrated that administering high-dose steroids did not decrease mortality, morbidity, delirium, postoperative cognitive dysfunction, or persistent pain among cardiac surgery patients.<sup>6,8-10,12</sup>

Surgical site infection is a serious and potentially lethal complication of cardiac surgery, which is also linked to a significant morbidity and mortality rate. Surgical wound infection (SSI), also called postoperative wound infection, is prevalent. It significantly impedes the postoperative recovery of numerous patients. Postoperative infections within the initial 30-day period are rare due to multiple risk factors. Prior research has indicated no correlation between steroid usage and surgical site infections, although this finding is not consistent with the results of the Whitlock study.<sup>8,10,11</sup>

Even though SIRS recruited patients with a higher risk of morbidity and mortality based on the EuroSCORE, the incidence of surgical site infections was lower than that reported in previous cohorts. Cotogni et al.<sup>13</sup> found that the incidence of surgical site infection was 8.1% among 1,020 patients who participated in a single-center prospective cohort study. 4.4% of patients who underwent cardiac surgery were found to have an incidence of surgical site infection, according to the findings of a single-center retrospective cohort study that compared various antibiotic prophylactic regimens.<sup>18</sup>

The administration of perioperative corticosteroids did not significantly decrease the likelihood of wound infection following cardiac surgery. However, it did result in a reduction in the incidence of infection at all sites. The risk of surgical site infection was found to be independently associated with various factors such as obesity, diabetes, female gender, renal failure, increased cardiopulmonary bypass time, CABG, preoperative use of dual antiplatelet therapy, and maximal ICU blood glucose within the first 24 hours of admission. Preoperative ICU and vasopressor requirements showed an opposite relationship with postoperative wound infection. Infections have been correlated to smoking, COPD, advanced age, a high EuroSCORE, blood transfusion volume after surgery, insulin requirements in the ICU, and using H2 receptor antagonists within a week before surgery.<sup>10</sup>

## CONCLUSION

The relationship between administering corticosteroids and the likelihood of surgical site infections remains debated in current research. Research indicates that administering corticosteroids can decrease the frequency of postoperative delirium.

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