

Milk drip: Is it the solution to the initiation of feeding in kwashiorkor patients?

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Abstract

A case series of seven children with Kwashiorkor who presented, to our facility in the Wesley Guild Hospital, Ilesa (a unit of Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife), with persistent diarrhoea and were managed with milk given as continuous drip via a nasogastric tube during the stabilisation and re-feeding phase are reported. In addition to milk drip, the patients were also given Vitamin A, zinc, copper, potassium supplement, folic acid, multivitamins as well as bactericidal antibiotics. Their pedal oedema and loss of appetite resolved within one week after commencement of the drips; after which they were commenced on thickened cereal and locally available food. All of them made uneventful recovery except for case 3 whose kwashiorkor was complicated by meningitis but she recovered with neurological sequelae. From this preliminary report, it could be inferred that milk drip would be ideal for initiating feeding after resuscitating a patient with kwashiorkor.

Keywords: Children, continuous nasogastric tube feeding, kwashiorkor.

INTRODUCTION

Kwashiorkor is viewed as a severe form of protein energy malnutrition which is still commonly seen in clinical practice in the tropics. It is characterised by apathy, irritability, pitting oedema, growth failure, muscle wasting and fatty infiltration of the liver (Gupte and Gomez, 2009). The exact aetiology remains a myth, despite several decades of research (Gupte and Gomez, 2009; Brewster et al., 1995; Oyelami et al., 1995). Various hypotheses have been advanced to explain the pathogenesis of kwashiorkor. These include dietary protein deficiency, niacin deficiency, antidiuretic hormone-like action of excess free ferritin, dysadaptation, aflatoxicosis and an imbalance between the production of free radicals and their safe disposal. (Gupte and Gomez, 2009; Brewster et al., 1997; Oyelami et al., 1995). Since the exact aetiology of kwashiorkor is unknown, nutritional rehabilitation in these patients poses a lot of problems because of the associated intestinal mucosa injury and loss of many villi along with the disaccharidases enzymes

on the villi predisposing them to diarrhoea- "a usual feature" (Gupte and Gomez, 2009). These enzymes are vital in the digestion of disaccharides (lactose, maltose and sucrose) (Sood, 2007). The goal of therapy during the early "Stabilisation and Re-feeding phase" is to provide adequate energy and protein to maintain normal physiologic processes in the body (WHO, 1999). Therefore, it should be initiated cautiously and should start early in the management shortly after resuscitation (WHO, 1999).

Milk is the most effective, economical and convenient basis for dietary therapy in patients with kwashiorkor (Wharton et al., 1963). It is central to most re-feeding diets (Wharton et al., 1963; Brewster et al., 1997). Since diarrhoea is a frequent complication of the disease, giving these patients milk which contains lactose may further worsen the diarrhoea because of the lactase deficiency in them. Lactose free milk is now available with the aim of improving carbohydrate absorption even in the face of chronic diarrhoea, severe mucosa damage and loss of route of administration is by cup and spoon; however

debilitated and severely ill children can be fed through a nasogastric tube either as bolus small frequent feeds or when given in form of drip over a period of time (Alajandro and Marina, 1985).

In this report, seven patients with kwashiorkor were successfully managed with milk given as a continuous nasogastric tube feeding. This was based on the fact that severely affected children's gastrointestinal tract may not tolerate optimally if given in bolus form and milk is rated as the best food to initiate feeding in kwashiorkor patients. (Bowie et al., 1967; Donowitz et al., 1995). Milk drip is an old art that is being largely abandoned; this report highlight how such a simple intervention can be used to manage kwashiorkor, a common problem whose exact aetiology is still largely unknown.

METHODOLOGY

Seven patients with kwashiorkor between years 2006 to 2012 who presented to our facility and who were given continuous nasogastric tube feeding in lieu of the traditional intermittent nasogastric feeding were monitored. Their baseline anthropometric, clinical and biochemical parameters were assessed. The milk drip was started at 100 mls per kilogram body weight divided into 3 equal feeds each given for 7 hours with a rest period of one hour between the feeds.

