

might have been caused by the activation of the mast cells because of the sting or by the resuscitation measures themselves but not by the neuronal or cardiac ischemia.^{4,5} Quite the contrary, the initial shock treatment (epinephrine, antihistamines, corticosteroids) might have even lowered the initial BTC.

In conclusion, it is noteworthy to physicians of all specialties that a thorough dermatologic inspection and specific questions searching for clinical symptoms of mediator release are required in the workup of Hymenoptera-allergic patients with a history of severe reactions because measurement of the BTC alone might not be sufficient to rule out mast cell–derived risk factors.

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SUBCUTANEOUS IMMUNOGLOBULIN INFUSION TO TREAT INFANTS AND TODDLERS WITH ANTIBODY DEFICIENCIES

To the Editor: IgG replacement in children with primary or secondary antibody deficiencies (ADs) clearly prevents recurrent bacterial infections, particularly in the respiratory tract.¹ Although the efficacy and safety of intravenous immunoglobulin (IVIG) replacement have been well documented,² intravenous access, central catheter infections, and systemic untoward effects associated with IVIG^{3–5} can be especially problematic in infants and toddlers with ADs. Although subcutaneous immunoglobulin (SCIG) therapy has gained wider acceptance in the United States, parents of infants and toddlers with ADs are rarely offered SCIG as an alternative to IVIG, and infants younger than 2 years are excluded from pharmaceutical clinical trials of new SCIG preparations, even though SCIG has successfully been given in children and adults since the 1970s.^{4–6}

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SCIG therapy is usually given weekly but can be given more often in small amounts to accommodate the personal preferences of patients with ADs and their families. SCIG therapy provides slow release of IgG into the bloodstream, enabling the provision of appropriate and stable serum IgG levels.⁷ SCIG has been reported to improve the quality of life in AD patients and often at a substantially lower cost than IVIG replacement.⁸ Despite this, little has been written about using SCIG in infants and toddlers with ADs, and our academic practice is often consulted about whether SCIG can be an effective alternative to IVIG in the youngest infants. We have found that infants and toddlers can be effectively treated with SCIG, given their poor venous access and often abundant subcutaneous tissue. We described 3 young children with different ADs as examples, many of whom we have successfully treated with SCIG therapy.

The first child was a 4-month-old (32 week gestation) infant with transient hypogammaglobulinemia of infancy. Three weeks after birth she developed an upper respiratory tract infection complicated by *Haemophilus influenzae* conjunctivitis. At 8 weeks of age, she was hospitalized with respiratory distress and lethargy secondary to pneumonia and *Klebsiella pneumoniae* bacteremia. Immunologic evaluation at 2 months was remarkable for a serum IgG level of 146 mg/dL (reference range at 40 weeks' gestation, 170–595 mg/dL), an IgM level of 22 mg/mL (reference range at 40 weeks' gestation, 6.3–25 mg/dL), a repeat serum IgG value of 89 mg/dL, and an IgA level of 9 mg/dL (reference range at 2 months of age, 2.8–47 mg/dL) at 4 months of age. The patient had normal T- and B-cell numbers for age and T-cell function but had not received any vaccinations. As a result of her clinical course, she was given an empiric prophylactic trial of IVIG, with an initial dose of 400 mg/kg at 4 months of age. She was switched to SCIG at 5 months of age, was thriving, and remained infection free with SCIG therapy for 5 additional months with stable IgG levels (Figure). She is currently not

