ankle jerks and vibration sense at the first metatarsophalangeal joint). Vibration perception threshold at the great toe was measured in 101 of the diabetic patients (23 with periosteal reaction) and was significantly higher in those with periosteal reactions (median 30.5 v 20 units, $p < 0.05$).

Comment

Periosteal reaction has been observed in diabetes¹ and in association with trophic ulcers² and neuropathic joint disease.³ It was not, however, mentioned in a review of foot radiographs in 162 diabetic patients with gangrene.⁴ Formation of new bone at the metatarsal periosteum, perhaps resulting from previous fracture, has been reported in diabetes,⁵ but its nature seems quite different from the pattern of periosteal changes described here.

Periosteal reaction in an ulcerated foot is generally believed to indicate infection in or around the affected bone. We found metatarsal periosteal reactions in radiographs of asymptomatic diabetic feet without

evidence of infection, fracture, or ulceration. The cause is unknown, but the association with raised vibration perception threshold suggests a common (perhaps vascular) aetiology. Osteomyelitis can be particularly severe in the diabetic foot, and infection should always be considered when a localised periosteal reaction is present. Our results, however, suggest that metatarsal periosteal reactions are common among diabetic patients and do not of themselves indicate osteomyelitis.

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- 1 Staple TW. Radiography of the diabetic foot. In: Levin ME, O'Neal LW, eds. *The diabetic foot*. St Louis: C V Mosby, 1983:201-31.
- 2 Rubin LM. Periostitis associated with diabetic ulcer. *J Am Podiatr Med Assoc* 1969;59:154-5.
- 3 Verlickov L, Djankov L. Periostreaktionen bei diabetischen Osteoarthropathien. *Radiol Diagn (Berl)* 1971;12:107-13.
- 4 Lither F, Heitla SO, Steen L. Skeletal lesions and arterial calcifications of the feet of diabetics. *Acta Med Scand [Suppl]* 1984;687:47-54.
- 5 Newman JH. Non-infective disease of the diabetic foot. In: Connor H, Boulton AJM, Ward JD, eds. *The foot in diabetes*. Chichester: Wiley, 1987:81-90.

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Incidence and consequences of ejection in motor vehicle accidents

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A widespread misapprehension exists that people thrown clear from a vehicle in an accident have a lower risk of serious injury than those remaining inside, though published reports generally contradict this view.^{1,2} There are, however, few reports on the incidence of ejection in restrained and unrestrained vehicle occupants and the consequences in terms of severity of injury. We studied people who were ejected completely from their vehicles and compared their severity of injury with that of the large number of people who were not ejected.

Patients, methods and results

From January 1983 to January 1985 information was collected prospectively by this group on all patients injured in road traffic accidents in the catchment area of this hospital. Injuries were coded by region and scored with the abbreviated injury scale.³ Altogether 1550 vehicle occupants were injured (871 drivers, 375 front seat passengers, 304 rear seat passengers). Forty five were completely ejected from the vehicle in the accident (11 drivers, nine front seat passengers, and 25 rear seat passengers; 27 male and 18 female; mean age 25 (range 1 to 51)). The incidence of ejection was 2.9%

overall. It was lower for drivers (1.2%) and front seat passengers (2.4%) but significantly higher for rear seat passengers (8.2%) ($\chi^2 = 42.5$; $df = 1$; $p < 0.001$).

The table shows the consequences of ejection in terms of increased severity of injury and death. Being ejected was associated with a significantly greater incidence of severe or critical injury ($\chi^2 = 51.1$, $p < 0.0001$) and a higher incidence of fatal injuries. Deaths were due to severe head injury (two), laceration of the aorta (one), and multiple fractures of long bones with severe contusion of the lung (one). The most important sites of injury in severely injured patients were the abdomen (five patients), chest (two), head (two), and spine (one).

None of the ejected rear seat passengers were wearing a seat belt. Of the 834 occupants known to be wearing seat belts, only five were ejected (two front seat passengers and three drivers). We did not know whether the remaining 218 drivers and front seat passengers were wearing seat belts; six of them were ejected. Two small children travelling on the laps of front seat passengers were ejected. Ejection occurred most commonly in accidents at high speeds and those in which the vehicle rolled over.

Comment

Our data show that rear seat passengers have a higher risk of ejection. None of the ejected rear seat passengers were wearing seat belts. In the front seats five of the 20 ejected occupants (drivers and passengers) were known to be wearing seat belts. The rate of ejection was 0.6% for those known to be wearing seat belts and 7.3% for those known not to be wearing them. Clearly seat belts safeguard against ejection, and this is particularly relevant in the rear seat, an observation in keeping with the findings of Hobbs.⁵

When ejection occurred the incidence of fatal injury was over twice that for the non-ejected group, a finding supported by other studies.^{1,4} The difference between ejected and non-ejected people was most apparent in the severely or critically injured group, ejected people being far more likely to sustain such injuries.

In conclusion, ejection from a vehicle in an accident results in a much higher rate of serious injury and death than would otherwise occur. The incidence of ejection depends heavily on seating position and is reduced by the proper use of restraints. Fitting and using restraints in the rear seat, where the risk of ejection is greater,

Severity of injury and deaths in ejected and non-ejected vehicle occupants

Maximum abbreviated injury scale*	No (%) not ejected	No (%) ejected
1 and 2	1179 (78.3)	22 (48.9)
3	231 (15.4)	9 (20.0)
4 and 5	35 (2.3)	10 (22.2)†
Deaths	60‡ (4.0)	4 (8.9)
Total	1505	45

*1 And 2=minor/moderate; 4 and 5=severe/life threatening.

† $\chi^2 = 51.1$; $df = 3$; $p < 0.0001$.

