Individual Study

METRIC PRESCRIBING SIMPLIFIED

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All general practitioners should now ask themselves, am I prepared for metric prescribing?

You may have been taught, and brought up to use the Imperial System (Apothecaries and Avoirdupois), but the day may not be far distant when the Apothecaries system will have passed into history, and you will be required to use metric units only. Already a number of London's teaching hospitals have changed entirely to the metric system, and provincial hospitals are following suit. Why not try now, therefore, and learn to think in both languages, and to convert from one to the other. It is not difficult. To-day, it is necessary to convert in order to utilize the present weights, measures, and bottles. When metric equipment is freely available, and the prescriber is more accustomed to metric thinking, the mathematics of prescribing and dispensing will be found to be much simpler in every way.

The change-over can be made in three easy stages:—

(1) Study of the conversion tables.
(2) Use of metric system for solids.
(3) Use for liquids.

The Conversion Tables

A preliminary study of the conversion tables is essential, for apparent anomalies can be difficult to understand. These tables are printed in the B.P. 1958, B.P.C. 1954, B.N.F. 1957, Martindale's *Extra Pharmacopia*, and manufacturing-chemists' diaries ; the latter also are beginning to supply tables as a medium for advertising.

Accurate metric equivalents of apothecaries doses are sometimes unrealistic and not very practical. For this reason there are two types of conversion tables:—

(*a*) Tables of approximate equivalents of doses in the Imperial/Metric systems.
(*b*) Tables of accurate equivalents of basic quantities.

(a) The tables of approximate equivalents of doses in the Imperial/Metric systems are intended to give some idea of the relationship between the two systems, and are to be used by the prescriber in translating doses from one system to the other. Because exact equivalents are sometimes unrealistic, these figures are especially chosen for ease of memory and simplicity, and in view of the small quantities of substances used in medical therapy and pharmacy.

For example " grains 1½ " is exactly equivalent to " 97.6 mg.", which is unsatisfactory for everyday use: and so 100 mg. has been chosen for its equivalent as a more practical unit. Likewise " grains 1 " is more conveniently represented by " 60 mg." instead of 64.8 mg. Most but not all of the fractions of gr. 1 are based on this approximation. The approximate figures are not necessarily accurate enough for dispensing purposes, simply because multiplication might raise the error to a significant degree.

(b) Accurate equivalents must be used when ordering total quantities of drugs, such as in a mixture, or for dispensing. Again these metric figures may appear unrealistic, and adjustment to a near whole number may be desirable for the sake of simplicity. Table I is an example of this.

TABLE I

ELIXIR CHLORAL P.I. B.N.F. IN IMPERIAL AND METRIC UNITS

Item	*Apothecaries prescription —one dose*	*Metric prescription —one dose*	*Accurate metric conversion —16 doses**	*Alternate metric prescription*
Chloral hyd. ..	gr. 1	60.00 mg.	1.036 g.	1 g.
Water	m. 1	0.06 ml.	0.944 ml.	1 ml.
Syrup of black currant	m. 10	0.60 ml.	9.400 ml.	10 ml.
Syrup	to m. 60	to 4.00 ml.	to 56.640 ml.	to 56 ml.

*60 m. is accurately equivalent to 3.54 ml.

Have available at all times a copy of the tables of approximate equivalents of doses in the Imperial/Metric systems from the current B.P. 1958, and note also the basic accurate equivalents. The range of the different tables must cover normal prescribing habits in practice. Remember it is dosage with which you are particularly concerned. Reprints of these tables may be obtained from College headquarters.

Use of the Metric System for Solids

The tables of approximate equivalents of doses for solids should convert grains to grammes and milligrammes.

Although the B.P. uses g. weight for quantities of 0.1 g. and over, I have found that in speech and writing, metric quantities of 0.5 g. and above are best ordered in grammes (g.), and quantities

TABLE II

APPROXIMATE EQUIVALENTS OF DOSES BY WEIGHT IN THE IMPERIAL/METRIC SYSTEMS

Grains	*Grammes*
150	10.0
120	8.0
90	6.0
75	5.0
60	4.0
45	3.0
30	2.0
25	1.6
20	1.2
15	1.0
12	0.8
10	0.6
8	0.5
Grains	*Milligrammes*
6	400
5	300
4	250
3	200
2½	150
2	120
1½	100

Grains	*Milligrammes*
1	60
3/4	50
3/5	40
1/2	30
1/3	20
1/4	15
1/5	12
1/6	10
1/8	8
1/10	6
1/20	3
1/30	2
1/50	1.2
1/60	1.0
1/100	0.6
1/120	0.5
1/200	0.3
1/240	0.25
1/320	0.2
1/500	0.12
1/600	0.1

less than 0.5 g. in milligrammes (mg.). The range of the tables for grains to milligrammes should be, therefore, from gr. 6 being equivalent to 400 mg. down to gr. 1/600, being equivalent to 0.1 mg. Custom has not yet decided at what level micrograms shall be used, but probably doses of or less than 0.1 mg. will be ordered as 100 micrograms (mcg.) and less.

