

STUDIES ON HEPATITIS B VACCINES

M.E.MAKVANDI,* Ph.D., P.Y.DIGHE,** D.Sc., AND
H.KALANTARI,*** Ph.D.

From the * Department of Microbiology and Immunology, Ahwaz University of Medical Sciences, Ahwaz, ** Beharat Serum and Vaccines, Thana, University of Bombay, and the *** School of Pharmacy, Ahwaz University of Medical Sciences, Ahwaz, Islamic Republic of Iran.

ABSTRACT

HBs vaccines were prepared by three different methods: 1) Heat inactivation (Krugman, et.al; 1971); 2) Ammonium sulphate precipitation followed by column chromatography (Sephadex G-200); 3) PEG-6000 (polyethylene glycol) precipitation followed by column chromatography using Sephadex G-200.

Their efficacy was studied in guinea pigs, and the results compared with commercial Japanese vaccine (Green Cross Corporation, Osaka, Japan). We conclude that vaccine prepared by PEG-6000 precipitation gives better results.

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INTRODUCTION

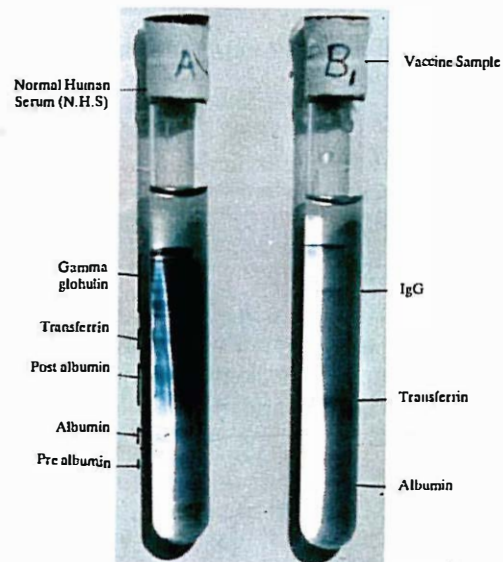
About 200 million people of the world's population are estimated to be infected with hepatitis B virus (HBV).¹ Prevention of hepatitis B is therefore of great international importance. In the absence of successful replication of HBV in cell culture, one of the present sources of antigenic material to prepare the vaccine is plasma of human carriers of hepatitis B surface antigen (HBsAg).²⁻⁵ We have used the following methods for the preparation of vaccine:

- 1) Heat inactivation vaccine by Krugman's method;
- 2) Ammonium sulphate precipitation vaccine;
- 3) Polyethylene glycol (PEG) 6000 precipitation vaccine.

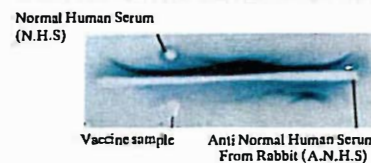
MATERIAL AND METHODS

High titre HBsAg-positive plasma was used for all methods of preparation of HBs vaccine. Detection of HBsAg was carried out by counterimmunoelectrophoresis (CIEP)⁶ and reserve passive hemagglutination (RPHA) commercial test kit by Green Cross of Japan. We have used the following methods for preparation of vaccine.

Photographs Show Purity of HBs Vaccine Prepared By Heat Inactivation Method.