CASE 1

A one year old boy (C1) was admitted to the Wesley Guild Hospital, Ilesa (a tertiary unit of Obafemi Awolowo University Teaching Hospitals' Complex) on the 22nd October, 2006 with two months history of passage of watery, mucoid but non-bloody stool, occasional vomiting, and progressively worsening weight loss and body weakness. He was previously treated at home with over the counter drugs, in traditional homes and private hospitals without appreciable improvement. Mother stopped breastfeeding about a month before presentation.

Examination on admission revealed a cachetic, weak, apathetic, hypothermic (axillary temperature less than 35°C), severely pale and dehydrated boy, with ulcers on the mouth, genitals, buttock and the legs. There was bilateral pitting pedal oedema up to the knee. The peripheral lymph nodes were not significantly enlarged. His weight on admission was 5Kg (fifty percent of expected weight for his age). Other anthropometric parameters were also low for his age. There were no abnormalities in any of the systems.

He was diagnosed as having marasmic kwashiorkor with sepsis, severe anaemia, hypoglycaemia, hypothermia and extensive mucocutaneous candidiasis. Following adequate resuscitation, he was commenced on

maize and soya infant cereal (nutrend) given via nasogastric tube, 75mls every 3 hours. The vomiting and diarrhoea worsened over the next 24- 48 hours. His weight dropped to 4.0 kg within 72 hours of admission. He became more apathetically irritable. This necessitated the use of lactose free milk which was given as bolus via nasogastric tube, 75mls every 3 hours. Diarrhoea subsided slightly but the vomiting became more pronounced. In addition he was put on Vitamin A, zinc, copper, potassium supplement, folic acid, multivitamins and Ciprofloxacin and Gentamicin.

Towards the end of the second week of admission, lactose free milk in form of a milk drip was commenced, 250ml over 7 hours and a rest period of one hour afterwards. This was done three times a day. Both the vomiting and diarrhoea subsided completely within 72 hours. He began to gain weight, pedal oedema gradually subsided and the general outlook became better. His weight rose to 5.6kg at the end of the second week of satisfactory continuous nasogastric milk feeding. Thereafter, he was weaned to cup and spoon and a week later, he started eating locally available food.

He was discharged two weeks later with a weight of 6.2kg. At follow-up clinic three weeks after, his weight was 7.0kg and the ulcers on the gluteal region which were the only ulcers present at discharge had already healed.

CASE 2

A fourteen month old boy, C2 was admitted on the 9th December, 2006 with one month history of passage of watery, non mucoid and non bloody stool, occasional vomiting, fever, progressively body swelling of two weeks and a day history of pallor and reduced activity. He was treated at home with over the counter drugs without appreciable improvement. Mother stopped breastfeeding about two months before onset of problem.

Examination on admission revealed a boy, severely pale, wasted, hypothermic (auxiliary temperature less than 35°C), dehydrated, dyspnoeic and had widespread scaly desquamating skin, ulcers on the mouth and both buttocks. He also had pitting pedal oedema up to the knee. There was no significantly enlarged peripheral lymph node. His weight on admission was 7.0kg (about 67 percent of expected for his age), mid-arm circumference was 11.5cm. The other anthropometric measurements were normal for his age. No other systemic abnormality was found. The mother had stopped breastfeeding about two months before onset of problem.

He was diagnosed to have kwashiorkor and was commenced on lactose free milk by the second day of admission, given as a drip via nasogastric tube, 250 mls over 7 hours and a rest period of one hour afterwards. This was repeated thrice a day for ten days. He was also

given Vitamin A, zinc, copper, potassium supplement, and folic acid, multivitamins as well as Cefuroxime and Gentamicin. The diarrhoea and vomiting subsided within 72 hours of commencement of milk drip, the general condition of the child improved. He was later fed by cup and spoon.

