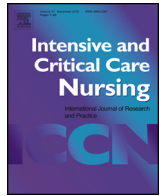




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### Review

## Intubation-associated pneumonia: An integrative review

Ana Sabrina Sousa<sup>a,b,c,\*</sup>, Cândida Ferrito<sup>d</sup>, José Artur Paiva<sup>a,e</sup>

<sup>a</sup> Hospital de S. João, Alameda Prof. Hernâni Monteiro, 4200-319 Porto, Portugal

<sup>b</sup> Universidade Católica Portuguesa, Rua Arquiteto Lobão Vital, Apartado 2511, 4202-401 Porto, Portugal

<sup>c</sup> Escola Superior de Enfermagem do Porto, Rua Dr. António Bernardino de Almeida, 4200-072 Porto, Portugal

<sup>d</sup> Instituto Politécnico de Setúbal-Escola Superior de Saúde, Campus do Instituto Politécnico Setúbal, Edifício da ESCE, Estefanilha, 2914 Setúbal, Portugal

<sup>e</sup> Faculdade de Medicina da Universidade do Porto, Alameda Prof. Hernâni Monteiro, 4200-319 Porto, Portugal

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### ABSTRACT

*Objective:* This article aims to characterise intubation-associated pneumonia regarding its diagnosis, causes, risk factors, consequences and incidence.

*Research methodology:* Integrative literature review using database Pubmed and B-on and webpages of organisations dedicated to this area of study.

*Setting:* The research took place between May and July 2015. After selection of the articles, according to established criteria, their quality was assessed and 17 documents were included.

*Results:* Evidence has demonstrated that intubation associated pneumonia has a multifactorial aetiology and one of its main causes is micro-aspiration of gastric and oropharynx contents. Risk factors can be internal or external. The diagnostic criteria are based on clinical, radiological and microbiological data, established by several organisations, including the European Centres for Disease Control and Prevention, which are, however, still not accurate. In recent years, there has been a downward trend in the incidence in Europe. Nevertheless, it continues to have significant economic impact, as well as affecting health and human lives.

*Conclusions:* Several European countries are committed to addressing this phenomenon through infection control and microbial resistance programmes; however there is a much to be done in order to minimise its effects. The lack of consensus in the literature regarding diagnosis criteria, risk factors and incidence rates is a limitation of this study.

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### Implications for Clinical Practice

- It is important for health care professionals to deepen knowledge about Intubation-associated pneumonia (IAP) for this is the most frequent healthcare associated infection in intensive-care units worldwide, causing multiple healthcare and economic impairments.
- IAP has a multifactorial aetiology and its main cause is the micro-aspiration of oropharynx colonisation agents. Health care practitioner develops an important role in preventing this phenomenon.
- Risk factors are not consensual including extrinsic and intrinsic factors (related to the patient). The presence of nasogastric feeding tube shows to increase the risk of IAP and its removal as possible may reduce the incidence of this infection.
- The diagnostic of IAP varies according to the recommendation adopted and include clinical, radiological and microbiological data. Most analyses are not specific to IAP and can lead to diagnostic errors.
- This review has shown that IAP's true incidence is unclear, as surveillance definitions are subjective and non-specific. Tight surveillance and prevention programs are needed, as well as antimicrobial control and accurate usage.

\* Corresponding author at: Hospital de S. João, Alameda Prof. Hernâni Monteiro, 4200-319 Porto, Portugal.  
E-mail address: [sabrinasousa72@hotmail.com](mailto:sabrinasousa72@hotmail.com) (A.S. Sousa).

## Introduction

Intubation-associated pneumonia (IAP) is one aspect of a major problem, healthcare associated infections (HCAI), which health systems are facing worldwide. Intubation-associated pneumonia is defined by The European Centers for Disease Control and Prevention (ECDC), as pneumonia occurring 48 hours or more after patients have been subjected to an invasive respiratory device, even if only intermittently, preceding the onset of infection (ECDC, 2010).

It is known that new advances in health and technology have led to an improved prognosis in the treatment of numerous diseases. These advances, however, have led to increased costs, including those associated with the use of invasive techniques involving an increased risk of infection. These and other factors establish HCAs as the most frequent complications in hospitalisation, and IAP as the most frequent HCAI in the intensive care unit (Pina et al., 2010).

## Background and significance

The concept of (HCAI) also referred to as “nosocomial” or hospital infection, has been repeatedly redefined over the years. Healthcare associated infection is currently defined by the World Health Organisation (WHO) as “an infection occurring in a patient during the process of care in a hospital or other health care facility which was not present or incubating at the time of admission. Healthcare associated infections can affect patients in any type of setting where they receive care and can also appear after discharge” (World Health Organization, 2016). It should be evident that the infection was not present or incubating at the time of admission to the hospital (Costa et al., 2009). This type of infection may result from any contact at different levels of care, from primary to different hospital facilities. These infections are considered a major health problem which results in prolonged hospital stays, disability, increased resistance to antimicrobials, higher additional costs for health care systems and elevated mortality (World Health Organization, 2016).

