

MARY CASTLE

HOSPITAL INFECTION CONTROL

Principles
and Practice

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**HOSPITAL
INFECTION
CONTROL**
Principles and Practice /

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HOSPITAL
INFECTION
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In memory of Susan, who inspired me not to be a meatloaf queen

Foreword

The extraordinarily rapid growth of the Association for Practitioners in Infection Control, the appearance of its new journal, *American Journal of Infection Control*, the simultaneous appearance of other journals relating to hospital infections, both in the United States and abroad, and the increasing number of people who identify themselves as hospital epidemiologists all provide eloquent testimony to the rapid growth and development of hospital infection control as an identifiable discipline in hospital practice. Information emerging from the Study of the Efficacy of Nosocomial Infection Control documents the rapid growth of infection control activities in American hospitals. Ten years ago, the number of infection control practitioners in the United States was exceedingly small, perhaps no more than two dozen, and all were well known to one another; today the number of infection control practitioners extends into the several thousands.

It is abundantly clear that the training and educational needs of infection control prac-

tioners are not being adequately met. One need only review the list of people awaiting acceptance into the course offered at the Center for Disease Control to verify this fact. Training in the principles and techniques of hospital infection control is just barely beginning to be found in the curricula of advanced degree programs in schools of nursing. Many of the ad hoc courses in hospital infection control to be found are of uncertain content, have uncertain standards, and sometimes have little or no academic review. The rapid growth of the annual meeting of the Association for Practitioners in Infection Control and the proliferation of activities of local metropolitan area chapters of that association underscore the educational needs perceived by infection control practitioners.

Until recently, the standard written works in the field were the American Hospital Association's monograph, *Infection Control in the Hospital*, and the CDC monograph, *Isolation Techniques for Use in General Hospitals*. To these should now be added the

textbook, *Infection Control*, edited by Drs. Brachman and Bennett of the Center for Disease Control. All are useful resource documents, but none provides direct and immediate help to the novice infection control practitioner who wonders how to do it and what to do first.

Here, finally, is a volume that provides some practical instruction and advice to the beginning as well as to the more experienced infection control practitioner. Mary Castle wrote this volume from the perspective of a number of years of experience as the Infection Control Practitioner at Colorado General Hospital, a 350-bed university hospital of the University of Colorado Health Sciences Center. She drew heavily on experiences and problems that we had shared in Colorado General Hospital in developing the

excellent series of examples cited to illustrate specific points.

This is a book written by an infection control practitioner for infection control practitioners. It does not provide all the information an infection control practitioner should know, but it does provide an excellent and fundamental base of information from which to begin. This base of information, when supplemented by the existing resource documents previously mentioned, will contribute enormously to the resolution of a major educational gap in infection control practice.

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Preface

This text is designed as an introduction, as a current reference, and as a background for infection control practice. Part I outlines the structure of an infection control program and how each person on the infection control team fits, clinically and administratively, into the hospital structure and functioning. Part II deals with the concept of infection itself and how hospitalized persons acquire infections. The most common nosocomial infections and the role of the infection control practitioner in identifying, controlling, and intervening to prevent these infections are discussed. Part III is a series of chapters on different activities of the infection control practitioner and infection control committee, including surveillance, reporting, isolation, and inservice education.

For the beginning infection control practitioner, infection control committee chairperson, or the student in a graduate program in infection control or a related field, the text can serve as an outline of the components of practice and major facets of concern. It is intended to introduce the reader in a systematic way to the entire scope of infection con-

trol as it is defined today. Although the book specifically discusses hospital infection control, it is hoped that personnel in extended care facilities will be able to adapt much of this material for their use.

In addition to serving the student in the field of infection control, the text will be useful as a reference for practitioners and committees with previous experience and education. Since there are few texts available on this subject, information is needed as a basis for change or justification for activities. Regulating bodies have in the past provided most of the input into the formulation of policy and practice in the field.

Infection control is a new field, in terms of being a specific specialty in hospitals and health care facilities. For the most part, the practitioner and chairperson are unique in the institution in their knowledge and activities. It is hoped that this text will provide a meaningful and current reference with which these specialists can verify their priorities and determine new areas to investigate in this exciting field.

Mary Castle

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My sincere appreciation goes to Molly Ross for her excellent illustrations and to Rosanne Spandrell for her patience and efficiency in typing the manuscript.

It would be a most difficult task to try to express my gratitude to all those who educated me, influenced my ideas, and helped me form the basis for my infection control practice. I can only offer this general acknowledgment of their contributions.

To Dr. Ted Eickhoff, who has been a col-

league, friend, and great source of advice to me over the years, I am especially indebted. I wish to thank Gladys Chelgren, Sue Kellerhals, and Jim Olson, very special friends and colleagues, whose unfailing support and friendship were invaluable to me. And finally, I want to express my deep appreciation to and admiration for Dr. Joan Cornoni Huntley, my mentor and friend, who inspired me professionally and personally.

Mary Castle

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PART I

**STRUCTURE OF INFECTION
CONTROL PROGRAMS**

1

Introduction to Infection Control

HISTORY OF NOSOCOMIAL INFECTIONS

Infection has been defined as "the state or condition in which the body or a part of it is invaded by a pathogenic agent (microorganism or virus) which under favorable conditions, multiplies and produces effects which are injurious. . ." (1). Infection ~~dates back~~ to the earliest forms of life. Microorganisms have always resided on and in the human body, more or less in a balance favorable to both. The upsetting of this balance, with resulting invasion and infection, poses a problem of varying degrees of severity for the host.

