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Statement of Retraction

The following article which was first published online ahead of print on 2nd of November 2011 has been retracted from publication in *Immunopharmacology and Immunotoxicology:*

Elsa Vitale. An evaluation of the association of malnutrition with nosocomial infections in elderly patients. Immunopharmacology and Immunotoxicology 2011, 1–4, Early Online. DOI: 10.3109/08923973.2011.625033

This article has been found to reproduce content to a high degree of similarity, without appropriate attribution or acknowledgement by the authors, from the following original article:

Elena Paillaud, Stephane Herbaud, Philippe Caillet, Jean-Louis Lejonc, Bernard Campillo, Phuong-Nhi Bories. Relations between undernutrition and nosocomial infections in elderly patients. Age and Ageing 2005, 34, 619–625. DOI: 10.1093/ageing/afi197.

In addition, because some of Dr Vitale's data is identical to some of Dr Paillaud's, we have advised Dr Vitale's institution, the University of Bari, to investigate the origin and source of her data.

Immunopharmacology and Immunotoxicology published this article in good faith, and on the basis of warranties made by the corresponding author regarding the originality of her work. The article is withdrawn from all editions by the Editor. The author accepted this decision.

Emilio Jirillo (Editor in Chief)
Joris Roulleau (Managing Editor,
Informa Healthcare)

Addendum

After the publication of this retraction statement, it has since been confirmed that the article does also contain instances of data fabrication.

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RESEARCH ARTICLE

An evaluation of the association of malnutrition with nosocomial infections in elderly patients

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Abstract

Background: Hospital-acquired infections and malnutrition were of major concern in public health in elderly patients. However, the interactions between these two entities are not well-established. *Objectives:* To determine the incidence of nosocomial infections (NI) and its association with malnutrition, 85 hospitalized older adults aged over 70 years old were nutritionally assessed on admission by measurement of their Body Mass Index, serum nutritional proteins and C-reactive protein levels. During hospitalization, patients' progress was closely monitored, particularly for the detection of nosocomial infections. *Results:* The incidence rate of NI was 57% ($n = 48$ patients). The most common infection site was the urinary tract. The nutritional status of the population was studied by comparing 3 groups defined according to the absence (group I, $n = 10$), presence of one infection (group II, $n = 25$) or presence of more than one infection (group III, $n = 13$). Albumin and C-reactive protein levels differed significantly among the 3 groups. Age, energy intake, length of hospital stay and the presence of a urinary catheter were independent risk factors of nosocomial infection. *Conclusion:* Patients with multiple NI were older, showed an altered nutritional status, a prolonged recovery, more frequently had urinary catheters and more discharge placement.

Keywords: Malnutrition, nosocomial infection, immunocompromised host, malnutrition and elderly patients, nosocomial infections and elderly patients

Introduction

Hospital-acquired infections are of major concern in public health. They are a frequent complication of hospitalization and are associated with high morbidity, mortality rate and costs.[1,2] Malnutrition is known to impair immune function, particularly cell-mediated immunity.[3,4]

Several studies have reported infections as a complication of malnutrition in different populations of patients, mainly in surgical units.[5–10] Less attention has been paid to elderly hospitalized patients. Malnutrition is often seen in elderly people: 30–60% of geriatric patients in intermediate- or long-stay wards are malnourished. Thus, those patients might particularly be at risk of developing a nosocomial infection.

Data from the National Nosocomial Infections Survey have shown that 54% of all nosocomial infections (NI) occurred in people aged 65 and older.[11] The urinary tract and lung are the most commonly encountered sites of hospital-acquired infection. Risk factors for NI depend on the infection's site and care settings. Mechanical ventilation and indwelling urinary catheter are the most important risk factors of nosocomial pneumonia and urinary infection, respectively. A number of other risk factors have been identified in older patients, including neurological diseases, respiratory diseases, diabetes mellitus, decreased consciousness, deteriorating health, disorientation, difficulty with swallowing, aspiration, nasogastric tube, inhalation therapy, increased agitation, dependency, central vascular or peripheral line, incontinence, previous antibiotic therapy, history of nosocomial infection and sedation medication.[12–14] Moreover, some studies have evaluated malnutrition as a possible risk factor for NI in those patients[15,16] but the results were not convincing.

However, those studies differed in terms of criteria used to evaluate nutritional status and in terms of populations selected. Therefore, this prospective study

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was designed to determine the global infection rate of nosocomial infection in elderly in-patients and to evaluate its association with the nutritional status assessed by anthropometric and biological measurements.

Material and methods

Sample and survey administration

Eighty-five patients aged 70 years or older (35 males and 50 females, over 70 years old), consecutively admitted to the Polyclinic of Bari Hospital, in the orthopedic unit, between November 2010 and June 2011 were enrolled. Patients included in this study were medically stable at admission and required long-term care and rehabilitation. Patients were also excluded from the study if their stay in the rehabilitation unit was shorter than 72 hours. Patients were informed of the purpose of the study and gave their oral consent.

Measures

A standardized questionnaire was used on admission to hospital (Day 0) for recording age, gender, some information on past medical history and their drug therapy.[17]

Patients were nutritionally assessed on Day 0 by measurement:

- Anthropometric variable: body weight, height and body mass index (BMI) (weight/height^2).
- Laboratory test: determination of serum proteins and C-protein level.

In addition, during their stay in hospital, patients' progress was closely monitored, particularly for the detection of NI until discharge from the rehabilitation unit or death.

