of reactions or the rate of administration and the risk of reactions. The experience is, however, insufficient to give a decisive answer.

The clinical observations were made on behalf of the Medical Research Council by Drs. Helen Brown, A. C. Dornhorst, G. W. Hayward, D. H. G. MacQuaide, P. L. Mollison, N. Whittaker. The observers were well aware that in the literature similar observations have been recorded on many of the points raised in the present report; they have, however, made no attempt to correlate these with their own findings. They wish to express their thanks to the staffs of hospitals in the London Sector who placed clinical material at their disposal, and to Dr. Bradford Hill for his help in the statistical analysis of the data collected.

HYPERTONIC SODIUM SULPHATE: PRACTICAL APPLICATIONS

BY

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My experience of the use of sodium sulphate as a hypertonic agent for wounds was first published in 1935.¹ In 1939, with war imminent, I appealed² for a trial of this method. In February, 1940,³ I recorded the results of this treatment alone in over 1,000 consecutive cases, with experiments and suggestions to explain its success.

It is now generally admitted that bactericidal antiseptics do more harm to the body tissues and leucocytes than they do to invading germs. The need is urgent for a ready and effective way of treating large numbers of infected wounds. I feel, therefore, that the following brief summary of the practical applications of this method may not be out of place.

Details of the Method

The Principle.—The surface of an infected wound is kept in contact with material soaked (and kept soaked) with the strongest tolerable solution of the optimal osmotic and diffusive agent available. For this purpose no other hypertonic agent hitherto used approaches sodium sulphate in efficiency; but other relatively feeble agents in use, with varying degrees of appreciation of the true nature of their reactions, are Epsom salts, common salt, Dakin's solution, urea, insulin, partially evaporated pus, saliva, and sweat.

The Solution.—To make a saturated solution of sodium sulphate (Glauber's salt) place a quantity (say 2 lb.) of the salt in a Winchester, fill up with cold reasonably sterile water, and shake. Add more water as the solution is used, so long as undissolved crystals remain. Do not dilute.

The Medium.—This may be of any material which will hold the solution—plain lint, or cotton-wool if cavities are deep and irregular. Loose particles of wool will not adhere.

The Covering.—This should consist of elastoplast wherever practicable; otherwise oiled silk or grease-proof paper and bandage will do. Clean shallow fresh wounds will heal under a bandage alone.

Method of Application: (a) *Fresh Clean Wounds, Non-penetrating.*—Do not wash with water or antiseptic. Bathe gently with the solution. Soak the material in the solution, apply to the wound, and cover completely with elastoplast. Leave the dressing twenty-four hours or longer if there is no pain, fever, or discharge. Before removing, soak the material with the solution. If no suppuration or inflammation occurs, repeat the dressing and leave for a further period; if septic, treat as below.

(b) *Penetrating, Dirty, or Already Septic Wounds.*—Remove obvious foreign bodies, but avoid disturbing exposed tissues—particles of dirt will work out later. Bathe with solution and apply dressing and elastoplast as above. Avoid unnecessary

changes of dressing, but *apply more solution at frequent intervals* (hourly if necessary) by turning back a corner of the covering, or through an elastoplast-covered window.

Never hesitate to apply this treatment, however deep the wound or minute the breach of surface. Two important accessories are, first, elevation by means of a sling for the arm and bed or a foot-rest for the leg; secondly, immobilization, using splinting or plaster when necessary.

Difficulties that Arise

Types of Injury.—In cuts requiring suture primary healing is invariable if dressing soaked in solution is applied over the stitches. If foreign bodies cannot be removed, treat as for penetrating wounds: septic inflammation may be prevented until removal later. Septic inflammation after tannic acid treatment of burns and scalds is immediately relieved, and large burns heal well under continuous application. No hesitation need be felt in using sulphonamide chemotherapy as well. Since the series published (Lyth, 1940) I have treated numerous cases with sulphonamides and with sulphapyridine along with this method without ill effect. Exception may be made in jaw injuries (see below).

Localities.—In the case of orifices and cavities (for example, nostril, external auditory meatus, axilla, interdigital hollows of hand or foot, orbits) pack with wool kept soaked with solution. The cornea tolerates the saturated solution, which can also be used in an eye bath. A simple way of covering the fingers and toes with elastoplast is to run a two-inch strip from base over tip and down to base, press the sides together, and cut off superfluous edges, making an adhesive finger-stall. For maxillo-facial injuries treat an external penetrating wound as above. Where the mouth is affected a specialist surgeon told me he is trying to arrange a form of irrigation which will avoid the swallowing of solution. I doubt whether sulphonamide drugs could be used concomitantly in jaw injuries.

Conclusion

First-aid posts and casualty clearing hospitals throughout Britain are now going into action; but it is not too late to equip them with a wound dressing far superior in results to any hitherto used, and one which is safe, easy to apply by semi-trained personnel, cheap, and ready to hand. There need be little or no suppuration of the grossly infected wounds we shall see; and débridement can be reduced to reasonable and practical limits. And once more: *No other hypertonic agent used approaches sodium sulphate in efficiency.*

REFERENCES

- ¹ Lyth, J. C. (1935). *British Medical Journal*, 2, 903.
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- ³ — (1940). *Lancet*, 1, 216.

E. L. Kendig, jun., and T. W. Kirmsl (*Arch. Pediat.*, 1940, 57, 1) state that though typhoid fever has declined both in morbidity and mortality among adults in the United States during the past few decades, the mortality among infants and children remains relatively high. Ninety-five cases of typhoid fever were treated in the wards of the Children's Medical Services of Bellevue Hospital, New York, from 1924 to 1938, during which time over 30,000 patients were admitted. Apart from an epidemic in Manhattan in 1924-5 only sporadic cases were admitted; forty-one were girls and fifty-four boys. The ages ranged from 14 months to 12 years. The sources of infection were as follows: contact with known cases 28; swimming in water probably polluted, 10; visits to resorts 5; raw milk and oysters 2 each; ice-cream sticks and water supply 1 case each; other foods 3; source undetermined 43. There were 7 deaths, which were due to gastro-intestinal haemorrhage in 4, and pneumonia, myocarditis, and meningitis 1 case each.