Hospital Topics

How elderly patients with femoral fracture develop pressure sores in hospital

MARGARET VERSLUYSEN

Abstract

The routine hospital management of 100 consecutive elderly patients was studied to determine the reason for the high incidence of pressure sores among patients admitted to hospital for femoral fractures. Of these patients, 66 developed sores, 83% occurring by the fifth day in hospital. This was due to the long periods that patients were immobilised on high pressure surfaces in the casualty department, wards, and theatres before repair of the fracture and restoration of their weight bearing function. Sores are not simply a ward or nursing problem, but an unintended consequence of hospital treatment.

To reduce the incidence of sores elderly patients should be treated on low pressure patient support systems from the point of entry to hospital until mobility is restored.

Introduction

Pressure sores are common among elderly patients with femoral fractures and tend to occur when the patient has just been brought into hospital.¹ As the reasons for sore development have been neglected this paper examines why sores develop during the initial period of treatment for fractures.

Sores occur in relation to the amount of time soft tissue is compressed against underlying bone and the amount of pressure exerted on the patients skin.^{2,3} After a femoral fracture patients cannot bear weight and are bedfast on their back; the same body sites are therefore continually subjected to pressure until after surgery, when the incidence of sores diminishes. We assessed the amount of time that patients were typically immobilised in the

casualty department, wards, and theatres and the contributory pressures of trolleys, beds, and theatre tables.

Patients and methods

We studied 100 consecutive patients, chosen according to age and orthopaedic diagnosis, over 18 months. Aged 70-94, they had primary diagnoses of femoral fractures on arrival at two hospitals; there were 88 women and 12 men, and half were aged over 80. Of these 100 patients, 97 had confirmed fractures (three patients were discharged after bedrest only); 88 injuries were at the proximal femur and nine in the shaft. In all, 89 patients underwent surgery, the most frequent operations being internal fixation (52), hemiarthroplasty (29), total hip replacement (4), and external reductions (4). Femoral fracture is generally associated with other morbidity,^{4,6} and at admission 91 of the subjects shared a total of 315 separate diagnoses of concurrent illness of different body systems. Systemic conditions known to be associated with pressure sores were present^{7,8}; the prevalence of cardiac disease was 45%, of neurological disease 40%, and of arthritis or rheumatism and impaired mobility 30%. Once in hospital 71% of patients suffered from incontinence, one of the most sensitive indicators of vulnerability to pressure sores.

After arrival in the casualty department patients were followed up intensively for 15 days and examined daily for signs of tissue trauma; any lesions were measured and classified. Data on timing of patient progress through each clinical area were collected. Two hourly pressure relief by turning is a recognised antisore prophylactic⁷; hence we took two hours as a notional maximum "safe" period of patient immobility. Pressure measurements were carried out on a volunteer (aged 24; height 1.8 m; weight 75 kg), who was placed on the support systems in the same position as the elderly patients—that is, semirecumbent with three pillows in the casualty department and the ward and supine in the most common operating positions in theatre. Measurements were made at sacral and heel sites with a Talley pressure sensor, and mean capillary pressure (usually cited in a range of 28-38 mm Hg) was taken as the maximum "safe" level of pressure.³

Results and comment

Vulnerability to pressure injury because of immobilisation begins with the initial fracture. In all, 62 patients could recall the time of their fall and

Department of Medical Electronics and Physics, St Bartholomew's Hospital, London EC1A 7BE

MARGARET VERSLUYSEN, BSC, RGN, principal research officer

arrived at hospital anywhere from five minutes to four days after the injury (median 3 hours 15 minutes). Only 33 patients reached the casualty department in under two hours, and in the remainder the conditions for pressure injury had already begun before they had reached hospital.

CASUALTY DEPARTMENT

Patients were brought into the casualty department on a stretcher and transferred to a treatment trolley, where they remained during diagnosis and until a ward bed was found. Data were complete for 86 patients who waited in the casualty department from 54 minutes to 12 hours 30 minutes (median three hours 15 minutes). Twelve patients waited in casualty for less than two hours; 50 for two to four hours; 20 for four to six hours; three for six to eight hours; and one for 12 hours 30 minutes. They were put on two main types of trolley, where pressures at the point of contact with the patients' skin were far greater than mean capillary pressure. Before most patients had left casualty long periods had been spent on high pressure surfaces.

WARD

On admission to wards 98 subjects were positioned on their backs; 88 had skin traction applied and thus could not be turned away from pressure areas on the sacral or buttock and leg areas. Of 89 subjects who underwent surgery, data on time bedfast in the ward before operation were complete for 78. For medical or organisational reasons patients waited for surgery for between 30 minutes and eight days (median 45 hours).

Most subjects were on the table for less than two hours, although unconsciousness and peripheral circulatory changes probably increased susceptibility to localised pressure at this time. The most common operating position was supine for 58 patients, and 30 patients were operated on on their sides. Two operating tables were used: a traction table with boot extensions for internal fixation and a standard orthopaedic table for other hip operations. Pressure on the traction table was highest of all the equipment tested, while on the standard orthopaedic table sacral pressure was in the acceptable range but heel pressure was well above it (table).

