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Post-operative mediastinitis in a Heart Hospital of Recife: contributions for nursing care

MEDIASTINITE PÓS-CIRÚRGICA EM UM HOSPITAL CARDIOLÓGICO DE RECIFE: CONTRIBUIÇÕES PARA A ASSISTÊNCIA DE ENFERMAGEM

MEDIASTINITIS POSTOPERATORIA EN UN HOSPITAL CARDIOLÓGICO DE RECIFE: CONTRIBUCIONES PARA LA ATENCIÓN DE ENFERMERÍA

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ABSTRACT

The objective of this study was to determine the prevalence of post-operative mediastinitis with the purpose to contribute to nursing care knowledge. To do this, an analysis was performed on 896 medical records of patients who underwent heart surgery involving sternotomy at the Cardiology Emergency Room of Recife-PE, in the period between June 2007 and June 2009. The following variables were considered: gender, age, type of surgery, personal history, length of stay, use of antibiotics, and culture of the surgical wound. A high death rate from mediastinitis was observed (33.3%). Several risk factors were identified, including: systemic arterial hypertension (80.9%); smoking (61.9%); diabetes mellitus (42.8%); and obesity (33.3%), most of which (76.2%) were identified in patients who underwent surgery for myocardial revascularization. It is concluded that mediastinitis is a serious infection that needs continuous nursing supervision and preventive measures to assure an early diagnosis and, thus, reduce mortality.

DESCRIPTORS

Mediastinitis
Osteomyelitis
Thoracic surgery
Perioperative nursing

RESUMO

O objetivo deste estudo foi determinar a prevalência de mediastinite pós-cirúrgica com o intuito de contribuir para a assistência de enfermagem. Para tanto, foi realizada a análise de 896 prontuários de pacientes submetidos à operação cardíaca com esternotomia no Pronto Socorro Cardiológico de Recife-PE,no período de junho de 2007 a junho 2009. As variáveis consideradas foram: sexo, idade, tipo de operação, antecedentes pessoais, tempo de internamento hospitalar, uso de antibióticos e cultura de ferida operatória. Observou-se alta letalidade por mediastinite (33,3%). Vários fatores de risco foram identificados no estudo, tais como: hipertensão arterial sistêmica (80,9%); tabagismo (61,9%); diabetes mellitus (42,8%) e obesidade (33,3%), sendo a maioria (76,2%) em pacientes submetidos à cirurgia de revascularização do miocárdio. Conclui-se que a mediastinite é uma infecção grave que necessita de supervisão contínua da enfermagem e medidas preventivas para o diagnóstico precoce e a diminuição da mortalidade.

DESCRITORES

Mediastinite
Osteomielite
Cirurgia torácica
Enfermagem perioperatória

RESUMEN

Este estudio objetivó determinar la prevalencia de mediastinitis postoperatoria con la intención de contribuir a la atención de enfermería. Fueron analizadas 896 historias clínicas de pacientes sometidos a operación cardíaca con esternotomía en Urgencia Cardiológica de Pernambuco, en el período de junio 2007 a junio 2009. Las variables consideradas fueron: sexo, edad, tipo de operación, antecedentes personales, tiempo de internación hospitalaria, uso de antibióticos y cultivo de la herida operatoria. Se observó alta mortalidad por mediastinitis (33,3%). Fueron identificados en el estudio algunos de los factores de riesgo, tales como: hipertensión arterial sistémica (80,9%), tabaquismo (61,9%), diabetes mellitus (42,8%) y obesidad (33,3%), ocurriendo la mayoría (76,2%) en pacientes sometidos a cirugía de revascularización del miocardio. La mediastinitis es una infección grave que necesita de supervisión continua de enfermería y medidas preventivas para el diagnóstico precoz y disminución de la mortalidad.

DESCRIPTORES

Mediastinitis
Osteomielitis
Cirugía torácica
Enfermería periperatoria

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INTRODUCTION

The most prevalent hospital infections are characterized by the installation and development of microorganisms in the surgical incision[1]. The pathogenesis of postoperative mediastinitis is both complex and multifactorial. It is defined as an infection and/or inflammation of joint tissue in the mediastinum, associated with sternal osteomyelitis, with or without instability, and may even reach the retrosternal space[2,3-4]. It can be caused by medium sternotomy[5-6], esophageal rupture[7-8], deep cervical infections and, rarely, by pleural empyema, vertebral or costal osteomyelitis, retroperitoneal and subphrenic abscesses[4-5,9].

