Selective Use of Low Dose Tranexamic Acid in Orthopedic Surgery

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Tranexamic acid, a synthetic derivative of lysine, is the most commonly used antifibrinolytic agent to reduce blood loss associated with surgical procedures. The regimens and routes used are highly variable. There is a current shift from systemic (intravenous) use towards topical instillation and periarticular injections. We aimed to analyze the efficacy and safety for selective use of low dose tranexamic acid in major orthopedic surgery. The use of tranexamic acid (Exacyl) was retrospectively reviewed from our Hospital’s electronic database. Over a period of 12 months, a number of 46 surgeries in 45 patients were identified, with a mean age was 66 years old. An average of 1.17 units of tranexamic acid (500mg/5mL) were used per case (range 1-3). The drug was administered immediately postoperatively and if necessary repeated once after 8-24 h. The maximum dose per administration was 10mg/kg body weight, with a mean of 7.3 (SD 1.92). The average drop in hemoglobin (from preoperative to lowest consecutive postoperative) was 2.55 (range 0.1-5.8, median 1.3). 22/46 of surgeries required transfusions, with an average of 1.8 red blood cell mass per case (range 1-4). The average duration of postoperative hospital stay was 13 days (range 7-25). There were no complications directly related to tranexamic acid administration. Even in low dose, postoperative intravenous administration of tranexamic acid reduces total blood loss and requirements for transfusion.

Key words: tranexamic acid, total knee arthroplasty, hip replacement, blood loss

Tranexamic acid is a synthetic derivative of the amino acid lysine that reversibly binds to plasminogen, blocks the interaction with fibrin and inhibits clot breakdown. It is currently the most commonly used antifibrinolytic agent to reduce blood loss for a variety of surgical procedures. For major orthopedic surgery in particular, it significantly reduces total blood loss and the need for transfusion. It is inexpensive, well tolerated and does not increase the risk of deep vein thrombosis and pulmonary embolism [1].

The regimens and routes used to administer tranexamic acid are highly variable. There is a current shift from systemic (intravenous) use towards topical instillation and periarticular injections. The per dose amount ranges from 10 to 15mg/kg and the number of doses range from 1 to 3. The timing is either preoperative, before Tourniquet deflation, postoperative or a combination. The effects and potential cautions are dose dependent [2].

Experimental part

We aimed to analyze the efficacy and safety for selective use of low dose tranexamic acid in major orthopedic surgery.

The use of tranexamic acid (Exacyl) was retrospectively reviewed from our Hospital’s electronic database. Over a period of 12 months, a number of 46 surgeries in 45 patients were identified: 22 patients were male and 23 female. The mean age was 66 years old (range 36-78). We extracted pre and postoperative hemoglobin (Hb) levels, comorbidities, adverse events and length of hospital stay (fig. 1a,b). All knees had cemented implants and passive drains, clamped for 2 h. Most primary and all revision hips were uncemented. Approximately one third of the primary hips were performed via a posterior approach, while the rest via a modified lateral (Hardinge). None of the trauma cases had cement augmented fixation of the fractures [3].

Results and discussions

An average of 1.17 units of Exacyl (500mg/5ml) were used per case (range 1-3). The drug was administered immediately postoperatively and if necessary repeated once after 8-24 h. The maximum dose per administration was 10mg/kg body weight, with a mean of 7.3 (SD 1.92). The intent was to complement transfusions in cases where

Fig. 1a, b. Distribution of surgery types and associated diseases among patients who received tranexamic acid
The average drop in hemoglobin (from preoperative to lowest consecutive postoperative) was 2.55mg/dL (range 0.1-5.8, median 1.3). 22/46 of surgeries required transfusions, with an average of 1.8 red blood cell mass per case (range 1-4). The average duration of postoperative hospital stay was 13 days (range 7-25).

There were no complications directly related to tranexamic acid administration. All that occurred were associated with cases who had multiple surgeries. A patient with recurrent dislocation of total hip replacement and hyper toxicity due to Parkinson’s disease developed a postoperative hematorrhage after revision for periprosthetic fracture dislocation. A patient with septic loosening of a total knee arthroplasty had ischemic coronary episode after implant removal, cement spacer insertion and tranexamic acid administration. The incident was considered to be caused by transient hypotension.

The incidence of deep vein thrombosis and pulmonary embolism are very low [2]. These potential complications cause less concern compared to risks related to erythropoietic stimulating agents. The effects on myocardial and cerebral ischemia require further evaluation of safety. Tranexamic acid has been extensively used in cardiac surgery and presently the only significant caution for administration is recent history of ischemic stroke [1,4,5].

Apart from tranexamic, epsilon-aminocaproic acid and aprotinin have also been intensively studied. The effect of epsilon-aminocaproic acid is much lower than for tranexamic. Aprotinin has the strongest effect on containing perioperative blood loss but increased risk of thrombotic – ischemic events stopped its use [6,7].

Both topical and systemic administration reduce blood loss after arthroplasty, but the effects are dependent on dose and timing. For hip replacements, systemic administration seems to be more efficacious. Nonetheless, decreased blood loss is seen primarily in the immediate postoperative period and the total amount is less reduced comparative to knee arthroplasty [8,9]. In our series, all primary knees were performed under Tourniquet which is known to enhance local fibrinolysis [10]. Future directions in knee surgery should be aimed towards limiting invasive techniques such as intramedullary reaming and focus on cartilage preservation, protection and replacement [11-13].

Recent systematic reviews found a 0.52-0.62 decrease in the risk for transfusion. Our series had reduced transfusion requirements, comparable to reports from the literature: 1-31 mean transfused units, accounting for a mean of 130-920mL of blood in 20-96% of patients. One of the main limitation of our series is that we were not able to determine the total blood loss. Reports in the literature range between 690-1510mL [1,4,5,10]. Our average hemoglobin decrease is higher than expected (1.6-2mg/dL) [Seo 2013]. The two main reasons are unsystematized postoperative determinations and high percentage of revision, septic and complex cases which take longer to perform and require extensive approaches [15,16].

Even in low dose, postoperative intravenous administration of tranexamic acid reduces total blood loss and works to complement transfusions for patient homeostasis.

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References

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