J Shoulder Elbow Surg (2014) 23, 605-612

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

JAPAN SHOULDER SOCIETY ARTICLES

Venous thromboembolism after elective shoulder surgery: a prospective cohort study of 175 patients

Hiroyuki Takahashi, MD[a], Nobuyuki Yamamoto, MD, PhD[a], Hideaki Nagamoto, MD[a], Hirotaka Sano, MD, PhD[a], Minoru Tanaka, MD[b], Eiji Itoi, MD, PhD[a,*]

[a]*Department of Orthopaedic Surgery, Tohoku University School of Medicine, Sendai, Japan*
[b]*Department of Orthopaedic Surgery, Tohoku Rosai Hospital, Sendai, Japan*

Background: The purpose of this study was to investigate the incidence of venous thromboembolism (VTE) after elective arthroscopic shoulder surgery.
Materials and methods: One hundred seventy-five consecutive patients who underwent arthroscopic shoulder surgery were enrolled (mean age, 61 years). Patients who had VTE preoperatively and underwent trauma surgery or arthroplasty were excluded. All the patients used foot pumps or elastic stockings after surgery for deep venous thrombosis (DVT) prophylaxis. DVT in the 4 limbs was assessed by ultrasound before and after surgery. Pulmonary embolism was diagnosed by computed tomography pulmonary angiography. Risk factors related to DVT were assessed.
Results: The overall incidence of DVT was 10 of 175 patients (5.7%). Most of the DVT cases were detected at 1 to 2 days after surgery. All patients were asymptomatic. There were no patients who had symptomatic pulmonary embolism. However, an asymptomatic pulmonary embolus developed in 1 patient during the 3-month follow-up period. There were no significant differences between the DVT and non-DVT groups regarding the risk factors.
Discussion and conclusion: Our data have shown that symptomatic VTE is rare after elective arthroscopic shoulder surgery. However, asymptomatic VTE may occur even with DVT preventive measures. Because most of the DVTs were found in the calf veins, we recommend that surgeons pay attention to the possibility of DVT in the lower extremities even after arthroscopic shoulder surgery. The incidence of asymptomatic VTE after elective arthroscopic shoulder surgery was 5.7%. All patients were asymptomatic, and most of the DVTs occurred 1 or 2 days after surgery.
Level of evidence: Level I, Prospective Cohort, Prognosis Study.

Keywords: Venous thromboembolism; deep venous thrombosis; pulmonary embolism; shoulder surgery; arthroscopy; asymptomatic; ultrasonography

The incidence of calf deep venous thrombosis (DVT) after total knee or hip arthroplasty has been reported to be 20% to 40%.[17] Guidelines for the diagnosis, treatment, and prevention of venous thromboembolism (VTE) after total knee or hip arthroplasty and open surgery for

This study was approved by the institutional review board of Tohoku University Graduate School of Medicine (study No. 2011-250, 2012-1-96).

*Reprint requests: Eiji Itoi, MD, PhD, Department of Orthopaedic Surgery, Tohoku University School of Medicine, 1-1, Seiryo-machi, Aoba-ku, Sendai, Japan 980-8574.
E-mail address: itoi-eiji@med.tohoku.ac.jp (E. Itoi).

1058-2746/$ - see front matter © 2014 Journal of Shoulder and Elbow Surgery Board of Trustees.
http://dx.doi.org/10.1016/j.jse.2014.01.054

proximal femoral fracture have been published. The guidelines include DVT standard prophylaxis such as intermittent pneumatic compression devices, elastic stockings, and anticoagulation therapy for perioperative management.[11,15,17,18]

According to the DVT guidelines published by the Japanese Circulation Society in 2009, patients undergoing surgery of the upper extremity are not at risk for postoperative DVT if there are no risk factors related to DVT.[17] Preventive measures—with the exception of early ambulation and active calf stretch exercises—are not recommended.[11,18] In 1990, Burkhart[5] reported the first case of symptomatic DVT after shoulder arthroscopic surgery. Meanwhile, the number of reports about symptomatic VTE after shoulder surgery has been gradually increasing.[1,3,4,7,8,10,12-14,16,19-24,27] In 2009, Willis et al[27] reported that the prevalence of DVT after shoulder arthroplasty was 13% in 100 patients. Although there has been increased awareness of the existence of DVT after open shoulder surgery, it still has not been a major concern for shoulder surgeons after arthroscopic shoulder surgery. Some retrospective studies have shown that the incidence of symptomatic VTE events after shoulder surgery was extremely low, ranging from 0.01% to 0.68%.[8,10,16,20,23] However, there have been only 2 prospective studies investigating the incidence of VTE after elective shoulder surgery.[26,27]

The purposes of this study were (1) to prospectively investigate the incidence of VTE after elective arthroscopic shoulder surgery and (2) to clarify the risk factors related to VTE events. Our hypothesis was that symptomatic VTE events after elective arthroscopic shoulder surgery are rare whereas asymptomatic VTE might occur even with DVT prophylaxis.

