

ANALYSIS OF BIOLOGICAL SAMPLES AND BEADS FROM A CASE OF BINDEEZ BEADS (AQUA DOTS) INGESTION

Guy's and St Thomas'
Poisons Unit

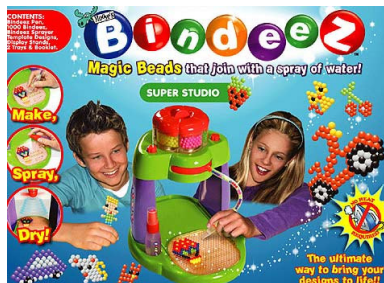
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Introduction

- There have been a number of published cases of children presenting with drowsiness, bradycardia and seizures associated with ingestion of the popular toy, Bindeez beads (Aqua Dots in the USA) [1,2].
- The first published cases were from Australia in 2007. Urine toxicology analysis in these cases was positive for Gamma-hydroxybutyrate (GHB) due to 1,4 Butanediol (1,4BD) being used in the manufacture of the beads instead of the non-toxic plasticiser 1,5 Pentanediol (1,5PD) [1].
- 1,4BD is metabolised to GHB which is responsible for the toxicity seen in bindeez beads ingestion cases.
- Subsequent to these cases there was a world-wide withdrawal of Bindeez beads products in November 2007 - 4.2 million toys were recalled from the US market [3].
- However, since the product withdrawal, cases of ingestion have continued, including a recently reported case in the UK [2].
- We report here analytical results of blood and serum samples from this case (previous reported cases have only involved urine analysis) together with preliminary results of analysis of the beads.



Case Report²

- A 7 year old girl presented to her local Emergency Department (ED) around 2300, after being found collapsed at home by her parents.
- She was surrounded by Bindeez toy beads that had been given to her as a Christmas present, and some were found in her mouth.
- She had a pre-hospital respiratory arrest requiring bag and mask ventilation.
- On arrival in the ED, she had a Glasgow Coma Scale (GCS) of 3/15 with poor respiratory effort and was therefore intubated and ventilated.
- Initially she had a marked bradycardia, but this settled rapidly and her blood pressure remained normal throughout.
- A flexible bronchoscopy was performed by the local hospital to exclude inhalation of the beads and associated airway obstruction as the cause for her collapse and respiratory compromise - no beads were seen in her airways.
- She was therefore transferred to our regional poisons Paediatric Intensive Care Unit (PICU) for further management.
- The following morning at around 0815 she vomited approximately 80 Bindeez toy beads.
- In view of the intact beads vomited more than 8 hours after ingestion, whole bowel irrigation was recommended during a toxicology consult to remove any remaining beads from her gastro-intestinal tract.
- She remained drowsy, with a fluctuating level of consciousness whilst the whole bowel irrigation was performed, suggestive of ongoing GHB toxicity.
- Once she was fully awake and alert, approximately 24 hours after initial presentation she was extubated.
- She remained on the regional poisons PICU for a further 12 hours of observation, during which she did not develop any further evidence of GHB-like toxicity.
- She was therefore transferred back to her local paediatric unit, prior to being discharged home.

Methods

- Informed consent for analysis of samples collected was obtained from the patient's mother.
- GHB, 1,4BD and 1,5PD were analysed using a gas-chromatograph with mass spectrometric detection.

Biological samples

- Biological samples were sent to the Analytical Unit, St George's, University of London for analysis.
- GHB in biological samples was converted to gamma-butyrolactone (GBL) for analysis.

Bindeez Toy bead analysis

- Samples of recalled Bindeez beads were obtained from a national high street toy supplier.
- Beads were analysed to determine the content of 1,4BD, 1,5PD and GHB.
- The maximum time for 1,4BD to 'leach' off the beads was determined.



Figure 1. Analytical Unit, St George's, University of London.

Results

- Blood and serum samples from the child were positive for GHB at significant concentrations of 90mg/L and 96mg/L respectively.
- Beads analysed from recalled packets were screened to determine the GHB source, and were positive for 1,4BD at a concentration of greater than 10mg of 1,4BD per bead. Neither GHB or 1,5PD were found on the beads.
- Further investigations showed that 1,4BD is slowly released from the beads over time, with at least 10mg per bead being released in the first 48 hours.

Conclusions

- The source of the GHB in this case was the 1,4BD in the beads and the delayed release of 1,4BD seen in the dissolution studies explains the atypical, ongoing GHB toxicity seen in this case.
- Accurate quantification of total 1,4BD per bead has been impeded by the nature of the bead itself, however further analysis of the beads continues and we hope to have more detailed data to be able to quantify the amount of 1,4BD per bead and therefore the risks associated with ingestion.
- This is the first report of blood concentrations measured following ingestion of Bindeez beads and highlights the continued public health hazard presented by these beads despite their worldwide recall and publications in the medical and public press.
- Further studies are needed to determine the rate of dissolution of 1,4BD from the beads and factors which alter this (e.g. stomach pH, co-ingestion of food).
- Clinical toxicologists can then determine the optimal length of observation and appropriate management of children following ingestion of the beads.

References

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