Nosocomial infection was defined as a well-documented infection absent on admission and occurring after surgery.

Results

The incidence rate of NI was 57% ($n=48$ patients). The most common infection site was the urinary tract (45%; $n=22$ patients), especially in catheterized patients.

The nutritional status of the population was studied by comparing 3 groups defined according to the absence (group I, $n=37$; 43%), presence of one infection (group II, $n=20$; 24%) or presence of more than one infection (group III, $n=28$; 33%) during their stay in hospital.

The most common micro-organisms present were:

- *Escherichia coli* ($n=21$; 33%),
- *Enterococcus faecalis* ($n=15$; 23%),
- *Staphylococcus aureus* ($n=11$; 18%),
- *Pseudomonas aeruginosa* ($n=8$; 12%),
- *Proteus mirabilis* ($n=4$; 6%),
- *Klebsiella pneumoniae* ($n=5$; 8%).

Table 1. Characteristics of the patients.

n	Non infection	One infection	>One infection
Gender			
Male	17	13	5
Female	20	12	18
Length of stay (days)	7 ± 3	9 ± 4	11 ± 5

Table 2. Anthropometric variables in the three groups of patients.

	No infection	One infection	>one infection
n	37	20	28
Weight (kg)	63 ± 1.5	58 ± 2.1	51 ± 1.8
BMI (kg / m2)	23.8 ± 0.5	24 ± 1.2	21.1 ± 0.5

Table 3. Biological variables in the three groups of patients.

	No infection	One infection	>one infection
n	37	20	28
Albumin (g/L)	36.3 ± 0.4	34.6 ± 0.6	31.7 ± 0.9
CRP (mg/L)	16 ± 2	37 ± 10	44 ± 8
Lymphocytes (g/L)	1.7 ± 0.1	1.8 ± 0.3	1.5 ± 0.1
PMN leukocytes (g/L)	4.4 ± 0.2	6.1 ± 1.0	6.7 ± 0.7

Three groups were defined:

One for patients who did not develop an infection during their stay in hospital;
One for those who suffered one infection;
And one for those who suffered more than one infection (Table 1).

The proportion of patients with BMI <20 did not differ significantly among the 3 groups (Table 2).

As far as laboratory data were concerned (Table 3), albumin and CRP levels differed significantly among the 3 groups.

The group with several infections had a mean albumin level below the normal range (35–48 g/L) and lower than the other two groups.

The 3 groups of patients differed in terms of outcome. A higher proportion of patients from the group without infection (43 %) could return home after being discharged from the hospital.

On the other hand, infected patients had a higher risk of mortality during their stay in hospital.

Discussion

This study shows that NI and under nutrition are common and interrelated among older patients. The most frequent infection sites were the urinary and respiratory tracts. Previous studies have reported slightly higher infection rates: 10.6 per 1000 bed days in a rehabilitation ward[18] and 10.3 per 1000 bed days in an acute geriatric care.[19]

Moreover, older age was one of the factors identified as being associated with NI. This study agrees with the fact that elderly patients are at a particularly high risk of

developing nosocomial infection. Nevertheless, the frequency of infection remains probably underestimated in the elderly because infections can be difficult to diagnose, some of them may present atypically or without febrile responses.[20,21]

In this study, the presence of a urinary catheter was the major determinant for NI. The high prevalence of NI occurring in the urinary tract, most often secondary to an indwelling urinary catheter, is well-known.[22–25] The main objective of this study was to evaluate the association of malnutrition with NI.

The prevalence of under nutrition as evaluated by BMI <20, was 40% in the population considered, which agrees with data reported in the literature. It did not differ significantly among the non-infected patients and those with one or more than one infection.

Body Mass Index and serum nutritional protein levels were comparable between non-infected patients and those with one infection. However, these variables were more severely altered in patients with more than one infection, strongly suggests that protein energy malnutrition may favor multiple infections. Discrepant results have been reported about the association between malnutrition and NI in elderly people.

An important finding in this study relates to the association of NI with lower energy intake, which could not meet energy needs in such patients with a catabolic state and therefore might increase the risk of protein energy malnutrition. A number of studies have shown that artificial nutrition reduced complications especially infections in malnourished surgical patients.[26–28] Therefore, evaluation of daily intake along the stay in hospital, is fundamental to identify patients who would benefit from nutritional support.

Another independent factor that could be associated with NI, was the length of hospital stay. A striking difference was observed between patients with no or one infection and those with more than one infection who stayed in hospital twice as long as the former ones. Prolonged hospital stay has been described as a risk factor for development of NI and conversely the latter have been shown to increase the length of hospital stay,[29,30] which may favor nutritional depletion during hospitalization.

Older patients have longer hospital stays and prolonged recovery owing to the severity and multiplicity of underlying diseases; extended periods of stay contribute to longer duration of exposure to pathogens and invasive procedures in the hospital settings.

Conclusion

This study shows that elderly patients hospitalized were at particularly high risk of NI and that 20% of them presented multiple infections. These latter patients were older, presented an altered nutritional status, had lower food intake, had more urinary catheters, showed a prolonged recovery, increased mortality and had more discharge placement.

A better understanding of the predisposing factors for nosocomial infection in elderly hospitalized patients may allow some preventing strategies to reduce the risk.

In addition, a reduction in the number of invasive procedures, particularly urinary catheterization, a nutritional assessment on admission and if necessary, a nutritional intervention, may help to reduce the incidence of NI.

Declaration of interest

The author declares no conflict of interest.

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