similar plasma concentrations of progesterone and its metabolites occur with each method of administration. Of interest would be the 5B reduced metabolite, pregnanolone, which appears to be responsible for the well known hypnotic effect of progesterone.[19]

Some measure of patient preference for progesterone was indicated from interview data; women had been asked to rate change from their original (pretreatment) condition (table II). More change was detected during treatment with progesterone than during placebo. Women also reported that more symptoms grew worse while they were taking placebo. More patients were clearly shown to respond, according to both the menstrual distress questionnaire and the daily symptom record, to progesterone than to placebo.

Many women requested to continue treatment with progesterone and told others about it. We were unable to continue the treatment outside the clinical trial approval granted. There was no significant difference between progesterone and placebo in the incidence of side effects. The large incidence of reported drowsiness may have been related to the patients being told that this was a reported side effect of progesterone.

This study showed that an oral formulation of micronised progesterone was effective in alleviating many premenstrual complaints including those of anxiety, stress, depression, hot flushes, swelling, and water retention. Although these results indicate a beneficial pharmacological effect of progesterone, they do not necessarily imply that progesterone deficiency is the cause of the premenstrual syndrome. Further studies are needed to determine the optimum duration of treatment.

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Effect of seat belts on injuries to front and rear seat passengers

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Abstract

Data on 2520 occupants of cars involved in accidents were analysed in relation to injury and the severity of the crash to investigate the effect of rear seat passengers on injury to restrained and unrestrained front seat occupants and vice versa. Unrestrained front seat occupants showed a higher incidence of serious injury when there were rear seat passengers. The presence of a rear seat passenger did not affect significantly the overall incidence of injury among restrained front seat occupants within the range of crash severity considered. Unrestrained rear seat passengers behind unrestrained front seat occupants showed a higher incidence of moderate injury and a lower incidence of no injury than those behind restrained front seat occupants.

It is concluded that legislation on seat belts has not greatly increased the risk of person to person injury.

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Introduction

Concern has been expressed about injuries to people in the front seats of cars caused by passengers in the back seat being thrown forward in collisions and directly or indirectly injuring the front seat occupant.[1 2] Front seat occupants may not, therefore, be receiving full benefit from the use of a seat belt, and more active encouragement or even legislation for the installation and use of rear seat belts may be required.[3] Complementary to this possibility that rear seat occupants injure front seat occupants is that they themselves may be injured in collisions with front seat occupants. Unrestrained rear seat passengers might be at greater risk of injury in collisions in which the front seat occupant is held in position by a seat belt.

In this study the severity of injuries sustained by restrained and unrestrained front seat occupants in cars with and without rear seat passengers was compared. Similarly, the injuries sustained by unrestrained rear seat passengers were assessed in relation to the use or non-use of seat belts by the person directly in front.

Patients and methods

The investigators were members of a medical and an engineering team. A total of 2520 car occupants involved in accidents over 30 months before the use of seat belts became compulsory (on 31 January 1983) were included in the sample. All car accidents that occurred within the catchment area of the John Radcliffe Hospital, Oxford (roughly, the county of Oxfordshire), for which ambulances were called out were included. Accidents for which ambulances were not called out but which were reported to the police were also included if any car was damaged enough to have to be towed away from the scene. Vehicles were examined by the engineering team at the scene or within 48 hours at recovery garages. Thus a representative sample of accidents was studied; this necessarily included a fairly small proportion of more serious collisions. Damage that had occurred within the vehicle was noted and was correlated with the nature of the injuries received. The severity of the crash was calculated from the external damage to the vehicle with the CRASH 2 computer program and expressed as a change of speed on impact.[4]

Injured patients were examined at the accident unit of the hospital by the surgeon attached to the project. The results of any postmortem examinations were recorded. All injuries were classified according to the abbreviated injury scale (AIS80).[5] Injuries were also classified as minor, moderate, or serious (including death), corresponding to maximum injury severities of one, two, or more than two, respectively, on the abbreviated injury scale.

