example of the use of measurements in serum or urine of tumour-produced substances in the diagnosis of certain tumours.


Vitreous Surgery

New surgical techniques, instruments, and vitreous substitutes have opened an exciting era in the field of surgery of the vitreous of the eye. Cases of retinal detachment, which have hitherto been thought inoperable by conventional means, are being treated successfully with increasing frequency. Because of the failure of chemical and drug therapy in the treatment of vitreous haemorrhage, ophthalmic surgeons are turning to mechanical means of removing opaque vitreous from the eye.

Miniature scissors have recently been devised which enable vitreous bands and membranes to be cut in order to release vitreous traction on the retina. The blades are 5 mm in length and the part that enters the eye has a diameter of 1-6 mm. An instrument with an inflatable balloon at its tip has been used in positioning detached retina and in breaking adhesions between the detached retinal flap of a giant tear and the underlying retina in order to make it mobile and more accessible to surgery.

The most significant advance in vitreous surgery has been the introduction of the vitreous infusion suction cutter, which has made seemingly untreatable disease of the vitreous treatable. The instrument, which is the size of a fountain pen, consists of three parts: an electric micrometer that drives the cutting mechanism; a suction system; and an infusion system. It is introduced into the vitreous cavity and simultaneously diseased vitreous is mechanically destroyed, aspirated, and replaced by a balanced salt solution, and vitreous strands are also eliminated. The action of the instrument is observed through a fundus contact lens with the operating microscope. Long-standing vitreous haemorrhage, vitreous membranes, and retinitis proliferans in diabetic patients, and difficult cases of retinal detachment with vitreous traction and giant tears, have been successfully treated by this method. The technique is tedious and long, requiring excellent surgical skill and judgement. So far the best results have been achieved in cases of long-standing vitreous haemorrhage. These heroic procedures should be confined to desperate cases, as treatment in the early stage of their development is hazardous.

The injection of vitreous substitutes into the vitreous cavity has been a useful adjunct in certain types of operations for retinal detachment. The purpose of these injections is to replenish the volume of the vitreous cavity and to restore normal intraocular pressure in eyes which are hypotonic after the drainage of subretinal fluid. By eliminating undesired folds in the retina and pushing the retina and retinal tears towards their required contact with the intact choriocod they also act as retinal splints. In certain cases vitreous substitutes are used to break down vitreous bands and membranes which, by exerting excessive pull on the retina, have rendered conventional methods of retinal reaposition ineffective.

Several liquids and gases are being tried with varying degrees of success. They include saline, human donor vitreous hyaluronic acid, silicone oil, and air. Attempts at vitreous transplantation by means of eye-bank donor vitreous have not proved to be entirely satisfactory owing to its rapid de-polymerization after removal from the donor eye, rendering it no more viscid than water. Hyaluronic acid has been recently used with a moderate degree of success. It is superior to saline because of its higher viscosity and is well tolerated by the eye. Liquid silicone is a non-absorbable vitreous substitute with a high viscosity. Its use is reserved for patients with only one potentially useful eye which has an otherwise hopeless prognosis and no chance of cure by conventional procedures for treating retinal detachment. The long-term visual results with silicone are disappointing owing to the many late complications encountered, which include damage to the retinal cells. It has been used only in 37 hopeless cases of retinal detachment in the last nine years at the Retinal Unit of the High Holborn Branch of Moorfield Eye Hospital.

Air is a useful substitute for vitreous and is absorbed a few days after its injection into the eye. Because of its low specific gravity its location within the eye can be controlled by altering the position of the patient's head postoperatively. This is of particular value in the treatment of giant retinal tears. Its main disadvantage is that it makes postoperative fundoscopy difficult.

The perfect vitreous substitute should be a gel with the same physical and optical properties as vitreous. Unfortunately gels cannot be injected through needles without fracturing them, and much more research in this field is necessary.


Pilot Error

The development of aircraft has brought them to a point where they can be flown by more automatic control than many airports permit. A high proportion are capable of partial automatic landing down to a height of 30 metres and a visual range on the runway of 400 metres, yet few airports allow this degree of automation, though Heathrow does do so. That pilots are capable of error like the rest of us is unfortunately true, as shown by a number of recent inquiries. But aircraft accidents remain a relatively rare circumstance in mass transportation. Much the largest proportion occur in the immediate neighbourhood of airports and are related to take-off and landing. Consequently the task that pilots undertake and the strains imposed on them during this part of the aircraft's flight, while being of special con-

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cern to the pilots and the general public, are subject also to special study by physiologists and psychologists.

Recently A. N. Nicholson and colleagues\(^1\) have reported attempts to measure the workload of pilots. They have shown that the pulse rate can rise to 140-160/min, and peaks of 168 were recorded. This would seem to be in the range of maximum physiological competence of the normal heart. Their findings also indicate that when responsibilities are shared on the flight deck and where the aerodrome aids are good, the neurological arousal of the pilots is lower and their pulse rate remains slower. The lesson of this work would seem to be that many more airports should install more sophisticated navigation and landing aids which at present they lack.

