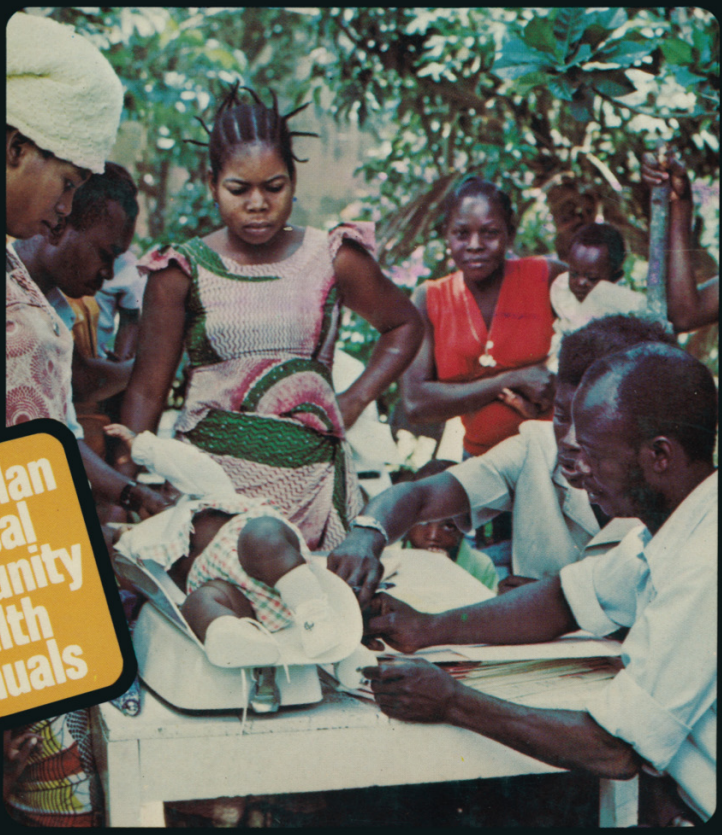
A Handbook of Tropical Paediatrics

G. J. Ebrahim



Macmillan Tropical Community Health Manuals

A HANDBOOK OF TROPICAL PAEDIATRICS

Macmillan Tropical Community Health Manuals
General Editor: Dr J. Grant, London School of Hygiene and Tropical Medicine

This series has been set up specifically to meet the needs of trainee and practising medical personnel in the tropical and sub-tropical developing countries. Some of the books will appeal to others involved in Community work—e.g. school teachers, public health inspectors, environmental health officers, and even literate parents. Early on there will be heavy concentration on aspects of care offering best prospects for improved standards of preventative treatment and therefore health in the community. Inevitably there will be strong emphasis on infant, child and mother care, as infants and children account for up to half the total population in some tropical developing countries, and more than half of the presentations for treatment.

Most titles will be short practical books written for trainee and practising doctors, nurses, auxiliaries, medical officers and assistants and other grades of health-care personnel engaged in frontline health-care delivery, often in small rural centres and sub-centres.

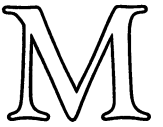
Other titles by G. J. Ebrahim in the Macmillan Tropical Community Health Manuals Series

Breast Feeding: the Biological Option	cased ISBN 978-0-333-23802-8 paper ISBN 978-0-333-23803-5
Child Care in the Tropics	cased ISBN 978-0-333-24038-0 paper ISBN 978-0-333-25361-8
Practical Mother and Child Health in Developing Countries	cased ISBN 978-0-333-24111-0 paper ISBN 978-0-333-25363-2
Care of the Newborn in Developing Countries	cased ISBN 978-0-333-24112-7 paper ISBN 978-0-333-25362-5

The paperback edition of *A Handbook of Tropical Paediatrics* is published at a specially low price as a result of a subsidy provided by the Catholic Fund for Overseas Development.

A HANDBOOK OF TROPICAL PAEDIATRICS

G. J. EBRAHIM



Published with the support of the
Catholic Fund for Overseas Development

Softcover reprint of the hardcover 1st edition 1978

First published 1978 by
THE MACMILLAN PRESS LTD
London and Basingstoke
Associated companies in Delhi Dublin
Hong Kong Johannesburg Lagos Melbourne
New York Singapore and Tokyo

British Library Cataloguing in Publication Data

Ebrahim, G J
Handbook of tropical paediatrics – Revised ed.
– (Macmillan tropical community health manuals).
1. Pediatrics 2. Tropical medicine
I. Title
618.9'2'000913 RJ47

ISBN 978-0-333-25364-9 ISBN 978-1-349-15949-9 (eBook)
DOI 10.1007/978-1-349-15949-9

Contents

To:
The Residents and Nursing Staff,
Paediatric Department,
Muhimbili Hospital.

Preface

The HANDBOOK OF TROPICAL PAEDIATRICS evolved out of the various regimens of treatment developed in the paediatric wards of the Muhimbili Hospital, Dar-es-Salaam. It was observed that in common with similar busy paediatric departments the quality of care tended to be better for day-time admissions as compared to children admitted at night or during week-ends. It became necessary to establish common standards of care for the guidance of interns and junior staff. These standards were further modified and simplified with experience. Facilities for investigation and treatment are naturally better in teaching hospitals as compared to regional and district hospitals and health centres. The various regimens were then further tried in these health institutions and modified in the light of the comments received.

In more recent years several Fellows of the UNICEF/WHO-sponsored Course for Senior Teachers of Child Health have used the above regimens in different centres in the developing world. Based on their comments the regimens have been revised and re-written and several improvements have been made.

A HANDBOOK OF TROPICAL PAEDIATRICS is one of a set of four manuals which together comprise the Health Centre Set. Each manual is intended for a specific member of the health team. The Handbook is meant for the "doctor" in the health team. It is hoped that the manuals of the Health Centre Set will help to raise the standards of teaching and care of children in the rural areas of the developing world.

Acknowledgements

The section on nutrition is based on the work of Dr Leslie Burgess, WHO inter-country consultant in nutrition, and Mrs Ann Burgess.

Chapter 1

Growth

Assessment of growth

The assessment of growth in the individual child is best done by measurements at regular intervals, intelligent clinical observations and examination. Tables and charts help to compare the individual with a group of average healthy subjects of the same age. In their use, it is important to remember that there is a wide variation of the 'normal' and therefore serial measurements over a period of time are more valuable than one isolated examination.

Percentile weight and height tables and charts are commonly used instead of the average or mean values. Such charts take into account the very wide spectrum of 'normal'. Some children may be small or large from a very early age and maintain an individual pattern of growth; their growth curves may be above or below the average but parallel to it indicating that increments in height and weight are comparable with

TABLE 1 Weight for age

Age in months	*Standard*		*80%*		*60%*	
	lb–oz	Kilos	lb–oz	Kilos	lb–oz	Kilos
0	7– 8	3.4	5–14	2.7	4– 6	2.0
3	12– 8	5.7	9–14	4.5	7– 8	3.4
6	16– 5	7.4	13– 0	5.9	9–14	4.5
9	19– 9	8.9	15– 9	7.1	11–11	5.3
12	21–12	9.9	17– 6	7.9	13– 3	6.0
15	23– 5	10.6	18–11	8.5	14– 1	6.4
18	24–14	11.3	19–13	9.0	14–15	6.8
24	27– 5	12.4	21–12	9.9	16– 8	7.5
30	29–11	13.5	23–12	10.8	17–13	8.1
36	31–14	14.5	25– 8	11.6	19– 2	8.7
42	34– 2	15.5	27– 5	12.4	20– 8	9.3
48	36– 5	16.5	29– 0	13.2	21–12	9.9
54	38– 4	17.4	30–13	14.0	23– 2	10.5
60	40– 8	18.4	32– 5	14.7	24– 3	11.0

Source: H. C. Suart and S. Stevenson (Harvard, 1959)

TABLE 2 Length for age

Age in months	Length in cms
0– 5	58.0
6–11	69.8
12–17	77.5
18–23	83.8
24–29	89.2
30–35	93.7
36–47	99.4
48–59	106.5
60–71	113.4

those of normal children. Those who have been tall as children will grow into tall adults if growth proceeds normally; similarly, those who have been small as children may grow into short statured adults.

Percentile charts for African children are still in the process of being computed; those based on Harvard Standards may be found in any large textbook of paediatrics. Table 1 is an example of one such weight chart used in the children's clinics in East Africa.

In addition to height and weight, other methods of measuring growth include skin–fold thickness (for subcutaneous fat), muscle mass in the upper arm, and the ratio of head and chest circumferences. These methods are useful for community assessment of growth and nutrition and are occasionally used in clinical paediatric practice.

TABLE 3 Skin–fold thickness and mid-arm circumference

Age in months	*Mid-arm circumference (cm)*	*Triceps [skin–fold] (mm)*	*Mid-arm muscle circumference (cm)*
0– 5	13.0	8.0	10.5
6–11	15.2	10.0	12.1
12–17	16.0	10.6	12.6
18–23	16.1	10.5	12.8
24–29	16.3	10.0	13.1
30–35	16.4	9.7	13.3
36–47	16.7	9.3	13.8
48–59	17.0	8.9	14.2
60–71	17.1	8.6	14.4

Muscle circumference is calculated using the formula

$$C = c - \pi s.$$

(where C = Muscle circumference (cm)
c = mid-arm circumference (cm)
s = skin–fold thickness (convert to cm))

TABLE 4 Head and chest circumference

Age (months)	*Head (cm)*	*Chest (cm)*
birth	35	35
3	40.4	40
6	43.4	44
12	46.5	47
18	48.4	48
24	49.0	50
36	50.0	52
48	50.5	53
60	50.8	55

For intelligent use of the tables above, the exact age of the child should be known; in practice very few of the rural mothers remember the birth dates or the ages of their children. Some assessment of age can be made by reference to a calendar of local or national events or examining the stage of dentition.

For rapid assessment of growth in nutrition surveys of the community, estimation of chronological age by examining dentition or by reference to a calendar of events may be time-consuming and often not satisfactory. To overcome such a difficulty use may be made of tables showing relationship of height and weight.

TABLE 5 Average eruption time of deciduous teeth

Tooth	*Lower jaw*	*Upper jaw*
Central incisors*	6 months	$7\frac{1}{2}$ months
Lateral incisors	7 months	9 months
Cuspid	16 months	18 months
First molar*	12 months	14 months
Second molar*	20 months	24 months

* Incisors – range ± 2 months
* Molars – range ± 4 months

Changes in body proportions

Upper measurement – crown to upper border of symphysis pubis.
Lower measurement – upper border of symphysis to floor.
Span – finger tip to finger tip, the child facing a wall with arms fully stretched along it.
Sitting height – Patient sits on floor with back firmly against the wall and legs fully extended along the floor. (See table 7.)

TABLE 6 Weights for lengths—percentage of Harvard standards

Length (cm)	*Weights (kg)*				
	Percentage of mean				
	100	90	80	70	60
	—	—	—	—	—
52	3.8	3.4	3.0	2.7	2.3
53	4.05	3.65	3.2	2.85	2.45
54	4.3	3.9	3.4	3.0	2.6
55	4.55	4.1	3.6	3.2	2.75
56	4.8	4.3	3.8	3.4	2.9
57	5.0	4.5	4.0	3.5	3.0
58	5.2	4.7	4.2	3.6	3.1
59	5.35	4.9	4.4	3.8	3.25
60	5.7	5.1	4.6	4.0	3.4
61	6.0	5.4	4.8	4.2	3.6
62	6.3	5.7	5.0	4.4	3.8
63	6.6	5.95	5.25	4.6	3.95
64	6.9	6.2	5.5	4.8	4.1
65	7.2	6.5	5.75	5.05	4.3
66	7.5	6.8	6.0	5.3	4.5
67	7.8	7.05	6.25	5.5	4.7
68	8.1	7.3	6.5	5.7	4.9
69	8.4	7.55	6.75	5.9	5.05
70	8.7	7.8	7.0	6.1	5.2
71	8.93	8.05	7.2	6.25	5.35
72	9.2	8.3	7.4	6.4	5.5
73	9.45	8.5	7.6	6.6	5.65
74	9.7	8.7	7.8	6.8	5.8
75	9.95	8.95	8.0	6.95	5.95
76	10.2	9.2	8.2	7.1	6.1
77	10.4	9.35	8.35	7.25	6.25
78	10.6	9.5	8.5	7.4	6.4
79	10.8	9.7	8.65	7.55	6.5
80	11.0	9.9	8.8	7.7	6.6
81	11.2	10.1	8.95	7.85	6.7
82	11.4	10.3	9.1	8.0	6.8
83	11.6	10.45	9.25	8.15	6.95
84	11.8	10.6	9.4	8.3	7.1
85	12.0	10.8	9.6	8.4	7.2
86	12.2	11.0	9.8	8.5	7.3
87	12.4	11.15	9.95	8.65	7.35
88	12.6	11.3	10.1	8.8	7.6
89	12.85	11.55	10.3	9.0	7.75
90	13.1	11.8	10.5	9.2	7.9
91	13.35	12.0	10.7	9.35	8.05
92	13.6	12.2	10.9	9.5	8.2
93	13.8	12.4	11.05	9.65	8.3
94	14.0	12.6	11.2	9.8	8.4

TABLE 6 (*continued*) Weights for lengths—percentage of Harvard standards

Length (cm)	*Weights (kg)*				
	Percentage of mean				
95	14.25	12.85	11.4	10.0	8.55
96	14.5	13.1	11.6	10.2	8.7
97	14.75	13.3	11.8	10.35	8.85
98	15.0	13.5	12.0	10.5	9.0
99	15.3	13.75	12.25	10.7	9.2
100	15.6	14.0	12.5	10.9	9.4
101	15.85	14.25	12.7	11.1	9.55
102	16.1	14.5	12.9	11.3	9.7
103	16.4	14.75	13.15	11.5	9.85
104	16.7	15.0	13.4	11.7	10.0
105	17.0	15.3	13.6	11.9	10.2
106	17.3	15.6	13.8	12.1	10.4
107	17.35	15.9	14.1	12.35	10.6
108	18.0	16.2	14.4	12.6	10.8

TABLE 7 Changes in body proportions

Age	*Males*		*Females*	
	Span x 100	*Upper Measurement x 100*	*Span x 100*	*Upper Measurement x 100*
	Standing Height	Lower Measurement	Standing Height	Lower Measurement
Birth	95.7	169	95.2	173
6 months	95.8	161	95.3	160
1 year	96.0	154	95.5	152
2 years	96.3	144	95.8	142
3 years	96.6	133	96.2	132
4 years	97.0	127	96.6	125
5 years	97.4	121	97.0	119
6 years	97.8	114	97.4	113
7 years	98.4	110	97.8	109
8 years	99.1	106	98.3	105
9 years	100.0	103	98.8	102
10 years	100.7	102	99.2	101
11 years	101.2	99	99.6	100
12 years	101.6	98	100.0	99
13 years	102.0	98	100.3	99
14 years	102.3	97	100.6	99
15 years	102.6	97	100.8	100
16 years	102.8	97	101.0	100
17 years	103.0	97	101.2	100
18 years	103.2	97	101.3	101
19 years	103.4	98	101.3	101
20 years	103.5	98	101.3	101

Approach to the diagnosis of growth retardation

HISTORY

(1) Information concerning stature of *parents* and *siblings.*
(2) Precise nutrition history.
  (a) Duration of breast-feeding.
  (b) If on a milk formula, the concentrations used and frequency of feeds.
  (c) Weaning diet and age of weaning.
  (d) Food fads, eating habits, and food taboos if any.
(3) Birth weight and, if known, gestation age.
(4) *Prenatal history.* Intrauterine growth retardation occurs in toxaemia of pregnancy, pyuria in pregnancy, rubella infection in first trimester, chromosomal disorders, toxoplasmosis and cytomegalic inclusion disease.
(5) Detailed social and psychological history.

EXAMINATION

(1) Measurement of weight, height, head and chest circumference, span. Serial measurements are more informative than one single reading.
(2) Comparisons of degree of retardation in weight and height and in bone age.
(3) Clinical examination directed towards identification of those diseases which are known to interfere with growth, such as chronic lung disease, congenital cardiac defects, hypothyroidism, neurologic disease (e.g. birth injury, multiple congenital anomalies, mongolism), metabolic disease (e.g. Galactosemia).

LABORATORY INVESTIGATIONS

(1) *Urine examination*:
  (a) Pyuria.
  (b) Fixed low specific gravity.
  (c) Constant alkaline pH.
(2) *Stool*:
  (a) Presence of parasites.
  (b) Faecal fat.
(3) *If malabsorption is suspected*:
  (a) 24 hour faecal fat excretion.
  (b) D-xylose excretion test.
  (c) Sweat sodium content.
  (d) Barium meal and follow through.

(4) *In girls with short stature*:
Study of buccal mucosa for chromatin.
(5) *If endocrine disease is suspected*:
(a) X-ray skull for pituitary fossa.
(b) Insulin sensitivity test.
(c) Protein bound iodine and blood cholesterol.
(d) Water loading test.
(e) Urinary 17-ketosteroids and oxosteroids before and after A.C.T.H.

