



Tourniquet Release Prior to Dressing Application Reduces Blistering Following Total Knee Arthroplasty



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ABSTRACT

Skin blisters occur in up to 20% of patients after total knee arthroplasty (TKA). Tourniquet release results in a limb volume increase of 10%. We hypothesized that releasing tourniquet before application of circumferential dressing will decrease blister formation. A prospective study was conducted on 135 consecutive primary TKAs. The tourniquet was released immediately after wound closure to allow for re-perfusion and then a dressing was applied. These patients were compared to a historical cohort of 200 primary TKAs, where the tourniquet was released after application of dressing. There was a significant difference in the incidence of blisters between the two groups [Late 7.5% (15/200) vs early release 2.2% (3/135) $P = 0.028$]. Releasing the tourniquet prior to dressing application has reduced the incidence of blistering following TKA.

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Total knee arthroplasty (TKA) has shown to be a safe and cost effective treatment for knee osteoarthritis [1,2]. Blistering, defined as the development of a fluid-filled sac under the epidermis, has been reported in up to 20% of patients after total joint arthroplasty (TJA) [3]. Among other wound complications, they are associated with higher rates of superficial and deep infections following TJA [4–6]. While intact blisters are sterile in nature, they can get contaminated soon after they rupture and may lead to surgical site infections [6,7].

A pneumatic tourniquet is commonly used in TKA because it improves visualization, saves time [8,9] and achieves a dry surface for cementation. Tourniquet release after TKA results in an immediate increase of the limb volume by 10% due to the return of pre-exsanguinated blood to the limb and post-ischemic hyperemia [10]. Application of a circumferential compression dressing prior to tourniquet release may cause shearing forces between the skin layers and the attached dressing as a result of limb expansion upon re-perfusion and may lead to blistering.

The hypothesis of this study was that releasing the tourniquet before application of dressing to the incision will decrease blister formation around the knee following TKA.

Materials and Methods

After obtaining approval from the institutional review board, we prospectively followed 111 consecutive patients (135 primary TKAs) performed at our institution between 12/2013 and 6/2014. All patients were operated on by the senior author and were followed for the appearance of blisters around the operated knee for at least 30 days after the index surgery. Patients with prior surgeries or previous injuries to the overlying skin of the operated knee were excluded from the study. Patients were also excluded if the specified dressing was not used. One patient who had previous skin graft on the operated knee because of previous burns was excluded from the study group and received a different, occlusive dressing (Fig. 1).

For skin preparation, a solution containing chlorhexidine gluconate and isopropyl alcohol was used, then the lower limb was exsanguinated and the tourniquet was inflated to 250 mm Hg for all cases. Stryker® non-sterile pneumatic tourniquet cuffs were used for all patients. All surgeries were done through a medial parapatellar approach, utilizing the same surgical technique. Drains were not used. The tourniquet was released during wound closure at the time of application of the skin adhesive glue. When the glue had dried and after complete limb re-perfusion, the wound was covered with Adaptic non-adhering dressing, gauze, sterile cotton undercast padding and an elastic bandage wrap. Complete reperfusion was assumed when skin color turned red, as a sign for skin reperfusion. Continuous passive motion machines were not used.

Surgical wounds were evaluated once daily for any wound complication, including blistering, until the patient was discharged from hospital. Blisters were categorized according to their location, consistency (clear filled or blood filled), number, size, skin breakdown and the timing of blister appearance (Fig. 2). Wounds were evaluated again at

