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European Journal of Internal Medicine 17 (2006) 185 – 188

EUROPEAN JOURNAL OF INTERNAL MEDICINE

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Original article

Enterobacter sakazakii in the mouths of stroke patients and its association with aspiration pneumonia☆

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Received 28 June 2005; received in revised form 10 November 2005; accepted 15 November 2005

Abstract

Background: Previous studies by our group have identified a high prevalence of Gram-negative bacilli in the mouths of stroke patients. Eradication of such organisms by selective decontamination of the digestive tract (SDD) has not previously been studied. *Enterobacter sakazakii* is a rarely found organism that has previously been identified as a cause of neonatal meningitis and sepsis but that has rarely been reported as a pathogen in older people. The purpose of this study was to look specifically for *E. sakazakii* in the mouths of stroke patients and to correlate its isolation with response to SDD gel and the presence of clinical complications such as pneumonia.
Methods: Following an acute stroke, 203 patients were recruited for the study and received placebo or SDD in a 50:50 ratio. Oral swabs were obtained on nine separate occasions and *E. sakazakii* was cultured from them. Clinical data were prospectively collected and analysed.
Results: E. sakazakii was identified in 7 of 203 patients. The organism was almost exclusively removed by SDD gel, but in those patients in whom an abnormal swallow was present, pneumonia was found in two of the four cases.
Conclusion: E. sakazakii may colonise the mouths of acute stroke patients. Since SDD gel is not routinely administered to such patients, this organism may be implicated in patients who subsequently develop aspiration pneumonia.

Keywords: Enterobacter sakazakii; Stroke; Oral flora; Aspiration pneumonia

1. Introduction

Enterobacter sakazakii was first described in 1980 as a new member of *Enterobacteriaceae* [1]. Prior to this date, the organism was rarely isolated and considered to be a yellow pigmented *Enterobacter cloacae*.

Enterobacter are regularly recovered from the human gastrointestinal tract and thought like *Escherichia coli* and *Klebsiella* to be members of the normal faecal flora. *E. sakazakii* has been associated with neonatal meningitis and sepsis [2]. A hypothesised source of the infection has been the birth canal, although three of the eight patients described were delivered by caesarean section, thus casting doubt on this pathogenesis. In 2002, Weir [3] reported an outbreak of *E. sakazakii* associated with the use of powdered milk formula in a neonatal intensive care unit. The U.S. Food Net 2002 survey of invasive infections in infants under the age of one showed *E. sakazakii* to be present in 1 in 100,000 infants [4]. *E. sakazakii* exhibits tropism for the central nervous system with a large number of cases of meningitis that subsequently result in a brain abscess, cyst formation or the development of hydrocephalus [5].

Although *E. sakazakii* is less commonly found in the elderly population than in young subjects, it has been found

☆ Contributors: MAG and MVM co-ordinated the clinical trial. AEW enrolled participants and collected samples from them supervised by MAG. MG and AEW performed all the microbiological assays supervised by MVM. All authors contributed to the analysis of the data and the article was revised and approved by all authors.

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doi:10.1016/j.ejim.2005.11.010

to be particularly related to adults with serious underlying diseases. In some series, up to 50% of the adults with the infection had an underlying malignancy [5]. Zogaj et al. [6] in 2003 found that *E. sakazakii* were able to produce cellulose and curli fimbriae, which might contribute to the significant role that such organisms play in biofilm-related infections such as catheter-induced urinary tract infections. Therefore, despite the organism's natural habitat and reservoir being unknown, most reported cases are nosocomial and involve infants [7,8].

Gram-negative bacilli are often found in the mouths of patients in both the acute and rehabilitation setting after a stroke [9]. The oral flora of the mouth following a stroke is rapidly altered and the organisms identified are often aerobic Gram-negative bacilli (AGNB) [10]. The objectives of the present study were to identify the presence of *E. sakazakii* in the mouths of patients following a stroke and to correlate its isolation to clinical outcome. We also sought to document the antibiotic sensitivities of the organism studied to determine if SDD gel would eradicate them and therefore identify the antibiotics of choice in such infections.