COMMON CAUSES OF SHORT STATURE

(1) *Familial and congenital dwarfism:*
(a) Hereditary short stature.
(b) *Syndromes*: Laurence-Moon-Biedl Syndrome, Pseudo-hypoparathyroidism.
(c) Chromosomal disorders: mongolism, Turner's syndrome, Trisomy–D or E.
(2) *Intrauterine growth retardation.*
(3) *Malnutrition*:
(a) Protein calorie malnutrition.
(b) Malabsorption.
(c) Regional ileitis or ulcerative colitis.
(4) *Hormonal*:
(a) Growth hormone deficiency:
Height age more retarded than skeletal age.
Growth retardation begins in 2nd-3rd year.
Insulin hypersensitivity. Hypercholesterolaemia.
Growth hormone deficiency may occur by itself or in association with failure of sexual development and late failure of other endocrine functions.
(b) Organic hypopituitarism–Craniopharyngioma, T.B., meningitis, encephalitis, reticuloses.
(c) Thyroxine deficiency.
(d) Excess corticosteroids–usually iatrogenic.
(e) Androgens and anabolic steroids.
(5) *Chronic diseases*:
Bronchiectasis.
Congenital heart defects.
Renal disease.
Hepatic disease.

Chapter 2

Motor, Mental and Social Development

At varying age periods the baby develops different motor skills and language and social functions. Consistent and marked delay in the development of psychomotor function may be an indication of cerebral palsy or diminished intellectual capacity, though it must be realised that stimulation at home, environmental factors, parental interest, etc., are important factors in the development of psychomotor skills, and that these skills are not dependent on intellectual capacity alone.

It has been the impression of many clinicians that the average African child is much more advanced developmentally, compared with his European counterpart, up to the age of 3 years. It has also been shown that the newborn African baby in the first few weeks of life shows performances comparable with the European baby of two to three times his age.

In table 8 below the average milestones of development are indicated as seen in the European baby. The defects of such a yardstick as applied in a non-European situation are obvious. These tables should best be considered as part of the neurological examination of a child rather than a measure of intellectual capacity.

TABLE 8 The average milestones of a European baby

Age	*Motor*	*Reflex*	*Special Senses*	*Adaption*	*Language*	*Social*	*Other*
1–2 weeks	Extremities in flexion. Hands clenched when awake. Raises head from prone position.	Moro reflex, Grasp reflex, Crossed extensor and stepping reflexes present. Sucking, swallowing and rooting reflexes present.	Responds to loud noises. Can follow light over an angle of 30°.	–	–	–	–
1 month	Swimming movement in prone position. Lifts head 1"–2" in prone position.	–	–	Responds to sound by stopping all activity.	–	–	–
2 months	–	–	Eyes follow person moving near crib. Head and eyes turn toward sound.	–	Coos.	Appearance of social smile.	–
3 months	Sucks fingers. Shakes rattle.	Moro reflex usually disappears. Grasp reflex gone.	Fixes on objects.	–	Coos.	–	–

TABLE 8 (*continued*)

Age	*Motor*	*Reflex*	*Special Senses*	*Adaption*	*Language*	*Social*	*Other*
4 months	Holds head. Reaches for and grasps objects.	–	–	Recognises the bottle or breast as a familiar situation.	Squeals, grunts, laughs aloud.	'Stares' at people usually with a sponta-neous smile.	–
5–6 months	Can sit alone with support. Can roll from prone to supine positions with ease. Assists in being pulled to sitting position.	–	Can visually pursue a toy which has been dropped. Co-ordination of eyes and hands.	Plays actively with rattle. Can transfer toy from one hand to another.	'Talks' to self or to toys.	Recognises strangers.	–
7–8 months	Sits alone.	–	Can perceive a toy across the room.	–	Will say 'dada' or 'mama'.	Can play simple games like 'peek-a-boo'.	–

TABLE 8 (*continued*)

Age	*Motor*	*Reflex*	*Special Senses*	*Adaption*	*Language*	*Social*	*Other*
9–10 months	Can use finger and thumb for picking objects. Stands with support; crawls.	–	–	Purposeful release develops so that objects are dropped to attract attention.	One or two sounds consistently used in connection with a person or object.	Responds to his name and also to 'no, no' used as prohibition. Waves 'bye-bye'.	–
1 year	Can walk with support. Can drink from a cup.	–	–	–	Understands simple commands. Says 2 words other than 'mama' or 'dada'.	–	–
18 months	Can walk forward and backwards.	–	–	–	Begins to name objects. Says at least five words.	Bladder and bowel control beginning. Uses spoon well for feeding.	–
2 years	Runs. Can climb stairs.	Flexor plantar reflex.	–	–	Puts words in phrases.	Toilet training complete.	Negativism. Has developed sense of personal identity.

Chapter 3

Average Biochemical Standards

TABLE 9 Biochemical standards

Standard bicarbonate	21.3	to	24.8	m.eq./l
Base excess	−4	to	+2	m.eq./l
Aldolase	3.8	to	10	units/ml
Amylase in serum	80	to	180	units
Bilirubin	0.1	to	0.8	mg/100 ml
Calcium	9	to	11.5	,,
Cholesterol	100	to	220	,,
Creatine phosphokinase	0	to	1.2	units/ml
Creatinine	0.9	to	1.5	mg/100 ml.
Electrolytes				
sodium	136	to	145	m.eq./l
potassium	4	to	5.5	,,
chloride	100	to	110	,,
CO_2 combining power	20	to	27	,,
Glucose, fasting	75	to	95	mg/100 ml
Iron	60	to	200	mcg/100 ml
Iron binding capacity	250	to	400	mcg/100 ml
Non-esterified fatty acids (N.E.F.A.)	0.45	to	0.9	m.eq./l
Phosphatase—alkaline	10	to	20	K.A. units
—acid	1	to	4	,,
Phosphorus—inorganic	3.5	to	6.0	mg/100 ml
Proteins—total	6.3	to	8.1	gm/100 ml
albumin	3.6	to	4.8	,,
globulin	2.3	to	3.7	,,
gamma-globulin	0.6	to	1.0	mg/100 ml
Protein bound iodine	3	to	7	mcg/100 ml
Thymol turbidity	0	to	4	units
Transaminase—S.G.O.T.	8	to	40	S.F. units
—S.G.P.T.	5	to	35	S.F. units
Urea	20	to	40	mg/100 ml
Uric acid	2	to	3.8	,,

TABLE 10 Enzymes in duodenal juice

Age	*Trypsin units/cc*	*Amylase units/cc*	*Lipase units/cc*
6 months	138.8	25.3	26.6
12 months	250	113	34.6
1–2 years	262	177	18
5 years	195	237	19.6

Urine

24 hr Calcium excretion:
- On a normal diet, 100–300 mg/24 hr.
- On a dietary intake of less than 200 mg/24 hrs. the urinary output is 13–18 mg/24 hrs.
- On a dietary intake of 200 mg–600 mg/24 hrs. the urinary output of calcium is 50–200 mg/24 hrs.

24 hr Chloride excretion:
- 100 m.eq./24 hrs (as chloride).
- 3.55 gm/24 hrs (as chloride).
- 5.85 gm/24 hrs (as sodium chloride).

24 hr Creatine excretion:
- At 1 month–9 mg/kg body weight.
- At 6 yrs–4 mg/kg body weight.
- At 10 yrs–2 mg/kg body weight.
- Average adult–0–50 mg in 24 hours.

24 hr Potassium excretion:
- 1.4 gm–3.5 gm in 24 hours in a normal adult.

TABLE 11 Urine

	0–5 years	6 years to puberty	Beyond puberty
17–ketosteroids (in milligrams)	0.5–3	0.5–5 (males)	8–25 (males)
		0.5–4 (fem.)	6–15 (fem.)
17–hydroxycorticosteroids	0.5–1		4–10
17–ketogenic steroids			10–20 (males)
			5–15 (fem.)

24 hour excretion of 17–ketosteroids:

Under the age of 7 years, the urinary excretion of 17–ketosteroids is very low; the assays are of value in patients with suspected hyperactivity of the gland.

Amino acids in urine

In normal adults the daily urinary output of amino acids is about 1.1 gm as free amino acids and 2.0 gm as conjugated amino acids, with a wide variation between individuals.

In babies increased amounts of glycine, alanine, threonine, serine, asparagine, glutamine, cystine, glutamic acid and proline are excreted in the urine.

Chapter 4

Biochemical Tests

Tests of Renal Function

(1) *Concentration test*
The urine concentration test gives early indication of diminished tubular efficiency. Starting after breakfast the patient is put on a dry diet for 24 hours, (i.e. nothing that can be poured is allowed). After starting the test at 8.00 a.m. the patient voids at 8.00 p.m. This urine is discarded. Thereafter, all urine passed is collected; at 8.00 a.m. the next morning, the patient voids and adds this to the urine collected overnight.

In a normal person the specific gravity of urine should be 1.025 or above. When functioning glomeruli number less than 800,000 the specific gravity becomes fixed at 1.010. In diabetes insipidus the specific gravity persists at 1.010.

During hot weather children may not be able to tolerate the test and the dry period may have to be shortened by starting at noon.

If renal function is moderately impaired, the specific gravity will be between 1024 and 1010; in severe renal damage the specific gravity will be as low as 1010.

(2) *Acidification test*
After oral ammonium chloride, 0.1 gm/kg body weight in water, urine specimens are collected and examined for pH. Normally, urine pH falls below 5.3 within three hours.

(3) *Endogenous creatine clearance test*
The endogenous creatine clearance approximates glomerular filtration rate if renal function is normal. In renal failure the endogenous creatine clearance is higher than glomerular filtration rate. Thus the test is not very sensitive.

During estimation of serum creatinine other serum chromogens are also measured; in older children and adults these are negligible but in small infants where serum-creatinine is low, non-creatinine chromogens

may be responsible for 50 per cent of the colour reaction. Hence in infants and small children the test may not be very reliable.

Test On the previous day the patient is allowed a normal diet but no tea or coffee. At bed-time the patient drinks a large quantity of 5 per cent glucose, flavoured with orange juice. On waking in the morning a large drink of 5 per cent glucose is given. No breakfast is allowed, but fruit juice, water or 5 per cent glucose is given as much as is desired.

When the patient voids in the morning the time is noted and the specimen discarded. At the next voiding, all urine passed is saved and kept in a bottle with toluene 0.5 cc–1 cc added as a preservative. Also 5 cc of blood is taken in an oxalate bottle for creatinine estimation.

All through the test, the patient should be in bed.

$$\text{Endogenous creatine clearance} = \frac{U \times V}{P}$$

U = urine creatinine in mg/100 ml.
V = volume of urine in ml/min.
P = plasma creatinine in mg/100 ml.

Normal values: newborns – 40–65 cc/min.
$1\frac{1}{2}$ years and older – 124 ± 25.8 cc/min in males. 108.8 ± 13.5 cc/min in females.

(4) *Urea clearance test*

In the early stage of chronic nephritis, before blood urea begins to rise, the clearance rate will provide a useful measure. In the late stages, serial determinations of blood urea will give as much information.

The procedure is the same as for endogenous creatinine clearance test above.

Normal values: newborns 35 cc/min
adults 75 cc/min

(5) *Addis count*

This is a simple and sensitive test for the determination of active renal disease.

Urine is collected as in the concentration test. Instead of toluene, 0.5 cc of 40 per cent formalin is used as a preservative. Urine is collected over 12 hours, and total volume is measured.

After thorough mixing 10 cc are measured out and centrifuged. The sediment is resuspended in super-natant urine to a total volume of 0.5 cc. After thorough mixing, RBC, WBC and casts are counted in a hemocytometer and the quantity for the total volume of urine is calculated.

Normal values:

RBC	– 1 million
WBC & epithelials	– 2 million
Casts	– 10,000
Protein	– 55 mg

Tests for Malabsorption

(1) *Stool fat content*
A child on an average ward diet with at least 1 pint of full cream milk daily should not excrete more than 5 g of fat in 24 hours. If the average of three consecutive 24 hours periods exceeds 5 g malabsorption should be considered.

(2) *Reducing substance in stool*
Stool is collected on cellophane, a piece of rubber or plastic. Two volumes of water are added to one volume of stool in a test-tube and mixed well. Fifteen drops of the suspension are placed in a test-tube and a clinitest tablet is added. The chemical reaction is similar to that of urine; a result of 1/4 per cent or less is negative, between 1/4 per cent and 1/2 per cent is suspicious and above 1/2 per cent is indicative of abnormal amounts of sugar in the stools.

(3) *D-xylose absorption test*
In coeliac syndrome and other types of malabsorption d-xylose is absorbed poorly; excretion in the urine is a measure of the degree of absorption.

Method. After the evening meal no food or drink is offered. On waking up in the morning the patient voids and the urine is discarded. 5 gm of d-xylose in water is given orally, and all the urine passed over the next 5 hours is collected. The amount of d-xylose in the collected urine is estimated.

A normal child should excrete at least 1.5 gm of d-xylose over a period of five hours.

Endocrine Studies

(1) *Water excretion test* (or urine dilution test)
The test is used as a screening procedure for adrenal cortical function. If it is abnormal, further more definitive tests are indicated.

Patients with adrenal cortical insufficiency tend to excrete large

amounts of salt in the urine so that the urine remains fairly concentrated despite large ingestion of water. They also have a relative inability to develop water diuresis. The diuretic function can be restored within $2\frac{1}{2}$ hours by 50 mg of oral cortisone acetate. Maximum diuresis occurs in 5 hours, and the effect lasts for 12 hours. It is specific for cortisone or hydrocortisone only.

Method. No steroids should have been administered for two days before the test. The patient should be on regular diet without added salt. The bladder is emptied in the morning and the patient drinks 20 ml/kg of water over a period of 30–45 minutes. The patient then rests in bed and the urine is collected each hour for the next 4 hours.

In the normal individual the results are as follows:

(a) The urine specific gravity falls to 1.002 during the ensuing diuresis.
(b) 50 per cent or more of the total volume ingested should be excreted during the first 2 hours.
(c) 80 per cent or more of the total ingested should be excreted in the first four hours.

(2) *Water excretion test of Kepler, Power and Robinson*

Method. No steroids should have been administered for 2 days before the test. The patient should be on regular meals without added salt.

After 6.00 p.m. on the previous day, no food or water is allowed. At 10.30 p.m. the bladder is emptied and the urine discarded. Between 10.30 p.m. and 7.30 a.m. the next morning, all urine passed is collected in a bottle and labelled as 'night-urine'.

A blood sample is taken for urea, sodium and chloride estimation.

The bladder is emptied at 8.30 a.m. and the urine discarded. The patient is given water, 20 ml/kg body weight, to drink. The urine is collected hourly for the next four hours.

Results. If any morning one-hour specimen exceeds the 'night-urine' the test is negative.

If the 'night-urine' volume exceeds any of the morning one-hour specimens, the following ratio is calculated.

$$\frac{\textit{Night urine urea (mg/100 ml)}}{\text{Blood urea (mg/100 ml)}} \times \frac{\textit{Serum cl (mg/100 ml)}}{\text{Night urine cl (mg/100 ml)}} \times \frac{\textit{Largest 1 hr urine volume (ml)}}{\text{Overnight urine volume (ml)}}$$

If the value exceeds 25, adrenal insufficiency is unlikely. If the value is less than 25, the following diagnoses should be considered:

(a) Addison's disease.
(b) Adrenal failure secondary to hypopituitarism.
(c) Renal failure.
(d) Malabsorption syndrome.

(3) *ACTH test—intravenous method*

(a) Urine collected for 24 hours before the test.
(b) Intravenous drip set up – 500 cc of normal saline with 10–20 units of ACTH over a period of 8 hours.
(c) 24 hour urine collection to commence at the time of setting up of the drip.

In a normal individual, urinary excretion of 17 – ketosteroids and oxosteroids will rise significantly, to about two-fold. Patients with adrenal deficiency will show no response. Those with pituitary deficiency will show an intermediate response; in Cushing's syndrome the rise will be five-fold.

Patients with prolonged corticosteroid therapy may show no response to a single infusion of ACTH. The test may need to be repeated on three to four successive days and the average taken.

(4) *Insulin sensitivity test*

This test is useful in detecting deficiency of the growth hormone as a cause of failure to thrive.

The child should have been on a carbohydrate-rich diet for 3–7 days, and should be fasting on the morning of the test.

An intravenous drip of normal saline is set up and blood is taken for estimation of fasting blood sugar. Soluble insulin 0.1 unit/kg is injected intravenously and blood samples are taken for estimation of glucose at 10, 20, 40, 60, 100 and 120 minutes after the injection.

Normally a rapid fall from a fasting level occurs, falling to as low as 30–40 mg/100 ml (i.e. 50 per cent of the fasting level) within the first 20–30 minutes of giving the injection. Subsequently, the blood sugar level rises to the fasting level within 90–120 minutes.

Provided undue sensitivity is not shown with this test dose, the test is repeated the next day with the full dose of 0.25 units/kg.

Increased sensitivity to insulin is seen in hypopituitarism (for the diagnosis of which the test is commonly employed), in adrenal cortical insufficiency, and in hyperinsulinism.

25 per cent glucose for intravenous use should be handy for immediate administration if hypoglycaemic coma occurs during the test.