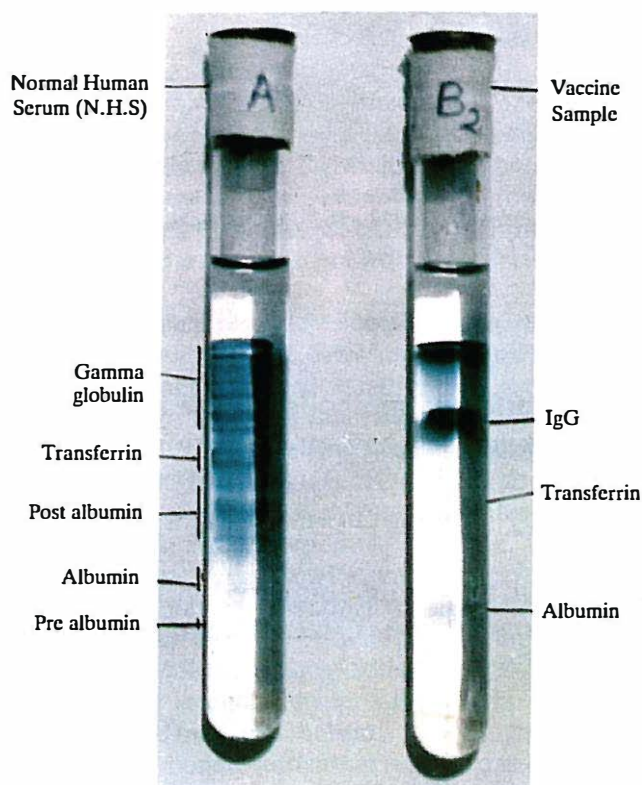


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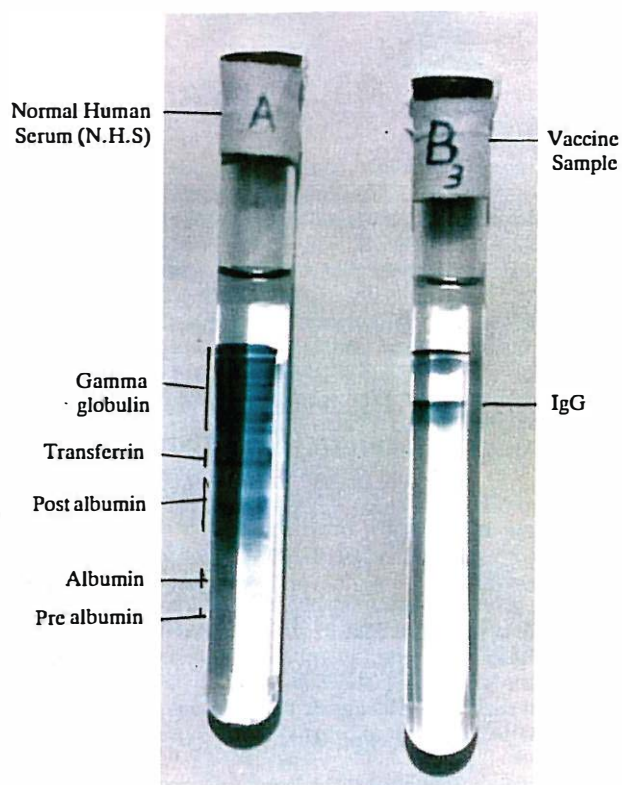
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Photographs Show Purity of HBs Vaccine Prepared By polyclene glycol (PEG) 6000 precipitation.



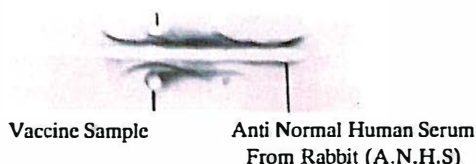
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Photographs Show Purity of HBs Vaccine Prepared By Ammonium Sulphate Precipitation Method.

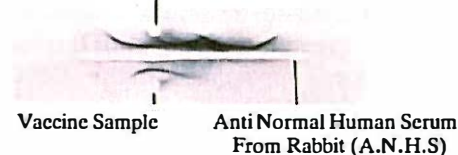


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Normal Human Serum (N.H.S)



Normal Human Serum (N.H.S)



Heat-inactivation vaccine

High-titre, HBsAg was heated at 98°C for one minute according to Krugman's method.⁷

Purity of vaccine was checked by polyacrylamide gel electrophoresis (PAGE)⁸ and immunoelectrophoresis (IE).⁹

Dose of vaccine

We have adjusted 0.5 ml of vaccine to 1:32 titre by CIEP and 1:32768 by RPHA. Thus, each of the five guinea pigs were immunized intramuscularly with 0.5 ml of vaccine without AIPO₄ as adjuvant.

Preparation of HBs vaccine by ammonium sulphate precipitation

HBsAg-positive plasma was treated with low concentration (13.4%) ammonium sulphate followed by

high concentration ammonium sulphate (16.6%).⁴ Inactivation was carried out by heat and formaline treatment.⁴ The final purification was carried out by column of Sephadex G-200.

Schedule of immunization

In our schedule one dose of vaccine without AIPO₄, and one dose vaccine with AIPO₄ were administered intramuscularly in guinea pigs.

Preparation of HBs vaccine by PEG-6000 precipitation

HBsAg-positive plasma was treated with low concentration of PEG-6000 (3.5%) followed by high concentration of PEG-6000 to 10%.³ Inactivation was carried out by heat and formaline treatment.⁴

The same schedules of immunization were followed as given above; only two doses of this vaccine were

