SURVEILLANCE OF INFECTIONS IN A COMMUNITY TEACHING HOSPITAL

The control of nosocomial infections depends on a surveillance system that will detect and identify problems at the time that they occur. During the past year, infection control at Springfield Hospital Medical Center was considerably strengthened by the addition of a full-time Infection Control Nurse and appointment of an Infection Control Officer. The latter position is presently filled by the full-time director of the microbiology laboratory and the clinical infectious disease service, but any other qualified member of the Infection Committee could perform these duties.¹

Springfield Hospital Medical Center (SHMC) is a community hospital with 481 beds. It is a general hospital with the usual clinical services except obstetrics and has post-graduate training programs in Medicine, Surgery, Anesthesiology, Pediatrics, and Pathology. Most chiefs of services and of the medical subspecialities are full-time employees of the hospital. The 340 “acute” beds provide about 11,400 patient care days per month with an average length of stay of 12.2 days.

Infection control at SHMC is the responsibility of the Infection Committee of the Professional Staff which is organized in accordance with the recommendations of the American Hospital Association.² In addition, an administrative Environmental Control Committee has been established, with members from all nonmedical services and from the Microbiology Laboratory, to coordinate the efforts of the Infection Committee to achieve the highest standards in hospital hygiene.

In direct patient care, the Infection Control Officer and the Infection Control Nurse are responsible for control, surveillance and reporting of nosocomial infections. The Infection Control Nurse reviews all control measures on her daily rounds through the hospital. She serves as a consultant to the other nurses, especially in the interpretation of the isolation procedures,³ which in our hospital are initiated by each head nurse without specific orders of a physician. She is also responsible for the collection of surveillance data used to determine the incidence of nosocomial infections. Such information is obtained from (1) the nursing units, during regular

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¹ Formerly Director of Microbiology and Infectious Diseases. Infection Control Officer, SHMC. Department of Clinical Pathology, Texas Medical Center, Houston, Texas 77025.
² Infection Control Nurse.
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visits, through direct communication with the ward nurses and the review of patients' charts, nurses' notes and files, and vital signs records; (2) daily inspection of the microbiology reports; (3) close cooperation with the Infectious Disease Service; and (4) review of autopsy findings. The data for each infected patient are reviewed regularly by a member of the Infection Committee who evaluates and classifies each case according to the guidelines of the Hospital Infections Branch, Center for Disease Control (CDC). The classification is entered as a special item on the PAS Form for later data retrieval by computer. Since January, 1970, we have been participating in the National Nosocomial Infections Study (NNIS) of CDC. Together with data from 71 other U. S. hospitals, our reports are statistically evaluated and compared to the findings in other hospitals. From these reports we analyzed the data for the six month period from January to June 1970.

In Table 1 the rate of nosocomial infection is presented by service. The total is comparable to that of university hospitals, but much higher than the incidence in other hospitals in our category ("Community Hospitals over 300 Beds"). We attribute this not only to the rather sophisticated procedures performed in our hospital, but also to an efficient surveillance system. Almost all hospital-acquired infections had a temporal association with one or more therapeutic factors (Table 2). A great number of urinary tract

| Service     | Number of Infections | Incidence per 100 Discharges |
|-------------|----------------------|-----------------------------|
| Medicine    | 130                  | 6.2                         |
| Surgery     | 204                  | 5.6                         |
| Gynecology  | 16                   | 12.9                        |
| Pediatrics  | 0                    | 0                           |
| Total       | 350                  | 5.4                         |

| Therapeutic Factor | Incidence |
|-------------------|-----------|
| All infections associated with one or more therapeutic factors | 91.5% |
| Urinary tract infections associated with manipulations | 87.7% |
| Lower respiratory tract infections associated with inhalation therapy | 35.5% |
| Primary and secondary bacteremias associated with intravenous catheterization | 16.6% |
Infections (88%) were directly related to urinary tract manipulation. In more than a third of the cases of lower respiratory tract infections, an association with prior inhalation therapy was seen. Whereas these findings were consistent with those of other hospitals of similar structure, the incidence of septic phlebitis, as well as primary and secondary bacteremia, in connection with intravenous catheterization was considerably lower (50%). This figure can be attributed to the work of SHMC's IV Team of registered nurses who enforce the strict rules governing indication for, and care of, intravenous catheters.

A review of the nosocomial infections in relation to site and service shows (Table 3) that the majority of such infections occurred in the urinary tract, particularly among medical and gynecological patients. In surgical patients, the postoperative wound infection, occasionally with secondary bacteremia, is still most prominent. The infection risk of all operative patients was 3.2%, but only 0.8% in clean surgical cases. Most of the respiratory complications were seen in older patients with medical and surgical conditions conducive to secondary infections, such as cardiovascular diseases, malignancies, diabetes mellitus, or simply inactivation due to a fractured femur. In gynecological patients wound infection and urinary tract infection, due to indwelling urethral catheters, were equally frequent complications of the postoperative course.

In accordance with the observations in other hospitals during the past decade, about two-thirds of isolates from nosocomial infections were Gram-negative bacilli (Table 4). Escherichia coli accounted for 20% of all isolates, whereas a further 50% were equally divided amongst Staphylococcus aureus, klebsiella, proteus, and pseudomonas. The frequency of the coagulase-negative Staphylococcus epidermidis in surgical wound and urinary tract infections was surprising. Most of these strains were multiply resistant to antibiotics and, on clinical grounds, could not be considered contaminants. In nosocomial infections of the lower respiratory tract the predominance of Gram-negative bacilli is often blamed on the use of IPPB equipment. However, almost two thirds of our cases received no respiratory therapy prior to infection. Most of these patients, as was mentioned above, were rather old and had impaired resistance. Since old people often harbor Gram-negative bacilli in their oral cavities or may acquire them during hospitalization, the high percentage of such bacteria in respiratory complications should not come as a surprise.