(5) *Adrenal inhibition test*

In the normal individual cortisone and its analogues inhibit adrenal cortical activity. Dexamethasone is preferred for the test. 0.5 mg given 6–hourly for 8 doses suppresses normal adrenals but not hyperplastic adrenals. 2.0 mg given 6-hourly for 8 doses suppresses benign adrenal hyperplasia but not malignant hyperactivity, and the total urine 17–oxogenic steroid output falls to less than 2.5 mg/24 hours.

Chapter 5

Haematological Data

Blood volume

In the full-term infant it is approximately 85 ml/kg body weight and in the pre-term infant it is approximately 108 ml/kg body weight.

At birth, delayed clamping of the cord is equivalent to a transfusion of about 150 ml of whole blood in a 3.5 kg infant.

Erythrocyte Sedimentation Rate (E.S.R.)

By the Westergren method the values are normally as follows:
Men: 3–5 mm/hour.
Women: 4–7 mm/hour.
Children: up to 15 mm/hour.

Blood pressure

The blood pressure cuff should be approximately 2/3 the length of the limb on which the pressure reading is being taken. Too wide a cuff gives a low reading and too narrow a cuff gives a high reading.

TABLE 12 Blood data in children of various ages

Whole blood haemoglobin	
Infant (full term, cord blood)	13.6–19.6 g/100 ml
Infant (3 months)	9.5–12.5 g/100 ml
Infant (1 year old)	11.0–13.0 g/100 ml
Children	11.5–14.8 g/100 ml
Packed cell volume	
Infant (full term, cord blood)	44–62 per cent
Infant (3 months)	32–44 per cent
Infant (1 year old)	36–44 per cent
Children	37–44 per cent

TABLE 13 Red cell fragility
(Presumptive test positive if haemolysis is present in more than half the red blood cells in 0.50% Nacl solution.)

% Nacl	% Haemolysis
0.85	0
0.60	0
0.50	0–5
0.40	50–90
0.30	97–100

A diastolic pressure which is constantly over 80 mm Hg under basal conditions in a child more than 4 years old requires investigation. Between 2–4 years, the significant level for investigation is 70 mm Hg.

Side-room techniques

(1) *Staining of thick blood film for detecting malaria parasites (Field's Stain)*:
A thick blood film is preferred for detecting malaria parasites, its advantages being that comparatively larger quantities of blood may be scrutinised in a short time so that parasites can be detected even if they are present in small numbers.

The thick blood film is dried in air. It is then dipped into Field's Stain A (polychromed methylene blue) for 1–2 seconds.

TABLE 14 Foetal haemoglobin

Age	% of acid resistant cells
5 weeks	70
10 weeks	40
20 weeks	20
30 weeks	12
40 weeks	5
4 years	Less than 2
Coagulation studies:	
Bleeding time	3 minutes (Duke's method)
Platelet count	More than 130,000/cu mm
Clotting time	3–5 minutes
Clot retraction	'Good' in capillary tube
Prothrombin activity	75–100% over 1 year of age
	60–75% below 1 year of age

TABLE 15 Blood pressure range for various age groups

Age	*Systolic*	*Diastolic*
	(mm Hg)	(mm Hg)
Newborn	80 ± 16	46 ± 16
6 months–1 year	89 ± 29	60 ± 10
1 year	96 ± 30	66 ± 25
2 years	99 ± 25	64 ± 25
3 years	100 ± 25	67 ± 23
4 years	99 ± 20	65 ± 20
5–6 years	94 ± 14	55 ± 9
6–7 years	100 ± 15	56 ± 8
7–8 years	102 ± 15	56 ± 8
8–9 years	105 ± 16	57 ± 9
9–10 years	107 ± 16	57 ± 9

The slide is then rinsed in buffered distilled water (pH 6.8–7.0) until the stain ceases to flow from the film (about 5–10 seconds).

The slide is then dipped into Field's Stain B (eosin) for 1–2 seconds and rinsed rapidly (1–2 seconds) in buffered distilled water.

The slide is then set upright to dry after the excess of water has been shaken off.

(2) *Staining of thin blood smears by Leishman's Stain*:
For good results the films should be stained as soon as they are dry.

The slide is flooded with Leishman's Stain, and after 2 minutes double the volume of distilled water is added, rocking the slide gently to aid mixing. The staining is allowed to continue for 5–7 minutes.

The slide is washed in a stream of buffered distilled water until the film has a pinkish tinge (about 2 minutes). The back of the slide is wiped clean and it is set up to dry.

(3) *The Sickling test*:
A drop of blood is placed between a slide and a cover slip; the preparation is sealed by means of a thin film of vaseline or liquid paraffin. After a period of 24–48 hours the slide is examined under a microscope. Sickled cells appear far more rapidly, from several minutes to hours, if a drop of freshly prepared solution of sodium metabisulphite (2 per cent) is added to the drop of blood before sealing with vaseline.

(4) *Reticulocyte count*:
Several drops of 0.3 per cent solution of brilliant cresyl blue in alcohol are placed at one end of a clean slide and spread evenly on its surface

by a to-and-fro movement with the edge of a spreading slide. Many slides can be made up this way and kept for later use.

A drop of blood, obtained by finger-prick, is applied on a cover-slip which is then inverted and pressed firmly onto the cresyl blue film.

The slide can be examined after a few minutes. Reticulocytes are easily recognised by the presence of basophilic strands inside the red cells. Their number is expressed per 100 red cells.

(5) *Gram's Staining test*:

(a) From the material to be examined—sputum, c.s.f., pus, pleural or ascitic fluid, etc. – a smear is made onto a clean slide, and fixed by flaming.
(b) The smear is stained with methyl violet solution for 1—2 minutes. The stain is then poured off.
(c) The methyl violet stain is washed off with iodine solution. The iodine solution is allowed to act for 1—2 minutes.
(d) Excess iodine is drained off.
(e) The slide is decolorised by flooding with acetone; several changes of acetone may be required until no further colour is removed.
(f) The slide is washed in water, and counter-stained with dilute basic fuchsin, till the film is pink, for 10—25 seconds. It is then washed and dried and is ready for examination.

(6) *Staining for acid-fast bacilli*:

The opaque or purulent portion of the sputum is selected for making a smear. It is allowed to dry by holding over a flame for a few seconds.

(a) The smear is covered with concentrated carbol-fuchsin (Ziehl-Neelsen stain) and heated gently over a flame until steam rises. This may be repeated 3—4 times over a period of five minutes, taking care to avoid boiling and to avoid making the film dry. Fresh stain may be added, if necessary.
(b) The slide is washed in running water for 1 minute.
(c) Decolorise with 20 per cent sulphuric acid in water for several minutes.
(d) Wash in running water for 1 minute. The smear should be colourless or faint pink. If it is definitely red, repeat stage c and wash again.
(e) Pour methylated spirit and allow to act for 1 minute; wash off with water.
(f) Counter-stain with 1 per cent aqueous methylene blue for half a minute or longer.
(g) Wash in water and allow to dry.

Chapter 6

Nutrition and Dietetics

Normal requirements

CALORIES

Calorie requirements vary according to age (see table below).

TABLE 16 Calorie requirements

Age	*Requirements*
1 year	100 cals/kg/24 hrs
5 years	75 cals/kg/24 hrs
10 years	50 cals/kg/24 hrs
15 years	40 cals/kg/24 hrs

Utilisation of available calories takes place along the following directions (approximately):

50% for basal metabolism.
5% for specific dynamic action.
25% for growth.
15% for activity (specific figures for different age groups are given in table 17).
5% for losses (specific figures for different age groups are given in table 17).

PROTEIN

Protein requirement is comparatively high during childhood because of rapid growth. During infancy the daily requirement is 2.5–3.5 gm/kg/day and in later childhood it amounts to 2–3 gm/kg/day.

Animal protein (milk, eggs, meat, fish) is superior to protein from vegetable sources (legumes, cereals, etc.) because of a well balanced and higher content of essential amino acids. If the dietary protein has to be provided from a vegetable source the intake should be higher and the

TABLE 17 Calorie utilisation

Age Range	*Weight (kg)*	*Approximate distribution of daily calorie requirement in an average European child's diet (cal/kg/day)*					*Total calorie requirement daily*		*Protein sparing CHO requirement (gm/kg/day)*	*Protein requirement (gm/kg/day)*	*Water requirement (cc/kg/day)*
		Specific dynamic/ action	*Loss*	*Activity*	*Growth*	*Basal*	*cal/kg/day*	*cal/lb/day*			
Premature	2.5	7	20	5	30	60	110–150	50–70	14		150
Full-term infant											
1st week	2.5	7	11	5	–	60	60–80	28–36	14		50–150
2–4 weeks	5	7	11	17	20	60	100–110	50–55	14	2–2.5	150
10 months	5.10	7	10	20	8	55	110–130	50–60	13		150
1–3 years	10	7	10	20	10	52	90–100	41–45	7		125
4–6 years	–	6	9	13	9	48	80–90	36–41	7		100
7–9 years	40	3	9	16	7	45	70–80	32–36	7	2 to 3	75
10–12 years		3	7	23	5	37	60–70	27–32	7		75
13–15 years	40	2	5	25	6	32	50–60	23–27	6		50
15–18 years		2	5	18	4	24	40–50	18–23	6		50
Adult	60	2	5	7	–	24	40–45	18–21	6	0.5 to 1	50

diet more varied; amino acid deficiences of one vegetable protein will be balanced by the other vegetable proteins.

In considering the protein value of any food, the protein content of the *dry* food should be taken into account rather than the percentage of protein in the food, as purchased. Thus, to compare the protein contents of cows' milk and rice:

	Cows' milk	Rice
% protein	3	7
% total dry nutrients	15	95
% water	85	5
Proportion of protein/total dry nutrients	3/15	7/95
	= 0.2	= 0.07

Thus, in spite of the apparent low percentage of protein, cows' milk is in fact a richer source.

Ten amino acids are *essential*—they cannot be synthesised by the body and so must be provided in the diet. The deficiency of any one of them in one meal cannot be made good by its presence in the following meal; in other words, all the ten essential amino acids should be present simultaneously in each meal. The essential amino acids are: arginine, histidine, lysine, tryptophane, phenylalanine, methionine, threonine, leucine, isoleucine, valine.

Fat provides the most concentrated form of calories. It is also the source of fat-soluble vitamins. To a large extent fat provides the 'palatability' of a diet.

Linoleic acid appears to be essential for nutrition. Human milk is a good source of this fatty acid whereas cows' milk is a poor source. Cotton seed, peanut, soya bean, corn and sunflower seed oils are rich sources of linoleic acid.

The carbohydrates are usually the main staple and provide bulk.

Besides the above three categories of food, a balanced diet also requires minerals and vitamins.

In constructing diets, it is best to think of four groups of foods:

(1) Staple—maize, banana, cassava, rice.
(2) Vegetable protein (v.p.)—peas, beans, and lentils, groundnuts.
(3) Animal proteins (a.p.)—meat, fish, milk, eggs.
(4) Dark green vegetables (d.g.v.)—spinach, cabbage, french beans, cauliflower, pumpkin, etc.

Depending upon the home circumstances, season and availability of foods an appropriate mixture of the above groups should be suggested, based on the general principle that the more mixed and varied the diet,

the better it is. Accordingly, there will be the following mixtures in order of superiority:

(1) Quadrimix – staple/a.p./v.p./d.g.v.
(2) Triple mix – staple/v.p./a.p.
– staple/a.p./d.g.v.
– staple/v.p./d.g.v.
(3) Double mix – staple/a.p.
– staple/v.p.
– staple/d.g.v.

Table 18 gives the nutrient contents of the commonly used tropical foods.

Protein Score is a measure of the quality of the protein in a food. It is calculated by comparing the amino acid pattern of the food protein with that of the reference protein as defined by the Joint FAO/WHO Expert Committee on Energy and Protein Requirements. For practical purposes, the amino acids compared in this way are lysine and the sulphur–containing amino acids. In the reference protein the suggested

TABLE 18 Nutrients in commonly used tropical foods

Food	*Protein g/100g*	*Calories /100g*	*Limiting S.A.A.* mg/g protein*	*Amino Acids lysine, mg/g protein*
Egg	13	158	54	59
Chicken	19	139	35	86
Fish (fresh, lean)	17	73	39	86
Fish (dried, white)	29	125	39	86
Dried skim milk	36	357	37	80
Dried whole milk	25.5	500	37	80
Soya beans	35	382	30	64
Average legume (e.g. cowpea)	22	340	20	72
Groundnuts (dry)	27	579	20	35
Wheat flour (70% extraction)	10	350	31	21
Rice (polished)	7	352	32	25
Maize (96% extraction)	9.5	362	25	19
Millet (Pennisetum)	9	365	28	21
Sorghum (Guinea corn)	10	353	27	19
Oats	12	388	32	27
Potatoes (Irish)	2	75	26	48
Sweet Potatoes	1.5	114	26	48
Taroes	2	113	26	48
Yams (fresh)	2	104	26	48
Plantains	1	128	16	48
Bananas	1	116	16	48
Cassava flour	1.5	342	16	48

*Total sulphur-containing amino acids (cystine + methionine)

levels are – lysine 55 mg/1 gm of protein and the sulphur–containing amino acids (methionine + cystine), 35 mg/1 gm of protein. Protein score is calculated by first obtaining the quantities in mg/gm of protein of these two groups of amino acids from food tables and then taking the smaller of the two quantities to apply in the formula

Protein score

$$= \frac{\text{amino acid in mg/gm of protein}}{\text{same amino acid in mg/gm of reference protein}} \times \frac{100}{1}$$

for example, to calculate the protein score of wheat:

From the food table, (Table 18) per gm of wheat protein:

s.a.a. = 31 mg.
lysine = 21 mg.

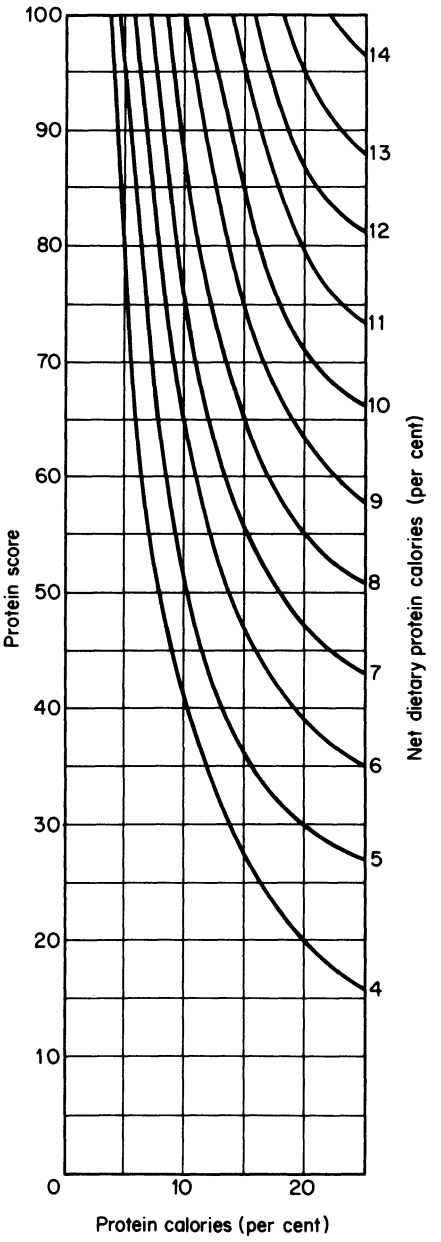
Protein score is calculated from lysine which is the smaller of the two:

$$\text{Protein score of wheat} = \frac{21}{55} \times 100 = 38.$$

Table 19 gives the protein scores of the common tropical foods.

TABLE 19 Protein scores of tropical foods

Food	*Protein Score*
Egg	154
Chicken	100
Fish	111
Fish (dried, white)	111
Dried skim milk	105
Dried whole milk	105
Soya beans	85
Legumes	57
Ground nuts	57
W. Flour	38
Rice (polished)	45
Maize (96% ext.)	34
Millet	38
Sorghum	34
Oats	49
Potatoes	74
Sweet potatoes	74
Taroes	74
Yams	74
Plantains	45
Bananas	45
Cassava flour	45


100
90
80
70
60
50
40
30
20
10
0
10
20
Protein score
Protein calories (per cent)
14
13
12
11
10
9
8
7
6
5
4
Net dietary protein calories (per cent)

NDp.Cal. per cent (net dietary protein calories per cent)

For adequate nutrition, the protein in the diet should be of good quality as judged by its protein score, and be consumed in a sufficient amount to provide a specific proportion of the total calorie intake. If this is low, the diet is inadequate and if high, the protein is wasted as it is metabolised to produce calories. These two aspects, the quality and quantity factors of dietary protein, are brought together in the concept of NDp.Cal. per cent which is calculated from the nomogram on page 30. The ideal food should be adequate in total calories and should provide NDp.Cal. per cent of between 7 and 8.

