Off-Pump Coronary Artery Bypass Reduces Early Stroke in Octogenarians: A Meta-Analysis of 18,000 Patients

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Background. **Data comparing results of off-pump and conventional operations in octogenarians is very limited. Thus we chose to compare early adverse events between off-pump coronary artery bypass grafting (OPCABG) and on-pump CABG (ONCABG) in patients older than 80 years.**

Methods. **Systematic review of multiple databases was performed to obtain original studies fulfilling search criteria. End points—early mortality, stroke, respiratory failure, atrial fibrillation, and myocardial infarction—were compared between these cohorts. A random-effects weighted analysis was performed using the trim-fill adjustment when necessary. Results are presented as risk ratios (RRs) with 95% confidence intervals (CIs); $p < 0.05$ is considered statistically significant.**

Results. **Sixteen retrospective studies (9,744 ONCABG and 8,566 OPCABG patients) were included in the systematic review. OPCAGB patients received significantly fewer grafts (2.54 ± 0.16) compared with ONCABG patients (3.22 ± 0.41). Early mortality was comparable at 4.6% and 5.2% in the OPCABG and ONCABG cohorts, respectively (risk ratio [RR], 0.91; 95% CI, 0.64–1.28; $p = 0.598$). Stroke rates were higher in the ONCABG cohort (RR, 0.65; 95% CI, 0.49– 0.87; $p < 0.01$). Respiratory failure was higher with ONCABG (RR, 0.74; 95% CI, 0.57–0.97; $p = 0.03$). New-onset renal failure ($p = 0.99$), atrial fibrillation ($p = 0.27$), and myocardial infarction ($p = 0.99$) were comparable.**

Conclusions. **Coronary artery bypass in octogenarians can be performed safely with low early mortality. Although off-pump operations reduce the risk of early stroke, all other adverse events are comparable in on- and off-pump coronary artery bypass operations. Data regarding late mortality is at present limited; however, both on- and off-pump procedures appear to produce comparable survival.**

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Coronary artery bypass grafting (CABG) is possibly the most common procedure performed on adults by cardiac surgeons the world over. With increasing life expectancy, the mean age at operation is gradually increasing in many centers. Octogenarians pose a higher surgical risk because of their age-related comorbidities. Two recent randomized controlled trials [1, 2] demonstrated that the results of off-pump and on-pump coronary artery bypass are comparable in patients with advanced age. However, authors have considered octogenarians as an independent high-risk group when they undergo cardiac operations [3]. Hence we have conducted a systematic review and meta-analysis comparing the early results between off-pump CABG (OPCABG) and on-pump CABG (ONCABG) in octogenarians.

Material and Methods

A systematic review of MEDLINE, Scopus, and Web of Science was conducted from inception until February 2014 to identify studies fulfilling the following criteria: (1) articles were in peer-reviewed English-language journals; (2) articles could be either randomized controlled trials or retrospective observational studies; (3) studies discussed and compared clinical results in human participants older than 80 years who underwent either OPCABG or ONCABG; and (4) selected studies reported at least data regarding the primary end point (early mortality). Many also reported event rates regarding the other secondary end points considered for evaluation.

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Case reports, review articles, and editorials were excluded. Two authors (SEA and SVD) independently conducted the review process. Data from selected articles were extracted using a prespecified form. First author, country, study period, year of publication, sample size of each cohort, and raw event rates regarding the primary and secondary end points were obtained from each study. Propensity-matched data were obtained from studies when possible.

The systematic review was reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [4]. Study quality was assessed using the Newcastle Ottawa scale [5], and all the included studies had a Newcastle-Ottawa scale assessment score of 7 or greater.

Statistical Methods

The risk ratio (RR) was implemented as a measure of the treatment effect. The random-effects model described by DerSimonian and Laird was implemented for statistical analysis [6]. If a study had zero events in the experimental or control arm, 0.5 was added to each cell in the 2×2 table to allow us to calculate an RR and include the study in the meta-analysis. If both arms contained zero events, the study did not contribute to the pooled result [6].

