

The Use of Autologous Fibrin Glue to Reduce Perioperative Blood Loss in Total Knee Arthroplasty – Results of a Controlled Study

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Introduction

Fibrin glue is currently applied broadly for hemostasis, gluing and sealing tissue and is also used as a carrier for cells, growth factors and pharmacologic substances. Homologous commercial fibrin glue is expensive for use in larger quantities, involves the risk of infection, is not biocompatible, and is probably cytotoxic. Autologous fibrin glue (AFG) can be produced from the patient's own platelet-poor plasma by cryoprecipitation (production of fibrinogen and thrombin) in larger amounts of up to 16 ml and can be deep-frozen (Fig. 1 and 2). This allows the possibility of using autologous fibrin glue safely and in large amounts for orthopedic surgery. The goal of this study was to determine the effect of using autologous fibrin glue with total knee arthroplasty (TKA) in terms of perioperative blood loss, the postoperative need for blood transfusions, wound healing and rehabilitation.

Material and Methods

As a controlled test of its effectiveness, TKA was selected as the standardized surgery procedure. A bloodless operating field was achieved during surgeries, which in many cases results in drain blood loss immediately following surgery (Fig. 3). A controlled pilot study was initially performed with 21 patients. In the control group, hemostasis was performed by diathermy. In the study group AFG was additionally used to spray the wound. All patients (AFG group n = 10, control group n = 11) had combined spinal-epidural anesthesia. The following parameters were measured: blood loss, hemoglobin, CRP, cardiovascular stability, need for postoperative blood transfusion according to a transfusion trigger, visual analog pain score (VAPS), range of motion, wound healing.

Results

Total blood loss in the control group was 1033 ml and 526 ml in the AFG group (Fig. 4). Two patients from the control group each received two RBC concentrate transfusions according to an individual transfusion trigger. The hemoglobin level in the study group was generally 0.5 points higher and then equaled the control group seven days after surgery (Fig. 5). The CRP rose in both groups up to 150 and normalized following the second week. During the entire follow-up period, the range of motion was somewhat better in the study group by 11 degrees. Within 24 hours following surgery, the visual analog pain score was markedly better in the study group at 1.3 in comparison with a score of 4.0 in the control group.

Discussion

The perioperative blood loss was reduced by 50% using a large surface application of autologous fibrin glue. Patients with AFG had better cardiovascular stability, better range of motion and less pain in comparison with the control group. So far, no adverse effects such as arthrofibrosis or infection have been found. The surgical procedure for use with AFG must be slightly modified and thermodynamic devices; disposable tubing kits and trained personnel are required. Since these are the results of an early pilot study, larger patient numbers and observation periods are necessary to confirm the results.



Fig. 1

Apheresis is used to separate the components of 600 ml of blood. Erythrocytes are reinfused into the patient. Cryoprecipitation (THERMOGENESIS CORP.) is used to produce the fibrin glue components thrombin and fibrinogen which are drawn separately into sterile syringes.

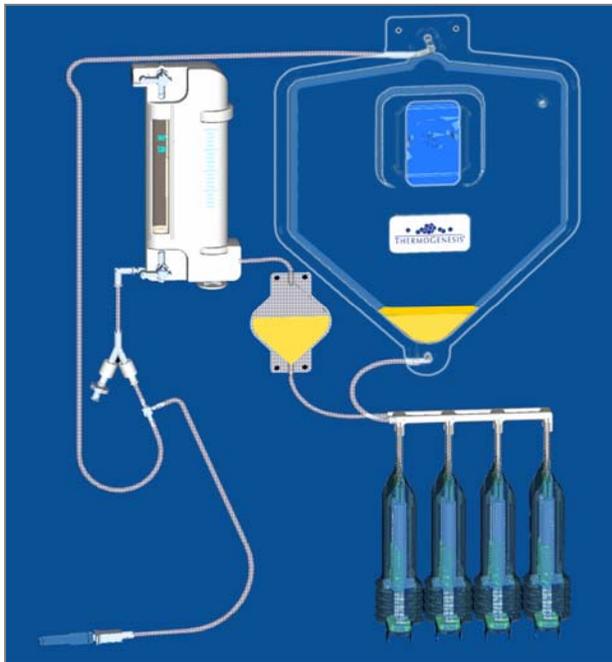


Fig. 2

The ready-to-use syringes are deep-frozen at 80°C and can be stored for up to a year. The application systems are thawed intraoperatively on a warming shelf.



