ELSEVIER

European Journal of Radiology 71 (2009) 350–355

EJR
EUROPEAN JOURNAL OF RADIOLOGY

www.elsevier.com/locate/ejrad

Percutaneous mechanical thrombectomy combined with catheter-directed thrombolysis in the treatment of symptomatic lower extremity deep venous thrombosis

Hong-Jian Shi *, You-Hua Huang, Tao Shen, Qiang Xu

Department of Radiology, The Affiliated Wujin Hospital of Jiangsu University, 2 North Yongning Road, Changzhou 213002, China

Received 25 October 2007; received in revised form 19 April 2008; accepted 21 April 2008

Abstract

Purpose: To evaluate the efficacy of percutaneous mechanical thrombectomy (PMT) combined with catheter-directed thrombolysis (CDT) in the treatment of massive symptomatic lower limb deep venous thrombosis (DVT).

Materials and methods: One hundred and three clinically confirmed DVT patients were discharged from our institution. Sixteen patients with massive lower limb DVT were included in this retrospective study. After prophylactic placement of inferior vena cava filters (IVCFs), percutaneous mechanical thrombectomy (ATD, $n = 10$; Straub, $n = 6$) and catheter-directed thrombolysis were performed in all patients. Complementary therapy included percutaneous transluminal venous angioplasty (PTA, $n = 3$) and stent placement ($n = 1$). The doses of thrombolytic agents, length of hospital stay, peri-procedure complications and discharge status were reviewed. Oral anticoagulation was continued for at least 6 months during follow-up.

Results: The average hospital stay was 7 days. The technical success rate (complete and partial lysis of clot) was 89%, the other 11% patients only achieved less than 50% clot lysis. The mean dose of urokinase was 3.3 million IU. There were no significant differences of clinical outcome between the ATD and Straub catheter group. The only major complication was an elderly male who experienced a fatal intracranial hemorrhage while still in the hospital (0.97%, 1/103). Minor complications consisted of three instances of subcutaneous bleeding. No transfusions were required. Vascular patency was achieved in 12 limbs during follow-up. No pulmonary emboli occurred. There is one recurrent DVT 4.5 months after the treatment.

Conclusions: Percutaneous mechanical thrombectomy combined with catheter-directed thrombolysis is an effective and safe method for the treatment of symptomatic DVT. A randomized prospective study is warranted.

Keywords: Deep venous thrombosis; Therapy; Interventional; Anticoagulation; Percutaneous mechanical thrombectomy; Catheter-directed thrombolysis

1. Introduction

Deep venous thrombosis (DVT) is a significant cause of morbidity and mortality. It has been estimated that the yearly incidence of DVT is as high as 250,000 cases in the United States alone and as many as 100,000 individuals die annually from pulmonary emboli (PE) [1] In addition to early risk of PE, later morbidity may develop from recurrent thrombosis and post-thrombotic syndrome [2].

Inferior vena cava filters (IVCFs) can effectively decrease the incidence of fatal pulmonary emboli. Although conventional anticoagulation therapy has been proven effective in the treatment of DVT and PE, the incidence of recurrent DVT (2–10%) and post-thrombotic syndrome (20–50%) is fairly high after the first episode [3,4]. Moreover, venous valvular insufficiency is not uncommon: there are reports in the literature of incidences as high as 100% after the primary DVT event [2]. Complete removal of the thrombus can improve clinical outcomes. Percutaneous mechanical thrombectomy (PMT) combined with catheter-directed thrombolysis (CDT), a comprehensive interventional therapy, can quickly minimize the burden of thrombus in the treatment of symptomatic massive DVT (many phlegmasia cerulea dolens), reduce the thrombolysis drug use, avoid venous gangrene and decrease the high post-thrombotic syn-

* Corresponding author. Tel.: +86 519 85336190x2172; fax: +86 519 85325466.
E-mail address: shihongjian@sina.com (H.-J. Shi).

0720-048X/$ – see front matter © 2008 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.ejrad.2008.04.015

drome rate [5]. The purpose of this retrospective study was to evaluate the efficacy of combined therapy with percutaneous mechanical thrombectomy and catheter-directed thrombolysis in patients with lower extremity DVT.

2. Materials and methods

From January 2004 to September 2006, 103 consecutive clinically confirmed DVT patients were discharged from our hospital. Among them, 16 symptomatic massive DVT patients who underwent percutaneous mechanical thrombectomy combined with catheter-directed thrombolysis had complete follow-up data. We retrospectively analysed the records of these 16 patients. Inclusion criteria are as follows: patients who had overwhelming symptoms of lower extremity swelling, incapacitating pain, or phlegmasia dolen. Or patients presented with a high risk of pulmonary embolism, extensive iliocaval or iliofemoral thrombus that compromised lower limb blood flow. Exclusion criteria are that patients with asymptomatic DVT who underwent conventional anticoagulation treatment at our constitution; patients had contraindication to anticoagulation therapy and patients follow-up data were not available. The study was approved by our institutional review board. Informed consent was obtained from each patient.

