

Treatment of Severe Protein Deficiency in
Children (Kwashiorkor)

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IT IS NOW well recognized that severe protein malnutrition in children is an almost universal problem in the so-called underdeveloped areas of the world. It occurs most frequently in the young child soon after weaning due to the failure of the parents to introduce proper complementary feeding and to provide an adequate substitute for the protein of breast milk after weaning.

When, despite a lack of adequate protein in the diet, the child receives sufficient calories from sugar and starchy foods, the result is "classic" or "sugar baby" kwashiorkor. Only a very few of the many areas in which protein malnutrition in children is a serious problem report this type; far more frequently there is also an acute or chronic deficiency of calories and the combined deficiency produces the so-called marasmic type of kwashiorkor. The former represents an easier treatment problem since subcutaneous fat is well retained and marked tissue wasting is not present. A diet rich in protein of high biologic value readily

cures it without much need for supporting measures.¹

Neither of the two conditions should be confused with simple starvation or marasmus which represents a different etiopathogenic problem. Marasmus occurs when there is a severe dietary deficiency of both protein and calories; the child does not show the loss of enzyme activity, apathy, and anorexia found when the deficiency of protein is more marked than that of calories. Perhaps the starved child has been living on its own tissues and in this sense has been consuming protein of good quality. At any rate there is increasing evidence that there are important physiologic and biochemical differences between kwashiorkor in any form and classic marasmus.¹ The treatment of the ordinary case of marasmus is essentially the same as that for mild kwashiorkor without serious electrolyte imbalance and will not be discussed further in this paper.

The marasmic form of kwashiorkor is also associated with severe tissue wasting and loss of subcutaneous fat and generally shows dehydration despite the edema.²⁻⁶ Moreover, these cases are likely to have an infection which has helped to precipitate the acute form of the disease. Treatment in these cases becomes a far more complex problem, involving restoration of fluid and electrolyte balance and combat of infection, as well as refeeding. In Central America, as in most other areas in which kwashiorkor is prevalent, the "classic" form is almost never seen. The present paper outlines the management of cases of marasmic kwashiorkor with the observation that in "classic" cases many of the measures indicated may be unnecessary. No detailed description of the characteristics of kwashiorkor is attempted, since these have been adequately reviewed.^{7,8} Similarly, the biochemical responses to treat-

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ment have been reported in detail elsewhere,^{9,10} and the problems of prevention extensively discussed.^{11,12}

GENERAL MEASURES

Children with kwashiorkor are very susceptible to infection and should be separated from other patients on admission to the hospital to protect them from cross infection. As compared with the recovery of children admitted to a large open ward, the relative isolation provided by individual cubicles in small hospital wards improves the rate of recovery of kwashiorkor patients, even without the introduction of strict isolation technic.¹⁰

The skin of the child with kwashiorkor is likely to be excoriated and to require good nursing care to control secondary infection of the involved areas. If the child's position is not frequently changed, decubitous ulcers are likely to develop and bronchopneumonia is also a more serious hazard. Since these children are initially extremely apathetic and will ordinarily stay in a position without moving, this must be taken into consideration by the nurses and other ward attendants. These patients are also susceptible to cold and must be kept well covered.

When kwashiorkor patients are given only routine attention by the hospital staff, recovery is much slower than when they can be given special attention. Extreme patience is required on the part of the nursing staff, particularly in the feeding of children during early treatment. These children are usually extremely anorexic and will not ordinarily eat well enough of their own accord for satisfactory recovery.

MEDICAL HISTORY AND PHYSICAL EXAMINATION

The medical history and physical examination must be sufficiently thorough to determine the type and severity of case, character, and degree of dehydration as well as the presence of any kind of infection. It is obviously important to know about the possible presence of pneumonia, tuberculosis, meningitis, malaria, amebiasis, infectious diarrhea, contagious diseases of childhood, and other conditions requiring immediate attention if normal recovery

is to be obtained. Information as to the medical and dietary history will also be of help in giving instructions to the parents designed to prevent a recurrence after discharge from the hospital.