He was discharged home after 24 days of hospitalisation. Unfortunately, he was never brought for any follow-up visit after the discharge.

CASE 3

This twenty three month old girl C3, was admitted on the 10th of November, 2011 with two weeks history of passage of loose, mucoid and bloody stool, occasional vomiting, fever, progressively worsening body swelling; multiple convulsions and failure to pass urine of twelve hours and loss of consciousness of one hour. She was treated at home with over the counter drugs and in a maternity centre without appreciable improvement. Mother stopped breastfeeding about two months before onset of problem.

Examination on admission revealed a girl, unconscious (Glasgow coma score of 8), hypothermic (axillary temperature less than 35°C), mildly pale, severely dehydrated with cold clammy extremities; widespread scaly desquamating skin, ulcers on the mouth and both buttocks. She also had pitting pedal oedema up to the knee and facial puffiness. There was no significantly enlarged peripheral lymph node. Her weight on admission was 9.5kg (79 percent of expected for her age), mid-arm circumference was 12.5cm (borderline). The other anthropometric measurements were normal for her age.

Systemic examination on admission revealed fast thready pulse, un-recordable blood pressure, and widespread coarse crepitation on respiratory examination, increased tones and reflexes in the upper and lower limbs.

She was diagnosed as having kwashiorkor with shock, acute kidney injury, sepsis and hypothermia. Following resuscitation, she was commenced on whole infant formula milk (lactose free milk was not available) given via nasogastric tube, 125mls every 3 hours. In addition Vitamin A, zinc, copper, potassium supplement, folic acid, multivitamins Cefuroxime and Gentamicin were given. The vomiting subsided after 72 hours but she continued to have diarrhoea, 10 days into re-feeding her clinical condition also deteriorated. She became moribund. A repeat lumbar puncture for cerebrospinal fluid analysis revealed meningitis with *Klebsiella* specie isolated sensitive to Ceftriaxone (similar to the isolated organism from blood culture at admission). Milk drip was commenced at this stage in addition to other management including intravenous Ceftriaxone. It was given as 360mls over 7 hours and a rest period of

one hour afterwards. This was repeated three times a day. The diarrhoea subsided after five days of milk drip and the oedema resolved one week after the commencement of milk drip. After two weeks of successful continuous nasogastric milk feeding, she was weaned to cup and spoon and few days later, she started eating locally available food.

She was discharged ten days later with post meningitis neurologic deficit to be followed up in out-patient clinic and to have physiotherapy. Unfortunately, she was never brought for follow-up visit after discharge.

CASE 4

A nineteen month old boy, C4 who was admitted on 16th April, 2012 with passage of watery, mucoid but non-bloody stool, occasional vomiting and weight loss of two weeks, fever, cough and progressively worsening difficulty with breathing of three days. He was treated at home with over the counter drugs and also at a private maternity centre with no improvement in his condition. He was weaned off breast milk four months before presentation.

Examination on admission showed an apathetic acutely ill-looking boy, moderately pale, in respiratory distress, moderately pale and dehydrated with bilateral pitting pedal oedema, extensive mouth ulcers and hypo pigmented patches in the perineum and flaky skin lesions in the arms. There was no significant peripheral lymph node enlargement. His weight on admission was 9kg (eighty-two percent of expected). The mid-arm circumference was 12.5cm (borderline low). The other anthropometric parameters were normal for his age. Systemic findings on admission revealed she was tachypnoeic, had dull percussion notes on the left hemithorax in the axilla and posteriorly below the scapular. The breath sound was also reduced on the same side with coarse crepitation. There were no other systemic abnormalities found.

