Man and the mountain environment

Michael Ward

About ten million people live at altitudes exceeding 12,000 ft mainly in South America, but about one-fifth in Central Asia.

In South America, the communities which live permanently between 12,000–14,000 ft, are pastoral and agricultural, but mining villages are found up to 17,500 ft. The main hazards to populations coming from sea-level to live at these altitudes appear to be due to cold and infertility. Protection from the cold is achieved by clothing and shelter, whilst at altitudes above 14,000 ft freezing temperatures are found at some time during every month. Thus at and above this level the area is mainly pastoral whilst below it the position is reversed. The fertility of incoming populations may be reduced. When the Spaniards founded the city of Potosi, 13,000 ft, in the sixteenth century, their wives had to descend to lower levels to bear children. However, the fecundity and fertility of the indigenous natives was unimpaired. Fifty-three years were to elapse before the birth occurred in Potosi of the first Spaniard to survive infancy. This was known as the miracle of St. Nicholas Tomalino.

On the Central Asian plateau and the valleys leading from it, the inhabitants also have a mixed agricultural and pastoral economy. Potatoes, barley and other crops are grown whilst at certain times of year yaks are taken to high pastures between 16,000 and 17,000 ft. Trade routes may involve crossing glacier passes of 19,000 ft, and many days are spent away from all fixed habitations. Many of these populations are therefore partially nomadic and some travel long distances. The majority of the population of Tibetan ethnic origin are found in the south and east and in the high valleys of the adjoining independent kingdoms of Nepal, Sikkim and Bhutan. None of these Tibetan populations lives as high as the highest (17,500 ft), permanent village, Aconquilcha, in South America. Presumably this is because grazing stops at about 16,000 ft and above this level mining is the only reason for permanent dwellings.

Attempts to establish a permanent residence higher than 17,500 ft, so as to be closer to the mines at Aconquilcha, resulted in the miners being taken ill with the classic symptoms of 'mountain sickness'. On this evidence it has been assumed that 17,500 ft represented the highest level for permanent habitation and the maximum altitude to which man could become permanently adjusted. Above this, though acclimatisation has been shown to occur up to about 23,000 ft, the opposite process, high-altitude deterioration, starts.

The only people who live for long periods above 17,500 ft are mountaineers; the longest period spent at 19,000 ft is about ninety days, whilst above this the periods shorten progressively until at 27,500 ft, two nights is the maximum. Successive expeditions to the Himalaya have shown that after a period of acclimatisation heights of 28,000 ft may be reached without oxygen. The Duke of the Abruzzi's expedition to Bride Peak in the Karakorum in 1909 first demonstrated that men could ascend to 25,000 ft without oxygen, whilst on successive Everest expeditions in 1924 and 1933, men ascended to 28,000 ft. So far, oxygen has been necessary for men to attain 29,000 ft, though Hillary and Tenzing removed their sets for about ten minutes on the summit of Everest in 1953. This period has now been extended to one hour by successive summit parties. At this height it appears that oxygen consumption is adequate for the body's requirements in a resting state, but on exercise supplementary oxygen is needed.

1 Adaptation

The basic feature of all adaptive processes is that they are directed towards keeping the internal environment of the body constant so that the delicate and complicated intracellular mechanisms function correctly.

The two main climatological hazards of the mountain environment are cold and high altitude, and to both of these man can adapt with considerable success. However, each may produce characteristic disorders.

i *Adaptation to cold*

Maintenance of temperature depends on a balance between heat production and heat loss. Heat production depends on a normal body metabolism, which is influenced by oxygen uptake. Some heat may be gained from the sun, solar radiation, and this fact is of great importance in enabling man to live in the Polar regions. Heat loss occurs mainly by convection (transfer of heat to air or liquid), conduction (transfer to the ground) and evaporation (due to sweating or heat loss via the lungs). Wind increases heat loss dramatically. Thus, the chilling effect of + 20°F and a 45 m.p.h. wind is equivalent to that of – 40°F and a 2 m.p.h. breeze.