LABORATORY PROCEDURES

Of immediate practical necessity are assays of serum protein or serum albumin and routine stool, urine, and hematologic examinations. The serum protein or albumin determination gives a general idea of the severity of the protein deficiency and is the most convenient laboratory means for estimating response to treatment. The determination of the urine volume, density, and pH helps to evaluate the dehydration and electrolyte imbalance. Microscopic examination of the urine sediment may reveal a urinary infection which requires prompt treatment. A urine examination will also serve to detect renal disorders which may be responsible for edema. The severity and type of the anemia should be determined as a guide to supplementary therapy. An elevated white-cell count is of little value since even mildly infected cutaneous lesions can be expected to produce a leukocytosis, but the occasional occurrence of leukopenia, even in the presence of frank infection, is a grave sign.

Even without mention of the many laboratory determinations of research interest there are a number of additional procedures of value. In cases with severe dehydration, the determination of urine chloride, of CO₂ combining power in the blood, and of serum chloride and potassium will often lead to a more rational management of the case and may save additional lives, although admittedly these determinations are not ordinarily available where kwashiorkor is a major problem. Either pseudo-cholinesterase or serum amylase can be profitably followed as a further measure of recovery, although each gives essentially the same information with ordinary therapy as the serum protein.

The stool examination should indicate the presence or absence of amebiasis so that this complication may be treated immediately. Stool culture for the identification of pathogenic bacteria may be of value since Shigellosis

should also receive prompt and effective treatment. Because routine antibiotic administration is recommended, radiographic examination of the chest is not considered essential. However, bronchopneumonia is a frequent cause of early death in kwashiorkor and it is often virtually impossible to detect it by physical examination alone.^{13,14} A radiograph of the chest gives added confidence when bronchopneumonia is shown not to be present and encourages additional caution when it is found. It is also desirable for the detection of the not infrequent case in which pulmonary tuberculosis is a serious complication. For this reason also, a tuberculin test during the child's hospital stay is indicated, although the possibility of a false negative skin reaction in severe malnutrition makes it unreliable until substantial recovery has occurred.¹⁵

INITIAL THERAPY

The problem of severe dehydration and electrolyte imbalance has long been studied in connection with diarrheal disease. There is the further complication, however, that protein malnutrition alone, even in the absence of diarrhea, produces a deficiency of potassium and an imbalance of other electrolytes with an accompanied shift in the content of the fluid compartments.¹⁶⁻¹⁸ It is increasingly recognized that a major problem in the early management of kwashiorkor is the correction of the often severe dehydration and electrolyte imbalance found on admission, but there are few detailed studies to serve as a guide to rational therapy. We would suggest the following procedures.*

Mild Electrolyte Imbalance

(Frank kwashiorkor with no clinical signs of dehydration; no vomiting; diarrhea not severe.)

In very mild cases adding sufficient potassium chloride to provide a total of 4 to 6 meq of

potassium per body weight daily is sufficient. One gram of potassium chloride provides 13.4 meq and whole milk contains about 40 meq per liter.

In ordinary mild cases, we find it convenient for the first two to three days to add the major anions and cations in appropriate proportions to the milk formula, the amounts depending on the clinical condition of the child.* At the end of this time the electrolytes of the normal diet are sufficient to complete the correction of any remaining imbalance. In some of these children who present marked abdominal distention, it is desirable to increase the potassium intake, if adequate diuresis is present, by the direct addition of potassium chloride to the salt mixture incorporated in the milk formula. The total amount of potassium recommended is in the range of 10 to 12 meq per kg daily. This is on the assumption that less than half the ingested potassium may be absorbed in some cases and that the average absorption is not greatly over this.

Moderate and Severe Electrolyte Imbalance

(Kwashiorkor with marked clinical signs of dehydration).

(a) *Associated with Moderate to Severe Diarrhea:* The basic problem is severe dehydration, hyperosmolarity, metabolic acidosis, and multiple anion and cation loss, especially of potassium. As soon as possible after admission, the child should be given a buffered hypotonic solution intravenously to counteract the acidosis and hyperosmolarity as well as begin the correction of the dehydration and oliguria. If laboratory facilities for determining CO_2

* We have generally used 40 to 80 g of Lytren® (Mead Johnson & Co.), of which 80 g provides the following meq: sodium, 50, potassium, 20, calcium, 4, magnesium, 4, citrate, 50, sulfate, 4, chloride, 30, phosphate, 10, and lactate, 4.

When suitable commercial preparations are not available, the following mixture will prove satisfactory: Lemon juice, 100 ml, CaCO_3 , 0.5 g, NaCl , 0.5 g, KCl , 2.0 g, NaHCO_3 , 4.2 g, sugar, 50 g, water to 1,000 ml. It will provide the following meq: Na^+ , 59; K^+ , 27; Ca^{++} , 10; Cl^- , 35; citrate⁻⁻⁻ 78. The dosage is 120 to 200 cc per kg given in frequent small amounts throughout the day varying with the state of hydration.

