



Review

Combined versus single application of tranexamic acid in total knee and hip arthroplasty: A meta-analysis of randomized controlled trials



M.M. Peng Zhang¹, M.M. Jifeng Li¹, M.M. Xiao Wang*

Department of Orthopedics, Huaihe Hospital, Henan University, Henan, China

HIGHLIGHTS

- To compare the efficacy of the combined application of TXA for patients with THA and TKA.
- Only high quality studies were selected.
- Combined administration of TXA in total knee and hip arthroplasty was associated with significantly reduced total blood loss.

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ABSTRACT

Objective: To compare the efficacy and safety of the combined application of both intravenous and topical tranexamic acid versus the single use of either application in patients with total knee and hip arthroplasty.

Methods: Potentially relevant studies were identified from electronic databases including Medline, PubMed, Embase, ScienceDirect and the Cochrane Library. Patients undergoing primary total knee and hip arthroplasty were included in our studies, with an experimental group that received combined intravenous and topical application of tranexamic acid and a control group that received a single application of tranexamic acid or normal saline. The primary outcomes were total blood loss, hemoglobin decline and transfusion requirements. The secondary outcomes were length of stay, operation time and tranexamic acid-related adverse effects, such as superficial infection, deep vein thrombosis or pulmonary embolism. Modified Jadad scores were used to assess the quality of the included randomized controlled trials (RCTs). The data was pooled using RevMan 5.3. After testing for heterogeneity across studies, the data were aggregated using random-effects modeling when appropriate. We have registered the trial at <http://www.researchregistry.com>.

Results: Six RCTs that included 704 patients met the inclusion criteria. The present meta-analysis indicated significant differences existed in the total blood loss (MD = −134.65, 95% CI: −191.66 to −77.64, $P < 0.0001$), postoperative hemoglobin level (MD = 0.74, 95% CI: 0.39 to 1.10, $P < 0.0001$), drainage volume (MD = −40.19, 95% CI: −55.95 to −24.43, $P < 0.00001$) and transfusion rate (RD = −0.07, 95% CI: −0.11 to −0.03, $P = 0.0004$) between groups.

Conclusion: Combined administration of tranexamic acid in total knee and hip arthroplasty was associated with significantly reduced total blood loss, postoperative hemoglobin decline, drainage volume, and transfusion requirements. Based on the limitations of current meta-analysis, well-designed, high-quality RCTs with long-term follow-up are still required.

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1. Introduction

Total knee arthroplasty and hip arthroplasty (TKA and THA) are

major orthopedic surgeries used to treat degenerative arthritis and traumatic conditions such as displaced femoral neck fractures. More than 700 thousand TKAs are estimated to be performed annually in the United States. However, substantial perioperative blood loss has been associated with patient dissatisfaction and systemic diseases, especially in elderly individuals [1,2]. Many methods have been used to manage blood loss including tourniquet

* Corresponding author.

E-mail address: 3469660377@qq.com (M.M. Xiao Wang).

¹ Peng Zhang and Jifeng Li equally contributed to this study.

application, blood transfusion, administration of hemostatic agents and autologous donation [3]. Allogenic blood transfusion may increase the risk of adverse events, such as virus infections, immunologically mediated diseases and cardiovascular dysfunction, resulting in a financial burden and potentially life-threatening effects on patients [4].

Recently, the use of tranexamic acid in total knee or hip arthroplasty has become popularized in orthopedics. Tranexamic acid is a synthetic analog of an amino acid whose biological activity inhibits plasminogen from dissolving clots [5]. In previous studies, intravenous administration and topical application of tranexamic acid were reported to be associated with reduced perioperative blood loss and transfusion units. Furthermore, meta-analyses of high-quality randomized control trials (RCTs) indicated that tranexamic acid was effective and safe for the management of blood loss in patients with total knee or hip arthroplasty [6,7].

Despite this previous research, whether the combined application of tranexamic acid is superior to a single use remains unclear due to a lack of published studies and the inclusion of small sample sizes. Therefore, we performed the present systematic review and meta-analysis to evaluate the efficiency and safety of the combined application of intravenous and topical tranexamic acid compared to the single use of either application in patient with total knee and hip arthroplasty. We included only high quality RCTs that compared the efficacy and safety of combined application of intravenous and topical tranexamic acid with the single use of either application in patients with total knee and hip arthroplasty, in which the experimental group received combined intravenous and topical

application of tranexamic acid and the control group received a single application of tranexamic acid or normal saline.

