



## Wound infection in the management of hip fractures : A comparison between low-molecular weight heparin and mechanical prophylaxis

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A review of 205 consecutive patients was carried out to determine the association of low molecular weight heparin (LMWH) and the development of wound infection in patients having undergone surgery for a femoral neck fracture : 114 patients treated with LMW Heparin (Group A) and 91 patients with mechanical prophylaxis (Group B). The wounds were assessed using the ASEPSIS Score. Deep vein thrombosis (DVT) and pulmonary embolism (PE) were also noted.

Twenty-two patients (19%) in group A developed infection ; 9 patients (8%) showed severe infection. Eight patients (8%) in group B developed infection ; one patient (1%) showed severe infection.

The differences between these two groups regarding infection ( $p < 0.034$ ) and severity of the infection ( $p < 0.001$ ) were statistically significant.

None of the patients developed PE ; however 9 patients were diagnosed with a DVT.

Based on these findings, it appears that the use of LMWH for DVT prophylaxis may increase the likelihood of developing a severe wound infection.

The use of thromboprophylaxis in patients with fractures of the femoral neck is still controversial. Several studies have shown the complication rate associated with the use of LMWH to be quite high, including gastrointestinal bleeding, thrombocytopenia, and bleeding at an operative site (5, 6, 7). Furthermore, Harris *et al* have discontinued the use of heparin subcutaneously due to its high rate of complications and its lack of efficacy (5).

### INTRODUCTION

Hip fractures are the most common cause for admission to an orthopaedic trauma unit ; indeed in the financial year 1990-1991, 55,748 people were admitted to hospital with a fracture of the neck of the femur in England (2).

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Low molecular weight heparin, pneumatic compression / mechanical prophylaxis and warfarin have all been shown to reduce the rate of DVT and PE, with warfarin being the most effective agent. However LMWH and warfarin have a significantly higher association with oozing and minor hemorrhaging into the wound (3).

A publication of a large series in the recent study carried out by the Pulmonary Embolism Prevention (PEP) Trial Group has advised the use of low dose aspirin for hip fractures achieving a reduction in DVT and PE without a significant increase in post-operative bleeding (8).

The reported rates of wound infection following surgical management of hip fractures varies from 2 to 20% for extracapsular fractures and slightly higher at 2 to 25% for intracapsular fractures (1).

To our knowledge, although the association between LMWH and an increase in bleeding has been shown, there has not been a report showing an association with the use of LMWH and the development of wound infections.

The purpose of this study was to determine the incidence of wound infections following hip fracture surgery and to correlate our findings with the administration of the LMWH, Dalteparin sodium.

## PATIENTS AND METHODS

The notes of 205 consecutive patients undergoing surgery for fracture of the neck of the femur during 1999 in the Royal Oldham Hospital were reviewed. The mean age of the patients reviewed was 79.8 years (range : 40 to 96). Forty-seven percent (n = 96) of the fractures were extracapsular and 53% (n = 109) were intracapsular ; with 48% (n = 98) being treated with a Dynamic Hip Screw, 43% (n = 88) with hemiarthroplasty and 9% (n = 19) with cannulated Screws.

A comparative analysis of infection rates was carried out between the patients treated prophylactically against DVT with LMWH (Group A) and patients who received mechanical prophylaxis against DVT (Group B). The admitting consultant's preference determined the choice between pharmacological and mechanical prophylaxis for each patient.

The LMWH was started preoperatively and continued for 7 days. The mechanical prophylaxis in Group B consisted of antithrombotic stockings and early mobilisation on day one post-op.

Group A contained 114 patients with a mean age of 79.4 years (range : 45 to 96) and a male/female ratio of 1/4.

Group B contained 91 Patients with a mean age of 80.36 years (range : 40 to 94) and a male/female ratio of 1/4.

The wound status was assessed using a detailed proforma utilised by the hospitals wound care team (table I). In order to score the wounds the data from the proformas was input into a validated score system – ASEPSIS (9). Although there will naturally have been some degradation of data in using this method, the data provided on the wound care proformas was the same as that required by the ASEPSIS scoring system i.e. additional treatment required, the presence of serous discharge, erythema, purulent exudate, separation of the deep tissues, and the isolation of bacteria, with the general hospital notes providing information on the duration of inpatient stay and requirement for surgical debridement (9) (table II). Indeed, as can be seen, the wound care proforma actually provides more information than required for ASEPSIS scoring.

In addition (table II), we see that the ASEPSIS scoring system places more emphasis on objective rather than subjective data, giving 10 points to objective parameters such as in-patient stay of more than 14 days, isolation of the bacteria, the use of antibiotics and wound debridement under general anaesthesia.

Therefore, we feel that although the ASEPSIS scoring system has been used with retrospectively collected data, its usage is appropriate in this setting, and has enabled us to subdivide the patients according to the severity of any wound infection (table III).

The presence of DVT and PE was noted, as were the grade of the surgeon, the type of fracture and its treatment.

Data were processed in Excel® spreadsheet (Microsoft, Redmond, WA) using Chi-squared and Mann-Whitney tests for the statistical analysis. In addition the power of the study has been calculated using Stata® software (Stata Corporation, Texas).

## RESULTS

The analysis of the wound status showed that of the 205 patients reviewed, 30 (14.6 %) had wound infection. Analysing the two groups separately : Group A had 92 patients (80.7%) with satisfactory wound healing and 22 patients (19.3%) who developed a wound infection ; Group B had 83 patients

Table I. — Wound assessment, The Royal Oldham Hospital

**Date of dressing change** : use one column per dressing

Date									
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**Wound margin/surrounding skin** : tick approach boxes

Macerated							
Oedematous							
Erythema							
Eczema							
Fragile							
Dry/scaling							
Healthy/intact							

**Clinical Infection**

Clinical signs						
Swap taken						
Organism						
Antibiotic						

**Wound size**

Maximum length (mm)						
Maximum width (mm)						
Maximum depth (mm)						

(91.2%) with satisfactory wound healing and 8 patients (8.8%) with a wound infection. This difference was statistically significant ( $p = 0.034$ , Mann-Whitney) (fig 1).

