without interference with the blood supply of the cord, so increasing any existing paralysis.

Surgery is indicated in all cases where there are progressive neurological signs. Emergency intervention is necessary where paraplegia has a rapid onset, trauma often being a precipitating factor.

The surgical approach to a protruding intervertebral disc in the dorsal region may endanger the blood supply to the thoracic cord. It may be removed by transthoracic approach³ to the anterolateral part of the disc or by a lateral rachotomy, when the disc is exposed laterally after excision of the associated rib and enlargement of the intervertebral foramen.⁶

This may be combined with partial laminectomy of the vertebra above and below the affected level to improve the exposure. Thus exact location of the level of the disc prolapse is essential. The results of surgical relief in the past have been poor.²⁻⁵ This was the result partly of late diagnosis, when irreversible neurological damage had already occurred, and partly of the use of an unsuitable surgical approach to the protrusion.⁴⁻⁶ Approach by laminectomy, either extradural or transdural, is difficult if neurological deficit is not to be increased at operation and gives inadequate exposure of the prolapse. Extensive removal of the laminae, especially if the facet joints are excised, may cause the disc to protrude further into the spinal canal and produce complete paraplegia. The anterolateral or lateral combined approach, with unilateral facetectomy, allows better access with less risk of any interference with the spinal cord and its blood supply and its more frequent use now gives a better prognosis.²⁻⁷ Maximal improvement after operation is reached within six to eight weeks, but recovery may progress for a further two years. The condition then tends to become stationary.

Early diagnosis and operation are essential if the former poor prognosis of thoracic disc prolapse is to be avoided. Severe neurological deficit will indicate a poor end result.⁴ The best prognosis is given by the protrusion that produces unilateral pain and minimal neurological deficit. A slow onset, especially if a lateral prolapse is present, gives a better prognosis, but a rapid onset, which is often a central prolapse, needs urgent surgery. Reports show an inverse relation of the length of pre-operative history and postoperative result. The known anatomical paucity of the blood supply to the thoracic cord—and the considerable risk of aggravating this by any operative manipulation and the difficulty of removing a prolapse (which is often adherent to the dura)—make the risks of surgery for thoracic prolapse far greater than those in the cervical or lumbar region. On the other hand, while the operation does carry these risks, which are now reduced considerably by using the lateral approach, failure to intervene makes progressive deterioration certain.

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Clinical Topics

Icarus's syndrome: new hazards in flight

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Summary

The British Hang Gliding Association accident report for 1975 reported two deaths. The remaining cases were predominantly limb fractures. The major causes of the injuries were inexperience, high wind speed, turbulence, and stalling. It is contended that the sport is no more risky than is rock climbing, motor-bike racing, skiing, or potholing, yet against these undoubtedly dangerous sports no threat of prohibition exists. The current accident rate in hang gliding could be reduced dramatically by the provision of proper courses of instruction.

Introduction

The commonest hang glider—called kite—is the Rogallo design. It consists of a roughly V-shaped structure of aluminium tubes supporting about 18.5 sq m (200 sq ft) of sail. The rigidity of the assembly is increased by wire struts. The pilot is suspended in a saddle from the centre of the structure. In front of him, projecting downwards, is the A-frame—so named because of its shape (figs 1 and 2). The pilot can alter the attitude of the kite by shifting his weight in both an anterior-posterior and lateral direction in relation to the A-frame. Lift-off occurs at about 19-24 kph (12-15 mph), and flying speed is in the range of 24-56 kph (15-35 mph). Kites weigh about 16-18 kg (35-40 lb). In the event of sudden deceleration the pilot inevitably strikes part of the A-frame.

To take off, the pilot runs down hill until a sufficient airspeed is reached and then he hangs in the saddle or harness. To land, he flies straight and level with his feet just clearing the ground and holds the nose of the kite up, progressively trading speed for maintenance of height until the craft sinks gently at walking speed or at rest, and he then takes the weight on his feet. This

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manoeuvre is obviously a critical one achieved only by repeated practice and often hard-earned experience.

