

## Salmonella Infections of Central Nervous System

**Volume: 06****Issue: 02****July 1988****Page: 115-119**

B. N. Gokul

### Reprints request

, A Chandramuki, R Ravikumar, Neelam Khanna,

- Department of Medical Microbiology, National Institute of Mental Health & Neuro Sciences, Bangalore 560 029, India

### Abstract

Over a period of 8 years from 1979 to 1987, 27 cases of central nervous system Salmonella infection were encountered. These included 10 cases of community acquired pyogenic meningitis, 10 cases of post operative meningitis, 5 cases of brain abscesses and 2 cases of post traumatic meningitis. *S. typhimurium* was the most frequently isolated serotype accounting for 77.8% of cases. *S. typhi* was isolated from 18.5% of cases. The only other serotype found in this study was *S. enteritidis* isolated from a case of pyogenic meningitis. *S. typhimurium* was most frequently isolated from post operative cases. There was a preponderance of these salmonella infections in males of younger age group. Antibiogram showed the majority of *S. typhimurium* isolated were multidrug resistant. The other serotypes showed a variable sensitivity pattern. The 3 isolates of *S. typhi* from brain abscess cases were resistant to chloramphenicol.

### Key words -

**Meningitis,****Salmonella brain abscess,****CNS Salmonella infections,****Nosocomial infections**

Since the early part of this century, various species of Salmonellae have been incriminated as etiological agents in the causation of meningitis [1], [2], [3], [4], [5], [6], [7], [8], [9], [10]. The endemic nature of salmonellosis is prevalent all over India. Though there have been considerable number of reports of Salmonella meningitis from India and abroad, comparatively, they are not as frequent as other forms of bacterial meningitis. It is also to be noted that the definitive diagnosis of Salmonella infection can be made only after laboratory confirmation. This report shows our experience with central nervous system (CNS) Salmonella infections encountered over a period of 8 years at NIMHANS.

### Material and Methods

Cerebrospinal fluid (CSF) from acute meningitis cases and pus from intracranial abscess cases were collected with sterile precautions and transported immediately to the Department of Medical Microbiology, NIMHANS. The appearance and consistency of the specimen were noted. A cell count

was performed on CSF samples to know the number and type of cells. A Gram's stained smear of CSF or pus was examined to look for the presence of any organisms. Ziehl Neelsen's stain for evidence of acid fast bacilli, was also done on all the pus samples. CSF C-reactive protein was detected by latex agglutination test [11]. Both aerobic and anaerobic cultures were put up.

Briefly, the methodology for isolation of aerobic bacteria was as follows: The specimens were inoculated onto sheep blood agar, chocolate agar, MacConkey's agar (MA) and into thioglycolate broth. The characteristic non-lactose fermenting colonies on MA were identified by preliminary biochemical tests according to standard methods. The organisms biochemically suggestive of Salmonellae, were confirmed serologically using the standard 'O' and 'H' typing sera. The antimicrobial agents used for susceptibility testing by standard disc diffusion method included Ampicillin (Am), Carbenicillin (Cn), Cephaloridine (Cr), Chloramphenicol (C), Colistin (Cs), Co-trimoxazole (Ctm), Kanamycin (K), Gentamicin (G), Polymyxin-B (Pb), Streptomycin (S) and Tetracycline (T). Some of the isolates were sent to National Salmonella Phage Typing Centre at New Delhi for phage typing.

