

## CONFUSION AND FEVER IN THE ELDERLY: THE NECESSITY OF LUMBAR PUNCTURE FOR CSF EXAMINATION

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### ABSTRACT

**Objectives:** To determine the necessity of lumbar puncture for the cerebrospinal fluid examination in the evaluation of hospitalized elderly patients with confusion and fever.

**Methodology:** It is a descriptive study conducted in Ahwaz a city southwest Iran, from July 2006 to June 2007. Sixty elderly patients with confusion and fever admitted to a teaching hospital, who had a lumbar puncture and cerebrospinal fluid evaluation to evaluate fever and confusion, were studied. After final diagnosis patients were placed in two groups (meningitis group and bacteremic group) and compared in SPSS using chi square test.

**Results:** Of the total sixty patients, six (10%) were diagnosed as bacterial meningitis. The remaining fifty four (90%) were diagnosed as bacteremia. The primary origins for fever and confusion in bacteremic patients included urinary tract infections (20%), pneumonia (45%), gastroenteritis (17%) and soft tissue infection (8%).

**Conclusion:** Most hospitalized, elderly patients with fever and confusion have primary causes of the confusion outside the central nervous system and may not require a routine evaluation of their cerebrospinal fluid.

**KEYWORDS:** Confusion, Elderly, Fever, Meningitis.

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## INTRODUCTION

Average life expectancy has rapidly increased worldwide and geriatric infectious diseases have become an increasingly important issue.<sup>1</sup> Reasons for increased susceptibility include epidemiological elements, immunosenescence and malnutrition, as well as a large number of age-associated physiological and anatomical alterations.<sup>1-3</sup> The most important infections in the elderly are caused by bacteria.<sup>4</sup> As a result of rapidly growing number of elderly individuals, more emergency transports will involve the care of an elderly patient.<sup>5</sup> Distinguishing the cause of symptoms can be difficult for healthcare professionals, including emergency personnel. Clinical symptoms of infection may be absent, or not as

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obvious as with a younger individual. Transport of patients with confusion and fever has caused many challenges for emergency care personnel.<sup>5-7</sup> In the elderly, presence of confusion is an exclusive clue to the presence of a serious infection like bacteremia.<sup>8</sup> Mortality due to serious infections is significantly higher among elderly patients than among younger patients. Once bacteremia is recognized, its source must be identified. Most frequent source of bacteremia in order of decreasing frequency is urinary tract, intra abdominal sites and lungs.<sup>9-11</sup> Another cause of confusion and fever is bacterial meningitis.<sup>12-14</sup> Studies of bacterial meningitis have documented a peak of incidence among persons age 60 and older. Presentation of meningitis in older patients may be atypical; fever is not a consistent finding, and nonspecific symptoms such as confusion are often seen.<sup>3,14</sup> Nuchal rigidity is neither as sensitive nor as specific a sign as in younger patients. Definitive diagnosis relies on interpretation of cerebrospinal fluid (CSF) studies.<sup>14</sup>

Lumbar puncture (LP) performance for obtaining CSF to exclude meningitis in elderly is controversial. Some others rely on interpretation of CSF studies for definitive diagnosis, but some other's believe that LP has a low yield because most hospitalized elderly patients with fever and confusion have primary causes outside the central nervous system and may not require a routine evaluation of their CSF.<sup>14,15</sup>

Since, understanding the cause of confusion and fever is crucial to adequate care for aged individuals and rapid diagnosis and early treatment may save many lives. Because of lack of diagnostic facilities in the emergency rooms of developing countries for LP performance due to various reasons such as retinal examination, CT scan availability and for LP performance such as lumbar rigidity or deformity and patients relatives reluctance to give consent, the present study was designed to determine the causes of confusion and fever, identify the necessity of the CSF examination and find clinical markers as predictive of rapid diagnosis or exclude bacterial meningitis in this population.

## METHODOLOGY

Sixty elderly patients with confusion and fever were included in this descriptive study in a teaching hospital in Ahwaz, a city South West Iran from July 2006 to June 2007. Inclusion criteria were: Age above 65 years, change in mental status at least at the level of lethargy (confused patients responding to verbal stimulation) and oral temperature more than 37.5°C.

Exclusion criteria were: Death or leaving the hospital before definite diagnosis, lacking LP performance and hyperthermia.

Subjects who fulfilled the above mentioned inclusion criteria were studied. At first patients were evaluated to exclude bacterial meningitis. After excluding the space occupying lesion in the brain (retinal examination and brain CT scan) LP was performed and CSF was studied. Having completed medical past history, physical examining, laboratory examination (including CBC, blood culture, urine culture, CSF analysis and bacteriological studies, urinalysis, serological tests, blood sugar, blood gas studies, liver function tests and renal function tests), imaging studies (X-Ray, CT Scan, sonography) adequately. Bacterial meningitis was defined as: positive CSF culture, positive gram staining of CSF, or at least 100 polymorphs (PMN) plus protein more than 45mg/dl and glucose ratio (CSF/blood) lower than 0.4 in the CSF. Diagnosis of infection was based on isolation of etiologic agent or by serologic identifying in the clinical sample according to the site of infection such as sputum (pneumonia), blood (bacteremia), urine (urinary tract infection), feces (gastroenteritis) and deep skin discharge (soft tissue infection). The following data were inserted in a previously prepared questionnaire: sex, age, vital signs, clinical manifestations of meningitis such as signs of meningeal irritation (nuchal rigidity, Kernigs sign and Brudzinski sign), headache, vomiting and nausea, blood pressure, laboratory and imaging findings, previous prescribed antibiotic, duration between the onset of clinical symptoms and admission and finally diagnosis of the illness. Descriptive statistical

methods were used for data analysis using SPSS software (version 11.5.SPSS Inc, USA).

