

- ⁸ Weismann, R. E., *American Journal of Surgery*, 1973, 125, 437.
⁹ Boyd, S. G., and Percy-Robb, I. W., *American Journal of Medicine*, 1971, 51, 580.
¹⁰ Buchwald, H., *Journal of Artherosclerosis Research*, 1969, 10, 1.
¹¹ Helsing, N., and Rootwelt, K., *Nordisk Medicin*, 1969, 82, 1409.
¹² Swan, D. M., and McGowan, J. M., *American Journal of Surgery*, 1968, 116, 22.
¹³ Sodal, G., Gjertsen, K. T., and Schrupf, A., *Acta Chirurgica Scandinavica*, 1970, 136, 671.
¹⁴ Scott, H. W., *et al.*, *Annals of Surgery*, 1966, 163, 795.
¹⁵ Shepard, G. H., *et al.*, *Surgical Forum*, 1968, 19, 302.

Lightning

Nearly 50,000 thunderstorms occur each day throughout the world, with results varying from the fixation of nitrogen in the atmosphere to starting forest fires, interfering with the overhead distribution of electricity, damaging property, and occasionally killing animals and people. About 12 people a year are struck by lightning in Britain; the corresponding figure for the U.S.A. is 150. Among the six million inhabitants of Rhodesia, however, there are on average 60 deaths from lightning each year. Analysis of these figures¹ shows a preponderance of victims among rural Africans, and a regional variation with more deaths in the areas where "dry" thunderstorms are more common, the suggested explanation being that cloud-to-ground lightning strokes are more likely to be encountered in these conditions.

The mechanism of the lightning storm is complex and probably not fully understood. Traditionally thunder and lightning are linked to a change in weather characterized by wind, a fall in temperature, dark cloud formation, and rain. Less frequently lightning can occur on a clear day—the "bolt from the blue." In similar fashion the discharge itself may vary in type and may be from cloud to cloud or between cloud and ground. The lightning stroke is not a simple spark but a more complex discharge, with different constituent parts. First a leader forms a path from cloud to earth (or occasionally the reverse). This is then followed by the main return stroke, discharging along the same path in the opposite direction, with as many as 40 successive current peaks varying from 10,000-200,000 amps occurring in the space of a fraction of a second, and with a potential difference of up to 20 million volts.

Tall structures may initiate upward leaders, and for that reason people caught in a storm are advised not to shelter under trees and to avoid flat open areas such as golf courses, where they may form the highest point. Shelter indoors is safer than being outside, while anyone unable to take refuge in a building should avoid metal structures such as fences, sheds, park seats, and tentpoles.

The post-mortem findings associated with lightning strike² include damage to clothing and skin, fractured bones, burns, and magnetization of metallic articles worn or carried by the victim. Both the burns and respiratory and cardiac arrest may result from passage of electricity through the body, while the evidence of physical violence is related to the thermal effect of the discharge through the air.

Survival after lightning strike is sufficiently dramatic to be reported in the popular press: recovery may be spontaneous³ or may follow resuscitation. The victim of a lightning strike does not harbour any remaining electric charge and so can be approached safely. Cardiorespiratory arrest may respond to external cardiac massage and ventilation, and both should be continued for some time—Ravitch *et al.*⁴ and Nesmith⁵ agree that these patients may be able to withstand apnoea for

prolonged periods; indeed Taussig⁶ has suggested that the electrical effect of lightning strike halts cellular metabolism and delays the effect of anoxia.

Cerebral oedema may develop fairly rapidly after electrocution, so steps such as the administration of mannitol should be taken. Generalized paralysis has also been described, though it is rarely permanent unless secondary to such effects as cerebral hypoxia. Hanson and McIlwraith⁷ described gastrointestinal dilation as a complication and they suggested passing a gastric tube, which should also reduce the risk of pulmonary aspiration. They also warned that the blast effects of the discharge could cause contusion of the lung, intestine, and myocardium as further complications.

Lightning may in fact strike in the same place twice, but is unlikely to strike in the same doctor's experience more than once. The single most important feature of lightning injury is the delay in signs of response to resuscitation, and the rule should be that external cardiac massage and ventilation should be continued at least until the patient's arrival at hospital.

¹ Castle, W. M., and Kreft, J., *Central African Journal of Medicine*, 1974, 20, 93.

