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Review finds greatest risk of aluminum exposure is via parenteral nutrition

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Aluminum is one of the most common metals on earth and is in almost everything we eat, drink, put on our skin or infuse.

Studies indicate that the skin and gastrointestinal lining are effective barriers to aluminum (Priest ND. *J Environ Monit.* 2004;6:375-403; Flarend R, et al. *Food Chem Toxicol.* 2001;39:163-168). Therefore, aluminum ingested or placed on the skin is unlikely to result in significant accumulation in the body. If a high level of aluminum does make it to the bloodstream, it is cleared quickly by the renal system (Priest ND. *J Environ Monit.* 2004;6:375-403).

A new AAP technical report from the Committee on Nutrition reviews potential aluminum exposures in infants and children. The report, *Aluminum Effects in Infants and Children*, is available at <https://doi.org/10.1542/peds.2019-3148> and will be published in the December issue of *Pediatrics*.

Concern about aluminum toxicity arises when the renal system may not be functioning well, such as in neonates or patients who have kidney disease. A 1996 AAP policy statement on aluminum focused on renal patients because the dialysates contained aluminum. The patients on these dialysates developed bone pain until the dialysates were made aluminum-free. Currently, patients with renal disease should continue to avoid medications with a high aluminum content, according to the technical report.

One of the highest aluminum exposures of concern is from the components of parenteral nutrition in neonates. These patients may require long-term parenteral nutrition, and their blood-brain barrier is not as well-developed. Studies in neonates have documented effects on development and bone (Bishop NJ, et al. *N Engl J Med.* 1997;336:1557-1561; Fewtrell MS, et al. *Pediatrics.* 2009;124:1372-1379).

The Food and Drug Administration responded to these data with new rules requiring aluminum content labeling on parenteral nutrition components (effective July 26, 2004; <http://bit.ly/2N1CvE>). The labels allow us to calculate the potential aluminum exposure; but even with the best efforts, the aluminum concentrations are still above the recommended safe level.

Another concern has been the aluminum concentration in commercial infant formulas, which is relatively high. However, as noted above, the gastrointestinal lining provides a good barrier for aluminum. A study that looked at plasma levels of aluminum in formula-fed infants found that the blood levels were similar to those in breast-fed infants (Hawkins NM, et al. *J Pediatr Gastroenterol Nutr.* 1994;19:377-381). More studies are needed to see if aluminum is deposited in the body and has longer-term effects.

Aluminum is an effective adjuvant that is used in many pediatric vaccines. While multiple voices have blamed the aluminum for a variety of maladies, the World Health Organization's Global Advisory Committee on Vaccine Safety reviewed large numbers of vaccine data in 2008 and found no evidence of any harmful effects of the small amount of aluminum contained in vaccines (<http://bit.ly/2MYeaRW>).

Take-home points

- Patients with renal disease should avoid medications with a high aluminum level.
- Parenteral nutrition components contain high aluminum concentrations, and every effort should be made to minimize the aluminum content.



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- Aluminum ingested orally has not been documented to result in health concerns.
- The aluminum adjuvants in vaccines have no documented long-term adverse effects.

Dr. Corkins is the lead author of the technical report and a former member of the AAP Committee on Nutrition.