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Hospital Cluster Epidemic with *Morganella morganii*

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A cluster epidemic of 13 *Morganella morganii* infections involving 11 patients occurred over a 3-month period in 1977. This epidemic was unusual in that it involved four services and five hospital floors. The outbreak was effectively terminated when strict asceptic techniques were reinforced.

The Long Island Jewish-Hillside Medical Center has a surveillance system for patients with nosocomial infections. This surveillance, in effect since 1974, includes daily record review of the microbiology laboratory workbooks by the epidemiologist in addition to daily ward rounds. Awareness of potential cluster epidemics is heightened by our participation in the National Nosocomial Infections Survey and regular reporting of all nosocomial infections. A cluster of 13 *Morganella* (*Proteus*) *morganii* infections occurred in February, March, and April of 1977 and involved medical, surgical, obstetrical, and gynecological patients. A total of 11 patients were infected before the outbreak was controlled.

MATERIALS AND METHODS

All the infections involving *M. morganii* were identified as nosocomial by using the criteria defined for the National Nosocomial Infections Survey program. The bacteria were isolated from various specimens as detailed in Table 1. After isolation on the routine media previously described (4), the morganellae were identified according to the method of Brenner et al. (2). All antibiotic susceptibilities were determined by agar diffusion methods (1).

The suspicion that a cluster epidemic was developing in the institution was based initially on the recovery of the bacterium from several patients who had at one time or another resided in the intensive and progressive care units (ICU, PCU). To substantiate the suspicion, chart reviews and daily surveillance of all patients in the ICU and PCU were started. The appearance of the organism in cultures from patients in other locations was investigated to ascertain if these patients had ever stayed in the ICU. All necessary data pertaining to these patients were collected and used in the evaluation of the outbreak. These factors included the sex and age of the patients, their locations in the hospital, their underlying diseases, procedures performed, therapy applied, the presence or absence of catheters during this or earlier hospital stays, the antibiotic histories of the patients before admission and while in the hospital, the personnel involved in procedures such as surgical operations, the personnel in contact with the patients in the ICU, respiratory assistance therapy during the hospital stay, and other factors.

RESULTS

All organisms isolated displayed the biochemical characteristics typical of *M. morganii* (2).

The antibiotic susceptibility responses were quite uniform for the 11 isolates (Table 1). All organisms were resistant to ampicillin, cephalothin, and colistin. All were susceptible to carbenicillin, gentamicin, kanamycin, and trimethoprim-sulfamethoxazole when tested. There was some difference with respect to susceptibility to chloramphenicol and tetracycline in patient 2, whose morganellae displayed resistance to both drugs when isolated from the wound and blood after therapy with chloramphenicol. Morganellae from this patient, isolated before therapy, were susceptible to these antibiotic drugs. In addition, the *M. morganii* isolated from the urine of patient 4 displayed tetracycline resistance, as did the urinary *M. morganii* from patient 11, whereas this organism, isolated from the wound, was susceptible to the drug. Nalidixic acid and the trimethoprim-sulfamethoxazole disks were used only with those organisms isolated from urinary tract infections.

The source of the bacterium and the services involved are listed in Table 2. Although there are different clinical services listed, the initial cases were found only in the ICU. Secondary cases became manifest on the obstetrical and gynecological services. The table demonstrates that there were two secondary bacteremias, eight postoperative wound infections—including a complication of a cesarean section on the obstetrics service, and five urinary tract infections. A total of 13 anatomical sites were involved on these four services.

Epidemiological history of the outbreak. The index case was a 51-year-old woman with a lymphoma treated with chemotherapy, steroids, and radiation. She was admitted on 12 February

TABLE 1. *Specimen sources and antibiotic susceptibilities of M. morganii during the cluster epidemic*

Patient	Specimen source	Antibiogram[a]										
		Amp (15, 0)[b]	Carb (15, 100)	Cf (15, 0)	C (15, 87)	Co (15, 0)	Ge (15, 100)	K (14, 100)	NA (5, 100)	Su (15, 80)	Te (15, 74)	SXT (5, 100)
1	Blood	R[c]	S[c]	R	S	R	S			R	S	
	UTI[d]	R	S	R	S	R	S		S	R	S	S
2	Wound	R	S	R	R	R	S	S		S	R	
	Blood	R	S	R	R	R	S	S		S	R	
3	Wound	R	S	R	S	R	S	S		S	S	
4	UTI	R	S	R	S	R	S	S	S	S	R	S
5	Wound	R	S	R	S	R	S	S		S	S	
6	Wound	R	S	R	S	R	S	S		S	S	
7	UTI	R	S	R	S	R	S	S	S	S	S	S
	Wound	R	S	R	S	R	S	S		S	S	
8	Wound	R	S	R	S	R	S	S		R	S	
9	Wound	R	S	R	S	R	S	S		S	S	
10	UTI	R	S	R	S	R	S	S	S	S	S	S
11	Wound	R	S	R	S	R	S	S		S	S	
	UTI	R	S	R	S	R	S	S	S	S	R	S

[a] We determined susceptibilities by agar diffusion, using established criteria (1). Appropriate controls accompanied all antibiograms daily. Amp, Ampicillin; carb, carbenicillin; cf, cephalothin; C, chloramphenicol; Co, colistin; Ge, gentamicin; K, kanamycin; NA, nalidixic acid; Su, sulfadiazine; Te, tetracycline; SXT, trimethoprim-sulfamethoxazole.

