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Protection against *Listeria monocytogenes* by ODN Containing CpG Motifs in BALB/c and C57BL/6 Mice

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Abstract

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*Synthetic oligodeoxynucleotides containing CpG motifs have been shown to be effective immunoprotective agents in murine models for intracellular bacterial, viral and protozoan infections. In the present study, we demonstrated that CpG-ODN can induce protection against **Listeria monocytogenes** in BALB/c and C57BL/6 mice, the survival rate being higher in BALB/c mice. Further studies to determine the cause have been recommended.*

Key words: CPG-ODN, *Listeria*, protection, mice.

Introduction

Innate immune cells, such as dendritic cells, rely on a set of pattern recognition receptors

(PRRs), which have ability to detect certain molecular structures present in pathogens but not in self tissues. One such pattern recognition system is based on unmethylated CpG dinucleotides in particular sequence contexts (CpG motifs), which are common in bacterial DNA but are under represented and methylated in vertebrate DNA (Beutler,

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2004). Many studies demonstrated the immunoprotective effect of CpG ODN against *Listeria monocytogenes* infection. Resistance developed within 48h of pretreatment with CpG ODNs (Elkins *et al.*, 1999). Repeated administration of CpG ODN may provide long-term protection against bacterial infections (Klinman *et al.*, 1999).

The objective this study was to evaluate the immunoprotective effect of defined CpG ODN against *Listeria monocytogenes* in BALB/c and C57BL/6 mice based on survival rates and comparing the susceptibility of these strains of mice to *L. monocytogenes* after receiving CpG ODN.

Materials and Methods

Male BALB/c and C57BL/6 mice were obtained from Pasteur Institute of Iran at 6 to 8 wk of age and maintained under conventional conditions. In a typical experimental design, mice were injected i.p. with 40 μ g CpG ODN (treated groups) and inverted CpG ODN (control groups). After 48h, the mice were challenged i.p. with a lethal dose of 10^8 CFU and 10^{10} CFU *Listeria monocytogenes* (ATCC 19118) in BALB/c and C57BL/6, respectively. The immunostimulatory CpG ODN had the sequences: TCCATGACGTTTCCTGACG and control ODN had the same sequence except the CpG motifs were switched in GpC (TCCATGGACTTCCTGGAC).

Two experiments with 5 mice/group in each strain were performed. Statistical significance was evaluated by Mann-Whitney test and Chi-Square tests.

Results and Discussion

BALB/c mice were completely resistant (Table 1) when they received CpG-ODN before i.p. challenge to *Listeria monocytogenes* (100%). But protection of C57BL/6 mice against *L. monocytogenes* was 75% after CpG ODN treatment. Earlier studies demonstrated that the C57BL/6 and

Table 1
Impact of CpG ODN administration on survival after challenge by *L. monocytogenes* in BALB/c and C57BL/6 mice

Mice	Treatment	% survival
BALB/c	Control	25 ^c
BALB/c	CpG-ODN	100 ^a
C57BL/6	Control	20 ^c
C57BL/6	CpG-ODN	75 ^b

A/J strains of mice are prototype resistant and susceptible strains of mice when inoculated parenterally (i.v. or i.p. route) with *L. monocytogenes* (Cheers and McKenzie, 1978). Genetic regulation of innate resistance to *Listeria monocytogenes* in mice which were inoculated via the intravenous or intraperitoneal route is controlled chiefly by HC locus on chromosome 2 (Cheers and McKenzie, 1978). Other studies showed the same difference in susceptibility to *Listeria monocytogenes* via GI tract based on survival rates (A/J strain of mice was susceptible at an approximately 100-fold-lower LD₅₀ than C57BL/6) (Czuprynski *et al.*, 2003). In our study the susceptibility of BALB/c to *Listeria monocytogenes* was 100-fold-lower than C57BL/6.

There have been no published reports comparing the differing level of resistance of the strains of mice to i.p. infection with *L. monocytogenes*, after CpG ODN inoculation. The present study indicated that BALB/c mice were more resistant to i.p. challenge by *L. monocytogenes* after distinct CpG ODN inoculation than C57BL/6 ($P < 0.05$). Since C5 plays several critical roles in host response to infection, including target lysis and phagocyte recruitment, it has confirmed the causative role of C5 deficiency in the dysregulated cytokine response (Mullick *et al.*, 2004). It has been shown that HC locus controlled the level of the C5 component of complement. This suggested that the genetic susceptibility of A/J mice to *Listeria* infection

was directly due to or related to the C5 deficiency found in that strain. We concluded that C5-deficient BALB/c mice showed more resistance than C5-sufficient C67BL/6 mice to *L. monocytogenes* after receiving CpG ODN. Its reason could not be established and further studies are recommended.

Acknowledgement

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References

- Beutler, B. 2004. Innate immunity: an overview. *Molecular Immunol.*, 40: 845-859.
- Cheers, C. and McKenzie, I.F. 1978. Resistance and susceptibility of mice to bacterial infection: genetics of listeriosis. *Infect. Immun.*, 19: 755-762.
- Czuprynski, C.J., Faith, N.C. and Steinberg, H. 2003. A/J mice are susceptible and C57BL/6 mice are resistant to *Listeria monocytogenes* infection by intragastric inoculation. *Infect. Immun.*, 71: 682-689.
- Elkins, K.L., Rhinehart-Jones, T.R., Stibitz, S., Conover, J.S. and Klinmann, D.M. 1999. Bacterial DNA containing CpG motifs stimulates lymphocyte-dependent protection of mice against lethal infection with intracellular bacteria. *J. Immunol.*, 162: 2291-2298.
- Klinman, D.M., Conover, J. and Coban, C. 1999. Repeated administration of synthetic oligodeoxynucleotides expressing CpG motifs provides long-term protection against bacterial infection. *Infect. Immun.*, 67: 5658-5663.
- Mullick, A., Elias, M., Picard, S., Bourget, L., Jovceviski, O., Gauthier, S., Tuite, A., Harakidas, P., Bihus, C., Massie, B. and Gros, P. 2004. Dysregulated inflammatory response to *Candida albicans* in a C5-deficient mouse strain. *Infect. Immun.*, 75: 5868-5876.
- एम. रैड, एम. अहमदी, आर.एफ. हुस्सेनी, ए.ए. अशकर, एम. नेजाती, बी. ताबाराई, डी. नौरोजियन। बाल्ब/सी और सी 57 बी एल/6 मूषकों में सीपीजी मोटिफ युक्त ओडीएन द्वारा लिस्टीरिया मोनोसाइटोजिनेज से सुरक्षा।
- अंतः कोशिकीय सूक्ष्माणविक, विषाणुविक और प्रोटोजुआई संक्रमणों के लिए मुराइन माडलों में संश्लेषित ओलिगोडिआक्सीन्यूक्लीयोटाइड युक्त सीपीजी मोटिफों को प्रभावी प्रतिरक्षी रक्षक पाया गया है। इस अध्ययन में बाल्ब/सी और सी57 बीएल/6 मूषकों में लिस्टीरिया मोनोसाइटोजिनेज से सीपीजी-ओडीएन से प्रतिरक्षा दिखाई है। कारण जानने के लिए और अध्ययनों की संस्तुति की गई है।