

Low incidence of deep vein thrombosis after knee arthroscopy without thromboprophylaxis

A prospective cohort study of 335 patients

Marnix R Hoppener¹, Harmen B Ettema³, Chris P Henny², Cees CPM Verheyen³ and Harry R Büller¹

Departments of ¹Vascular Medicine, ²Anaesthesiology, Academic Medical Center, University of Amsterdam, ³Orthopedic Surgery and Traumatology, Isala Clinics (De Weezenlanden Hospital), Zwolle, the Netherlands

Correspondence CCPMV: c.c.p.m.verheyen@isala.nl

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Background There is little data on the risk of deep vein thrombosis after knee arthroscopy.

Patients and methods We performed a prospective cohort study to establish the incidence of venous thrombo-embolic (VTE) complications after knee arthroscopy in daycare, as detected by bilateral complete compression ultrasonography (CCUS) at day 14 (11–17) postoperatively. 335 patients completed bilateral extended ultrasound. No thromboprophylaxis was given.

Results 19 (5.7%; 95% CI: 3.5%–8.7%) showed VTE on CCUS, of whom 2 were symptomatic. 1 patient developed a non-fatal pulmonary embolus during the 8-week follow-up period. There was no difference in immobilization characteristics between the patients who developed postoperative DVT and those who did not; nor could other risk factors be identified.

Interpretation Since the incidence of VTE is low and a specific high-risk group for the development of VTE could not be identified, it seems justified to withhold routine pharmacological thromboprophylaxis after arthroscopy of the knee in a daycare setting.

ing arthroplasty. Even with prophylaxis, total knee arthroplasty gives an incidence of postoperative symptomatic venous thromboembolism (VTE) of approximately 2% (Colditz et al. 1986, Hull et al. 1986, Clagett and Reisch 1988, Wirth et al. 2001).

Knee arthroscopy is the most commonly performed orthopedic operation, with over 3 million procedures each year globally. There is, however, little data on the incidence of DVT and consequently there is no consensus regarding the need for perioperative thromboprophylaxis (Ettema et al. 2004, Geerts et al. 2004). A recent review showed a relatively high incidence of VTE without the use of thromboprophylaxis (11%, 95%CI: 8–13%) (Hoppener et al. 2003). Compression ultrasound (CUS) of the leg has become established as an important diagnostic tool for the detection of symptomatic DVT. Recently, the reliability of this technique has been further improved. Using a standardized protocol for an extended compression ultrasound examination of the entire venous system, it has now become feasible to objectively screen patients for asymptomatic proximal and distal DVT (complete compression ultrasound, CCUS) (Schellong 2004).

The aim of our study was to establish the incidence of venous thrombo-embolic complications as detected by bilateral complete compression ultrasonography, and to identify risk factors—especially regarding the duration of immobilization—after arthroscopy in daycare surgery.

Without prophylaxis, the risk of venographically-detected deep vein thrombosis (DVT) ranges from 40% to 70% following major orthopedic procedures where it is standard practice to use pharmacological thromboprophylaxis in patients undergo-

Patients and methods

The study was conducted between May 2002 and June 2003 in two teaching hospitals in the Netherlands (Academic Medical Center, Amsterdam, and Isala Clinics, Zwolle). All consecutive patients older than 18 years of age, referred for arthroscopic knee surgery in a daycare setting, were considered eligible. The patients were scheduled for bilateral complete compression ultrasonography (CCUS) 14 (11–17) days postoperatively. Patients meeting one of the following criteria were excluded from the study: inability or unwillingness to give written informed consent, inability to be followed-up, ongoing treatment with anticoagulant therapy, any other cause of immobility, and an intraarticular reconstructive procedure of the knee.

Two follow-up contacts were scheduled, at CCUS and by telephone at 8 weeks. Patients were asked if they had had any clinical signs or symptoms of VTE following the operation. The clinical signs documented were pain, tenderness, swelling or redness of the legs, dyspnoea, chest pain and hemoptysis. In addition, patients were instructed to contact the hospital if one of these signs or symptoms occurred prior to a follow-up contact. At the 2-week follow-up visit, patients were asked to record their period of immobilization during the first week following the arthroscopy.

Clinical data including date of birth, sex, race, weight and height were recorded at entry. Pre-operative assessment and operation details were recorded. CCUS of the leg veins was performed by 6 experienced physicians. All of them had undergone a supervised period of training before participating as a sonographer in this study. The ultrasound devices used were a 5- or 7.5-MHz linear-array sonographic scanner (Acuson 128XP; Acuson, Siemens, Mountain View, CA). A standardized protocol for complete compression ultrasonography was applied (Schellong et al. 2003).