Factors associated with the development of infection in cardiac surgery are generally related with the patient (skin colonization, obesity, Diabetes Mellitus, age, preoperative hospitalization time, pre-existing infections, disease severity, etc.) and/or with the surgical procedures (ischemia[10], inadequate approximation of wound borders, presence of necrotic tissue or foreign body, duration of surgery, etc.)[1,11]. The surgical wound (SW) contamination type and degree also depend on the physiological systemic response, release of inflammatory mediators, local blood supply, nutrition, the patient's immunological condition[11], among others.

Factors like diabetes-related obesity, mainly in patients under insulin therapy, re-operation with longer perfusion and polytransfusion times have been elevated risk factors[8,11-12], which contribute to the appearance of mediastinitis[3,11]. The use of two mammary bypass grafts has been highly discussed, as this predisposes to sternal devascularization, creating a favorable environment for the appearance of infection[3,8,11].

Among the infectious agents found in inflamed mediastinal tissue cultures, *Staphylococcus aureus, Staphylococcus epidermidis, Pseudomonas sp* and *Escherichia coli* stand out. The latter is associated with a high mortality rate[9,13]. Mixed infections are also reported though[8]. In some cases, mediastinal exudate cultures can be negative, which in most cases is due to previous antibiotics use[5].

The incidence of postoperative mediastinitis varies according to the institutional routine, use of prophylactic antimicrobials, standardization of aseptic techniques etc. Estimated rates figure between 0.4 and 5.0%, with a mean 2.0%, according to the Guidelines of the American College of Cardiology and the American Heart Association (ACC/AHA)[14]. The mortality rate seems to be related with delays in the diagnosis and start of treatment, increasing this frequency by 10.0 to 47.0%[3].

The signs and symptoms mediastinitis patients present range from persistent fever after the fourth postoperative day to toxemia, leukocytosis, bacteremia, purulent secretion and surgical wound dehiscence (in 70 to 90% of cases), normally associated with thoracic pain and sternal instability[1,8,12].

The diagnosis is generally late, demanding confirmation through at least two of the following findings: identification of microorganisms in the fluid collected from the mediastinal space, culture of mediastinal tissues, radiologic evidence of infection and sternal surgical wound dehiscence[15]. A permanent diagnosis, however, is reached through a sternal puncture or surgical wound exploration[3,12].

Its treatment ranges from antimicrobial therapy to total sternectomy and reconstructive plastic procedure of the thoracic wall[1,3,12]. In patients whose mediastinal wound infection is only accompanied by subcutaneous problems, treatment involves the initial opening of the lesion and judicious analysis of the infectious process and its extent, guided use of antimicrobials and, at the same time, following the principles of open wound treatment with dressings[1].

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Due to the fact that hospital infections are connected with patient and procedure-related factors, the multiprofessional team plays a fundamental role in the prevention of hospital infections. This demands preventive measures, in-service training, attitude changes and permanent education from health teams and institutions as an essential point in the care process. Moreover, the costs deriving from the hospitalization and treatment of a patient with mediastinitis reveal to be thrice as high than those of a patient without infection[1,12].

As a result of advances in hospital care technologies, the first Hospital Infection Control Commissions (HICC) emerged. In 1997, the Ministry of Health (MH) approved law 9431/97, which established the compulsory presence of a Hospital Infection Control Commission and hospital infection Control Programs in all hospitals, independently of the complexity of care delivery. In the following year, Ministry of Health decree 2616/98 determined on the obligatory presence of the nurse in the professional team that constitutes the Hospital Infection Control Commission[16].

The responsibility for care delivery demands that decisions on interventions be based on the assessment of patients' health conditions, on the clinical situation and on the nature of the infection one wishes to obtain. Nursing's cognitive and perceptive skills are factors that influence care and the early identification of signs and symptoms[2,17].

The importance of this study is due to the fact that it cooperates with data that can be used to identify risk

groups for the development of this disease, to elaborate preventive methods in mediastinal infection and for the nursing team to create a therapeutic plan, in view of the scarce number of studies about this pathology in Brazil, mainly in the Northeast.

OBJECTIVE

To investigate the prevalence of postsurgical mediastinitis in patients hospitalized at the Cardiology Emergency Unit in Pernambuco (PROCAPE), with a view to contributing to nursing care.

