

Paediatric Society CME

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MALNUTRITION

The effect of malnutrition on cardiac function in African Children

Archives of Dis Child on-line publication Nov 9th 2015

- **How did the investigators measure cardiac function?**

Using a Doppler ultrasound probe to measure aortic blood flow velocity. When this is multiplied by the cross-sectional area of the aorta you get the stroke volume (SV) of the heart, and when the SV is multiplied by the heart rate you get the cardiac output (CO).

- **What is the difference between cardiac output and cardiac index?**

Cardiac index is cardiac output divided by the body surface area (BSA). Adjusting for BSA helps understand the CO relative to the size and metabolic demand of the patient. To calculate BSA:

Square root of:

$\text{weight (kg)} \times \text{height (cm)}$

3600

- **What were the main findings of the study?**

The study found that cardiac output was lower in children with severe malnutrition than age-matched control children without malnutrition, but when the CO was adjusted for BSA the cardiac index was not different between stable children with severe malnutrition and children without malnutrition. In fact the CI in some children with severe malnutrition was higher than in their well-nourished comparator patients, because the systemic vascular resistance was lower. SVR will be lower in some cases of sepsis or generalised inflammation where inflammatory mediators lead to vasodilatation. When SVR is lower, this is called reduced “afterload”, and the heart pumps stronger to maintain the same blood pressure. Reduced SVR / afterload and the resulting high CI also occurs in severe anaemia and in some children when large amounts of calories are given.

- **What factors might influence cardiac index in malnutrition?**

Children with severe dehydration will have reduced pre-load, and therefore may have reduced SV and CI. Hypoalbuminaemia also leads to decreased preload if there is capillary leak. Sepsis or inflammation from bacterial translocation from the gut may lead to a low afterload (reduced SVR), capillary leak and shock. Anaemia is associated with low SVR and hyperdynamic state. Thiamine deficiency may also lead to lower SVR and lead to a hyperdynamic state and myocardial impairment (beri beri). Fluid overload and oedema may occur in severely malnourished children who receive too much IV fluids, because of high levels of antidiuretic hormone and reduced free water and sodium excretion. Vitamin D deficiency and hypocalcaemia and selenium deficiency have also been described as causes of heart failure in some patients with severe malnutrition.

HIV

Prevention of mother-to-child transmission of HIV and the health-related Millennium Development Goals: time for a public health approach

Lancet 2011; 378:282-84

- **What is Option B+?**
This is now the recommended strategy for prevention of mother-to-child transmission of HIV in settings where CD4 counts are often unavailable. It involves commencing all HIV positive women who are pregnant on life-long ART regardless of the CD4 count.
- **Why did Malawi change to this option?**
The difficulties of obtaining CD4 counts. A “start-stop” ART regimen for women where pregnancy rates within 2 years of giving birth are high can lead to increased risk, and in settings where loss to follow-up rates are high, pregnancy may be the best chance for mothers to get onto life-long ART before they develop advanced stage disease. B+ was also introduced to increase the coverage of PMTCT. The drug regimen became available as a fixed dose combination drug, thus making adherence better, and the safety profile of the drugs was good. Each of these reasons made B+ a favourable option.
- **Prior to Option B+, what was the recommended CD4 count for starting ART in pregnant women?**
Previously it was recommended that a threshold of 350 cells / microL, or HIV disease in clinical stage 3-4 was needed.
- **In Option B+, what treatment is given to the baby, and for how long?**
In Malawi, nevirapine for 6 weeks was the treatment for the baby, but in PNG it is 6 weeks of twice daily zidovudine (AZT)
- **Are there any potential disadvantages of Option B+?**
It means that some asymptomatic women will be commenced on ART some time before they may have previously been considered to require it, and therefore with potential for greater exposure to side-effects. However the drug safety profile is improved on previous combinations. Starting asymptomatic people on ART may lead to poorer adherence, and there may be potential for resistance. So effort has to go into education and support for mothers who are on ART, so they understand the benefits to them, as well as to their children. The cost of starting a larger number of women on ART earlier has also been raised, but cost-effectiveness studies generally favour Option B+.

TUBERCULOSIS

Interventions to improve adherence to treatment for paediatric tuberculosis in low- and middle-income countries: a systematic review and meta-analysis

Bull World Health Organ 2015;93:700-711

- **What factors did the authors find promoted or threatened adherence to treatment for paediatric tuberculosis?**
The authors found that combinations of interventions were most likely to have a beneficial effect. These were in the areas of education and psychosocial support, improving health care delivery, improving follow-up and health systems and improving social and financial protection. No one area can be relied upon to be effective alone. Promising results came from studies which addressed all or several of these areas.
- **What interventions had the most success in promoting adherence?**
Examples included family education, support for food and transportation, tracer systems, home visits, reducing out of pocket expenses, even a deposit that was refundable on treatment completion.

Achieving high treatment success for multidrug resistant TB in Africa: initiation and scale up of MDR TB care in Ethiopia – an observational cohort study

Thorax 2015;70:1181-1188

- **In Ethiopia what rate of treatment completion was achieved for MDR TB?**

This study achieved a very high rate of successful treatment: among 612 patients 64.7% were cured, that is they completed 2 years of MDR treatment and they proved they were cured by having at least 3 consecutively negative cultures one month apart, after the intensive phase. In addition to the patients who had proven cure, an extra 13.9% completed the 24 months of treatment, but had no record of the negative cultures necessary to define a cure. So overall 78.6% completed MDR treatment in this study in Ethiopia. Note that 603 98% of these patients had previously been treated for TB, and most had had 2 previous treatment courses, and 133 (21%) had HIV co-infection, which makes the results of the study even more impressive as they were a difficult group of patients to achieve successful treatment in.

- **What drugs were used in the treatment, and what was the treatment duration?**

24 months. A standardised second line drug regimen, consisting of (1) at least 3 oral agents to which the patient was presumed to be susceptible (levofloxacin, ethionamide, cycloserine, or para-amino salicylic acid), plus (2) pyrazinamide, (3) an aminoglycoside (amikacin or kanamycin) or a polypeptide (capreomycin) injectable agent. Treatment duration was a minimum of 18 months after bacteriological conversion (smear negative) of which at least 8 months included injectable drugs. Most patients were hospitalised at least until they became smear negative. All patients had proven DST (bacteriological) or genotypic drug resistance to both rifampicin and INH, or had presumed resistance based on multiple directly observed therapy failures or being close contacts with a patient with bacteriologically proven MDR.

- **What were the key elements of the follow-up program? What adherence strategies were used?** The follow-up was extensive and meticulous. Consisted of monthly home visits by an roving TB nurse who supervised treatment, and gave injectable drugs if the patient was still on these, and monthly visits by the patient to the outpatient department, identification of a patient supporter to assist with DOT, monthly food baskets, psychosocial support, housing support for the most destitute. The study concluded that all other successful programs that reported low loss to follow up had this level of nutritional, social and economic support and nursing outreach for follow-up in the home.

- **What side effects were described from the MDR TB treatment?**

Side effects were common, including gastritis (43%), nausea and vomiting (40%), joint pains and arthritis (39%). 14% had mental health problems, including depression, anxiety and suicidal ideation. Hypothyroidism and peripheral neuropathy were common, occurring in 18% and 13% respectively. Some specific side effects, such as hearing (6% overall) especially with amikacin / kanamycin.