Nosocomial infections probably date back to the first hospital, room, or gathering of sick people in a geographic area together. The word *nosocomial* means, strictly, *bed-side-associated*, but in practice it also means an association with any institution in which people are gathered and given care. Included in this practical definition would be hospitals, extended care facilities, psychiatric in-

stitutions, and outpatient care facilities. Nosocomial infections may have occurred, therefore, the first time one person was cared for by another.

Perhaps the most well-known report of the recognition of and efforts to reduce nosocomial infections dates back to the 19th century. Puerperal sepsis, or childbed fever, was well known in Europe as a fatal disease. In 1843 Oliver Wendell Holmes presented his ideas to the Boston Society for Medical Improvement. He believed that physicians who performed autopsies and then examined women in labor were transmitting this disease from the autopsied body to patients (2). His paper and ideas were not accepted by the other physicians.

Ignaz Philipp Semmelweis, a physician in an obstetric ward in a Vienna hospital, was concerned that the mortality rate from puerperal sepsis in one hospital, which was operated by physicians, was higher than a nearby hospital operated by midwives. His investigation revealed that the physicians performed autopsies and did not wash their hands after leaving the autopsy room to care for patients. By contrast, the midwives had

no contact with postmortem examinations and were more careful about personal cleanliness. He found that the mortality rate was greatly decreased in his hospital when physicians rinsed their hands in a solution of chlorinated lime after performing autopsies. Both Semmelweis and Holmes were unaware that bacteria were being transmitted from patient to patient, and both suffered the disbelief of their colleagues (2).

Many years later Joseph Lister demonstrated the relationship between bacteria and infection and developed the first concepts of antisepsis. Florence Nightingale, Shimmelbusch, and others initiated some of the aseptic techniques that we are still using today—for example, rubber gloves, isolation procedures for infected patients, and hospital ventilation and sanitation. These early infection control practitioners recognized that infection morbidity and mortality rates could be lowered, and they worked to determine how to achieve this goal.

With the discovery of penicillin in 1928 by Dr. Howard Florey in Great Britain and its subsequent manufacture and release in the United States in the early 1940s, the antibiotic era began. The drug was so effective in preventing and treating infections that less emphasis was placed on aseptic techniques. When clinicians determined that many bacteria were developing strains resistant to existing antibiotics and that infections were continuing to occur in spite of the drugs, new antibiotics were sought and developed. Only recently have health care personnel turned their focus back to aseptic techniques, in combination with antimicrobial therapy, to deal effectively with infections.

Through the work of the Center for Disease Control (CDC), the Joint Commission on Accreditation of Hospitals, and state regulatory agencies, guidelines have been created that recognize, measure, and analyze noso-

comial infections. These guidelines also provide control measures in the form of patient care procedures and administrative guidelines for health care institutions. In recent years these agencies have stressed the adoption of programs to monitor nosocomial infections. Now, more and more infection control practitioners and clinicians are looking at established and new guidelines to determine methods that will reduce nosocomial infection morbidity and mortality.

SCOPE OF THE PROBLEM

About 5 percent of all patients admitted to hospitals in the United States acquire a nosocomial infection. Approximately 100,000 people die each year from nosocomial infections. However, this number may be considerably higher, since this information is not yet available for extended care or other types of health care institutions. Estimates have been made that nosocomial infections cost patients and insurers more than \$2 billion each year (3). Despite the changes and improvements in therapeutic measures, including antimicrobial therapy, diagnostic and treatment procedures, the rates of nosocomial infections have remained stable; the population of people at risk has changed, as have the microorganisms responsible for the infections.

In addition to the moral commitment of health care professionals "to do the patient no harm," regulatory agencies are requiring institutions to have programs that deal with nosocomial infections. Because of the outcome of the well-known *Darling vs Charleston Community Memorial Hospital* case in

1965, health care institutions began to experience additional pressure in the form of possibility of lawsuits related to nosocomial infections (4). In this case, the court awarded damages to a college student whose leg had to be amputated because of an infection that was contracted following treatment of a fracture. The result of this and other court decisions has been to strengthen the guidelines and regulations provided by agencies, thus standardizing the practice of infection control (5).

INFECTION CONTROL PROGRAMS: THE SOLUTION

Infection control programs have evolved in an attempt to solve the problem of nosocomial infections. The key to the control of infections lies in the institution's Infection Control Committee (ICC), the Infection Control Practitioner (ICP), and the program itself. Each of these essential components of infection control programs will be dealt with in more detail in the following chapters.

The remainder of this text will cover the nature and epidemiology of nosocomial infections, including specific nosocomial infections in terms of incidence, patho-

fections in terms of incidence, pathophysiology, means of transmission, and control measures. Finally, certain aspects of the infection control program, such as surveillance, isolation procedures, education, and the investigation of epidemics, will be covered in more detail.

The infection control program is the method currently being used to address the problem of nosocomial infections in health care institutions. The purpose of this book is to provide those involved in the planning, implementation, or evaluation of infection control programs with useful information on the current state of the art in infection control practice.

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