2. Methods

2.1. Search strategy

Potentially relevant studies were identified from electronic databases including Medline (1966–2017.5), PubMed (1966–2017.5), Embase (1980–2017.5), ScienceDirect (1985–2017.5) and the Cochrane Library. The following key words were used in combination with the Boolean operators AND or OR: “total knee replacement OR arthroplasty”, “total hip replacement OR arthroplasty” and “tranexamic acid”, “blood loss” or “blood transfusion”. The bibliographies of the retrieved trials and other relevant publications were cross-referenced to identify additional articles. We placed no restrictions on the publication language. The search process was performed as presented in Fig. 1. We have registered the trial at <http://www.researchregistry.com>.

2.2. Inclusion criteria and study selection

Tranexamic acid is an antifibrinolytic agent that inhibits fibrinolysis by reversibly blocking the lysine-binding sites of plasminogen; this agent is commonly used in orthopedic surgery to decrease intraoperative blood loss and transfusion amounts. The bioavailability of tranexamic acid is 34% and its half-life is 3.1 h. Studies were considered for inclusion if they met the following

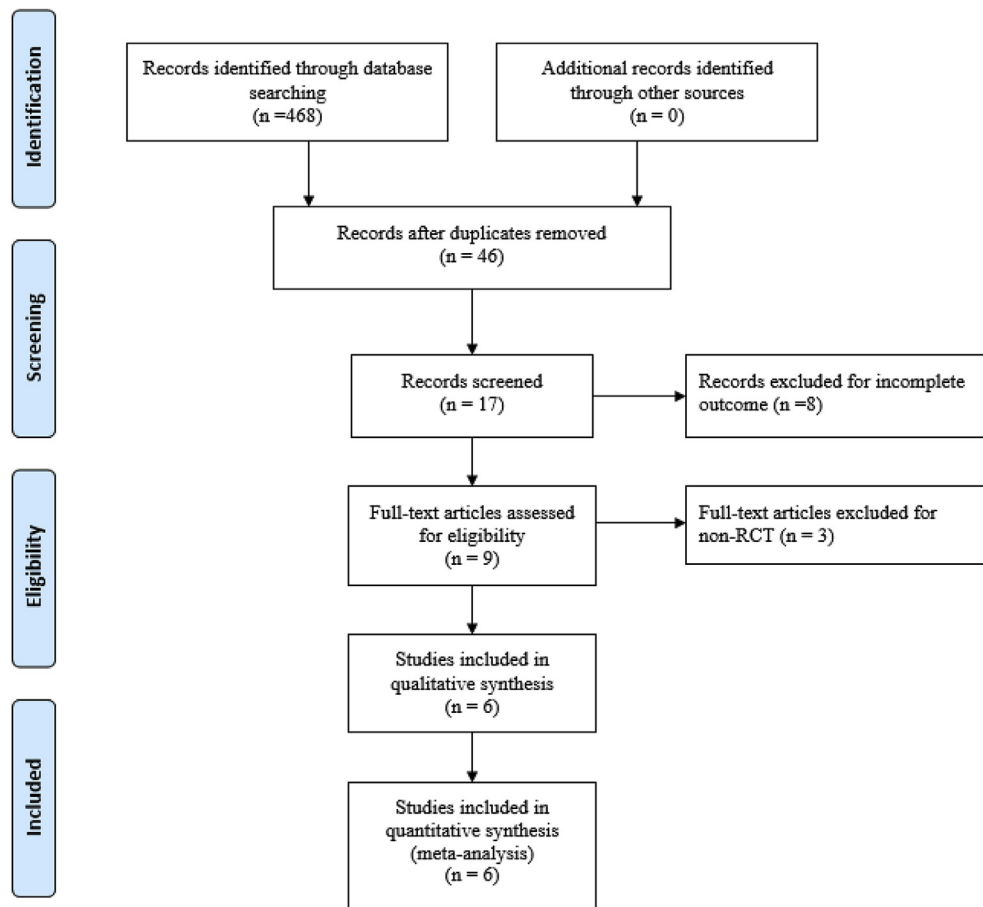


Fig. 1. Search results and the selection procedure.

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