The high incidence of pseudomonas (14%) and klebsiella (14%) in urinary infections during and after urethral catheterization caused much concern, especially when compared with the 8-8.5% incidence in the NNIS average. The majority of these cases had a white cell count of more than
Table 3. Hospital-Acquired Infections By Service And Site (SHMC) January-June 1970

| Service      | Bacteremia prim. | Bacteremia sec.* | Surgical wounds | EENT | Lower respir. tract | Vasc. | GI | Urin. tract | Gyn. | Cutaneous | Total |
|--------------|------------------|------------------|-----------------|------|---------------------|-------|----|-------------|------|-----------|-------|
| Medicine     | 3                | 6                | 4               | 4    | 35                  | 3     | 1  | 73          | 0    | 7         | 130   |
| Surgery      | 4                | 11               | 92              | 7    | 27                  | 2     | 1  | 66          | 1    | 4         | 204   |
| Gynecology   | 0                | 0                | 8               | 0    | 0                   | 0     | 0  | 7           | 1    | 0         | 16    |
| **Total**    | **7**            | **17**           | **104**         | **11**| **62**              | **5** | **2**| **146**     | **2**| **11**    | **350**|

* Secondary Bacteremia not included in Total.

Table 4. Isolates From Hospital-Acquired Infections (SHMC) January-June 1970

| Type/site of infection | Staphylococcus aureus epiderm. | Streptococcus pneum. | Influenza * | E. coli | Klebs. sp. | Enterob. sp. | Proteus sp. | Pseudomonas sp. | Other sp. | Total no. of isolates |
|------------------------|--------------------------------|---------------------|-------------|---------|------------|--------------|-------------|-------------------|-----------|----------------------|
| Bacteremia primary     | 7                              | 1                   | 1           | 1       | 2          | 2            | 1           | 1                 | 1         | 9                    |
| secondary              | 17                             | 3                   | 3           | 5       | 3          | 2            | 2           | 3                 | 1         | 22                   |
| Surg. wound            | 104 (6)**                      | 25                  | 11          | 5       | 16         | 30           | 12          | 9                 | 6         | 7                   | 129    |
| EENT                   | 11 (2)**                       | 4                   | 1           | 5       |            |              |             |                   |           | 10                   |
| Lower respiratory tract| 62 (12)**                      | 9                   | 1           | 10      | 2          | 2            | 4           | 16                | 7         | 9                    | 71     |
| Vascular               | 5                              | 3                   | 1           | 1       |            |              |             |                   |           | 6                    |
| Gastrointest           | 2                              | 1                   |             |         |            |              |             |                   |           | 3                    |
| Urinary tract          | 146 (3)**                      | 4                   | 8           | 3       | 15         | 53           | 26          | 9                 | 38        | 3                    | 186    |
| Gynecologic            | 2 (1)**                        | 1                   |             |         |            |              |             |                   |           | 1                    |
| Cutaneous              | 11 (1)**                       | 5                   |             |         | 1          | 2            | 1           |                   | 4         | 4                    | 18     |
| **Total**              | **350** (25)                   | **55**              | **24**      | **11**  | **16**     | **41**       | **94**      | **57**            | **27**    | **58**               | **51**  |

* Secondary bacteremia not included in Total.

** Figures in parentheses indicate cases not cultured.
10 per high-power field in the urinary sediment, indicating true urinary tract infection and not merely contamination of the urine. Many of our patients who developed urinary tract infections were rather old and had underlying diseases requiring Foley catheterization, unfortunately the gynecological patients with postoperative urinary tract infections were a good deal younger. Since one is never sure about proper follow-up care, this finding has considerable significance with regard to the medical future of these women.

Over-utilization of indwelling urethral catheters, as well as breaks in the strict procedures for their care, were concluded to have been contributory factors. Spot checks on the nursing units revealed the validity of this assumption and we are presently trying to reemphasize good technique, until a better solution, e.g., the establishment of a urinary catheterization team, can be found.

In 7% of cases with nosocomial infection the diagnosis was established without culture. One half of these cases were lower respiratory infections diagnosed by clinical and radiological findings alone. In some urinary tract infections only the results of urine analysis indicated the presence of infection. In surgical wound infections, however, cultures are necessary. Formerly in our hospital, cultures could only be obtained through written order by the attending physician; this rule was changed recently to permit the Infection Control Officer or the Infection Control Nurse to order laboratory work on all patients, if the infection control policy so requires.

The experience with the present program has taught us that infection surveillance is the most important tool of an infection committee in its attempt to prevent nosocomial infections. Although written procedures form the basis for a good control program, only continuous educational efforts and close contact between the infection committee and the nursing and medical staff, preferably by daily communication, will be effective in the control of hospital-acquired disease.

SUMMARY

The incidence of nosocomial bacterial infections can be evaluated only by a good surveillance program. Springfield Hospital Medical Center (481 beds) has instituted such a program with the help of a full-time infection control nurse. Since January, 1970, the hospital also has participated in the National Nosocomial Infections Study (NNIS) of the Center for Disease Control. The rate of nosocomial infections was 5.4 per 100 discharges and was comparable to that reported by NNIS university hospitals but considerably higher than in other community hospitals. More than one third of these
were urinary tract infections in patients with indwelling urethral catheters. *Escherichia coli* accounted for 20% of all nosocomial isolates, a further 50% were almost equally divided amongst *Staphylococcus aureus*, klebsiella, proteus, and pseudomonas.

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