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Master's Thesis

**THE SPECIFIC ASPECTS OF EMERGENCE AND TREATMENT OF
COMPLICATIONS IN PATIENTS REQUIRING LONG-TERM CARE**

Master of Science in Nursing

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ABSTRACT

The caregivers often have to find a balance between work and family life, as well as cope with emotional, physical, financial and psychological stress, since the caregivers help people fight often life-threatening diseases. In order to cope with this task, the guidance and assistance of medical personnel, in particular nurses, is often necessary to cope with the problems occurring in treatment of and care for patients with protracted disease. Long-term care includes a variety of services designed to meet the health needs or self-care needs of a person over an extended period of time. These services help people live as independently and safely as possible when they can no longer capable of their daily activities on their own.

The data for this project was to investigate the specific aspects of emergence and treatment of complications in patients requiring long-term care.

Patients with the diseases that require prolonged treatment and care were diagnosed with complications, including such events as pressure ulcers, various types of nosocomial infection, pneumonia and catheter-associated urinary tract infections. In the study were used special scientific research methods: clinical examination and history collection, surgical examination, neurological examination, examination by an internist, as well as laboratory tests, including clinical pathology, bacteriology and instrumental assessments. For the scientific analysis of study results, were used the scientific methods of comparison, system analysis and statistical methods.

It was studied the problems occurring in treatment of and care for patients with protracted disease, investigated the risks for the causes, and the principles guiding treatment and prevention of nosocomial infection in long-term inpatient treatment and protracted disease. It was studied the specific aspects in development of nosocomial pneumonia, as well as pneumonia in patients with a prolonged and severe course of disease and the specific aspects of occurrence of catheter-associated urinary tract infections.

TABLE OF CONTENTS

INTRODUCTION	3
CHAPTER 1 THE PROBLEMS OCCURRING IN TREATMENT OF AND CARE FOR PATIENTS WITH PROTRACTED DISEASE (REVIEW OF LITERATURE)	6
CHAPTER 2 THE OBJECT OF RESEARCH AND METHODS OF STUDY	16
CHAPTER 3 PRESSURE ULCERS: THE TYPES, CAUSES, STAGES, PREVENTION AND TREATMENT OF THIS COMPLICATION IN PATIENTS WITH PROTRACTED DISEASE	17
CHAPTER 4 THE RISKS FOR, THE CAUSES, AND THE PRINCIPLES GUIDING TREATMENT AND PREVENTION OF NOSOCOMIAL INFECTION IN LONG-TERM INPATIENT TREATMENT AND PROTRACTED DISEASE	29
CHAPTER 5 THE SPECIFIC ASPECTS IN DEVELOPMENT OF NOSOCOMIAL PNEUMONIA, AS WELL AS HYPOSTATIC OR CONGESTIVE PNEUMONIA IN PATIENTS WITH A PROLONGED AND SEVERE COURSE OF DISEASE	38
CHAPTER 6 THE SPECIFIC ASPECTS OF OCCURRENCE OF CATHETER-ASSOCIATED URINARY TRACT INFECTIONS	45
CONCLUSIONS	49
REFERENCES	50

INTRODUCTION

The relevance of the study. Caring for the sick can be very difficult [23, 26, 44, 47], but at the same time this work is very morally rewarding. The caregivers often have to find a balance between work and family life, as well as cope with emotional, physical, financial and psychological stress, since the caregivers help people fight often life-threatening diseases [25, 33, 42, 45]. In order to cope with this task, the guidance and assistance of medical personnel, in particular nurses, is often necessary to cope with the problems occurring in treatment of and care for patients with protracted disease [24, 28, 46].

A special place in protracted course of the disease [26, 45] and in prevention of severe complications belongs to the management of care for patients with limited mobility with an emphasis on prevention of pressure ulcers [18, 30, 37, 38, 49], prevention of nosocomial infections, in particular bladder infections after prolonged use of a urinary catheter [8, 11, 12, 43], prevention of pneumonia and prevention of other complications in the long course of the disease in some severe diseases [23, 28, 47], especially in diabetes [1-7, 21, 22], stroke, pneumonia, neurological disease, malignant neoplasms, and other diseases with a long and severe course [25, 35].

In the [US](#), as assessed by the [Centers for Disease Control and Prevention](#), approximately 1.7 million cases of nosocomial infections caused by all types of organisms cause or accompany 99,000 deaths annually [11, 16, 45, 46, 50].

In [Europe](#), according to the results of hospital studies, the mortality from nosocomial infections is 25,000 cases per year; of these, two thirds are caused by [Gram-negative](#) microorganisms [19, 35, 36, 43, 44, 51].

Long-term care includes a variety of services designed to meet the health needs or self-care needs of a person over an extended period of time. [23, 45]. These services help people live as independently and safely as possible when they can no longer capable of their daily activities on their own.

Long-term care is provided in various places by different caregivers depending on the person's needs [28, 33, 34, 46]. In most cases, long-term care is provided in the home by family members and significant others, as well as by healthcare personnel [34, 42]. It may also be provided in a facility such as a nursing home or in the community such as an adult long-term care center.

The aim of the study: to investigate the specific aspects of emergence and treatment of complications in patients requiring long-term care.

Study objectives.

- To study the problems occurring in treatment of and care for patients with protracted disease.
- To study the features of the occurrence of pressure ulcers; to study the features of pressure ulcer prevention and treatment in patients with a protracted course of the disease.
- To investigate the risks for, the causes, and the principles guiding treatment and prevention of nosocomial infection in long-term inpatient treatment and protracted disease.
- To study the specific aspects in development of nosocomial pneumonia, as well as pneumonia in patients with a prolonged and severe course of disease.
- To study the specific aspects of occurrence of catheter-associated urinary tract infections.

The object of the study. Patients with complications due to the disease that requires prolonged treatment and care.

The subject of research. Complications in the patients, which require prolonged treatment and care, including such complications as pressure ulcers, various types of nosocomial infection, pneumonia and catheter-associated urinary tract infections.

The methods of study: patients with the diseases that require prolonged treatment and care were diagnosed with complications, including such events as pressure ulcers, various types of nosocomial [infection](#), pneumonia and catheter-associated urinary tract infections. In the study, we have used the following special scientific research methods: clinical examination and history collection, surgical examination, neurological examination, examination by an internist, as well as laboratory tests, including clinical pathology, bacteriology and instrumental assessments. In this research study, the following general clinical assessments have

been used in all patients: history of present disease and health history, observation, objective examination, general health assessment, and collection of information about the main complaints. For the scientific analysis of study results, we have used the scientific methods of comparison, system analysis and statistical methods.

The scientific and practical value of the study. The investigator has studied the problems occurring in treatment of and care for patients with protracted disease, researched into the specific aspects of pressure ulcer development, studied the specific aspects of pressure ulcer prevention and treatment in patients with protracted course of the disease, investigated the risks for, the causes, and the principles guiding treatment and prevention of nosocomial [infection](#) in long-term inpatient treatment and protracted disease, studied the specific aspects in the development of nosocomial pneumonia, as well as pneumonia in patients with a severe protracted course of the disease, and studied the specific aspects in the development of catheter-associated urinary tract infections.

CHAPTER 1

THE PROBLEMS OCCURRING IN TREATMENT OF AND CARE FOR PATIENTS WITH PROTRACTED DISEASE (REVIEW OF LITERATURE)

The most common type of long-term care is patient assistance, i.e. helping the patient with their daily chores, also referred to as activities of daily living (ADLs) [26, 28]. These activities include bathing, dressing, grooming, using the toilet, eating, and moving around, such as getting out of bed and into a chair.

Long-term care also includes community services such as meals, adult day care and transportation services [33, 42, 26]. These services can be provided either free of charge or for a fee.

People often need long-term care, when they have a serious chronic disease, such as severe diabetes [9, 10, 13, 17, 31], which may sometimes lead to foot amputation [29], or if they have disability. The need for long-term care may appear suddenly, i.e. after a heart attack or stroke. However, more often this need appears and increases gradually, as people are becoming older and weaker, or as their health or disability deteriorates.

The nurse will need to be able to determine the patients who need long-term care.

It is difficult to predict what scope and type of care a person may need. Several things increase the risk of requiring long-term care: age, gender, marital status, lifestyle, health status and family history.

- Age. The risk usually increases with age.
- Gender. Women are at greater risk than men, primarily because they tend to have longer life expectancies.
- Family status. Single people are more likely to need paid care than married people.
- Lifestyle. Poor diet and lack of physical exercise may increase the risk.
- Health and family history. These factors also affect the risk.

The nurse also needs to know what types of long-term home care services are available [45, 47].

Long-term home-based care includes medical services, personal services and support services to help people stay in the home and to have as much autonomy as possible. In most cases, long-term care is provided either in the home of the person receiving the services, or in the home of a family member [23, 34]. Home-based services may be short-term, e.g. for those recovering from a surgery, or long-term, i.e. for the people who need constant care.

Most home-based services include assistance with self-care, e.g. with bathing, dressing and taking medicines, as well as human safety monitoring [28, 47]. Family members, friends and neighbors provide for a substantial part of this type of care.

The services of long-term home-based care can also be provided by paid caregivers, including informally employed caregivers, and health professionals, such as nurses, home care aides, visiting therapists and housewives who are hired through home care agencies. These services include home-based health services, household services, friendly visitor/companion services and emergency response systems [23, 46].

Home-based health services include part time medical services as assigned by the physician in a certain disease. These services may include direct patient care in order to help a person recover after a surgery, an accident, or an illness. Home-based health services may also include physical therapy, occupational therapy or speech therapy and temporary home-based health care services [26, 45]. These services are provided by home care agencies approved by Medicare, the public health insurance program for people over 65 years of age.

Sometimes the nurse may advise to find helpers who will be providing household services and the services of personal hygiene assistant.

Home care agencies offer household care and personal care services that can be purchased without a doctor's authorization. "Housewife" services include assistance with cooking and household chores. Personal care includes assistance with bathing and dressing. Agencies do not have to be approved by Medicare to provide these services.