For example, to calculate the NDp.Cal. per cent in a double mix—rice 100 gm, legume 10 gm:

	Protein	*Calorie*	*S.A.A.*	*Lysine*
100 gm rice	= 7 gm	352	224 mg	175 mg
10 gm legume	= 2.2 gm	34	44 mg	158 mg
Total	9 gm	386	268 mg	333 mg

$$\text{Protein Score} = \frac{268}{9 \times 35} \times 100 = 85$$

Calories from protein = 9 x 4 = 36 = 9%
From the nomogram NDp.Cal. per cent = 7

Suggested Schedule for Infant and Child-Feeding

(1) At 0–4 months:	breast-feed; fresh fruit juice may be added.
(2) At 4–6 months:	breast-feed; introduce a gruel. Thin at first and gradually brought to a thicker consistency. Gradually add egg, milk, pounded ground nuts.
(3) At 6–12 months:	breast-feed; enriched gruel as above. Introduce soft strained foods; mashed potatoes, bananas, beans, or peas, fruit like banana or paw-paw, boiled fish, minced meat or liver.
(4) At 12–24 months:	breast-feed; gruel and strained foods as above. Also introduce parts of family meal and the staple.
(5) From 18 months onwards:	gradually stop breast-feeding, making sure that the child has daily egg, milk and nutritious portions of family meal.

TABLE 20 Recommended daily dietary allowances

	Age in years (from/to)	*Weight (kg)*	*Height (cm)*	*Calories*	*Proteins (gm)*	*Calcium (gm)*	*Iron (mg)*	*Vitamin A (i.u.)*	*Thiamine (mg)*	*Riboflavine (gm)*	*Niacin (mg)*	*Ascorbic Acid (mg)*	*Vit. D. (i.u.)*
Infants	0– 1	8	..	kg x 115 ± 15	kg x 2.5 ± 0.5	0.7	kg x 1.0	1,500	0.4	0.6	6	30	400
Children	1– 3	13	87	1,300	32	0.8	8	2,000	0.5	0.8	9	40	400
	3– 6	18	107	1,600	40	0.8	10	2,500	0.6	1.0	11	50	400
	6– 9	24	124	2,100	52	0.8	12	3,500	0.8	1.3	14	60	400
Boys	9–12	33	140	2,400	60	1.1	15	4,500	1.0	1.4	16	70	400
	12–15	45	156	3,000	75	1.4	15	5,000	1.2	1.8	20	80	400
	15–18	61	172	3,400	85	1.4	15	5,000	1.4	2.0	22	80	400
Girls	9–12	33	140	2,200	55	1.1	15	4,500	0.9	1.3	15	80	400
	12–15	47	158	2,500	62	1.3	15	5,000	1.0	1.5	17	80	400
	15–18	53	163	2,300	58	1.3	15	5,000	0.9	1.3	15	70	400

(U.S. National Research Council)

Human and Cows' Milk

TABLE 21 Comparison of milk composition

	Human colostrum	*Human transitional*	*Mature milk*	
	(1–5 days)	(6–10 days)	Human	Cow
Water (gm/100 ml)	87	86	88	87
Energy (cal/100 ml)	58	74	71	69
Total solids (gm/100 ml)	12.8	13.6	12.4	12.7
Fat (gm/100 ml)	2.9	3.6	3.8	3.7
Lactose (gm/100 ml)	5.3	6.6	7.0	4.8
Protein (gm/100 ml)	2.7	1.6	1.2	3.3
Calcium (mg/100 ml)	31	34	33	125
Phosphorous (mg/100 ml)	14	17	16	96
Potassium (mg/100 ml)	74	64	55	138
Sodium (mg/100 ml)	48	29	15	58
Iron (mg/100 ml)	0.09	0.04	0.15	0.10
Protein distribution in gm/100 ml				
Total proteins	2.7	1.6	1.2	3.3
Casein	1.2	0.7	0.4	2.8
Lactalbumin	–	0.8	0.3	0.4
Lactoglobulin	–	0.5	0.2	0.2
Essential amino acids mg/100 ml				
Arginine	126	64	51	124
Histidine	57	38	23	80
Isoleucine	121	97	86	212
Leucine	221	151	161	356
Lysine	163	113	79	257
Methionine	33	24	23	87
Phenylalanine	105	63	64	173
Threonine	148	79	62	152
Tryptophane	52	28	22	50
Valine	169	105	90	228
Vitamins: per 100 ml				
Vit. A–mmg	89	88	53	34
Vit. D–units			0.42	2.36
Vit. C mg	4.4	5.4	4.3	1.6
Folic acid mmg	0.05	0.02	0.18	0.23
Nicotine acid mmg	75	175	172	85
Pyridoxine mmg			11	48
Riboflavin mmg	29.6	33.2	42.6	157
Thiamine mmg	15	6	16	42
Vitamin B 12 mmg	0.045	0.036	trace	0.56

(From the composition of milks, publication 254 (1953) Academy of Sciences, National Research Council, Washington D.C.)

Routine feeding instructions

(1) Never try to force any food. The child should learn to enjoy his food. All meal times should be play and fun with no coercion.
(2) All new foods will be refused in the beginning. When introducing any new foods, small quantities should be offered at first to allow the child to develop a taste for the food.
(3) Food intake varies from day to day and from one meal time to another.
(4) The child needs to eat more often than the adults; besides the three main meals several snacks should be offered in the day.
(5) The child should not eat from the communal pot but his portion should be served on a plate and an attempt be made to make him finish all his portion.

Treatment of Protein–Calorie Malnutrition

Principles underlying the treatment of in-patients are:

(1) To restore tissue proteins and supply calories in a digestible form.
(2) To replace additional materials lost during the course of the illness, e.g. fluids and electrolytes and vitamins.
(3) To diagnose and treat infections so frequently associated with malnutrition.
(4) To treat associated conditions like parasitic infestation, anaemia, etc., which affect the general health of the patient.

REPLACEMENT OF PROTEIN

The optimum requirement is 4 gm/kg (2 gm/lb) daily. For an economic utilisation of this protein, at least 20 calories per gram of protein must be provided. Cure can be achieved with lesser amounts of proteins and calories but progress will be slow. With the quantities shown in table 22, improvement usually begins in about five days of commencing treatment.

Any of the 'milk' formulae shown in table 22 may be used to supply these requirements.

It may not be possible to weigh exact quantities in the milk kitchen of a paediatric ward; a volume measure (a spoon or a fluid ounce measure) may be used to obtain approximate quantities of each ingredient as shown in table 23 on page 36.

Different brands of milk powder vary in weight per unit volume; before using table 23, the actual weight of the proposed ingredient should be checked against the volume measured.

TABLE 22 Comparison of milk diets*

	Casein skim milk diet	*Reinforced milk diet*	*Casein full-cream milk diet*
Ingredients	gm	gm	gm
Calcium caseinate	35	–	30
Dried skim milk	35	120	–
Full cream milk	–	–	60
Sugar	35	30	30
Edible oil	70	35	45
Water (oz)	35 oz	35 oz	35 oz
Nutrient content			
Protein (gm)	44.1	43.2	42.3
Fat (gm)	71.0	36.2	62.0
Carbohydrate (gm)	52.8	91.2	52.5
Calories	1028	863	939
Cals/gm/protein	23	20	22
Vitamin A i.u.	14	48	720
Thiamine mg	0.16	0.54	0.18
Riboflavin mg	0.54	1.84	0.69
Niacin mg	0.4	1.3	0.5
Vitamin C mg	6	20	8
Mineral content			
Iron (mg)	0.35	1.20	0.48
Calcium (mg)	861	1512	900
Sodium (mg)	238	720	264
Potassium (mg)	471	1602	771
Magnesium (mg)	43	133	70
Phosphorous (mg)	648	1260	696

*Dosage for all diets: 110 ml/kg/day or 2 fl oz/lb/day.

ADMINISTRATION

(1) Most children suffering from protein calorie malnutrition are anorexic. In order to ensure that adequate amounts of nutrients are taken, intragastric feeding may be required. The milk formula is administered at 4 hourly intervals by a syringe or by a continuous drip from a bottle using the intravenous fluid–giving set connected to the naso-gastric tube.

(2) Replacement of vitamins, mineral and electrolytes: if there is associated diarrhoea and/or dehydration, fluid and electrolyte replacement should be done with urgency. Half-strength Darrow's solution is suitable for most cases; the route of administration will depend upon the degree of dehydration.

Additional vitamins and iron in the form of Abidec (0.3 cc daily), Becosym (1 tablet daily), folic acid (5 mg daily) and iron (50–100 mg daily) should be added to the above milk formulae.

TABLE 23 Approximate quantities of milk diets to be used if weighing scales are not available

Ingredients	*Casein skim milk*		*Reinforced milk*		*Casein full-cream milk*	
	fl oz measure	*rounded dessert spoon*	*fl oz measure*	*rounded dessert spoon*	*fl oz measure*	*rounded dessert spoon*
Calcium caseinate	7	8	–	–	6	7
Dried skim milk	2	3	7	9	–	–
Full-cream milk	–	–	–	–	7	8
Sugar	$1\frac{1}{2}$	2	$1\frac{1}{4}$	2	$1\frac{1}{4}$	2
Oil	3	9	$1\frac{1}{2}$	5	2	6
Water	35	–	35	–	35	–

(3) Infections, worm infestation and other associated conditions should receive necessary attention.

LACTOSE INTOLERANCE

Some children develop diarrhoea on this regime; where infection has been ruled out, such cases are due to lactose intolerance, and should be put on a lactose–free formula. Sobee is tolerated well and is nutritionally well-balanced but expensive; on the other hand a casilan based formula can be prepared in the milk kitchen of the ward but will need additional vitamins and minerals.

Lactose-free diet

This diet is composed of highly refined ingredients and contains no vitamins and few minerals. *It must be used with great care.*

TABLE 24 The lactose-free diet (Dsp = dessertspoon. Fl oz = using fluid ounce measure)

Ingredients	*Measures*		*Grams in measure*	
	Dsp	*Fl oz*	*Dsp*	*Fl oz*
Casilan	6 dsp	5.0	27	26
Glucose/dextrose	1 dsp	0.5	12	9
Sucrose	1 dsp	0.75	15	18
Oil	$4\frac{1}{2}$ dsp	1.5	35	39
Total mixed ingredients			89 g	92 g
Mist PCM		$\frac{1}{2}$ fl oz		
Water		17 fl oz		
Mist PCM				
NaCl	33 grams			
KCl	66 grams			
$Mg(OH)_2$	6.5 grams			
Distilled water	1 litre			
Use at rate of $\frac{1}{2}$ fl oz for every pint milk diet.				

The nutritive value of this diet (using dessertspoons for measuring dry ingredients and fluid ounces for oil) is as follows:

Protein g	24
Calories	562
Ca mg	324
Na mg	218
K mg	520
Mg mg	43
P mg	216

Virtually no vitamins or other minerals are found in this diet. A full vitamin supplement must be given even if ward diet is also being given.

When the diarrhoea stops on a lactose-free formula, eggs or other solids may be gradually added. After the child has been eating well for a few days, ordinary milk may be offered in small quantities at every meal and the stools should be examined daily for presence of lactose by means of the clinitest. If negative, the amount of milk can be increased gradually over a period of time.

When the oedema is lost and the child is well on his way to recovery, the routine ward diet may be offered together with the high-protein milk formula in amounts of 4–6 fluid ounces six to eight times in twenty-four hours.

Routine Ward Diet

A specimen ward diet for a paediatric ward might be as follows:

6.00 a.m. – 1 slice (1 oz) bread spread with 2–4 gm margarine or peanut butter.
6–7 fl ounces tea containing approximately 60% reconstituted milk and sugar.

10.00 a.m. – 2 oz paw paw cut into small pieces and 5–6 ounces of porridge containing 43% fresh milk, 8% maize flour, 12% eggs and 2% sugar.

12.00 noon – 5–6 oz rice or stiff porridge.
3–4 oz mince meat containing 50% mince meat, 5% fish meal, 2% oil.
3 oz soup containing 7% carrot, 7% turnip, 15% spinach and bone broth.

3.00 p.m. – 1 slice (1 oz) bread and 2–4 gm margarine.
6–7 fl oz tea as at 6.00 a.m. Half a fresh orange.

6.00 p.m. – 5–6 oz rice. 3–4 oz mince as at lunch, or beans, or ground nut stew, and 3 oz soup.

TABLE 25 Average intake of a child who is eating well

Food	*(g)*	*Cals.*	*Prot. (g)*	*Fat (g)*	*CHO (g)*	*Ca (mg)*	*Fe (mg)*	*Vit. A (i.u.)*	*Thia-min (mg)*	*Ribofl. (mg)*	*Niac. (mg)*	*Vit. C (mg)*
Bread	30	74	2.1	0.2	16.0	3.40	0.30	–	0.2	0.1	0.2	–
Margarine	2	15	–	1.7	–	0.08	–	56				–
Tea	212	119	4.5	2.1	20.0	159.00	0.13	91	0.055	0.198	0.17	2.3
Breakfast		208	6.6	4.0	36.0	162.5	0.43	147	0.26	0.3	0.37	2.3
Porridge with eggs	156	112	5.6	4.7	12.3	90.0	0.80	280	0.55	0.16	0.16	0.6
Paw paw	56	22	0.4		5.2	11.4	0.20	568	0.02	0.02	0.20	34.0
Sugar	10	40	–	–	10.0	–	–	–	–	–	–	–
Mid-morning		174	6.0	4.7	27.5	101.4	1.0	848	0.57	0.18	0.36	34.6
Rice	155	132	2.8	0.16	28.8	1.86	0.31		0.022	0.011	0.37	–
Mince	100	137	12.4	9.80	–	14.00	1.70		0.050	0.110	2.70	–
Soup	80	9	0.7	0.08	1.4	34.00	0.56	530	0.016	0.040	0.24	14
Stiff porridge	162	226	5.7	0.84	49.0	2.35	1.30		0.032	0.019	0.39	–
Mince	100	137	12.4	7.80	–	14.00	1.70		0.050	0.110	2.80	–
Soup	80	9	0.7	0.08	1.4	34.00	0.56	530	0.016	0.040	0.24	14
Lunch with rice		278	15.9	10.04	30.2	49.9	2.6	530	0.09	0.16	3.4	14

TABLE 25 (*continued*)

Food	*(g)*	*Cals.*	*Prot. (g)*	*Fat (g)*	*CHO (g)*	*Ca (mg)*	*Fe (mg)*	*Vit. A (i.u.)*	*Thia-min (mg)*	*Ribofl. (mg)*	*Niac. (mg)*	*Vit. C (mg)*
Lunch with stiff porridge		372	18.8	10.72	50.4	50.4	3.6	530	0.10	0.17	3.4	14
Bread	32	80	2.2	0.2	17.1	3.60	0.35		0.019	0.013	0.22	0
Margarine	3	23	–	2.5	–	0.12	–	85	–	–	–	–
Tea	212	119	4.5	2.1	20.0	159.00	0.13	91	0.055	0.198	0.17	2.3
Orange ($\frac{1}{2}$)	70	37	0.6	–	9.1	21.00	35	21	0.060	0.020	0.14	31.0
Tea		259	7.3	4.8	46.2	183.7	0.83	197	0.13	0.23	0.5	33.3
Rice	110	94	2.0	0.11	20.4	1.3	0.22	–	0.015	0.008	0.26	–
Mince	113	155	14.0	11.10	–	15.8	1.92	–	0.057	0.124	3.16	–
Soup (no vegetables)	46	–	–	–	–	–	–	–	–	–	–	–
Supper		249	16.0	11.2	20.4	17.1	2.14	–	0.07	0.13	3.4	–
Average total daily		1215	53.3	35.1	170.4	514.8	7.5	1722	1.13	1.01	8.03	84.2
Recommended allowance	1–3 yrs.	1130	40			400	7	2000	0.6	1.0	6	35
	3–6 yrs.	1510	50			400	8	2500	0.8	1.2	8	50

TABLE 26 Average diet of malnourished child who has started eating solids

(Supplemented with High Protein Milk Protein Formula)

Time	*Food*	*g*	*Cals.*	*Prot. (g)*	*Fat (g)*	*CHO (g)*	*Ca (mg)*	*Fe (mg)*	*Vit. A (i.u.)*	*Thiam. (mg)*	*Ribofl. (mg)*	*Niac. (mg)*	*Vit. C (mg)*
3.00 a.m.	Casein skim milk formula (4 oz)	–	81	4.4	4.8	6.1	112.0	0.07	2	0.03	0.10	0.07	1.0
6.00 a.m.	Bread and margarine	17	52	1.1	1.8	8.0	1.8	0.15	56	0.10	0.05	0.10	–
	Tea + milk + sugar	120	66	2.5	1.2	11.4	90.0	0.07	52	0.03	0.11	0.10	1.3
9.00 a.m.	Casein skim milk formula (6 oz)		129	6.6	7.2	9.1	168.0	0.10	4	0.04	0.15	0.11	1.7
10.00 a.m.	Special porridge	139	133	4.6	3.9	20.1	74.5	0.65	232	0.05	0.14	0.13	0.5
	Paw paw	34	13	0.2	–	3.0	6.9	0.10	340	0.01	0.01	0.10	20.0
12.00 p.m.	Lunch (stiff porridge mince)	110	144	6.3	3.3	22.1	8.2	1.14	46	0.17	0.04	1.05	1.2
	Casein skim milk formula (5 oz)		108	5.5	6.0	7.6	140.0	0.08	3	0.04	0.13	0.09	1.4
3.00 p.m.	Casein skim milk formula (5 oz)		108	5.5	6.0	7.6	140.0	0.08	3	0.04	0.13	0.09	1.4
	Bread and margarine	17	52	1.1	1.8	8.0	1.8	0.15	56	0.10	0.05	0.10	–
	Tea + milk + sugar	86	48	1.8	0.8	8.2	65.0	0.05	37	0.02	0.08	0.07	0.9
	Orange ($\frac{1}{2}$)	70	37	0.6	–	9.1	21.0	0.35	21	0.06	0.02	0.14	31.0