² Simpson, K., *Forensic Medicine*, 4th edn. London, Edward Arnold, 1961.

³ *Sunday Express*, 18 August 1974.

⁴ Ravitch, M., *et al.*, *New England Journal of Medicine*, 1961, 264, 36.

⁵ Nesmith, M., *Journal of the Florida Medical Association*, 1971, 58, 36.

⁶ Taussig, H., *Annals of Internal Medicine*, 1968, 68, 1345.

⁷ Hanson, G., and McIlwraith, G., *British Medical Journal*, 1973, 4, 271.

Intrauterine Chemical Release

The pill and I.U.D. are firmly established as alternative and complementary forms of conception control. The frequency of undesirable side effects and lower efficacy of the inert, "first-generation" types of device have, however, prompted a search for improved design and led to the development of active, "second-generation" I.U.D.s. These are, in effect, local systems for the release of specific contraceptive agents into the uterine cavity.

Devices depending on the release of metallic copper, such as the Cu-T and Cu-7, are perhaps the most familiar of these new types of I.U.D. Zipper *et al.*¹⁻³ showed that copper (and certain other metals such as zinc) attached to an intrauterine carrier can markedly enhance its contraceptive efficacy in both experimental animals and women. The clinical performance of the latest models of copper I.U.D.s such as the Gravigard is very encouraging. While the rate of unintended pregnancy associated with their use is higher than that with the combined pill, it is much the same as with sequential and progestogen-only types of oral contraceptive, while their rates of expulsion, medical removal, and continuation are generally superior to those of the inert devices. Copper I.U.D.s can also be inserted more easily than conventional ones in multiparous women and in those with a narrow or distorted cervix. These general impressions may need modification, however: a recent British trial of 2,000 fittings of the Gravigard device has yielded a cumulative pregnancy rate substantially higher than that recorded in earlier, small-scale studies.⁴

The precise mode of action of the copper devices is still far from clear, but there may be several mechanisms. The prevail-

ing view, derived from both animal and clinical observations, is that their effect basically resembles that of the inert, linear devices but is reinforced or complemented by factors with specific contraceptive properties.^{3 5 6} In rats and monkeys copper stimulates a massive endometrial exudation of leucocytes, believed to be embryotoxic,⁷ but this effect seems to be less pronounced and less constant in the human uterus. In addition, it is thought that copper devices may modify the physicochemical properties, and hence penetrability, of the cervical mucus;^{8 9} be directly toxic to spermatozoa, possibly by an alteration of the copper-zinc ratio in the head region, affecting sperm motility;¹⁰ or induce changes in the metabolism and enzyme content of the endometrium which render it, or the uterine environment, unsuitable for implantation.^{5 6 11} A comprehensive account of the hormonal, histological, and histochemical changes induced by copper devices in women has been published by Hagenfeldt.¹¹

The second type of system is based on the local contraceptive action of progesterone released from an intrauterine capsule or other device and affecting the endometrium directly. This approach assumes that excess progestogen may lead to abnormal endometrial development as much as its deficiency and in this way interfere with implantation. Several years ago progestogen-impregnated I.U.D.s were shown to induce a secretory endometrium in monkeys,¹² and this was confirmed by Scommegna *et al.*¹³ in women fitted with intrauterine silastic (silicone polymer) capsules containing 10-30 mg progesterone. Subsequent endometrial biopsy showed decidual or pseudodecidual changes in the endometrium and definite atrophy of the uterine glands, unaccompanied, however, by suppression of ovulation or appreciable disturbance of the menstrual pattern. Scommegna *et al.* chose a silastic capsule since this material permits the slow release of its contents and is therefore capable of prolonged drug delivery.

Since then the same group of workers has conducted an extensive clinical trial¹⁴ of the method, in which nearly 250 women were fitted with a modified T-shaped device releasing minute amounts of progesterone (on average 128 µg/day) from an attached silastic capsule, and tested for six months. No pregnancies occurred during this period when an active, progesterone-releasing I.U.D. was present in the uterine cavity, though one woman conceived in whom the device had become displaced into the cervix. Special investigations in selected subjects indicated that the contraceptive effect of the device was due neither to inhibition of ovulation nor to changes in the cervical mucus but was probably related to decidual transformation and glandular atrophy of the endometrium induced by the constantly released progesterone.

