

## SHORT REPORT

## Diabetic ketoacidosis in Asian children

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**Abstract**

**Over the 10 year period 1987-1996, 328 children with type 1 diabetes mellitus presented in the city of Birmingham, England, of whom 27% had diabetic ketoacidosis. Asian children under the age of 5 had an eightfold increased risk of presenting in diabetic ketoacidosis compared with non-Asian children of the same age.** (*Arch Dis Child* 2001;85:60-61)

Keywords: diabetic ketoacidosis; Asian children

Up to 30% of newly diagnosed diabetic children present in ketoacidosis,<sup>1</sup> and in Birmingham it has been observed that many of these children are of Indo-Asian origin. Our aim in this study was to test the clinical observation that young Asian children are more likely to present acutely with ketoacidosis than non-Asian children.

**Methods**

All children aged 0-15 years who developed diabetes between 1987 and 1996 in Birmingham were identified by paediatricians, and ascertainment was checked by contacting general practitioners and diabetes nurse specialists. Details of age, sex, and mode of presentation were obtained from medical case notes. Patients who were diagnosed outside the city boundaries, or who did not fulfil World Health Organisation criteria for type 1 diabetes,<sup>2</sup> were excluded. Missing or incomplete notes were discarded. Diabetic ketoacidosis was defined as an arterial pH of 7.25 or less, or a plasma bicarbonate of 15 mmol/l or less, in the presence of hyperglycaemia and ketonuria.

Ethnic groups were taken from the 1991 British Census. The "Asian" categories encompassed Indians, Pakistanis, Bangladeshis, Chinese, and Asian (other). In this study "Asian" denotes children whose parents originated in the first three categories and includes Sri

Lankans. Ascertainment of subjects did not rely solely on names, as personal contact was made with all children through clinics. Eligible children required both parents to be of Asian origin as defined above. The "non-Asian" comparison group, although predominantly white, included all other categories.

Analysis of results to evaluate the association of sex, age, and ethnicity with the presence or absence of diabetic ketoacidosis was by logistic regression adjusted odds ratios.

**Results**

Three hundred and twenty eight children (146 female, 182 male) fulfilled the study criteria. Ninety seven (29%) were under the age of 5 years, and 90 (27%) presented in diabetic ketoacidosis. The total number of Asian children was 46, and 22 (48%) presented in ketoacidosis during the 10 year period, comprising 24% of all children in diabetic ketoacidosis.

Fifteen of 40 children (38%) under the age of 5 who presented in ketoacidosis were Asian. As a percentage of all Asians who presented in ketoacidosis, the Asian under-5s comprised 68% (15/22), compared with 32% (25/78) of non-Asian children under 5 in diabetic ketoacidosis.

There was no significant evidence of sex differences over the period in the under-5s who presented in ketoacidosis (Asians: boys 53%; non-Asians: boys 52%). No significant difference in diabetic ketoacidosis presentation was found between the two ethnic groups over the age of 5, or between non-Asian age groups. Within Asians, the risk of metabolic decompensation was less for the over-5s than for the under-5s.

The most striking finding, however, was that there was an eightfold increased risk of presenting in diabetic ketoacidosis when the subject was an Asian child under the age of 5 compared with a non-Asian child of the same age (table 1).

**Discussion**

This study has confirmed the clinical observation that young Asian children appear to be particularly vulnerable to diabetic ketoacidosis. The results showed that up to 48% of Asian children present in diabetic ketoacidosis, and that newly presenting Asian children under the age of 5 years are eight times more likely to present in diabetic ketoacidosis than their age

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Table 1 Details of children with diabetic ketoacidosis

Subjects	DKA (n)	DKA (%)	Odds ratio	95% CI
(1) Asian <5 years (n=19)	15	78.9	(1) v (2), 10.71	2.64 to 43.41
(2) Asian >5 years (n=27)	7	25.9	(2) v (4), 0.76	0.30 to 1.92
(3) Non-Asian <5 years (n=78)	25	32.1	(1) v (3), 7.95	2.39 to 26.42
(4) Non-Asian >5 years (n=204)	43	21.1	(4) v (3), 0.57	0.32 to 1.01

CI, confidence interval; DKA, diabetic ketoacidosis.

matched non-Asian counterparts. Clearly this has major clinical implications.

The most obvious explanation for this discrepancy would be that the urgency of the condition is underestimated in the primary care setting where type 2 diabetes is more prevalent, especially in Asians,<sup>3</sup> and that referral to hospital practitioners is delayed (in this study 13% of the Asian children were initially referred for outpatient appointments).

An alternative explanation is that the correct diagnosis has not been considered, and therefore medical professionals may undertake inappropriate management. In this study 58% of Asian children under the age of 5 years who subsequently developed ketoacidosis had made at least one visit to their general practitioner in the 48 hours before presenting at their local hospital. In some cases they were referred to the hospital as acutely ill children, but in others they were sent home with analgesia and antibiotics, to present spontaneously at a later time. In only one instance did a child have urinalysis performed in the surgery with an appropriate diagnosis and referral as a result.

A further possible explanation is that young Asian children with diabetes have a more rapid metabolic decompensation than non-Asian children. To evaluate this a prospective study of larger numbers with measurement of C peptide to assess residual  $\beta$  cell mass would be

required. This study, although involving small numbers, has shown the propensity of young Asian children to present with severe diabetic ketoacidosis, and demonstrates the need for enhanced awareness of this condition in ethnic minority children, especially as there is evidence that the incidence of childhood diabetes in Asians is approaching that of the indigenous population.<sup>4</sup>

The diagnosis of diabetes can be confusing in very young children, who may not present with classical symptoms, and we would recommend that all health professionals who deal with sick children have a high index of suspicion for this eminently treatable condition.

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### Breath holding

I can tell you from personal experience that breath holding spells can be terrifying for parents, even those who have spent a fair amount of their time trying to reassure other parents of the benign nature of these attacks. An American paediatric neurologist (F J DiMario Jr. *Pediatrics* 2001;107:265-9) has provided follow up data on 95 children seen over a period of nine years.

All of the children had breath holding spells severe enough for them to be referred to a paediatric neurology clinic. Forty nine were said to have had cyanotic attacks, 27 pallid attacks, and 19 had had both. The spells sometimes started in the neonatal period (4 cases) but half of the children (47) began their attacks at between 6 and 12 months. They began between 25 and 30 months in only three. At their peak, usually around 18 months, they occurred about once a week on average but a quarter of the children had more than one episode a day. The average age when the spells stopped was 36 months but one child was still having them at 7 years. Fifteen had hypoxic convulsions. Of the 67 patients whose breath holding spells had stopped, 12 subsequently had fainting spells. There was a first degree family history of breath holding spells in one third of cases.

Estimates of the incidence of breath holding spells have varied but a figure of around 7% with 2% having severe spells (with loss of consciousness) is probably not far off the mark.

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