2. Methods

The project was approved by the research and ethics committees of all three hospitals involved in this study. Repeated oral swabs were performed on 203 consecutive presenting patients admitted with an acute stroke. Oral swabs were taken three times per week for a total of nine swabs. Following consent, all patients were randomised in a double-blind, placebo-controlled trial to receive either SDD gel containing 2% (w/v) tobramycin, 2% (w/v) polymixin E and 2% (w/v) amphotericin B, or placebo gel. The SDD gel was continued for 2 weeks in patients who were identified as having a normal swallow at the time of admission and 3 weeks for those with an abnormal swallow.

3. Results

We identified *E. sakazakii* in 10 swabs from seven patients, six of whom had the organism isolated on only one occasion, with the remaining patient having four separate positive swabs. Four of the seven patients had an abnormal swallow, two of whom were receiving SDD gel. The remaining two patients with an abnormal swallow who were randomised to receive the placebo gel both developed clinical and radiologically confirmed pneumonia.

A variety of other organisms were detected in the mouths of these patients and are discussed elsewhere [11]. The SDD was successful in eradicating most of the organisms in the active group, but it is the presence of *Enterobacter* that is so unique and that forms the basis of this report.

Two patients with an abnormal swallow receiving active gel were found to have *E. sakazakii* present in the oral cavities. One patient in whom the organism was identified on four separate occasions was considered to be fully compliant with the gel and, despite this, the *E. sakazakii* was not eradicated. It is possible that antibiotic resistance emerged under antibiotic pressure, and this will always remain a risk in patients who have received SDD for prolonged periods even when no oral or intravenous administration forms part of the SDD. In the second patient, the organism was isolated on day 21, just after discontinuing the oral gel at the end of a 3-week period of treatment.

Of the three patients with a normal swallow, two received active gel and were found to have the organism present on only one occasion, one prior to starting the gel and the other on day 8. The third who received placebo was well at

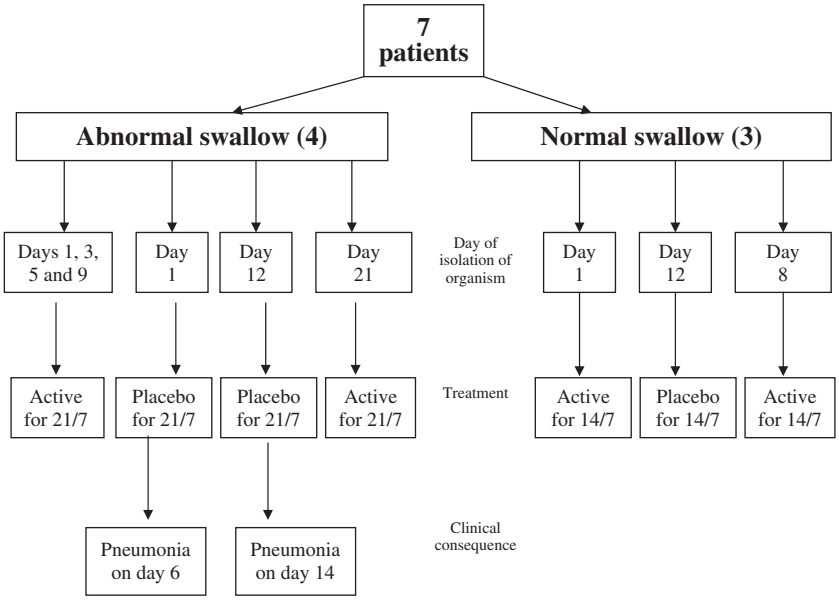

Fig. 1. Data regarding patients identified as having *Enterobacter sakazakii* in their mouths.