	Volume injected					
	0-0.025 ml	0-10 ml	0-10 ml	0-20 ml	0-25 ml	0-50 ml
Median (95% CI) pain score*	0 (0 to 0)	0 (0 to 1.3)	0 (0 to 0)	0 (0 to 1.0)	0 (0 to 0)	0 (0 to 0)
% (95% CI) Patients scoring <10% of worst pain	92 (85 to 100)	80 (70 to 91)	77 (65 to 88)	77 (65 to 88)	77 (65 to 88)	75 (63 to 86)

*0=No pain at all, 21=worst pain, on visual analogue scale.

volume. Insertion of sharp 27 gauge or 28 gauge needles was essentially painless, with a median pain score of 0 (95% confidence interval 0 to 3.1) for the NovoPen, 3.05 (0 to 9.8) for the Plastipak, and 5.0 (2.0 to 12.8) for the Omnikan. Blunted needles increased the median pain score to 11.9 (1.8 to 20.5) for the NovoPen, 19.45 (3.5 to 20.5) for the Plastipak, and 20.15 (6.5 to 20.5) for the Omnikan.

Comment

The pain of subcutaneous injection is associated with the bluntness of the needle but is related neither to the needle diameter in the range of 26-28 gauge nor to an injection volume up to 0.5 ml. The major importance of the needle trauma for subcutaneous injection pain is consistent with a previous report,⁴ according to which simply inserting the needle produces a vascular reaction within the subcutaneous tissue lasting 10 minutes.

Syringe-needle units get blunted by piercing the rubber membrane of the vial to aspirate insulin⁵; as this does not occur with preloaded insulin pens, such devices may be associated with less injection pain than syringes. Finally, small injection volumes, as are required by most diabetic patients with intensive insulin treatment and <80 U/day, are unlikely to induce pain. A change of insulin concentration from 40 U/ml to 100 U/ml to reduce the possible pain of injection is therefore unfounded.

- 1 Krall LP, ed. *Joslin diabetes manual*. 11th ed. Philadelphia: Lea and Febiger, 1978:81-105.
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- 3 Scott J, Hoskinson EC. Graphic representation of pain. *Pain* 1976;2:175-84.
- 4 Williams G, Pickup J, Clark A, Bowcock S, Cooke E, Keen H. Changes in blood flow close to subcutaneous insulin injection sites in stable and brittle diabetes. *Diabetes* 1983;32:466-73.
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Cost of road traffic accidents to an orthopaedic department

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The cost of inpatient treatment of road traffic casualties to the orthopaedic unit of a district general hospital can be great, yet much of this money could be recouped from motor insurance companies. I conducted a retrospective study to determine the cost in a district general hospital and how much money was recovered.

Patients, methods, and results

I studied all patients who had had road traffic accidents and had required emergency admission to the orthopaedic unit of this hospital between 1 April 1989 and 31 March 1990. Of 50 005 people newly attending the accident and emergency department, 1394 had been injured in road traffic accidents; 147 of these had required hospital admission and 51 had been admitted to the orthopaedic unit.

I calculated the length of stay in hospital for the orthopaedic patients, including any subsequent admissions directly related to injuries sustained in the accident (for example, for removal of an external fixation device). The total cost of inpatient treatment was determined by applying a daily charge of £165 per patient. This figure was calculated by the hospital finance department as a charge to motor vehicle insurers to recover the costs of treating road casualties and was the average daily cost per patient of maintaining the hospital and its staff and of maintaining and treating patients.

During the study period a maximum of £2000.37 could have been recovered for each patient admitted for treatment.¹ I examined the hospital's road traffic accident accounts to determine how much money had been recovered and the delay between the road traffic accident and receipt of payment.

The mean length of inpatient treatment was 23.76 days (range one to 103), costing £199 980. By applying

a limit of £2000.37 per patient the maximum amount that could have been recovered from motor insurance companies was £81 257.73. This represents 40.6% of the total cost. None of the costs of inpatient treatment incurred during the study period had been recovered. Among all admissions after road traffic accidents during 1986-90, accounts had been settled for only 12. The mean delay between the date of accident and receipt of these payments was 23 months (range nine to 36).

Comment

Since 1930 hospitals have been able to reclaim some of the costs of treating the casualties of road traffic accidents from motor vehicle insurers.² In practice, however, the recovery of inpatient costs is low. This is primarily due to the inadequacies of the statutory provision, which is weighted heavily in favour of insurance companies. The maximum amount recoverable for each patient is limited to £2000.37. With hospital costs of £165 per patient a day this would cover a stay of only 12 days. This ceiling resulted in a deficit of almost £120 000 between the costs incurred by the orthopaedic department and the maximum amount reclaimable.

Inpatient costs have to be paid only when the insurer makes a separate settlement for injuries resulting from the accident. To pursue such a claim many road accident victims would have to resort to legal action, and with no guarantee of a successful outcome the cost and effort entailed act as deterrents. A successful claim may take years to settle and it is only then that the hospital is eligible for repayment of treatment costs. Even at this stage payment is not automatic. The insurer must have been made aware of the hospital's interest, and many hospitals then rely on the good nature of the insurer to inform them that a settlement has been made and to request a bill. As this study suggests, there is little incentive for insurers to do so.

1 Road Traffic Act 1988. London: HMSO, 1988.

2 Road Traffic Act 1930. London: HMSO, 1930.

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