Sequential mechanical and pharmacological thromboprophylaxis in the surgery of hip fractures

A pilot study

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Summary. Two hundred and thirty-eight patients with femoral neck fractures were entered into a randomised pilot study comparing the use of sequential treatment by 'Flowtron DVT' garments in the perioperative period followed by Enoxaparin (Clexane-Rhône-Poulenc Rorer), and Enoxaparin alone. One hundred and ninety-three patients were excluded indicating the difficulty of achieving pure comparisons in this population. The remaining 44 were randomised: 21 received Enoxaparin from the time of admission, and 23 had sequential treatment. There was no statistically significant difference in the incidence of thromboembolism. Patient preference did not indicate a favoured treatment subjectively. The operation field was drier in the sequential group, although this did not reach significance. Sequential treatment was not shown to be better or worse than treatment with Enoxaparin, but the trends favoured sequential treatment rather than drug treatment alone. The technique allows the operation to be carried out without the problems produced by low dose heparins and mobilisation is not hindered by compression garments.

Résumé. 238 patients présentant une fracture du col du fémur ont fait l'objet d'une étude pour comparer un traitement séquentiel avec utilisation d'une compression intermittente du mollet en période péri-opératoire (Flowtron DVT) suivie d'un traitement par Enoxaparin (Clexane – Rhône Poulenc Rorer) et un traitement habituel d'une

Enoxaparin débuté à l'admission du patient. 193 sujets furent exclus indiquant la difficulté de comparaison dans cette population de patients. Parmi les 44 restants, 21 reçurent l'Enoxaparin seule et 23 le traitement séquentiel. Il n'y a pas eu de différence significative dans l'incidence des complications thrombo-emboliques au sein de cette étude et les patients n'ont pas montré de préférence pour l'un ou l'autre des traitements. Le champ opératoire paraissait plus sec, dans le groupe séquentiel mais de façon non significative. Les auteurs suggèrent de poursuivre ce type d'étude sur des échantillons plus grands afin de pouvoir préciser si le traitement séquentiel est meilleur que le traitement par Héparine de bas poids moléculaire seul.

Introduction

Patients undergoing operations for fractures of the hip are at high risk of developing deep vein thrombosis (DVT) or pulmonary embolism, but the most effective prevention is not agreed. Pharmacological methods can be complicated by bleeding which is not seen with mechanical devices, although these may limit mobilisation after operation.

We investigated the use of mechanical methods in the perioperative period, followed by a low molecular weight heparin started on the second day after operation.

Table 1. Patients excluded from the trial

Reason	Number
Dementia	82
Currently taking NSAID or warfarin	37
Human error	19
Peptic ulcer within past year	10
Died during trial period	10
Previous CVA	9
Known cancer	9
History of DVT/PE	5
Patient transferred to other hospital	4
Refused consent	3
Nonoperative treatment of fracture	2
Refused scans after entry to trial	1
Refused surgery	1
Admitted to non orthopaedic ward	1
Total	193

Patients and methods

All patients with fractures of the femoral neck admitted between 2 June 1994 and 18 September 1995 were considered for the trial. The exclusion criteria are listed in Table 1. The principle reasons were dementia, which would affect compliance with the trial, and a concurrent illness or medication which might affect the incidence of thromboembolism.

Patients who were not excluded were randomised by selection of an unmarked envelope to one of 2 groups.

Group 1 were managed by the application of intermittent calf compression garments (Flowtron DVT – H.N.E. Huntleigh) at the time of admission until 48 h after fracture fixation. The garment on the fractured leg being removed only for the duration of the operation. At 48 h, the garment was removed and daily injections of Enoxaparin (Clexane-Rhône-Poulenc Rorer) were started and continued until 7 days after operation.

Group 2 were given daily injections of Enoxaparin from the time of admission until 7 days after operation.

A record was kept for every patient of the operation performed, the state of the operative field, the need for blood transfusion before and after operation, wound drainage and haemoglobin levels before operation, on day 2 and on day 7.

Colour Duplex Doppler scans of the femoral and popliteal venous systems were carried out in every patient at one and 6 weeks after operation. Those patients who transferred from calf compression to Enoxaparin were asked which method they preferred. Compliance with the regime was checked by daily visits from a research nurse.

Results

Of the 238 patients admitted with fractures of the femoral neck during the trial period, 193 were excluded, mostly because of dementia or the use of nonsteroidal anti-inflammatory drugs (Table 1). Forty-five patients (38 women and 7 men) were therefore entered into the trial.

On randomisation, 21 were allocated to group 1 and 24 to group 2. The mean age in group 1 was 78.7 years (range 41 to 91 years) and in group 2 80.2 years (range 41 to 90 years). In group 1 there

were 13 subcapital and 8 trochanteric fractures; in group 2, the corresponding numbers were 13 and 11.