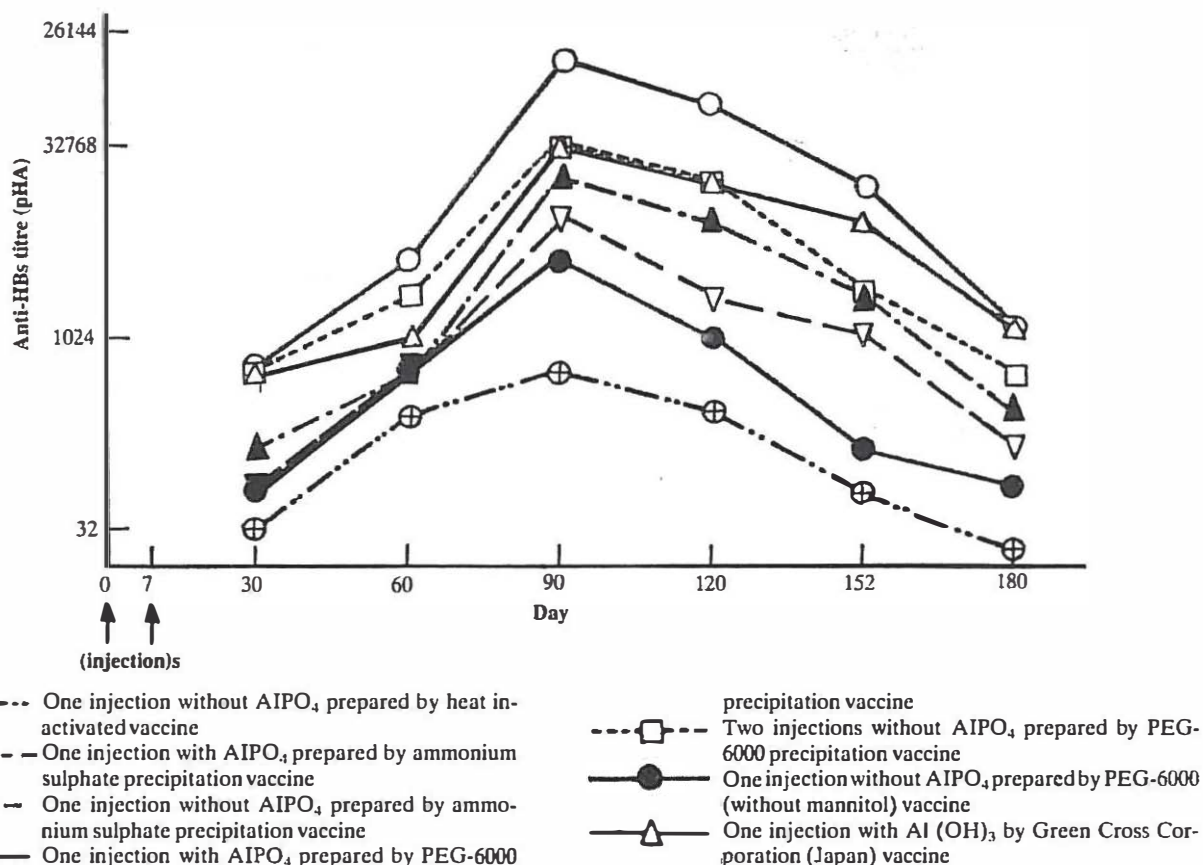


Figure 1. Anti-HBs titre in guinea pigs immunized with different HBs vaccines

administered with AIPO₄.

Standard vaccine

One dose containing 20 µg of Green Cross commercial vaccine were administered to each of five guinea pigs.

Antibody detection

CIEP and PHA (Passive Hemagglutination) tests used for detection of anti-HBsAg were prepared and standardized according to PHA test kit marketed by Green Cross Corporation, Japan.

RESULTS

Table I. Recovery of HBS vaccine by different methods.

Type of vaccine	Heat inactivated	Ammonium Sulphate ppt.	PEG6000 ppt
% of Recovery	15.82	37.5	80.55

It was observed from Table I that the recovery of HB vaccine is better by PEG-600 method.

Table II reveals that treatment with PEG-6000 gives a pure vaccine.

Table II. Purity of vaccines by polyacrylamide gel electrophoresis and immunoelectrophoresis.

Type of vaccines	Protein contaminations	
Heat Inactivated	IgG	Transferrin
Ammonium Sulphate ppt.	IgG	Transferrin
PEG 6000 Precipitation	IgG	

Single dose of vaccine (prepared by PEG-6000) with AIPO₄ showed antibody titre 1:512 on 30th day. Its peak antibody reached 1:13107 (1:16 by CIEP) on 90th day. It gradually dropped to 1:1024 on 180 th day.

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Table III. Anti-HBs titre by CIEP and PHA by different immunized HBs vaccines in guinea pigs.

DAY		0	30	60	90	120	150	180
Titre								
Heat-inactivated vaccine	CIEP	-	-	-	-	-	-	-
	PHA	-	1:32	1:256	1:512	1:256	1:64	1:16
Ammonium sulphate ppt. vaccine with AIPO ₄	CIEP	-	-	-	1:1	-	-	-
	PHA	-	1:128	1:1024	1:16384	1:8192	1:2048	1:256
Ammonium sulphate ppt. vaccine without AIPO ₄	CIEP	-	-	-	-	-	-	-
	PHA	-	1:64	1:512	1:8192	1:2048	1:1024	1:128
PEG 6000 ppt. vaccine with AIPO ₄	CIEP	-	-	-	1:16	1:8	1:1	-
	PHA	-	1:512	1:4096	1:131072	1:65536	1:16384	1:1024
PEG 6000 ppt vaccine without AIPO ₄	CIEP	-	-	-	-	-	-	-
	PHA	-	1:64	1:512	1:4096	1:1024	1:128	1:64
Two dose PEG 6000 ppt without AIPO ₄	CIEP	-	-	-	1:4	1:1	-	-
	PHA	-	1:512	1:2048	1:32768	1:16384	1:4096	1:512
GCC vaccine	CIEP	-	-	-	1:4	1:1	-	-
	PHA	-	1:512	1:1024	1:32768	1:16384	1:8192	1:1024

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Comment:

This article is an academic research conducted on production of hepatitis of a vaccine must be proven with standardized procedures which conform to the guidelines of the World Health Organization.

*Dr. Hossein Mir Shamsi
Vaccine Production Unit
Pasteur Institute of Iran.*