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Yersinia enterocolitica in Donor Blood: a Case Report and Review

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Routine sterility control of a unit of leukocyte-depleted erythrocyte concentrate yielded growth of *Yersinia enterocolitica* serotype O:3. Plasma of the donor showed a high titer of agglutinins against the homologous organism. Although the donor was apparently well at the time of donation, he had a history of protracted terminal ileitis treated by surgery. The recipient of the contaminated blood was taking broad-spectrum antibiotics and did not experience any adverse effect. Fourteen other cases of transfusion-associated yersiniosis have been reported.

Bacterial contamination of donor blood is a rare cause of posttransfusional bacteremia and bacterial shock. Such contamination may originate from the skin flora, from environmental saprophytes introduced at the time of collection and during processing (17), or from bacteria circulating in the blood of an apparently healthy donor. The introduction of closed collection systems together with more stringent attention to skin disinfection have almost eliminated exogenous contamination of blood at the time of donation. The risk remains, however, that a donor suffering from an asymptomatic bacteremia will transmit the infection to the recipient through donated blood, as may be the case in syphilis. The risk is particularly real when the bacterium is able to proliferate at refrigerator temperature and if the blood is stored for a prolonged period. We describe the isolation of a virulent strain of *Yersinia enterocolitica* serotype O:3 from an erythrocyte concentrate obtained from an apparently healthy donor. We also review 14 reported cases of severe transfusion reaction, 9 of them fatal, involving at least three different pathogenic serotypes of *Y. enterocolitica*.

On 15 March 1988, a routine sterility control test of a sample of leukocyte-depleted erythrocyte concentrate (RCC) was positive for *Y. enterocolitica*. The blood of the donor had been collected into citric acid-phosphate-glucose-adenine (Double Pack; Fenwal) and processed immediately into RCC and fresh frozen plasma. The RCC was stored at 4°C. On day 7, the unit was treated with cotton-wool filtration (Immuungard; Terumo) according to the manufacturer's instructions. After centrifugation, the supernatant was removed and a sample of the leukocyte-depleted RCC was retained for sterility control. No signs of hemolysis or turbidity were noted. Immediately after the filtration, approximately 2 ml of the RCC was injected into a closed blood culture system (Venoject; Terumo) for routine sterility control and incubated at room temperature. On day 5, there was growth of motile, gram-negative rods which were identified as *Y. enterocolitica* serotype O:3, biotype 4. Identification was confirmed by the Belgian Reference Laboratory for *Yersinia* (G. Wauters, Université Catholique de Louvain, Brussels). The isolate was negative in the pyrazinamidase test and was calcium dependent at 37°C, a combination of characteristics that is known to correlate with the presence of a virulence plasmid (12). A sample of fresh frozen plasma from the index donor was thawed and used for the tube agglutination test with Formalin-killed suspensions of *Y. enterocolitica* (ECO-BIO, Genk, Belgium). A titer of 1:3,200 was found against serotype O:3, with no detectable antibodies against serotype O:9.

The donor was identified as a 36-year-old man working in a saw mill. He felt perfectly healthy at the time of blood donation and was seen again for a medical examination 7 weeks later. A culture of blood obtained at that time remained sterile, and a stool culture was negative for yersiniae. The antibody titer against *Y. enterocolitica* remained abnormal at 1:200. History revealed a febrile episode with diarrhea 2 years previously. This was followed shortly afterwards by a febrile syndrome with pain in the right iliac fossa, suggesting acute appendicitis, for which he underwent surgery. Intraoperatively, terminal ileitis rather than appendicitis was evident. The postoperative course was complicated by loosening of the wound suture 6 months and again 1 year after the intervention. Fistulization resulted, for which surgical repair was performed in April 1987. Retrospective examination of two stored serum specimens, obtained 3 and 1 year before the contaminated blood donation, were both negative for *Yersinia* agglutinins.

The recipient of the RCC was a 45-year-old woman who was treated for blast transformation of a chronic myeloid leukemia. She received oral norfloxacin for selective decontamination of the gastrointestinal tract. At the time of the transfusion, she had passed through a febrile episode for which she was given empirical treatment with intravenous ceftazidime and vancomycin. During and immediately after the transfusion, there was no significant rise in temperature or pulse rate and the blood pressure remained unchanged. Blood cultures taken after transfusion of the RCC remained sterile. A *Yersinia* agglutination test performed 2 weeks later was negative.

Human *Y. enterocolitica* infections are particularly frequent in Belgium (6). As in other parts of Europe, most isolates belong to serotypes O:3 (84%) and O:9 (11.6%). Septicemia due to this organism is rare and is responsible for less than 1% of all isolates of *Yersinia* (6). Most septicemic infections occur in individuals whose host defense is compromised by an underlying disease. However, in a review of 55 cases (2), 22% were in patients reported to have no predisposing conditions. Even in such patients, *Y. enterocolitica* septicemia is a serious infection requiring prolonged antibiotic therapy (8).