TABLE 26 (*continued*)

(Supplemented with High Protein Milk Protein Formula)

Time	*Food*	*g*	*Cals.*	*Prot. (g)*	*Fat (g)*	*CHO (g)*	*Ca (mg)*	*Fe (mg)*	*Vit. A (i.u.)*	*Thiam. (mg)*	*Ribofl. (mg)*	*Niac. (mg)*	*Vit. C (mg)*
6.00 p.m.	Supper: rice & mince	158	143	7.8	5.1	16.0	6.1	1.00	–	0.04	0.06	1.70	–
	Casein skim milk formula (4 oz)		81	4.4	4.8	6.1	112.0	0.07	2	0.03	0.10	0.07	1.1
9.00 p.m.	Casein skim milk formula (5 oz)		108	5.5	6.0	7.6	140.0	0.08	3	0.04	0.13	0.09	1.4
12.00 a.m.	Casein skim milk formula (4 oz)		81	4.4	4.8	6.1	112.0	0.07	2	0.03	0.10	0.07	1.1
	Total from Casein skim milk formula (33 oz)		710	36.4	39.6	50.1	924.0	0.56	20	0.23	0.82	0.59	9.2
	Total from ward diet		688	25.8	17.9	105.9	277.3	3.66	840	0.58	0.56	3.49	54.9
	Total		1398	62.2	57.5	156.0	1201.3	4.22	860	0.81	1.38	4.08	64.1
	Recommended allowance: 1–3 yrs.		1130	40.0			400	7.00	2000	0.6	1.0	6	35

TABLE 27 Summary of nutrient contents of diet for a paediatric ward

Diet	*Amt. fl oz*	*Cal.*	*Prot. (g)*	*Fat (g)*	*CHO (g)*	*Ca (mg)*	*Fe (mg)*	*Vit. A (i.u.)*	*Thia. (mg)*	*Ribofl. (mg)*	*Nia-cin (mg)*	*Vit. C (mg)*	*Remarks*
(1) Casein skim milk formula only	30 50	645 1075	33.0 55.0	36.0 60.0	46.0 76.0	840 1400	0.51 0.85	18 30	0.21 0.35	0.75 1.25	0.54 0.90	8.4 14.0	Made with dried skimmed milk, casilan sugar and oil.
(2) Casein skim milk formula. Porridge, tea, bread, orange juice		1098	47.9	49.1	114.9	1178	1.98	474	0.59	1.27	1.23	42.9	i.e. assuming not eating lunch, supper or paw paw.
(3) Casein skim milk formula and full ward diet		1398	62.2	57.5	156.0	1201	4.22	860	0.81	1.38	4.08	64.1	
(4) Recommended allowances:													
1–3 yr old		1130	40.0			400	7.00	2000	0.60	1.00	6.00	35	
3–6 yr old		1510	50.0			400	7.00	2099	0.80	1.20	8.00	50	
(5) Ward diet only		1215	53.3	35.1	170.4	515	7.50	1722	1.13	1.01	8.03	84.2	Not taking account of 2nd helping.

TABLE 28 Nutrient content of common tropical foods

Nutrient	*Daily Requirement* M. (20–29 yrs.)	F.	Child (1–3 yrs.)	*FOOD SOURCE and approximate nutritive value (in units given below each nutrient in col. 1) per 100 g (3½ oz) of edible portion*			
Protein (g)	70	65	40	Whole milk	3	Fish, fresh	18
				Dried milk	30	Fish, dry	60
				Offal	18	Pulses (peas, beans, etc.)	20
				Egg	13	Soya beans	35
				Meat	18	Groundnuts	27
				Cheese	20	Cereals	8
Calories	2850	2150	1300	Oils	900	Pulses	340
				Butter, lard	750	Cereals	350
				Oil seeds, groundnuts	580	Starchy roots and fruits	110
Calcium (mg)	500	400	400	Whole milk	120	Beans and peas	100
				Evaporated milk	300	Sesame seeds	1500
				Dried milk	1000	Dark green leaves (e.g. spinach)	250
				Cheese (hard)	800	Dried fish (in which bones are eaten)	3000
				Soya beans	200		
				Whole finger millet	350		
Iron (mg)	13	15	9	Liver	10	Dark green leaves	3
				Kidney	10	Mid-green leaves (e.g. cassava, pumpkin)	3
				Heart	4	Millets	3
				Meat	3	Sorghum	4
				Fish, dry	8	Maize flour	2
				Eggs	3	Oil seeds	5–10
				Yeast	20	Cashew, pumpkin, sesame seeds	10
				Lake fly	66	Beans, peas	5–9

TABLE 28 (*continued*)

Nutrient	*Daily Requirement* M. (20–29 yrs.)	F.	Child (1–3 yrs.)	*FOOD SOURCE and approximate nutritive value (in units given below each nutrient in col. 1) per 100 g (3½ oz) of edible portion*			
Vitamin A (i.u.)	4800	4400	2000	Liver	20,000	Dark green leaves	3000
				Kidney	1,000	Mid-green leaves	1000
				Egg	1,000	Carrots	3000
				Butter	3,000	Pumpkins	350
				Animal ghee	2,000	Mangos	600
				Cheese	1,400	Paw paws	1000
				Fortified margarine oil and ghee	3,000	Cooking bananas	100
				Whole dried milk	1,200	Sweet potatoes	100
						Jak fruit	150
				Fish liver oil	100,000	Yellow maize	150
				Red palm oil	20,000		
Thiamin (mg)	1.4		0.6	Maize, whole	0.4	Lake fly	1.2
				Low extract millet whole	0.3	Beans, peas	5–9
				Millet flour	0.2	Soya beans	1.1
				Sorghum whole	0.5	Oil seeds, e.g.	0.9
				Sorghum flour	0.4	ground nuts, cashew	0.6
				Rice unpolished	0.3	Sesame, sunflower	1.0
				Yeast, brewers	9.5	Liver, heart, kidney	0.4
				Sorghum beer	0.2	Milk powder	0.4

TABLE 28 (*continued*)

Nutrient	*Daily Requirement* M. (20–29 yrs.)	F. (20–29 yrs.)	Child (1–3 yrs.)	*FOOD SOURCE and approximate nutritive value (in units given below each nutrient in col. 1) per 100 g (3½ oz) of edible portion*			
Riboflavin (mg)	1.5	1.3	0.9	Whole milk	0.2	Pulses	0.2
				Dried milk	1.3	Soya beans	0.3
				Cheese	0.4	Oil seeds	0.2
				Liver	2.5	Dark green leaves	0.3
				Kidney	2.0	Mid green leaves	0.2
				Meat	0.2	Mushrooms	0.5
				Maize whole	0.1		
				Millet whole	0.1		
				Sorghum whole	0.1		
Niacin (mg)	14	12	6	Liver	13.0	Beans and peas	2.0
				Kidney, heart	7.0	Groundnuts	17.0
				Meat	5.0	Sesame and sunflower seeds	5.0
				Chicken	9.0	Mushrooms	6.0
				Maize	1.0	Yeast	30.0
				Millets	1.0		
				Rice	1.0		
				Sorghum	3.5		
				Fish, fresh	2.0		
				Fish, dry	6.0		
Vitamin C (mg)	25	25	20	Dark green leaves	100	Baobab pulp	370
				Other green leaves	45	Mangos, pineapples	30
				Citrus fruit	40	Liver	30
				Oranges, tangerines		Fresh cassava	30
				Paw paws	50	Bananas	20
				Guavas	200	Sweet potatoes	30

Chapter 7

Water and Electrolytes

Water

TABLE 29 Normal requirements

Weight	*Calories per kg per day*	*Water in ml kg/day*
2nd day of birth	0–40	0– 50
3–7 days	40–50	60–100
10–15 kg	65–45	100–75
15–25 kg	50–40	75–60
25–35 kg	40–35	70–50
35–60 kg	35–30	60–45
over 60 kg	30–25	45–30

TABLE 30 Average water loss per day, resting without sweating

	Urine ml	*Stool ml*	*Insensible ml*	*Total ml*
Infant (2–10 kg)	200– 500	25– 50	75– 300	300– 840
Child (10–40 kg)	500– 800	40–100	300– 600	840–1500
Adolescent or Adult (60 kg)	800–1000	100	600–1000	1500–2100

Sodium

Daily requirements of sodium are as follows:

Newborn (first two weeks)	– 1–1.5 m. eq./kg/day
2–3 months	– 3 m. eq./kg/day
larger child	– 2–3 m. eq./kg/day

Potassium

Before administering potassium intravenously, it should be ascertained that renal function is established and adequate urine excretion occurs. Where possible, serum levels of potassium should be obtained before administering potassium intravenously.

Replacement of losses by parenteral fluid therapy in dehydration is handicapped by the fact that an intracellular electrolyte, that is, potassium, must be given into the extracellular fluid from which it is subsequently distributed according to metabolic activity. Therefore, caloric expenditure should be also taken into account during administration of potassium.

In some situations, such as diarrhoea, with dehydration or treatment of diabetic coma, clinical indications for intravenous administration of potassium are very strong; in such cases intravenous potassium therapy may be started pending the results of laboratory investigations.

Potassium intoxication will be rare if the following rules are followed:

(1) Circulatory and renal functions should be restored by replacing deficits of water and extracellular electrolytes either partially or completely before starting solutions containing potassium.
(2) In all intravenous solutions, the concentration of potassium should be limited to less than 40 m. eq. per litre.

Assessment of water and electrolyte loss in dehydration

The laboratory is of limited value in determining treatment, and a careful clinical appraisal is required for planning fluid therapy. The following factors should always be carefully assessed.

(1) *History*:
(a) Intake — Quantity.
— Kind: water, electrolyte, protein drugs.
(b) Output — Quantity.
— Kind: urine, vomiting, diarrhoea, sweat.
(c) Balance — Weight change.
(d) General medical — Age.
— Cardiovascular, respiratory, renal or C.N.S.
— disease.
(2) The state of the fontanelle, skin turgor, ocular tension, state of mucous membranes of the mouth.
(3) Mental state, restlessness, apathy, confusi

(4) Temperature, pulse rate and blood pressure.
(5) Estimation of dehydration:
(a) *Mild* – Thirst, mild oliguria.
(b) *Moderate* – Obvious loss of skin tone, sunken fontanelle, dry mucous membranes, thirst and oliguria.
(c) *Severe* – All the above, plus sunken eyes, cold skin, thready pulse, grey colour or cyanosis.

Intravenous replacement therapy

(1) In severe dehydration, there is shrinkage of extracellular volume and either shock or borderline shock exists. Hence, expansion of extracellular volume is the major need. This is done by starting therapy with Hartman's solution (Ringer – lactate) in the proportion of 20 ml/kg body weight, over a period of 4–5 hours.
(2) Half-strength Darrow's solution in 5% glucose may be given orally at the same time at the rate of 30 cc per hour.
(3) If by the time the Hartman's solution has been administered, there is general improvement and renal function is established as seen by passage of urine, the remainder of the estimated quantity of fluid can be administered in the form of half-strength Darrow's solution, over the next 24 hours.

If there is no clinical improvement, and urine has not been passed by the time Hartman's solution has been infused, dextrose in 1/5th saline should be given intravenously and the oral Darrow's solution should be continued. At this stage, blood should be taken for estimation of serum electrolytes and blood urea.

Rapid rehydration leads to a high incidence of disturbances of the central nervous system. This particularly applies when sodium levels are over 150 m. eq./l (hypernatraemia) and to a lesser extent when hyponatraemia is present. This can be avoided by (a) not over-estimating the fluid requirements; (b) using hypotonic fluids; (c) repeated evaluation of patients during intravenous infusions; (d) slow replacement of deficits and losses over a period of twenty-four hours.
(4) Review of the patient and therapy is essential at frequent intervals. It should be done before changing from one kind of solution to another and at least every 24 hours. Laboratory assessment may be needed in certain cases in addition to clinical examination. An intravenous fluid record chart should be maintained and should show the type of fluid given, the frequency and approximate quantity of stool and urine passed, and the rate of drip flow. At every review the fluids for the next 24 hours should be planned.

TABLE 31 Assessment of fluid and electrolyte requirements

	Severe diarrhoea				*Moderate diarrhoea*			
	H_2O ml/kg	Na m.eq./kg	Cl m.eq./kg	K m.eq./kg	H_2O ml/kg	Na m.eq./kg	Cl m.eq./kg	K m.eq./kg
Deficit	100	9	9	12	45	4	4	6.5
Normal expenditure	100	2	2	1.5	100	2	2	1.5
Stool losses	60	4	4	2	35	2	2	1
Total requirement	260	15	15	15.5*	180	8	8	9*

* These quantities of potassium should be replaced *slowly* over 2 to 3 days, the usual daily amount being 3 m.eq./kg.

TABLE 32 Electrolyte contents of common solutions used in therapy (m.eq. per litre)

	Na	K	Ca	Cl	lactate
Normal or isotonic saline (0.9% NaCl)	154	–	–	154	–
Hartman's solution (Lactated ringer solution)	130	4	3	109	28
1/5th Normal saline	31	–	–	31	–
Darrow's solution	122	35	–	104	53
$\frac{1}{2}$ strength Darrow's solution	61	17	–	52	26

Fluid requirements in surgical conditions

Fluid requirements for the surgical patient should be considered in 3 phases—pre-operative, operative and post-operative.

PRE-OPERATIVE PHASE

The aim is to supply the existing deficits, due to vomiting, as in intestinal obstruction or pyloric stenosis, or rarely due to diarrhoea, e.g. in ulcerative colitis. The commonest electrolyte abnormality is a hypokalaemic akalosis secondary to loss of H^+ and Cl^- from the gastric contents.

If shock or impending circulatory collapse exists, blood or a plasma expander is indicated. Dehydration is clinically assessed as to whether mild, moderate or severe, and fluid requirement estimated accordingly.

Hydration is begun with 1/5th of the estimated fluid deficit being given as Hartman's solution or N/5 saline in dextrose. Once adequate urine flow is established half-strength Darrow's solution is substituted.

OPERATIVE PHASE

Potassium containing solution are usually withheld and fifth-normal saline in dextrose substituted, as a slow drip.

POST-OPERATIVE PHASE

In the immediate post-operative phase, there will be a period of antidiuresis dependent upon the length of anaesthesia. During this phase water and sodium retention may occur.

Later, excessive urinary excretion of nitrogen and potassium occurs. In addition, there may be further losses from gastric aspiration, ileostomy, etc.

In the early post-operative period, 1/5th normal saline in dextrose should be continued as a slow drip – 4–5 drops per minute. When urine flow is established Hartman's solution should be substituted. If intravenous fluids have to be continued for more than twenty-four hours, serum electrolyte estimation should be done daily and the fluid requirement planned accordingly.

Burns

Severity of burns depends upon percentage of the body surface area burned and the depth of burn. Any child with more than 10 per cent of body surface area burned should be hospitalised; parenteral fluid

therapy is required when more than 10–15 per cent of body surface is burned.

ASSESSMENT OF AREA OF BURN

The 'rule of nine' may be used to obtain an approximate assessment of the area burned. However, the surface areas of different parts of the body in the child undergo changes with growth. The area of the head makes up a relatively larger proportion of the body in infants as compared with adults; on the other hand the extremities take up a smaller proportion of the body surface area. The following table may be used in small children:

TABLE 33 Per cent surface area of the body

	0	*1yr*	*5yrs*	*10yrs*	*15yrs*	*Adult*
$\frac{1}{2}$ of head	$9\frac{1}{2}$	$8\frac{1}{2}$	$6\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{1}{2}$	$3\frac{1}{2}$
$\frac{1}{2}$ of thigh	$2\frac{3}{4}$	$3\frac{1}{4}$	4	$4\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{3}{4}$
$\frac{1}{2}$ of leg	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3	$3\frac{1}{4}$	$3\frac{1}{2}$

INITIAL PROCEDURES ON ADMISSION

(1) Relieve pain by Inj. Morphine (1 mg for each 10 lb body wt) or Inj. Pethilorfan 25 mg.
(2) Inj. A.T.S.–1,500 units.
(3) Obtain blood for: Hb., P.C.V., blood, urea, grouping and cross-matching.
(4) Local treatment, if any, of the area of burn.

FLUID THERAPY

(1) To counteract shock – 1 cc of colloid (blood, plasma or dextran) x kg body weight x per cent of body surface burned, followed by
(2) Electrolyte solution – e.g. Hartman's or dextrose in normal saline – 1 cc x kg body wt. x per cent of body surface burned, followed by
(3) Dextrose in N/5 saline – 20 c.c.–30 c.c. x kg body wt. to cover normal daily requirements for insensible water loss and urine volume.

