Diabetic ketoacidosis (DKA) in children with type-1 diabetes mellitus (T1DM): an Italian multicentre survey

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Background and Aims

In Italy children are followed by pediatricians provided by the National Health Service free of charge and children with T1DM are usually followed by pediatric diabetologists. Since recent data on epidemiology and management of primary DKA in children with T1DM are lacking a questionnaire was sent to the 77 centres belonging to the study group of diabetology of the Italian Society for Pediatric Diabetology and Endocrinology (ISPED), enquiring on epidemiology (2012-2013) and present management of DKA.

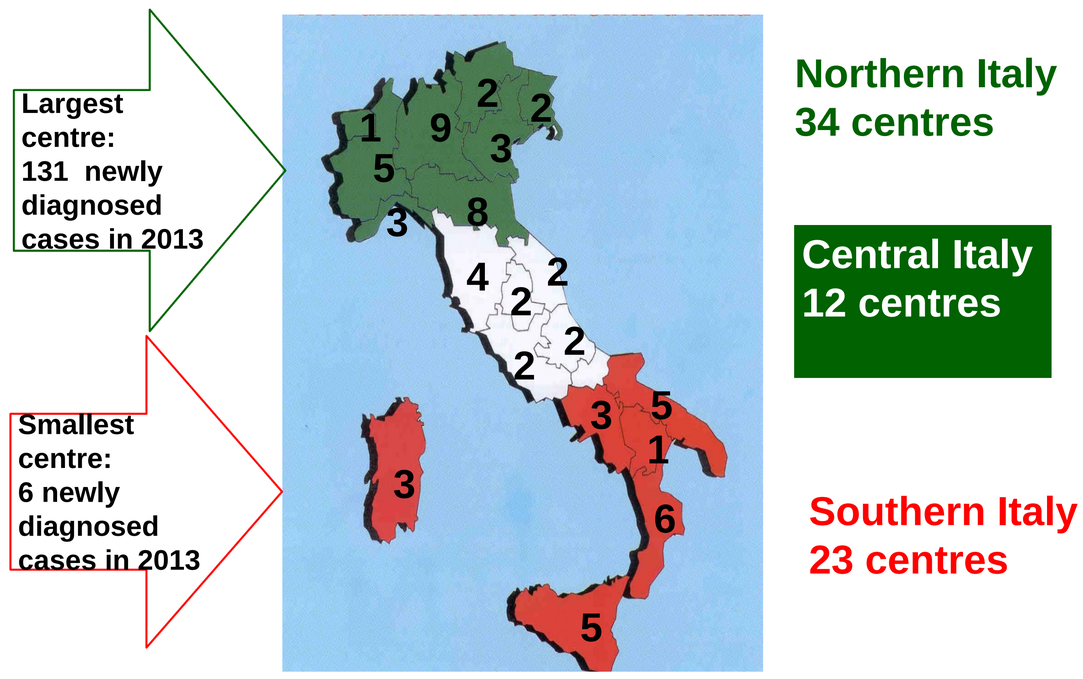
Methods

Each of the 77 centers referring to the ISPED was asked to review all charts of patients under 15 years of age, presenting T1D onset **between January 2012 and December 2013**.

Results

Centre characteristics

68/77 centres (87%) answered to our survey. A total of **14.493 patients** were followed (under age 20), 89.4% in the 39 tertiary referral centres (following 100 or more patients). Among the 68 responder centers, 43 (63.2%) had local registries: 26 from tertiary referral centers (66.6%) and 17 from primary/secondary referral centers (58.6%) (p<0.001). **Pediatric Intensive Care Unit was present in only 28/68 centers (41%).** In 10 tertiary referral centers (14%) DKA was managed by a pediatric diabetologist, in 45 centers (66%) by general pediatrician + pediatric diabetologist (by phone) and in 13 centers (19%), all primary/secondary referral, by general pediatrician alone**. Serum beta-hydroxybutyrate to rate DKA severity and to evaluate DKA management follow-up was measured in 43/68 centers (63%).**



Epidemiology

In the 2 years of the survey, a total of **2453 children 0-14 years** of age were newly diagnosed and **DKA observed in 945/2453 patients (38.5%)**, **severe in 253/2453 (10.3%).** Evaluating DKA occurrence and tertiary vs primary/secondary referral centers, no difference was observed either for total DKA (35.5% vs 38.9%, p=0.562), or severe DKA (10.6% vs 10.2%, p=0.893)**.**
In preschool children, total DKA was observed in 445/618 patients (72%) (p<0.001 vs patients >6 years of age), and severe DKA in 103/618 patients (17%) (p<0.001 vs patients >6 years of age**). Cerebral edema was observed in 5/945 patients (0.53%).**

Protocols

All 68 centres declared to manage DKA according written protocols: **46 centers (68%) used IDF/ISPAD guidelines,** 15 centers used a protocol based on Lestradet indications, or slightly modified respect the one utilized during the IMDIAB study, called GETREM and 7 centers (10%) used local protocols not necessarily referring to any international recommendation.

Fluids

All centres declared to use 0.9% saline during the first 2 hours, but at different infusion rates: 48 centers (71%) at 5-10 ml/kg/h, 11 centers (16%) at 10-20 ml/kg/h, 3 centers (4%) at less than 5 ml/kg/h, and 6 centers (8%) calculated infusion rate according square meter (usually 3 l/m2).
After the first 2 hrs, all centres agreed that the amount of fluids to be infused should never exceed 3 l/m2/day.
A **significant difference was observed regarding the nature of fluid infused after the first 2 hours**, saline either 0.9% or 0.45% in 51 centers (75%), 5%-10% glucose solution, irrespective of glycemic values, in 13 centres (19%) and different solutions in the remaining 4 centers,
Hypotonic solutions were never used when BG was above 250-300 mg/dl. **By contrast, when BG began to fall below that value, non-hypotonic solutions** (containing at least 77 mEq/L of Sodium) **were used only in 30 centers (44.1%),** whereas 38 centers infused 5-10% glucose solutions with sodium concentration ranging from 0 to 34 mEq/L.
Potassium was supplemented in all centres, despite at different rates: 20-40 mEq/l in 43 centers (63%), calculated as mEq/kg/h in the remaining 25 centers (37%). **Bicarbonates were never used in 12 centers (17%), while were exceptionally used according to pH and most of all clinical conditions in the remaining centres.**

Insulin

Insulin was infused using an automated syringe in 53 centers (78) starting from 2nd or 3rd hour in all 68 centers**. Insulin infusion rate was 0.05-0.1 U/kg/h in 49 centres (72%), while the remaining centres used lower rates (0.02-0.07 U/kg/h).**

Conclusions

Notwithstanding prevention campaign and pediatric care, DKA is still observed at diabetes onset in Italian children. Despite international guidelines significant variability in DKA treatment still exists, underlying the need to share them among pediatric centres. Furthermore, most of the Italian centers treating children with DKA do not have an ICU in their hospital, do not measure serum beta-hydroxybutyrate and do not infuse insulin with an automated syringe. In our country cerebral edema is a rare complication of DKA in children with newly diagnosed diabetes.