He was diagnosed as having kwashiorkor with sepsis, pneumonia complicated by pleural effusion and cutaneous candidiasis. After resuscitation, he was commenced on triple mix of guinea corn, soya beans and groundnut. In addition Vitamin A, zinc, copper, potassium supplement, folic acid, multivitamins Cefuroxime and Gentamicin were also given. Over the next 48 hours, his diarrhoea worsened but no vomiting. This necessitated the introduction of milk, which was given by continuous drip via a nasogastric tube at 300mls over 7 hours and a rest period of one hour. This was repeated three times a day. The diarrhoea subsided completed over the next 72 hours, pedal oedema gradually subsided over one week and the general condition was better. Thereafter, he was weaned to cup and spoon feeding and a week later, he started taking locally available food.

He was discharged two weeks later, to be followed up in the clinic.

CASE 5

This seventeen month old boy, C4 was admitted on the 26th May, 2012 with history of passage of watery, mucoid but non-boody stool, fever, occasional vomiting and progressive weight loss of two weeks; and generalised body weakness of four days. He was initially treated at home but subsequently taken to a general hospital where he was on admission for five days without appreciable improvement in his clinical condition, following which he was referred to our hospital. The mother had stopped breastfeeding about two weeks before the outset of the illness.

At admission, examination revealed a lethargic and apathetic boy, moderately pale, hypothermic and dehydrated, with cold clammy extremities and bilateral pitting pedal oedema up to the ankle. He had evidence of wasting and ulcers on the mouth and buttock bilaterally. The peripheral lymph nodes were not significantly enlarged. His weight on admission was 8.5kg (about 77 percent expected for age). The other anthropometric measurements were normal for his age. Apart from the fast thread pulse, un-recordable blood pressure and firm non tender palpably enlarged liver, no other significant abnormalities were found on systemic examination.

He was diagnosed to have kwashiorkor with shock, acute kidney injury and sepsis. Following adequate resuscitation, he was commenced on infant formula milk given by continuous gavage (drip) feeding via a nasogastric tube as 300mls over 7 hours and a rest period of one hour afterwards this was repeated three times a day. He also received Vitamin A, zinc, copper, potassium supplement, folic acid, multivitamins Cefuroxime and Gentamicin. The patient did not have any episode of vomiting while he was on the milk drip and the diarrhoea subsided over one week. The pedal oedema also resolved within one week. He was weaned to cup and spoon and subsequently locally available food.

He was discharged home after three weeks of admission. At the follow-up clinic one week after discharge, his weight had increased by 18 percent to 10kg and the gluteal ulcers were healing well.

CASE 6

This three year old girl, C6 was admitted on the 8th August, 2012 with history of generalised body swelling of unknown duration. The child had been living with the paternal grandmother and the historian (the mother) could not ascertain when the illness started. However, three months before presentation, she claimed the child

was apparently well. She denied diarrhoea, vomiting or change in the urine colour and output. The mother decided to bring her to this hospital when she saw the patient's condition.

Examination on admission revealed an apathetic and irritable girl, moderately pale, no evidence of dehydration, with bilateral pitting pedal oedema up to the knee and the dorsum of the hand. She had evidence of wasting and ulcers on her mouth. The peripheral lymph nodes were not significantly enlarged. Her weight on admission was 10kg (about 71 percent expected for age). Her mid-arm circumference was 12.5cm. The other anthropometric measurements were normal for her age. No other significant abnormalities were found on systemic examination.

She was diagnosed to have kwashiorkor. She was commenced on infant formula milk given by continuous gavage feeding via a nasogastric tube as 330mls over 7 hours and a rest period of one hour afterwards this was repeated three times a day; in addition to Vitamin A, zinc, copper, potassium supplement, folic acid, multivitamins Cefuroxime and Gentamicin. The patient did not have any episode of vomiting or diarrhoea while on the milk drip. The generalised oedema resolved after seven days of milk drip. She was weaned to cup and spoon and subsequently locally available food and was discharged home after two weeks of admission. At the follow-up clinic one week after discharge, her weight was 10kg and she was friendly.