In spite of their preliminary nature, the results of the trial are distinctly promising. It seems that intrauterine progesterone, like intrauterine copper, can efficiently protect against pregnancy; also that progesterone does so by a local, direct and hence "economical" mechanism of action, and one which does not seem to interfere with ovulation and the hormonal control of the cycle.

Much remains to be done to substantiate and extend these observations. In particular, it will be necessary to prove the clinical efficacy and acceptability of the method on a larger scale, monitor the continued retention of the capsule within the uterus, and try to prolong its pharmacological life span, perhaps by substituting progestogens released more slowly than progesterone. Even so, the feasibility of using intrauterine devices or carriers as local delivery systems for specific contraceptive agents appears to be established: the technique deserves further exploration.

- ¹ Zipper, J. A., Medel, M., and Prager, R., *American Journal of Obstetrics and Gynecology*, 1969, 105, 529.
- ² Zipper, J. A., *et al.*, *American Journal of Obstetrics and Gynecology*, 1969, 105, 1274.
- ³ Zipper, J. A., *et al.*, *American Journal of Obstetrics and Gynecology*, 1971, 109, 771.
- ⁴ Williams, M., and Snowden, R., *The Gravigard Device (Cu-7)*. Family Planning Research Unit, University of Exeter, Report No. 8, 1974.
- ⁵ Chang, C. C., and Tatum, H. J., *Contraception*, 1970, 1, 265.
- ⁶ Chang, C. C., Tatum, H. J., and Kincl, F. A., *Fertility and Sterility*, 1970, 21, 274.
- ⁷ Cuadros, A., and Hirsch, J. G., *Science*, 1972, 175, 175.
- ⁸ Elstein, M., and Ferrer, K., *Journal of Reproduction and Fertility*, 1973, 32, 109.
- ⁹ Oster, G. K., *Fertility and Sterility*, 1972, 23, 18.
- ¹⁰ Chandler, J. A., personal communication, 1974.
- ¹¹ Hagenfeldt, K., *Acta endocrinologica*, Suppl. 169, 1972.
- ¹² Doyle, L. L., and Clewe, T. H., *American Journal of Obstetrics and Gynecology*, 1968, 101, 564.
- ¹³ Scommegna, A., *et al.*, *Fertility and Sterility*, 1970, 21, 201.
- ¹⁴ Scommegna, A., *et al.*, *Obstetrics and Gynecology*, 1974, 43, 769.

N.H.S. Finances

As the nation begins to tighten its belt to face a fall in living standards in coming months, prudent businessmen and families are examining their budgets and looking for economies. Within the N.H.S., in contrast, all seems to be confusion. The cuts made in 1973 in Government expenditure on health have not been restored; the hospital building programme has come to a virtual halt;¹ while as a result of inflation many area health authorities have overspent their budgets to such an extent that they may run out of money completely before the end of the financial year.¹ Yet the Government seems reluctant to admit there is any crisis, and very little attention was paid to the financial plight of the N.H.S. during the election campaign.

The lack of electoral interest in the N.H.S. reflects the broad agreement on major issues among the political parties—private practice and prescription charges have a negligible effect on N.H.S. finances and generate little heat outside the health professions. There seems to be a political consensus that the N.H.S. should continue to be financed from central taxation—and that means that it will need to continue to compete for money with education, defence, and the social services.

While the politicians make reassuring noises doctors and other health service workers are in no doubt that this source of income will prove far from adequate in the immediate future. Last week the Royal Colleges and Faculties took an unprecedented step by sending a joint statement to the Government asking for a careful scrutiny of the funding of the N.H.S. (the full text is printed at p. 237). The gap between medical care provided for patients and what might be achieved in the light of modern knowledge is widening, says the statement; health service workers are finding that they are not being given the resources to allow them to make use of their training; and the combination of this frustration with low pay has seriously lowered morale.

In these circumstances an open, honest assessment of the financial possibilities is essential. Economies can be planned only when a realistic estimate of income is available. The colleges have no political axe to grind and they should be supported by the profession in their request for plain dealing by the Government. If, as seems inevitable, the N.H.S. is to face some years of financial stringency then resources will need to be rationed; and in helping to decide priorities the informed advice of those working in the Service will be vital.

¹ House of Commons Committee on Expenditure, *Fourth Report*. London, H.M.S.O., 1974. See *British Medical Journal*, 1974, 3, 697.