OPCABG and ONCABG were considered as experimental and control cohorts for each analysis. Hence if the RRs and 95% confidence intervals (CIs) were less than 1, the results favored the OPCABG cohort, whereas the converse was true if it was greater than unity. All results are presented with 95% CIs; $p < 0.05$ is considered statistically significant.

The result was depicted using the Forest plot. This represents the RR and the 95% CI for each study as a square and a horizontal line, respectively. The size of the square is proportional to the percentage weight the study contributes to the overall effect. The final result is shown as a diamond; its center corresponds to the RR, whereas each arm extends to the 95% CI.

We used the I^2 statistic, which estimates the percentage of total variation across studies that is caused by heterogeneity rather than chance. Suggested thresholds for heterogeneity were used, with I^2 values of 25% to 49%, 50% to 74%, and 75% or greater indicative of low, moderate, and high heterogeneity, respectively [6, 7]. If the overall pooled result demonstrated heterogeneity,

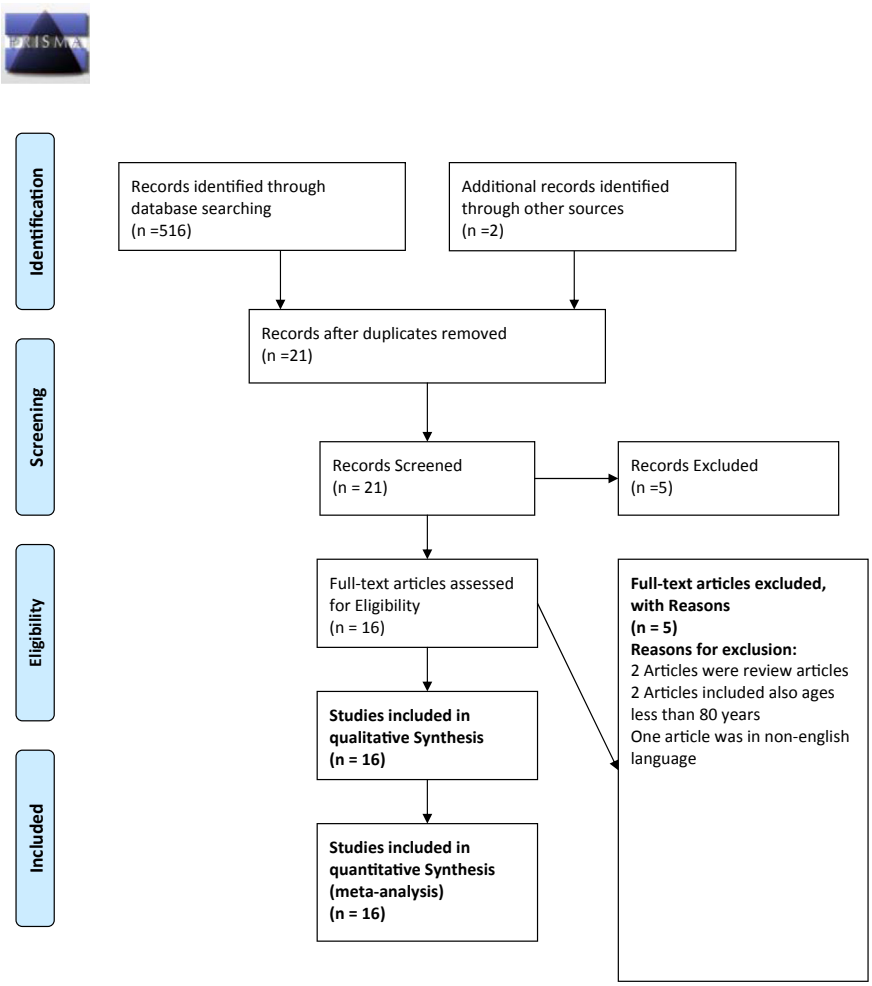

Fig 1. Flow chart depicting study selection for meta-analysis. (Adapted from Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6:e1000097.)