[b] First number in parentheses indicates total isolates tested; second number indicates percent susceptible.

[c] R, Resistant; S, susceptible.

[d] UTI, Urinary tract infection.

TABLE 2. *Distribution of M. morganii by service and infection characteristic*

Service	No. of infections		
	Secondary bacteremia[a]	Wound[b]	Urinary tract infection[b]
Medicine	1	0	1
Surgery	1	4	0
Obstetrics	0	1	2
Gynecology	0	3	2

[a] Secondary bacteremias are not listed as separate infections.

[b] Wound infections accounted for 61% of *M. morganii* infections, and urinary tract infections accounted for 39%.

for gastrointestinal bleeding. This was her first admission to this institution. A Foley catheter was inserted on admission and discontinued on her second day in the hospital. Blood cultures drawn on admission to evaluate the low-grade temperature of the patient were negative. On the seventh hospital day, the patient spiked a temperature to 103°F (39.4°C). Blood and urine cultures were positive for *M. morganii*. The patient was discharged on 9 March. At no time did this patient reside in the ICU-PCU section of the institution.

M. morganii was recovered next from a postoperative surgical wound of a 74-year-old man in the 12-bed ICU on the sixth floor of the institution. He had been admitted for gastric ulcer surgery on 10 February. After the first few postoperative days, he developed a pulmonary embolism and required intubation. He improved over the next few days but then became febrile. On the 11th postoperative day, he developed a wound infection and a secondary bacteremia caused by *M. morganii* and *Enterobacter aerogenes*. The original blood and urine cultures taken on admission as well as a peritoneal culture taken during the surgical procedure yielded no organisms. The patient then developed a subphrenic abscess which was drained surgically; a gangrenous gallbladder was removed at the same time. Post-operatively, he developed severe bilateral pneumonia. On 8 March, he was transferred to the adjacent 18-bed PCU and then on 2 April, he was moved to the surgical floor. The patient made an uneventful recovery and was discharged on 28 April.

The third patient, a 75-year-old woman, was admitted directly to the PCU on 5 February for

TABLE 3. *Distribution of M. morganii nosocomial infections by service and infection characteristic*

Service	No. of infections			
	Wound	Lower respiratory tract infection	Urinary tract infection	Other
1975				
Surgery	5	1	1	2
Gynecology	0	0	1	0
1976				
Medicine	0		2	
Surgery	5		1	
Obstetrics	1		0	
Nursery	1		0	

uncontrolled diabetes and gangrene of the left foot. A femoral-tibial bypass was performed on 9 February; it became infected with *M. morganii* on 25 February after two thromboembolectomies (11 and 12 Februrary) and an above-the-knee amputation on 19 February. This original wound continued to drain and required irrigation until her discharge on 4 March.

The fourth patient was a 32-year-old woman admitted to the fourth-floor gynecology service for a ruptured tubal pregnancy. She developed a wound infection caused by *M. morganii* 4 days post-operatively. Ten days after the onset of the wound infection, she was discharged, the wound still requiring irrigation.

The next patient was an 80-year-old male who underwent an abdominal perineal resection on 22 February. He was kept in the PCU for 6 days post-operatively and developed a wound infection after transfer to the eighth floor on 5 March.

M. morganii was recovered 6 days post-operatively from a 37-year-old woman on the fourth-floor gynecology service who had undergone a total abdominal hysterectomy and developed wound and urinary tract infections on 8 March.

A 22-year-old woman was admitted to the eighth floor and underwent surgery for a retroperitoneal abscess as well as a cesarean section on 2 March. Two weeks post-operatively, her peritoneal wound became infected with *M. morganii*. She remained on the eighth floor during her recovery.

The ninth patient was also on the eighth floor. This 86-year-old woman had been admitted for a partial colectomy and removal of a tumor. This site became infected on the sixth postoperative day with *M. morganii*.

The 10th infection caused by this bacterium occurred in a 40-year-old obstetrical patient who had a cesarean section on 1 April and 1 day later developed a urinary tract infection.

