Fumonisin Exposure in Guatemalan Women of Child-Bearing Age: A Potential Link to the Observed High Incidence of Frontoethmoidal Encephalocele

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Background: Frontoethmoidal encephalomeningocele (FEEM) is a neural tube defect (NTD) characterized by a persistent foramen cecum and herniation of cranial contents through an anterior skull defect. The mycotoxin fumonisin, a contaminant of maize, has been implicated in the pathogenesis of FEEM as it disrupts sphingolipid metabolism and decreases folate bioavailability. Studies have demonstrated that exposure to fumonisin in experimental animals induces FEEM.

A high prevalence of FEEM has been observed at the rural Casa Colibri Clinic (CCC) in Nuevo Eden, Guatemala. Fumonisin exposure in women of childbearing age is a suspected contributory risk factor due to the high consumption of maize.

Methods: This investigation involved a review of the FEEM cases that have presented to the CCC, as well as a toxicological analysis of fumonisin exposure in women of childbearing age residing in villages surrounding the CCC. To determine the exposure level and accumulation of fumonisin breakdown products, urine and finger-stick blood samples were collected and analyzed using high performance liquid chromatography.

Findings: Eight cases of FEEM (3 males: 5 females) were evaluated. The average age at presentation was 6.3 years. Three sub-types of frontoethmoidal encephalocele were observed as follows: 5 nasoethmoidal; 1 nasofrontal; and 2 naso-orbital.

Fumonisin exposure was quantified in 104 women from two FEEM villages and four non-FEEM villages. Analysis of the exposure data demonstrated an average fumonisin intake of 6.33 μg/kg (range = 0.0 μg/kg − 118.81 μg/kg) (World Health Organization provisional maximum tolerable daily intake (PMTDI) is 2.0 μg/kg). When comparing FEEM and non-FEEM villages significant differences in mean fumonisin exposure were revealed, with a mean fumonisin exposure of 14.62 μg/kg in FEEM villages (95% confidence interval = 5.63 μg/kg − 23.61 μg/kg), and 3.12 μg/kg in non-FEEM villages (95% confidence interval = 1.79 μg/kg − 4.5 μg/kg) (p-value = 0.015).

Interpretation: Fumonisin exposure levels in villages with known cases of FEEM were significantly higher than those of non-FEEM villages. Of the villages sampled, four of six had mean fumonisin exposure levels that exceeded the WHO PMTDI. Due to the startling number of cases of FEEM in this rural region, exposure to fumonisin has been implicated as a contributory risk factor.

Source of Funding: None.

Abstract #: *LAN.014*

Distributed Thermistor for Continuous Temperature Monitoring of Malnourished Infants at Risk for Hypothermia

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Program/Project Purpose: Severe acute malnutrition affects around 19 million children under 5 years worldwide, and kills 400,000 of them each year, according to the WHO. Hypothermia and hyperthermia, two clinical effects of malnutrition, often lead to death in low- and middle-income countries (LMIC) where understaffed hospitals are unable to continuously and simultaneously monitor the temperature of malnourished infants. A low-cost device that can collect temperature data of patients and wirelessly transmit this data to a single source for nurses would significantly alleviate the strain on human resources and decrease infant morbidity/mortality.

Structure/Method/Design: Since 2014, preliminary prototypes for this wireless thermistor device have been created and tested, specifically in hospitals in Malawi. The final design consists of a silicone armband, a thermistor, and a circuit board with a rechargeable battery, microcontroller, A-D converter, and antenna. The armband attaches to the child's upper arm with the thermistor situated in the axilla. Temperature data is transmitted via Bluetooth to an Android device. The device is reusable, low-cost, user-friendly, and easily sanitized, attributes well-suited for use in LMIC where malnutrition is widespread.

Outcome & Evaluation: Researchers traveled to Malawi in the summer of 2015 to introduce the design to hospitals and perform preliminary testing of communications. Nursing staff were enthusiastic about the device and could clearly grasp its function and use. The range for data-transmission was tested, and it was found that the device worked successfully at all distances within and around the hospital. This experience defined final improvements of the device before implementation, including band design and mobile application development.

Going Forward: A wireless thermistor device has the potential to permit more efficient and effective use of human resources, while reducing infant deaths due to hypothermia in LMIC. A simple interface and sustainable design is ideal for remote hospitals that suffer from this problem. With improvements to the band design and mobile application development, the device will be ready for implementation in Malawi hospitals by the summer of 2017.

Source of Funding: Pediatric Medical Device Institute.

Abstract #: *LAN.015*

Knowledge, Attitudes, and Practices of Exclusive Breastfeeding at Dhulikhel Hospital, Nepal

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Background: Forty-one percent of children under five are stunted in Nepal, where infant mortality remains high. As one approach to