Friendly visitor/companion services are usually staffed by volunteers who pay regular short visits (less than 2 hours each) to people who are frail or living alone.

Transportation services help people get to and from healthcare facilities, malls and other places in the community. Some senior housing facilities and community groups offer transportation services. Many public transportation agencies provide services for people with disabilities.

The patients may also use emergency response systems that automatically respond to medical and other emergencies through electronic monitors. [28, 33, 42]. The user wears a necklace or bracelet with a button that can be pressed in an emergency. Pressing the button calls an ambulance service. This type of service is especially useful for people who live alone or are at risk of falls. A monthly fee usually applies.

Long-term care planning is a particularly important part of nursing responsibilities [25, 47].

Neither the patient nor their relatives can never know for sure whether they are going to need long-term care. They may never need it in their lifetime. However, an unexpected accident, illness or injury can change their needs, sometimes suddenly and dramatically. It is best to think about long-term care before the person needs it.

Planning for potential long-term care provides time to explore different services and their costs. This also allows the patient to make important decision while they still can.

People with Alzheimer's disease or other cognitive impairments should begin long-term care planning as early as possible.

The nurse may help the patient learn more about the preliminary care planning and help make a decision concerning long-term care [24, 34, 42].

It may be helpful to start with contemplating what may happen if the patient gets seriously sick or becomes a disabled person. A good strategy is to talk to family, friends and a legal adviser about who will be providing help if the patient

needs assistance over a long period of time. The nurse can help the patient with preparation of advance medical directives.

The nurse may also help the patient delay or prevent the need in long-term care while retaining relative health and autonomy. The patient should talk to their physician and nurse about their medical/family history and lifestyle. The health care professional may suggest the actions the patient may take in order to improve their health.

A healthy diet, regular physical activity, smoking cessation and limited alcohol consumption may help maintain health even in the presence of serious disease such as diabetes mellitus [15, 20, 27, 32, 39] and diseases requiring surgical treatment [8, 36, 51]. The same applies to active social life, safe home and regular medical check-ups.

When contemplating long-term care [34, 45], it is important to consider where the patient is going to live in an old age and how their place of residence can best meet their needs if they are no longer able to fully care for themselves.

The nurse may participate in making financial decisions for long-term care [36]. Long-term care can be expensive. Americans spend billions of dollars each year on care-related various services. How much people are paying for their long-term care depends on their financial situation and the types of services they may use. They often rely on a variety of payment sources, including personal funds, such as pensions, savings and stock income.

At a certain moment, support from family, friends, and local programs may not be enough. People who require assistance on a permanent basis can move to a residential facility that provides many or all of the long-term care services they may need [34, 42].

Facility-based long-term care services include the following types of facilities: boarding houses, nursing homes and continuing care retirement communities.

Some institutions provide only housing and housekeeping services, but many also provide personal care and medical services. Many institutions offer special programs for people with Alzheimer's disease and other types of dementia.

Specialist institutions, also called skilled care facilities, are providing a wide range of medical and patient care services [25, 46, 47]. Their services are more focused on health services than those of the majority of facilities for the elderly. These services usually include direct patient care, in particular for patients with diabetes mellitus [32, 39, 40, 41, 48, 50], pressure ulcers, trophic ulcers, etc. [18, 30, 38], etc., as well as round-the-clock nursing supervision, three meals a day and assistance with activities of daily living. Rehabilitation services such as physical therapy, occupational therapy and speech therapy are also available.

A serious illness changes the life not only of the patient, but also that of their entire family. Helping a sick relative on a daily basis is hard work and a huge emotional burden.

Sometimes, with lack of proper care, negative consequences are possible in seriously ill patients [29, 34, 46].

Home-based care for a bedridden patient requires not only time and effort, but also certain skills from the patient's family and significant others [45, 47]. Lack of special knowledge and experience often leads to deterioration of the patient's condition. Potential complications of severe illness with improper care include the following conditions:

Development of a contracture. In the setting of a prolonged persistence of immobility of extremities, the functions of the joints are impaired. When a contracture develops, it is almost impossible to bend or straighten a leg or an arm.

In bedridden patients, this complication develops against the background of cicatricial contraction of the skin and the tendons. It is very difficult to eliminate the consequences of a contracture. It is much easier to prevent this adverse condition. For successful prevention, the bedridden patient should have regular exercise with alternate flexion and extension of the inactive joints. It is also important to provide the patient with a comfortable body position.

Development of pressure ulcers. Such sequelae are developing in a setting of prolonged stay of the patient's body in one position with insufficient hygienic skin care. Pressure ulcers are leading to destruction (necrosis) of soft tissues [30, 38]. Changing the patient's body position every 2 hours helps avoid this adverse event. It is also important to monitor the condition of the patient's skin and perform regular hygienic cleaning of the skin surface. When caring for a severely ill patient, it is also important to avoid pressure and friction of body parts in a bedridden patient.

Infectious processes. Bedridden patients spend all of their time in a horizontal position, which leads to decrease in lung volume on inspiration and deterioration of pulmonary ventilation. In turn, pulmonary congestion may trigger the development of infectious processes (pneumonia). It is very difficult to cure such a disease. A severe pulmonary infection may lead to patient's death. Prevention of infections [8, 16, 43] includes changing the patient's body position frequently, regular airing of the room and respiratory exercise.

Bruises and injuries. In order to prevent the occurrence of pressure ulcers and contractures, it is necessary to change the position of the patient's body often. However, when the patients is turned over or transferred, falls and injuries may occur. In order to avoid traumatic sequelae, the patient needs to adhere to safety precautions and to equip the bed with special appliances. To this end, the patient's bed is equipped with special-purpose handrails, supports and holding devices.

Impaired swallowing. Severely ill patients often experience difficulties when swallowing. When providing care to such patients, it is important to carefully monitor the health condition and position of the patient. Soft food must be prepared to prevent the patient from choking.

In order to avoid the above negative consequences, the caregiver of the severely ill patient should have special training [25, 33, 42].

In nursing, patient care is divided into general and special. The interventions of general care include all the required actions aimed at maintaining the vital bodily functions of a supine person [28, 34, 45]. If the patient's disease requires special conditions for the provision of medical and household care, such a situation is regarded as the need for special care. The health care personnel of residential care facilities is expected to have the skills of care for patients with various disease [18, 38].

The nurse should know the rules of care for severely ill patients [42, 47].

A bedridden person is experiencing an intense stress and often sinks into apathy. The inability to accept their current situation and the feeling of weakness and helplessness can lead the patient to depression. This only further deteriorates the patient's condition. Caregivers should be provided with comfortable physical and psychological conditions. This helps provide a favorable emotional background essential for the life of a severely ill person [23, 34].

Experts recommend compliance with the following rules of care for temporarily or permanently bedridden subjects:

Comfortable conditions in the room. The room where the bedridden patient is living should be spacious, bright and comfortable. Near the bed, it is preferable to have a window that is suitable for airing the room. It is necessary to pay special attention to lighting. Also, the importance of entertainment for the patient should not be underestimated. A TV, a home theater or a music center, especially those

that use modern voice control technology, may distract the patient from their difficult physical condition.

Optimal microclimate conditions. The optimal temperature in the room of a bedridden patient is from 18 to 21°C. In regions with very hot climate, it is recommended to install an air conditioner in the room. In winter, it is undesirable for the bed of a seriously ill subject to be situated near a central heater. To reduce the risk of infections, it is recommended to monitor not only temperature, but also relative humidity in the room [43, 51]. If the air is too dry, it makes sense to consider purchasing an air humidifier.

Providing clean bed linen. Bedridden patients often suffer from disrupted thermoregulation, which is accompanied by increased sweating. Sweat becomes a favorable growth medium for various opportunistic bacteria and microbial pathogens. This precipitates the formation of pressure ulcers. In order to prevent such complications, bed linen should be changed at least once every 2 days. However, since the patient eats in their bed, it is better to consider changing bed linen daily. If the patient suffers from urinary or fecal incontinence, it is important to change linen often, and also use special hygiene products [11, 16]. Such products include diapers, sanitary napkins, absorbent diapers, etc.

Changing posture. Prolonged immobility leads to muscle atrophy, degeneration of joints and weakening of the skeleton. In this connection, the patient should be moved very carefully. Any falls, bumps and awkward movements may lead to bruises, muscle and tendon damage and bone fractures. The healing process, on the contrary, is complicated by the metabolic slowdown. In order to change the patient's position often without the risk of harming the patient, the caregivers will need to think about equipping the bed with special assisting devices and purchasing a modern wheelchair. When selecting the position

for the patient's body, the caregivers will need to be attentive to what the patient feels and is concerned about.

Personal hygiene. Severely ill patients are unable to keep their bodies clean independently. For this, they rely on their caregivers. The scope of responsibilities of caregivers includes oral hygiene, wiping the skin with wet sponges, and washing the patients' private parts after voiding or bowel movements. Patients should have their hair washed with shampoo and water at least twice a week. It is also important to keep the patient's nails clean. Today, the pharmaceutical market offers a wide array of cosmetic products specially designed for the care of bedridden patients. Their use will facilitate hygienic care.

The nurse should help adjust the daily routine of a bedridden patient [25, 34].

In order to follow the rules of patient care, the physicians recommend making a detailed daily routine and follow it strictly. Bedridden patients often have moodiness and emotional lability. Having a daily routine creates discipline, which often helps build rapport with the patient. In addition to fixed times of waking up and going to sleep, the daily routine must include the following items:

- Daily hygienic care, i.e. brushing teeth, skin rubbing, changing diapers and changing bed linen;
- Diagnostic measurements, i.e. measuring blood pressure, blood sugar levels (where applicable) and taking body temperature;
- The patient should have 3-4 meals a day; the food should be simple, safe and palatable;
- Taking medicines as prescribed by the treating physician;
- Exercise and massage therapy in order to prevent pressure ulcers and contractures;

- Working with physical/occupational therapist, speech therapist and psychologist (as required);
- Daytime nap;
- Entertainment: watching TV, reading books, surfing the Internet.