The criterion for the diagnosis of DVT was inability to compress the veins with the ultrasound transducer. Ultrasonographic findings were recorded as normal (negative), abnormal (positive), or inadequate for interpretation if a complete vein or segment of a vein could not be identified. A venous thrombus was classified as proximal thrombosis (with or without concomitant calf

vein thrombosis), isolated calf vein thrombosis or muscle vein thrombosis. The proximal venous system was defined as the deep veins in the pelvis, the thigh, and the popliteal region cephalad to the trifurcation of the calf veins.

The primary outcome parameter of the study was the incidence of symptomatic and asymptomatic venous thromboembolic complications after arthroscopy of the knee during the 2-week follow-up (as diagnosed by a single postoperative compression ultrasound, CCUS or spiral CT scan). The secondary outcome was the incidence of symptomatic venous thromboembolic complications after arthroscopy of the knee during the 8 weeks of follow-up.

The study was approved by our Institutional Review Board.

Statistics

Continuous variables were compared using Student's t-test or, in the case of an abnormal distribution, the Mann-Whitney U test. Categorical data were compared with cross tabulation (Chi-square, Fisher's exact test).

Results

402 consecutive patients were scheduled for arthroscopy in a daycare setting. 47 patients (12%) met an exclusion criterion: age under 18 years (8 patients), use of anticoagulant therapy (9 patients), another cause of immobilization (2 patients), inability to obtain informed consent (17 patients), and inability to be followed-up (11 patients). Thus, 355 patients were eligible and gave their consent (Table 1). Ultimately, in 335 patients (94%) a complete bilateral extended ultrasound test was performed; one patient was excluded because of a unilateral ultrasonography only (result: no DVT) due to plaster cast immobilization of the unoperated leg. 19 patients did not undergo an ultrasound examination due to patient refusal or for administrative reasons.

All ultrasounds were evaluated as adequate. In 19 patients (5.7%; 95% CI: 3.5%–8.7%), the CCUS was positive for VTE. 1 of these patients developed symptomatic DVT, confirmed by CCUS before the scheduled 2-week follow-up contact; another patient presented with symptomatic DVT

Table 1. Baseline demographic characteristics of the 335 study patients

Center (number)	
AMC ^a	202
Wzl ^b	133
Age in years, mean (SD)	42 (13)
BMI, mean (SD) ^c	26 (4)
Sex (number)	
Male	190
Female	145
Ethnicity (number)	
White	281
Black	31
Asian/Pacific	1
Mixed	6
Side (number)	
Left	169
Right	164
Both	2

^a Academic Medical Center Amsterdam;

^b De Weezenlanden Hospital;

^c BMI: body mass index.

Table 2. Results of extended duplex ultrasonography 2 weeks after arthroscopy, and cumulative results after 8 weeks of follow-up, n (%)

	2 weeks	8 weeks
Proximal DVT	3 (0.9)	3 (0.9)
Pulmonary embolus	0 (0.0)	1 (0.3)
Calf vein thrombosis	8 (2.4)	8 (2.4)
Muscle vein thrombosis	8 (2.4)	8 (2.4)
Total VTE	19 (5.7)	20 (6.0)
Symptomatic	2 (0.6)	3 (0.9)
Asymptomatic	17 (5.1)	17 (5.1)

at follow-up. The rate of symptomatic DVT was therefore 0.6% (95% CI: 0.0–2.1) (Table 2). 1 patient, in whom the scheduled CCUS showed a superficial thrombophlebitis but no DVT, developed a symptomatic non-fatal pulmonary embolus 3 weeks after arthroscopy. The secondary rate of VTE at 8 weeks follow-up was therefore 6% (95% CI: 3.7–9.0) for total VTE and 0.9% (95% CI: 0.02–2.6) for symptomatic VTE (Table 2).

All 16 patients with calf or muscle vein thrombosis at the 2-week follow-up underwent repeat sonography after 1 week. None of the CCUS results showed progression of the thrombus, and therefore none of the patients were treated for VTE and no patients developed symptomatic VTE

Table 3. Risk factors for the 335 study patients, with and without venous thromboembolism, n (%)

	Patients with VTE (n = 20)	Patients without VTE (n = 315)	P-value
Previous DVT	0	5 (2)	1
Previous PE	0	4 (1)	1
Malignancy	0	10 (3)	1
Contraceptives			
Current use	1	43 (14)	0.5
Previous	8	92 (29)	0.3
HRT ^a			
Current use	1	7 (2)	0.4
Previous use	0	3 (1)	1
Family history of VTE	2	42 (13)	1
Protein C/S deficiency	0	1 (0.3)	
Lupus anticoagulants	0	1 (0.3)	1

^a Hormone replacement therapy.

during the 8-week follow-up period. The patient characteristics, operation details and risk factors of the patients who developed VTE were similar to those of patients who did not—with the exception of preoperative systolic blood pressure, which was found to be higher in the former group (Tables 2, 3 and 4).