PRESSURE SORES

Of the 100 subjects, 66 developed sores of varying degrees of severity. In 23 patients the worst sore consisted of persistent skin discoloration at the same site for 48 hours and more. In the largest group of 33 subjects sores entailed loss of epidermal tissue; in eight patients there were cavities through to the dermis; and in two subjects sores penetrated into subcutaneous tissue, and one had to be surgically repaired. On the day of maximum sore incidence 66 subjects shared a total of 225 separate lesions, mainly about the sacrum and buttocks and feet. Sores ranged in surface area from 1 cm² to over 36 cm²; 53 subjects developed sores of a progressive ulcerative type suggestive of repeated pressure, while 13 patients developed gangrenous sores suggestive of very high pressure.

Onset of sores was concentrated in the first few days in hospital: 11% of sore sufferers had a lesion on admission to the ward; 48% on the first to second day in hospital; and 24% between the third and fifth day. Thus by the fifth day in hospital 83% of all affected subjects had at least one lesion. The

Pressures from casualty trolleys, ward beds, and operating tables

	Pressure (mm Hg)			
	At sacrum		At heel	
	Range	Mean	Range	Mean
<i>Casualty department trolleys</i>				
Siemens Elema AB trolley with Kifa 4.5 cm foam mattress	48-60	54	160-200	182
Nesbit Evans solid top trolley with 5 cm foam mattress	56-60	58	150-60	154
<i>Ward beds</i>				
Nesbit Evans solid base King's Fund bed with 6" Polyfloat mattress	32-8	34	92-8	96
Old style tubular steel frame bed with 7" Dunlopillow mattress on wire mesh base	40-2	41	120-50	136
<i>Operating tables</i>				
Matt-burn Orthotec-4 operating table with 8 cm Stanmore antistatic mattress	28-38	32	100-140	116
Fracture operating table with traction boot extension and 4.5 cm Eschmann antistatic mattress	75-80	78	60-120	190

Only 11 patients went to theatre on the day of admission; 34 spent one to two days in a ward before operation, 14 two to three days, 13 three to five days, and six seven to nine days. Eleven patients were not operated on, and there were no data available for 11. Of those who remained in bed before operation, only one was immediately put on an alternating pressure mattress; 12 subjects were nursed on old style tubular steel beds and most of the others on King's Fund beds. The Polyfloat ward mattress gives pressures at the sacrum within the acceptable range but heel pressures well above mean capillary level. The old style combination of mattress and bed produces unacceptable levels of pressure at both body sites.

On the day of operation, after a period of fasting, patients were prepared for theatre and given a sedative. As dehydration and sedation are believed to increase a patient's vulnerability to soft tissue trauma patients should be transferred to theatre as soon after preparation as possible. In fact on the day of their operations 70 patients for whom there was data waited for between 10 minutes and 14 hours 30 minutes (median two hours) for transfer to theatre. Only 35 subjects were transferred to the theatre area within two hours, 22 within two to four hours, 12 within four to eight hours, and one after 14 hours 20 minutes.

THEATRE

On arrival in the theatre area most patients were induced and put on to the operating table in less than half an hour; after the operation most subjects left the recovery area in a similar period of time. Hence time spent on the operating table itself was the major cause for concern. Patients spent between 10 minutes and three hours 50 minutes on the table (median: one hour 18 minutes). Seventeen patients spent up to one hour on the table, 62 between one and two hours, and eight between two and four hours. There were no data available for two patients and 11 were not operated on.

onset of the sore was also related to the day of surgery. Aside from the 27% of patients with sores present before the operation, the largest single number of new cases on one day (20%) occurred on the day of operation. Between the first and third days after operation an additional 32% of affected subjects developed lesions so that by the third postoperative day 79% of all sore sufferers had a lesion.

Most patients spent periods of time bedfast in most clinical areas far in excess of a notional safe period of two hours. Of all the equipment tested, only the Polyfloat ward mattress and the Stanmore mattress on the standard orthopaedic table gave safe pressures at the sacrum. All other equipment produced pressures far in excess of mean capillary pressure, particularly at the heels, and thus at a level sufficient to cause tissue damage. Cumulative pressure and isolated episodes of high pressure appeared to be the primary cause of a high incidence of multiple sores soon after admission to hospital.

Discussion

Most previous work relating cumulative and incidental pressure to sore formation has been carried out experimentally with animals.² Doctors have generally regarded pressure sores as a ward and nursing problem, but with elderly patients with fractures soft tissue trauma is an unintended consequence of the total system of hospital treatment. This system was developed to treat the younger sick, and procedures and equipment that are tolerated by younger, fitter patients are commonly damaging to the comparatively recent influx of elderly patients prone to pressure sores.