To equip airports to the same standard of competence as many modern aircraft now enjoy is not the only problem. Inefficiency of the flight deck crew from tiredness has been reported by the British Airline Pilots' Association. Here modern technology has little part to play, for the causes of the tiredness can vary considerably from arduous duty rosters imposed by an airline to unwise personal habits adopted by a pilot. Prevention of the risk to the flying public that tiredness among pilots may impose is clearly a matter of good, co-operative management among other things. One of the advantages claimed for the Concorde is that its capacity for fast outward and return journeys in an allowable working day\(^2\) will reduce the risk of undue fatigue on the flight deck.

Finally, despite the private tragedies and the mass gloating that attend aircraft accidents, it is worth remembering that flying is still good value in the safety stakes no matter how they are viewed. The design criteria for airworthiness are aimed at not more than 1 fatality per 10\(^7\) passenger miles. The scheduled air services in 1972, worldwide, achieved 3.7\(^{-1}\) fatalities per 10\(^7\) passenger miles.\(^3\) In that year approximately 2,000 passengers were killed throughout the world in all types of aircraft accidents, while in the same period approximately 6,500 people were killed on the roads in Great Britain.


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**Penicillin in the Treatment of Syphilis**

Thirty years have passed since J. F. Mahoney and his colleagues\(^4\) first reported on the treatment of four patients with primary syphilis with penicillin. The replacement of protracted courses of treatment with arsphenamines and bismuth, which at times seemed as toxic for the patients as the treponeme, by short courses of non-toxic penicillin has been one of the most beneficial of its uses. Though the immediate effectiveness of penicillin in early syphilis was soon apparent, there were some doubts about its long-term ability to prevent the development of the late manifestations of the disease. O. Idsøe, T. Guthe, and R. R. Willcox\(^5\) have reviewed the experience of three decades in a monograph which presents current ideas about the use of penicillin for treating this disease.

*Treponema pallidum* is fortunately very sensitive to the action of penicillin, and there is nothing to suggest that insensitive strains have emerged over the years, as has happened with the gonococcus. *T. pallidum* multiplies slowly and has a division time of 30 to 33 hours. Penicillin is active only against actively dividing organisms, and P. Collart and his colleagues\(^6\) have shown that *T. pallidum*, when not dividing, can withstand high concentrations of penicillin in vitro but retain its virulence when subsequently transferred to experimental animals. The aim of treatment is to maintain a sustained blood level of 0.03 unit penicillin per ml over a period of at least 7 to 10 days.

For the treatment of primary and secondary syphilis doses of 600,000 units of aqueous procaine penicillin G daily for 7 to 10 days or a single dose of 2.4 megauunits of benzathine penicillin will produce and maintain this concentration in the blood. In late latent or late symptomatic syphilis doses of 6 to 9 megauunits given over a period of 10 to 15 days are recommended. In early syphilis the lesions heal rapidly, and surveys of published series show that tests for antilipoal antibody (reagin) become negative in about 95% of patients followed up for two years. The recurrence rate has been about 3%, but many of these are thought to be due to re-infections rather than to relapse. Treatment given at this stage of the disease cuts it short before substantial immunity can develop.

Had penicillin been ineffective in preventing the late manifestations of syphilis, we should by now have seen increasing numbers of such cases. In fact, their numbers have steadily declined over the years. F. J. G. Jefferiss\(^7\) states that he has never seen a patient with early syphilis who was properly treated with a reliable penicillin who later developed a significantly abnormal spinal fluid, neurosyphilis, or any form of late syphilis. It seems that penicillin can produce cures, in the bacteriological sense, when used to treat early syphilis.

In patients with late latent and late symptomatic syphilis the outlook depends on the site and amount of damage already caused by the treponeme. Treatment with penicillin may arrest the disease, but it cannot replace damaged tissue. The progress from latent to symptomatic infection can be averted, and the results in uncomplicated aortitis and asymptomatic neurosyphilis are good. The serological response to treatment is less marked, for only about 20 to 30% of patients with late latent infections become reagin-negative, and this proportion is not increased by further treatment. Specific tests, such as the T.P.I. and F.T.A.-A.B.S. tests, almost always remain positive after treatment of late syphilis and are of no help in assessing progress. This must be done on clinical grounds, though persisting high titres of reagin or a progressive rise in titre suggest that the disease is still active. The persistence of treponeme-like forms in the tissues of some patients after treatment of late syphilis with penicillin was first described by P. Collart and his colleagues.\(^8\) Subsequent work in this field has recently been reviewed by E. M. C. Dunlop.\(^9\) If these forms are *T. pallidum*, they are thought to be persistent of diminished virulence which are probably not causing much harm to the host, though in a small number of cases they have been shown to be infective for experimental animals. These observations are not thought to call for alteration of the established methods of treatment.

About 1 to 2% of patients attending venereal disease clinics give a history of a previous reaction to penicillin. When the use of penicillin is so precluded, a course of 30 to 40 g of tetracycline or erythromycin in divided doses over 10 to 15 days can be given as alternatives. Tetracyclines should