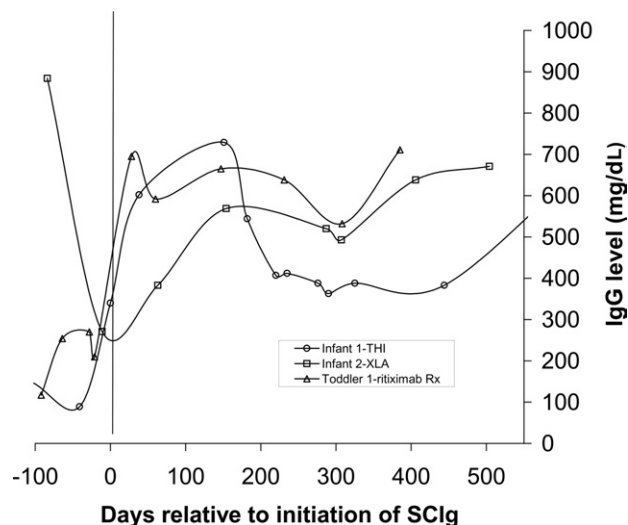


Figure. Serum immunoglobulin levels before and after initiation of subcutaneous immunoglobulin (SCIG) in infants and toddlers. Patient immunoglobulin levels were obtained via the Core Laboratory of the North Shore LIJ Health System and graphed relative to initiation of SCIG treatment. Rx indicates prescription; THI, transient hypogammaglobulinemia of infancy; XLA, X-linked agammaglobulinemia.

receiving immunoglobulin therapy. Her serum IgG level normalized for age and continues to appropriately increase without SCIG therapy as anticipated for an infant with transient hypogammaglobulinemia of infancy.

The second child was a 3-month-old, full-term infant with X-linked agammaglobulinemia (XLA). He has a known family history of XLA; his mother is an XLA carrier, and 2 maternal uncles have XLA. Cord blood showed a CD19⁺ B-cell count of 7/ μ L (reference range, 110–600/ μ L), with normal quantitative T-cell subsets. The serum IgG level at 1 week of age was 884 mg/dL (reference range, 250–1200 mg/dL). By 3 months it had decreased to 271 mg/dL, and he was started on SCIG therapy. He continued to receive weekly SCIG therapy, without serious infections or systemic adverse effects. Serum IgG levels are stable (Figure).

The third child was a 2-year-old toddler with hypogammaglobulinemia and B-cell lymphopenia secondary to rituximab. She was diagnosed as having steroid-resistant hemolytic anemia and was treated with a single, 375-mg/m² dose of rituximab. Subsequently, she developed recurrent pneumonia requiring hospitalization. An immunologic evaluation showed absent CD19⁺ cells (2/ μ L; reference range, 200–2100/ μ L) and hypogammaglobulinemia (IgG, 117 mg/dL; reference range, 424–1051 mg/dL). The remainder of the evaluation was normal, suggesting that rituximab induced B-cell lymphopenia and hypogammaglobulinemia. The patient was then given IVIG and developed a periorbital cellulitis and maxillary sinusitis. She was subsequently switched to SCIG and has remained infection free with stable serum IgG levels (Figure).

We found the dose of SCIG required to obtain a biological level to be equivalent to that obtained with intravenous replacement. Thus, as with IVIG, we start SCIG replacement therapy using 500 mg/kg (the midrange of the recommended dose for IVIG⁹) rather than using 137% of the IVIG dose for SCIG replacement, given that the efficacy of these 2 doses was identical. SCIG maintains appropriate and stable IgG serum levels in infants and children just as it does in older children and adults and protects them from severe infection. These infants and children tolerate the procedure well, especially because they often have sufficient subcutaneous tissue. In addition, most of their parents have reported that they prefer SCIG over IVIG because of its convenience⁵ and the improvement in their daily routines.

All 3 children tolerated SCIG therapy without incident. Two were previously receiving IVIG and made the transition smoothly. No

significant infections were reported with SCIG therapy, and serum IgG levels remained stable (Figure). All 3 families learned to easily administer SCIG to their active children, and 2 of the families of infants who were previously receiving IVIG and transferred to SCIG therapy preferred SCIG replacement.

SCIG is safe and effective in infants and toddlers and is a flexible way to provide immunoglobulin replacement because doses can be given weekly, 3 times each week, or even daily, with minimal adverse effects. SCIG should be considered as an excellent alternative to IVIG in the youngest pediatric AD patients.

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