* In the preparation of this Section we have been greatly aided by the information presented at a Symposium entitled *Seminario sobre Desequilibrio del Agua y Electrolitos* by Drs. F. Gómez, J. Cravioto, S. Frenk, G. Gordillo, and R. Ramos Galván at the III Congreso Centroamericano de Pediatría y VII Congreso Nacional de Medicina held in Guatemala, November, 1956.

combining power and serum electrolytes are not available, this therapy must depend on clinical observation and experience.

We recommend a so-called 1-2-3 solution* of one part of $\frac{1}{6}$ molar sodium lactate, two parts of Ringer's solution,† and three parts of 5 per cent glucose. The lactate in this solution combats the acidosis, the glucose diminishes the ketosis and the Ringer's solution, which contains 6 meq of calcium and 4 meq of potassium per liter, helps to correct the hypocalcemia and potassium depletion. The dosage varies from 40 to 50 cc per kg‡ administered intravenously at a rate of 40 to 50 drops per minute.

In most cases diuresis begins after the preceding treatment has been administered. (If not, the solution can be continued some hours longer if a slower rate is employed.) It is then advisable to continue with Darrow's solution§ more slowly, approximately 20 to 25 drops per minute at a dosage of 90 to 110 cc per kg per day, and to give additional 5 per cent glucose in either normal saline or Ringer's solution to help replace the total water loss. It is usually necessary to give between 150 and 200 cc of fluid per kg in the first 24 hours. Close and frequent examination is required to guide this therapy, since clinical signs and the diuresis are the best indices of the amount required. Oral feeding should begin as soon as the patient's condition permits, often within a few hours after admission.

(b) *Associated with Moderate to Severe Vomiting as well as Diarrhea:* These cases are rare, but may present a slightly different problem due to the loss of hydrochloric acid from the

stomach and the superimposition of metabolic alkalosis on the fluid and electrolyte disturbances discussed previously. If vomiting has been sufficiently acute to produce alkalosis, the sodium lactate is omitted from the solution given. The remainder of the treatment is essentially the same.

It is important, however, to point out that in children suffering from edema, especially when this condition is associated with dehydration through diarrhea and/or vomiting, derangements of the fluids and electrolytes equilibrium are very complicated and not yet clearly understood. Consequently these imbalances are difficult to correct. Metcalf *et al.*¹⁹ have found hypotonicity associated with intracellular edema and suggest the possibility of successful use of hypertonic solutions in these cases. We feel, however, that the use of such solutions has not been as yet critically studied and it might well be that it may prove dangerous in some instances.

Use of Antibiotics and Chemotherapy

Even when infection is not initially present, the susceptibility to infection of the child with kwashiorkor is so great that routine antibiotic therapy is recommended. It is important to realize that in severe kwashiorkor neither fever nor elevated white-cell count may develop, even when the infection is severe; the child seems to lose his ability to respond to infection in these classic ways. Our experience suggests that a high percentage do have infection present even though it may not be obvious upon initial clinical examination. This is particularly true for bronchopneumonia which is a frequent autopsy finding even when clinically undetected.^{13,14}

It is our practice to give 600,000 to 1,200,000 units of crystalline penicillin daily intramuscularly every four hours for at least the first 24 hours, and then change to long-acting penicillin in a doses of 300,000 to 600,000 once daily for six to eight days.

We have not tried "broad-spectrum" antibiotics because of their known tendency to produce diarrhea and/or vomiting in children, and because of the theoretic possibility of encouraging fungus infections and staphylococcal di-

* If facilities are not available for preparing this solution, the Ringer-lactate solution of Hartmann can be used, which, however, supplies less lactate. It contains per 1,000 ml: NaCl—6.0 g, KCl—0.3 g, CaCl₂—0.2 g, and Na lactate—3.1 g.

† Although normal (0.9 per cent) saline can also be employed, Ringer's solution is better. It contains per 1,000 ml: NaCl—8.5 g, KCl—0.3 g, and CaCl₂—0.2 g.

‡ Many authors advocate the technically more correct procedure of calculating dosage on a surface area basis. With the abnormal weight relations in kwashiorkor due to edema and marasmus and the variation in appropriate dosage with the individual, we doubt whether this extra step is justified.