Complete immobilization data were obtained from 347 patients. During the first postoperative day, 55% of the patients had been immobilized for more than 8 hours, 20% for 4–8 hours and 26% for 0–4 hours. On the second postoperative day, two-thirds of patients had been immobilized for more than 4 hours. The immobilization time showed a gradual decline over time. 7 days postoperatively, 86% of all patients had been immobilized for less than 4 hours a day. 3% of all patients had still been immobilized for more than 4 hours after 10 days. None of the patients who developed VTE were in this group. There was no difference between the immobilization characteristics of the patients who developed postoperative DVT and of patients who did not.

Discussion

A recently published article reviewed all studies dealing with daycare arthroscopic surgery (Hop-

Table 4. Operation characteristics of the study patients with and without venous thromboembolism

	Patients with VTE (n = 20)	Patients without VTE (n = 315)	P-value
Anesthesia, n (%)			
Spinal	13	204 (65)	
General	6	108 (35)	
Both	1	3 (1)	0.3
Operation type, n (%)			
No intervention (lavage)	1	34 (11)	
Meniscectomy (partial)	11	213 (68)	
Debridement	5	31 (10)	
Loose body	3	28 (9)	
Synovectomy	0	9 (2)	0.2
Duration in min, mean (SD)			
Arthroscopy	35 (16)	31 (14)	0.2
Tourniquet	43 (14)	37 (14)	0.07
Preoperative blood pressure in mmHg, mean (SD)			
Systole	147 (16)	138 (19)	0.05
Diastole	85 (13)	81(11)	0.2

pener et al. 2003). 5 of these studies evaluated the incidence of postoperative VTE after daycare arthroscopy diagnosed by ultrasonography. The pooled overall estimate of the incidence of all VTE, without the use of thromboprophylaxis, was 7.4% (95%CI: 4.9–11)—symptomatic 2.0% (95%CI: 0.8–4.1) and asymptomatic 5.4% (95%CI: 3.3–8.3). Our findings are in full agreement with these data. Demers et al. (1998), however, used venography as the diagnostic modality and found a higher incidence of DVT (18%; 95%CI: 13–24), as compared to studies which used ultrasonography. Recently, the accuracy of CUS has been improved: the examination has been made more comprehensive in terms of venous anatomy and the procedure has been standardized in terms of patient position, probe position and ultrasound modalities (Schellong 2004). Although we found that this improved CCUS method seems adequate for the diagnosis of both distal symptomatic and asymptomatic DVT, a complete validation of the technique must still be performed.

The mean overall postoperative immobilization period in our patients does not seem to be exceptional. After 10 days, 3% of the patients were still immobilized for prolonged periods of

time during the day, but none of the patients who developed VTE were in that group. In the past, before arthroscopy of the knee was performed in a daycare setting, patients were hospitalized for several days while receiving thromboprophylaxis. The rationale behind withholding thromboprophylaxis in daycare surgery has been the idea that early mobilization would prevent development of VTE. To our knowledge, there are no data in the literature describing the postoperative immobilization period after arthroscopy of the knee. We found that in general, patients are indeed immobilized for a short period of time. The patient characteristics of the relatively small group who developed VTE were not significantly different from those of the group that did not, with the exception of a slightly higher preoperative blood pressure noted in the former group. The pressure was only measured to determine the appropriate perioperative tourniquet cuff pressure, and the difference seems of no clinical importance.

The mean operation time was generally short (30 min) and the procedure caused relatively little trauma, since we excluded reconstructive and other arthroscopic knee procedures not performed in daycare in the 2 hospitals involved, which possibly contributed to the low rate of VTE.

A potential limitation of our study is the relatively small number of patients studied, although the 95% confidence intervals are narrow.

How should these data be interpreted clinically? Is it justifiable to withhold thromboprophylaxis in this setting? The prevalence of VTE in our study was 6% and most (5%) were asymptomatic distal calf/muscle vein thromboses. There is no consensus as to whether this type of thrombosis must be treated. During the follow-up period, none of the asymptomatic DVTs became symptomatic, despite the fact no anticoagulants were given. Thus, if the asymptomatic thromboses are discarded, we are left with an incidence of 0.9% for symptomatic VTE. Clearly, thromboprophylaxis could be considered in patients with a cluster of risk factors such as previous VTE, prolonged and difficult procedures, and concomitant diseases such as cancer.

Until more extensive studies have been performed, it seems justified to withhold thromboprophylaxis in patients undergoing uncomplicated arthroscopic procedures in a daycare setting.

Contributions of authors

All authors contributed to conception and design of the study, analysis and interpretation of data, writing the manuscript. MRH and HBE also collected the data.

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