Under normal conditions the temperature at the centre of the body is higher than at the periphery; and the inner core temperature, which contains the organs vital to life, may be preserved at the expense of the peripheral structure such as muscle and skin.

General adaptation to cold can occur either by increasing heat production, by allowing the temperature to drop, or by increasing insulation. Local adaptation, as shown by the increasing ability to expose the hands to the cold, may occur as a result of little understood changes in local blood flow.

A number of legends have grown up relating how lamas have been able to sit or stand almost naked in below-zero temperatures at high altitudes in Tibet. The opportunity to investigate one such case scientifically occured in 1961 on the Himalayan Scientific Expedition. A sherpa named Man Bahedur, normally resident at intermediate altitudes, turned up at Mingbo, 14,000 ft, saying that he was on a pilgrimage. In the ensuing weeks he slept frequently outside at 17,000 ft in the snow, in bare feet, with the minimum of clothes, and in temperatures down to – 15°C. Despite sub-zero temperature he neither suffered from frost-bite nor exposure. Investigations showed that his rate of heat production was higher than normal, and that he was less sensitive to the painful stimuli produced by cold. At no time did the temperature of his skin fall below 10°C, thus frost-bite could not occur.

Whilst indigenous natives show evidence of adaptation, visitors, i.e. Polar travellers and mountaineers, show little evidence of any such adaptation. In modern Polar travel the stimulus to such general adaptation may be lacking as the time spent in the open may only be fifteen per cent of the total. Local adaptation of the hands may occur, though, as noted above, the actual physiological mechanism is far from clear.

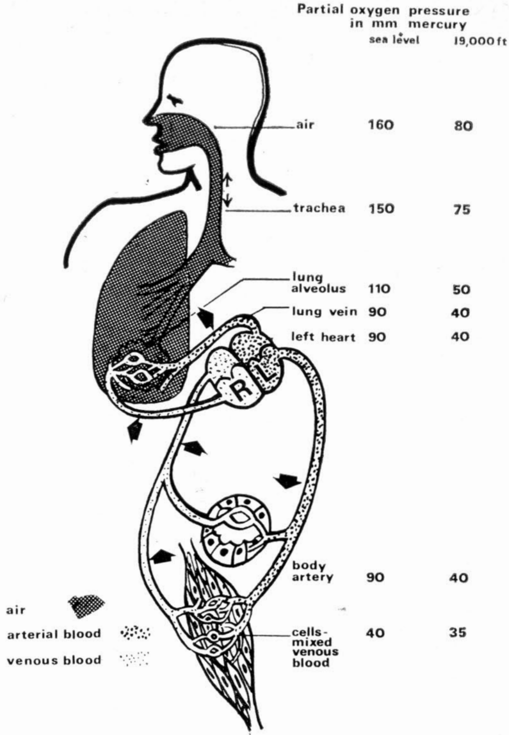
ii *Adaptation to altitude*

The provision of oxygen is one of the most important factors in keeping cells alive, and without it the brain cells die within three to four minutes—though others can survive for longer periods.

At sea-level the pressure exerted on the earth's surface by the air is equivalent to 760 mm of mercury; about twenty per cent or 150 mm, is due to oxygen. At the summit of Everest the barometric pressure is diminished to one-third, and the partial pressure of oxygen is one-third the sea-level value, or about 35–40 mm. On fine days this pressure may be a little higher than on dull days, and in addition figures for barometric pressure in mountain regions are higher than for similar altitudes taken in aircraft.

It is this pressure that drives oxygen from the air into the blood, and from the blood to the cells in the tissues. There energy is provided, as a result of cell function, and carbon dioxide is formed, which travels in the blood to the lungs to be exhaled. Reference to the accompanying diagram will illustrate the drop in pressure that occurs as oxygen is transported to the tissues.

