221 Parvovirus Infections

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Parvoviruses, members of the family Parvoviridae, are small (diameter, ~22 nm), nonenveloped, icosahedral viruses with a linear single-strand DNA genome of ~5000 nucleotides. These viruses are dependent on either rapidly dividing host cells or helper viruses for replication. At least four groups of parvoviruses infect humans: parvovirus B19 (B19V), dependoparvoviruses (adeno-associated viruses; AAVs), PARV4/5 virus, and human bocaviruses (HBoVs). Human dependoparvoviruses are nonpathogenic and will not be considered further in this chapter.

PARVOVIRUS B19

DEFINITION

B19V is the type member of the genus *Erythroparvovirus*. On the basis of viral sequence, B19V is divided into three genotypes (designated 1, 2, and 3), but only a single B19V antigenic type has been described. Genotype 1 is predominant in most parts of the world; genotype 2 is rarely associated with active infection; and genotype 3 appears to predominate in parts of western Africa.

EPIDEMIOLOGY

B19V exclusively infects humans, and infection is endemic in virtually all parts of the world. Transmission occurs predominantly via the respiratory route and is followed by the onset of rash and arthralgia. By the age of 15 years, ~ 50% of children have detectable IgG; this figure rises to >90% among the elderly. In pregnant women, the estimated annual seroconversion rate is ~1%. Within households, secondary infection rates approach 50%.

Detection of high-titer B19V in blood is not unusual (see "Pathogenesis," below). Transmission can occur as a result of transfusion, most commonly of pooled components. To reduce the risk of transmission, plasma pools are screened by nucleic acid amplification technology, and high-titer pools are discarded. B19V is resistant to both heat and solvent-detergent inactivation.

PATHOGENESIS

B19V replicates primarily in erythroid progenitors. This specificity is due in part to the limited tissue distribution of the primary B19V receptor, blood group P antigen (globoside). Infection leads to high-titer viremia, with >10^{12} virus particles (or IU)/mL detectable in the blood at the apex (Fig. 221-1), and virus-induced cytotoxicity results in cessation of red cell production. In immunocompetent individuals, viremia and arrest of erythropoiesis are transient and resolve as the IgM and IgG antibody response is mounted. In individuals with normal erythropoiesis, there is only a minimal drop in hemoglobin levels; however, in those with increased erythropoiesis (especially with hemolytic anemia), this cessation of red cell production can induce a transient crisis with severe anemia (Fig. 221-1). Similarly, if an individual (or, after maternal infection, a fetus) does not mount a neutralizing antibody response and halt the lytic infection, erythroid production is compromised and chronic anemia develops (Fig. 221-1).

The immune-mediated phase of illness, which begins 2–3 weeks after infection as the IgM response peaks, manifests as the rash of fifth disease together with arthralgia and/or frank arthritis. Low-level B19V DNA can be detected by polymerase chain reaction (PCR) in blood and tissues for months to years after acute infection. The B19V

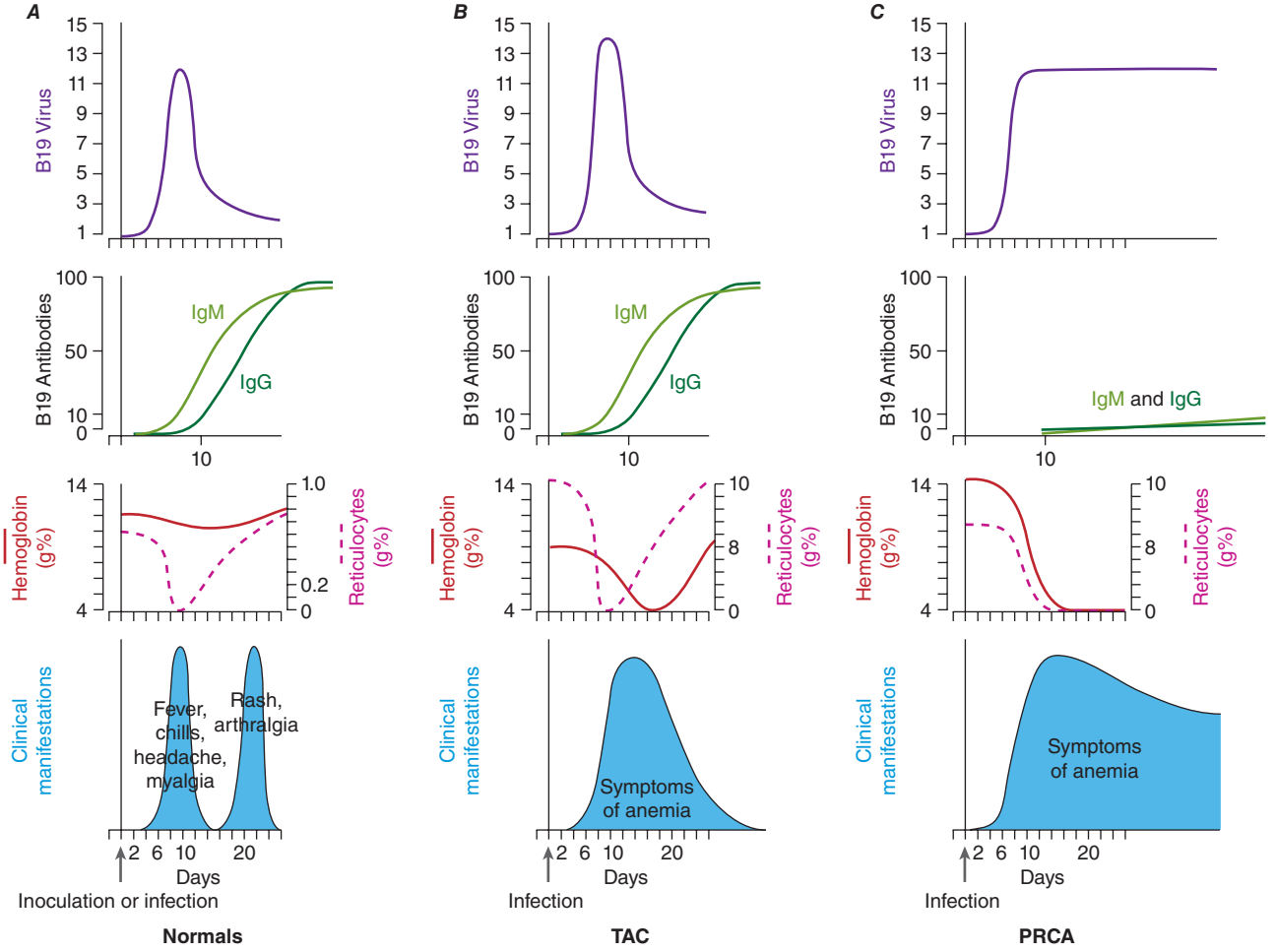

FIGURE 221-1 **Schematic of the time course of parvovirus B19V infection** in (***A***) normals (erythema infectiosum), (***B***) transient aplastic crisis (TAC), and (***C***) chronic anemia/pure red-cell aplasia (PRCA). *(Reprinted with permission from NS Young, KE Brown: N Engl J Med 350:586, 2004. © 2004 Massachusetts Medical Society. All rights reserved.)*