Any additional patient care interventions are determined by the diagnosis and the current health status of the patient with prolonged illness [23, 28, 33, 42].

As for the psychological rehabilitation of seriously ill patients, the nurse should also help in its implementation.

The loss of mobility and self-care potential is a serious blow to the patient's mental stability. Such individuals become capricious, irritable, and often project their negativism on those closest to them. It is important to use calm and gentle communication techniques with such patients, and avoid provoking them to anger and aggression.

If the patient is conscious, they must have a course of psychotherapy. The aim of the specialist is to destroy the negative attitudes such as "I have no chance to survive", "I would rather die" and "I am a burden to everyone". These should be replaced by positive thoughts, such as "I will definitely get better", "Today I can do more than the day before", "I am grateful for the care and help of my family". Positive thinking and hoping for the best is an important key to success and often full recovery of seriously ill patients.

People who have immediate family are in great need of their support. At this time, they will need to "rally around" their patient and help them with their many problems.

In most cases, the healthcare institution for long-term patient care [24, 33, 46] is expected to be fully equipped with special patient care aids. Such aids include the following:

- special-purpose beds that can be adjusted and used for quick transportation of the patient;
- orthopedic products that are necessary for a comfortable change in the patient's position, such as bolsters, pillows and blankets;
- high-quality anti-decubitus mattresses equipped with an automatic massage functionality;
- modern maneuverable wheelchairs that improve the patient's mobility;
- professional equipment for intravenous infusion therapy;
- first aid equipment.

By making a choice in favor of a nursing home or a skilled care facility, the family entrusts their seriously ill relative [26, 47] to the care of nurses and doctors who are professionals in the field of medical care and rehabilitation. Compliance with the daily routine, psychological assistance and organization of various leisure activities are all beneficial for patients who have been bedridden for a long time [25, 45, 46]. The family can use the time of their patient's stay in a medical institution for their emotional and physical recovery. A team of experienced medical professionals, which includes nurses and doctors, will ensure a diligent attitude to each patient and the development of an individual care program, as well as compliance with the applicable requirements.

CHAPTER 2

THE OBJECT OF RESEARCH AND METHODS OF STUDY

Patients with complications due to the disease that required prolonged treatment and care were the object of research in this study.

The subject of research included complications in the patients, which require prolonged treatment and care, including such complications as pressure ulcers, various types of nosocomial [infection](#), pneumonia and catheter-associated urinary tract infections.

Study design: we have conducted several series of the research study and analyzed the results. Patients with the diseases that required prolonged treatment and care were diagnosed with complications, including such events as pressure ulcers (32 patients of the 238 patients who have had protracted serious illness and took part in this series of the study), various types of nosocomial [infection](#) (in this study series, we have been observing 64 patients with some types of nosocomial [infection](#), including 57 patients with hospital-acquired pneumonia, 2 patients with ventilator-associated pneumonia, and 5 patients with catheter-associated urinary tract infections (of the 207 surgical patients in this study series). In addition to that, we have studied 42 patients with hypostatic or congestive pneumonia (in patients who have been on treatment for a long time), which was due to the severity of the underlying disease.

In the study, we have also used the following special scientific research methods: clinical examination and history collection, surgical examination, neurological examination, examination by an internist, as well as laboratory tests, including clinical pathology, bacteriology and instrumental assessments. In this research study, the following general clinical assessments have been used in all patients: history of present disease and health history, observation, objective examination, general health assessment, and collection of information about the main complaints. For the scientific analysis of study results, we have used the scientific methods of comparison, system analysis and statistical methods.

CHAPTER 3

PRESSURE ULCERS: THE TYPES, CAUSES, STAGES, PREVENTION AND TREATMENT OF THIS COMPLICATION IN PATIENTS WITH PROTRACTED DISEASE

Pressure ulcers (also referred to as decubitus ulcers, bedsores) are dystrophic ulcerous necrotic lesions developing in bedridden debilitated patients who are not able to move for a long time. As a rule, pressure ulcers are formed in sites where soft tissue is pressed between a bony prominence and the surface of the bed. The most frequent sites include the sacrum, the shoulder blades, the elbows and the greater trochanter. Reducing pressure at the lesion site is the most important thing that can be done to improve the patient's condition.

The first sign of a pressure ulcer is paleness of skin with subsequent redness, swelling and desquamation of the epidermis. At a later stage, vesicles and skin necrosis appear. In severe cases, the necrosis involves the surface layer of the bone. If the wounds are infected, this may lead to sepsis. The following types of pressure ulcers are distinguished:

- those caused by mechanical factors (exogenous), which have led to tissue necrosis. In such cases, regeneration and healing may occur provided that the causes that have led to a pressure ulcer have been eliminated;
- endogenous pressure ulcers, whose development is due to impaired vital bodily functions (i.e. neurotrophic tissue changes). The healing is possible if the overall health status of the patient improves, with improved supply of oxygen and nutrients to the tissues.

We have been investigating the causes of pressure ulcers in our study.

If pressure ulcers appear, the causes usually include impaired circulation and the subsequent ischemia of the skin. Bedridden patients remain in the same

position for long periods, with bones in selected sites exerting pressure on soft tissues, which leads to impaired blood flow. The causes of pressure ulcers also lie in the fact that the patient's subcutaneous fat layer is becoming thinner. This triggers the development of an abnormal process.

The causes of pressure ulcers are often related to the poor quality of patient care. Common factors include the following:

- poor body hygiene;
- infrequent changes of body position;
- poorly made bed (folds in the sheet, crumbs, etc.);
- hard bed (mattress not soft enough);
- insufficiently frequent change of bed linen.

These are the main causes of pressure ulcers. The risk of their development is higher if the patient has the following conditions:

- diabetes mellitus;
- smoking and other adverse social habits;
- dehydration;
- incorrect nutrition;
- enuresis;
- fecal incontinence;
- hyperhidrosis;
- involuntary muscle spasms.

The results of this series of the research study on the development of pressure ulcers.

A total of 238 patients with long-term severe illness have been included in the analysis sample (see Table 3.1). Within this sample, confirmed pressure ulcers have occurred in 32 cases (13.46% of all the patients in this study series, i.e. the patients with long-term severe illness).

Table 3.1. The principal conditions, which were the immediate causes of pressure ulcers in the patients who were participating in our study

Condition	No. of cases
Diabetes mellitus	9
Smoking and other adverse social habits	3
Dehydration	14
Incorrect nutrition	6
Enuresis	9
Fecal incontinence	5
Hyperhidrosis	14
Involuntary muscle spasms	17
Total patients with pressure ulcers	32
Total patients with long-term severe illness	238

Tissue necrosis may occur both in excessive dryness or in excessive moisture. If the skin is permanently moist, there is an increased risk of infection.

In our study, we have also been investigating the signs and symptoms of pressure ulcers.

The symptoms of pressure ulcers directly depend on how long proper care has been neglected, leading to progressive lesions.

The following 4 main stages of pressure ulcer formation are distinguished:

Stage 1. Initially, the skin in pressure sites becomes red. The hyperemia does not fade away even in the absence of pressure. These are the first signs of the beginning abnormal process.

Stage 2. If the treatment for pressure ulcers is not started immediately, the symptoms will only become worse. The epidermis will begin to peel off at the sites of redness. Sometimes there are bubbles with liquid and desquamation.

Stage 3. The wounds are becoming deeper. When infection adjoins, this is often followed by pus formation, and the sites of necrosis begin to have foul smell due to tissue necrosis.

Stage 4. At this stage, the wound becomes deep; the bone and tendons can be seen at its bottom. The patient is in severe pain, pus oozes from the wound.

Table 3.2. The main stages of pressure ulcer development, which have been observed in patients in our study

The stages of pressure ulcer development	No. of cases
1	19
2	7
3	4
4	2
Total patients with pressure ulcers	32
Total patients with long-term severe illness	238

The main symptoms of pressure ulcers in advanced stages are frequently accompanied by signs of intoxication, such as:

- fever;
- weakness;
- reduced blood pressure, etc.

Figure 3.1. The main stages of pressure ulcer development, which have been observed in patients in our study

In our study, we have also reviewed the methods to fight pressure ulcers, i.e. the methods, which can be used to avoid the occurrence of pressure ulcers or improve their treatment.

The management of pressure ulcers begins with restoring circulation of blood in the problem area. Special inflatable rubber rings are used for this purpose. They are placed under the affected area in order to relieve pressure. In addition to that, the patient's position should be changed every 3 hours.

The following algorithm of actions should be followed when caring for a patient with pressure ulcers:

At first, the wound needs to be cleansed from pus and dead cells, and treated with an antiseptic: such debridement of the wounds due to pressure ulcers may be performed by a physician.

Then a wound healing ointment should be applied.

After that, favorable conditions for tissue regeneration (preventing excessively moist or dry skin). Special-purpose applications and hydrogel dressings are well suited for these purposes.

The wounds should be treated several times a day. The drugs to be used during debridement and for other wound treatments shall be selected by the surgeon. Additional administration of antibiotics, vitamin supplements and other products may be required, but they can only be used as prescribed by the physician.

If the disease is advanced and the nurses cannot find a way to get rid of the pressure ulcer, a surgical intervention may be required. In an intensively disseminated necrosis, an operation is used where necrotic cells are completely removed and soft tissue grafting is performed.

If a bedridden patient develops pressure ulcers, the problem may not be ignored; specialist medical care should be sought as soon as possible.

Prevention of pressure ulcers.

Studies demonstrate that vitamin C supplementation (at 500 mg 2 times a day) can reduce the pressure ulcer-affected area by up to 84%. If permitted by the physician and in absence of contraindications, the patient should use such supplements. The main thing in prevention of pressure ulcers is meticulous care for the patient's skin.