A number of adjustments occur as a result of high altitude. There is an increase in the rate and depth of respiration. In the early stages breathing becomes disordered and so-called Cheyne-Stokes respiration occurs. After the individual



70 *Transport of oxygen by the blood from the air to the body tissues* The two columns give values for the partial pressures of oxygen at various points throughout the respiratory and circulatory systems according to altitude

becomes well acclimatised this diminishes, and may disappear; except at extreme altitudes. The capacity of the oxygen to diffuse through the lung walls into the blood is probably increased in the acclimatised native. He has a higher rate of breathing, and therefore more air passes into the alveoli; in addition the small blood vessels in the lung are more profuse and dilated.

An increase in the red blood cell count was first described by a Frenchman, Viault, at the end of the last century. This means that despite a fall in oxygen saturation of the haemoglobin the oxygen content of a given volume of blood may approach the sea-level figure. The rate at which oxygen is taken up and is given off, by haemoglobin (to which it is attached) is increased between 10,000 and 25,000 ft and it also varies with the acidity of the blood. Despite the adaptive mechanisms, the pressure of oxygen in the blood just before it enters the cells is greatly reduced at high altitude. To enable the oxygen to be transferred more easily to the cells a number of further adaptations are made: the number of small blood vessels are increased, the amount of myoglobin (the protein in muscle to which oxygen is attached) is increased, and there is an increase in the number of enzyme systems which enable oxygen to be taken up by the cells.

Another interesting adjustment is that the right side of the heart increases in size. This is probably because there is an increase in the amount of blood in the lungs, and also some constriction of the arteries leading to the lungs occurs. In some species, for instance cattle, this effect is more marked than in man, and failure of the right side of the heart is not uncommon.

Certain adjustments, too, in the secretion of hormones from the adrenal gland have become recognised in the last few years, but their exact significance is not yet apparent.

Complete acclimatisation takes years to develop, as individuals who live at high altitudes have a greater working capacity than visitors. There is at present no method of assessing the rate and efficiency with which an individual will acclimatise. It does appear, however, that repeated visits result in more rapid acclimatisation, but the explanation of this is not apparent. Individuals too, who are used to a high oxygen intake, or who take hard physical exercise, seem to acclimatise more rapidly, though innumerable exceptions can be quoted.

Climbing above 23,000 ft seems to impose a considerable strain, with increasing weight loss, exhaustion, and slow recovery from fatigue. Long continued residence around 14,000–16,000 ft, where it is possible to undertake strenuous exercise, without undue long-term fatigue, with excursions up to 22,000 ft may be the best and quickest method of becoming well acclimatised. Food intake must be adequate. Below 18,000 ft about 4300 cals/day have been estimated as an adequate intake, whilst up to 22,500 ft only 3800 cals may be necessary. The normal amount of vitamins must be included in a well-balanced diet, remembering that fats are less well tolerated, and carbohydrates (sugar) are a favourite item.

Fluid intake at high altitude should be at least five to six pints daily, to compensate for loss from the lungs, which is a great deal higher than at normal levels. It is unusual over 18,000 ft for mountaineers to sweat a great deal, as oxygen lack inhibits strenuous exertion, thus loss of salt (present in the sweat) is not unduly great, and cramps from this cause are probably unknown.

Acclimatisation seems to last a period which is measured in weeks rather than months, and blood value may take only six weeks to return to normal. Mountaineers going to the Alps immediately after climbing in the Himalaya, seem to become unduly fatigued, probably a long-term effect of residence at high altitude.

2 Environmental disorders

i *Cold injury*

a General: hypothermia. Generalised cold injury, hypothermia or exposure, is probably commoner than generally recognised. Reduction in the heat content of the body so that the inner core temperature is lowered produces a number of clinical features which may initially be puzzling. Symptoms are insidious in onset and consist of listlessness, undue fatigue, and often insubordination, confusion and irrational behaviour may be the first signs of impending collapse. Loss of consciousness leads to a rapid decrease in heat production, the body temperature is lowered still further, and death may occur in two or three hours.