§ Darrow's solution contains per 1,000 ml: NaCl—3.0 g, KCl—2.7 g, and NaHCO₃—4.4 g.

arrhea. Both chloramphenicol and sulfadiazine have been used routinely by other authors.

If either malaria or amebiasis are diagnosed, specific therapy is given at once. Similarly, when acute bacillary dysentery due to *Shigella* can be specifically identified, sulfadiazine or chloramphenicol is given.

Initial Diet

It is of general practice to give half-skim milk, although most of the African workers have used skim milk in the early treatment of kwashiorkor,^{20,21} and the successful use of whole milk has been reported from Mexico.²² When either half-skim or whole milk is used, the diarrhea is better controlled if the milk is acidified to produce a finer curd.* Half-skim milk gives a slightly higher fat and calorie intake without significant reduction in the protein. Not only is there no contradiction to a moderate fat intake in either diarrhea in general or the diarrhea of kwashiorkor in particular, but on the contrary, the inclusion of fat in the therapeutic diet for these conditions has been strongly recommended.^{23,24}

For the first 24 hours we employ the milk diluted with water to half strength but with 5 per cent sugar added and give either 120 cc every two hours (eight times a day) or, if not well tolerated, 60 cc every hour (16 times a day). If large single volumes are given, there is a risk of producing an acute dilatation of the stomach or of provoking vomiting. Not infrequently, it is necessary to resort to gastric intubation due to the extreme anorexia of the child and inability of the nurse to persuade him to accept sufficient formula. With the use of a polyethylene tube we have encountered no complications from this procedure, and the tube can be left in place for several days, if necessary. This initial diet supplies only 1 to 2 g of protein and 30 to 60 cal per kg during the first 24 hours.

If it is well tolerated, the concentration should be increased to three-quarters strength during the second 24 hours and to full strength by the third or fourth day. In the meantime,

the amount of formula given is increased as rapidly as tolerated to 180 cc every three hours six times daily, and then to 240 cc at the same intervals five times daily, so that the child is receiving approximately five g of protein and 100 cal per kg by the fourth to sixth day. If the child will accept solid food, it is desirable to give half a banana twice a day as early as the second or third day as a source of well-tolerated calories which does not increase the diarrhea. If the child is hungry he can soon be given a whole banana twice a day. While we have utilized calcium caseinate without difficulty, as recommended by Dean,²⁵ we have abandoned its use because the foregoing regimen alone has given an adequate response.

Role of Plasma and Blood Transfusion

Whole blood transfusion is widely recommended and employed for the initial treatment of severe kwashiorkor. As our experience with the management of these cases has grown, we have come to use transfusion very rarely, and now believe that except for severe anemia, it is indicated only when the child's life seems in danger from collapse or shock produced by severe dehydration or toxicity due to infection. In these cases blood or plasma should be considered a necessary part of the treatment scheme. Usually 10 to 20 cc of whole blood per kg is sufficient or, if not available, 20 to 30 cc per kg of plasma can be given. Larger transfusions can cause too fast a loss of edema with more rapid circulatory changes than the child can tolerate. As protein sources, neither plasma nor intravenous or oral protein hydrolysates are necessary or justified.

Role of Enzyme and Lipotropic Preparations

Despite the reduced duodenal enzyme activity in kwashiorkor, milk protein is satisfactorily absorbed from the beginning,^{26,27} and enzyme recovery is very rapid.^{10,28} There is no reason to believe that the administration of enzyme preparations will have a significant effect on promoting recovery. Much the same comment applies to the various lipotropic preparations recommended. Liver fat disappears rapidly with milk treatment alone and we regard the supposed advantages of adminis-

* Six cc of lactic acid or 20 cc of lemon juice added drop by drop to 1,000 cc of the milk with constant stirring.

tering methionine and choline preparations as unsubstantiated.

FURTHER TREATMENT

During the second week of therapy whole non-acidified milk is gradually introduced and the amount increased to supply approximately 7.0 g of protein per kg. With two bananas a day and 120 cc of orange juice, the total calories are brought to approximately 130 per kg. During the second or third week of hospitalization, green and yellow vegetables are added. During the third or fourth week, depending upon the appetite and progress of the child, meat, eggs, cereals, and bread are added. At the end of one month of hospitalization the child should receive a varied and balanced diet which contains all necessary vitamins and minerals in physiological amounts. By this time the protein intake should average 5.0 to 6.0 g per kg and the caloric intake 140 to 150 per kg.