Chapter 8

Common Emergencies

In all paediatric emergencies, rapid and accurate diagnosis and treatment are most essential for a successful outcome. By the time the child reaches the hospital ward, many valuable hours have passed since the onset of the illness and so rapid action is essential. After taking the history and an early institution of therapy, as many further details as possible in the history of the illness should be obtained from the parents; blood and other material for necessary investigations should be obtained early on so that laboratory help can be mobilised to assist with diagnosis and control of treatment.

The unconscious child

Common causes of loss of consciousness are:

(1) Intracranial disorders, such as
(a) Trauma.
(b) Vascular conditions, e.g. haemorrhage, thrombosis embolism, etc.
(c) Infections, e.g. meningitis, encephalitis, thrombosis of venous sinuses due to extension of infection from the face or middle ear.
(d) Space-occupying lesions.
(e) Convulsive states.
(f) Hyperpyrexia.
(2) Systemic disorders affecting the C.N.S. secondarily, such as
(a) Metabolic – hypo or hyperglycaemia, uraemia or fluid/electrolyte disturbances.
(b) Poisons and toxins.
(c) Infections.
(d) Haemorrhagic diathesis.

During clinical evaluation of the child, the following signs should be looked for:

(1) *Increased intracranial pressure* as evidenced by a bulging fontanelle and enlargement of the head with separation of sutures.

(2) Signs of meningeal irritation.
(3) Eye signs, e.g. (a) pin-point or dilated pupils or unequal pupils. (b) conjugate deviations or nystagmoid movements of the eye.
(4) Presence of papilloedema or retinal haemorrhages.
(5) Paralysis, increased tone and altered reflexes.
(6) Full clinical examination, including blood-pressure.

TREATMENT

Oxygen should be administered as soon as possible.
Pharyngeal secretions should be aspirated and a patent airway maintained by nursing the patient on his side, by means of repeated sucking, and an oropharyngeal airway. If this is not successful a tracheostomy may be required.

Haemorrhage and shock should be treated.

A naso-gastric tube for feeding and administering drugs should be passed.

The following investigations should be done to elicit the cause of unconsciousness:

(1) Lumbar puncture and examination of C.S.F.
(2) Serum electrolytes.
(3) Blood urea.
(4) Blood sugar.
(5) Blood slide for malaria parasites.

Convulsions

Common causes of convulsions in older children are:

(1) Febrile convulsions – common in malaria, upper respiratory infections, pyelonephritis, measles and exanthem subitum.
(2) Intracranial infections – meningitis, encephalitis, cerebral abscess, venous-sinus thrombosis.
(3) Electrolyte disturbances – hyponatraemia, hypernatraemia.
(4) Metabolic disturbances – hypo or hyperglycaemia, uraemia or hypocalcaemia.
(5) Hypertensive encephalopathy.
(6) Poisons or toxins – lead, insecticides, for example.
(7) Vascular conditions, e.g. after trauma, in acute infantile hemiplegia, sickle-cell disease, etc.
(8) Cerebral degenerative disease.
(9) Congenital brain anomalies.
(10) Space-occupying lesions.
(11) Idiopathic epilepsy.

EMERGENCY TREATMENT

(1) Clear and maintain an airway.
(2) Protect the tongue.
(3) Administration of oxygen.
(4) Parenteral anticonvulsant therapy as paraldehyde (0.1 to 0.15 ml/kg) or phenobarbitone (4–10 mg/kg) or diazepam (Valium) 0.1 mg/kg.
(5) Emergency specific therapy like parenteral glucose or calcium if indicated.
(Investigations for convulsions are the same as those for coma.)

Meningitis

The older child will present with the classical picture of neck rigidity and other signs of meningeal irritation. These may be absent in the small infant and a full or bulging fontanelle may be the only positive sign.

Diagnosis is established by a lumbar puncture. The C.S.F. should be taken in two separate containers – one for the laboratory and for the side-room tests. If the C.S.F. is purulent a smear should be made for gram staining to see whether the infecting organism is gram positive or negative. If the C.S.F. is clear, it should be examined by Pandy's test, by gram staining, and for the presence of acid-fast bacilli.

Treatment is begun by control of convulsions. Intravenous drip of dextrose in N/5 saline is set up to provide 50 cc/lb body weight in twenty-four hours. 1 million units of crystalline penicillin is added to the drip, unless the organism in the C.S.F. has been found to be gram negative.

(1) For meningitis due to gram + ve organism:
(a) Penicillin – intravenous 1 million units 12 hourly for first two days.
– crystalline penicillin 250,000 units 6–8 hourly by intramuscular injection.
(b) Sulphadiazine – 200 mg/kg body wt. stat followed by 50/mg/lb body wt. in twenty-four hours daily.
(c) Chloramphenicol – 50 mg/kg daily.
(2) For meningitis due to gram – ve organisms:
(a) Ampicillin (50–100 mg/kg/day) or tetracycline (25–50 mg/kg/day) in intravenous drip.
(b) Sulphadiazine and Chloramphenicol as above.
(c) Streptomycin 25–100 mg/kg/day in two divided doses daily.

Lumbar puncture is repeated after 48 hours to evaluate the efficacy of therapy. If there is no general improvement and the C.S.F. does not show change towards normal, the therapy should be reviewed.

Cerebral malaria

The diagnosis is made when a child is admitted with fever, convulsions, or coma, heavy parasitaemia and a normal C.S.F.

Emergency treatment as for convulsions and coma is started.

An intravenous drip of dextrose in N/5 Saline to deliver 100 cc/kg in twenty-four hours is put up. Injection chloroquine 50 mg is administered SLOWLY through the drip; it is repeated after six hours if the blood slide is still positive.

Through the naso-gastric tube chloroquine is administered—200 mg stat and 100 mg eight-hourly until symptoms subside.

Congestive cardiac failure

In small infants the onset is often abrupt and should be thought of in all babies who present with sudden deterioration, or sudden onset of dyspnoea.

The consistent diagnostic signs are tachycardia (above 140/minute in infants), tachypnoea (above 60/minute in infants) and hepatomegaly. In infants and small children peripheral oedema is rarely seen; a more useful sign of water accumulation is rapid weight gain.

COMMON CAUSES OF CARDIAC FAILURE:

(1) Congenital heart disease.
(2) Endo-myocardial fibrosis.
(3) Rheumatic heart disease.
(4) Anaemic heart failure.
(5) Myocarditis of viral origin.
(6) Associated with pulmonary infection.
(7) Arrhythmias.
(8) Hypertension – renal disease, lead poisoning, corticosteroid therapy, idiopathic.

The treatment includes bed rest, salt restriction and oxygen if indicated.

Digoxin – total digitalising dose – 0.04 mg/kg–0.06 mg/kg. Half the total dose is given initially, and the remaining half over the next 12–24 hours. Daily maintenance dose is 1/3 to 1/5 of the digitalising dose.

Parenteral digitalising dose is 2/3 of the oral dose.

Diuretics – Inj. mersalyl 0.5 cc two to three times per week is adequate in most cases.

A child who is being treated for congestive failure should have pulse rate, blood pressure, liver size and body weight recorded daily.

Respiratory emergencies

LARYNGO–TRACHEO–BRONCHITIS

On admission

(1) Sedate with chloral hydrate.
(2) Administer humidified oxygen by a nasal catheter, rate of flow 3–4 L/minute.
(3) Start on Inj. crystalline penicillin 250,000 units stat and 6 hourly. Inj. streptomycin 1/4 gm stat and twice daily.
(4) Re-assess after one hour. If restlessness due to anoxia persists, if there is marked retraction in the intercostal, suprasternal and xiphisternal areas with little air entry on auscultation, TRACHEOSTOMY should be considered.
(5) Throat swabs should be taken for culture.

ASPIRATED FOREIGN BODY

Should be suspected when there is sudden onset of coughing, choking and dyspnoea in a person previously well.

X-rays of the chest should be obtained *promptly* and preparation for bronchoscopy should be done. It is particularly important to undertake prompt bronchoscopy after aspiration of nuts, peas, beans and foreign bodies of vegetable origin, because of the danger of mucosal oedema and onset of severe pneumonia.

BRONCHO-PNEUMONIA

At the beginning of treatment, a naso-pharyngeal swab should be taken for culture and isolation of causative organisms. Most cases of bacterial pneumonia in children are of pneumococcal origin in which case the drug of choice is penicillin.

Staphylococcal pneumonia should be suspected in newborns and infants, in malnourished children and in cases where there is a rapid progress of signs and toxicity. X-rays should be done urgently to determine the extent of the disease and to exclude pulmonary complications. Immediate treatment with methicillin 100 mg/kg body weight in twenty-four hours should be started.

BRONCHIOLITIS

It is seen chiefly in infants and is most frequent in those under six months of age. Following in the wake of upper respiratory infection, there is abrupt onset of respiratory distress, tachycardia and occasionally cyanosis.

Administration of oxygen, fluid and electrolytes is essential. The baby may be too ill for oral feeding and a naso-gastric tube may have to be passed. Superadded bacterial infection is common and Ampicillin 25 mg/lb body weight in twenty-four hours should be administered during the acute phase.

ACUTE ASTHMA

Management should be along the following lines:

(1) Epinephrine – 1:1000 solution dose 0.01 ml/kg (maximum dose 0.25 ml) given subcutaneously. May be repeated TWO more times at 20 minutes intervals. If there is no relief with epinephrine, the patient is in *status asthmaticus.* In which case, the following treatment is begun:
(2) *Fluids.* Evaluate state of hydration. In most severe cases dehydration of a moderate degree exists. Intravenous fluids, dextrose in n/5 saline, 40 ml–80 ml/kg body weight in twenty-four hours is started.
(3) *Aminophylline.* Ascertain that no aminophylline has been given in the out-patients or dispensary. 4 mg/kg may be added to the intravenous fluid to be administered over 12 hours. If no aminophylline has been given previously, half the calculated dose may be given directly through the rubber tubing of the drip, SLOWLY, over a period of 5–10 minutes. A dose of 4 mg/kg may be mixed with each 12 hourly fluid-bottle being administered to the patient.
(4) *Hydrocortisone.* To be used if:
(a) In previous attacks the patient has needed hydrocortisone.
(b) If with epinephrine and aminophylline as above there has been no improvement after 12 hours. 4.0 mg–5.0 mg/kg body weight intravenously every 12 hours.
(5) *Antibiotics.* A broad-spectrum antibiotic may be prescribed if any of the following indications are present:
(a) Obvious clinical infection.
(b) White cell count over 15,000 with fever.
(c) Severe asthma for more than twenty-four hours.
(6) Oxygen and humidity and sedation with chloral hydrate as required.

ACUTE PERIPHERAL FAILURE

Most commonly seen in gastro-enteritis but may also occur in overwhelming sepsis, e.g. gram-negative septicaemia or severe lung

infection. It may occasionally occur in susceptible children after injection of chloroquine.

Clinical features include onset of shock, weak pulse, unobtainable blood pressure, pallor or cyanosis.

The treatment should proceed as follows:

(1) Ensure a clear airway.
(2) Intravenous therapy with dextran, blood or Hartman's solution.
(3) Injection aramine (metaraminol) 1.25 mg–2.5 mg intramuscularly.
(4) Injection Hydrocortisone 25–100 mg intravenously.
(5) If no improvement in half hour, aramine may be given intravenously, as 0.1% solution adjusting the drip rate according to blood pressure.

Cardiac arrest

Seen after trauma, shock, poisoning, etc. There may be complete asystole or ventricular fibrillation. The child is pale with no pulse or heart sounds.

EXTERNAL CARDIAC MASSAGE should proceed as follows:

(1) Place the child on a firm surface on his back. With the flat of the hand on the sternum compress the heart rhythmically between sternum in front and the spine at the back, at a rate of 80–100 per minute.
(2) The airway should be maintained clear. Connect the child to oxygen supply by nasal catheter, delivering humid oxygen at 2 L–3 L per minute. If there is no spontaneous respiration, mouth-to-mouth respiration, at a rate of 20 per minute, should be commenced.
(3) Intravenous drip with dextran, blood or dextrose in normal saline should be started. Sodium bicarbonate may be given intravenously assuming a base deficit of 20 m. eq. (using the formula base deficit x 0.3 x wt. in kg = m. eq. of sodium bicarbonate).

Poisoning

The commonest poisoning in children is due to kerosene, medicinal substances like aspirin and barbiturates, insecticides and disinfectants.

Principles of management of accidental poisoning are:

(1) Remove the unabsorbed poison by means of stomach wash-out except in the case of corrosives or when only a small quantity of hydrocarbon has been swallowed.
(2) Identify the poison.

(3) Administer an antidote for the poison that may have been absorbed.
(4) Begin symptomatic treatment as indicated.

KEROSENE POISONING

The *symptoms* are those of aspiration pneumonia or C.N.S. depression. If more than 100 ml (4 ounces) have been ingested a stomach wash-out should be done, keeping the child in a position that will minimise aspiration.

If a small quantity has been swallowed, gastric lavage is avoided.

An X-ray of the chest is taken in all cases to exclude the presence of pneumonitis.

SALICYLATE POISONING

Toxicity occurs if the amount swallowed exceeds 0.15 mg/kg, the peak of toxicity being about four hours. The symptoms pass through two phases:

(1) Respiratory alkalosis – due to hyperventilation. This lasts a few hours only.
(2) Metabolic acidosis. Acidosis and ketosis may be associated with hypoglycaemia.

Treatment should be as follows:

(1) Gastric lavage. Keep specimen for police identification.
(2) Take blood for electrolytes and salicylate level.
(3) Administer intravenous fluids with dextrose in N/5 saline at the rate of 10–20 drops per minute. Inject 18 to 36 m. eq. of sodium bicarbonate intravenously over a five minute period.
(4) Collect all urine and examine for pH (with labstix or hemocombistix). If urine is not alkaline after 30 minutes repeat with 9 to 18 m. eq. of sodium bicarbonate.
(5) After the urine is alkaline, continue the infusion with 9 m. eq. of sodium bicarbonate per every 100 cc of fluids given.

BARBITURATE POISONING

Barbiturate poisoning causes coma and respiratory depression.

Treatment should be as follows:

(1) Gastric lavage. Keep specimens for police identification.
(2) Maintain clear airway.
(3) Support patient by intravenous fluids, and artificial respiration if necessary.

(4) Intravenous coramine may be given.
(5) Specific antidotes like megimide are not reliable and may be dangerous.
Excretion of absorbed barbiturate may be enhanced by diuresis.

D.D.T. POISONING

It causes vomiting, convulsions, incoordination and signs of C.N.S. depression.

Treatment should be as follows:

(1) Gastric lavage.
(2) Caffeine or sodium benzoate 0.25 mg given subcutaneously.
(3) Supportive therapy with intravenous fluids, oxygen, sedative.

ORGANIC PHOSPHATES POISONING

They are used widely as insectides, and act by inhibition of cholinesterase resulting in a pattern of parasympathetic stimulation.

Symptoms are headache, lachrimation, blurring of vision, respiratory distress and C.N.S. stimulation followed by depression.

Treatment should proceed as follows:

(1) Gastric lavage; keep specimen for police identification.
(2) Atropine sulfate – 0.5 mg given subcutaneously; repeat half-hourly until signs of atropine effect appear.

WARFARIN POISONING

Warfarin is used as a rodenticide. It is an anticoagulant and causes generalised haemorrhages.

Treatment should proceed as follows:

(1) Gastric lavage. Keep specimen for police identification.
(2) Vitamin K1 is the specific antidote. 10 mg–20 mg of water-soluble analogue of vitamin K should be given intravenously.
(3) Transfusion of fresh blood if indicated.

Emergencies in the newborn

RESPIRATORY DISTRESS

Tachypnoea of more than 50/min after the second hour of birth should be regarded with suspicion and investigations in the form of radio-

graphic examination should be arranged. Common causes of respiratory distress are:

(1) Gross pulmonary lesions like atelectasis, pneumothorax, massive aspiration or pneumonia.
(2) Idiopathic respiratory distress (Hyaline membrane disease) common in low birth weight babies, and babies of diabetic mothers.
(3) Congestive cardiac failure. The onset may be abrupt. Presence of tachycardia, tachypnoea and hepatomegaly should lead to the diagnosis of a cardiac cause.
(4) Extrapulmonary lesions like vascular rings, oesophageal atresia, micrognathia and choanal atresia.

All babies with respiratory distress should be fed by naso-gastric tube to avoid inhalation of milk; oxygen should be administered by a funnel or nasal catheter and antibiotic cover provided as a prophylaxis against lung infection.

HAEMORRHAGIC DISEASE OF THE NEWBORN

The tendency to bleed usually manifests itself between the second and fifth day of life, accompanied by petechiae or echymoses on the skin. Besides excessive loss of blood, life may be threatened by bleeding in vital organs.

On diagnosis, Inj. vit. K 2.5 mg is given and the haemoglobin and blood group are ascertained. 5 cc of the mother's serum is sent to the laboratory for cross-matching. If bleeding is excessive, a blood transfusion may be necessary.

If in addition to pallor there are signs of sudden collapse, adrenal haemorrhage should be suspected and intravenous hydrocortisone 25 mg twice daily should be given additionally.