In Great Britain the prevalent wet–cold conditions are an important factor. Water is a good conductor of heat, which is thus lost rapidly—a higher output of energy is needed to keep up heat production, and if this is impossible due to fatigue, heat loss will increase.

Older men are less susceptible to hypothermia than adolescents, and more experienced mountaineers are less likely to be placed in a position where this condition is likely. Tall, thin adolescents appear to be more at risk, too, than short, thickset men. Inability to regulate output of energy and strength, and a tendency to use up mental and physical reserves unsparingly, is another characteristic of adolescence. Whilst this tendency is of little significance in field sports, there is always potential danger in the mountain environment. Women are more resistant to exposure, and in a number of incidents have survived unscathed in situations where even experienced mountaineers have lost fingers through frost-bite or even died. Possibly the insulating properties of their relatively thick layer of subcutaneous fat plays an important part. Paradoxically, too, though the female instinct is directed more towards survival and race protection, she is less often exposed to a survival situation than a man.

Eliminating heat loss by the removal of wet clothing and sheltering from the wind, and increasing heat production, are methods used in treatment. If heat production is too small, re-warming by hot drinks, a hot bath, or by placing in a sleeping bag should be considered. Alcohol, as it dilates the peripheral vessels, increases heat loss and should not be given. It should be remembered also that heat loss from the face and head, because of their vascularity, is relatively high.

b Local: frost-bite, etc. Various forms of local cold injury occur, and of these chilblains and trench-foot can occur at temperatures above freezing. By definition, frost-bite occurs when the tissues freeze, and is commonly found in mountaineers and Polar travellers.

The essential feature is the formation of ice crystals between the cells, these increase in size by sucking water from within the cells, thus interfering with delicate enzyme mechanisms. Cellular death may then occur. In addition, cold causes constriction of local small vessels, and if this becomes severe, arteriolar-venular shunts open up, whereby blood, instead of going to the affected part, is by-passed. Thus cooled blood is prevented from recirculating to the brain, and where it would cause general body cooling by acting on the temperature-regulating centre.

The severity and depth of injury in frost-bite depends on the degree of cold and the time that the part is exposed. At high altitude almost any injury or illness may be associated with frost-bite, as body cooling is relatively frequent. This is because heat production depends on oxygen intake, which may be diminished. It is thus possible for men to become frost-bitten even when fully clothed—since if they are so fatigued or ill their oxygen consumption and heat output will fall, leaving the peripheral structures to cool.

ii *High-altitude disorders*

Originally any illness at high altitude was given the term 'mountain sickness'. It is now possible to distinguish a number of separate conditions.

a Acute mountain sickness, or 'seroche.' Sudden exposure to high altitude may cause acute mountain sickness or even death, as was the case of Tissandier and his colleagues who ascended inadvertently by balloon to 28,000 ft. Two of three men so exposed died.

The first description of mountain sickness was given by Father Joseph de Acosta, a Jesuit priest, when crossing a pass of 14,000 ft in the Andes in 1740:

'I was surprised with such pangs of straining and casting as I thought to cast up my soul too; for having cast up meate, flemgue and choller, both yellow and greene, in the end I cast up blood with the straining of my stomach.'

He considered that this was due to 'the elements of aire (which is there so subtile and delicate as it is not proportionable with the breathing of man which requires more grosse and temperate aire)'. Edward Whymper, in his book *Travels amongst the Great Andes of the Equator*, also gave some graphic accounts of mountain sickness during his expedition to South America of 1879–80. Professor Joseph Barcroft of Cambridge gave one of the first fully clinical descriptions during an investigation carried out in the Andes in 1924; later he lived in a decompression chamber for six days, the pressure being gradually decreased so that it was equivalent to 18,000 ft. He complained of all the typical features of this condition during this period.