At the time of admission some of the children with kwashiorkor show a microcytic hypochromic anemia due to iron deficiency. The remainder have a normocytic or macrocytic anemia which very frequently becomes microcytic as treatment proceeds because iron becomes limiting.¹⁰ The therapeutic diet suggested above, although adequate to supply ordinary iron requirements, does not replete iron reserves sufficiently rapidly for optimum hematologic response. We therefore recommend the oral administration of iron in a dosage of 300 mg of ferrous sulfate once or twice daily depending upon the severity of the anemia. This should be started during the second week or as soon thereafter as diarrhea stops and is usually, but not always, well received. A suitable preparation of iron for intramuscular administration would seem appropriate for use wherever oral therapy is not well tolerated, although we have not had personal experience with it.

When ocular lesions are present, it is wise to give supplementary vitamin A daily from the time of admission. No other supplementary vitamins need be given either parenterally or orally, even if the child presents signs suggesting other specific vitamin deficiencies. There is evidence that early vitamin B-complex administration in high doses may be distinctly

harmful.²⁹ After satisfactory recovery has taken place, the child should receive adequate treatment for such intestinal parasites as may be present.

VEGETABLE PROTEIN MIXTURE

There is sufficient evidence to conclude that a properly selected and prepared mixture from vegetable protein sources can be used for the treatment of kwashiorkor.^{12, 25, 30, 31} These studies have had as their object the testing of vegetable protein combinations to be used for the prevention of kwashiorkor and do not necessarily represent the most convenient method of treatment. Nevertheless, where adequate supplies of milk are not available, there is no reason why vegetable mixtures may not also be used. The difficulty lies only in being sure that the particular combination available is really safe and effective.

PSYCHOLOGIC FACTORS IN RECOVERY

At the time of admission the child is generally profoundly apathetic and anorexic and when aroused is hyperirritable. He has generally arrived at this state after a long period of neglect and frustration.^{32, 33} It is important from the beginning to try to give the child attention and to treat him sympathetically and with understanding. An effort should be made to arouse the interest, curiosity, and sociability which should characterize children of this age. In general, these children are backward in their psychomotor development. Attention to their speech, walking, and play brings about better cooperation with the therapeutic regime and more rapid recovery. Cheerful surroundings and a friendly attitude on the part of the staff as well as the provision of a few toys and a play area mean a great deal.

PREVENTION OF RELAPSES

The prevention of a relapse begins when the child is given a balanced diet and learns to accept green and yellow vegetables, meat, eggs, and other components of a varied diet. Advantage should be taken of the visits of the parents to explain to them the purely dietary nature of the treatment and the fact that a poor diet was responsible for the development

of the disease in their child. The parents can usually be convinced of the necessity of giving the child an improved diet after its discharge from the hospital. In our own experience at least, recurrences are not only very rare when there has been an opportunity to indoctrinate the parents, but also the child on successive follow-up visits is frequently in better physical condition than other children of the same age in the neighborhood.

Whenever possible, arrangements should be made for the child to be brought back at regular intervals for re-examination, preferably monthly for the first three to six months and quarterly thereafter. This gives a further opportunity to check on the diet provided by the parents and to give additional instruction to them. An opportunity is often presented at this time for examination of other children in the family and for giving advice on their care and on the better use of the family income for food purchases. Much can also be gained if the parents can be persuaded to continue giving a good diet, even if diarrhea should develop. The customary withdrawal of solid

food and administration of purgatives in such an event poses a constant threat to the recovered child.

GENERAL COMMENTS

The recommended treatment of uncomplicated but severe protein malnutrition (kwashiorkor) in children without pronounced diarrhea is almost entirely dietary. The principles of treatment of this syndrome are summarized in Table I. The problems of initial management derive from complications such as diarrhea, water and electrolyte imbalance, and infection, and from the usual but not invariable accompaniment of a significant degree of marasmus. Acute vitamin-A deficiency and severe anemia may also be associated problems. Detailed suggestions for handling these complications and related deficiencies have been given, but the general problems of hospital care should be mentioned further.