METHOD

This retrospective, descriptive and cross-sectional study with a quantitative approach was developed between June 2007 and June 2009, at the Cardiology Emergency Unit of *Universidade de Pernambuco*, where all files of patients diagnosed with mediastinitis. Information was collected through data the Hospital Infection Control Commission at the hospital provided. This sector sets standards and routines, aimed at developing, guiding and supervising actions professionals in health and related areas perform, with a view to minimizing the development and/or occurrence of hospital infections.

The variables used in this study were: gender, age, diabetes mellitus (DM), chronic obstructive pulmonary disease (COPD), obesity (BMI ≥ 30kg/m²), smoking, preliminary heart disease, duration of cardiopulmonary bypass (> 120 minutes), surgery and hospitalization at Intensive Care Units (ICU), postoperative polytransfusion and use of mammary bypass graft.

Study limitations included the identification of skin color, occupation and education level in the sample, due to the lack of data and incomplete patient files, so that these variables were excluded from the analysis.

The study variables were stored in EPI-INFO software, version 3.5.1/2008 - Atlanta/USA, used for statistical calculations with analysis and interpretation.

A data collection instrument was used with objective checklist questions, which the researchers completed by consulting the patient files in the hospital's medical archives. Identification, history of current and preliminary disease, current disease diagnosis, surgery type, pre-, trans- and postoperative data, recovery, hospitalization time and hospital discharge data were used. The instrument was applied between January and April 2010.

Approval for the research project was obtained from the Research Ethics Committee (CEP) at *Hospital Universitário Oswaldo Cruz* (HUOC) under protocol number: 5066.0.000.106-09. Mediastinitis was defined based on the diagnosis present in the medical evolution.

RESULTS

According to the hospital infection control reports from the Cardiology Emergency Unit of *Universidade de Pernambuco*, between June 2007 and June 2009, 896 cardiac surgeries were accomplished. According to the data obtained from the Hospital Infection Control Commission, 35 files of patients diagnosed with mediastinitis were analyzed. Four (04) of these were not found in the medical archives, seven (07) did not have a diagnosis that confirmed thoracic cavity infection and three (03) patients were operated on at another hospital, so that they were excluded from the research. Hence, the study included 21 files of patients with a confirmed medical diagnosis of postoperative mediastinitis were included, hospitalized at the Cardiology Emergency Unit of *Universidade de Pernambuco* between June 2007 and June 2009.

At this hospital, the Hospital Infection Control Commission nurses, responsible for the primary assessment of surgical wounds with signs of infection, previously inform patients that, after discharge, they are expected to visit the hospital for diet monitoring, dressing cleaning and exchange, so as to continue treatment and avoid unnecessary rehospitalization. As from this initial assessment, the protocols start which nurses use in infection control. These consist in: request for a medical surgeon's opinion on the inspection of the patient's thoracic cavity, presence of exudate, osteomyelitis, investigation of infection signs and symptoms, imaging and laboratory tests and clinical assessment of the patient's general condition, in order to define the case. After confirmation, treatment starts through anamnesis and physical examination, carefully observing the infected area, defining the type of dressing and the use of antimicrobials, if necessary.

In comparison with other infections, mediastinitis stands out in this study. In total, 96 cases (10.7%) of postoperative infections were found. Twenty-one (2.3%) of these referred to mediastinitis after cardiac surgery with sternotomy, including seven deaths (33%) (Figure1).

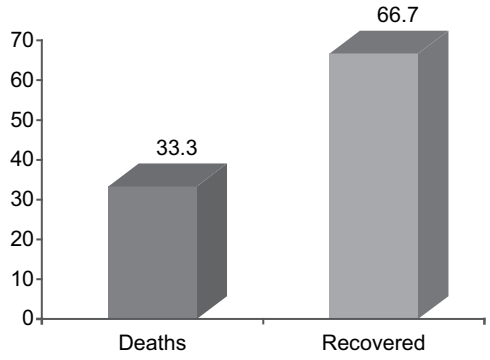


Figure 1 – Frequency of deaths and recovered patients at the Cardiology Emergency Unit of *Universidade de Pernambuco* - Recife, PE, 2007/2009.