Techniques for measuring pressures where the patient comes into contact with a bed or trolley have many limitations,⁹ and our data are comparable with other measurements made with fit volunteers.¹⁰

The figures should be seen as indicative rather than absolute values and probably underrepresent the direct loading on tissue actually experienced by debilitated and emaciated elderly people, who have less fat and muscle to dissipate the forces transmitted. Secondly, the instruments available cannot measure indices of shear and friction, which are believed to increase the damaging effects of pressure on the microcirculation¹⁰ and are probably important in patients treated by appliances like traction.

As the onset of sores is concentrated at the beginning of admission to hospital prophylaxis should begin then. A significant reduction in the incidence of pressure sores would ensue if all high risk patients were treated on low pressure support systems from arrival at hospital until mobility is restored and danger of sores diminishes. Secondly, many complex factors determine the rate of a patient's progress through treatment facilities, but if this were accelerated it could only benefit sick patients with major injuries.

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References

- 1 Versluisen M. Pressure sores in elderly patients: the epidemiology related hip operations. *J Bone Joint Surg* 1985;67:10-3(b).
- 2 Kosiak M. Aetiology and pathology of ischaemic ulcers. *Arch Phys Med Rehabil* 1959;40:62-9.
- 3 Reswick JB, Rogers JE. Experience at Rancho Los Amigos Hospital with devices and techniques to prevent pressure sores. In: Kenedi RM, Scales JT, Cowden J, eds. *Bedsore biomechanics*. London: Macmillan, 1976:113-22.
- 4 Brocklehurst JC, Exton-Smith AN, Lempert-Barber SM, Hunt L, Palmer MK. Fracture of the femur in old age: a two centre study of associated clinical factors and the cause of the fall. *Age Ageing* 1978;7:7-15.
- 5 Ceder L, Elmquist D, Svenson S. Cardiovascular and neurological function in elderly patients sustaining a fracture of the neck of the femur. *J Bone Joint Surg* 1981;63:560-6.
- 6 Campbell AJ. Femoral neck fractures in elderly women. A prospective study. *Age Ageing* 1976;5:102-9.
- 7 Norton D, McLaren R, Exton-Smith AN. *An investigation of geriatric nursing problems in hospital*. London: Churchill Livingstone, 1975.
- 8 David JA, Chapman RG, Chapman EJ, Lockett B. *An investigation of the current methods used in nursing for the care of patients with established pressure sores*. London: Nursing Practice Research Unit, Northwick Park Hospital and Clinical Research Centre, June 1983.
- 9 Barbenel JC. Measurement of interface pressure. In: Barbenel JC, Forbes CD, Lowe GDO, eds. *Pressure sores*. London: Macmillan, 1983.
- 10 Redfern SJ, Jeneid PA, Gillingham ME, Fletcher Lunn H. Local pressures with ten types of patient support system. *Lancet* 1973;ii:277-80.

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For Debate . . .

The doctor, the patient, and their contract

I The general practitioner's contract: why change it?

DENIS PEREIRA GRAY, MARSHALL MARINKER, ALAN MAYNARD

The publication by the government of *Primary Health Care*, although presented as setting an "agenda for discussion," represents the opening stages of a debate which will persist throughout 1986.¹ The government has chosen the issues on which views are to be sought, although there is an invitation to raise other matters. The profession therefore has a unique opportunity to influence the pattern of primary health care for decades to come.

The discussion document covers a wide range of issues, and this article and the two that follow cover only part of the ground. They are concerned almost exclusively with the general practitioner's contract and its relationship to the quality of care.

This first article discusses the existing contract against the background of the changes in medicine and society which have

taken place since the negotiation of the GP's Charter in the mid 1960s, and asks why appreciable changes should be made. The second article explores in detail the form which a performance related contract might take. Finally, the third article examines some of the potentially more radical options which the government might have chosen.

Achievements

General practice has changed out of all recognition since the beginning of the National Health Service. Collings described a poorly equipped, poorly motivated, demoralised profession engulfed by demands for health care to which general practice in 1950 could scarcely respond.² Today most practices are well equipped, group practice has become the norm, and many premises are purpose planned. Several thousand practice nurses are playing an increasingly active and extended part, and most community nurses and health visitors are attached to practices. Planned preventive care—for example, child care surveillance—is becoming common, and in some district health authorities about three quarters of all the cervical smears are taken in general practice.³ General practice is the largest single source of immunisations, family planning advice, care for the common acute problems, care for the mentally ill, and care for the elderly. The vast majority of all consultations are handled within the primary care team, and only about 5% of consultations lead to hospital referral.⁴

Department of General Practice, Postgraduate Medical School, University of Exeter

DENIS PEREIRA GRAY, OBE, FRCGP, general practitioner and senior lecturer in-charge

The MSD Foundation, Tavistock Square, London WC1H 9LG
MARSHALL MARINKER, MD, FRCGP, director

University of York

ALAN MAYNARD, MA, professor of health economics

Correspondence to: Dr Marinker.