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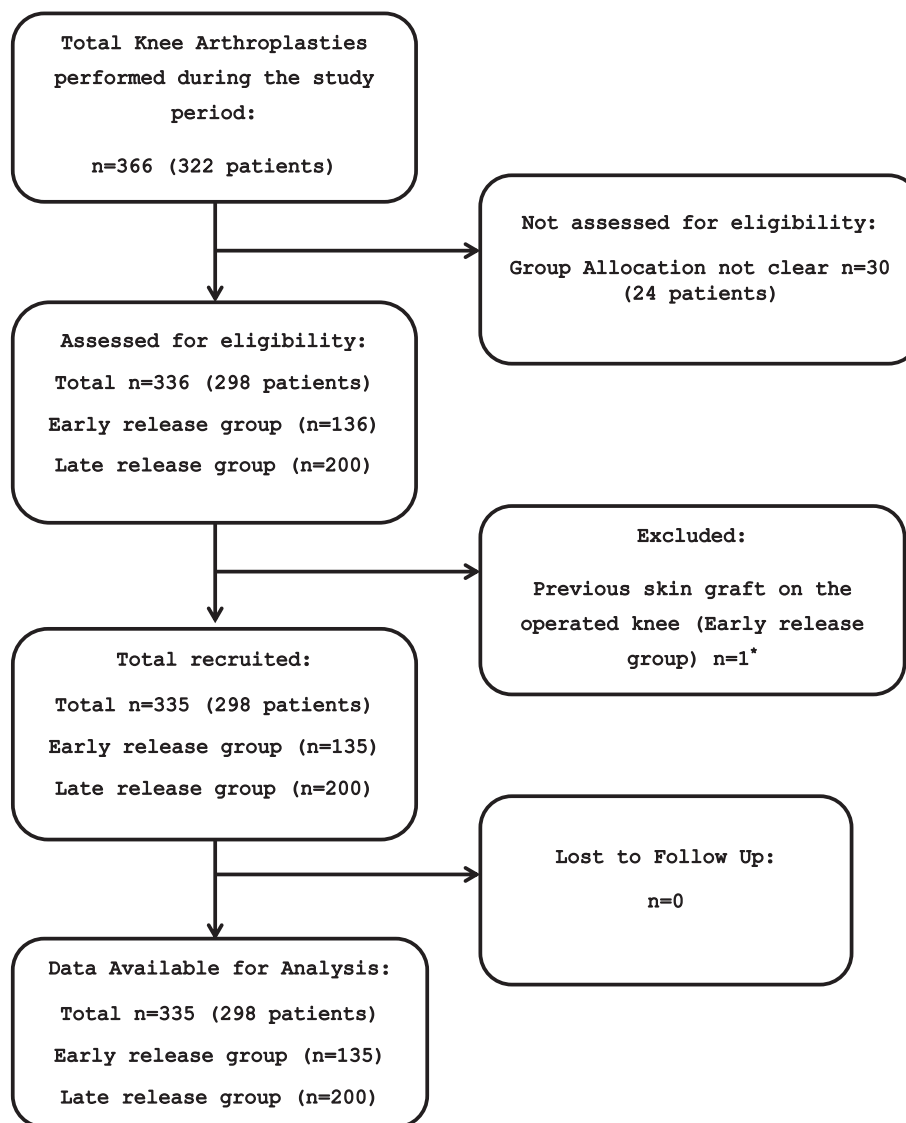


Fig. 1. Flow diagram. *The patient had simultaneous bilateral TKA. Only one knee was excluded.



Fig. 2. An example of a clear blister with an intact roof in a TKA patient.

1 month after surgery and any wound healing issues that had occurred were documented.

The early release group was compared to a retrospective cohort of 200 consecutive TKA (187 patients) that were performed by the same surgeon between 6/2012 and 8/2013 (just prior to the prospective study) for whom the tourniquets were released after the application of circumferential dressings (late release group). Skin preparation, surgical technique and skin closure, and perioperative care were the same for both groups. Data regarding skin complications for the later release group were retrospectively obtained from the medical records.

Patient's notes were reviewed to obtain demographic data, duration of surgery, limb ischemia time, body mass index (BMI), and American Society of Anesthesiology (ASA) scores. Surgical site infection (SSI) was defined by the Centers for Disease Control (CDC) criteria [11]. We were concerned that earlier tourniquet release might increase blood loss, especially since no attempt was made to identify and coagulate bleeders. Therefore, blood loss was calculated from the preoperative hematocrit levels, hematocrit levels at the first postoperative day (16–23 h after the surgery) and the volume of blood transfusion during the time period between the two blood tests, according to a previously validated formula presented by Rosencher et al [12] (Fig. 3).

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