In order to maintain skin healthy, essential preconditions include proper nutrition (the food should contain at least 20% protein) and hydration (unless there are restrictions, the patient should drink at least 1.5 liters of fluid per day);

It is important to dry moist skin and moisturize dry skin.

It is recommended that the patient slept in a prone position.

Patient should be having air baths.

Several times a day, the patient should be rotated from side to side. If the patient is capable of independent movements, they should change the position of their body every 15-20 minutes. When the patient is unable to move, it is

recommended to change their position every hour (if the patient is reclining in a chair) or every 2 hours (if the patient is in the bed).

When changing bed linen, the nursing personnel should first raise the patient a little, and not pull the patient independently by pulling the sheet from underneath the patient or by pushing a urinal under the patient.

The patient will need a soft but firm air mattress or foam mattress (at least 15 cm thick).

The nurse should make sure that there are no seams, buttons, folds and/or patches on the bedding or on the underwear of the patient.

The nurse should make sure that no food crumbs get to the patient's bed.

The individuals who are in bed for a long time should be placed on an inflatable rubber ring so that the sacrum is hanging in the opening of the circle; bags filled with millet or flax seed can be placed under the motionless arms or legs.

The skin should be wiped daily with a towel dampened with warm water or a disinfectant solution. The end of the towel is moistened, squeezed and rubbed on the patient's neck, behind the ears, back, buttocks, front surface of the chest, armpits, and folds under the mammary glands (in women). The caregiver is advised to wipe the patient dry, gently rubbing their skin. After drying, problem areas of the skin can be powdered with talcum powder.

A special highlight should be given to the problem of pressure ulcers in neurological practice, as well as the special aspects of their treatment and prevention.

The pressure ulcers in bed-ridden neurological patients have always plagued neurological hospital units; this problem has been especially relevant in older and old patients with injuries and diseases of the spinal cord.

In most countries of the world, medical treatment is preferred in pressure ulcers in patients with spinal cord injuries. For the most part, this is due to two reasons.

The first one is an economical consideration. In the US, the cost of a decubitus wound treatment varies from 2 thousand dollars (medical treatment) up to 40 thousand dollars (surgical treatment).

The second reason is the high percentage of postoperative complications. On the average, as reported by different authors, only 50-75% of pressure ulcers heal by primary intention after a surgical treatment. In other cases, additional prolonged medical treatment or reoperation is required.

In the world's leading clinics dealing with this problem, surgeries are performed in only 20-30% of such patients. These are mostly patients with Stage IV pressure ulcers. The surgery is preceded by a long preparation, which usually lasts anywhere from 2-3 months to a year. Stage II and Stage III pressure ulcers are treated medically. Exactly these reasons make the specialists look for increasingly more effective methods for medical treatment of pressure ulcers. However, despite the immense arsenal of methods and treatment modalities, prevention is probably the most important thing.

The anti-decubitus regimen in neurological practice consists of three main items:

- reduction in the degree and duration of skin compression;
- activation of blood circulation;
- protecting the skin from infection.

Here we shall review the main preventive measures against pressure ulcers in neurological practice in more detail.

Reduction in the degree and duration of skin compression. The patient's position in the bed should be changed every 2 hours. In order to reduce the

pressure on the sacrum, avoid raising the head end of the bed more than 45 degrees. When the patient is confined to bed, inflatable rings (preferably in pillowcases) are used, which are placed under the sacrum, calcaneal tubercles and other bone prominences in such a way as to avoid their contact with the supporting surface. In some cases, it is recommended for the patient to be in a prone position. However, the most effective approach is the use of special anti-decubitus mattresses or beds. The sheets on the patient's bed should be tightly stretched and without folds.

Decubitus-preventing skin care in neurological practice.

The rule of thumb for decubitus prevention in neurological practice is this: dry the wet skin and moisturize the dry skin. Alcohol-based products, such as lotions and camphor alcohol, should only be used in patients with oily skin. When washing the patient, the caregiver should gently use a soft sponge in pressure sites to avoid trauma to the upper skin layers. A daily massage is recommended not only in potential pressure ulcer sites, but also along the spine to improve the overall blood supply and nerve supply of the tissues. Exercise therapy and physical therapy is very important; a physical therapist will help select the best exercise program for a particular patient.

Patients with fever may have excessive sweating; in this case, it is better to wipe the patient's skin with a weak solution of vinegar (1 tablespoon of vinegar per 1 glass of water). As a result of increased sweating during the hot season, intertrigo may occur in the inguinal and gluteal folds and between the toes. These areas should be regularly wiped with swabs moistened with a chamomile or calendula decoction, boric alcohol, then dried and lubricated with an antiseptic.

In addition, it is necessary to keep perineal skin dry and promptly identify and treat scratches and other types of compromised skin integrity. Adequate

nutrition with sufficient amounts of proteins and vitamins is an important contribution to improving the condition of the skin.

The specific features of early diagnosis of pressure ulcers in neurological practice.

It is important to examine the patient every day. A pale or red spot, which does not disappear within 3-5 minutes after a change in body position, is a marker of an initial stage pressure ulcer. On the heels, the development of bedsores may occur imperceptibly due to the thick epidermal layer of the skin. The harbinger of an initial decubitus development on the skin above the calcaneal tubercles is the presence of a white spot; Stage 2 is a superficial skin defect (impaired integrity of the epidermis, sometimes with the involvement of the dermis) may manifest in the form of a bubble on the background of an erythema; Stage 3 is the damage through the entire skin thickness; Stage 4 is the destruction of the skin and deep tissues (down to the fascia, bone or joint).

The specific features of treatment of pressure ulcers in neurological practice.

The therapeutic goal is to restore skin integrity in the decubitus site. Depending on the stage of the process, this can be achieved by medical interventions (cleansing the wound, stimulation of granulation formation, protection of granulations from drying and secondary infection) or surgically (surgical removal of necrosis and closure of the decubitus wound).

When deciding on a pharmaceutical agent for cleansing the wound and the type of dressing material, the following factors are taken into account: the depth of the lesion, the presence of a scab, the state of the granulating surface and the maturity of granulations, and the presence of discharge (as well as its color, smell and whether its free outflow is possible). Water-soluble creams, gels, hydrocolloid products, alginates and dressing materials from tissue sorbents are used for dressings.

It is not recommended to use tanning agents (e.g. potassium permanganate solution, brilliant green), as they damage the papillary layer of the skin, and lead to deep necrosis and the transition to more severe stages of the lesion.

For stimulation of granulation tissue, the wound bed should be continuously kept moist using the appropriate dressings and water-based creams. This prevents cell death due to drying and creates a microclimate, which is conducive to the necessary proliferative activity.

When water-based creams are used, gauze bandages do not stick to the edges of the wound, and, respectively, do not harm the newly formed epithelium and granulations when removed.

In the treatment of pressure ulcers, Argosulfan, a silver-containing cream, has proven itself well as an antibacterial drug for the treatment of decubitus and trophic ulcers. It provides effective protection against infection, reduces wound pain, promotes wound healing and reduces treatment duration. The active ingredient of the drug is 2% silver sulfathiazole, which has a wide spectrum of antibacterial action against Gram-positive and Gram-negative bacteria.

The mechanism of action of sulfathiazole (i.e. inhibition of growth and reproduction of microorganisms) is associated with competitive antagonism with para-aminobenzoic acid and inhibition of dihydropteroate synthase, which leads to impaired synthesis of dihydrofolic acid and, ultimately, of tetrahydrofolic acid, its active metabolite, which is necessary for the synthesis of purines and pyrimidines in the microbial cell. The silver ions present in the formulation produce a tenfold increase in the antibacterial effect of sulfathiazole, i.e. they inhibit the growth and division of bacteria by binding to the DNA of the microbial cell. Silver ions at a concentration of 2% penetrate even into necrotic tissues and have a strong bactericidal effect. Thanks to its pH-optimized hydrophilic base, Argosulfan provides pain relief and wound hydration for faster wound healing.

In addition, improving the course of reparative processes in the wound allows achieving a good cosmetic effect after healing. The silver salt of sulfathiazole contained in the drug has a low solubility. As a result, the concentration of the drug in the wound after topical application is maintained at a constant bactericidal level over a long period of time. Due to the high concentration of silver, Argosulfan retains a constant bactericidal activity in the acidic environment of the wound. The minimal resorption of the drug product safeguards against toxic effects.

After cleansing and debridement, Argosulfan is applied to the wound with sterile precautions in a 2-3 mm thick layer 1-2 times a day. During the treatment, the wound should be completely covered with the cream. Argosulfan is used with an open method or with the use of occlusive dressings. The cream is applied until complete healing of the wound or until skin grafting is performed. It is important that bacteria do not develop resistance to silver. The use of silver-containing 2% Argosulfan cream in the treatment and prevention of pressure ulcers is an opportunity to continue the fight against the disease and to return to a healthy lifestyle.

CHAPTER 4

THE RISKS FOR, THE CAUSES, AND THE PRINCIPLES GUIDING TREATMENT AND PREVENTION OF NOSOCOMIAL [INFECTION](#) IN LONG-TERM INPATIENT TREATMENT AND PROTRACTED DISEASE

Nosocomial [infections](#) (also referred to as hospital-acquired [infections](#)) include, according to the [WHO](#) definition, any clinically significant [diseases of microbial](#) origin, which affect the patient during their hospitalization or hospital

[visit](#) with therapeutic [purpose](#), or after being discharged from the [hospital](#) (e.g., [wound infection](#)), as well as the hospital personnel by virtue of their professional activities, regardless of whether the [symptoms](#) of this disease are manifest when these individuals remain in the [hospital](#).

The infection is considered nosocomial if its first manifestations appear in 48 hours or later after hospital admission, provided that the clinical manifestations of these infections were absent at the time of admission and that an [incubation period](#) has been ruled out. The common English terminology for these infection is “nosocomial infections”.