The onset of mountain sickness is delayed for a few hours after arriving at altitude and clinical features are generalised in character, being nausea, headache, vomiting, lassitude and weakness. Improvement occurs after 24–48 hours. The severity of symptoms varies greatly and is determined by the rate and degree of ascent.

Mountain sickness is commoner when ascending by plane, train or car than on foot. In the Himalaya, severe cases are relatively rare, as due to hypoxia and subsequent poor physical performance long ascents are not made daily. Longstaff managed to ascend 5000 ft in one day on Trisul but as he did not delay for a long period on the summit symptoms did not have time to appear.

The cause of symptoms which are predominantly cerebral in origin is not clear. Oxygen lack tends to dilate the cerebral blood vessels, but this is counteracted by the change in acidity of the blood when overbreathing, which causes constriction of these vessels. There is some evidence that fluid retention occurs on first ascending to altitude, and evidence from other clinical sources suggests that transient swelling (oedema) of the brain may be the cause of symptoms. Extreme individual variation occurs, some men being unaffected whilst others are prostrated by similar changes in barometric pressure.

b Pulmonary oedema. In recent years oedema of the lungs due to high altitude has become increasingly recognised as a distinct entity. Possibly the first recorded example was by Angelo Mosso, who described in 1898 the case of a physician, Dr Jacottet, who died in 1891 at 14,300 ft in the Vallot hut after ascending Mont Blanc (15,771 ft). The first case recorded in the Himalaya occurred on K2 in 1902, at 18,000 ft, and in 1921 after an illness lasting several days Dr A. M. Kellas died of a 'heart condition' on the approach to Everest. In 1934 on Nanga Parbat, a German mountaineer died of 'pulmonary oedema', and in 1954, despite the use of oxygen, a young Italian guide died on K2. Hurtado, a South American physician, recorded a number of cases in 1937, and Houston has focused the attention of mountaineers on this condition.

The onset is rapid, often occurs on re-ascent to high altitude after descent, is associated with severe exercise and can occur in children. Patients become breathless, cyanosed, froth may appear on the lips, and death occurs rapidly. Chest X-rays show blotchy patches, due to fluid in the lung alveoli, in both lung fields. Certain individuals seem particularly susceptible and may have more than one attack.

Fluid in the lung alveoli interferes with the oxygen transport from lungs to arterial blood, which becomes poorly saturated. As the cells of the brain are particularly sensitive to oxygen lack, cases of pneumonia and high-altitude pulmonary oedema may occur, with signs of irrational behaviour. The exact mechanism which causes this condition is unknown. There is no evidence that it is due to infection or failure of the left side of the heart. It may be due to the direct action of hypoxia on the cells lining the walls of the lung alveoli. This, together with the increase in blood flow through the lungs at exercise, may cause a change in composition of this cell layer, allowing fluid to leak out from the blood vessels into the small alveoli.

c High-altitude deterioration. As noted at the beginning of this article, man cannot live permanently at extreme altitude, and the critical level is thought to be 17,500 ft. Attempts to make a permanent settlement at 18,000 ft resulted in miners developing features of 'mountain sickness'. Recent observations in the Himalaya, when a hut was placed at 19,000 ft and occupied for four months, confirmed these observations, though objective evidence of physical and mental deterioration was difficult to obtain.

The term 'high-altitude deterioration', which has been used to describe the effects of living for long periods over 17,500 ft, was first used by Howard Somervell on Everest in 1922. Though deterioration became more severe and rapid at greater altitudes, some acclimatisation occurred up to 23,000 ft.

Assessment of deterioration has proved difficult in both experimental animals and man. At the moment, loss of weight is the most valuable objective criteria, and though a progressive fall in blood value (i.e. haemoglobin percentage and red blood cell count) has been observed in animals, it has so far not been noted in man. Decrease in working capacity probably occurs, though objective measurement has, once again, proved extremely difficult.

