

# Staphylococcal enterotoxins in scarlet fever complicating chickenpox

M. Gary Brook and Barbara A. Bannister

Department of Infectious and Tropical Diseases, Coppett's Wood Unit of The Royal Free Hospital, Coppett's Wood Hospital, Coppett's Road, London N10 1JN, UK.

**Summary:** Two cases of scarlet fever are described, both following super-infection of chickenpox. Enterotoxin B and C producing staphylococci were the only pathogens identified. The role of staphylococcal and streptococcal toxins in the pathogenesis of scarlet fever and toxic shock syndrome is discussed.

## Introduction

A generalized scarlatiniform eruption in a febrile child is likely to be diagnosed as streptococcal scarlet fever or toxic shock syndrome (TSS). The following cases demonstrate that there is a third alternative to be considered, especially when empirical therapy is planned.

## Case reports

### Case 1

A 5 year old boy presented on the fifth day of an attack of chickenpox with deterioration marked by high fever (40°C), myalgia, painful knee joints and a rash. He was found to have a generalized erythematous eruption with marked skin-fold accentuation, a red strawberry tongue and conjunctival injection. The chickenpox was represented by healing crusted lesions, none of which had obvious bacterial super-infection. Full blood count and renal function tests were normal, but the serum creatine kinase was raised at 340 IU/l (normal range <200 IU/l). Parenteral benzyl penicillin 2 mega U and flucloxacillin 250 mg, both 6 hourly, were administered. Abscesses developed in 3 lesions over the following 3 days, requiring subsequent incision and drainage. The fever and erythematous rash disappeared on the fourth day and were followed by peripheral desquamation. At no time was there hypotension or diarrhoea.

### Case 2

On the fourth day of her chickenpox, an 11 year old girl developed pain, enlargement and erythema of one of the lesions on her abdomen, and a temperature of 38.5°C. Oral flucloxacillin was commenced at a dose of 250 mg 6 hourly. The following day a generalized erythematous rash appeared, starting on the head and spreading downwards. There was also a white strawberry tongue. Full blood count and renal function test were normal. The fever resolved on the first day of the scarlatiniform eruption, although the infected lesion required incision and drainage. The rash faded and desquamation followed after 7 days. At no time was there diarrhoea or hypotension.

## Bacteriology

In both cases *Staphylococcus aureus* was isolated from swabs of secondarily infected chickenpox lesions as the only identifiable bacterial pathogen. In case 1, serial anti-streptolysin 'O' titres were also negative.

The organism from case 1 was found *in vitro* to elaborate enterotoxin B and that from case 2 produced enterotoxin C.<sup>1</sup> Tests for other enterotoxins,<sup>1</sup> toxic shock syndrome toxin<sup>2</sup> type 1 (TSST-1) and exfoliatin toxins A and B<sup>3</sup> were negative in both cases.

## Discussion

Staphylococcal scarlet fever (SSF) was first described over 60 years ago as a staphylococcal infection complicated by a scarlatiniform rash, but

Correspondence: M.G. Brook, M.D., M.R.C.P.  
Accepted: 28 March 1991

with none of the features otherwise diagnostic of the TSS.<sup>4,5</sup> TSS is associated with manifestations which include hypotension and diarrhoea and is the more commonly diagnosed exanthematous complication of *Staphylococcus aureus* infection.<sup>2,6-8</sup> Staphylococci elaborating novel exfoliative exotoxins (exfoliatins A and B) have been reported in several studies of SSF and are also implicated in Ritter's disease (scalded skin syndrome) and bullous impetigo.<sup>3,9,10</sup> Toxic shock syndrome toxin type 1 (TSST-1) producing strains of *S. aureus* are the most frequently identified cause of TSS,<sup>2,6-8,11</sup> although some instances of extra-vaginal TSS have been related to other staphylococcal toxins including enterotoxin B<sup>11</sup> and, less commonly, enterotoxins A and C.<sup>12</sup> Enterotoxins have not, however, been previously associated with SSF.

Although 2 cases do not prove a causal link, there seems little doubt that enterotoxins can stimulate rash production. Not only have they been firmly associated with TSS,<sup>11,12</sup> but enterotoxin B has also been shown to have a close amino acid sequence homology with the erythrogenic toxin implicated in streptococcal scarlet fever.<sup>13</sup> A scarlatiniform rash seems to be the endpoint of a chain of events that can be triggered by several different substances (enterotoxins, TSS-1, exfoliatins and

erythrogenic toxins) and organisms (staphylococci and streptococci),<sup>6,10,11,13</sup> and is possibly mediated by interleukin 1.<sup>14</sup> Enterotoxin-related SSF may well represent a *forme fruste* of TSS.