The child is particularly susceptible to both respiratory and enteric infections and should be protected from these as much as is practical, as well as from the contagious childhood diseases:

TABLE I
Summary of the Therapeutic Regimen Recommended for Kwashiorkor
(Marasmic Type)

	First 24 hours	Second to fourth day	First to second week	Second to fourth week	Convalescence
Fluids and electrolytes	Electrolyte imbalance, Mild: Electrolyte solutions orally Moderate to severe: intravenous electrolyte solutions	Electrolytes or K added to formula Continue intravenous electrolyte solutions	K added to the formula if necessary	—	—
Antibiotics	Crystalline penicillin, 600,000–1,200,000 units/day	Long-acting penicillin, 300,000–600,000 units/day	Long-acting penicillin, 300,000–600,000 units/day	—	—
Proteins g/kg/day	1–2	2–5	5–7	5–7	5–6
Calories kg/day	30–60	60–100	100–130	130–150	140–150
Ferrous Sulfate orally mg/day	—	—	300–600	300–600	300–600
Diet	Half-skim acidified milk, half-strength	Half-skim acidified milk $\frac{3}{4}$ to full strength	Whole milk plus banana, orange juice, vegetables	Same plus meat, eggs, cereals	Balanced high protein-high calorie diet

infections of any kind are likely to retard recovery and may endanger the life of the child. Often a small hospital unit can do a better job than a large one since the facilities required for treatment are not specialized and the child is likely to receive more individual attention and less exposure to cross infection in the former. Figure 1 portrays the complete recovery possible with the treatment recommended.

Careful attention to the details of the therapeutic regimen outlined will result in large savings to hospital administrators. Routine blood transfusion, parenteral vitamins, enzymes, and amino-acid preparations are expensive and quite unnecessary; eliminating their use can result in substantial savings. Even more important is the cost of prolonged hospitalization. The duration of hospitalization in the Guatemala General Hospital has been found to be much longer than for cases treated under our supervision in a nearby well run hospital under the auspices of a private charity. Furthermore, the condition of the children at the time of discharge from these private hospitals is consistently better despite the shorter treatment period. We believe that the more favorable response of children in the private institutions was due to a combination of more attention to the diet actually consumed by the child, reduced exposure to secondary infections, and more concern for surroundings and the psychologic aspects of care.

Although beyond the formal scope of this paper, better outpatient care could reduce the number of cases requiring hospitalization. cursory dietary instructions to the mother, which are beyond both her comprehension and economic resources, are of little value. Even worse is the treatment of diarrhea by the physician without any attention to the early or distinct signs of malnutrition which may be present in the patient. In some areas of the world most children in lower economic groups are in a state of pre-kwashiorkor; in these children diarrhea may have serious consequences and often leads to the development of outright kwashiorkor. The prevention and proper management of diarrhea thus play an important part in prophylaxis.

The prophylaxis of kwashiorkor cannot be



Fig. 1. A 17-month-old boy is shown on the left at the time of his admission to the hospital with moderately severe kwashiorkor and at the right at the time of discharge from the hospital. Good recovery took place in this child in 5 weeks.

left to public-health workers alone; physicians charged with outpatient care should help to prevent hospitalized cases by realistic dietary instructions to parents with malnourished children. They should also see that children attending outpatient clinics who develop kwashiorkor are hospitalized before they develop dangerous therapeutic complications which require costly and prolonged hospital treatment.

SUMMARY

Detailed suggestions for the treatment of children with severe protein malnutrition (kwashiorkor) are given. These include attention to the fluid and electrolyte imbalances which are likely to characterize the acute case due to secondary complications and instructions for beginning treatment with frequent feedings of milk diluted to half strength. One to 2 g of protein and 30 to 60 cal per kg are given in the first 24 hours and the strength and amount of milk increased to provide 5 g of protein and 100 cal per kg by the end of the first week. Bananas, fruit juice, meat, eggs, vege-

tables, and cereals are gradually added to give a diet throughout most of the recovery period containing 5 to 7 g of protein and 130 to 150 cal.

Penicillin is given routinely for the first eight to ten days and supplementary iron therapy is started after one week has elapsed. Vitamin A is given when serious ocular lesions are present and whole blood transfusion may be necessary in the rare case of collapse, shock, or severe anemia; no other vitamins or minerals and no special enzyme or lipotropic preparations are indicated. The importance of protection from infection and the need for sympathetic and understanding care are stressed. The cost of hospitalization of kwashiorkor cases can be drastically reduced by eliminating the use of costly proprietary preparations and by greatly shortening the hospital stay through close attention to the principles of treatment described.

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