This study included 9 males and 7 females, with a mean age of 53.3 ± 15.6 years (range 32–81 years). Acute DVT was present in 18 limbs (left, 13 limbs; right, 5 limbs) of 16 patients (Table 1). The thrombi were located in the iliofemoral-popliteal veins (left, 11 limbs; right, 3 limbs), inferior vena cava and bilateral iliofemoral-popliteal veins (2 patients). The average DVT age (time from the onset of lower limb symptoms or signs suggestive of DVT to the time of a definitive diagnosis) was 4.9 ± 3.9 days (range 1–15 days). In this group, risk factors for DVT included malignancy ($n = 3$), trauma ($n = 2$), recent surgical operation ($n = 4$), and hypercoagulable state ($n = 4$). All patients underwent venography and five patients received color Duplex Doppler ultrasound exams prior to admission to the hospital [6,7].

Intravenous administration of non-fractionated heparin (heparin sodium, Changzhou Qianhong Bio-Pharma Co. Ltd., Changzhou, China) at the rate of 12,500 IU qd and subcutaneous injection of low molecular weight heparin (Fraxiparine, Glaxo Smith Kline, Suzhou, China) at the rate of 0.4 ml q 12 h were utilized for the initial anticoagulation treatment. Each patient's international normalized ratio (INR), coagulation function, and platelet count were monitored every 2 days.

All interventional radiologic procedures were performed by experienced interventional radiologists (H.S., Y.H., T.S., Q.X.). Under sterile conditions, prophylactic inferior vena cava filters were placed in the angiography suite under local anesthesia through the right jugular vein or contralateral superficial femoral vein in 15 cases (11 Trapease Filters, Cordis, Miami; 1 Optease filter, Cordis; 1 Simmon nitinol filter, Bard, Crawley, UK; 2 Gunther-Tulip filters, Cook, Bloomington, IN). In one case, a Trapease filter was placed under general anesthesia in a patient with Stage IV rectal cancer, who had compulsive position and suffered severe pain caused by diffused metastatic lesions.

Percutaneous mechanical thrombectomy was conducted with the 8F Amplatz thrombectomy device (ATD, Microvena, White Bear Lake, MN) via ipsilateral popliteal vein access in the first 10 patients. The ATD catheter used was comprised of a double inverted helix rotating at 150,000 revolutions per minute (rpm) in a protective sleeve. It is driven by compressed air controlled by a foot pedal (working pressure 5–6 bar). This device is advanced through the thrombus at a speed of 15 cm/min.

6 F Straub-Rotarex catheter rotational thrombectomy (Straub Medical, Wangs, Switzerland) was performed in the final six cases via ipsilateral popliteal vein ($n = 4$) and bilateral popliteal veins ($n = 2$, bilateral DVTs). The design of the Straub-Rotarex catheter is based on a coated stainless steel spiral that rotates

Table 1
Patients' characteristics and treatment results

Patient no.	Age/sex	DVT age (days)	Predispose factors	Urokinase dose (million IU)	Treatment duration (h)	Procedural outcome (grade)	Complementary procedures	Follow-up
1	52/M	1		5.75	12	2		Partial
2	81/M	3	HP, DM	3.80	144	3	PTA	Died
3	38/F	3	Infection	5.25	48	3		Complete
4	60/F	10		2.50	36	3		Complete
5	80/F	1	Operation	1.80	36	3		Complete
6	74/F	1		4.20	48	1		Recurrent
7	43/M	1	Operation	4.50	36	3		Complete
8	68/M	4	Bone tumor, HP	3.70	48	3		Partial
9	44/M	7	Operation	2.70	24	3	PTA	Complete
10*#	32/M	7	Abdominal pain	1.50	24	1		Partial
11#	53/F	7	Rectal cancer	4.50	36	2	PTA, stent	Died
12	56/F	3	Operation	2.75	24	3		Complete
13	48/F	6	Pelvic trauma	3.00	30	3		Complete
14	49/M	15	Head injury	0.25	12	3		Complete
15*	42/M	2	Colon cancer	5.40	48	2		Partial
16	33/M	7	Ex-DVT	1.00	12	2		PTS

Abbreviations: *, bilateral DVT; #, vena cava and iliac thrombosis; HP, hypertension; DM, diabetes mellitus; PTA, percutaneous transluminal angioplasty; partial, partial patency; complete, complete patency; PTS, post-thrombotic syndrome.