---

## Results

The CNS Salmonella infections were categorised as community acquired pyogenic meningitis, brain abscess, post traumatic meningitis and post operative meningitis. Three serotypes namely S. typhimurium, S. typhi and S. enteritidis were encountered. S. typhimurium was the most frequently infecting serotype accounting for over 77% of the cases. All the 10 cases of post operative salmonella infections were due to S. typhimurium. Table 1 shows the number of different serotypes, source and resistance patterns of Salmonellae isolated in different CNS infections. It was found that the incidence of CNS salmonella infections was more common in males (66.66%) and in children (63%). In all the cases where S. typhi was isolated, the serum Widal test was positive in high titres for 'TO' and 'TH' antibodies. There was only one isolate of S. enteritidis from the CSF of a case of community acquired pyogenic meningitis in a young girl of 4 years. Three out of 5 cases of brain abscess were due to S. typhi and the other 2 due to S. typhimurium. The 7 cases of community acquired meningitis in which S. typhimurium was isolated, were from children of younger age group.

*Table 1a - Serotypes, source and resistance patterns of Salmonella isolates from various CNS infections*

*Table 1a - Serotypes, source and resistance patterns of Salmonella isolates from various CNS infections*

*Table 1a - Serotypes, source and resistance patterns of Salmonella isolates from various CNS infections*

*Table 1a - Serotypes, source and resistance patterns of Salmonella isolates from various CNS infections*

Table 2 shows the phage types of 14 S. typhimurium isolated which were sent for phage typing. Majority (71.4%) were untypable. All except one isolate showed a multiple drug resistance pattern. The other phage types namely 2, 36 and 129 were sensitive strains.

*Table 1 - Phage types of 14 S. typhimurium isolates*

*Table 1 - Phage types of 14 S. typhimurium isolates*

Three of the 7 *S. typhi* isolates were com phage typed. One belonged to El, one to A and the third from a brain abscess case to UVS3. Phage types El and A were classified as biotype I and UVS3 as biotype II.

There were 3 brain abscess cases from which *S. typhi* was isolated (Table 1) and surprisingly all these were resistant to chloramphenicol, unlike the *S. typhi* isolates from pyogenic meningitis cases, which were sensitive to chloramphenicol.

---

## Discussion

Meningitis due to organisms belonging to the genus *Salmonella* has been reported as early as 1907 by Ghon which perhaps is the first report of such infection [9], [12]. Though the entity of *Salmonella* meningitis has been known for so long, it is usually not thought of in a case of pyogenic meningitis [10]. unless a previous history of salmonellosis or a definite finite bacteriological or serological proof is obtained. There have been a number of reports of meningitis caused by various serotypes of *Salmonella* [1], [2], [3], [4], [5], [6], [7], [8], [9], [10], [12].

In this study *Salmonella* infections of the CNS were in the form of meningitis and brain abscess. Most of the previous reports mention *Salmonella* meningitis. In an extensive review of extra intestinal manifestations of *Salmonella* infections, Cohen et al [12] have reported a total of 144 meningitis cases-137 in children and only seven in adults. Other CNS *Salmonella* infections such as intra cranial abscesses and infected hematomas are very rare and so far there are only fourteen such cases reported [12]. The five cases of *Salmonella* brain abscess in this study (Table 1), three due to *S. typhi* and two due to *S. typhimurium* were encountered over a period of eight years. It was interesting to note that all the three *S. typhi* isolates from these brain abscess cases showed resistance to chloramphenicol. None of the other isolates of *S. typhi* from pyogenic meningitis cases showed such resistance. This raises a question whether the acquisition of chloramphenicol resistance in *S. typhi* strains makes them more virulent and neurotrophic.

Majority of *S. typhimurium* isolates were phage untypable and 90% of these untypable strains showed a multiple drug resistance pattern. It was also interesting to know that till June 1986 there were only 5 cases of postoperative meningitis due to *S. typhimurium* and subsequently till June 1987, the number increased to 10. All these isolates except one were multiple drug resistant and it is possible that these resistant organisms have colonised the hospital environment and frequently are producing such nosocomial infections. It is probable that all these infections are due to a single index strain as evidenced by similar phage typing results and drug resistance pattern. All the multidrug resistant isolates of *S. typhimurium* in this study were sensitive only to Gentamicin and resistant to Ampicillin, Carbenicillin, Cephaloridine, Chloramphenicol, Colistin, Co-trimoxazole, Kanamycin, Polymyxin-B, Streptomycin and Tetracycline. There are previous reports of such multidrug resistant strains of *S. typhimurium* causing meningitis [4], [9], [10]. The only isolate of *S. enteritidis* was from the CSF of a young girl with pyogenic meningitis. This case was also unique. After recovery of the organism from CSF, the patient was treated with specific antibiotics and there was remarkable clinical response. The symptoms of meningitis disappeared and the cultures and other CSF parameters returned to normal. But 3 weeks after stoppage of antibiotics the patient came with a relapse of symptoms and the same organism was reisolated from CSF. The patient was treated vigorously with antibiotics, this

