J. Pharm. Pharmacol. 1992, 44: 279–280
Communicated June 7, 1991

Letter to the Editor

Attempts to improve the Pharmacopoeial water-holding capacity test for absorbent dressings

T. J. BETTS, *School of Pharmacy, Curtin University of Technology, Kent Street, Bentley, Western Australia 6102*

We made comment previously (Betts et al 1988) that the "water-holding capacity" test of the British Pharmacopoeia (Appendix XX L2) for unwoven absorbent dressings which is conducted in a wire basket "probably does not reflect the ability of a dressing to absorb exudate". This is partly because the test is conducted on dressings that are not compressed, as they would be in use. A compression test was first applied about forty years ago (Savage et al 1952) weighing water retained by a wetted dressing against the pressure of an inflated balloon. The 1988 Pharmacopoeia includes the first official test on a wetted dressing under pressure (Appendix XX T), but only for Perforated Film Absorbent Dressings, applying a weight over 100 cm^2 for 30 s before determining the "water-retention capacity".

This author finds the current wire basket test procedure unsatisfactory. The 30 s drainage time specified from the horizontal basket is too short, as about 4 g more water is ready to leave the wet dressing if the basket is turned. This is confirmed by the puddle of water appearing in the tared beaker during the final weighing. The pass values in the British Pharmacopoeia for water held are thus inflated due to inadequate drainage of unwoven Absorbent Cotton ("not less than 23·0 g g^{-1}") or of Absorbent Cotton and Viscose Wadding ("not less than 20·0 g g^{-1}"). The latter is commonly available in Australia as "Cotton Wool—cotton and cellulose fibre blend" containing some viscose. With a more complete drainage procedure, these values have to be reduced. An alternative is to find a different container, preferably one which applies some compression to the dressing, and which does not yield slow drainage. A length of wide plastic tubing which sinks in water was selected, being strong but flexible, and easy to clean and dry between tests. The basket retains threads at its wire junctions and tends to buckle and come apart with repeated use. In plastic tubing, the wet dressing drains readily, and water droplets on the outside of the plastic can readily be flicked off. After experimenting with various lengths of tubing up to 7 cm, and various weights of dressing, the test conditions given in the method were selected as giving reliable results, with some discrimination. The water-holding values in plastic tubing were compared for three dressings with their values by the official basket test procedure, and the basket test with extra drainage. This lattermost involved standing the basket with wetted dressing in a vertical position for two min, then gently agitating it up and down until drops of water ceased to fall freely.

Materials and methods

PVC general purpose tubing (PURP 15110-20 mm) and a 50 mL Erlenmeyer wide-necked (34 mm) conical flask (DIN 12385) (Duran, Schott & Gen, Mainz, Germany) were used.

Method. Weigh accurately a 4 cm length of transparent PVC plastic tubing (o.d. 23 mm, i.d. 19 mm, weight about 7·3 g). Pack exactly 0·850 g unwoven absorbent dressing for test into this tubing so that the ends are flush. Hold the packed tubing vertically and drop it lightly onto the surface of water at 20°C (so that the lower end is wetted) to a depth of 6 cm, contained in a conical flask with a neck which can support the tubing almost vertically without holding it. Measure the time taken by the packed tubing to sink below the surface of the water. It should be not more than 25 s. Remove the packed tubing from the water with forceps without squeezing it and allow its wet contents to drain vertically for about 10 s whilst carefully removing water droplets from the outside of the plastic tubing. Place the drained tubing in a tared dish and weigh to the nearest 10 mg. Repeat the procedure on two further samples and calculate the average values of sinking time and water-holding capacity as an evaluation of the absorbency of the test dressing. Fig. 1 shows the method.

Results and discussion

Results are presented in Table 1.

Dressing F clearly fails the Pharmacopoeial sinking time requirement, although it just complies on average with the water-holding standard. One of the three determinations is below the required value, as it is with dressing C.

From Table 1, the tubing method yields sets of results with less spread than the basket test. However, the different average values are closer together than with the basket, and the two cotton and viscose dressings are transposed in sequence of water-holding capacity, presumably the effect of testing under constriction. For all its faults, the basket technique may discriminate between dressings more reliably than the tubing. The results suggest that with more complete drainage, pure Absorbent Cotton can only be expected to hold not less than 18 g g^{-1} water, and Absorbent Cotton and Viscose Wadding not less than 16 g g^{-1}. Due to the compression of the dressing, the

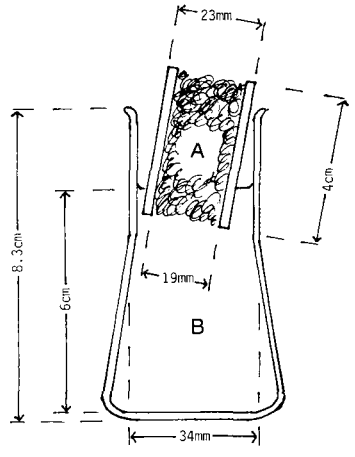

FIG. 1. Diagram to show the apparatus. A. 0·850 g absorbent unwoven dressing packed into plastic tubing. B. Water to 6 cm depth.

