Acta orthop. scand. *54*, 164–167, 1983

SCREENING AND TREATMENT OF PULMONARY EMBOLISM AFTER TOTAL HIP REPLACEMENT

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The effect of anticoagulative treatment of pulmonary embolism was studied in 63 patients out of 348 operated on with total hip replacement. Screening diagnosis of pulmonary embolism was obtained from ^{99m}Tc perfusion scintigraphy in combination with ^{99m}Tc-microaerosol ventilation scintigraphy and chest radiogram. The administration of heparin and warfarin was associated with hemorrhagic side effects in 7 per cent. The final outcome of surgery, however, was not interfered with. Fatal pulmonary embolism occurred in one patient (0.3 per cent) in whom the diagnosis had been missed.

Key words: dextran 70; heparin; hip replacement; pulmonary embolism; radionuclide imaging; warfarin

Accepted 21.ix.82

Pulmonary embolism (PE) constitutes the main cause of death following total hip replacement (THR) (Coventry et al. 1973, Johnson et al. 1977, Fredin & Nillius 1982). Frequencies of PE up to 11 per cent have been reported when based on physical examination alone (Hurson et al. 1979), and up to about 20 per cent when using pulmonary scintigraphy (Nillius et al. 1978, Fredin & Arborelius 1982). The mortality of untreated PE varies between 30 per cent and 50 per cent (Morrell et al. 1963, Pollak et al. 1973). Death from PE may occur in spite of heparin treatment (Fredin & Nillius 1982). However, few reports are available.

The aim of the present investigation was to study the effect of and the complications of treatment of PE after THR as diagnosed by screening scintigraphy.

MATERIAL AND METHODS

A total of 348 patients were operated on with THR, 321 patients with primary operations and 27 with revision arthroplasties. There were 114 men and 234 women with an average age of 65 ± 10 years. Patients with rheumatoid arthritis were excluded. A standardized procedure of THR was performed using either the Charnley or the Lubinus prosthesis. The thromboembolic prevention was randomly allocated between two groups.

One group was given dextran 70 (Macrodex®). The doses were 1000 ml on the day of the operation and 500 ml on the first and third postoperative days, respectively. If the peroperative blood loss exceeded 2000 ml, another 500 ml of dextran 70 was added on the second day. Before the initial infusion of dextran 70, 10 ml of monovalent haptendextran (15 per cent dextran 1, molecular weight 1000 dalton, Pharmacia AB, Sweden) was injected i.v. (Messmer et al. 1980).

The other group was given a fixed combination of 5000 IU of sodium heparin and 0.5 mg dihydroergotamine mesylate (Orstanorm®) (HDHE). The dose was given subcutaneously every 12 h during 10 days starting 1–2 h prior to surgery. The combination was approved by the Pharmaceutical Department of the National Social Welfare Board.

Weight-bearing was allowed on the first or second post-operative day.

A pulmonary scintigraphy was performed on 324 patients using ^{99m}Tc-perfusion scintigraphy 10–14 days after surgery (Fredin & Arborelius 1982). In 24 patients scintigraphy could not be performed for various reasons such as discharge from hospital before the 10th day or refusal to participate.

In 36 unselected patients with PE, a second perfusion scintigraphy was carried out after 1 week of heparin treatment in order to study the re-perfusion of the scintigraphic defect, in the remaining 27 this procedure was omitted. Four of the latter had a second THR performed on a later occasion. At that time there were no remaining scintigraphic perfusion defects.

The treatment with heparin and warfarin was started immediately after a positive scintigraphic diagnosis was obtained. Sodium heparin was given i.v. in a dose of 7500 IU six times a day. The dose was reduced to 5000 IU in patients over the age of 70, or weighing less than 60 kg.

The heparin treatment was discontinued when the prothrombin complex (P&P) measured with Simplastin A (Warner & Chilcott, USA) had reached a therapeutic level – ≤ 25 per cent – following peroral administration of warfarin. A daily dose of 12.5, 10 and 7.5 mg warfarin was given the first 3 days, in all patients with a P&P > 90 per cent. The P&P was measured once a week after a steady state had been attained. The warfarin treatment ended after 6 weeks.