Fig. 3

The bloodless field is opened surgically temporarily to stop more extensive hemorrhaging. Subsequently, pressure is re-applied followed by the application of the fibrin glue via the spray applicator on the surfaces of the wound.

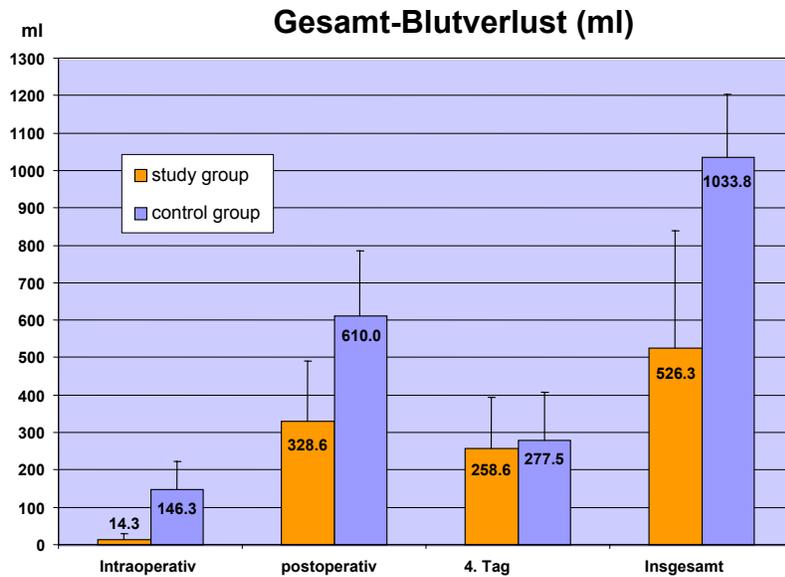


Fig. 4 – Total blood loss (ml)
The total blood loss in the study group was reduced by approx. 50%.

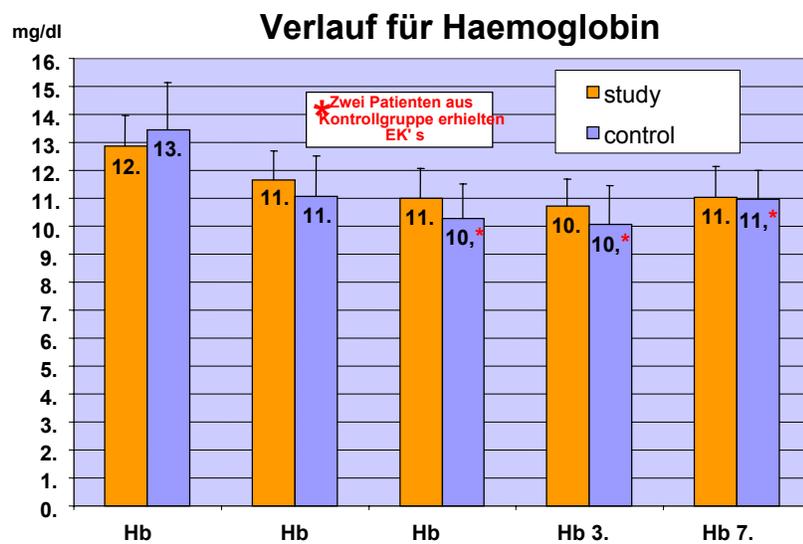


Fig. 5 – Hemoglobin (Hb) levels
Comparison of hemoglobin levels during the course of the first seven days following surgery. Two patients from the control group received donor RBC concentrate transfusions according to a transfusion trigger.