

pitalized here with blood-culture-documented infections due to *H. influenzae* (excluding meningitis), 40 during the last five years. There were 25 children with epiglottitis in this group and 36 with other types of infection: 10 with septic arthritis, nine with orbital cellulitis, seven with pneumonitis, three with superficial cellulitis and seven with bacteremia with no obvious localization. Although increased recognition through greater interest or improved laboratory methods may have contributed, it is clear that the increase is not due to greater numbers of very young infants with these infections. The youngest child with epiglottitis was five months of age (20 of 25 were two years of age or older), and only one of the 36 children with other bacteremic infections was less than three months of age.

A number of very young infants with meningitis due to *H. influenzae* have been seen recently in Pittsburgh as in Miami; there were 15 patients here under three months of age during the 1960's, as compared to six in the 1950's and three in the 1940's. Infants under three months, however, still account for a small proportion of the total number of Pittsburgh cases (consistently 3 to 4 per cent during the past three decades), since there has been an increase of similar magnitude among older children. If others find that the increase in infections due to *H. influenzae* affects older children as much as very young infants and adults, explanations should be fashioned to take this fact into consideration.

RICHARD H. MICHAELS, M.D.  
Pittsburgh, Pa. Children's Hospital of Pittsburgh

#### DEMONSTRATION OF CANDIDA IN BLOOD SMEARS

*To the Editor:* Candida sepsis associated with various conditions of altered host resistance and with use of intravenous catheters is well documented in the literature,<sup>1-5</sup> but as pointed out by Portnoy et al. (N Engl J Med 285:1010-1011, 1971), it is often not recognized in individual patients. Thus, it is clear that early detection of candidiasis and possibly other fungal infections by demonstration of organisms in blood smears, as those authors reported in two patients with candida sepsis, could be a useful tool. In their patients the organisms were detected in blood drawn through intravenous catheters and from a peripheral vein on one occasion. The authors expressed uncertainty, however, about the importance of organisms that they found in catheter blood since there may have been contaminants "colonizing the catheter." Other authors have also been skeptical on this point.<sup>1,2,5</sup>

Our purpose in writing this letter is to describe autopsy findings in two patients suggesting that detection of candida organisms in blood smears obtained via intravenous catheters may, contrary to previously expressed doubts, have special consequence for patient management and for the pathogenesis of candida sepsis in patients undergoing prolonged intravenous therapy.

Both our patients received hyperalimentation with casein hydrolysate, a procedure previously noted to be associated with a high incidence of candidiasis.<sup>2</sup> Both showed candida sepsis during life and disseminated inflammatory lesions containing yeast forms at autopsy. One patient was an adult who underwent colectomy for toxic megacolon due to ulcerative colitis, and in whom a postoperative wound infection containing candida developed. The second patient was a newborn infant on whom an ileal resection was performed as treatment of intestinal perforation caused by meconium ileus.

The autopsies revealed recent and organizing thrombus material at the catheter tips and on the walls of the superior vena cava and right atrium in the areas subjected to effluent stream from the catheters. Most notably, yeast forms and

pseudohyphae were found to be growing in the catheter-related thrombus material (Fig. 1). Organisms were also seen within the wall of the superior vena cava in the patient with ulcerative colitis.

We have concluded from these findings that catheter-related thrombi may be a favored site for proliferation of candida, perhaps especially in patients receiving hyperalimentation with casein hydrolysate since these solutions have been shown to enhance growth of candida in vitro.<sup>2</sup> Furthermore, it is conceivable that blood drawn through an intravenous catheter will be the most reliable way to demonstrate candidiasis when the organisms are growing in a thrombus located



Figure 1. Thrombus in Superior Vena Cava (X20), Showing Outline of Catheter (C).

The inset (X600) shows yeast and pseudohyphae within the thrombus.

near the catheter tip. Finally, although removal of the catheter is often adequate to control candidiasis,<sup>1,4</sup> our findings suggest that a continuing source for dissemination of the organisms may be left behind in the bloodstream when there is a catheter-related thrombus.

ARTHUR O. ANDERSON, M.D.  
JOHN H. YARDLEY, M.D.  
Johns Hopkins University  
School of Medicine

Baltimore, Md.

1. Ashcroft KW, Leape LZ: Candida sepsis complicating parenteral feeding. JAMA 212:454-456, 1970
2. Boeckman CR, Krill CE: Bacterial and fungal infections complicating parenteral alimentation in infants and children. J Pediatr Surg 5:117-126, 1970
3. Hart PD, Russell E Jr, Remington JS: The compromised host and infection. II. Deep fungal infection. J Infect Dis 120:169-191, 1969
4. Smits H, Freeman LR: Prolonged venous catheterization as a cause of sepsis. N Engl J Med 276:1229-1233, 1967
5. Ellis CA, Spivak ML: The significance of candidiasis. Ann Intern Med 67:511-522, 1967