Review

Risks associated with red blood cell transfusion in the trauma population, a meta-analysis

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ABSTRACT

Introduction: A previous meta-analysis has found an association between red blood cell (RBC) transfusions and mortality in critically ill patients, but no review has focused on the trauma population only.
Objectives: To determine the association between RBC transfusion and mortality in the trauma population, with secondary outcomes of multiorgan failure (MOF) and acute respiratory distress syndrome (ARDS) or acute lung injury (ALI).
Data sources: EMBASE (1947–2012) and MEDLINE (1946–2012).
Study eligibility criteria: Randomized controlled trials and observational studies were to be included if they assessed the association between RBC transfusion and either the primary (mortality) or secondary outcomes (MOF, ARDS/ALI).
Participants: Trauma patients.
Exposure: Red blood cell transfusion.
Methods: A literature search was completed and reviewed in duplicate to identify eligible studies. Studies were included in the pooled analyses if an attempt was made to determine the association between RBC and the outcomes, after adjusting for important confounders. A random effects model was used for and heterogeneity was quantified using the I^2 statistic. Study quality was assessed using the Newcastle-Ottawa Scale.
Results: 40 observational studies were included in the qualitative review. Including studies which adjusted for important confounders found the odds of mortality increased with each additional unit of RBC transfused (9 Studies, OR 1.07, 95%CI 1.04–1.10, I^2 82.9%). The odds of MOF (3 studies, OR 1.08, 95%CI 1.02–1.14, I^2 95.9%) and ARDS/ALI (2 studies, OR 1.06, 95%CI 1.03–1.10, I^2 0%) also increased with each additional RBC unit transfused.
Conclusions: We have found an association between RBC transfusion and the primary and secondary outcomes, based on observational studies only. This represents the extent of the published literature. Further interventional studies are needed to clarify how limiting transfusion can affect mortality and other outcomes.

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Introduction

Blood transfusion has been commonly relied upon as a treatment modality in the trauma population. Death from haemorrhage remains the second most common cause of death in this population, second only to central nervous system injury [1]. More than 50% of severely injured patients are transfused, and over 15% of patients receive massive transfusion (>10 units of packed red blood cells) in some high income countries [2]. Despite the widespread use of transfusion in this population, evidence surrounding the risks and benefits is based primarily on small observational studies.

Randomized controlled studies in other critically ill populations have been undertaken to identify the risks of blood transfusion. A randomized controlled trial of critically ill patients by Hebert et al [3] suggested that patients receiving restrictive transfusion may have a lower in-hospital mortality risk than patients receiving a liberal transfusion strategy (Risk Difference 5.8% fewer deaths, 95%CI −0.3 to 11.7%, P = 0.05). Another randomized controlled trial by Hajjar et al assessed restrictive and liberal transfusion practices in cardiac surgery patients, but did not find a difference in 30-day mortality or severe morbidity between groups (10% in liberal, 11% in restrictive; risk difference 1%, 95%CI −6% to 4%, P = 0.85). The authors did however find that the number of transfused units was an independent risk factor for the primary endpoint by using Cox regression analysis.

Marik et al. performed a meta-analysis to assess the efficacy of RBC transfusions in the hospitalized adult population [5]. The review only included cohort studies that assessed the independent effects of RBC transfusion on mortality, infections, multi-organ dysfunction and acute respiratory distress syndrome. The pooled analysis revealed that blood transfusion increased the odds of mortality (Odds Ratio 1.69, 95%CI 1.46–1.92), compared with not receiving a blood transfusion. However, only 12 of the 45 studies were reported adequately enough to include in the meta-analysis, and the patient population was diverse.

The priority in treatment of trauma is to minimize bleeding and stabilize the patient, while priorities can differ for surgical and intensive care unit patients. The effect of transfusion on outcomes of trauma patients may differ from that of other critically ill populations, due to the timing and amount of transfusion required by the trauma population.

The objective of this meta-analysis is to assess the association between red blood cell transfusion and mortality, multi-organ failure and acute respiratory distress syndrome or acute lung injury, in the trauma population.

Methods

The methodology of this review conformed to the PRISMA guidelines [6]. The study participants were trauma patients. Inclusion was not limited by trauma severity, mechanism of injury or pattern of injury. The primary exposure was red blood cell transfusion (RBC); there were no limits to the type of transfusion or the amount transfused. We included studies that assessed red blood cell transfusion as a dichotomous variable, categorical variable and continuous variable (i.e. per one unit increase).

The primary outcome was mortality. Secondary outcomes included acute respiratory distress syndrome (ARDS)/acute lung injury (ALI) and multiorgan failure (MOF). ARDS, ALI and MOF were not defined *a priori* since strict definitions can differ geographically and may not be explicitly stated. We did not limit the follow up time frame for these outcomes.

Studies had to be comparative in nature, assessing RBC transfusion in the trauma population. Both observational and interventional studies were eligible for inclusion.

Search strategy and selection

Studies were identified through searching the EMBASE (1947–2012) and MEDLINE (1946–2012) databases. The search was conducted in May, 2012. Bibliographies of identified studies were reviewed to identify other publications. Non-English articles were included and translated as needed.

Search terms used to identify potential studies included: ["blood transfusion" or "transfusion" or "erythrocyte transfusion"] AND ["trauma" or "injury" or "wounds and injury"] AND ["mortality" or "acute lung injury" or "adult respiratory distress syndrome" or "multiorgan failure"]. The explode functions were used to capture permutations of these terms.

Once studies were identified, title screening, abstract screening and full text review were undertaken in duplicate by two authors (SVP, BK), based on predetermined selection criteria. Disagreements were resolved by a third independent reviewer on whether to include or exclude studies. The kappa statistic was used to determine agreement between authors.

Data abstraction

Data abstraction was completed in duplicate (SVP, BK). A standard extraction form was created and used by both authors. The following was data was abstracted: type of study, study population, number of participants, RBC categorization, outcomes assessed, type of analysis, average age, average injury severity