A start in metric prescribing may be made by giving all tablet strengths in metric terms. One soon becomes accustomed to writing Tab. Butobarb. 100 mg., or Tab. Phenobarb. 15 mg. Be

careful that the smaller quantities are correct, such as 0.3 mg. for gr. 1/200, and do not forget the zero to be used in front of the decimal point when quoting quantities less than One, e.g., 0.5 g.

The next step is to order ointments and creams in convenient metric quantities—e.g., 5 g., 10 g., or 50 g., or any other simple number as required, preferably a multiple of 10. Manufacturing chemists are already dispensing these quantities, and mental pictures of differing requirements soon develop. It is much easier to think in percentages when dealing with pure metric terms, and the chemist prefers it. Do not let the container problem worry you, the chemist will deal easily with this, and patients do not worry unduly if a carton is not filled.

Use of the Metric System for Liquids

Tables of approximate equivalent doses for liquids must convert minims to millilitres.

TABLE III

APPROXIMATE EQUIVALENTS OF DOSES BY FLUID MEASURE IN THE IMPERIAL/METRIC SYSTEMS

Minims	*Millilitres*	*Minims*	*Millilitres*
150	10.0	12	0.80
120	8.0	10	0.60
90	6.0	8	0.50
75	5.0	6	0.40
60	4.0	5	0.30
45	3.0	4	0.25
40	2.6	3	0.20
30	2.0	2½	0.15
25	1.6	2	0.12
20	1.3	1½	0.10
15	1.0	1	0.05

For dosage of mixtures, one fluid dram is equivalent to 4 ml., interpreted by the pharmaceutical chemist as one teaspoonful; 2 fl. drams to 8 ml., interpreted as 2 teaspoonsful or 1 dessertspoonful; and ½ fl. oz. to 15 ml. interpreted as one tablespoonful. These figures are only approximate but they have been chosen for simplicity

and ease of arithmetic. They bear no relationship to the British Standard teaspoon or tablespoon for medicine, which have not yet been standardized in metric units. Manufacturing chemists who make mixtures up to a 5 ml. dose usually provide a plastic teaspoon to be used, but this, too, is only approximate.

Simple metric quantities are easy to order and dispense: for example Linctus Scillae co. B.N.F. 100 ml., or Lin. Alba B.N.F. 200 ml. The Blood Transfusion Service for many years has supplied 400 ml. of sterile distilled water in a 16 fl. oz. bottle for reconstituting plasma. These simple metric quantities do not, however, fill present dispensing bottles; this should be explained to patients who may be sensitive about it. The metric quantities quoted in table IV can be ordered when a full bottle is required. They are accurate equivalents for practical purposes, although very slight variations may occasionally be required in order to prescribe multiples of a dose for mixtures. For example, 224 ml. are ordered for an 8 ml. dose, but 225 ml. for a 15 ml. dose. It can, however, be argued that these are unrealistic metric quantities—yet while this may well be true, remember that this is the transition phase of a change-over. The dispensing chemist is content to use these figures, knowing that his present bottles are a measure of these capacities. Indeed the pharmacy of one London hospital has calibrated its bottles, knowing the metric quantities necessary to fill up to the base of the shoulder, shoulder, and neck. Until pure metric capacity bottles are freely available, these figures are satisfactory and easy to remember in every day use.

TABLE IV

ACCURATE METRIC EQUIVALENTS OF IMPERIAL CAPACITY BOTTLES

Imperial capacity	*Metric capacity*	*Imperial capacity*	*Metric capacity*
2 fl. dr.	8 ml.	6 fl. oz.	168 ml.
½ fl. oz.	15 ml.	8 fl. oz.	225 ml.
1 fl. oz.	28 ml.	10 fl. oz.	285 ml.
2 fl. oz.	56 ml.	12 fl. oz.	330 ml.
3 fl. oz.	84 ml.	16 fl. oz.	450 ml.
4 fl. oz.	112 ml.	20 fl. oz.	540 ml.

The most difficult aspect of metric prescribing concerns mixtures because prescribing habits vary, and because accurate metric equivalents can be impractical.

Mixtures are ordered in one of three ways:—

(1) By prescription of a dose, with an order for a number of doses.

(2) By prescription of a dose, with an order for a quantity of medicine, leaving the chemist to calculate the number of doses.

(3) By prescription of total quantities of items in a quantity of medicine, and quoting the dose to be taken.

(1) *By prescription of a dose, with an order for a number of doses.* This technique is a practical method of prescribing because it facilitates dispensing, and the patient receives a full bottle of medicine. The prescription is ordered in metric dosage equivalent to the apothecaries doses, or in abbreviated form if from a standard formulary. The number of doses is then stated. An example is " Mist. Ammon. et Ipec. B.N.F. 15 ml. Mitte tales 20 ". The following table shows how the number of doses can be interpreted by the chemist to permit him to utilize an imperial bottle.