There was no significant difference in the fall of haemoglobin concentration between the 2 groups (Student's *t*-test, $P > 0.05$). In group 1, the mean preoperative haemoglobin was 12.4 g/100 ml, falling to 10.7 on day 2, and 10.1 on day 7. In group 2, the fall was from a preoperative mean of 12.4 to 10.9 on day 2 and 10.4 on day 7. The same number of patients in each group received perioperative blood transfusions, with no transfusion in 16 of group 1 and 19 of group 2. Five patients in each group were given transfusions of 2 units each.

The operative field was not considered by the surgeon to be different in the 2 groups. In group 1, the field was classed as dry in 2, normal in 17 and oozing in 2. In group 2, the corresponding numbers were 0, 21 and 3. Mean wound drainage was 314 ml in group 1 and 402 ml in group 2 (chi-squared with Yates correction = 0.48, $P > 0.05$).

The patients did not express a preference for either treatment, equal numbers preferring each of the 2 types when compliance with 24-hour a day calf compression is rigidly enforced.

Two patients in group 1 developed DVT which was noted on the 6 week scan. Four in group 2 developed DVT, 2 at the one week scan and 2 on the 6 week scan. This trend does not reach statistical significance (chi-square test with Yates correction = 0.25, $P > 0.05$). One patient in group 1 developed a nonfatal pulmonary embolism between scans, no thrombus having been noted at one week.

Discussion

It is recognised that in orthopaedic practice the epidemiology and prophylaxis of thromboembolic disease remain under discussion and that further work is required [8]. Meanwhile each patient should undergo a risk assessment according to current guidelines [7], and be offered thromboprophylaxis accordingly. All patients with hip fractures are in the high risk category, with a proximal DVT rate of 10–30%. All those undergoing operation will therefore require some type of prophylaxis, although not necessarily low molecular weight heparin. Although this treatment results in low rates of thromboembolic complications [2], it is associated with bleeding during and after operation. Some anaesthetists are unwilling to use epidural anaesthesia on these patients. Caution is

also needed in patients who are taking nonsteroidal anti-inflammatory drugs, and those with disorders of coagulation or peptic ulceration.

Mechanical methods do not have these drawbacks and seem to be effective [3], but can limit mobilisation of patients with limb fractures. They have been shown to compare favourably with other methods of thromboprophylaxis [1], and single devices are probably as cost effective as complicated sequential compression systems [4].

We have demonstrated that sequential treatment with mechanical methods in the perioperative period, followed by pharmacological treatment during mobilisation, can be successful. It has been suggested that these methods together simply delay the appearance of clot until prophylaxis has been discontinued [5, 6, 9]. All our patients had a further scan at 6 weeks and, while most thrombi were discovered on this scan, the incidence was at least as low as described in previous studies which have reported findings within the early postoperative period when the patient was still taking the prophylaxis.

A large number of patients were excluded from this study in order to obtain a compliant population without confounding variables related to medical conditions and medications. Nevertheless, the trends favour sequential treatment rather than pharmacological treatment alone. Further studies are justified in this area since it has not been addressed in other studies of thromboprophylaxis. Sequential treatment allows the operation to be carried out without the problems which can occur with chemical antithrombotic agents, whilst al-

lowing postoperative mobilisation unhindered by mechanical compression garments.

References

1. Borow M, Goldson H (1981) Postoperative venous thrombosis: evaluation of five methods of treatment. *Am J Surg* 141: 245–251
2. Clagett GP, Resch JS (1988) Prevention of venous thromboembolism in general surgical patients. *Ann Surg* 208: 227–240
3. Pidala MJ, Donovan DL, Kepley RF (1992) A prospective study on intermittent pneumatic compression in the prevention of deep vein thrombosis in patients undergoing total hip or total knee replacement. *Surg Gynecol Obstet* 175: 47–51
4. Salzman EW, McManama, Shapiro AH, Robertson LK, Donovan AS, Blume HW, Sweeny J, Kamm RD, Johnson MC, Black PMcL (1987) Effect of optimisation of haemodynamics on fibrinolytic activity and antithrombotic efficacy of external pneumatic calf compression. *Ann Surg* 206: 636–641
5. Scurr JH (1990) How long after surgery does the risk of thromboembolism persist? *Acta Chir Scand [Suppl]* 556: 22–24
6. Sikorski JM, Hampson WG, Staddon GE (1982) The natural history and aetiology of DVT after total hip replacement. *J Bone Joint Surg* 63: 171–177
7. Thromboembolic Risk Factors (THRIFT) Consensus Group (1992) Risk of and prophylaxis for venous thromboembolism in hospital patients. 305: 567–574
8. Venous Thromboembolism Guidelines Working Party of the Royal College of Anaesthetists, the Royal College of Obstetricians and Gynaecologists and the Royal College of Surgeons of England (1995) Statement on prophylaxis against venous thromboembolism
9. Wroblewski BM (1990) Revision surgery in total hip arthroplasty. Springer, New York, pp 221–224