On earlier expeditions men's condition was influenced by a number of outside factors, which accentuated deterioration. Poor living conditions, inadequate food and fluid intake all contributed, and it was not until a prefabricated hut with adequate shelter and cooking facilities was made available in the winter of 1960–1 that it was possible to study this problem adequately.

Climbing at high altitudes is extremely exhausting, as adequate oxygen consumption is only obtained by breathing at the maximum possible rate, and accounts by mountaineers contain statements such as 'the descent was an infinite effort of concentration', and 'I have never been so exhausted'. Perhaps the most disheartening feature is the fact that recovery at high altitude is so slow.

It has been postulated that the continuous strain of living and working at high altitude results in failure of the adrenal gland to produce hormones; a feature of other conditions of long-continued stress. Whilst the clinical features of such conditions are similar, biochemical estimations have not so far confirmed this.

d Thrombotic episodes. Thrombotic episodes, when blood clots in the vessels, are rare in fit, young people, yet at least four cases of cerebral thrombosis and two cases of pulmonary thrombosis have been recorded on Himalayan expeditions. Two of the four cases of cerebral thrombosis died. Any individual who has a high red cell count, as occurs at high altitude, is liable to thrombotic

71 *Use of oxygen at high altitude:* Peter Mulgrew being treated for pulmonary thrombosis and frost-bite on Makalu

episodes. The precipitating factor on expeditions is inactivity, which is so common at high camps, and relative dehydration. The classic, and unfortunate case of Gilkey, who was stormbound on K2 for several days at 24,500 ft, demonstrates these points very clearly.

Not only are humans susceptible to this condition, but cattle which are liable to failure of the right side of the heart due to living at high altitudes also have a tendency to thrombosis in the vessels of the lung.

e Monge's Disease. Some years ago a South American physician, Carlos Monge, described an unusual condition which is now called Monge's Disease, or 'chronic mountain sickness'. Individuals who have acclimatised normally to 12,000 ft and above appear to lose their ability to acclimatise. This is associated with a great increase in the number of red blood cells in the blood, and loss of ventilatory response to hypoxia which is probably due to the respiratory centre in the brain becoming insensitive. The cause of this condition is unknown, and so far cases have only been described in South America. As far as is known no cases have been recorded in mountaineers, though the association of decreased sensitivity of the respiratory centre to oxygen lack and larger than normal red cell count was observed in one climber on the Himalayan Scientific Expedition 1960–61.

iii *Mental symptoms*

Too little attention has been paid to the occurrence of mental symptoms in hypothermia, high-altitude deterioration, starvation, fatigue and exhaustion. These are of particular significance in the mountain environment.

At high altitude, as the cortical brain cells are so sensitive to oxygen lack, an individual may act in a peculiar manner and even become unconscious. Smythe in 1933 at 28,000 ft describes how he observed a pulsating object in the sky; Hunt in 1953 was escorted from the South Col (26,200 ft) in a severely exhausted state, yet his diary makes little reference to this fact. After ascending to about 25,000 ft on Makalu in 1961, the author became unconscious for twenty-four hours.

Spasm of the arteries in the brain, possibly due to thrombosis, may give rise to paralysis of one side of the body. 'Migraine' attacks with loss of speech may be precipitated by conditions at high altitude. Any underlying psychological disturbance will be aggravated, and one man on Everest in 1933 suffered from paranoid delusions, taking little part in the expedition. A number of mountaineers have described the illusion that they have an extra companion, and have even offered him food. This phenomenon is not confined to great altitudes, however, as it has been observed at sea-level.

That hunger may induce an individual to become irrational and irritable is well known. Progressive under-nutrition may occur on expeditions spending long periods in the field, especially at high altitude. Not only does this result in loss of weight but the metabolic rate of the body falls and the subject becomes abnormally sensitive to cold, and thus to exposure. Psychological changes include mental apathy, moral deterioration, depression, and lowered intellectual capacity.