TABLE V

METRIC DOSAGE TABLE FOR USE WITH IMPERIAL DISPENSING BOTTLES

Capacity bottle	*Doses* × 4 *ml.*	*Doses* × 8 *ml.*	*Doses* × 15 *ml.*
½ fl. oz.	4	2	1
1 fl. oz.	8	4	2
2 fl. oz.	16	8	4
3 fl. oz.	24	12	6
4 fl. oz.	32	16	8
6 fl. oz.	48	24	12
8 fl. oz.	64	32	16
10 fl. oz.	80	40	20
12 fl. oz.	96	48	24
16 fl. oz.	128	64	32
20 fl. oz.	160	80	40

Thus " Mist Ammon. et Ipec. B.N.F. 15 ml. Mitte tales 20 " can be interpreted as 20½ fl. oz., and a full 10 fl. oz. bottle supplied.

(2) *By prescription of a dose, with an order for a quantity of mixture.* This technique introduces a metric quantity, but the chemist can interpret the prescription according to his art. The dose is ordered as above, but a metric quantity of mixture—a multiple of the dose—is ordered.

Thus " Mist. Ammon. et Ipec. B.N.F. Mitte. 300 ml." gives 20 pure metric doses. The pharmacist can dispense 300 ml. in an incompletely filled 12 fl. oz. bottle. Alternatively by interpreting 20 doses as 20 ½ fl. oz. he can dispense in a 10 fl. oz. bottle to his and the patients satisfaction. With this technique, it is fitting that simple quantities should be ordered, if only to facilitate dispensing: thus 300 ml. is an excellent unit of treatment for an adult for one week, and two or more units of treatment can be ordered as necessary. But as bottles of metric capacity are not yet available in this country, the dispensing bottles will not be filled. If a full bottle of medicine is required, the quantities stated in table IV can be ordered. It will be noted that the metric capacity of the smaller bottle sizes (except 15 ml.) are multiples of 4 ml., but not necessarily of 8 ml,, and the capacity of the larger bottle sizes are multiples of 15 ml. It should be remembered that with this technique, unless the prescription is quoted from a standard formulary, the quantity of mixture ordered must be a multiple of the dose, or the chemist will be embarrassed in his dispensing.

(3) *By prescription of total quantities of items in a quantity of medicine.* With the introduction of standard formularies, this technique is probably less favoured than formerly, but, it is still used occasionally. Accurate conversion may be required, but if the quantity is unrealistic, adjusting to a whole number will ease dispensing and probably not alter the dose significantly. The example

TABLE VI

MEDICINE DOSAGE TABLE FOR CHILDREN BASED ON AGE AND WEIGHT

Age (years)	*Average weight Kg. (lbs.)*	*Dose and frequency (ml.)*	*Total daily dose (ml.)*	*Quantity to order (ml.)*
1	10 (22)	4 ml. t.d.s.	12	50 or 56
2		4 ml. q.q.h.	16	80 or 84
3	15	4 ml. qqh tert.	20	100
4		8 ml. t.d.s.	24	160 or 168
5	20 (44)	8 ml. t.d.s.	24	160 or 168
6		8 ml. q.q.h.	32	200
7	25	8 ml. q.q.h.	32	200
8		12 ml. t.d.s.	36	200
9	30 (66)	12 ml. t.d.s.	36	200

quoted in table I shows how total metric quantities can be used in a prescription, after rounding off.

Children's Mixtures

For children, the following technique is used.

The B.N.F. bases its dose of mixtures for infants on a 1 fl. dram dose (4 ml.) for a child of one year of age, and the prescriber is left to work out for himself a suitable dose for older children based on weight and age. The following table is used when ordering mixtures-for-infants of the B.N.F., other than sulphonamides.

Conclusion

With the introduction of these new techniques, it is obvious that personal prescribing habits may need reviewing and, if necessary, critical examination. The pharmacist must be left in no doubt what he is to supply; yet he can be permitted to interpret the prescription according to his art. To this end clear and legible prescribing will be a mutual help and encourage understanding.

Anaphylactic Reaction following Intramuscular Injection of B. complex

The following case history is submitted by Dr Kwong-Chin Poon of Hong-Kong:—

An old woman, aged 58, has been having chronic bronchitis since September, 1955. Whenever she had an attack of acute exacerbation, she was put on streptomycin combined with penicillin. These antibiotics usually control the infection. In 1957, she had acute contact dermatitis on left side of chest wall after applying some herbs topically. In December 1957, she had sore tongue, chelosis and anorexia. One ml. vitamin B complex plus 50 mgm. thiamin was given intramuscularly every two days. The composition of the vitamin B complex solution is vitamin B 20 mgm., vitamin B_2 2.5 mgm., vitamin B_6 2.5 mgm., nicotinamides 75 mgm., sodium pantothenate 7.5 mgm., re-distilled water to 1 ml.

On the fourth visit, she felt unusually warm after intramuscular injection and while she was walking out the office she started to vomit. Her face became red, and her eyes were congested. She told me that she had severe abdomen pain and her tongue became numb. Soon the face turned pale. 0.75 ml. of adrenalin was given immediately. The patient complained of blurred vision and wanted to defecate, then suddenly she had generalized convulsion, and bowel and urine incontinuence. She was unconscious after the convulsion. 0.25 gm. Aminiphylline was given intravenously and she recovered during injection.