CASE 7

An eighteen month old girl, C7 admitted on the 13th September, 2012 with history of recurrent passage of loose watery stool of one-month, generalised body swelling and progressive weakness of two-weeks. She denied vomiting or change in the urine colour and output. The mother stopped breastfeeding about two weeks before onset of illness. She was initially treated at home but mother decided to bring her to this hospital when she noticed her worsening condition.

Examination on admission revealed an apathetic and irritable girl, not pale, no evidence of dehydration, with bilateral pitting pedal oedema up to the knee. She had evidence of wasting. The peripheral lymph nodes were not significantly enlarged. Her weight on admission was 7.5 kg (about 69 percent expected for age). Her mid-arm circumference was 11.5cm. The other anthropometric measurements were normal for her age. No other significant abnormalities were found on systemic examination.

A diagnosis of kwashiorkor was made. She was commenced on infant formula milk given as continuous milk drip through a nasogastric tube at 300mls over 7 hours and a rest period of one hour afterwards this was repeated three times a day. In addition, she was given

Table 1. The demographic characteristics of the patients at admission

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
AGE (in months)	12	14	23	19	17	36	18
SEX	Male	Male	Female	Male	Male	Female	Female
WEIGHT (in kg)	5.0	7.0	9.5	9.0	8.5	10.0	7.5
MAC (cm)	11.0	11.5	12.5	12.5	13.5	12.5	11.5

MAC = Mid-Arm Circumference

Table 2. The result of investigations in the patients at admission

Investigations	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
PCV (%)	19	12	30	32	26	24	31
Total WBC/ cmm	16,700	6300	10,400	3,200	6,900	11,900	10,500
Neutrophil (%)	84	66	78	10	60	60	34
Lymphocytes (%)	16	34	22	90	40	40	66
Urea (mmol/ L)	3.2	4.1	4.5	11.1	5.9	6.7	2.4
Creatinine (μmol/L)	77	82	67	Not done	Not done	56	Normal
Sodium (mmol/ L)	119	132	128	130	104	112	135
Potassium (mmol/L)	1.2	0.9	3.2	2.4	2.9	4.1	3.3
Bicarbonate (mmol/L)	22	14	21	15	19	18	20
RBS (mmol/ L)	2.0	Not done	3.2	4.2	2.7	3.3	4.0
Serum protein Total/ Albumin (g/L)	55/ 40	42/ 20	16/ 10	Not done	Not done	65/ 38	40/ 25
RVS (HIV I and II)	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Chest X-ray	Normal	Normal	Normal	Pneumonia	Normal	Normal	Normal
Blood culture	S. aureus	Normal	Klebsiella	No growth	No growth	No growth	No growth

Vitamin A, zinc, copper, potassium supplement, folic acid, multivitamins Cefuroxime and Gentamicin. She did not have any episode of vomiting when she was on the milk drip and the diarrhoea subsided. The generalised oedema resolved after six days of milk drip. She was weaned to cup and spoon and subsequently locally available food and was discharged home after two weeks of admission (Table 1 and 2)

DISCUSSION

Initiation of feeding in children with kwashiorkor is fraught with difficulties because of secondary malabsorption of nutrients including carbohydrate intolerance and impaired hepatic function associated with the illness (Gupte and Gomez, 2009; WHO, 1999). The intolerance to carbohydrates is caused by an impaired absorption of carbohydrate due to either a decrease in the absorptive surface during diarrhoea episodes because of the mucosal damage (villi atrophy) and the subnormal levels of disaccharidases particularly lactase which are necessary for digestion of disaccharides (Brewster et al.,

1997). As a result of these problems, they are unable to tolerate the large amounts of nutrient particularly proteins, fats and oil found in most food during this stabilisation and re-feeding phase. The key therefore, is gradual introduction of enteral feeds and giving just enough energy and protein to meet the basic metabolic needs of the body i.e. calorie of 90-100 kcal/kg body weight per day and protein of 0.7- 1.2g/kg body weight per day during the re-feeding phase (WHO, 1999; JC, 1999).

