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Title	Case of anaphylaxis to maltose solution
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Relation	



1 A case of anaphylaxis to maltose solution

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25 Anaphylaxis may be triggered by various medications. Antibiotics and nonsteroidal anti-  
26 inflammatory drugs (NSAIDs) are major causes but anaphylactic reactions to infusion fluids are  
27 rare<sup>1)</sup>. We here report a case of anaphylactic reaction to maltose solution, a widely-used infusion  
28 fluid as a carbohydrate source in Japan.

29 A 23-year-old man developed a reddish skin rash, pruritus, and difficulty in breathing  
30 immediately after receiving intravenous infusion of 5%-maltose lactated Ringer's solution  
31 (maltose lactated solution) with sodium salicylate and methylmethionine sulfonium chloride  
32 for flu. No additives were contained in the Ringer's solution. He received intramuscular  
33 epinephrine, and recovered without further complications. He had a previous history of two  
34 events of anaphylaxis due to uncertain causes.

35 He was referred to our department for further examination. We first performed prick  
36 testing using 5%-sodium salicylate, 4%-methylmethionine sulfonium chloride, maltose lactated  
37 solution and 10% maltose in saline, but no skin reactions were observed. Then we carried out  
38 an intradermal testing with the same reagents, resulting in positive reactions to maltose  
39 lactated solution and 10% maltose (Fig. 1A).

40 A month later, we performed a histamine release test (HRT) with various concentrations  
41 of maltose lactated solution and maltose diluted in assay buffer<sup>2)</sup>. The release of histamine was  
42 observed by maltose lactated solution (Fig. 1B) and maltose (Fig. 1C) from the patient's  
43 basophils in the presence of 10% serum of the patient, but not from basophils of a healthy  
44 control (data not shown). No or only a marginal amount of histamine release was induced by  
45 maltose in the absence of the serum (data not shown). These results suggest that the infused  
46 maltose obtained antigenicity with molecules in the patient's serum and induced anaphylaxis  
47 via type I hypersensitivity. A careful review of his medical history revealed two previous  
48 incidents of anaphylaxis upon receiving an infusion of maltose solution.

49 Maltose is a naturally occurring disaccharide consisting of two glucose molecules, and is  
50 present in human blood. Intravenously administered maltose migrates into cells in a non-  
51 insulin-dependent manner, and is hydrolysed to two molecules of glucose by  $\alpha$ -glucosidase  
52 (maltase) in the cells. It is further metabolized via anaerobic glycolysis system and a TCA cycle.

53 The size of maltose itself is too small to cross-link multiple IgE as an antigen. However,  
54 there are reports of anaphylaxis induced by dextran which also consists of glucose<sup>3)</sup> and by  
55 icodextrin which can be decomposed into maltose<sup>4)</sup>. These results suggest the presence of IgE  
56 that recognize maltose as (a part of) the antigen. Moreover, cefotiam, an antibiotics with small  
57 molecular weight less than 600, is known to become an antigen with human serum albumin<sup>2)</sup>.  
58 Therefore, maltose may also bind to serum protein, forming into an antigen recognized by  
59 antibodies in the patient.

60 There are a few other reports of anaphylactic reactions induced by maltose solution<sup>5)</sup>.  
61 In some cases, patients repetitively received infusion of maltose solution many times, because  
62 physicians could not conceive that an infusion fluid would cause anaphylaxis. Therefore, it is  
63 important to note that maltose solution can induce anaphylaxis.

64

65 Figure Legend:

66 (A) Intradermal test of 5%-sodium salicylate, 4%-methylmethionine sulfonium chloride, 5%-  
67 maltose lactated ringer's solution and 10% maltose. Results were positive with 5%-maltose  
68 ringer's lactated solution and 10% maltose in saline.

69 (B) Histamine release test for maltose Ringer's lactated solution and (C) maltose. Histamine was  
70 released from the patient's basophils by maltose lactated Ringer's solution and maltose, but not  
71 from healthy control. Net release is shown in this graph.

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73 Conflict of interest: none declared.

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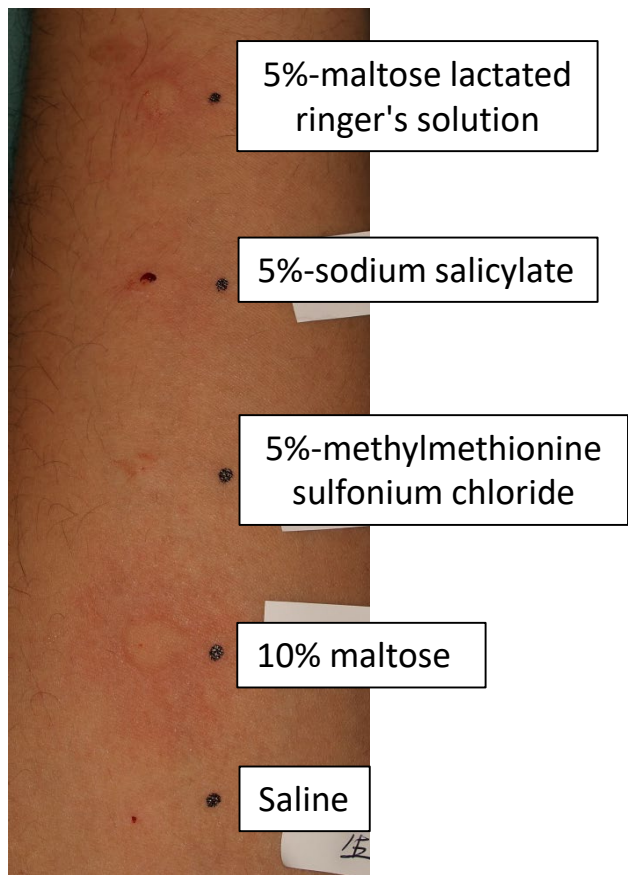
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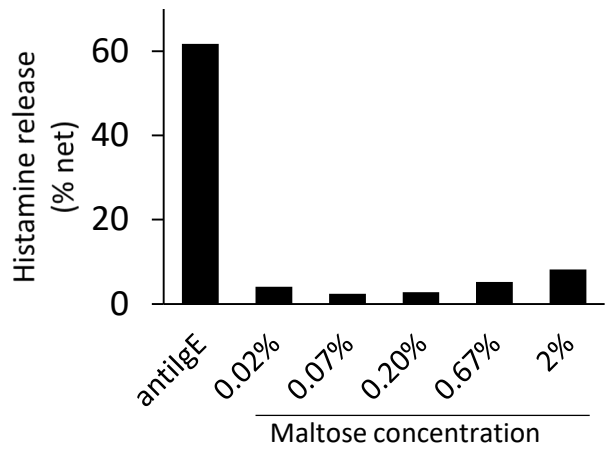
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(A)



(B)



(C)