Materials and methods

This is a prospective cohort study of VTE that occurred after elective arthroscopic shoulder surgery.

Patients

A prospective cohort study was designed to document the incidence of VTE after shoulder surgery in consecutive patients. Between June 2011 and May 2013, a total of 353 consecutive shoulder surgeries were performed at our hospital, as well as a related hospital (one of our affiliated hospitals). Of the patients, 175 who met the following inclusion criteria were enrolled: (1) patients underwent elective arthroscopic shoulder surgery and (2) patients provided informed consent. The exclusion criteria were (1) patients who had a history of symptomatic VTE preoperatively, (2) trauma patients including elective fracture surgery cases, (3) patients who underwent arthroplasty, and (4) patients who were unable to undergo ultrasound examination before and after surgery. Arthroscopic surgery was performed in 175 shoulders in 175 patients. There were 145 arthroscopic rotator cuff surgeries, 17 arthroscopic Bankart repairs, and 13 other procedures (Table I). There were 125 men and 50 women, and the mean age at the time of surgery was 61 ± 13 years (range, 18-80 years). All procedures were performed with patients under general anesthesia, in the beach-chair position. The procedure was not conducted in the lateral decubitus position in any patient.

DVT preventive measures

During and after surgery, DVT prophylaxis such as elastic stockings, pneumatic compression pumps, and early ambulation was used in all patients. Intermittent pneumatic compression devices were used as DVT prophylaxis for the lower extremities during surgery in 173 cases (99%). An elastic stocking for the lower extremities was used in 2 of 175 cases (1%) during surgery. None of the patients in this study used low–molecular weight heparin or aspirin. The pneumatic compression pumps were used from the beginning of surgery for 24 hours. Patients who were not able to begin early ambulation used pneumatic compression pumps until they started ambulation. On the day after surgery, 171 patients (98%) were able to get out of bed. After surgery, intermittent pneumatic compression devices were used in 162 patients (93%), elastic stockings in 2 (1%), and the combination thereof in 11 (6%).

Questionnaire and ultrasound examination

A questionnaire was completed before surgery. The potential risk factors associated with VTE, which have been previously reported, were assessed.[2,17,27] As preoperative factors, the patient's background (age, sex, race, body mass index [BMI], and smoking habit), the presence of malignant disease, and comorbidities diagnosed previously were documented (Table II). As perioperative and postoperative factors, operative time, complications, length of hospitalization, and any associated VTE complications, such as symptomatic or fatal pulmonary embolism (PE), were recorded.

A 4-limb surveillance duplex ultrasound examination was performed to investigate the incidence of DVT. All examinations were performed and interpreted by a single orthopaedic surgeon specializing in musculoskeletal ultrasonography. In addition, he had 3 months of training in venous ultrasonography to detect DVT in the 4 limbs. To show the accuracy of detecting DVT by ultrasound in this study, the incidence of lower-extremity DVT in patients who underwent total knee arthroplasty during the same period was also investigated by conducting the same ultrasound procedure. Thirty-nine patients who had total knee arthroplasty at our hospital were enrolled, comprising 7 male and 32 female patients with a mean age of 72 years. Their diagnoses were osteoarthritis in 31 cases, rheumatoid arthritis in 7 cases, and psoriatic arthritis in 1 case. The ultrasound examination was performed between 3 days and 1 month after total knee arthroplasty.

The ultrasound devices used in this study were the Hi-Vision Preirus system (Hitachi-Aloka Medical, Tokyo, Japan) and M-Turbo system (SonoSite, Bothell, WA, USA) with linear probes ranging from 6 to 13 MHz and convex probes ranging from 2 to 5 MHz. The posture was the supine position with the arm in slight abduction. The examination sites were from the elbow joint level to the subclavian vein in the upper extremity and from the posterior calf to the inguinal area in the lower extremity. Duplex