Hospital-acquired infections should be discerned from the often confused related concepts of [iatrogenic](#) and [opportunistic](#) infections.

Iatrogenic infections are the infections introduced during diagnostic or therapeutic procedures.

Opportunistic infections are the infections that develop in patients with compromised [immune defense mechanisms](#).

Examples of nosocomial infections include the following:

- [Ventilator-associated pneumonia](#) (we observed 2 patients with this condition in our study)
- [Tuberculosis](#)
- [Urinary tract infections](#) (we observed 5 patients with this condition in our study)
- [Nosocomial pneumonia](#) (we observed 57 patients with this condition in our study)
- [Gastroenteritis](#)
- [Staphylococcus aureus](#)
- [Methicillin-resistant](#) *HYPERLINK*

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s aureus](#) (MRSA)

- [Pseudomonas aeruginosa](#)
- [Acinetobacter baumannii](#)
- [Stenotrophomonas maltophilia](#)
- [Vancomycin-resistant Enterococci](#)
- [Clostridium difficile](#)

This study series included an additional observation of 31 patients with various types of nosocomial [infections](#).

Nosocomial agents may cause severe [pneumonia](#), [urinary tract infections](#), hematological infections and infections of other [organs](#).

Nosocomial infections have their own characteristic epidemiological features, which set them apart from classical infections. These include the following: peculiar mechanisms and factors of transmission, the distinctive course of epidemiological and infectious processes, the important role of the healthcare team of the healthcare institution in the emergence, maintenance and spread of the [foci](#) of nosocomial infection.

Many types of infections are recalcitrant due to [antibiotic resistance](#), which is gradually beginning to spread among Gram-negative bacteria, which are dangerous in the community environment.

The presence of the following links of the [infectious process](#) is required for emergence of a nosocomial infection:

- the source of infection (i.e a patient or a healthcare worker);
- the causative agent (a microbial organism);
- [factors of transmission](#);
- the susceptible host.

In most cases, the sources of infection include:

- health care personnel;
- the carriers of [occult forms of infection](#);
- patients with acute, obliterated or chronic forms of infectious disease, including wound infection.

Hospital visitors are very rare sources of nosocomial infection.

Transmission factors may include dust, water, foods, equipment, medical instrumentation and other [fomites](#).

The leading routes of infection in a medical institution setting are the contact route and the airborne route (via droplets or dust particles). Parenteral route is also possible (which is typical for [hepatitides B, C, D](#), etc.).

Mechanisms of infection transmission: aerosol, fecal-oral, contact and via contact with blood.

The factors of nosocomial environment that contribute to the spread of nosocomial infection include the following:

- underestimation of the epidemiological hazards of nosocomial infection sources and the risk of infection through contact with the patient;
- hospital overload;
- the presence of unidentified carriers of nosocomial strains among the health care personnel and the patients;
- violation of [aseptic](#) and [antiseptic](#) precautions and personal [hygiene](#) regulations by the health care personnel;

- untimely current and terminal [disinfection](#), violation of the cleaning schedule;
- insufficient supply of [disinfection agents](#) to the healthcare institution;
- violation of the schedule for disinfection and [sterilization](#) of medical instrumentation, devices, equipment, etc.;
- outdated equipment;
- unsatisfactory condition of catering facilities and water supply;
- absence of filtration [ventilation](#).

People with increased risk for contracting a nosocomial infection include patients or subjects from the following demographics:

- [homeless people](#), migrant population;
- people with prolonged incompletely treated chronic somatic and infectious disease;
- people without access to specialized medical care;
- patients receiving a therapy that inhibits the immune system (i.e. radiation therapy, [immunosuppressants](#));
- patients who are having extensive [surgical interventions](#) with subsequent blood replacement therapy, long term [hemodialysis](#) and [infusion therapy](#);
- puerperas and neonates, particularly [premature](#) and postmature;
- children with congenital [developmental anomalies](#) and [birth trauma](#);
- personnel of a healthcare institution.

Etiology of nosocomial infection.

In total, there are more than 200 agents that potentially cause nosocomial infection. Before the advent of antibiotics, the main ones were streptococci and anaerobic bacilli. However, with the ubiquitous clinical use of antibiotics, previously non-pathogenic or opportunistic microbial organisms became the

causative agents of the main nosocomial infections: *St. aureus*, *St. epidermidis*, *St. saprophiticus*, *Escherichia coli*, *Enterococcus faecalis*, *Enterococcus durans*, *Klebsiella sp.*, *Proteus mirabilis*, *Providencia spp*, *Acinetobacter*, *Citrobacter*, *Serratia marcescens*, etc.

It has been also established that nosocomial infection may be associated with the dissemination of rotavirus, cytomegalovirus, Campylobacter, hepatitis B, C and D viruses, as well as HIV infection.

As a result of circulation of microorganisms in a hospital unit, they undergo natural selection and mutation with the formation of the most resistant hospital strain, which is a direct cause of nosocomial infection.

A hospital strain is a microbial organism, which has changed its genetic characteristics as a result of circulation in the hospital unit, due to mutations or transfer of genes (plasmids). Such an organism has acquired certain characteristic features, which are foreign to the “wild” strain and allow it to survive in a hospital setting.

The main adaptive features include resistance to one or several broad spectrum antibiotics, environmental stability and reduced sensitivity to antiseptics. Hospital strains are highly variable; each hospital or unit may have its own characteristic strain with its own unique set of biological properties.

Classification of nosocomial infection.

Depending on the degree of dissemination of infection:

Generalized infections: [bacteriemia](#) (viremia, mycemia), [septicemia](#), [septicopyemia](#), toxic-septic infection ([bacterial shock](#), etc.).

Localized infections:

- Infections of the skin and subcutaneous tissue (infections of burn wounds, surgical wounds, traumatic wounds, injection site [abscess](#),

[omphalitis](#), [erysipelas](#), [pyoderma](#), subcutaneous abscess and cellulitis, [paraproctitis](#), [mastitis](#), dermatomycosis, etc.);

- Respiratory infections ([bronchitis](#), [pneumonia](#), lung abscess and gangrene, [pleurisy](#), [empyema](#) etc.);
- Eye infections ([conjunctivitis](#), [keratitis](#), [blepharitis](#), etc.);
- ENT infections ([otitis](#), [sinusitis](#), [rhinitis](#), [mastoiditis](#), [tonsillitis](#), [laryngitis](#), [pharyngitis](#), [epiglottitis](#), etc.);
- Dental infections ([stomatitis](#), abscess, etc.);
- Infections of the digestive system ([gastroenterocolitis](#), [enteritis](#), [colitis](#), [cholecystitis](#), [hepatitis](#), [peritonitis](#), peritoneal abscess, etc.);
- Urological infections ([bacteriuria](#), [pyelonephritis](#), [cystitis](#), [urethritis](#), etc.);
- Reproductive system infections ([salpingoophoritis](#), [endometritis](#), etc.);
- Infections of bones and joints ([osteomyelitis](#), infection of the joint or articular capsule, intervertebral disc infection);
- CNS infections ([meningitis](#), brain abscess, [ventriculitis](#), etc.);
- Infections of the cardiovascular system (infections of the arteries and veins, [endocarditis](#), [myocarditis](#), [pericarditis](#), postoperative [mediastinitis](#)).

Prevention of nosocomial infections is a complex and multifaceted process, which should include the following three components:

- minimizing the possibility for introduction of infection from the outside;
- excluding the spread of infection between the patients inside the institution;
- excluding the spread of infection beyond the healthcare institution.

The treatment of nosocomial infection.

Ideally, a narrow-spectrum antimicrobial should be given, which is active against a specific microorganism, which has been isolated on a microbial test. However, in practice, nosocomial infection, especially in the first days, is almost always treated empirically. The selection of an optimal scheme of antimicrobial therapy depends on the predominant microbial flora in the unit and the spectrum of its antibiotic resistance.

In order to reduce the antibiotic resistance of the causative agents, the physicians should practice regular rotation of antibacterial drugs (when certain antibiotics are used in the hospital unit as empirical therapy over several months, and then replaced by the drugs of the next group).

Initial antimicrobial therapy.

The most effective treatment for nosocomial infections caused by Gram-positive microorganisms is vancomycin, while carbapenems (imipenem and meropenem), fourth-generation cephalosporins (cefepime, cefpirome) and modern aminoglycosides (amikacin) have the highest activity against Gram-negative bacteria.

From the foregoing, one should not conclude that nosocomial infections are susceptible only to the aforementioned drugs. For example, the pathogens that cause urinary tract infections remain highly sensitive to fluoroquinolones, third-generation cephalosporins, etc.

However, serious nosocomial infection indeed requires the administration of carbapenems or IV generation cephalosporins, since they have the broadest activity spectrum and are active against polymicrobial flora, including the multi-resistant Gram-negative pathogens and many Gram-negative microbial organisms. The disadvantage of drugs of both groups is their lack of activity against methicillin-resistant staphylococci, so in severe cases they have to be combined with vancomycin.

In addition to that, none of the aforementioned drugs is active against fungal pathogens, whose role in the development of nosocomial infections has grown substantially. Consequently, in the presence of risk factors (such as significant immunodeficiency) the patients should receive antifungals (fluconazole, etc.).

The recommendations on empiric treatment of certain nosocomial Gram-negative infections are given in the table below.

Location	Drugs of choice
Lower respiratory tract	Imipenem, amikacin
Urinary tract	Piperacillin/tazobactam, III generation cephalosporins, imipenem, amikacin, ciprofloxacin
Skin and soft tissue infections	Ceftazidime, imipenem, amikacin, ciprofloxacin. When <i>E. coli</i> and/or <i>Proteus spp.</i> are predominant, it is possible to use III generation cephalosporins and piperacillin/tazobactam.

In nosocomial infection, the efficacy of initial antibacterial therapy has an immediate influence on the mortality rates in hospitalized patients. The mortality rate among the patients who were receiving ineffective initial therapy was higher than in patients who were receiving the antibiotics with sufficient activity against most causative agents. Moreover, in case of inadequate initial therapy, even a subsequent change of an antibiotic already with microbiological data did not result in lower mortality rates.