Both cases reported here were in children with chickenpox. This disease is commonly complicated by bacterial superinfection.<sup>15</sup> One might speculate that secondary infection of already damaged skin allowed a high degree of toxin absorption.

How may the clinician differentiate streptococcal and staphylococcal scarlet fever? It seems that conjunctival injection, as demonstrated in case 1, can be found when staphylococcal infection is the cause but is rare in streptococcal scarlet fever.<sup>16</sup> However, the absence of conjunctival injection does not exclude a staphylococcal aetiology, as noted in case 2. Empirical antimicrobial chemotherapy should include both anti-staphylococcal and anti-streptococcal agents whenever there is diagnostic uncertainty.

#### Acknowledgements

We would like to thank Dr R. Marples, Division of Hospital Infection, CPHL, Colindale for the bacterial toxicology and Leo Laboratories for their assistance in the literature search.

#### References

1. Symkovicova, M. & Gilbert, J. Serological detection of enterotoxin from food poisoning strains of *Staphylococcus aureus*. *J Med Microbiol* 1971, 4: 19-30.
2. Schlievert, P.M., Shands, K.N., Dan, B.B., Schimcl, G.P. & Nishimura, R.D. Identification and characterisation of an exotoxin from *Staphylococcus aureus* associated with toxic shock syndrome. *J Infect Dis* 1981, 143: 509-516.
3. Fleurette, J., Monnet, P. & Brun, Y. Exfoliatin or the epidermolytic toxin of *Staphylococcus aureus*. *Lyon Med* 1976, 235: 683-687.
4. Pilot, I. & Afremow, M.L. Studies of staphylococcal filtrates; demonstration of exotoxin by skin tests in man and its neutralisation by antitoxin serums. *JAMA* 1927, 89: 939.
5. Dunnet, W.N. & Schallibaum, E.M. Scarlet-fever-like illness due to staphylococcal infection. *Lancet* 1960, ii: 1227-1229.
6. Todd, J., Fishaut, M., Kapral, F. & Welch, T. Toxic shock syndrome associated with phage-group-1 Staphylococci. *Lancet*, 1978, ii: 1116-1118.
7. Shandos, K., Schmid, G.B., Bruce, D.B. *et al.* Toxic shock syndrome in menstruating women. *N Engl J Med* 1980, 303: 1436-1442.
8. Eykyn, J. Toxic shock syndrome. Some answers but questions remain. *Br Med J* 1982, 284: 1585-1586.
9. Schlievert, P.M. Staphylococcal scarlet fever. Role of pyrogenic exotoxins. *Infect Immunol* 1981, 31: 732-736.
10. Larregue, M. & Bresieux, J.M. Scalded child syndrome (Ritter-Lyell disease, Lyell's staphylococcal disease, staphylococcal scarlet fever). Induced by exfoliative toxin produced by serotype II staphylococci. *Rev Pediatr* 1977, 13: 367-384.
11. Schlievert, P.M. Staphylococcal enterotoxin B and toxic shock syndrome toxin-1 are significantly associated with non-menstrual TSS. *Lancet* 1986, i: 1149-1150.
12. Yagoob, M., McClelland, P., Murray, A.E., Mostafa, S.M. & Ahmad, R. Staphylococcal enterotoxins A and C causing toxic shock syndrome. *J Infect* 1990, 20: 176-178.
13. Johnson, L.P., L'Italien, J.J. & Schlievert, P.M. Streptococcal pyrogenic exotoxin type A (Scarlet fever toxin) is related to *Staphylococcus aureus* enterotoxin B. *MGG* 1986, 203: 354-356.
14. Parsonnet, J., Gillis, Z.A. & Pier, G.B. Induction of Interleukin 1 by strains of *Staphylococcus aureus* from patients with non-menstrual toxic shock syndrome. *J Infect Dis* 1986, 154: 55-63.
15. Christie, A.B. Chickenpox. In: *Infectious Diseases*. Churchill Livingstone, Edinburgh, 1987, pp. 353-375.
16. Dick, G.F. & Dick, G.H. Symptoms. In: *Scarlet Fever*. The Year Book Publishers, Chicago, 1938, pp. 35-52.