Yersinia enterocolitica: Comparative In Vitro Activities of Seven New β -Lactam Antibiotics

R. K. SCRIBNER,¹ M. I. MARKS,^{1*} A. WEBER,¹ AND C. H. PAI²

Department of Pediatrics (Infectious Diseases), University of Oklahoma Health Sciences Center, Oklahoma City, Oklahoma 73190,¹ and Department of Microbiology, Montreal Children's Hospital, Montreal, Quebec, Canada²

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Minimum inhibitory concentrations of seven new β -lactam derivatives were determined against 35 isolates of *Yersinia enterocolitica*. Ceftizoxime and ceftriaxone were the most active of the antimicrobial agents tested.

Yersinia enterocolitica infections are common in certain geographic locations (5, 9). Gastroenteritis is the most frequent manifestation; however, terminal ileitis, septicemia, and extragastrointestinal infections also occur (3). Previous in vitro susceptibility studies of *Y. enterocolitica* indicated that trimethoprim-sulfamethoxazole and aminoglycosides were the most active antimicrobial agents available (1, 2, 6). Although trimethoprim-sulfamethoxazole therapy failed to shorten the clinical or bacteriological course of uncomplicated *Y. enterocolitica* gastroenteritis, complicated infections and *Y. enterocolitica* gastroenteritis in abnormal hosts require antimicrobial therapy (C. Pai, F. Gillis, E. Tuomanen, and M. Marks, Program Abstr. Intersci. Conf. Antimicrob. Agents Chemother. 21st, Chicago, Ill., abstr. no. 776, 1981). Selection of drugs for the latter indications are limited to the bacteriostatic combination (trimethoprim-sulfamethoxazole) or aminoglycosides with potential serious toxicity. We therefore examined the activity of new β -lactam derivatives against recent *Y. enterocolitica* isolates.

A total of 35 isolates of *Y. enterocolitica* from the stools of Canadian children with gastroenteritis were identified with the differential characteristics defined by Martin and Washington (4). All isolates were biotype 4, serotype 0:3. Minimum inhibitory concentrations of ceftazidime (Glaxo, Inc.), ceftriaxone (Hoffmann-La Roche, Inc.), ceftizoxime (Smith Kline & French Laboratories), cefmenoxime (Abbott Laboratories), cefotaxime (Hoescht-Roussel Pharmaceuticals Inc.), moxalactam (Eli Lilly & Co.), and SQ 26,776 (E. R. Squibb & Sons, Inc.) were determined by the agar dilution method, using Mueller-Hinton agar and a Steers replicator (7). Stock solutions of each antimicrobial agent were prepared from dry powder and used immediately. After preparation, agar dilution plates were either used immediately or stored at 4°C for no longer than 48 h. Plates were allowed to warm to

room temperature and were then inoculated with approximately 10^4 colony-forming units (10^{-4} dilution of a 0.5 McFarland standard) of a log-phase culture of *Y. enterocolitica*. Duplicate sets of plates were incubated at 25 and 37°C for 18 h in ambient air. Control organisms of known susceptibility were included in all sets of inoculations, and minimal inhibitory concentrations were consistent within one twofold dilution of established values.

The results of the susceptibility tests at 37°C are shown in Table 1. All isolates were highly sensitive to the antimicrobial agents tested at both temperatures. Results were identical for 88.6% of the tests and within one twofold dilution for the rest. As expected, growth was more luxuriant after 18 h at 37°C, but this did not affect endpoint determinations. Ceftizoxime and ceftriaxone demonstrated the greatest antimicrobial activity, with 90% of the isolates inhibited by 0.06 μ g/ml. To our knowledge, there are no published reports of the activity of ceftizoxime, ceftriaxone, or SQ 26,776 against *Y. enterocolitica*. Our results confirm Verbist's findings for moxalactam, cefotaxime, and cefmenoxime in terms of median minimal inhibitory concentration, geometric mean minimal inhibitory con-

TABLE 1. Activity of β -lactam antibiotics against 35 clinical isolates of *Y. enterocolitica*^a

Agent	MIC ^b Range	MIC (%)	
		50	90
Ceftizoxime	≤ 0.015 –0.12	<0.03	0.06
Ceftriaxone	≤ 0.015 –0.12	0.06	0.06
Cefotaxime	≤ 0.015 –0.25	0.03	0.12
Ceftazidime	0.03–0.25	0.12	0.25
Cefmenoxime	≤ 0.015 –0.25	0.06	0.12
Moxalactam	0.06–0.25	0.12	0.25
SQ 26,776	0.12–0.5	0.5	0.5

^a The agar dilution method was carried out at 37°C.

^b MIC, Minimal inhibitory concentration.

centration, and 90% minimal inhibitory concentration (8). Ceftazidime, however, was more active in the present study.

This study demonstrates considerable in vitro activity of these newer β -lactams against clinical isolates of *Y. enterocolitica*. These drugs may prove to be useful alternatives to trimethoprim-sulfamethoxazole or aminoglycosides in the treatment of selected *Y. enterocolitica* infections.

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