Navigation-assisted total knee arthroplasty with normal pressure drainage reduces blood loss – a prospective comparative study of three modalities

KO JY[1], CHOU WY[1], WONG T[1], WANG FS[2]

[1]*Department of Orthopaedic Surgery, Kaohsiung Chang Gung Memorial Hospital, Taiwan, Republic of China*
[2]*Department of Medical Research, Kaohsiung Chang Gung Memorial Hospital, Taiwan, Republic of China*

kojy@adm.cgmh.org.tw

Several modalities have been developed to reduce perioperative blood loss during total knee arthroplasty (TKA) and a navigation system has been successfully introduced in TKA. We conducted a prospective, comparative study between January 2005 and September 2009 to evaluate the perioperative blood loss and postoperative range of motion among patients by conventional TKA with negative pressure drainage (Group A, 60 patients), by navigation-assisted TKA with negative pressure drainage (Group B, 64 patients) and by navigation-assisted TKA with normal pressure drainage (Group C, 66 patients). Indications for TKA included advanced osteoarthritis, rheumatoid arthritis and traumatic arthrosis. Contraindications included knee sepsis with previous osteomyelitis, a remote source of ongoing infection, extensor mechanism dysfunction, severe vascular disease and recurvatum deformity secondary to muscular weakness. We hypothesized that navigation-assisted TKA with normal pressure drainage would further improve the perioperative blood loss.

The use of acetylsalicylic acid was stopped 1 week before the surgery and continued on the next day after the surgery. Other nonsteroidal anti-inflammatory drugs were not restricted before or after surgery. No antithrombus medications were given perioperatively. All surgeries were conducted under general anesthesia and were performed by or under the direct supervision of the senior orthopedic surgeon. Conventional TKA was performed in a bloodless field using a pneumatic tourniquet at a pressure of 300 mm Hg after a single injection of antibiotic (cefazolin sodium 1 g). A midvastus approach was used through a midline skin incision of 10-12cm. The femur and tibia bone cuts were adjusted via an intramedullary guide. The prosthesis (Advantim Knee System, posterior stabilizing type; Wright Medical Technology, Arlington, TN, USA) was implanted with cement fixation. A 1/8 inch haemovac (Zimmer Haemovac; Zimmer, Warsaw, IN, USA) was inserted as a closed drainage system and was maintained at a negative pressure (700 mm Hg). A navigation-assisted TKA was performed on the Group B patients with a similar midvastus approach through a midline skin incision. A CT-free Navigation System (Vector Vision; Brain LAB, Heimstetten, Germany) with anatomical mapping of the knee and kinematics analysis was employed to generate a working model of the patient¡¦s knee. Osseous cut was achieved without intramedullary violation and the prosthesis (LPS-Flex system, Nexgen; Zimmer, Warsaw, IN, USA) was implanted with cement fixation. The ideal mechanical axis of within a 1.0¢Xdeviation was obtained after soft tissue balancing with the aid of a real-time computer screen. The tourniquet was released when the wound was closed. A 1/8 inch haemovac was also inserted as a closed drainage system and was maintained at a negative pressure (700 mm Hg). Patients in Group C were operated on using the same navigation-assisted procedure as Group B. However, the tourniquet was released when the joint was closed and a 1/8 inch haemovac was inserted as a close drainage system and maintained at a normal pressure (760 mmHg) without compressing the haemovac to a negative pressure. Haemovac drainage volume, reduction of haemoglobin, estimated total blood loss, range of motion at 3 months after surgery, number of blood transfusions and hospitalisation days were all recorded.

There were no statistical differences in the demographic data of the patients in the 3 groups. Patients in Group B had significantly lower haemovac drainage volume ($p < 0.01$), blood transfusion rate ($p < 0.01$), estimated total blood loss ($p < 0.01$) and better range of motion 3 months after surgery ($p <$

0.01) than the patients in Group A, although Hb loss (g) or Hb reduction did not significantly differ between the two groups. Patients in Group C had also significant reduction in the haemovac drainage volume ($p < 0.01$), blood transfusion rate ($p < 0.01$) and estimated total blood loss ($p < 0.001$) than the patients in Group B. In the comparison between Groups A and C, we observed that patients in Group C showed significant reductions in haemovac drainage volume ($p < 0.01$), Hb reduction($p = 0.03$), estimated total blood loss ($p<0.01$), blood transfusion rate ($p < 0.01$), hospitalisation days ($p < 0.01$) and better range of motion 3 months after surgery ($p < 0.01$) when compared to Group A. The navigation groups (B and C) had better range of motion 3 months after surgery when compared with Group A and there was no significant difference between Group B and C (119.5 ¡Ó 9.3¢X vs 115.8¡Ó12.4¢X, respectively, $p = 0.213$). In this study, navigation-assisted TKA with normal pressure drainage was proven to be the most effective at reducing perioperative blood loss, transfusion rate and hospitalisation days. Navigation-assisted TKA affords a technical advance in reducing blood loss by the avoidance of an intramedullary violation. Normal pressure drainage avoids excessive blood loss while evacuating intra-articular haematomas. This drainage strategy is simple and easy and no additional equipment or nursing care is required.