Milk-based diet has been recommended as the appropriate diet in patients with kwashiorkor (WHO, 1999; Brewster et al., 1997) Brewster et al. (1997) compared the outcome in kwashiorkor patients treated with milk and maize based diets that were similar in energy and protein densities. They found milk to be superior in terms of mortality, weight gain, clinical sepsis and improvement in intestinal permeability. In the present case series, re-feeding in all the patients was successfully done using milk. In the first and third patients, re-feeding was initially started using cereal based diets. However, the diarrhoea and vomiting in the two patients worsened but subsequently subsided

following change to infant formula milk. The mortality in patients with kwashiorkor has been reported by several studies to be as high as 30 to 50 percent (Wharton et al., 1963; Anonymous, 1994; Anonymous, 1995). In our hospital, between January 2006 and September 2012, eight of the twenty-five (32 percent) patients with kwashiorkor managed in our hospital died (unpublished data). However, it is noteworthy that none of the patients in these case series died. Although, it is difficult to conclude that giving milk as continuous infusion was responsible for the decreased mortality, it may be enough to state that continuous milk infusion was associated with reduced morbidity and possibly mortality. However, this is a preliminary report and a detailed, clinically controlled work, need to be done.

Another problem during the stabilisation and re-feeding phase is the route and mode of administration of the feed. The recommended route of feeding is enteral either by cup and spoon or by nasogastric tube-feeding (WHO, 1999). However, due to the apathy, irritability and poor appetite seen in patients with kwashiorkor, enteral feeding with cup and spoon although desirable is difficult to establish during the early stabilisation phase. In a study in Malawi, (Brewster et al., 1995) the researchers found that routine nasogastric tube feeding in the initial management of kwashiorkor patients was beneficial and associated with improved body weight gain and faster recovery. Also, giving small and frequent feeds to patients with severe undernutrition allows for better absorption and utilisation (Cutz et al., 1997; Kneepkens and Hoekstra, 1996). Diarrhoea and mucosal injury worsens when a patient with persistent diarrhoea is fed with a large amount of feed especially carbohydrate (Donowitz et al., 1995). Although, the activity of disaccharidases in the brush border especially lactase is reduced in patients with severe undernutrition particularly kwashiorkor, leading to lactose intolerance and the risk of prolonged diarrhoea. Several studies however, have concluded that milk is not contraindicated in severe malnutrition despite higher stool volumes, because it did not delay clinical recovery (Rothman et al., 1980; Solomons et al., 1984; Bowie et al., 1967).

Grant and Denne, 1991 and Toce et al., 1987 demonstrated better tolerance of milk in preterm newborn following continuous nasogastric milk feeding than when fed with intermittent bolus milk feeding. These babies also gained weight faster and were discharged earlier.

The diarrhoea in both the first and second patients reviewed did not subside when they were placed on intermittent small frequent bolus milk feeds despite the use of lactose free milk in the first case. The diarrhoea subsequently subsided with improvement in their clinical state when both were given milk by continuous nasogastric milk feeding. Similar finding was observed in the remaining three patients reviewed, despite the use of lactose containing infant formula. The use of continuous nasogastric milk feeding in our centre is based on the

premise that secondary lactase deficiency even when present is often not complete and the small amounts of milk per time will be better digested by the few lactases in the gut. Furthermore, the trophic effect of the milk promotes gut healing, (Santosham et al., 1985; Duggan et al., 1992) thus, allowing for faster recovery and better outcome in these patients. According to Duggan and Nurkos, 1997, the mucosal atrophy and lactase deficiency provided the scientific basis for continued enteral feeding in chronic or persistent diarrhoea especially those associated with severe undernutrition as exemplified by the cases reviewed.

In conclusion, we recommend the use of milk given via continuous nasogastric tube feeding for initiation of re-feeding in the management of patients with kwashiorkor. However, extensive case-control studies on the usefulness of continuous milk infusion in these patients are necessary to justify our claim in these case series.

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