Therefore, in severe nosocomial infections the very concept of "reserve antibiotic" is devoid of sense. The efficacy of initial therapy is an important factor on which prognosis for life hinges.

The concept of deescalation therapy was developed based on these data. The essence of the concept is that a combination of antimicrobial agents that are effective against all possible infectious agents is used as an initial empirical therapy, and this therapy begins immediately after the diagnosis. For example, carbapenem or cefepime is combined with vancomycin (plus fluconazole) depending on the composition of the likely pathogens.

The arguments in favor of combination therapy are as follows:

- a wider activity spectrum;
- overcoming resistance (the likelihood of resistance is higher when a single agent is used);
- the availability of theoretical data concerning the synergy of certain agents.

Before antibiotics are started, biological fluids should be sampled for a microbiological test. After the results of the microbiological test have been obtained and clinical efficacy of treatment has been evaluated, the therapy may be adjusted in 48 to 72 hours; e.g., if a Gram-negative pathogen has been identified. In theory, the whole combination may be changed in favor of a drug with a more narrow spectrum; however, in a severely ill responder any physician would prefer to leave the prescribed antibiotics as they are.

The option for deescalation therapy depends on the effective operation of the microbiological service and on the credibility of their test results. If the causative pathogen remains unknown, this whole concept loses its sense, and using it may lead to deterioration of therapeutic outcomes. The feasibility of deescalation therapy should be primarily discussed in patients with serious life-threatening infections (i.e. ventilator-associated pneumonia, sepsis).

It should be borne in mind that a reverse approach (i.e. “escalation therapy”) in such situations may result in the death of the patient even before the results of the microbiological examination are available.

CHAPTER 5

THE SPECIFIC ASPECTS IN DEVELOPMENT OF NOSOCOMIAL PNEUMONIA, AS WELL AS HYPOSTATIC OR CONGESTIVE PNEUMONIA IN PATIENTS WITH A PROLONGED AND SEVERE COURSE OF DISEASE

Nosocomial pneumonia (also referred to as hospital-acquired pneumonia) is a [pneumonia](#) that develops 48-72 hours after hospital admission and did not exist or was in an [incubation period](#) before admission.

At the same time, hypostatic or congestive pneumonia is a potentially lethal condition, which occurs in bedridden patients. The main cause of such pneumonia is slowing down of blood flow due to immobility. If signs of the disease are noticed in a timely fashion, the disease may be managed successfully.

Ventilator-associated nosocomial pneumonia is a pneumonia that developed no earlier than 48 hours after intubation and after the start of mechanical ventilation, in the absence of signs of a pulmonary infection at the time of intubation. However, in many cases, nosocomial pneumonia in surgical patients may manifest at an earlier time.

The incidence of hospital-acquired pneumonia reaches 20% of all [hospital-acquired infections](#); it is more often observed in patients recovering from thoracic or abdominal surgery, in patients on mechanical ventilation and in patients with [immunodeficiency](#).

Any therapeutic or diagnostic procedure increases the risk for nosocomial infection; this risk is also proportional to the invasiveness of the intervention. According to some reports, almost 15% of patients become infected when receiving medical care.

Up to 86% of cases of nosocomial pneumonia among surgical patients occur in patients who are on [mechanical ventilation](#).

We have studied the main causes of hospital-acquired pneumonias according to the type of underlying pathogen (Table 5.1).

Table 5.1. The causes of hospital-acquired pneumonias according to the type of the infectious agent

Pathogen	No. of cases	%
Pseudomonas aeruginosa	12	21.05
Staphylococcus aureus	9	15.79
Klebsiella pneumoniae	9	15.79
Escherichia coli	2	3.51
Other Gram (-) coli aerobic bacilli	11	19.29
Haemophilus influenzae	1	1.75
Pneumocystis carini	2	3.51
Mycoplasma pneumoniae	4	7.02
Legionella pneumophila	7	12.28
Total pneumonia cases investigated	57	100

Nosocomial pneumonia develops as a result of an imbalance between the mechanisms of anti-infection protection associated with the underlying disease,

patient's treatment and the pathogenicity factors of the potential causative agents that colonize the airway at the time therapeutic interventions are performed.

Figure 5.1. The causes of hospital-acquired pneumonias according to the type of underlying pathogen

The classification depending on the time of occurrence of nosocomial pneumonia is as follows:

- early nosocomial pneumonia occurring within the first 4 days from hospital admission; the characteristic pathogens are sensitive to the traditional antibacterial agents;
- late nosocomial pneumonia developing not earlier than the fifth day after hospital admission; its characteristic features include a high risk of infection by polyresistant bacteria and a less favorable prognosis.

The factors that predispose to the development of hospital-acquired pneumonia are as follows:

- chronic lung disease;
- treatment in an intensive care unit;
- therapy of community-acquired pneumonia;
- [tracheal intubation](#) and [anesthesia](#);
- [bronchoscopy](#);
- [immunodeficiencies](#);
- thoracic and abdominal surgery;
- being in a horizontal position for prolonged periods;
- [smoking](#);

- [renal failure](#);
- [impaired consciousness](#);
- uncontrolled antibiotic therapy with broad-spectrum agents;
- taking antibiotics in the previous 90 days.

Diagnosis

The standard for lung examination is spiral computed tomography. Recently, ultrasound has been used in intensive care units to detect pulmonary disease. An important assessment is microbiological diagnosis, which includes the testing of sputum, blood and pleural effusion (in pleurisy). Endotracheal aspiration is used to obtain biological material in patients on [mechanical ventilation](#).

In 2008, Centers for Disease Control and Prevention published the currently accepted diagnostic criteria for nosocomial pneumonia for the first time:

- Radiological criteria (any of the findings on two chest x-rays)
- new or progressive and persistent infiltrates;
- [consolidation](#);
- cavitation (destruction).

Systemic criteria, at least one:

- [fever](#) > 38 °C;
- [leukopenia](#) < 4,000 [WBCs](#)/μl or [leukocytosis](#) > 12,000 WBCs/μl;
- for adults over 70 years: altered mental state, in the absence of other potential causes.

Pulmonary criteria, at least two:

- new-onset purulent [sputum](#) or change in the nature of sputum, or increased secretion from the tracheobronchial tree, or increased need for [suction](#);
- new-onset or worsened cough, [dyspnea](#) or [tachypnea](#);
- wheezing or bronchial breathing;

- deterioration of [gas exchange](#).

Differential diagnosis. Nosocomial pneumonia should be primarily differentiated from [pulmonary embolism](#), [pulmonary edema](#) and [acute respiratory distress syndrome](#). In situations when [pulmonary embolism](#) is highly likely, CT angiopulmonography should be performed immediately.

In most cases, the treatment begins with empirical therapy. After identification of the causative agent, the treatment is adjusted taking into account the antibiotic sensitivity of the specific pathogen. Empirical therapy should be started as soon as possible after the diagnosis of nosocomial pneumonia has been confirmed.

Congestive pneumonia is a secondary inflammation of the lungs, which develops against the backdrop of local disorders of hemodynamics and ventilation. The clinical and radiological presentation of congestive pneumonia includes cough, dyspnea, production of sputum, subfebrile (less frequently febrile) body temperature and new-onset pleural effusion. The primary role in the diagnosis of congestive pneumonia is played by auscultation and radiological findings. The treatment of congestive pneumonia includes antibiotics, bronchodilators, cardiac glycosides, diuretics, inhalation therapy, exercise therapy, and back and chest massage. If necessary, puncture of pleural cavity or pericardium is used.

The causes of congestive pneumonia.

The pathomorphological basis for congestive pneumonia is congestion of blood in the pulmonary circulation. The hemodynamic disorders are accompanied by impaired drainage function of the bronchi and impaired pulmonary ventilation. In a setting of hypostasis and hypoventilation, thick and viscous sputum accumulates in the bronchi with an increase in opportunistic and pathogenic microbial flora, which causes the development of congestive pneumonia.

As a rule, congestive pneumonia occurs in patients with a history of the following somatic diseases:

- coronary artery disease,
- atherosclerosis,
- atherosclerotic and postinfarction cardiosclerosis,
- angina,
- heart defects (mitral stenosis),
- hypertension,
- premature ventricular contractions,
- atrial fibrillation,
- asthma,
- emphysema,
- bronchiectasis,
- chronic pyelonephritis,
- diabetes mellitus, etc.

In our research study, we have studied 42 patients with hypostatic or congestive pneumonia (in patients who have been on treatment for a long time), which was due to the severity of the underlying disease.

The microbiological substrate of congestive pneumonia usually includes typical bacterial agents, such as pneumococci, streptococci, staphylococci, *Haemophilus influenzae*, etc. More often, congestive pneumonia develops in the lower portion of the right lung; in some cases, it can be bilateral.

In terms of the time of occurrence, congestive pneumonia can be early (i.e. developing in the first 2-3 days of bed confinement) and late (i.e. developing in 2 to 6 weeks). Early congestive pneumonias are often masked by the symptoms of underlying disease. For example, in patients with stroke, impaired consciousness and respiratory distress (loud, arrhythmic, bubbling breathing) come to the fore. In

cardiovascular disease, a possible manifestation of congestive pneumonia may include escalating signs of heart failure.

The treatment algorithm in congestive pneumonia includes control of bacterial infection, regulation of ventilation and perfusion in the lungs, and reduction of edema. Antibiotics, expectorants, antioxidants, immunomodulants, diuretics, cardiac glycosides and cardiometabolic drugs are used as a part of multimodality therapy for congestive pneumonia. Oxygen therapy is used, as well as inhalation therapy, chest and back massage and exercise therapy. In order to evacuate sputum from the tracheobronchial tree, cleansing bronchoscopy and bronchoalveolar lavage are used.