‡Three people died from natural causes while driving.

would substantially reduce the incidence of serious injury. Thus we strongly recommend that all passengers should be adequately restrained in suitable safety devices.

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- 1 O'Day J, Scott RE. Safety belt use, ejection and entrapment. *Health Educ Q* 1984;11:141-6.
- 2 Agran PF, Dunkle DE, Winn DG. Motor vehicle childhood injuries caused by non-crash falls and ejections. *JAMA* 1985;253:2530-3.
- 3 American Association for Automotive Medicine Committee on Injury Scaling. *The abbreviated injury scale*. Arlington, Illinois: AAAM, 1985.
- 4 Hobbs CA. *The effectiveness of seat belts in reducing injuries to car occupants*. Crowthorne: Transport and Road Research Laboratory, 1978. (Report LR 811.)
- 5 Hobbs CA. *Car occupant injury patterns and mechanisms*. Crowthorne: Transport and Road Research Laboratory, 1981. (Supplementary report 648.)

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Postnatal presentation of coeliac disease

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Coeliac disease in adults has an insidious onset; intestinal symptoms are minimal or even absent, and malabsorption and anaemia are the main symptoms.^{1,2} At our hospital two women who presented with coeliac disease in the postnatal period both had an acute diarrhoeal illness with evidence of severe malabsorption.

Case reports

Case 1—A 29 year old woman presented in June 1974, 16 weeks after her first delivery. She had had diarrhoea for eight weeks and intermittent acroparaesthesia and tetany for five days. She had breast fed her baby initially but stopped after two weeks. On admission she looked well nourished but had bilateral carpopedal spasm and Chvostek's and Trousseau's signs. Investigations confirmed a malabsorption state with hypocalcaemia (table). The electrolyte imbalance was corrected by intravenous treatment, and coeliac disease was diagnosed after jejunal biopsy. She was given a gluten free diet. Her symptoms resolved and haematological values returned to normal. One year later jejunal biopsy showed blunted villi and regression of inflammation consistent with treated coeliac disease.

Results of investigations in two women with coeliac disease

Investigation	Normal range	Case 1	Case 2
Haemoglobin (g/l)	115-160	115	114
Mean cell volume (fl)	81-100	78	70
Folate (mmol/l)	Serum 9.1-27.2	Serum 2.27	
	Red cell >227		Red cell 590
Sodium (mmol/l)	135-148	139	138
Potassium (mmol/l)	3.5-4.8	2.0	2.8
Albumin (g/l)	35-50	27	33
Calcium (mmol/l)	2.15-2.65	1.29	1.49
		1.54*	1.63*
Magnesium (mmol/l)	0.7-1.0	0.56	0.40
Average faecal fat (g/24 h)	<5	38	18

*Corrected (measured calcium + (40 - albumin) × 0.02).

Case 2—A 25 year old woman presented in December 1985, 10 weeks after her first delivery, having had watery diarrhoea for four weeks and acroparaesthesia and tetany for two days. She had been breast feeding since delivery. She looked well nourished but had bilateral carpopedal spasm and Chvostek's and Trousseau's signs. Initial investigations showed abnormalities similar to those in case 1 (table). In

addition, absorption of D-xylose, vitamin A, and vitamin B₁₂ was severely defective. Surprisingly, though she had been taking folate supplements during pregnancy, her red cell folate concentration was normal. The electrolyte imbalance was corrected with calcium, magnesium, and potassium salts given intravenously. An endoscopic duodenal biopsy showed changes typical of coeliac disease, and she was started on a gluten free diet. She remained well one year later, and results of repeat biopsy were consistent with treated coeliac disease.

Comment

The ratio of women to men who have coeliac disease is about 2:1, a difference that is due chiefly to a high proportion of cases in women of childbearing age. The supposition that this is the result of increased nutritional demands is consistent with the finding that the occurrence of anaemia and calcium malabsorption with coeliac disease is also more common in women.^{1,2} Pregnancy may precipitate the disease in some women and may reverse a remission in the teenage years experienced by women in whom the disease was diagnosed in childhood.⁴

In our patients pregnancy seemed to be the principal factor unmasking a predisposition to coeliac disease. By the criteria of maternal haemoglobin concentrations and weight gain and fetal development, however, they had met the nutritional burdens of pregnancy and lactation. Their disease presented as a diarrhoeal illness starting acutely at the end of the puerperium and characterised by fat malabsorption, hypocalcaemia, and hypokalaemia. The accompanying hypoalbuminaemia is unusual in coeliac disease and may merely have reflected its severity.

The distinctive presentation of coeliac disease in these two cases suggests an effect of pregnancy on women predisposed to the disease that is quite independent of depletion of nutrients. The onset was probably too long after pregnancy for the disease to have been precipitated by an endocrine mechanism, but changes in immune reactivity at this stage might have caused loss of borderline tolerance to gluten. This possibility could be tested by studying immune responsiveness to gluten before and after delivery in women with treated coeliac disease.

- 1 Logan RFA, Rifkind EA, Busuttil A, Gilmore HM, Ferguson A. Prevalence and "incidence" of celiac disease in Edinburgh and the Lothian region of Scotland. *Gastroenterology* 1986;90:334-42.
- 2 Logan RFA, Tucker G, Rifkind EA, Heading RC, Ferguson A. Changes in the clinical features of coeliac disease in adults in Edinburgh and the Lothians 1960-79. *Br Med J* 1983;286:95-7.
- 3 Swindon CM, Levi AJ. Is coeliac disease underdiagnosed? *Br Med J* 1980;281:1258-60.
- 4 Barry RE, Baker P, Read AE. Coeliac disease: the clinical presentation. *Clinics in Gastroenterology* 1974;3:55-69.

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