Altogether 953 of the 2520 car occupants were defined as not injured. Information was obtained on these occupants by subsequent interview. There were 2114 front seat occupants, 384 rear seat passengers, and 22 whose seating position was unknown.

Results

RISKS TO FRONT SEAT OCCUPANTS

Table I shows how many front seat occupants used restraints and relates this to the presence or absence of rear seat passengers. Half of the vehicles were in frontal collisions, and for the purpose of this study analysis of the injuries to front seat occupants was carried out for these impacts only.

The incidences of no, minor, moderate, and serious injury were evaluated according to the use of restraint and presence or absence of a rear seat passenger. The only significant difference made by the presence of rear seat passengers was in the incidence of moderate and serious injuries sustained by unrestrained front seat occupants, who were less likely to have been moderately injured and more likely to have been seriously injured when there was a rear seat passenger ($p < 0.01$, χ^2 test). This suggested that the severity of the injury of several front seat occupants was increased from moderate to serious by the effect of the rear seat passengers.

Table II shows the incidences of different severities of injury among unrestrained front seat occupants in three ranges of crash severity. In about 35% of cases we could not estimate the change in speed on impact. Apart from the general increase in the incidence of serious injury with crash severity it can also be seen that the increased incidence of serious injury and decreased incidence of moderate injury when there was a rear seat passenger became noticeable when the change in speed on impact was over 16 km/h. It was most apparent when the change in speed on impact was over 32 km/h. The available data did not warrant further disaggregation above 32 km/h.

The presence or absence of rear seat passengers did not affect significantly the incidence of injury among restrained front seat occupants (table III). Furthermore, no effect was found when the accidents were grouped according to crash severity. The inclusion of the population for whom the change in speed on impact was unknown was not thought to introduce significant bias.

TABLE I—*Use of seat belts by front seat passengers related to presence of rear seat passengers*

	Front seat occupants			
	All impacts*		Frontal impacts	
	Unrestrained	Restrained	Unrestrained	Restrained
No rear seat passenger	921	514	514	273
One or more rear seat passengers	235	165	136	93

*Excluding 279 cases in which use of restraint was not known.

TABLE II—*Incidences of injuries of different severities among unrestrained front seat occupants with and without rear seat passengers at different crash severities*

	No rear seat passenger			One or more rear seat passengers		
	No injured	Incidence (i) (%)	σi* (%)	No injured	Incidence (i) (%)	σi* (%)
			0-16 km/h			
Uninjured	58	41·7	4·2	23	53·5	7·6
Minor injury	62	44·6	4·2	15	34·9	7·3
Moderate injury	17	12·2	2·8	3	7·0	3·9
Serious injury	2	1·4	1·0	2	4·7	3·2
Total	139			43		
			17-32 km/h			
Uninjured	22	15·7	3·1	8	22·2	6·9
Minor injury	63	45·0	4·2	19	52·8	8·3
Moderate injury	44	31·4	3·9	4	11·1	5·2
Serious injury	11	7·9	2·3	5	13·9	5·8
Total	140			36		
			Over 32 km/h			
Uninjured	6	10·9	4·2	0	0	0
Minor injury	17	30·9	6·2	1	6·7	6·5
Moderate injury	16	29·1	6·1	2	13·3	8·7
Serious injury	16	29·1	6·1	12	80·0	10·3
Total	55			15		

*σi = Standard deviation of incidence (i) according to binomial distribution ($\sqrt{0.01\,i\,(1-0.01\,i)/\text{total}} \times 100$).