Numbers of pilots and accidents

In 1975 the membership of the British Hang Gliding Association was 2461. The report listed 70 accidents, but of these pilots only 45 were members. This gives an overall incidence of 1.8%, clearly an approximation of low accuracy owing to the uncertainty of the flying population concerned and also to the possibility of unreported accidents. In the figures presented hereafter it was rare for all aspects to have been reported in every case, which accounts for the varying numbers of cases in different aspects discussed. Furthermore, in some of the "accidents" it was the kite that had sustained the injury and not the pilot.

Injuries were graded according to severity in the following manner. Pilot injury—PO, none; P1, soft-tissue injury (cuts, bruises, abrasions, and sprains); and P2, fractures, fracture-dislocations, and concussion.

Kite damage—KO, none; K1, torn sail; and K2, bent or fractured or both, booms, bolts, or rigging.

Of the pilots involved in accidents, 45 were men, one was a woman, and in the remaining 18 the sex was not recorded. Two pilots—both men—were killed. Out of the total accident survey of 70 incidents, 20 pilots were not injured at all. Altogether 58 pilots had made 2190 flights before their accident, giving a figure of 38 flights per pilot per

TABLE I—Injuries sustained by 51 pilots*

	No of pilots		No of pilots
Concussion	2	Fractured ribs	2
Fracture of:		Fracture of:	
Spine	1	Femur	1
Coccyx	1	Tibia	3
Shoulder†	1	Ankle†	1
Humerus	4	Foot†	1
Ulna	2	Bruising and soft-tissue injury	19
Radius	2	Strained ligaments	4
Wrist†	5		
Hand†	1		
Dislocated clavicle	1		

*Two further patients were killed.
†Bone fractured not known.

TABLE II—Fractures associated with damage to the kite

Location and No of fractures	Structural damage to kite (K2)		
	A-frame	Other booms	None
Arm (15)	12	2	3
Ribs and vertebrae (5)	2	2	5
Leg (7)	4		3

TABLE III—No of accidents related to the pilot's experience as months of flying, shown grouped according to the grade of injury

Grade of injury to pilot	Months of flying experience														
	<1	1	2	3	4	5	6	7	8	9	10	11	12	>12	
0	3	3	0	2	1	2	2	1	2	3	1	0	0	3	
1	7	2	2	0	3	1	1	3	0	0	0	1	0	5	
2	11	4	1	0	4	2	0	1	1	0	1	0	1	3	
Total	21	9	3	2	8	5	3	5	3	3	2	1	1	11	

TABLE IV—No of accidents related to the pilot's experience quoted as his total No of completed flights, grouped according to the grade of injury

Grade of injury to pilot	No of flights											
	<9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-109	>110
0	2	4	2	3	2	1	3	0	0	0	0	1
1	6	1	0	2	0	1	1	0	0	0	0	8
2	11	3	3	2	1	1	2	0	0	0	0	1
Total	19	8	5	7	3	3	6	0	0	0	0	10

FIG 1—Hang glider: stern view, showing relation of pilot to A-frame in particular.

FIG 2—Hang glider and pilot: lateral view.

accident, although five pilots made 192 flights per pilot per accident. If these data are deducted then the new figures are 53 pilots having 1230 flights per accident—that is, 23 flights per pilot per accident.

Types of injury

Medical details were supplied by the injured pilots themselves in their reports of the 51 injuries (one pilot may have several injuries) two pilots were concussed; 27 (53%) injuries were fractures or fracture-dislocations; and 21 (45%) were soft-tissue injuries. Of the 27 fractures, 15 (55%) occurred in the arm, seven (27%) in the leg, and five (18%) in the ribs or spine (table I). There was a predominance of arm fractures associated with damage to the A-frame (table II).

Reasons for accidents

EXPERIENCE

Tables III and IV show the number of accidents in relation to experience as measured by the total number of flights made and to months of flying experience respectively. The risks facing the beginner are obvious—accidents are clearly related to inexperience. In contrast accidents not associated with injury continued to occur at about two a month, whereas the numbers of injuries fell as time passed.

OTHER CAUSES

Wind speed and turbulence were major causes of accidents (table V). The stall caused 18 accidents, thereby accounting for 10 of the 15 arm fractures, two of the six leg fractures, and (in sharp contrast)

only five of the 23 cases of bruising and soft-tissue injury. The weight of the pilot was not related to injury.

