Diabetic ketoacidosis occurs in approximately 25-40% of newly diagnosed children with T1DM . Cerebral edema is a relatively rare (1%), but serious complication of pediatric DKA, associated with significant morbidity and mortality (40-90%). Cerebral edema accounts for 50-60% of diabetic related deaths in children.[1]
The exact mechanism of edema is not entirely known, although purported culprits have been osmolar shifts, rate of fluid infusion and administration of sodium bicarbonate. Routine administration of bicarbonate in patients who are not critically ill with DKA has fallen out of favor in pediatric and emergency medicine practice; however, we have seen at least 5 children in DKA admitted to the PICU in the past month for DKA, all of whom received sodium bicarbonate for pH > 7.0. Is such treatment necessary or even potentially dangerous?

P: In children in DKA
I: does routine administration of sodium bicarbonate
C: in addition to IVF and IV insulin
O: increase risk of cerebral edema?

PubMed: diabetic ketoacidosis AND cerebral edema AND sodium bicarbonate
Cochrane: sodium bicarbonate; diabetic ketoacidosis
ACP Journal Club: sodium bicarbonate; diabetic ketoacidosis
BestBETs: diabetic ketoacidosis; sodium bicarbonate; cerebral edema
TRIP Database: sodium bicarbonate

Author/Locale/Year	Study Type	Patient Group	Key Results	Limitations
[1]Glaser et al. USA 2001	Retrospective, Case control	N=61 DKA w/ CE	↑ incidence of CE in bicarb RR 4.2 (P=0.008)	Retrospective Small numbers Kitchen sink effect?
Marcin et al. USA 2002	Retrospective cohort	N=61 (same as above)	Poor outcome not statistically significant with bicarb	Retrospective Small numbers… Bicarb N=2
Lawrence et al. Canada 2004	Case control	N=21	Bicarbonate assoc'd with greater incidence of CE (P=0.093)	Weak inclusion criteria Controls not matched No findings withstood Bonaferroni correction
Green et al. USA 1998	Case series	N=147 Bicarb=57 None=49	Bicarb increases LOS without decreasing time to serum HCO3 normalization	Retrospective Small numbers

Bottom Line: No randomized, double-blind, prospective clinical trials exist with regard to utility/danger of routine bicarbonate use in pediatric DKA. Case-control and case series with limited numbers are all we have to go on, in which data is limited at best. Judicious use of bicarbonate is suggested by the ADA Consensus Statement on Pediatric DKA for only those children with arterial pH <6.9, with decreased cardiac contractility and peripheral vasodilation that impairs tissue perfusion or those with life-threatening hyperkalemia. Dosages should not exceed 1-2mmol/kg over 60 minutes.

References

Glaser et al. "Risk Factors for Cerebral Edema in Children with Diabetic Ketoacidosis." *New England Journal of Medicine*. 344(2001):264.
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