TABLE III—*Incidence of injuries of different severities among front seat occupants with and without rear seat passengers (including cases for which the change in speed on impact was unknown)*

	No rear seat passenger			One or more rear seat passengers		
	No injured	Incidence (i) (%)	σi* (%)	No injured	Incidence (i) (%)	σi* (%)
			Unrestrained front seat occupants†			
Uninjured	140	27·2	2·0	42	30·9	4·0
Minor injury	218	42·4	2·2	56	41·2	4·0
Moderate injury	108	21·0	1·8	15	11·0	2·7
Serious injury	48	9·3	1·3	23	16·9	3·2
Total	514			136		
			Restrained front seat occupants‡			
Uninjured	96	35·2	2·9	32	34·4	4·9
Minor injury	119	43·6	3·0	45	48·4	5·2
Moderate injury	32	11·7	1·9	10	10·8	3·2
Serious injury	26	9·5	1·8	6	6·5	2·5
Total	273			93		

*σi = Standard deviation of incidence (i) according to binomial distribution ($\sqrt{0.01\,i\,(1-0.01\,i)/\text{total}} \times 100$).
†$\chi^2 = 11.8$, 3 df; $p = 0.0079$.
‡$\chi^2 = 1.173$, 3 df; NS.

TABLE IV—*Incidences of injuries of different severities among unrestrained rear seat passengers according to use of restraint by front seat occupant (front seat was empty or its occupant's use of restraint unknown in 61 cases)*

	Unrestrained person in front			Restrained person in front		
	No injured	Incidence (i) (%)	σi* (%)	No injured	Incidence (i) (%)	σi* (%)
Uninjured	49	27·1	3·3	47	40·5	4·6
Minor injury	86	47·5	3·7	54	46·6	4·6
Moderate injury	39	21·5	3·1	11	9·5	2·7
Serious injury	7	3·9	1·4	4	3·4	1·7
Total	181			116		

*σi = Standard deviation of incidence (i) according to binomial distribution ($\sqrt{0.01\,i\,(1-0.01\,i)/\text{total}} \times 100$).
$\chi^2 = 10.113$, 3 df; $p = 0.0176$.

RISKS TO REAR SEAT PASSENGERS

Table IV shows that unrestrained rear seat passengers behind unrestrained front seat occupants were more likely to have been moderately injured and less likely to have been uninjured than those behind restrained occupants ($p < 0.02$, χ^2 test). There was no detectable difference in the incidences of minor and serious injury between the two groups. The implication for rear seat passengers behind restrained front seat occupants was that injuries were less severe than they might have been.

Examination of the interiors of vehicles showed that substantial intrusion into the area for rear passengers was unusual. The serious injuries to rear seat passengers (16 cases) were caused by the passenger being thrown against the source of injury rather than by the source intruding on the passenger.

Discussion

This study showed that an unrestrained rear seat passenger was not a significant hazard to a restrained front seat occupant. Tests using dummies in controlled crashes suggested a large increase in risk of injury when there was a rear seat passenger[2]; these tests, however, were all in severe collisions (change in speed on impact 48 km/h). In this study only 2·5% of the crashes were due to such great changes in speed, and we would therefore not necessarily expect similar conclusions to apply. Examination of individual accidents showed that in some cases injuries to front seat occupants were worsened by the presence of rear seat passengers.[1 6] This study suggests that such instances are not common, and even in this moderately large sample there were only a few cases of very severe injury. Any causal factor for such injuries would therefore need to have a large effect to be detectable.

Table II shows an increase with crash severity of the effect of rear seat passengers on injury to unrestrained front seat occupants. It is reasonable to suggest that a study that concentrated on restrained front seat occupants in high severity crashes would also show an effect. Such a study would not, however, include a representative sample of crashes, or it would need to select a subset of cases from a much larger study. The low proportion of accidents with a large change in speed on impact, together with the low prevalence of use of seat belts in this study, makes the appropriate subset too small to give useful results.

This study showed that the use of a restraint by the person in front seemed to make rear seat passengers safer. This may be because the combination of the front seat and its restrained occupant has an increased capacity for absorbing energy that outweighs the increased risk of person to person injury.