A radical hysterectomy for cervical cancer in a 50-year-old woman provided the last case in this cluster epidemic. She was admitted to the eighth floor on 12 March and transferred post-operatively on 29 March to the fourth floor, where a wound infection and a catheter-related urinary tract infection became manifest on 3 and 8 April, respectively. She was discharged 2 days later after being put on antimicrobial therapy.

DISCUSSION

This report involves a cluster epidemic caused by *M. morganii*. It is interesting that this outbreak involved four medical services and five floors of the medical center.

Retrospective analysis of nosocomial infections at Long Island Jewish-Hillside Medical Center in the preceding 2 years revealed that this bacterium was isolated from 19 nosocomial infections (Table 3). These infections occurred at great intervals. The last isolation of this bacterium from a nosocomial infection before the cluster epidemic was in June 1976, 8 months before the infections reported here.

The cluster epidemic was biphasic in nature. After the index case, the first area of the institution involved was the ICU-PCU; the second phase of the epidemic occurred on the eighth (surgery), fourth (gynecology), and third (obstetrics) floors.

The best explanation for the mode of spread of *M. morganii* can be deduced from epidemiological observations. The obstetrical service in this institution is entirely separated from the rest of the hospital with regard to all activity and personnel except for the house staff physicians who attend gynecological patients as well. The cluster epidemic came to an abrupt halt when strict asceptic techniques, i.e., handwashing, were reinforced.

The index case patient resided on the medical-surgical unit on the seventh floor of the institution and subsequently on the fifth floor, which is reserved for medical patients. The physicians on this service also attend patients in the ICU-PCU. All adult patients requiring intensive care, progressive care, or both reside in these units, regardless of the admitting service, for as long as their status warrants this type of care. Thus, acquisition of *M. morganii* in the ICU-PCU was probable for patients 2, 3, and 6. During this initial period, several gynecological patients were in the ICU-PCU without developing overt manifestations of infection. However, patient 4, an obstetrical patient, became infected and, 2 days later, so did patient 5, a gynecological patient. Before patient 5 was discharged, patients 7, 10, and 11 on the gynecology and obstetrics services developed infectious complications caused by this bacterium. Patient 8, who had undergone a complicated cesarean section, although never on the maternity floor, was at-

TABLE 4. *Length of stay in hospital*

Patient	Service	Stay (actual no. of days)	Infection[a]	Percentile[b]		
				50%	75%	90%
1	Medicine	24	UTI-blood	6	10	14
2	Surgery	77	Wd-blood	15	20	28
3	Surgery	27	Wd	9	16	23
4	Obstetrics	12	UTI		6	
5	Gynecology	14	Wd	6	9	12
6	Surgery	33	Wd	17	24	32
7	Gynecology	64	UTI-wd	6	9	12
8	Obstetrics-surgery	33	Wd	5	8	12
9	Surgery	37	Wd	17	30	33
10	Obstetrics	7	UTI		6	
11	Gynecology	29	Wd-UTI	8	14	20

[a] UTI, Urinary tract infection; wd, wound.

[b] Length of stay based on diagnosis, operative procedure, or both. Data based on guidelines of Commission on Professional and Hospital Activities.

tended by house officers of that service. She was on the eighth floor when patient 9 developed *M. morganii* complications.

This cluster epidemic served as an educational tool for physician and nursing personnel indoctrination with regard to the role that hygenic and environmental factors may play in the spread of nosocomiosis, in spite of adequate and pertinent antibiotic therapy.

M. morganii has been involved in hospital-acquired infections only as a single incident (5). However, involvement of *Providencia* (*Proteus*) *rettgeri* in wound complications has been reported (3). In these instances, only one service and usually one ward of an institution were involved, an observation common to most reports of cluster epidemics. The importance of considering critical areas such as the ICU as reservoirs from which organisms can be disseminated throughout the institution and cause infectious complications in compromised patients was underlined by this particular outbreak. The outbreak illustrates that the potential danger of hospitalization or professional activity in shared facilities such as the ICU demands efforts to control infectious hazards meticulously in order to prevent dissemination.

In addition to the considerations uppermost in the minds of health care professionals, the impact of acquiring such infections on the length of hospitalization must also be considered. The acquisition of *M. morganii* prolonged the hospitalization of all patients by an appreciable amount of time (Table 4). Prolongation ranged from as little as 1 day for patient 10 to many more days for patients 2 and 7. It must also be remembered that many of the patients were discharged from the hospital while still requiring attention to the resolving infectious process. This increase in the length of hospitalization is additional evidence that organisms of so-called "low virulence" can affect the speedy recovery of individuals. It emphasizes further the concept that it is the patients and their health which determine the ability of an organism to become involved in infectious complication. Thus, any microorganism in a compromised patient is potentially hazardous and compels the strictest adherence to every type of preventive measure in order to safeguard the ability of individuals to recover from their underlying diseases.

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