

use. It is, however, encouraging that occasional users seemed to move towards abstinence rather than daily use. Other features of the results could also be regarded as encouraging—for example, even among those individuals who were taking opiates again at six months the amounts used were lower than at admission to treatment: the number of high dose users had dropped from 21 to three. Moreover, fewer subjects were taking opiates by injection: their number had dropped from 30 who were injecting regularly at admission to only 17 who had injected at any time during the six months after discharge. As the admission of the subjects studied coincided with the beginning of the campaign against the acquired immune deficiency syndrome this reduction in injecting may have been due in some part to a greater awareness of the hazards of injecting. Other studies have suggested that addicts are capable of modifying their drug taking behaviour to take account of such information.²⁵ This result also suggests the value of further research into the possibilities of building “harm reduction” packages into treatment programmes aimed at problem drug takers.

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Successful treatment of acute mountain sickness with dexamethasone

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Abstract

A double blind, randomised, placebo controlled trial of treatment with dexamethasone for acute mountain sickness was performed in the Capanna “Regina Margherita” at an altitude of 4559 m in the Alps Valais. After 12-16 hours of treatment (8 mg dexamethasone initially, followed by 4 mg every six hours) the mean acute mountain sickness score decreased significantly from 5.4 to 1.3, and eight of 17 patients became totally asymptomatic. Mean arterial oxygen saturation rose from 75.5% to 82.0%, and there

was a small increase in standard spirometric measurements. In the placebo group none of these variables changed significantly.

It is concluded that dexamethasone may be used as emergency treatment for acute mountain sickness to facilitate safe descent to a lower altitude.

Introduction

The early stages of acute mountain sickness are characterised by peripheral oedema, headache, lassitude, insomnia, and nausea. These may progress to vomiting, ataxia, severe lassitude, breathlessness, and frank pulmonary or cerebral oedema.^{1,2} The syndrome occurs in subjects who rapidly ascend to altitudes of 3000 m or more, taking from a few hours to a few days to develop. The incidence of acute mountain sickness in the Alps correlates with the speed of ascent and the absolute altitude.³

Acute mountain sickness may be prevented in most cases by graded ascent and prophylaxis with acetazolamide.^{1,4,5} Recently, dexamethasone has been shown to prevent the symptoms of acute mountain sickness in an altitude chamber, when its beneficial effects were thought to be due to a reduction in brain oedema.⁶

The only effective remedy for patients with fully developed acute

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mountain sickness is descent or evacuation to a lower altitude or, if this is impossible, treatment with oxygen.^{7,8} Occasionally, descent or evacuation may be prevented by weather or avalanche conditions and oxygen equipment is not available. In such circumstances a simple drug regimen for acute mountain sickness is desirable.

Previous studies have shown a high incidence of acute mountain sickness, in addition to pulmonary and cerebral oedema, in some of the high Alpine huts in Switzerland and Italy.^{3,8,9} The highest of them, the Capanna "Regina Margherita," is located at an altitude of 4559 m on the Punta Gniffetti summit of Monte Rosa in the Valais

sickness score, to 1.3 (2.0) ($p < 0.001$). In eight patients treated with dexamethasone all symptoms and signs of acute mountain sickness resolved (score 0), whereas in two the score fell by only one point (figure). In addition, the incidence of certain symptoms—namely, headache, nausea, and vomiting—was significantly reduced by dexamethasone ($p < 0.001$). In contrast, the mean acute mountain sickness score in the placebo group did not change significantly (4.4 (2.2)). In eight patients the score improved by 1.4 points, in two it remained the same, and in another eight it deteriorated by 1.4 points (figure). The change in the acute mountain sickness score was 4.1 in the dexamethasone group and 0.4 in the placebo group, a difference of 3.7 (confidence interval = -5.3 to -2.2).

Mean (SD) % changes in responses of patients to tests before and after treatment with placebo or dexamethasone

	Placebo	Dexamethasone	Mean difference (95% confidence interval)
Arterial oxygen saturation	1.6 (8.3) (n=18)	6.5 (8.0) <0.01 (n=17)	4.9 (-10.5 to 0.7)
Forced vital capacity	2.1 (5.5) (n=18)	4.8 (5.8) <0.01 (n=15)	-6.9 (-10.9 to -2.8)
Forced expiratory volume in one second	2.2 (9.3) (n=18)	5.8 (4.9) <0.001 (n=15)	-8.0 (-13.4 to -2.6)
Minute ventilation	7.8 (29.1) (n=17)	3.1 (24.0) (n=15)	4.7 (-14.7 to 24.0)

Alps. Symptoms and signs of acute mountain sickness develop in as many as half of the mountaineers there because of the rapid gain in altitude when they ascend to 2800 m or 3200 m in a cable car and then proceed to the summit by a technically easy climb over glaciers. This provided us with an ideal opportunity to study the effectiveness of dexamethasone in the treatment of acute mountain sickness.