CONVULSIONS

These may be due to any of the following causes:

(1) intracranial injury or hypoxia.
(2) Neonatal meningitis – a full fontanelle associated with fever and lethargy are indications for lumbar puncture or subdural tap.
(3) Hypoglycaemia – should be diagnosed if blood sugar is below 40 mg % in a full term and below 20 mg % in a low birth weight baby. On diagnosis 50% glucose 1–2 ml/kg is given intravenously followed by an intravenous drip of 15% glucose in N/5 saline at the rate of 75–100 ml/kg/day. Besides convulsions or twitching, hypoglycaemia may also present with lethargy, apnoeic spells, inability to feed or sudden change of colour.

(4) Hypocalcaemia – serum calcium is usually below 7 mg %. On diagnosis, calcium gluconate, 10% solution diluted 4 times with water to 2.5%, is given intravenously to deliver 30 mg/kg body weight.
(5) Pyridoxine deficiency – 5 mg given by intramuscular injection twice daily.

JAUNDICE

Raised levels of serum bilirubin are encountered in most newborns. Physiological jaundice is first seen on the second day and disappears within the week. Low birth weight and administration of drugs like sulphonamides, vitamin K salicylates, etc., may cause the physiological jaundice to be more intense and persist for more than one week.

Jaundice appearing in the first twenty-four hours of birth is serious and suggests haemolysis. Rhesus incompatibility is rare in tropical Africa and Asia, but A.B.O. incompatibility is occasionally seen. In all such cases the mother's and baby's blood groups should be ascertained. Baby's blood should also be examined for haemoglobin level and a peripheral smear should be made to look for reticulocytes, spherocytes and nucleated red cells. If the mother is Rh negative, her blood should be examined for Rh antibodies and a Coomb's test should be performed on the baby's blood.

Whenever blood group incompatibility is suspected, serial bilirubin estimations should be made on the baby's blood. An exchange transfusion is required to maintain the serum bilrubin below 20 mg per cent.

Sepsis in the newborn is also a common cause of jaundice and needs urgent treatment. Jaundice appearing for the first time in the second week of life may be due to hypothyroidism, galactosemia, atresia of the bile ducts or hepatitis. G–6–PD deficiency is a frequent cause of jaundice in neonatal life and should always be excluded in all male babies.

EXCHANGE TRANSFUSION

Exchange transfusion may be needed to maintain serum bilirubin levels below 20 mg per cent in cases of haemolytic disease of the newborn. In the case of rhesus incompatibility, antenatal diagnosis of sensitisation of the baby's cells is possible; this is not so in cases of A.B.O. incompatibility.

The indications on cord blood will be as follows:

(1) Cord blood haemoglobin level below 14 gm per cent.
(2) Positive direct Coomb's test.
(3) Unconjugated bilirubin level of 4 mg per cent and above.

If the condition has not been suspected antenatally and no cord blood is available the following guidelines are used as criteria for further investigations:

(1) Jaundice appearing in the first twenty-four hours of life.
(2) A rise of serum bilirubin level more than 1 mg per cent per hour.
(3) Serum bilirubin level of 12 mg per cent and above at the initial examination. Such a baby should have daily serum bilirubin estimations until it has fallen below 10 mg per cent.

If the initial serum bilirubin level is 18 mg per cent or above, twice daily bilirubin estimations should be made until the level falls below 12 mg per cent.

Blood should be taken from both the mother and the baby for the cross-match. For Rhesus incompatibility, group O Rh negative blood is used to carry out the exchange; in A.B.O. incompatibility haemolysin free group O blood is required.

The procedure is carried out in the operating theatre with full aseptic precautions. The infant should be sedated, well restrained and on an empty stomach. A feeding bottle containing a few ounces of 5 per cent glucose water should be available as pacifier if required.

Volume of donor blood required is 150 ml/kg body weight and not to exceed 300 ml/kg body weight at any one exchange.

NEONATAL TETANUS

On diagnosis, the spasms are controlled with Inj. Paraldehyde 0.2 ml/kg or Inj. Phenobarbitone 4 mg/kg and a naso-gastric tube is passed.

Inj. A.T.S. 40,000 units intramuscular stat is given and 5,000 units are infiltrated in the tissues around the umbilical stump.

The cord stump is cleansed with savlon solution 1 in 200 or $\frac{1}{2}$ per cent Hibitane in spirit.

Inj. crystalline penicillin 125,000 units is administered twice daily for two days followed by Inj. procaine penicillin 200,000 units daily for 1 week.

Sedation and control of spasms is maintained with phenobarbitone 6–12 mg/kg body weight in 24 hours divided in four equal doses at 6 hourly intervals (average 15–30 mg at 6 a.m., mid-day, 6 p.m., mid-night) to alternate with diazepam 2–8 mg/kg in 24 hours. (Average diazepam 2–4 mg at 9 a.m., 3 p.m., 9 p.m., 3 a.m.)

Dose of phenobarbitone to be adjusted according to sedation required and of chlorpromazine or diazepam according to control of spasms.

Chapter 9

The Newborn

The following information should be obtained in the case of all newborns admitted to the nursery or hospital wards:

(1) Previous history of abortions, stillbirths, neonatal disease.
(2) Maternal health during pregnancy.
(3) Whether antenatal care was given and how many total visits were made to the clinic.
(4) History of bleeding, toxaemia, hydramnios.
(5) Early rupture of membranes or prolonged leakage of liquor.
(6) Mechanical factors at delivery.
(7) Foetal distress, and response to resuscitation.
(8) Colour of the baby at birth, whether it cried well at birth and whether suckling.

Care in the labour room

(1) As soon as the head is born, the upper air passages should be cleared by gentle swabbing and suction.
(2) Oxygen should be available for administration by nasal catheter (rate 1–2 litres/minute) or by face mask (rate 2–4 litres/minute). The baby should be under constant observation until respiration is fully established.
(3) The cord is cut when all pulsation has ceased and after 'milking' it towards the baby. The baby is held at or below the level of the placenta during this time. The cord is tied securely in two places by a sterile tape. The number of vessels in the cord stump is noted.

Apgar score

The apgar score is taken at 1 minute and again at 5 minutes after birth. A score of 10 indicates an infant in the best possible condition; a score below 5 needs prompt action. (See table 34.)

TABLE 34 The apgar score

	0	1	2
Heart rate	Absent	Below 100/min	Over 100/min
Resp. effort	Absent	Slow, regular	Good cry
Muscle tone	Limp	Some flexion of extremities	Active motion
Reflex irritability	No response	Some motion	Cry
Colour	Blue or pale	Body pink–extremities blue	Completely pink

A simpler method of assessment takes into consideration only the time taken to establish respiration:

(1) Class A – cried at birth.
(2) Class B – delay of 2 minutes before onset of respiration.
(3) Class C – delay of 5 minutes.
(4) Class D – delay of 10 minutes or more.

Infant resuscitation

This is required in all babies who fail to breathe at birth and in all those whose one-minute apgar score is below 5.

Equipment required comprises mucus catheters, laryngoscope with infant blade, infant goudel airways of size 0 or 00, endotracheal tube, oxygen-delivering apparatus, and syringes.

Drugs required are Nikethamide, Nallorphine, Vandid.

(1) At birth: Note the time; clear nose, mouth and pharynx (and also stomach in hydramnios, diabetes and after caesarean section).
(2) Apnoea 1 minute: Oxygen by funnel – 4 litres/min. Vitamin K 1 mg intramuscularly. Nallorphine 0.25 mg if respiratory depression due to morphine analogue.
(3) Apnoea 2 minutes: Nasal oxygen – 2 l/min Nikethamide 0.5 ml to be put on the tongue a few drops at a time.
(4) Apnoea 3 minutes: Mouth-to-mouth breathing; cardiac massage.

If the baby was born asphyxiated, with no heart beat and respiration, proceed with step (4) above.

After resuscitation, all babies who had mouth-to-mouth breathing should be given Inj. streptomycin l/20 gm daily for three days.

Criteria for admission to the nursery

Except where nursery care is required, all babies should accompany their mothers on discharge from the labour ward. The following groups of babies are selected for nursery care:

(1) Low birth weight babies.
(2) Abnormal presentations, e.g. breech or face presentation.
(3) Instrumental deliveries.
(4) Illness in the mother, e g. pre-eclamptic toxaemia, diabetes or mental confusion.
(5) Infections in the mother, e.g. fever or tuberculosis.
(6) Mothers who had no antenatal care (unbooked cases) or babies born before arrival (B.B.A.).
(7) Mothers with post-partum complications.
(8) Babies with signs and symptoms of disease in the early neonatal period.

Nursery care will involve the following:

(1) On admission, the antenatal and obstetric data are recorded and a clinical evaluation of the baby's state is carried out.
(2) Injection vitamin K 2.5 mg is administered.
(3) The baby is sponged with savlon solution 1:200.
(4) Breast-feeding should be insisted upon for all babies admitted to the nursery. If a mother has no milk, pooled expressed breast milk from other mothers is utilised for feeding.

Care of low birth weight baby

Any baby weighing less than 4 lb 8 oz at birth is designated as low birth weight and should be given special care and attention. Such a baby may experience difficulty in adjusting to extrauterine life because of the following handicaps:

(1) Inability to regulate body temperature.
(2) Weak respiratory muscles; poor cough reflex.
(3) Physiological and biochemical immaturity of organs.
(4) Inability to maintain caloric and fluid requirements.
(5) Poor resistance to infection.

Special care given to the low birth weight baby will include the following:

(1) Environmental heat – nurse in a heated room. Hot water bottles are dangerous and should be avoided; electric wall heaters or a boiling kettle in one corner of the room are usually enough in a warm climate. Room temperature should be maintained between 85°F–90°F.
(2) Environmental humidity.
(3) Avoid physical exhaustion by minimal handling.
(4) Establishment and maintenance of respiration. Apnoeic spells, cyanotic attacks and respiratory distress are more common in the low birth weight baby. Concentrations of oxygen above 40 per cent are dangerous, but can rarely be achieved when oxygen is administered by a funnel or nasal catheter.
(5) Management of feeding. In all low birth weight babies early institution of oral feeds (within 12–16 hours of birth) should be the rule. If the suckling and swallowing reflex is present (as judged by presence of well-developed Moro reflex and Glabellar Tap reflex) the baby should be breast-fed followed by supplementation with expressed breast milk, 20 ml–30 ml, depending upon the size of the baby. If the suckling and swallowing reflex is absent, the baby should be tube-fed with expressed breast milk 30 ml every 3 hours. After the first week, the baby should be given oral iron in the form of colloidal iron drops twice daily.
(6) Protection from infection – rigid isolation precautions and care in handling are necessary.

Major symptoms of the newborn period

CYANOSIS

Peripheral cyanosis is common in the neonatal period. If the cyanosis is central, e.g. involving the mucous membrane of the mouth, the lips or the ear lobes, prompt action should be taken for diagnosis and treatment.

If it is *not associated with respiratory effort* the most likely cause is involvement of the *respiratory centre*, that is, immaturity of the centre as in the premature baby or depression of the centre by drugs or intracranial trauma. If the above causes are excluded and the baby is not limp, one should consider congenital heart disease or abnormality of the haemoglobin, such as methaemoglobinaemia or sulfhaemoglobinaemia.

If cyanosis is *associated with respiratory effort* pulmonary cause is most likely, that is, hyaline membrane disease, massive aspiration,

atelectasis, pneumothorax lobar emphysema, pneumonia, etc., and should be promptly excluded by means of chest X-rays. Congenital cardiac lesions may also be the cause of cyanosis associated with respiratory distress especially if tachycardia (heart rate above 140/min), tachypnoea (respiratory rate above 50/minute) and hepatomegaly coexist. Finally, developmental lesions needing prompt surgery may be the underlying cause of cyanosis, e.g. choanal atresia, oesophageal atresia, and diaphragmatic hernia. These could be excluded by checking the patency of the airway, by passing a naso-gastric tube to the stomach and by chest X-ray either plain or after feeding a small quantity of a contrast medium like hyopaque or lipiodol.

PALLOR AND HAEMORRHAGE

Bleeding from one monozygotic twin into another, into maternal circulation, or from the foetal side of the placenta masquerading as post-partum haemorrhage may be the cause of anaemia in the early neonatal period. *Haemorrhagic disease* of the newborn can produce haemorrhage into the gut lumen or in an internal organ, and is usually accompanied by skin manifestations. Such a bleeding tendency may be life-threatening because of blood loss or because of bleeding in a vital organ.

Anaemia may also be present in haemolytic states and often may be its sole manifestation.

Occult bleeding in hiatus hernia or infection (e.g. renal infection) should be looked for in cases of unexplained anaemia in the newborn period.

JAUNDICE

Jaundice becoming manifest in the first 24 hours of life is usually due to *haemolysis* and needs careful investigation for its cause. The blood groups of the baby and the mother, if not known, should be determined immediately and the haemoglobin and serum bilirubin estimations should be made on the baby's blood. Presence of reticulocytes, nucleated red cells and spherocytes in a thin smear drawn from the baby's blood confirms haemolysis.

Physiological jaundice appears usually on the second day and does not last more than one week, except in babies of low birth weight or where drugs like vitamin K, sulpha, chloramphenicol salicylates, etc., have been administered.

Any jaundice appearing for the first time in the *second week of life* needs careful investigation and treatment. Sepsis, congenital syphilis,

hepatitis, galactosemia, hypothyroidism, atresia of the bile duct and G–6–PD deficiency should all be excluded by relevant tests. (Also see page 63.)

TWITCHING AND CONVULSIONS

These are commonly due to cerebral anoxia or intracranial trauma occurring during delivery. Such babies should be handled as little as possible and should be sedated with chloral hydrate 30–60 mg twice daily. It is important to exclude potentially serious conditions like neonatal meningitis, hypoglycaemia, hypocalcaemia, and pyridoxine dependent convulsions.

Neonatal meningitis is suspected if there is a full or bulging fontanelle. There may be no other sign. Lumbar puncture is the only sure method of diagnosis. Gram-negative organisms are often the cause of meningeal infection and pending results of bacterial culture on the C.S.F. therapy should be started with a combination of penicillin, streptomycin, sulfadiazine and chloramphenicol.

Hypoglycaemia is diagnosed if two successive blood sugar estimations are below 40 mg per cent. On diagnosis 50 per cent glucose, 1–2 cc/kg is given intravenously followed by an intravenous drip of 15 per cent glucose in N/5 saline or water at the rate of 75–100 ml/kg/day.

Hypocalcaemia is rare in breast-fed babies. Spasms occur when serum calcium is below 7 mg per cent. On diagnosis, calcium gluconate is administered by slow intravenous injection – 0.3 cc/kg. of a 1 per cent solution which is diluted with thrice the quantity of water for injection before administration. (Also see page 63.)

VOMITING

Vomiting in the first few days of life is common and is usually due to swallowed liquor or blood.

If vomiting occurs with failure to pass meconium and with abdominal distension, intestinal obstruction should be suspected and plain X-rays of the abdomen, antero-posterior and lateral, in the erect position should be taken for confirmation of diagnosis.

When vomiting is first noted in the baby a naso-gastric tube should be passed and the stomach emptied of the contents. If swallowed liquor has been the cause, this procedure will help to stop any further vomiting. If at the first emptying of the stomach more than 50 ml of fluid is obtained, and especially if the fluid is bile-stained, intestinal obstruction should be considered as the most likely cause.

Chapter 10

Infectious Diseases

Swabs for culture

The media should be inoculated within half an hour of taking the sample. Dried swabs are useless for identification by gram staining and may be useless for culture.

(1) Tonsilitis, pharyngitis: swab directly from the lesion. Avoid contamination with saliva.
(2) Pneumonia, bronchitis, upper respiratory infections: Culture material should be obtained from the posterior nasopharynx on a small swab passed through the nostril until it hits the posterior wall. Leave it for about half a minute and twirl before taking out.
(3) Laryngitis: A post-nasal swab or a swab obtained by direct laryngoscopy.
(4) Dysentery, gastro-enteritis: Freshly passed stools should be plated. If the stool specimen has been kept too long, the causative organism may be missed.

Serological tests

WIDAL TEST

80 per cent of patients show a positive widal test during the 2nd week and 95 per cent by 4 weeks. Anti–O (somatic) antigens are more diagnostic than anti-H (flagellar) antigens. A progressive rise in titre suggests active infection.

(1) Anti–O titre of 1:60 or more is diagnistic.
(2) Anti–H titre of 1:80 or more is diagnostic.

In vaccinated persons, if over six months have passed since the date of vaccination and if the anti–O titre is above 1 in 100, the result is significant.