In the presence of pleural or pericardiac effusion, thoracentesis and puncture of the pericardium is indicated. In parallel with the treatment of congestive pneumonia, the patient may require improvement of any background underlying conditions that have contributed to secondary inflammation in the lungs.

Prevention of congestive pneumonia.

Due attention should be paid to prevention of congestive pneumonia in patients who have been on bed rest for a prolonged period of time. To this end, the patient needs to change their position frequently and to perform active movements in the bed and respiratory exercise.

It is advisable to conduct a percussion massage of the chest, compresses and other types of hydrotherapy. Debilitated patients require a balanced, variable and vitamin-enriched diet.

CHAPTER 6

THE SPECIFIC ASPECTS OF OCCURRENCE OF CATHETER-ASSOCIATED URINARY TRACT INFECTIONS

Catheter-associated urinary tract infections belong to the category of adverse conditions associated with hospital stay.

The term “never event”, meaning a medical error or an adverse event that should never happen because it is preventable, was coined by Ken Kizer, former CEO of the National Quality Forum and adopted by Medicare and Medicaid in the US to describe the adverse conditions associated with hospital stay.

Up of 60-75% of cases of catheter-associated urinary tract infection are avoidable if appropriate preventive measures are taken.

In this series of our study, we have determined the incidence of catheter-associated urinary tract infection in a medical center setting.

The incidence of this condition was determined as the number of cases of catheter-associated urinary tract infection based on the results of a culture-based study.

In addition to that, we have checked if there have been any appropriate indications to have a catheter in place for more than 48 hours:

- urinary retention or obstruction of urinary bladder outlet,
- the need for precise measurement of urine output;
- genitourinary surgery.

We have also checked whether applicable recommendations have been kept in these cases: large-volume intravenous infusions or high-dose diuretics, the presence of sacral or perineal wounds in patients with urinary incontinence, prolonged immobilization, the need to alleviate the condition of patients in the terminal stage of the disease, etc. In all cases of catheter-associated urinary tract infection, a microbiological study was performed.

The results of this series of our research study.

The data on a total of 207 surgical patients have been analyzed (Table 6.1). Within this sample, confirmed catheter-associated urinary tract infection have occurred in 5 cases (2.42% of all the surgical patients in this study series). The most frequent causative agent of urinary tract infection was *Escherichia coli* followed by *Pseudomonas aeruginosa*. In all patients with catheter-associated urinary tract infection, the catheter was removed within 48 hours or there have been some appropriate indications for a longer use: in 1 of 5 cases (20%), a urinary catheter was removed within 48 hours; in 4 of 5 cases (80%) there have been appropriate indications to keep the catheter in place, including neurogenic urinary bladder, the need for precise measurement of urine output, hematuria, urinary retention, and a prolonged effect of epidural anesthesia.

There is conclusive evidence that having a urinary catheter in place for more than 48 hours is related to an increased risk of developing a catheter-associated urinary tract infection. In order to reduce the incidence of catheter-associated urinary tract infections, it is critical not to use the catheter unless necessary.

In addition, our study shows that a catheter-associated urinary tract infection cannot be considered a never event. However, its disadvantage is that retrospective data have been studied within the same medical institution.

Table 6.1. The number of cases of catheter-associated urinary tract infection among the surgical patients in our study

	Total number of surgical patients	Females	Males
Catheter-associated urinary tract infection	5 (2.42%)	3	2
Urinary catheter was	1 (20%)	1	-

removed within 48 hours			
Cases when there have been appropriate indications to continue the use of a catheter	4 (80%)	2	2
Total surgical patients	207	114	93

Consequently, despite strict adherence to the protocol for prevention of catheter-associated urinary tract infection, these infections are common in clinical practice. This suggests the existence of certain risk factors, due to which some patients are more prone to catheter-associated urinary tract infections than others.

Based on the results of this research study, it should be emphasized that a modern nurse should have in-depth knowledge in this area, because the standards and protocols for the treatment of these complications offer a significant arsenal of medicinal products.

When working with drugs, the nurse should remember the rule of eight “rights”: the “right” patient (i.e., exactly the patient to whom the drug is prescribed); the “right” drug (i.e., this particular drug should be administered to the patient); the “right” dose (which must be re-checked before administration against the medication administration record; the nurse should think critically whether the doctor's order is error-free, especially in pediatric practice); the "right" administration route; the "right" administration time; the "right" reason for the administration (the patient's condition/disease); the "right" entry in the medication administration record; and the "right" effect of the drug (i.e., the therapeutic effect).

It is also important to have communication skills and to be able to listen to the patient, and observe the patient to detect any adverse effects of the medicinal product and notify the physician.

In a nutshell, the nursing process when working with patients that require long-term care can be represented in the following way:

- assessment: history of present disease, allergic history and the ability of the patient to take the drug as prescribed by the physician;
- nursing diagnosis: the right patient, the right drug, the right dose, etc.;
- planning: how to administer the drug and prevent adverse effects;
- nursing interventions: adhering to the algorithm of drug administration, observing the patient, and teaching the patient and their relatives;
- evaluation: whether the intervention has yielded the expected therapeutic outcome.

Adhering to the principles of nursing process when working with patients requiring long-term care can help the nurse avoid errors associated with prescription and administration of drugs. The conduct of the nursing process is a key issue in prevention of adverse reactions in the patient.

CONCLUSIONS

- The authors have studied the problems occurring in treatment of and care for patients with protracted disease.
- The authors have studied the features of the occurrence of pressure ulcers and investigated the features of pressure ulcer prevention and treatment in patients with a protracted course of the disease.
- The authors have investigated the risks for, the causes, and the principles guiding treatment and prevention of nosocomial infection in long-term inpatient treatment and protracted disease.

- The authors have studied the specific aspects in development of nosocomial pneumonia, as well as pneumonia in patients with a prolonged and severe course of disease.
- The authors have studied the specific aspects of occurrence of catheter-associated urinary tract infections.

REFERENCES

- Armstrong DG, Boulton AJM, Bus SA. Diabetic Foot Ulcers and Their Recurrence. *N Engl J Med*. 2017;376:2367-2375.
- Armstrong DG, Lavery LA, Diabetic Foot Study C. Negative pressure wound therapy after partial diabetic foot amputation: a multicentre, randomised controlled trial. *Lancet*. 2005;366:1704-1710.
- Association AD. Executive summary: Standards of medical care in diabetes-2014. *Diabetes Care*. 2014;37 Suppl 1:S5-13.
- Biz C, Gastaldo S, Dalmau-Pastor M, Corradin M, Volpin A, Ruggieri P. Minimally Invasive Distal Metatarsal Diaphyseal Osteotomy (DMDO) for Chronic Plantar Diabetic Foot Ulcers. *Foot Ankle Int*. 2018;39:83-92.
- Boulton AJ, Kirsner RS, Vileikyte L. Clinical practice. Neuropathic diabetic foot ulcers. *N Engl J Med*. 2004;351:48-55.
- Brownrigg JR, Hinchliffe RJ, Apelqvist J, Boyko EJ, Fitridge R, Mills JL, Reekers J, Shearman CP, Zierler RE, Schaper NC, International Working Group on the Diabetic F. Effectiveness of bedside investigations to diagnose peripheral artery disease among people with diabetes mellitus: a systematic review. *Diabetes Metab Res Rev*. 2016;32 Suppl 1:119-127.

- Bus SA, van Deursen RW, Armstrong DG, Lewis JE, Caravaggi CF, Cavanagh PR, International Working Group on the Diabetic F. Footwear and offloading interventions to prevent and heal foot ulcers and reduce plantar pressure in patients with diabetes: a systematic review. *Diabetes Metab Res Rev.* 2016;32 Suppl 1:99-118.
- Catheter Associated Urinary Tract Infections. Atlanta: Centers for DiseaseControl and Prevention. Published 2018. Accessed December 23, 2019; <https://arpsp.cdc.gov/profile/infections/CAUTI>.
- Crews RT, Candela J. Decreasing an Offloading Device's Size and Offsetting Its Imposed Limb-Length Discrepancy Lead to Improved Comfort and Gait. *Diabetes Care.* 2018;41:1400-1405.
- Edwards J, Stapley S. Debridement of diabetic foot ulcers. *Cochrane Database Syst Rev.* 2010:CD003556.
- Elvy J., Colville A. Catheter associated urinary tract infection: what is it, whatcauses it, and how can we prevent it? *J Infect Prev.* 2009;10 (2): 36-41;doi:10.1177/1757177408094852.
- [Feneley RC, Hopley IB, Wells PN. Urinary catheters: history, current status, adverse events and research agenda.](#) *J Med Eng Technol.* 2015;39(8):459-70. doi: 10.3109/03091902.2015.1085600. Epub 2015 Sep 18.PMID: 26383168
- Game FL, Attinger C, Hartemann A, Hinchliffe RJ, Londahl M, Price PE, Jeffcoate WJ, International Working Group on the Diabetic F. IWGDF guidance on use of interventions to enhance the healing of chronic ulcers of the foot in diabetes. *Diabetes Metab Res Rev.* 2016;32 Suppl 1:75-83.
- Ghauri AS, Nyamekye IK. Leg ulceration: The importance of treating the underlying pathophysiology. *Phlebology.* 2010;25(Suppl 1):42–51.