When further subdivided according to severity (table IV), it was shown that the wound infections seen in the patients given LMWH were significantly more severe than those who did not receive it ( $p = 0.001$ , Mann-Whitney) (fig 2). At the 95% confidence level, this result has a power of 61.1% and a power of 74.6% at the 90% confidence level.

Methicillin-resistant *Staphylococcus aureus* was the most common infecting organism in both groups, being found in 40% of cases (table V). However, we did not find LMWH to be associated with any particular type of infecting organism.

Nine patients were diagnosed with DVT with no difference in rate between the two groups, and none of the patients suffered a PE.

The grade of the surgeon performing the surgery was recorded (table VI). We did not find any association between infection and the grade of surgeon undertaking the operation.

**DISCUSSION**

Most of the literature on thromboprophylaxis following hip surgery is based on elective total hip arthroplasty surgery. Very little has been written with respect to the management of elderly patients with a fractured neck of femur.

Table II. — The ASEPSIS score

Wound Characteristics	Percentage of Wound Affected					
	0	< 20	20-39	40-59	60-79	> 80
Serous Exudate	0	1	2	3	4	5
Erythema	0	1	2	3	4	5
Purulent Exudate	0	2	4	6	8	10
Separation of Deep Tissues	0	2	4	6	8	10

An in-patient stay of more than 14 days (due to wound healing), the isolation of bacteria, the use of antibiotics, and wound debridement under GA each result in the addition of a further 10 points.

Table III. — The Severity of wound infection according to ASEPSIS score

Severity of wound infection	ASEPSIS Score
Satisfactory Healing	0-10
Disturbance of Healing	11-30
Minor wound infection	21-30
Moderate wound infection	31-40
Severe wound infection	> 40

Femoral fractures have been reported to have a post-operative PE rate as high as 3.2% in the absence of prophylaxis (4). The use of pharmacological thromboprophylaxis has been shown to reduce the risk of DVT and PE compared to a placebo, however it is not clear which method should be used (3).

Table IV

Wound Status	Group A	Group B
	(LMW Heparin) Number of patients (%)	(No LMW heparin) Number of patients (%)
Satisfactory healing	91 (79.8)	82 (90.1)
Disturbance of healing	1 (0.9)	1 (1.1)
Minor wound infection	7 (6.1)	4 (4.4)
Moderate wound infection	6 (5.3)	3 (3.3)
Severe wound infection	9 (7.9)	1 (1.1)

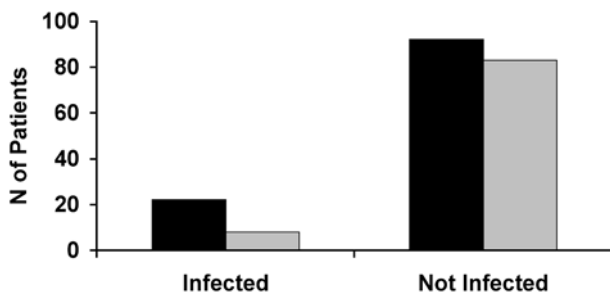


Fig. 1. — Relative Rates of Wound Infection

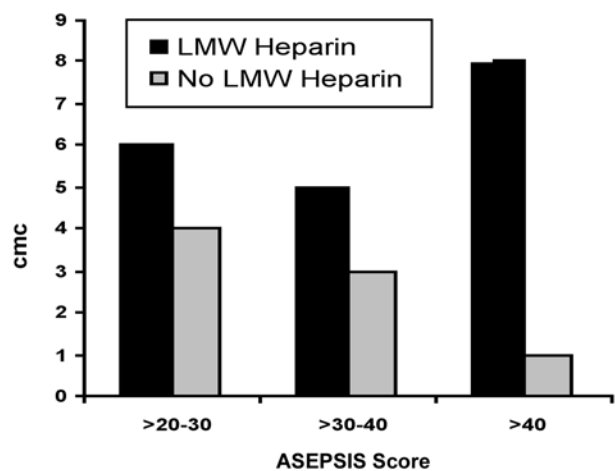


Fig. 2. — Comparison of Severity of Wound Infection

Table V

Type of Infection	Number of Patients (%)
MRSA	12 (40)
Staphylococcus aureus	9 (30)
Escherichia coli	4 (13)
Others	3 (10)
No isolated organism	2 (7)

Table VI. — Grade of the surgeon performing the operation

	Consultant	Middle Grade	Senior House Officer
Patients operated	46	110	49
Patients infected	6	19	5

Low molecular weight heparin has not been subject to rigorous scrutiny like aspirin in the PEP trial (8), however LMWH has been shown to be associated with more minor haemorrhage into wounds than aspirin or mechanical prophylaxis (3).

We have shown that the administration of LMWH may increase the chance of developing a wound infection ( $p = 0.034$ ), and that if patient does develop a wound infection it is likely to be more severe ( $p = 0.001$ ). We believe this to be related to the increase in oozing and haemorrhage into the wound that accompanies the administration of a LMWH.

This study has got an unselected sample of consecutive patients, which confers a high external validity and has also got a significant statistical power ; however the study is retrospective and the allocation of patients to each group was due to clinician prophylactic preferences alone. Therefore, our conclusions should only be regarded as

an indication of outcome. A further prospective randomised study comparing these two groups of patients will need to be carried out in order to validate our findings.

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