Subjects and methods

Climbers arriving at the Capanna "Regina Margherita" at noon or later who planned to stay over night received a posted message to determine whether they had any symptoms of acute mountain sickness. If they had symptoms they were invited to participate in the study. After giving informed consent, volunteers had to rest for at least two hours before they were evaluated with a questionnaire.¹ The presence of the symptoms listed was scored as follows: one point for mild headache, nausea, dizziness, shortness of breath and insomnia and two points for severe headache (not relieved by acetaminophen 500 mg) and for vomiting. Responses were checked with one of the investigators. Subjects then underwent a clinical examination for tachypnoea (two points), facial or peripheral oedema (one location one point, two or more locations two points), ataxia (heel to toe walking test and Romberg test two points), and pulmonary rales (discreet one point, pronounced two points).

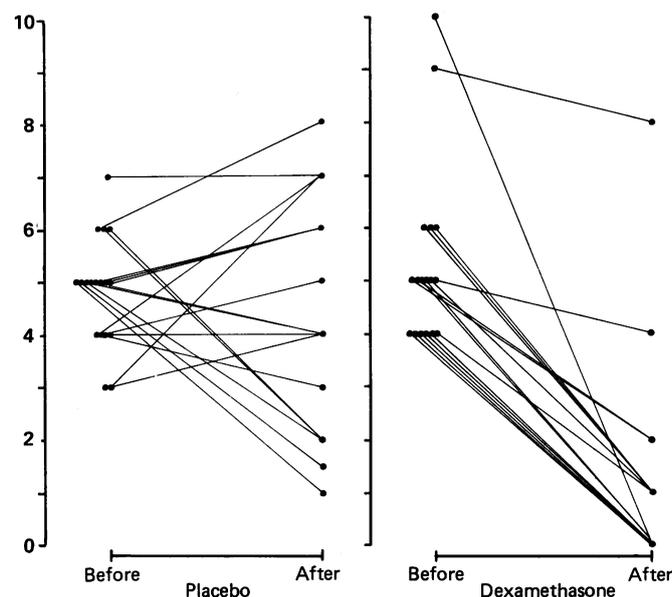
Patients with three or more points were selected for the drug trial. Three patients with frank high altitude pulmonary or cerebral oedema, or both, were not included in the study but evacuated by helicopter. Subjects were weighed and after 10 minutes' rest in a supine position arterial oxygen saturation was measured with an ear oxymeter (Biox II, Bioxymetry Technology). Resting minute ventilation, forced vital capacity, and forced expiratory volume in one second were then measured with a Volugraph 2000 (Mijnhardt, Holland). Retinal photography was performed as described, and the width of the arteries and veins was measured.⁶ Subsequently, 35 patients were randomly assigned to receive dexamethasone by mouth (8 mg initially and another 4 mg after six and 12 hours) or identical placebo. After 12-16 hours all procedures were repeated.

Statistical analysis—Data are presented as means (SD) or as differences between the treatment groups before and after treatment. The χ^2 test was used to evaluate the acute mountain sickness score. Patients with a score of ≤ 2 were considered to be cured and normal as one or two slight signs or symptoms occur in more than half of all mountaineers at this altitude. The paired t test was used, and confidence intervals are given in the results.

Results

The two groups were comparable in age, history of acute mountain sickness, and speed of ascent. There were five women and 13 men in the placebo group and two women and 15 men in the dexamethasone group. The mean acute mountain sickness scores for the groups before treatment were comparable: placebo group 4.8 (1.0), dexamethasone group 5.4 (1.7). After 12-16 hours of treatment dexamethasone reduced the symptoms and signs of acute mountain sickness noticeably, as assessed by the acute mountain

Weight did not change significantly in the placebo group (-0.23 (1.03)%) and dropped by 0.75 (0.65)% in patients treated with dexamethasone ($p < 0.01$, confidence interval of mean differences = -0.2 to 1.24). There were no significant changes in pulse rate or blood pressure in either group, but arterial oxygen saturation increased from 75.5 (7.8)% to 82.0 (8.0)% in patients treated with dexamethasone ($p < 0.01$) with no significant change in the placebo group (76.2 (6.3)% to 77.8 (8.2)%). Forced vital capacity and forced expiratory volume in one second increased slightly but significantly in climbers treated with dexamethasone but not in those who received placebo (table). There were no significant changes in resting minute ventilation or the diameter of the retinal arteries and veins.



Acute mountain sickness score of mountaineers before and after 12-16 hours of treatment with placebo or dexamethasone.

Discussion

In this study dexamethasone had a noticeable effect on the signs and symptoms of moderate to severe acute mountain sickness. We must emphasise, however, that patients with high altitude pulmonary or cerebral oedema were not included in the study. While most mountaineers treated with dexamethasone improved noticeably and descended without any help, several patients treated with placebo had to be helped because of ataxia, severe malaise, and headache. The clinical course of those in the placebo group also illustrates

the unpredictable and variable course of acute mountain sickness.