The exclusion of minor accidents for which ambulances were not called out may have affected the results. The results at higher crash severity (table II), however, suggest that inclusion of minor accidents would not greatly have affected our conclusions for front seat occupants. In the case of rear seat passengers (table IV) it seems likely that any bias in the excluded cases would be towards cars with restrained front seat occupants, so any corrections would reinforce the conclusions.

The greatly increased prevalence of use of seat belts after the introduction of legislation is unlikely to have put rear seat passengers more at risk, and belted front seat occupants do not appear to be greatly endangered by their rear seat passengers, with or without restraint.

There were few restrained rear seat passengers in this study (two adults and 19 children). We therefore have no significant evidence about the effectiveness of rear seat belts. Analysis of the mechanisms of injury, however, suggests that rear seat passengers were injured by being thrown against the source of the injury rather than by it intruding on them. As this type of contact and the resultant injury can be effectively prevented by the use of seat belts it is likely that their widespread use in rear seats would considerably decrease the incidence of injury to car occupants.

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SHORT REPORTS

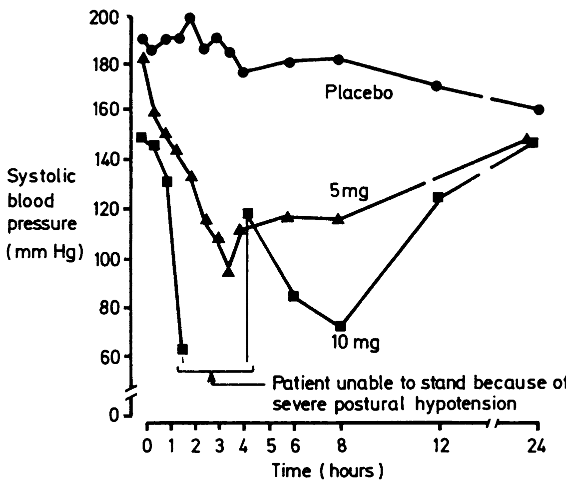
Initial dose of enalapril in hypertension

Enalapril, a new angiotensin converting enzyme inhibitor, has recently been released in the United Kingdom for the treatment of hypertension and congestive heart failure. The datasheet recommends that "when enalapril is added to previous diuretic therapy in hypertension the initial dose is 10 mg." We believe that this recommendation requires further evaluation because our recent experience suggests that this starting dose may be hazardous in some patients.

Case report

A 47 year old hypertensive woman participated in a randomised double blind clinical study in August 1984. After four weeks' treatment with bendrofluazide 5 mg daily as the sole drug she was allocated to receive a placebo and 10 mg and 20 mg enalapril as single oral doses separated by at least seven days. On each study day supine and standing blood pressures were measured with a Hawksley random zero sphygmomanometer before and at intervals after administration of the test drug.

The first study day, when she received the placebo, was uneventful (figure). On the second study day, when she received 10 mg enalapril, both supine and standing blood pressures fell steeply within one and a half hours of ingestion of the drug. She felt weak, lightheaded, and nauseated and was unable to stand up during the next four hours because of postural hypotension. Her blood pressure gradually returned to the usual value but she experienced nausea and vertigo for the next 72 hours. No abnormal neurological signs were elicited. Her treatment allocation was decoded, and she did not receive the 20 mg dose of enalapril. Two weeks later 5 mg enalapril was given under identical conditions, and a large drop in blood pressure was again observed. On this occasion symptoms of hypotension did not develop. On the second study visit, when she received 10 mg enalapril, the 24 hour urine volume was 2408 ml, 24 hour urinary sodium excretion 137 mmol (mEq), supine plasma aldosterone concentration 480 pmol/l (173 pg/ml), and supine plasma renin activity 11 nmol/l/h (14·3 ng/ml/h).



Standing systolic blood pressure at intervals after placebo and single doses of enalapril 5 and 10 mg.