Five patients with PE were not given anticoagulative therapy. One patient with a gastric ulcer and liver dysfunction received dextran 40 (Rheomacrodex®), 500 ml daily for 5 days. Initial misinterpretation in the scintigraphic procedure was the cause in four cases.

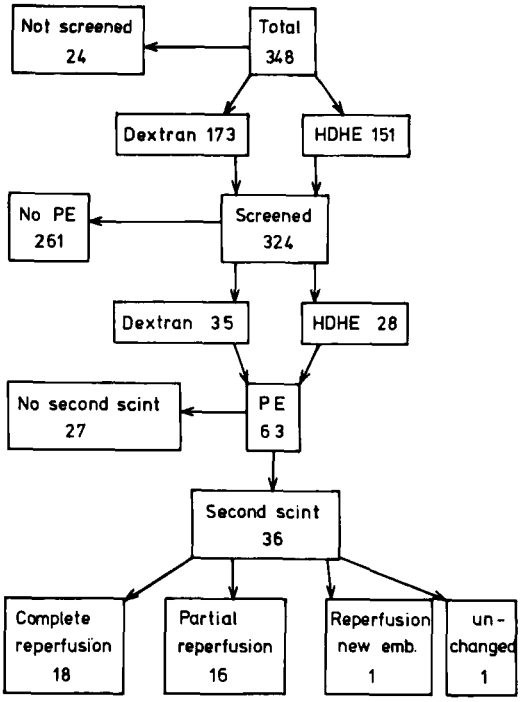

Figure 1. Flow scheme of patients with their thromboprophylaxis, screening and treatment for pulmonary embolism.

RESULTS

PE was diagnosed in 63 patients, 28 in the HDHE group and 35 in the dextran group (Figure 1). In all instances the diagnosis was based on the scintigraphy. Symptoms of PE prior to the scintigraphy were not observed.

Four of the 58 patients with anticoagulative treatment had complications during heparin and one during warfarin administration. One patient with multi-segmental emboli had several episodes of hemoptysis after 3 days on heparin and 12 days postoperatively. Three patients had a wound hematoma, one of these draining but with an uncomplicated healing of the wound. One patient had a subcutaneous hemorrhage following venous puncture after 9 days on warfarin.

The follow-up perfusion scintigraphy after 1 week of heparin administration, demonstrated a complete re-perfusion in 18 patients and a partial regression in 17 patients out of 36. In one of the 17 patients, re-perfusion was well as signs of new embolism were found. In another patient there was an unchanged perfusion image.

A follow-up scintigraphy was made in two patients among the five never treated with heparin or warfarin. One demonstrated a complete regression of the primary perfusion defect and the other a partial re-perfusion at the 1-week follow-up test.

The hospitalization period was prolonged until a steady state of P&P had been attained, on the average 5 days (range 4–19 days). The hemorrhagic complications in five patients delayed the discharge by on the average 6 days (range 2–19). The anticoagulant treatment with its complications added on the average 0.9 days of hospitalization, all patients included.

The mortality within 3 months after surgery was four patients out of 348, three of whom had

autopsy. In the fourth patient the clinical cause of death was cardiac infarction. This diagnosis was supported by laboratory signs and repeated electrocardiographic findings. In the autopsy cases the diagnosis was cardiac infarction in one case and septicemia following cholecystitis in another. One patient, however, died from pulmonary embolism:

A 73-year-old woman had DVT and PE found in routine phlebography and scintigraphy after her primary arthroplasty. Four years later she had her second hip arthroplasty performed. Low dose heparin in combination with dihydroergotamine was given as thromboprophylaxis for 10 days. The patient refused to participate in the screening phlebography of the operated leg but there were no signs or symptoms of DVT at any time. On the 13th postoperative day she had an episode of vertigo with sweating and palpitations interpreted as a relapse of atrial fibrillation previously verified by ECG. On day 14 there was dyspnea and coughing with a negative chest radiogram. On the suspicion of PE, heparin therapy was started but discontinued on the following day, since perfusion scintigraphy demonstrated only a slight defect atypical of PE and as 1 day later the ventilation scintigraphy did not support the diagnosis. Three weeks postoperatively a chest radiogram revealed pleura exudate, interpreted as due to cardiac failure. The following night she had an episode of pain in the back of her chest. Four weeks postoperatively, there was cardiac arrest and death. At autopsy, fresh emboli in the main trunks of the pulmonary artery were demonstrated as well as a major thrombosis in the femoral vein of the operated side.

DISCUSSION

Patients undergoing total hip replacement are at high risk of developing thromboembolism. Previous orthopaedic surgery has been reported to add further to the risk of fatal PE (Fredin & Nillius 1982), which is, on the whole, the most common cause of fatal outcome in the postoperative period. Reliable methods have been developed for the diagnosis of DVT as well as PE. These diagnostic efforts should, logically, result in anticoagulative therapy. However, this treatment may cause bleeding complications which could be disastrous in endoprosthesis surgery.

Treatment of PE with heparin and warfarin should be regarded as an extended prophylaxis against an enlargement of the PE and against further emboli. The purpose of anticoagulative treatment is also to prevent growth of existing DVT and the development of a post-thrombotic syndrome. The effect of heparin is to prevent thrombotic growth, while the natural fibrinolysis is active (Oakley 1968, Secker-Walker et al. 1970). However, it has also been reported that heparin may relieve the bronchial spasm by preventing the release of vasoactive amines from platelets in the embolus (Thomas 1965). Studies in dogs by Moser et al. (1973) indicated an enhancement of the embolic disintegration during heparin treatment by preventing accretion of fibrin-platelet layers on the surface of the embolus. Untreated patients demonstrated scintigraphic improvement less often and had more new perfusion defects than patients treated with anticoagulants (Secker-Walker et al. 1970).

Continuous administration of heparin provides a lower blood concentration and decreases the risk of bleeding complications (Salzman et al. 1975, Glazier & Crowell 1976). Intermittent administration, however, has recently been reported to prevent new PE (Wilson et al. 1981). There are also good reasons for adjusting the heparin dose to age and body weight (Salzman et al. 1975).

The complications to treatment with anticoagulants in the present study were almost exclusively due to heparin. However, no major disadvantage such as infection or delayed healing of the wound did occur as a result of the anticoagulative therapy.

We have considered the scintigraphic regression of the perfusion defect as a sign of recent PE. However, the PE might have resolved without heparin therapy as actually occurred in one of the patients studied.

Fatal PE is by some considered a rare event. The real incidence can be calculated only from autopsy data which must include every patient deceased within the first months after surgery. The clinical diagnosis is inadequate. Fatal PE is often asymptomatic and may therefore be mistaken for cardiac failure. The only patient with a fatal PE in this study demonstrates the fact that screening scintigraphy must be repeated if new symptoms or signs develop. As previously reported (Fredin & Nillius 1982), PE may recur in

spite of anticoagulative treatment – this was observed in one case in this study.

The selection of patients for treatment was entirely based on the screening scintigraphy, which is a simple and non-invasive but a less specific method than pulmonary angiography (Fredin & Arborelius 1982). Some smaller PE may have escaped detection. The outcome should be considered with this background.

Only 1/348 patients in this study died from fatal PE. This patient had not received proper treatment. The fatality rate is less but not significantly decreased as compared with earlier observations in our department (Fredin & Nillius 1982). Several thousands of observations would be needed to demonstrate significant differences in fatal PE.

This study demonstrates, however, that heparin – warfarin treatment may be used without serious side effects and with an investment of only one additional day of hospitalization on average.

ACKNOWLEDGEMENTS

Financial support was obtained from the Swedish National Association against Heart and Chest Diseases and from the Herman Järnhardt's Foundation.

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