The observation of 14 other cases (1, 3–5, 7, 9, 16, 18, 22; C. Janot, O. Agules, M. E. Briquel, J. C. Burdin, and F. Streiff, Abstr. XIV Congr. Natl. Transfusion Sanguine 1988,

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TABLE 1. Published cases of donor blood infected with *Y. enterocolitica*[a]

Case	Country	Yr	Serotype	Relevant findings[b]			Reference
				Donor	Recipient	Blood or blood product	
1	Netherlands	1975	O:9	Healthy M, 25 yr; stool culture, YE O:9; SA negative	F, 57 yr; septic shock, recovery; SA positive for YE O:9	Total blood, 16 days old; culture YE O:9	3
2	France	1982	O:3	Healthy	F, 28 yr; septic shock, death; blood culture YE O:3	Total blood	16
3	South Africa	1982	O:3	Healthy M, 19 yr; SA positive	F, 19 yr; septic shock, recovery; SA positive	RCC, 21 days old; culture YE O:3	18
4	South Africa	1982	O:3	Healthy M, 50 yr; SA positive	M, 80 yr; septic shock, death; blood culture YE O:3	RCC, 30 days old; culture YE O:3	18
5	Norway	1984	O:3	Recent diarrhea; SA positive for YE O:3	M, 55 yr; septic shock, death; blood culture YE O:3	RCC, 29 days old; culture YE O:3	1
6	USA	1985	NM	Healthy, SA positive	M, 61 yr; septic shock, death; blood culture YE	RCC, 21 days old	5, 22
7	Australia	1986	O:3	Healthy M	M, 61 yr; septic shock, death; blood culture YE O:3	RCC, 21 days old; culture YE O:3	9
8	France	1988	O:5, 27	Healthy; diarrhea 5 mo before; SA positive for YE O:5	Young F; septic shock, death; blood culture YE O:5, 27	RCC, 26 days old	Wallet et al., abstr.
9	France	1988	O:3	NM	M, 87 yr; septic shock, recovery	Total blood; culture YE O:3	Janot et al., abstr.
10	Australia	1988	O:5, 27	Healthy, SA positive for YE O:5, 27	Septic shock, death	Total blood; culture YE O:5, 27	7

[a] Four cases reported by the Centers for Disease Control (4) are not included.
[b] Abbreviations: M, male; F, female; SA, serum antibodies; YE, *Y. enterocolitica*; NM, not mentioned.

abstr. 13.5, p. 93; P. Wallet, C. Aubert, R. Leclercq, H. H. Mollaret, and N. Duedari, Abstr. XIV Congr. Natl. Transfusion Sanguine 1988, abstr. 13.4, p. 92) of asymptomatic *Yersinia* bacteremia in otherwise healthy young blood donors (Table 1) sheds a new light on the physiopathology of this organism. Mild diarrhea is one of the common manifestations of *Y. enterocolitica* infection and may often go unrecognized. There is evidence that in some patients, after the acute phase of enteritis, the organism may persist in mucosal, submucosal, and lymphoid tissue, from where it can stimulate the immune response, cause reactive sequelae, and give rise to episodes of symptomatic or cryptic bacteremia (11). Such a mechanism probably also applies to other invasive enteric pathogens. Blood cultures positive for *Salmonella typhi* have been reported in the absence of a clinical picture of typhoid fever (21). This is equally true for nontyphoid *Salmonella* strains, and transmission by transfusion of whole blood (19) and blood products (14) from healthy donors has been documented. Mild *Campylobacter* diarrhea may similarly be accompanied by transient bacteremia, and a probable case of transfusion-associated *Campylobacter jejuni* septicemia has recently been described (13). It is clear that asymptomatic bacteremia is only detectable by chance sampling of blood or by transmission of the pathogen through blood transfusion. The potential hazard of transmitting *Yersinia* spp. and other enteric pathogens through transfusion can only be evaluated and partly avoided by routine sterility control of blood products. The relatively high frequency of transfusion-mediated infection with *Y. enterocolitica* may be related to two special features not shared with other enteric pathogens: its ability to grow at refrigerator temperatures and stimulation of its growth by exogenous iron (15). After some time of conservation, blood and blood products will contain sufficient free hemin to provide a good growth medium, allowing profuse multiplication of this iron-dependent organism.

In contrast to the 14 previously reported cases of transfusion accidents caused by *Y. enterocolitica*, our recipient did not seem to be affected by the transfusion of contaminated RCC. Several reasons can account for this excellent tolerance. The patient was treated with norfloxacin and ceftazidime, two drugs with high activity against *Y. enterocolitica* (10, 20). The RCC was stored for only 1 week, versus an average of 3 weeks in the previously reported cases. Endotoxin may have been eliminated after the filtration procedure by reconcentrating the erythrocytes and removing the supernatant.

ADDENDUM IN PROOF

A case of fatal, transfusion-induced septic shock due to *Y. enterocolitica* in a 61-year-old American man was recently reported. *Y. enterocolitica* (serotype not mentioned) was recovered from the patient and the donated blood. The donor had a history of mild gastroenteritis and a significant titer of antibodies to *Y. enterocolitica* (S. E. Brown and S. E. White, Anesth. Analg. **67**:415–417, 1988). The article is the third report of case 6 (see Table 1).

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