- Giurato L, Vainieri E, Meloni M, Izzo V, Ruotolo V, Fabiano S, Pampana E, Lipsky B, Gandini R, Uccioli L. Limb salvage in patients with diabetes is not a temporary solution but a life-changing procedure. *Diabetes Care*. 2015;38:e156-157.
- Gould C., Umscheid C., Agarwal R., Kuntz G., Pegues D. Healthcare InfectionControl Practices Advisory Committee (HICPAC). Guidelines for prevention of catheter associated urinary tract infections 2009 (updated June 6, 2019). Accessed December 23, 2019; <https://www.cdc.gov/infectioncontrol/pdf/guidelines/cauti-guidelines-H.pdf>.
- Greenman RL, Panasyuk S, Wang X, Lyons TE, Dinh T, Longoria L, Giurini JM, Freeman J, Khaodhiar L, Veves A. Early changes in the skin microcirculation and muscle metabolism of the diabetic foot. *Lancet*. 2005;366:1711-1717.
- Grigoryan AY, Terekhov AG. [Modern concept about trophic venous ulcers.](#) *Khirurgiia* (Mosk). 2022;(1):73-80. doi: 10.17116/hirurgia202201173. PMID: 35080830
- Gyesi-Appiah E, Brown J, Clifton A. [Short-term urinary catheters and their risks: an integrated systematic review.](#) *Br J Nurs*. 2020 May 14;29(9):S16-S22. doi: 10.12968/bjon.2020.29.9.S16. PMID: 32407228
- Hinchliffe RJ, Brownrigg JR, Andros G, Apelqvist J, Boyko EJ, Fitridge R, Mills JL, Reekers J, Shearman CP, Zierler RE, Schaper NC, International Working Group on the Diabetic F. Effectiveness of revascularization of the ulcerated foot in patients with diabetes and peripheral artery disease: a systematic review. *Diabetes Metab Res Rev*. 2016;32 Suppl 1:136-144.
- Hinchliffe RJ, Brownrigg JR, Apelqvist J, Boyko EJ, Fitridge R, Mills JL, Reekers J, Shearman CP, Zierler RE, Schaper NC, International Working Group on the Diabetic F. IWGDF guidance on the diagnosis, prognosis and

management of peripheral artery disease in patients with foot ulcers in diabetes. *Diabetes Metab Res Rev.* 2016;32 Suppl 1:37-44.

- Hingorani A, LaMuraglia GM, Henke P, Meissner MH, Loretz L, Zinszer KM, Driver VR, Frykberg R, Carman TL, Marston W, Mills JL, Sr., Murad MH. The management of diabetic foot: A clinical practice guideline by the Society for Vascular Surgery in collaboration with the American Podiatric Medical Association and the Society for Vascular Medicine. *J Vasc Surg.* 2016;63:3S-21S.
- Hong S, Yu P, Chen X, Qian S. [Long-term care services and care workers in Hangzhou City, China: A cross-sectional survey.](#) *J Nurs Manag.* 2019 Oct;27(7):1546-1553. doi: 10.1111/jonm.12842. Epub 2019 Sep 15. PMID: 31418968
- Huskamp HA, Kaufmann C, Stevenson DG. [The intersection of long-term care and end-of-life care.](#) *Med Care Res Rev.* 2012 Feb;69(1):3-44. doi: 10.1177/1077558711418518. Epub 2011 Sep 8. PMID: 21903662
- [Ikegami N. Financing Long-term Care: Lessons From Japan.](#) *Int J Health Policy Manag.* 2019 Aug 1;8(8):462-466. doi: 10.15171/ijhpm.2019.35. PMID: 31441285.
- Intrevado P, Verter V, Tremblay L. [Patient-centric design of long-term care networks.](#) *Health Care Manag Sci.* 2019 Jun;22(2):376-390. doi: 10.1007/s10729-018-9445-7. Epub 2018 May 29. PMID: 29845399
- Jiang Y, Ran X, Jia L, Yang C, Wang P, Ma J, Chen B, Yu Y, Feng B, Chen L, Yin H, Cheng Z, Yan Z, Yang Y, Liu F, Xu Z. Epidemiology of type 2 diabetic foot problems and predictive factors for amputation in China. *Int J Low Extrem Wounds.* 2015;14:19-27.

- Kane J, de Vries K. [Dignity in long-term care: An application of Nordenfelt's work.](#) Nurs Ethics. 2017 Sep;24(6):744-751. doi: 10.1177/0969733015624487. Epub 2016 Jan 24. PMID: 26811400.
- Kono Y, Muder RR. Identifying the incidence of and risk factors for reamputation among patients who underwent foot amputation. Ann Vasc Surg. 2012;26:1120-1126.
- Krylov A, Khorobrykh T, Petrovskaya A, Gandybina E, Gogokhia T, Mansurova G. [Complex treatment of patients with venous trophic ulcer in the conditions of covid-19 hospital.](#) Georgian Med News. 2021 Mar;(312):7-14.
- Lavery LA, Davis KE, Berriman SJ, Braun L, Nichols A, Kim PJ, Margolis D, Peters EJ, Attinger C. WHS guidelines update: Diabetic foot ulcer treatment guidelines. Wound Repair Regen. 2016;24:112-126.
- Lipsky BA, Aragon-Sanchez J, Diggle M, Embil J, Kono S, Lavery L, Senneville E, Urbancic-Rovan V, Van Asten S, International Working Group on the Diabetic F, Peters EJ. IWGDF guidance on the diagnosis and management of foot infections in persons with diabetes. Diabetes Metab Res Rev. 2016;32 Suppl 1:45-74.
- [LONG-TERM CARE: What Is Long-Term Care?](#)
<https://www.nia.nih.gov/health/what-long-term-care>
- [McDonald T, Russell F. Long-Term Care Quality-of-Life Scale utility in community home care.](#) Nurs Health Sci. 2019 Dec;21(4):494-500. doi: 10.1111/nhs.12628. Epub 2019 Jul 8.
- Meneguetti MG, Ciol MA, Bellissimo-Rodrigues F, Auxiliadora-Martins M, Gaspar GG, Canini SRMDS, Basile-Filho A, Laus AM. [Long-term prevention of catheter-associated urinary tract infections among critically ill patients through the implementation of an educational program and a daily](#)

[checklist for maintenance of indwelling urinary catheters: A quasi-experimental study.](#) *Medicine (Baltimore)*. 2019 Feb;98(8):e14417. doi: 10.1097/MD.00000000000014417.

- Piechota H. [Indwelling Urinary Catheters: A Pathway to Health Care-Associated Infections.](#) [Prevention of Catheter-Associated Urinary Tract Infections.](#) *Aktuelle Urol.* 2016 May;47(3):220-8. doi: 10.1055/s-0042-101845. Epub 2016 Jun 7. PMID: 27271450
- Puri V., Venkateshwaran N, Khare N. Indian Trophic ulcers-Practical management guidelines / *J Plast Surg.* 2012;45(2):340-351. doi:10.4103/0970-0358.101317.
- Simms KW, Ennen K. [Lower extremity ulcer management: best practice algorithm.](#) *J Clin Nurs.* 2011 Jan;20(1-2):86-93. doi: 10.1111/j.1365-2702.2010.03431.x. Epub 2010 Nov 17. PMID: 21083786
- Suh HS, Oh TS, Hong JP. Innovations in diabetic foot reconstruction using supermicrosurgery. *Diabetes Metab Res Rev.* 2016;32 Suppl 1:275-280.
- Tamir E, Tamir J, Beer Y, Kosashvili Y, Finestone AS. Resection Arthroplasty for Resistant Ulcers Underlying the Hallux in Insensate Diabetics. *Foot Ankle Int.* 2015;36:969-975.
- Tamir E, Vigler M, Avisar E, Finestone AS. Percutaneous tenotomy for the treatment of diabetic toe ulcers. *Foot Ankle Int.* 2014;35:38-43.
- Thompson G, Shindruk CL, Adekoya AA, Demczuk L, McClement S. [Meanings of 'centredness' in long-term care facilities: a scoping review](#) [HYPERLINK "https://pubmed.ncbi.nlm.nih.gov/30099403/"](https://pubmed.ncbi.nlm.nih.gov/30099403/)protocol. *BMJ Open.* 2018 Aug 10;8(8):e022498. doi: 10.1136/bmjopen-2018-022498.
- Umscheid C.A., Mitchell M.D., Doshi J.A., Agarwal R., Williams K., Brennan P.J. Estimating the proportion of healthcare-associated infections

that are reasonably preventable and the related mortality and costs. *Infect Control Hosp Epidemiol.* 2011; 32 (2): 101-114; doi:10.1086/657912.

- Wald H.L., Ma A., Bratzler D.W., Kramer A.M. Indwelling urinary catheter use in the postoperative period: analysis of the national surgical infection prevention project data. *ArchSurg.* 2008;143 (6): 551-557; doi: 10.1001/archsurg.143.6.551.
- WHO: Integrated Continuum of Long-term care <https://www.who.int/teams/maternal-newborn-child-adolescent-health-and-ageing/ageing-and-health/integrated-continuum-of-long-term-care>
- Wu B, Cohen MA, Cong Z, Kim K, Peng C. [Improving Care for Older Adults in China: Development of Long-Term Care Policy and System.](#) *Res Aging.* 2021 Mar-Apr;43(3-4):123-126. doi: 10.1177/0164027521990829. Epub 2021 Feb 3. PMID: 33530855
- Ye L, Richards KC. [Sleep and Long-Term Care.](#) *Sleep Med Clin.* 2018 Mar;13(1):117-125. doi: 10.1016/j.jsmc.2017.09.011. Epub 2017 Nov 22. PMID: 29412978.
- Zeng Z, Dong Y, Hua Q, Kuang X, Li K, Deng X, Qiu S. Computed tomography perfusion study evaluating the curative effect of tibial transverse transport in patients with severe diabetic foot. *Journal of Orthopaedic Translation.* 2019;04:5-14.
- Zhadynskyi AM, Zhadynskyi MV, Zhadynskyi SM. [Development of local treatment approaches for trophic ulcers.](#) *Pol Merkur Lekarski.* 2021 Dec 16;49(294):401-404. PMID: 34919081
- Zhang P, Lu J, Jing Y, Tang S, Zhu D, Bi Y. Global epidemiology of diabetic foot ulceration: a systematic review and meta-analysis (dagger). *Ann Med.* 2017;49:106-116.

- Zhu Z, Wang Z, Li S, Yuan X. J Biomed Mater Res A. 2019 Feb;107(2):445-467. doi: 10.1002/jbm.a.36561. Epub 2018 Nov 23.