TABLE V—No of accidents related to the wind speed, shown grouped according to the grade of injury

Grade of injury to pilot	Wind speed (kph)							
	0–	5–	10–	15–	20–	25–	30–	35–40
0	0	0	1	3	6	3	2	5
1	1	0	1	5	5	4	1	2
2	2	2	4	3	2	9	1	2
Total	3	2	6	11	13	16	4	9

FATALITIES

Two fatal accidents were recorded. One was attributed to structural failure in the kite, and the other to the entanglement of the pilot's boot hook in a strut, resulting in weight shift and an irrecoverable dive.

Comments

The complete absence of skull injury and rarity of brain damage are presumably due to the universal use of crash

helmets. I think that the mild but definite predominance of arm fractures is due to impact with the A-frame during a heavy landing or a crash, as the legs are well below the level of the A-frame. The human frame cannot be appreciably armoured, and the A-frame has to be strong enough to be rigid; it is hard to see any way of reducing the consequences of mutual impact.

The message spelt out by these figures is obvious—prevention, rather than cure. The hazards facing the beginner are all too obvious and clearly constitute an unacceptable risk. I think that it is a sad reflection that many of the above accidents could have been prevented by a little ground-briefing. There is a clear necessity for recognised instruction, similar to that required by the Civil Aviation Authority for pilots of gliders. In particular, there is a need for dual instruction during flight; otherwise the present harvest of injury and suffering will surely continue to be reaped.

Finally, I believe that this sport is no more dangerous than horse riding, rock climbing, potholing, or motor cycle racing, and with training may probably be rendered less hazardous than any of these sports. Let those who disagree produce comparable accident statistics with which to back their assertions.

I am most grateful to the British Hang Gliding Association—of which I am a member—for kindly providing me with the *BHGA Accident Analysis Report for 1975*, from which all the data in this article were obtained and summarised.

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Letter from . . . South Australia

Woombering and Medibank

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I have been to Toowoomba, and not many people can say that. I was able to do this as a result of the generosity of my hosts at the Postgraduate Weekend, organised by the local branch of the Australian Medical Association, which was the ostensible reason for me being in the delightful small city of Toowoomba.

Toowoomba is in Queensland, about 100 miles inland from Brisbane. It must be about 1500 miles from Adelaide, but such is this phenomenal country that I was asked to go there and give four lectures, all at the expense of the local AMA. It is as if one were invited from London to go and talk to doctors in Rome or Marseilles just for the weekend. Distances here just have to be annihilated so that communication outside one's small circle may be established. Communication means real effort and much expenditure of time and money. Both are given unstintingly in the cause.

Like Professor Hugh Dudley, an erstwhile Australian, I have my doubts about the value of massive international congresses of various kinds, which increasingly seem to be for purposes of

tax relief for many of the enrollers. It is noteworthy that the speakers are often academics who have smaller incomes than their audience, and who are often out of pocket on the deal, despite the fact that their expenses and travel tickets are paid for. I "woomber" (a neologism coined for the weekend—the activity of idly daydreaming) about the apparent fact of life that primary producers receive less reward from their labours than those who use what they have to sell. Those middlemen in direct contact with the public always fare better than the suppliers of their wares whether those are wool, food, fuel, or ideas.

The Toowoomba Postgraduate Weekend was different in that with such a relatively small community, doctors of all disciplines attended, for it was an occasion. They all knew each other, or about each other, though several came from miles away. It was very much more stimulating than meetings of specialists who have a community of their own and keep up with the literature. What was said by the obstetrician, the paediatric surgeon, and the paediatrician at Toowoomba was fairly fresh to many of the audience. They were interested, and interesting and stimulating in discussion. The speakers knew of the variegated nature of the members of the weekend, and so tailored their themes appropriately. All were thereby brought in, and it was probably a valuable educational exercise for us all. The experience makes me woomber whether we should not break down the specialties a little more by such meetings. Of course, there must be a theme, but such is the interdisciplinary nature of medicine that we ought

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