Coronary artery bypass graft (CABG) surgeries were related with 76.2% of mediastinitis cases (16 patients), while the remainder occurred after dissection correction (3 cases) and valve replacement (2 patients) (Figure 2). The correlation between CABG surgeries and the development of mediastinitis has been well documented in the literature, appointing more than 80% of infection cases as complications associated with this surgery[8,19].

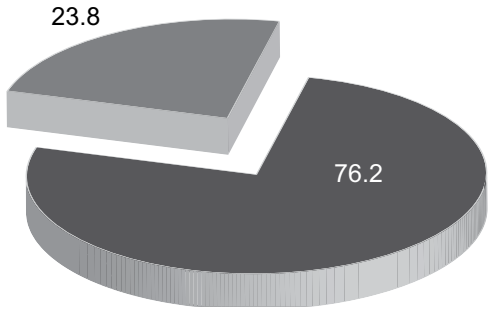


Figure 2 – Prevalence of coronary artery bypass graft surgeries at the Cardiology Emergency Unit of Universidade de Pernambuco - Recife, PE – 2007/2009.

As for sex, 52.4% of patients were male and 10 (47.6%) female. The mean age was 60.04 ± 15.60, ranging between 1 and 77 years. Concerning origin, 66.6% came from the state capital and 33.4% from the interior (Table 1). Most cases were found in 2007, corresponding to 38.1%. Significant reductions in case numbers were found in subsequent periods, with 33.4% and 28.5%.

Co-morbidity factors were predominant: systemic arterial hypertension (SAH) was present in 80.9% of cases; smoking was evidenced in 61.9%; diabetes mellitus in 42.8% and obesity in 33.3% of cases. The remainder showed no important diseases associated with the illness that motivated the surgery and which would represent risk factors for the development of mediastinitis.

As for the patient's preoperative skin preparation, all patients were subject to body hygiene, suggesting a decrease in skin colonization. No tissue lesions were identified, although 20% of patients had been bedridden even before the surgery.

The use of antibiotics therapy is indicated in large surgeries or in patients at risk of developing infections and who are immunodepressed. In this case, although known in practice, pre- and intraoperative prophylaxis with antibiotics use was not evidenced in the forms analyzed, with little written information about this aspect.

In the cardiac surgeries that took between 4 and 5 hours, higher rates of mediastinitis were found (35.3% and 29.4%, respectively). Literature data appoint that the intraoperative duration of this surgery is approximately five hours[20].

Table 1 – Epidemiological profile of patients who developed mediastinitis at the Cardiology Emergency Unit of Universidade de Pernambuco - Recife, PE – 2007/2009

Variables (n = 21)	Total	
Gender	**N**	**%**
Male	11	52.4
Female	10	47.6
Age (years)		
0 – 40	02	**9.5**
41 – 60	08	**38.1**
61 – 80	11	**52.4**
Origin		
Capital	14	**66.7**
Interior	07	**33.3**
Personal Antecedents*		
Systemic Arterial Hypertension	17	**80.9**
Alcohol consumption	02	**9.5**
Allergy	05	**23.8**
Diabetes Mellitus	09	**42.8**
Smoking	13	**61.9**
Chronic Obstructive Pulmonary Disease	01	**4.8**
Obesity	07	**33.3**
Previous Cardiac Surgery	05	**23.8**
Others	17	**80.9**