This study has shown that dexamethasone may be used not only prophylactically, as shown by Johnson *et al.*,⁶ but also to treat fully established acute mountain sickness. Johnson *et al.* observed a reduction in the diameter of retinal arteries and suggested that dexamethasone reduced cerebral oedema, and though we did not find a significant reduction in the diameter of retinal vessels, the pronounced reduction in cerebral symptoms, such as headache, suggests that such an effect is probable.

The reduction in symptoms in the dexamethasone group coincided with an increase in arterial oxygen saturation and a small improvement in spirometric variables. As the minute ventilation did not change the improvement in arterial oxygen saturation might have been due to a reduction in postulated interstitial pulmonary oedema. The weight loss in patients who received dexamethasone supports this theory and might be the result of a more general mobilisation of oedema fluid accumulated during the development of acute mountain sickness.

Though the potential long term effects of dexamethasone may be neglected during short term administration, this treatment should be reserved for emergencies to facilitate safe descent. Patients who improve with treatment should be discouraged from ascending further.^{10,11} Severe acute mountain sickness may be avoided in most cases by slow ascent and by taking rest days when early symptoms occur or, if these progress, by descent.^{7,12}

We thank the Club Alpino Italiano Sezione Varallo in the Capanna "Regina Margherita" and the Centre for Biostatistics at the University of Zürich for advice. This study was supported by a grant from the EMDO Stiftung.

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SHORT REPORTS

Intraregional variation in treatment of end stage renal failure

Though much has been written on the international and national variations of acceptance and treatment rates for end stage renal failure,^{1,2} more local data are not routinely available because the European Dialysis and Transplant Association Registry does not collect information by the area of residence. We report the results of a survey carried out by one region.

Patients, methods, and results

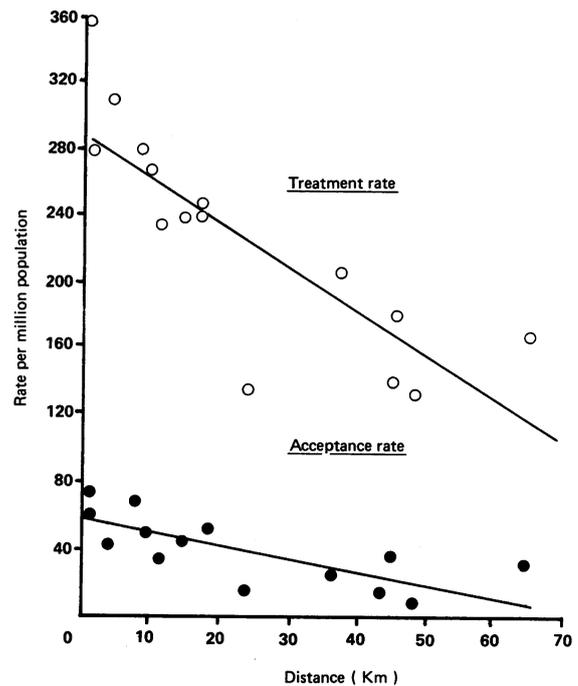
In 1984 information was obtained on the mode of treatment and area of residence of all patients living in the North West Thames region who were admitted to treatment for end stage renal failure during 1983 and were still alive and having treatment at 31 December 1983. Information was collected from the units within the region and from units within neighbouring regions. The district specific acceptance and treatment rates adjusted for age and sex were calculated by using the 1983 final population estimates published by the Office of Populations, Censuses, and Surveys. The distance in kilometres (as the crow flies) of all electoral wards was weighted by population to give the average distance for each health authority from the nearest unit. Spearman rank correlation tests were carried out to investigate the relation between the distance from the provision of service and treatment and acceptance rates.

The district specific acceptance rate ranged from 8 to 73 per million population and there was a similar differential pattern for the district specific treatment rate, from 134 to 357 per million population (figure). Significant rank correlations were found between the distance from a renal unit and the age/sex adjusted acceptance ($r=0.68$, $p<0.01$) and treatment ($r=0.89$, $p<0.002$) rates for end stage renal failure.

Comment

Treatment for end stage renal failure is traditionally provided in teaching hospitals in Britain. This may result in patients having to travel considerable distances. The distance as the crow flies was used as the measure of service access; evidence suggests there is little to choose between it and alternative measures.³ The survey did not include the private sector; nevertheless, few British residents receive treatment for end stage renal failure outside the National Health Service. Possibly there is a higher incidence of the disease in West Indian and Asian people.⁴

The numbers involved in the acceptance rate calculation are small; the pattern is very similar, however, for the rate of patients alive with end stage



Treatment and acceptance rates for end stage renal failure by district health authority with distance from nearest renal unit.

renal failure per million population on 31 December 1983. This suggests similar differential acceptance rates over a period of time. Our results suggest that the further one lives from a dialysis centre the less likelihood there is of receiving lifesaving treatment. These findings have not been noted before.

One reason for these differentials may be different referral practices by general practitioners and hospital consultants.⁵ Possibly the further hospital consultants and general practitioners are from a dialysis centre the less likely they will be to have up to date information about the methods of treatment, such as the use of continuous ambulatory peritoneal dialysis and the move