Two-year follow-up for children with melamine exposure in Hong Kong: a multicentre study

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Key Messages

1. The level of melamine exposure in Hong Kong children was near the tolerable daily limit set by the World Health Organization.
2. No evidence of renal dysfunction was noted in subjects over the 2-year follow-up period.
3. There was no evidence that low levels of melamine exposure were associated with haematuria, proteinuria, or ultrasound abnormalities.
4. Asymptomatic children (with no evidence of acute renal complications) after low-dose melamine exposure do not need routine follow-up.

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背景：在二零零八年，部份中國大陸的兒童被發現其急性腎臟症狀與攝取高劑量三聚氰胺有關。而香港兒童的三聚氰胺攝取量則接近世界衛生組織所訂的每日可容忍攝入量（按每公斤體重計算為0.2毫克）。因此本研究收集關於攝取低劑量三聚氰胺後對兒童健康影響的數據。
目標：調查香港兒童攝取三聚氰胺後其腎臟的中長期影響。
研究方法：在香港健康中心進行檢查的兒童如被發現有以下任何一項情況會被跟進：（1）超聲波顯示有腎結石，沈積物或阻塞物，（2）尿液試紙檢測結果異常。合適的兒童會根據以下條件決定召募的優先次序：（1）三聚氰胺估計攝取值，（2）腎病的臨床徵狀，（3）年紀較輕。所有參與者均接受了腎臟連續超聲波掃瞄，尿液檢測，尿液中Beta2微球蛋白含量測試及肌酸酐清除試驗（從單次血清肌酐酸濃度中計算）。另外，超聲波掃瞄顯示異常的兒童會接受進一步檢查以找出形成腎結石的原因。
結果：研究包括了62名在超聲波檢測發現異常及321名尿液樣本發現異常的兒童。攝取超過世界衛生組織所訂的每日可容忍攝入量（0.2微克/公斤體重）的兒童與並無超標的兒童之間並無發現臨床上的顯著差異。所有參與的兒童的腎功能參量亦處於正常水平。低三聚氰胺劑量估計攝取值與腎臟的症狀並無關係。
結論：研究並未發現三聚氰胺的估計攝取值與中長期腎臟不良後果有關。
建議：無證據支持需要對曾攝取低劑量三聚氰胺但無症狀的兒童進行定期跟進。

Introduction

In 2008, an outbreak of acute renal problems among children in the Chinese Mainland was linked to ingestion of melamine-tainted milk products (MTMPs).[1,2] In animal studies, the main adverse effects of melamine exposure include renal stones, renal tubular necrosis, melamine crystalluria, and haematuria.[3] There was no such study on humans. In Hong Kong, a large scale screening programme was initiated by the government.[1] Many asymptomatic children who were exposed to MTMPs were found to have abnormal urinalysis or ultrasound findings. The clinical significance of the renal stones and deposits, and asymptomatic haematuria was unknown. This study aimed to investigate whether Hong Kong children with low melamine exposure have adverse renal outcomes.

Methods

This study was conducted from April 2009 to September 2011. Children with abnormal urinalysis or ultrasound findings were recruited from three centres; priority was given to those estimated to have been exposed to melamine, had clinical features of renal disease or were of a young age. Recruited subjects were followed up and received repeated renal ultrasound scans and urine testing for renal function over a 2-year period. Ethical approval was obtained from the relevant Cluster Clinical Research Ethics Committees. Written informed parental consent was obtained from all cases.

Results

We recruited 62 children with ultrasound abnormalities and 321 with urine test abnormalities. Ultrasound abnormalities included renal stones, echogenic foci compatible with renal deposits, and a dilated renal pelvis. None of the children developed renal failure or life-threatening complications. In some children, ultrasound abnormalities resolved without treatment. Urine test abnormalities

included blood and/or protein positive on urine reagent strip testing. Only 3.4% of children were confirmed to have haematuria on microscopy. Among children who had marginally raised early morning urine protein/creatinine ratio, no other results were abnormal and they were referred to specialist renal clinics for further follow-up. Renal function estimates for all children were well within normal limits throughout the study period. None of the markers of renal outcomes measured deteriorated over the course of the 2-year follow-up.

Discussion

After 2 years of follow-up, no renal function abnormalities were detected in our subjects. The prevalence of haematuria and proteinuria was 0.2% each. There was no evidence that low-dose melamine exposure increases the risk of haematuria, proteinuria or renal dysfunction. Most abnormalities detected were unrelated to melamine consumption. No children had renal function deterioration over the 2-year follow-up. According to studies from the Chinese Mainland, although patients had acute problems, there were no long-term adverse effects.[4,5]

The main limitation of our study was that not all children who were screened were followed up. Nonetheless, the selection criteria prioritised children with highest risk of developing adverse renal complications. We were therefore able to undertake a relatively long period of follow-up to measure several markers of renal function and tubular damage on a cohort of children. Furthermore, despite involving only three centres, we assessed 55% of all children screened in the 2008 screening programme. This should provide a reasonable representation of the population. The second limitation was the lack of an objective marker of melamine exposure. However, detailed food questionnaires enabled a reasonable estimate of melamine exposure.

There was no evidence to support routine follow-up of asymptomatic children with no acute renal complications of melamine exposure. Low levels of melamine exposure are unlikely to pose a long-term health risk.

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