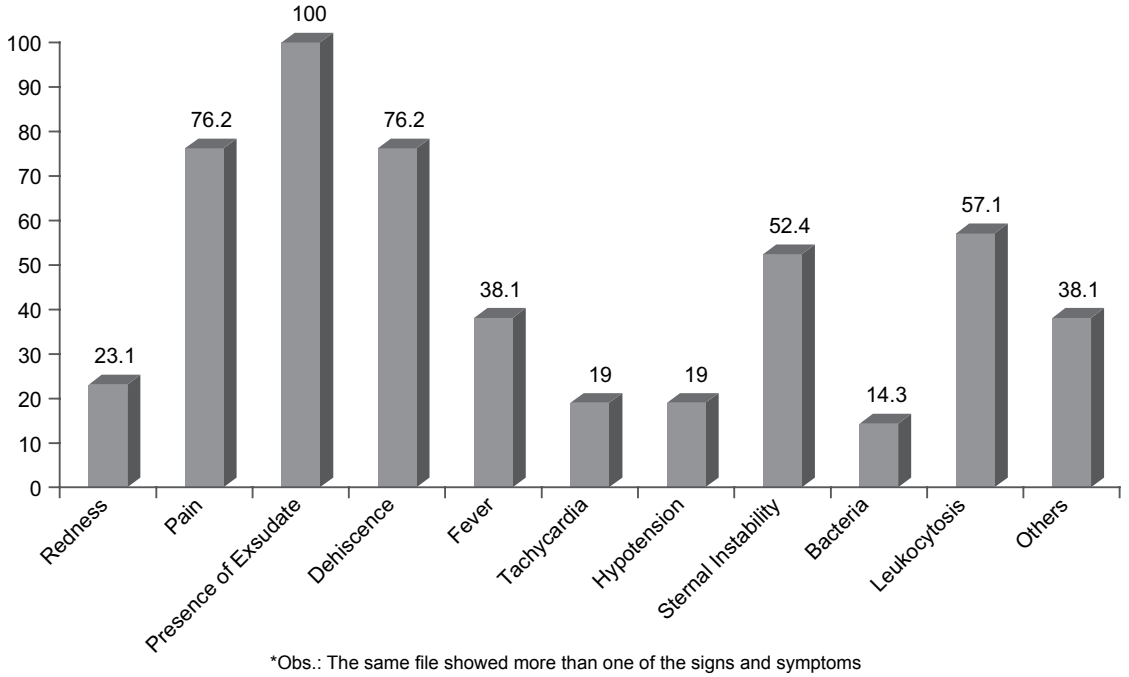
*Obs.: The same file showed more than one personal antecedent.

Mediastinitis was associated with the use of an external pacemaker in 23.8% of the cases. This is only necessary for patients at risk of heart rhythm disturbances, corresponding to a small percentage of the cases analyzed. This, however, is an important risk factor, as it creates a connection between the external environment and the interior thoracic cavity, through the external wire, which can constitute an infection route.

Patients' total hospitalization time ranged between 16 and 158 days, with the majority varying between 41 and 100 days (50.0%). It was observed, though, that a large part of patients (50.0%) was hospitalized for more than 20 days before the first surgery, contributing to the extended hospitalization time.

Another noteworthy factor is the long postoperative recovery period (21 to 120 days), which is quite high in comparison with the mean recovery time after large surgeries found in other studies (between 7 and 14 days in literature, with a mean 11 days)[21]. This can be related to the period between the surgery and the appearance of the first signs and symptoms (ranging between 2 days and 4 weeks), the delayed diagnosis and the complexity of the disease, which demands long treatments.

The most found signs and symptoms in the study sample were the presence of exudate (100.0%) and surgical wound dehiscence and pain (76.2% each). Patients affected by mediastinitis displayed signs and symptoms between three and 19 days after the surgery. Systemic signs, like fever, leukocytosis and tachycardia, are strong signs of cavitary infection, while local phlogistic signs like pain, redness and presence of exudate only indicate surgical wound inflammation, which may or may not be related with deep tissues (Figure 3).



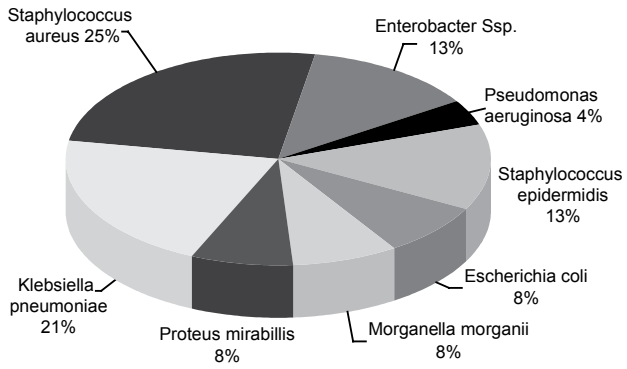
*Obs.: The same file showed more than one of the signs and symptoms

Figure 3 – Signs and symptoms in patients who developed mediastinitis at the Cardiology Emergency Unit of Universidade de Pernambuco - Recife, PE – 2007/2009

The distance between the date of the surgery and the appearance of the first signs and symptoms can be that long that patients are discharged before mediastinitis is diagnosed, reflecting in the high rehospitalization level found (23.8%).

Among the diagnostic confirmation methods used, the most common was the clinical method (43.0%), followed by culture (35.0%), using lesion tissue or exudate. Normally, the diagnosis is confirmed when combining two or more methods.