TABLE 35 Infectious diseases – isolation and preventive measures

Disease	*Incubation period*	*Period of infectivity of patient*	*Period of infectivity of contacts*	*Preventive or therapeutic measures*
Measles	10 days to onset of symptoms, 14 days to onset of rash. May be prolonged if gamma globulin given	2 weeks, and until free from discharge from eyes or nose	14 days	Gamma globulin useful within five days of exposure. Dose 0.2 ml/kg
Chicken pox	Up to 21 days	2 weeks	21 days. Exclusion from school not advised	In high risk patients gamma globulin given. Dose 0.3 ml –0.6/kg
German measles	14–21 days	7 days	Exclusion from school not advised	Gamma globulin 0.3–0.4 ml/kg for pregnant female contacts
Mumps	17–21 days	2 weeks, after swelling of parotids has subsided	Not excluded from school	
Whooping cough	7–14 days	4 weeks after symptoms have subsided	21 days	Upon exposure tetracycline and active immunisation may help. Gamma globulin of no proven value
Infectious hepatitis	14–40 days for infectious hepatitis; serum hemologus jaundice 60–120 days	6 weeks from onset of symptoms	3 weeks after onset of symptoms in patient	Gamma globulin 0.06 ml/kg
Poliomyelitis	14 days	3 weeks	14 days after onset of symptoms in patient	Gamma globulin 0.3 ml/kg

TABLE 36 Immunisations

Vaccine	*STORAGE*		*DOSE*		*Method*	*Age (minimal)*	*Interval (range)*	*Repeat*
	Main	*Transport*	*Min.*	*Optimum*				
D.P.T. (absorbed)	Lower part of refrigerator	Cold boxes with gel bags (or large thermos)	0.5 ml x 2	0.5 ml x 3	Intramuscular (lateral thigh)	1 month	1–3 months	18 months and school entry
SMALL-POX (freeze-dried)	Lower part of refrigerator	Cold boxes with gel bags (or large thermos) *Protect from light*	x 1	x 1	Multiple pressure	Birth–1 month	–	School entry
B.C.G. (freeze-dried)	Lower part of refrigerator	(as for smallpox)	x 1	x 1	Intradermal syringe or heaf gun	Birth	–	School entry
POLIO (oral trivalent)	Lower part of refrigerator	Cold boxes with gel bags (or large thermos) *Protect from light*	3 drops orally x 2	3 drops orally x 3	Oral drops	1 month	1–3 months	School entry
MEASLES (live attenuated)	Lower part of refrigerator	*Protect from light*		1000 tcd x 1 subcutaneously	Subcutaneous injection	9 months	–	–

BRUCELLOSIS

Agglutination test is considered positive if agglutination occurs in a dilution of 1:100 or more. Positive agglutination tests are obtained in the 2nd week of infection and may remain so for months or years.

The absolute proof of active brucella infection is isolation of the organisms from the blood or body fluids. Daily blood cultures for several days may be necessary.

Weil-Felix reaction–proteus agglutination

The results of Weil–Felix reaction should be interpreted strictly in relation to clinical findings – a positive reaction may be obtained in malaria, tuberculosis and infectious mononucleosis.

Proteus Ox 19 is useful in routine study since it will become positive earlier in the disease than the other tests, like complement fixation and rickettsial agglutination tests.

Positive reaction with Proteus Oxk is specific for scrub typhus. All proteus reactions are negative with Q fever.

Antistreptolysin–O titre

After acute streptococcal infection, the A.S.O. titre in the serum begins to rise in 1 week and is maximal in 3–5 weeks. It falls to the initial level in 6–12 months. Hence a rising titre or a high titre is taken as an indication of recent streptococcal infection. Normal range is 166–250 units.

Appendix I Drug Dosage in Tropical Diseases

Clinical diagnosis	*Drugs*	*Dosage*	*Notes*
Clinical malaria	Chloroquine	Oral tablets, 1 tablet = 200 mg base 0–1 yr: $\frac{1}{4}$ tab. daily for 2 days 1–5 yr: $\frac{1}{2}$ tab. daily for 3 days 5–10 yr: 1 tab. daily for 3 days Over 10 yr: 2 tab. daily for 3 days	
Cerebral malaria	In. Chloroquine	Subcutaneous injection 5 mg/kg/dose to be repeated after 6 hours if necessary.	In small children parenteral chloroquine is rapidly absorbed and may cause fatal collapse.
	Inj. Quinine	Not to exceed 5 mg/kg as single dose.	Preferred by intravenous route, well diluted, at a rate not exceeding 60 mg/minute.
Malaria prophylaxis	Chloroquine	Weekly or half the dose twice weekly. 0–1 yr: 50 mg 1–5 yr: 50 mg–150 mg 6–15 yr: 150 mg–300 mg	Tablets containing 50 mg and 150 mg of the base available.
	Proguanil	Daily 0–1 yr: 25–50 mg 1–5 yr: 50 mg 6–15 yr: 50 mg–200 mg	Tablets of 100 mg available.

APPENDIX I (*continued*)

Clinical diagnosis	*Drugs*	*Dosage*	*Notes*
Amoebic dysentery	Inj. Emetine for three days	Daily not to exceed 0–3 yr: 10 mg 3–6 yr: 20 mg Adult: 60 mg	Strict confinement to bed essential during treatment, and 3 days after treatment.
	then Flagyl	400 mg–800 mg for one week.	Flagyl acts against invasine intestinal disease, hepatitis, and other forms of extra–intestinal disease and also in the case of the symptomless cyst passers.
Amoebic hepatitis	Inj. Emetime then Chloroquine	Dose as above for a maximum of 9 days. 2 Tablets (0.3 gm base) daily for 21 days.	
Schistosomiasis	Inj. Sodium Antimony tartarate	Given i.v. dissolved in 5 to 10 ml of pyrogen-free water, on alternate days. Starting with 15 mg the dose is increased by 15 mg until a maximum of 60 mg is being given. Total dose of 500 mg–1000 mg required for cure.	Tissue irritation or necrosis can occur if there is leakage. Check literature before use.
	Inj. Astiban	I.M. in a course of 4–5 injections on alternate days. Total dose of 1.5 gm.	Check literature before use.
	Ambilhar	25 mg/kg daily for 5–7 days.	Blood counts should be done regularly if treatment is prolonged for over 7 days. Not to be administered with Isonex.

APPENDIX I (*continued*)

Clinical diagnosis	*Drugs*	*Dosage*	*Notes*
Filariasis	Diethylcarbamazine (Banocide)	6 mg/kg in three doses daily for 2–4 weeks.	Effective against w. bancrofti, loa loa and w. malayi infestation. Adult worms of most species also affected but less readily than microfilariae. Fever, pruritus, arthralgia and other allergic reactions during treatment may need antihistamines for control.
Tropical pulmonary Eosinophilia	,,	,,	Now believed to be an allergic reaction in the lungs to dead microfilariae.
Guinea worm	Diethyl carbamazine (Banocide)	6 mg/kg in three doses daily for 2–4 weeks.	Effective against immature forms of the worm, and in maximal doses even against adult worms. When an ulcer has appeared, the worm should be removed by gentle traction and massage or by incision.
Ankylostomiasis	Tetrachlorethylene	0.2 ml for each year of life.	Bephenium is more effective against A. duodenale than against Necator americanus.
	Bephenium (Alcopar)	Over 2 years, 1 packet (equals 2.5 gm of base). Under 2 years or weight less than 10 kg, half the dose.	Repeat doses are required with both the compounds for total eradication of the parasites. A combination of the two drugs given simultaneously reduces the number of repeat doses required.
Ascariasis	Piperazine Elixir	Children weighing less than 20 kg—24 ml.	
Enterobiasis (threadworm)	Viprynium emboate (Vanquin)	5 mg/kg body weight as a single dose.	
	Piperazine	Single dose as above.	The whole household should be treated to prevent reinfection.

APPENDIX I (*continued*)

Clinical diagnosis	*Drugs*	*Dosage*	*Notes*
Trichinosis (whipworm)	Dithiazahine iodide (Telmid Delvex)	0.2 mg three times daily (under 5 yrs of age, 50 mg four times daily)—for 21 days.	
Strongyloidiasis	Dithiazahine iodide (Telmid Delvex)	0.2 gm three times daily (under 5 yrs of age—50 mg four times daily)—for 21 days.	
	Thiabendazole (Mintezol)	25 mg/kg body weight on two successive days.	
Tapeworms (T. Solium)	Niclosamide salicylamide (Yomesan)	Before breakfast, one tablet (0.5 g) is chewed and swallowed with a few sips of water. 1 hr later a further tablet is chewed.	Causes disintegration of the worms, and so scolex may not be identified. For same reason may be dangerous in T. Saginatum (pork tapeworm).
Leprosy	Dapsone	Administered twice a week each dose 1st and 2nd week: 6—12 mg 3rd and 4th week: 12—25 mg 5th and 6th week: 18—37 mg 7th to 10th week: 25—50 mg Thereafter: 50—100 mg. Children under 6 are given the smaller dose; the larger dose is for children between 6—12 years.	To avoid toxic effects the dose should be built up gradually; coexistent anaemia and malnutrition should receive treatment.

Appendix II

Dosage of Drugs in the Newborn Period

Drug	*Route*	*Dose* (Premature infants)	*Dose* (Full-term infants)
Atropine (pre-operatively)	S.C.	0.065 mg	0.1 mg
Calcium gluconate 5%	I.M. / I.V.	1–2 ml	2–4 ml
Chloral hydrate (anticonvulsant)	oral	60 mg/kg/ dose	60 mg/kg/dose
Cortisone acetate	oral / I.M.	5–10 mg/day	10–20 mg/day
Pentobarbitone	oral / rectal	5 mg/kg dose	5 mg/kg dose
Phenobarbitone	oral / I.M.	8 mg	16 mg
Prednisone Prednisolone	oral	1–2 mg/day	2–5 mg/day
Vitamin K[1] Phytomenadione)	I.M.	0.5–1 mg once only	1–2 mg once only
Nalorphine HBr Nalorphine must be used only as an antagonist to opiates. It is not in itself a respiratory stimulant and in fact has a depressant effect.		0.2 mg/kg I.V. – repeat in 60 seconds if maternal sedation has been heavy and the response poor. When opiates have been given to the mother, inject 0.5–1 mg into the umbilical vein.	

Appendix III Dosage of Some Important Drugs*

Drug	*Route*	*Dose*	*Notes*	*Proprietary Name*
Adrenalin 1:1000	S.C.	0.012–0.015 ml/kg/ dose	May be repeated in 30 mins. In *status asthmaticus*, 0.05 ml every $\frac{1}{2}$–1 min. until relieved.	
Aminophylline	I.M.	3 mg/kg/8 hrs	Avoid concurrent use of ephedrine.	
	oral	5 mg/kg/8 hrs		
	rectal	7 mg/kg/8 hrs		
Amylobarbitone	oral	1.5–3 mg/kg	Minimum hypnotic dose.	'Amytal'
	I.M. / I.V.	6 mg/kg	Anticonvulsant dose. Double if necessary. CAUTION	
Aspirin	oral	10–15 mg/kg	Should not be used in infants under twelve months. Maximum single dose 600 mg. In rheumatic fever, initial dose 120 mg/kg/day (not more than 4g) and reduce after few days. Calcium aspirin – $\frac{1}{2}$ dose.	
Bephenium	oral	Under 2 years: 2.5 g Over 2 years: 5 g	For hookworm: single morning dose for one day. If diarrhoea present 3 such doses in one day or single daily doses for 4–7 days. Purging not necessary.	'Alcopar'

* When doses are calculated by weight, the maximum should not exceed that for a 50 kg patient. Unless otherwise specified, the doses given refer to single dose only.

APPENDIX III (*Continued*)*

Drug	*Route*	*Dose*	*Notes*	*Proprietary Name*
Calcium EDTA	I.M.	30–75 mg/kg/day	Give for 3–5 days, rest 2–3 days, give for 3–5 days further. Check pH in urine. Mix with procaine for injection.	'Versenate'
Chloral hydrate	oral	30–50 mg/kg/day	Sedative 4 or 6 hrly divided doses.	
		15–20 mg/kg	Usual single dose.	
		40 mg/kg	Maximum single dose.	
			CAUTION in large or repeated doses.	
Chlorothiazide	oral	250 mg	Infant, once or twice daily.	'Saluric'
		500 mg	Child, once or twice daily.	
Chlorpheniramine	oral	0.2 mg/kg/day	In 3 to 4 divided doses.	'Piriton'
Chlorpromazine	oral I.M.	0.5–1 mg/kg 0.5 mg/kg	May be given 4 to 6 hourly.	'Largactil'
Morphine sulphate	S.C.	0.15–0.2 mg/kg	Max dose 15 mg. CAUTION in small infants	
Nalorphine	I.M. I.V.	0.2 mg/kg	Max dose 10 mg.	'Lethidrone'

* When doses are calculated by weight, the maximum should not exceed that for a 50 kg patient. Unless otherwise specified, the doses given refer to single dose only.

APPENDIX III (*Continued*)*

Drug	*Route*	*Dose*	*Notes*	*Proprietary Name*
Paraldehyde	I.M.	0.1–0.15 ml/kg		
Pentobarbitone	oral	3–6 mg/kg	Hypnotic dose.	'Nembutal'
	I.V.	4–6 mg/kg	Dilute in 2–10 ml water. CAUTION: Inject slowly and observe for respiratory depression.	
Pentolinium	S.C. / oral	0.1 mg/kg	Increase dose according to response.	'Ansolysen'
Pethidine	oral / I.M.	0.6–1.5 mg/kg	Single analgesic dose. Max. single dose 75 mg.	
Phenindione	oral	First day: 2.75 mg/kg/day / Second day: 1.5 mg/kg/day	Then according to prothrombin activity.	'Dindevan'

* When doses are calculated by weight, the maximum should not exceed that for a 50 kg patient. Unless otherwise specified, the doses given refer to single dose only.

APPENDIX III (*Continued*)*

Drug	*Route*	*Dose*	*Notes*	*Proprietary Name*
Phenobarbitone	oral	0.5–2 mg/kg	Sedation. Repeat 4 to 6 hourly.	
	oral	3–6 mg/kg	Hypnotic dose.	
	I.M.	4–10 mg/kg	Anticonvulsant dose.	
Piperazine	oral	100 mg/kg	For ascariasis: single morning dose for one or two days.	
	oral	50–70 mg/kg	For Oxyuriasis: once daily for 7 days.	'Antepar'
Probenecid	oral	First dose 25 mg/kg then 30–40 mg/kg/day	Given in 6-hourly divided doses. Salicylates must not be given concurrently	'Benemid'
Promethazine HCl.	oral	0.5–1 mg/kg	Single dose at night.	'Phenergan'
Reserpine	I.M.	0.07 mg/kg	Repeat in 4 to 6 hours as necessary.	'Serpasil'
Spironolactone	oral	1.5–3 mg/kg/day	Given orally 6-hourly in divided doses.	'AldactoneA'
Urea	oral	50–200 mg/kg	Diuretic dose.	
	I.V.	1–1.5 g/kg	For cerebral decompression. May be given orally in the same dose daily.	

* When doses are calculated by weight, the maximum should not exceed that for a 50 kg patient. Unless otherwise specified, the doses given refer to single dose only.

Appendix IV Dosage of Principle Antibiotics and Chemotherapeutic Agents

Drugs	*Orally*	*Intramuscularly*	*Intravenously*	*Notes*
Penicillin G (crystalline)	– –	Minimum doses–0–1 year: 100,000 U 6 hourly. Over 1 year–250–500,000 U. hourly.	According to the severity of the infection and the sensitivity of the organism.	–
Penicillin V (phenoxymethyl penicillin) and Phenethicillin	0–1 year: 60 mg 4–6 hourly 1–5 years: 125 mg 4–6 hourly Over 5 yrs: 250–500 mg 4–6 hourly	–	–	May be increased if tolerated.
Methicillin	–	100 mg/kg/day given 4–6 hourly.	100 mg/kg/day given 4–6 hourly.	Higher doses may be given.
Cloxacillin	100 mg/kg/day given 4–6 hourly	100 mg/kg/day given 4–6 hourly.	–	Higher doses may be given.
Ampicillin	50–100 mg/kg/day given 4–6 hourly	50–100 mg/kg/day given 4–6 hourly.	50–100 mg/kg/day given 4–6 hourly	Higher doses may be given.
Sulphadimidine	200–400 mg/kg/day	–	200 mg/kg/day given 6 hourly.	–
Chloramphenicol	50–100 mg/kg/day	50–100 mg/kg/day	50–100 mg/kg/day	In neonatal period; for full-term: 50 mg/kg/day; premature: 25 mg/kg/day.

APPENDIX IV (*Continued*)

Drugs	*Orally*	*Intramuscularly*	*Intravenously*	*Notes*
Erythromycin	50–100 mg/kg/day	–	50–100 mg/kg/day	–
Framycetin	50–100 mg/kg/day	–	–	–
Fusidic acid	20–30 mg/kg/day	–	20–30 mg/kg/day	–
Isoniazid	10–20 mg/kg/day	–	–	Pyridoxine 25–50 mg/day should be given concurrently.
Kanamycin	–	15–50 mg/kg/day given 6 hourly	–	Ototoxic and nephrotoxic.
Neomycin	50–100 mg/kg/day	–	–	Not absorbed.
Nitrofurantoin	5–8 mg/kg/day, up to 10 mg/kg/day in refractory cases	–	6 mg/kg/day given 12 hourly	–
Nystatin	100,000–500,000 U given 6 hourly	–	–	Not absorbed.
P.A.S.	0.2–0.36 g/kg/day	–	–	–
Streptomycin	–	25–100 mg/kg/day	–	–
Tetracycline	25–50 mg/kg/day	25–50 mg/kg/day	25–50 mg/kg/day as 0.1% solution, very slowly.	–
Vancomycin	–	–	40 mg/kg/day	Intermittent or continuous intravenous infusion.

Index