An unresponsive, complaining, and unco-operative attitude was frequently observed in semi-starved persons after World War II in Western Europe; this disappeared when food intake was adequate.

In the past few years it has become apparent that an increasing number of hill walkers and mountaineers are affected by hypothermia (see p 138 above). Unreasonable behaviour may be the presenting feature. Physical and mental lethargy, failure to respond to instructions, slurring of speech, and outbursts of violent language have been all observed. Abnormality or failure of vision is very serious. Combinations of fatigue, cold, and mental anxiety are especially dangerous in promoting hypothermia, and in one series reported from the British Isles there were twenty-five deaths occurring in 100 cases at risk.

3 Accidents

Although ski-ing and mountaineering take place in the same environment they have fundamental differences. Ski-ing is a very popular, highly commercialised, organised and expensive spectator sport, whereas by contrast mountaineering is usually none of these.

The majority of skiers (piste skiers) use a specially-prepared, densely-populated area of mountain. Mechanical transport, food, shelter, tuition, and medical care are available, whilst snow conditions are analysed and avalanche danger foretold. An inexperienced skier tends to perform within his capabilities and he is both protected and inhibited by lack of technical skill.

The mountaineer and ski-tourer, on the other hand, use a natural unprepared environment, and if inexperienced the mountaineer is more at risk as his freedom of movement is greater and his skills are more natural. Accidents to mountaineers are associated with a mortality of fifteen to twenty-five per cent; and the majority are under twenty-five years old. About one-third are head injuries and one-third limb injuries. At great altitudes, above 18,000 ft, conditions contribute more to the incidence of accidents and illness than technical difficulty. Sixty-four people have been killed on expeditions to the world's ten highest mountains—up to and including their first ascent—and of these twenty-three out of a total of 300 at risk were non-porters, usually European; giving a mortality rate of about seven per cent.

By contrast, in ski-ing accidents deaths are rare, and minor injuries more common. One American authority considers that an accident rate of between two to thirteen per 1000 skiers per day is a fair estimate, and in 1958 it was estimated that there were 110,000 ski-ing accidents in the U.S.A. This figure must be greatly increased by now. About eighty per cent occurred in individuals under thirty years old, fifteen per cent on the first day; about fifty per cent of injuries were in beginners. Injuries to the lower limbs accounted for ninety per cent of the cases, and of these fractures made up thirty-five per cent and sprains forty-three per cent.

The recent introduction of release bindings appears to have decreased the likelihood of injury following a fall, but correct application is essential for maximum safety.

Some accident statistics

1 GREAT BRITAIN

Total of 1963, 4 and 6	496
Injured	414
Dead	82 (about 20%)

Nature of injury

Head	30%
Limbs	35%
Chest, abdomen	10%
Exposure	15%
Heart failure	5%
Others	5%

2 NORTH AMERICA

High peaks 1951–65

Total involved	824
Dead	207 (about 25%)

Practise cliffs 1951–65

Total involved	96
Dead	14 (about 15%)

3 MORTALITY ON WORLD'S TEN HIGHEST PEAKS UP TO THEIR FIRST ASCENT

Total	64
Total: non-Porter	23
Total: non-Porter at risk: about	300

(i.e. mortality rate of non-porters *c.* 7%)

Cause of death in 64 *cases*

Avalanche, accident	36
Exhaustion	15
? Heart failure	3
Frost-bite	2
Cerebrovascular accident	2
Enteric fever	1
Unknown	5

4 SKI ACCIDENTS (AN AMERICAN SERIES)

Total	851
Deaths	0

Injuries

Lower limb	90%
Upper limb	10%

Type

Sprains	43%
Fractures	35%
Bruising and lacerations	11%
Others	12%

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