Table 1. Water-holding capacity (g^{-1}) of unwoven absorbent dressing. Measurements in triplicate, with lowest, mean and highest shown.

	Dressing		
	C (pure cotton)	F (cotton & viscose)	J (cotton & viscose)
Wire basket with BP drainage method	22·70, 23·97, 24·96	19·63, 20·42, 21·23	20·75, 21·42, 22·12
—average sinking time (s)	4	42	3
Wire basket with more complete drainage	18·52, 19·57, 20·44	16·85, 17·07, 17·43	16·75, 17·30, 17·86
Plastic tubing method	13·19, 13·35, 13·52	12·69, 12·81, 12·89	12·32, 12·42, 12·52
—average sinking time (s)	12	34	9

BP = British Pharmacopoeia 1988.

requirements in plastic tubing go down to 13 and 12 g g^{-1}, respectively. Even a poor dressing, defined as such by excessive sinking time (British Pharmacopoeia Appendix XX L1), can hold a considerable amount of water, and only $\pm 10\%$ of the required weight will be involved in any discrimination. In fact the sinking times both in basket or tubing clearly reveal dressing F as inferior. A good dressing sinks in the basket in less than half the British Pharmacopoeia requirement of "not more than ten seconds". In the tubing, not more than 25 s can be expected. F failed our picric acid evaluation procedure (Betts et al 1988), as well as these sinking requirements. However, it holds about the same amount of water as J, under different tests here.

Although dressings C and J normally comply with Pharmacopoeial requirements, on a wet, humid day they both failed the water-holding basket test. With 5 g dressing involved, variation due to atmospheric change is detectable. This was not observed with the plastic tubing test, which involves less than a gram of dressing.

It is suggested that the water-holding capacity of official unwoven dressings should be evaluated by both a plastic tubing method, and a basket method modified to allow more complete drainage than at present. Values obtained need to be related to various dressings classified as good or bad. The actual significance of water-holding needs consideration.

The optimum plastic tube length and weight of dressing tested were recommended by Renea McDonagh and Elizabeth Rust in work with picric acid evaluation. Using their method Elizabeth Rust failed dressing F.

References

Betts, T. J., Czarniak, P. A., Filippin, P. (1988) New method for testing the absorbency of surgical dressings. J. Pharm. Pharmacol. 40: 664–665

British Pharmacopoeia (1988) Vol II, Her Majesty's Stationery Office, London, pp 1095, 1097, A226, A228

Savage, R. M., Bryce, D. M., Elliott, J. R. (1952) The water retention coefficient of surgical dressings. J. Pharm. Pharmacol. 4: 944 958

J. Pharm. Pharmacol. 1992, 44: 280–281
Communicated September 12, 1991

Letter to the Editor

Interaction of arteether with the red blood cell in-vitro and its possible importance in the interpretation of plasma concentrations in-vivo

*† GEOFFREY EDWARDS, * STEPHEN WARD, * ALASDAIR BRECKENRIDGE, **Department of Pharmacology and Therapeutics, University of Liverpool, Liverpool L69 3BX, †Department of Parasitology, Liverpool School of Tropical Medicine, Liverpool L3 5QA, UK*

Blood or plasma level monitoring of drugs is routinely used, often without proper consideration as to its meaning, to assess compliance with, or in the design of, therapeutic dosage regimens. Recently, this apparently more rational approach has been directed at the treatment of malaria (Panisko & Keystone 1990). Among the more promising new antimalarials is qinghaosu or artemisinin, the antimalarial principle isolated from the wormwood *Artemisia annua* L., and its derivatives arteether and artemether, which are respectively ethyl and methyl ethers of dihydroartemisinin, a reduction product of artemisinin with greater antimalarial activity than qinghaosu itself (Klayman 1985). Artemether has been widely studied in the Peoples Republic of China, and in 1987 was registered in that country as an antimalarial (World Health Organization 1990). Arteether has been selected for development by the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (Brossi et al 1988). Aside from the Chinese literature, there is little information on the clinical pharmacology of artemether and the human pharmacokinetics of arteether are unknown. The availability of novel analytical methodology (Idowu et al 1989; Melendez et al 1991) has prompted research in this area by western scientists but data available thus far are restricted to observations in plasma, whereas the concentrations within blood or the erythrocyte may be equally important. While attempting to adapt the analytical method of Idowu et al (1989) for use in the determination of arteether in whole blood, it became apparent that there were significant losses of this analyte when whole blood to which arteether had been added was stored at either room temperature (21°C) or 4°C or particularly after storage at −20°C, despite attempts to minimize adsorption to glassware. We hypothesized that these observations might be a result of drug decomposition or sequestration of arteether with the blood, particularly the

Correspondence: G. Edwards, Department of Pharmacology and Therapeutics, New Medical Building, The University of Liverpool, Liverpool L69 3BX, UK.