In 2011, the World Health Organisation (WHO) produced a report after a systematic literature review describing the epidemiology of HCAs across the world. According to this document, these infections represent a silent epidemic because of the unreliability of some data, especially in low- and middle-income countries where surveillance systems are lacking, and also due to its complexity and lack of uniformity of diagnostic criteria (Allegranzi et al., 2011). The epidemiological characterisation of HCAI is difficult due to its complexity. This issue involves a careful data analysis, and involves differentiated teams to structure a prevention program.

In Europe about 4,131,000 to 4,544,100 patients each year are affected by HCAs, corresponding to an average prevalence of 7.1% (Allegranzi et al., 2011). According to the WHO, based on data from a recent multi-centre study, the prevalence of these infections is considerably higher in high-risk populations, such as patients admitted into intensive care units (ICU), affecting 51% of these patients (Allegranzi et al., 2011). These data can be explained by the increased susceptibility of this population, as well as by exposure to numerous medical devices and invasive techniques.

The most frequent infection in ICUs is IAP, representing 32% of HCAs (Allegranzi et al., 2011). This infection is considered to be responsible for increased hospital economic costs, extended duration of mechanical ventilation, increased hospital length of stay and increased mortality (Klompas et al., 2014). Despite the efforts to combat this health problem through the implementation of several preventive measures, it is still the most frequent HCAI in the ICU.

The aim of this study is to characterise IAP in terms of its causes, risk factors, diagnosis, incidence and consequences world-

wide. Recognising the relevance of this issue, this article intends to explore the main aspects of IAP, so professionals may have a useful source of information.

This review was conducted according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) reporting standards, including all items that were found relevant. Because this report addresses questions relating to aetiology, diagnosis and epidemiology, some PRISMA items were modified, as recommended by the group (Moher et al., 2009).

## Method

The methodology adopted was an integrative literature review. The review was conducted between May and July 2015, using Pubmed and B-on databases, WHO, ECDC, Centers for Disease Control and Prevention (CDC) and Direção-Geral da Saúde (the Portuguese Directorate-General of Health – DGS) webpages. The literature search was conducted using the Medical Subject Headings terms “intubation, ‘intra-tracheal’, ‘pneumonia’ and ‘pneumonia, ventilator-associated’”. To increase the precision and accuracy of the results, we used the Boolean operator “and”. The inclusion criteria were: (a) articles addressing IAP diagnosis, causes, consequences, risk factors and incidence; (b) sample patient population  $\geq 18$  years of age; (c) studies only conducted in ICUs; (d) date of publication within the last 15 years. Studies not written in English, French, Spanish or Portuguese were excluded.

In Pubmed and B-on databases 202 results were found. After analysing the abstract to find if the article met the inclusion criteria, duplicated studies ( $n=50$ ), studies that did not address this review’s variables of interest ( $n=107$ ) and, again, studies written in languages other than English, French, Spanish or Portuguese ( $n=32$ ) were removed. To enhance quality, reliability and validity, the thirteen remaining articles were read in their entirety and then submitted to quality assessment.

Quality was assessed using Critical Appraisal Skills Programme tools (CASP). These instruments allowed a logical evaluation of the information provided so it could be concluded whether the research was valid and reliable. The assessment was made by two researchers independently. Prior the analysis, researchers resolved to give more weight to studies that scored “high” on quality, emphasising methodological accuracy.

Since this review aim to find descriptive results regarding diagnosis and epidemiological findings, reports that did not identify methodological aspects were found relevant in accordance with the inclusion criteria and the reliability of the sources. Disagreements were resolved through discussions between the investigators. Two studies were excluded because they did not clarify important methodological aspects, such as inclusion criteria and research databases used. All the other studies met the quality assessment and where included in the review.

A search of the WHO, DGS and CDC websites, retrieved six documents for inclusion. Data were extracted from the primary sources using a prepared instrument to summarise and organise the findings. Findings were hierarchised according to OCEBM Levels of evidence 2011 grading (OCEBM, 2011). Fig. 1 summarises the selection of evidence process.

## Results

A total of seventeen studies were included: three integrative literature reviews, one systematic literature review, one prospective randomised controlled trial (RCT), two retrospective descriptive studies, one retrospective observational cohort study, one prospective cohort study, four Guidelines and four epidemic reports. Data were compiled on five key areas: causes, risk factors, diagnosis, inci-

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