## RESULTS

A total of 60 patients were analyzed during the study period. Fifty four (90%) patients were diagnosed to have septicemia. The sources of infection in the bacteremic patients were as follow: twenty seven(45%) pneumonia, twelve(20%) urinary tract infection, ten(17%) gastroenteritis and 5(8%) soft tissue infection. Only six patients (10%) had meningitis.

As shown in Table-I, blood culture was positive in twelve patients and isolated microorganisms were: E.coli in six patients (50%), S.aureus in four (33.3%) and Klebsiela in two (16.7%). Among them only one patient had both positive blood culture and CSF culture for E.coli. From six patients with meningitis, E.coli was isolated in blood and CSF samples of only one patient.

The mean age of the patients was  $74.4 \pm 6.21$  years (male) and  $73.8 \pm 8.31$  years (female) with male to female ratio of 1.4:1. History of previous medication in meningitis patients and other patients was recorded in three (50%) and 32(59%), respectively ( $p=0.49$ ). Median onset of confusion and fever (two days) were

observed in five (83%) patients with meningitis and forty (74.4%) patients without meningitis ( $p=0.52$ ). Other results and sensitivity, specificity, positive predictive value and negative predictive value are shown in the Tables-I & II. Significant statistical differences were observed in signs and symptoms of central nervous system involvement between patients without meningitis and patients with meningitis ( $p<0.05$ ). There was no significant difference in sex, age, onset of symptoms, laboratories finding between two groups ( $p>0.05$ )

## DISCUSSION

In our study, bacterial meningitis was diagnosed in 10% of elderly patients with confusion and fever. These rates are similar to the incidence described in previous studies that have examined similar populations.<sup>3,15</sup> The median onset of confusion occurred two days before hospitalization in these patients, which is also in accordance with previous studies.<sup>12-14</sup> Some clinical manifestation, such as signs of meningeal irritation (e.g.nucal rigidity, Kernig, Brudzinski), head ache and nausea & vomiting, had a high prevalence in the bacterial meningitis in contrast to other infections. These clinical findings may be considered as a predictive clinical marker for rapid diagnosis (or

Table-I: Clinical and laboratory characteristics in aged patients with confusion and fever in Razi Hospital, Ahwaz, 2006-2007

<i>Clinical/laboratory finding</i>	<i>B. M. (n=6) N ( % )</i>	<i>O.T.M.(n=54)</i>	<i>p value N ( % )</i>
*Meningeal irritation signs	6 (100)	32(59)	0.04
*Head ache	2(33.3)	2(3.7)	0.04
*Nausea&Vomiting	3(50)	6(11.1)	0.03
Urinary incontiness	5(83.3)	28(70)	0.44
Leukocytosis	3(50)	32(59)	0.49
Polynucleosis	2(33.3)	32(59)	0.21
Leucopenia	0(0.0)	5(9.2)	0.57
Thrombocytosis	0(0.0)	2(3.7)	0.80
CRP positive	6(100)	38(70)	0.14

Abbreviation: BM; Bacterial meningitis, OTM; Other than meningitis

\* Pvalue below 0.05 are considered significant

Table-II: Clinical manifestation as predictive marker to include or exclude meningitis in aged patients with confusion and fever in Razi Hospital, Ahwaz, 2006-2007

Clinical finding	P +MN (%)	P -MN (%)	Sen. %	Spec.%	PPV%	NPV%
Signs of MI	6(100)	32(59)	100	41	15	100
Head ache	2(33.3)	2(3.7)	33	96	50	93
Nausea and vomiting	3(50)	6(11.1)	50	89	33	94
Total	6(10)	54(90)				

Abbreviation: P+M= patients with meningitis, P-M= patients without meningitis, Sen= sensitivity, Spec= specificity, PPV= positive predictive value, NPV= negative predictive value, MI= meningeal irritation

excluding) of bacterial meningitis in elderly patients with confusion and fever in restricted resources area with lack of CT scan facilities. The prevalence of these clinical markers may vary among study populations, and their predictive ability will need to be tested in other samples.

In contrast to results from previous studies, older age was not a statistically significant predictor of bacterial meningitis.<sup>3,14</sup> This finding may be attributable to the age cutoff ( $\geq 65$  years) among our patients and the other age-related factors such as illness severity. Our finding suggests that among elderly persons, extra meningeal infection with or without underlying illness, is a more important cause of confusion and fever than the bacterial meningitis. In addition, previously received medications had no significant effect on meningeal involvement in this study. Finally, abnormal laboratory findings for example, CBC abnormalities (leukocytosis, leucopenia, polynucleosis) thrombocytosis and CRP positively were not predictive of patients at risk for bacterial meningitis. Because many of these predictive markers were present in small numbers of patients, our study may have lacked sufficient power to assess adequately their predictive ability.

**Limitation of this study:** An important limitation of our study was the relatively small sample size. The sample size was restricted because of the hospital capacity and our selection criteria (to exclude deaths and transported out patients). This decision meant loss of some

meningitis diagnosed in other hospitals. Another important limitation was the effect of previous prescribed antimicrobial drugs on culture results. These limitations may have reduced the strength of clinical finding as a predictive variable. Examining elderly with confusion and fever in larger samples must be done in future studies.

## CONCLUSION

Most hospitalized, elderly patients with confusion and fever have primary causes of the confusion outside the central nervous system. Elderly patients suffering from fever and confusion, without signs of meningeal irritation may not require a routine LP performance for evaluation of their cerebrospinal fluid.

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*Ethical Consideration:* This work has been approved by the ethical committees of Jundishapour University of Medical Science and the subjects were appropriately informed about the work.

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