As soon as mediastinitis is suspected, antibiotics therapy is started, which can be modified after the culture in case of resistant bacilli. Culture results confirm the presence of infection and their causal agent, which can be more than one, known as mixed infection. The most frequently isolated germs were *S. aureus* (25.0%) and *K. pneumoniae* (21%) (Figure 4).



*Obs.: The same file showed more than one of the signs and symptoms

Figure 4 – Pathogens found in surgical wound cultures with mediastinitis at the Cardiology Emergency Unit of *Universidade de Pernambuco* - Recife, PE – 2007/2009

DISCUSSION

The low prevalence found in this study is in accordance with similar rates appointed in the literature. In Brazil, in the State of Minas Gerais, the prevalence rate in corresponds to 2.1% of the study population[5].

The intraoperative period of cardiac surgeries is critical for patients, due to its complexity and inherent procedures, such as cardiopulmonary bypass and extended duration. Various factors influence the incidence of surgical wound infection, including invasive procedures and the insufficient primary defense the surgical trauma and cardiopulmonary bypass provoke. This causes physiological changes in the immune system, especially due to the use of hypothermia and hemodilution, predisposing to infections and altering patients' normal physiology[19]. During this procedure, some nursing diagnoses can be observed, including: imbalanced fluid volume, impaired gas exchange, altered protection due to the inhibition of the coagulation system, with systemic heparinization and kidnapping of leukocytes from the circulation, inhibiting its phagocytosis of the germs invading the organism[2]. Therefore, nursing professionals should be prepared to intervene in these situations.

The most found comorbidity factors are also associated with cardiovascular complications that need special care and surgical correction through coronary artery bypass graft surgery. When it comes to mediastinitis, these turn into severe aggravating factors as, besides predisposing to the need for surgical intervention, especially systemic arterial hypertension, they systematically influence

the human metabolism, like diabetes mellitus, smoking and obesity for example, which hamper healing.

In that sense, nursing is responsible for the identification of these conditions as early as in the preoperative period, so as to plan control actions through health education practices, reducing expected postoperative damage.

The use of mammary grafts in coronary artery bypass graft surgeries can enhance the development of mediastinitis because it causes hypoxia in the sternum and local tissues, facilitating the installation and development of infectious microorganisms. Hence, the use of two grafts potentially increases infection risks, as it reduces the blood flow to the external muscles. In our study, only the use of one mammary graft was found.

The long hospitalization in this study corroborates greater infection risks, due to the greater chance that patients will have contact with pathogens (contact with other patients, health team and hospital environment), besides contributing to further stress and anxiety and depressive conditions, which may decrease their immunity.

Health professionals, especially in nursing, should heed cross infection control during invasive procedures. Simple actions like hand washing, adequate use of individual protection equipment (gloves, cloaks and masks) and maintenance of aseptic techniques help to prevent pathogen transmission. At teaching hospitals, preventive measures become even more important, due to the large flow of people (professionals from different areas and students) at the units.

The problems raised in this research were characterized to contribute to nursing interventions, with a view to solving not only the patient's problem, but also to achieve the necessary safety, obtained through diagnostic support, and to further decision making[22].

The scarce presence of the nursing process was observed, as well as these professionals' limited completion of the patient files (at the ward, ICU and HICC), which did not permit monitoring the services and how they influenced the evolution of patients' clinical conditions.

CONCLUSION

This study demonstrates the importance of nursing care to cardiac surgery patients, as a relevant measure to prevent and control the emergence of new mediastinitis cases, contributing to safe nursing practices and a low mortality rate due to this problem.

Together with the Hospital Infection Control Commission, clinical nurses are the best trained professionals to act in hospital infection control, due to their closer role and monitoring of patients' clinical evolution, as the first professionals to identify changes in their clinical conditions.

Based on this study, the set-up of nursing care systemization for surgical patients is suggested, including the formulation and implementation of print material for nursing care planning, with nursing diagnoses, outcomes and interventions needed for the sake of epidemiological surveillance; full completion of the Hospital Infection Control Commission's own form; description of surgical wound location, evolution and treatment; regular evaluation to monitor the patient's progress; routine nursing supervision in immediate and late postoperative patients, so as to identify signs and symptoms early; permanent education and in-service training for nursing professionals, furthering the problem-solving ability of care.

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