time for a prolonged period. This shows that there might have been some primary focus of infection which was not detected and this focus could have been responsible for the relapse of meningitis with the same organism.

This study clearly brings out the importance of specific bacteriologic diagnosis of CNS infections and sensitivity testing of the isolates, especially in these days of emergence of multidrug resistant salmonella strains. This is particularly helpful in satisfactory management of patients, more so in cases of nosocomial infections caused by highly resistant strains of these salmonellae. Further, a strict vigilance must be kept to check such outbreaks of hospital acquired infections and stringent precautions have to be taken to prevent the colonisation of such drug resistant organisms in the hospital environment.

---

### Acknowledgements

The authors thank the staff of the departments of Neurology and Neurosurgery for their co-operation and providing the clinical specimens. Thanks are also due to Ms. Madhu for her technical assistance and to Mr. S. K. Viswanath for secretarial assistance. We thank the Director, NIMHANS, for permitting to publish this interesting data.

1. Saphra I & Winter J W, Clinical manifestation of Salmonellosis in man An evaluation of 7779 human infections identified at New York Salmonella Centre  
*New England Journal of Medicine* Page: 256: 1128, 1957
2. Henderson L L, Salmonella meningitis-Report of three cases and review of 144 cases from literature  
*American Journal of Diseases in Childhood* Page: 75: 351, 1948
3. Rainowitz S G & Macleod N R, Salmonella meningitis. A report of three cases and review of literature  
*American Journal of Diseases in Childhood* Page: 123: 259, 1972
4. Koshi G & Kurien T L, Salmonella meningitis  
*Indian Paediatrics* Page: 13: 389, 1976
5. Devis F, Badiane S, Churion J P & Mar J D, Salmonella meningitis in infants  
*Lancet* Page: 1:910, 1977
6. Scragg J N & Applebaum P C, Salmonella typhi meningitis in children-Report of seven cases  
*Trans Royal Soc. Trop. Med. Hyg* Page: 73: 235, 1979
7. Kepilamoorthi T R, Ambujakshan V P, Chandrasekharan K G & Ganapathy Rao G, Salmonella typhi meningitis resistant to chloramphenicol  
*Kerala Med. J* Page: 23: 143, 1982
8. Das A K, Dakshinamoorthy K V, Rao S & Chandrasekhar S, Salmonella meningitis in an adult  
*Journal of Association of Physicians of India* Page: 31: 321, 1983
9. Ayyagari A, Agarwal K C, Garg R K, Varma A D & Sehgal R K, Meningitis due to Salmonella in Chandigarh : A 10 year study  
*Neurology India* Page: 33: 279, 1985
10. Chaudhary U, Sabharwal U & Tiwari A D, Salmonella meningitis: Report of five cases  
*Indian Journal of Paediatrics* Page: 53: 419, 1986
11. Gokul B N, Chandramukhi A, Rajendran R & Sreenivasababu P R, Detection of C-reactive protein in cerebrospinal fluid for rapid diagnosis and differentiation of pyogenic meningitis from other

diseases of central nervous system

*Neurology India (in press)*

12.Cohen J I, Bartlett J A & Corey G R, Extra-intestinal manifestations of Salmonella infections

*Medicine* Page: 66: 349, 1987

---