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Protective Effect of Liv.52 Against Beryllium Toxicity in Rats

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ABSTRACT

Lethan does (LD_{50}) of beryllium nitrate and beryllium sulphate have been measured in rats already primed with Liv.52, an Ayurvedic Drug, to assess its protective property. Our results revealed that Liv.52 increased the LD_{50} of beryllium salts in rats by many times and thus induced a significant protective index (PI).

INTRODUCTION

The toxicity by beryllium salts is well known in laboratory animals and human beings[1,2]. While extracting and processing beryllium metal from its ores, workers in the mines and industries are constantly exposed to its toxic effects. Lethal doses (LD_{50}) of some ionized beryllium salts have been measured in rats, mice and other laboratory animals through various routes[3-5]. It has also been reported that the toxic action of beryllium is primarily due to the liver damage and disturbance in carbohydrate metabolism[6]. In order to develop a prophylactic against beryllium toxicity, some of the approaches like steroid therapy[7] and aurintricarboxylic acid[8] (ATA) have been tried but these did not prove successful. An Ayurvedic drug Liv.52 (The Himalaya Drug Co., Bombay) is known to correct the liver function in acute hepatitis[9] and is also used to stimulate hepatic function in many chronic liver diseases[10]. Keeping in view the liver protective action of Liv.52, an attempt has been made in the present study to determine the lethal dose of beryllium salts in rats primed with Liv.52 and to evaluate its protective index (PI).

MATERIALS AND METHODS

Different doses of beryllium nitrate and beryllium sulphate were prepared in sterilized pyrogen-free distilled water as suggested by Horn[11] for lethal dose determination.

Liv.52 syrup was obtained from The Himalaya Drug Co. and it contains the extracts of *Capparis spinosa, Cichorium intybus, Solanum nigrum, Cassia occidentalis, Terminalia arjuna, Achillea millefolium* and *Tamarix gallica* (but does not contain selenium, conventional SH compounds or chelating agents).

Healthy adult Swiss female albino rats (150 ± 10 g) were selected from the animal colony of the department. All the animals were divided into 4 groups, maintained under uniform conditions of light and temperature, and were given Hindustran Lever's pelleted diet and water *ad libitum*. Animals of Groups 1 and 3 were kept as such and received distilled water as vehicle only, whereas rats of Groups 2 and 4 were primed with Liv.52 for 15 days (1 ml/rat/day/orally) prior to initiating the experiments. These animals were then given different treatments (Table 1). Animals of Groups 1 and 2 were injected with beryllium nitrate and those of Groups 3 and 4 were injected and those of Groups 3 and 4 were injected with beryllium sulphate respectively. Furthermore, the animals of Groups 2 and 4 continued to receive Liv.52 syrup daily whereas those of Groups 1 and 3 received

vehicle only. The animals were left in the cages and observed for 7 days for mortality. Lethal dose (LD_{50}) in terms of mg/kg was also converted into mg/m^2 as suggested by Prieur *et al.*[12]. The protective index (PI) was calculated by the following formula:

$$PI = \frac{LD_{50} \text{ of beryllium salt with Liv.52}}{LD_{50} \text{ of beryllium salt alone}}$$

RESULTS AND DISCUSSION

Table 1 shows the LD_{50} of beryllium nitrate to be 3.16 mg/kg body weight in intact rats. It increased to 20 mg/kg body weight in rats primed with Liv.52 for 15 days before exposure to beryllium nitrate. Similarly, the LD_{50} of beryllium sulphate increased from 4.30 mg/kg to 31.60 mg/kg body weight when the rats were primed with Liv.52 for 15 days. These observations clearly indicate that the lethal doses (LD_{50}) of beryllium nitrate and sulphate increased by many times with Liv.52 syrup when expressed in terms of body surface area (mg/m^2)[13]. Ten mg dose seems to be critical because with both the salts a complete reversal of lethality is obtained by priming the animals with Liv.52.

Table 1: Lethal dose (LD_{50}) of some beryllium compounds in rats primed with Liv.52

Group No.	Treatment	Dose* (mg/kg)	No. of rats died/No. of rats used	Lethal dose (LD_{50}) mg/kg (Confidence limits)	Lethal dose (LD_{50}) mg/m^2•	Protective index (PI)
1.	Beryllium nitrate (i.v.)	1.00	0/5	3.160 (1.86-5.38)	21.60	–
		2.15	2/5			
		4.64	3/5			
		10.00	0/5			
2.	Beryllium nitrate (i.v.) + Liv.52 (Oral)**	4.64	0/5	20.00 (13.70-29.10)	102.60	5.55
		10.00	5/5			
		21.50	3/5			
		46.40	5/5			
3.	Beryllium sulphate (i.v.)	1.00	0/5	4.300 (2.65-6.98)	25.80	–
		2.15	1/5			
		4.64	2/5			
		10.00	0/5			
4.	Beryllium sulphate (i.v.) + Liv.52 (Oral)**	10.00	5/5	31.60 (20.50-48.80)	189.60	7.34
		21.50	1/5			
		46.40	4/5			
		100.00	5/5			

*Doses have been selected according to the method of Horn[11] and LD_{50} was calculated using five animals per dosage level and a series of dosages corresponding to 3/10.

**Liv.52 (1 ml/rat/day) was administered orally for 15 days (primed) and then beryllium salts were injected intravenously only once.

***Expression in the term of body surface area (mg/m^2) Freireich *et al.*[13] mg/kg dose x S (S is species factor which is 6 in rats)

The cause of beryllium's toxic action has been studied by a number of workers. It has been stated that the immediate cause of death is lowering of the blood sugar and liver damage[6]. Others have reported its cause to be the inhibition of enzymic activities and disturbances in carbohydrate metabolism[14]. On the basis of the present study it is difficult to suggest the exact mode of the protective action of Liv.52 against beryllium toxicity as it requires many physiological and biochemical investigations. But it can be safely said that Liv.52 against beryllium toxicity as it requires many physiological and biochemical investigations. But it can be safely said that Liv.52 certainly provides a protective shield against beryllium toxicity as Liv.52 is known for correcting liver dysfunction[9,10]. Investigations are in

progress to elucidate the exact protective mechanism of Liv.52 in beryllium exposed rats in terms of its physiological and enzymological concurrences.

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