Original Article

Lead Toxicity

Reduction of Testicular Volume of Albino Rats in Lead Induced Toxicity and Reversal of IT with High Dosages of Vitamin C

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ABSTRACT

Objective: Lead toxicity is a common industrial hazard. It affects all systems of the body. The study was conducted to see reduction in volume of the testes of albino rats and reversal of it with high dosages of vitamin C.
Study Design: Experimental study
Place and Duration of Study: The study was conducted in the Department of Anatomy, Post Graduate Medical Institute (PGMI), Lahore from May 2007 to April 2009.
Materials and Methods: 90 albino rats were divided into five groups A, B, C, D and E. Each group was comprised of 18 animals and divided into 3 subgroups 1, 2 and 3 sacrificed after 5th, 6th and 7th weeks. Groups A was given normal saline, group B was given lead acetate 10mg/kg body weight, group C was given lead acetate with 250mg/kg body weight of vitamin C, group D was given lead acetate with vitamin C 500mg/kg body weight and group E was given vitamin C 1000mg/kg body weight with lead acetate intraperitoneally.
Results: The animals sacrificed after the 5th week in subgroups A1, B1, C1, D1 and E1 showed insignificant changes while in subgroup A2, B2, C2, D2 and E2 sacrificed after 6th week, P value was 0.015 which was significant. The P value of subgroup 3 sacrificed after 7th week was 0.002 which was significant.
Conclusion: This study showed that lead toxicity brought caused a significant reduction in the volume of the testes. The testes regained their normal size after heavy dosage of vitamin C.
Key Words: Lead acetate, vitamin C, Toxicity, Volume

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INTRODUCTION

Lead is a common, persistent toxic metal for mankind since thousands of years. Recently it has been seen that lead is causing diseases in millions of people.[1] Lead is a heavy metal present as such in the earth crust and is also produced with disintegration of uranium.[2] Environmental scientists and clinicians have much interest for its wide distribution and continuous emission from industry.[3] Lead can catalyze oxidative reactions and no system of the body is immune to its toxic effects.[4,5] Within 14 days lead can reduce stereogenic enzymes 3 beta hydroxyl steroid and 17 beta hydroxyl steroid which are forming follicle stimulating hormone and leutinizing hormone.[5] Excessive oxygen radicals are produced in the body due to lead than the antioxidant radicals present in the body.[6] Due to lead toxicity, the size of the testes is reduced because of degeneration of sperms, leydig cells and reduction in diameter of seminiferous tubules.[7] Vitamin C works as an antioxidant and protect the testes against oxidative stress.[8] A heavy dose of vitamin C can increase the sperm count and the volume of the testes is back to normal.[9]

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MATERIALS AND METHODS

For this study, 90 animals (albino rats) were taken from National Health Institute Islamabad. These were divided into five groups. Each group had 18 animals as group A,B,C,D and E . The animals of group A were given 10 mg/kg body weight and vitamin C 1000 mg/kg body weight daily intraperitoneally.
In the beginning of the experiment, Group A was divided into subgroup A1, A2 and A3. Group B into subgroup B1, B2 and B3. Group C, D and E were divided into C1, C2 and C3,D1,D2 and D3 and E1, E2 and E3 respectively. Subgroup 1 was sacrificed after the 5th week, subgroup 2 was sacrificed after the 6th week and subgroup 3 was sacrificed after the 7th week. Lead acetate was purchased and Vitamin C was given by the courtesy of Mr. Shoaib.

Statistical Analysis: After measuring the volume, the version SPSS 17 was applied. The P value was evaluated with ANOVA. The significant and insignificant values were calculated and added in to results.

RESULTS

In subgroup 1, 2 and 3 the volume of the testes was measured by Varnier Calliper. The mean volume of the testes was taken and Lambert formula was applied. In subgroup A1 the P value was 0.422 as in table 1 which was insignificant.

In multiple comparison of subgroups (A1,B1,C1,D1 and E1) with control, the P value of A1 to B1 was 0.094. A1 to C1 0.394, A to D1 0.653 and A to E1 was 0.935 which were insignificant as in table 2.

Table No. 1: Volume of Testes of Rats in mm^3 of subgroup 1

Sub group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
A1	6	212.983	7.975	3.256	204.613	221.353	199.30	221.80
B1	6	202.783	15.090	6.160	186.946	218.619	188.90	230.70
C1	6	207.900	5.762	2.352	201.852	213.947	201.70	215.00
D1	6	210.316	8.444	3.447	201.454	219.178	201.70	221.80
E1	6	212.500	10.938	4.465	201.020	223.979	195.20	228.00
Total	30	209.296	10.159	1.854	205.503	213.090	188.90	230.70

ANOVA

	Sum of Squares	Df	Mean Square	F	P value
Between Subgroups	415.605	4	103.901	1.008	0.422
Within subgroups	2577.545	25	103.102		
Total	2993.150	29			

Table No. 2: Multiple Comparisons of Volume of Testes in mm^3 of subgroup 1

I	J	(I-J) Mm^3	Std. Error	P value	95% Confidence Interval	
					Lower Bound	Upper Bound
A1	subgroup B1	10.200	5.862	0.094	-1.873	22.273
	subgroup C1	5.083	5.862	0.394	-6.990	17.157
	subgroup D1	2.666	5.862	0.653	-9.407	14.740
	subgroup E1	0.483	5.862	0.935	-11.590	12.557
B1	subgroup C1	-5.116	5.862	0.391	-17.190	6.957
	subgroup D1	-7.533	5.862	0.211	-19.607	4.540
	subgroup E1	-9.716	5.862	0.110	-21.790	2.357
C1	subgroup D1	-2.416	5.862	0.684	-14.490	9.657
	subgroup E1	-4.600	5.862	0.440	-16.673	7.473
D1	subgroup E1	-2.183	5.862	0.713	-14.257	9.890

Table No. 3: Mean Volume of Testes of Rats in mm^3 of subgroup 2

Sub group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
subgroup A 2	6	224.250	7.650	3.123	216.221	232.278	212.40	233.30
subgroup B 2	6	202.800	15.728	6.421	186.293	219.306	188.90	228.00
subgroup C 2	6	214.183	15.355	6.268	198.068	230.298	192.90	230.70
subgroup D 2	6	218.433	3.999	1.632	214.235	222.630	212.50	223.60
subgroup E 2	6	223.200	6.254	2.553	216.636	229.763	215.00	233.30
Total	30	216.573	12.858	2.347	211.772	221.374	188.90	233.30

ANOVA

	Sum of Squares	Df	Mean Square	F	P value
Between subgroups	1810.322	4	452.581	3.791	0.015
Within subgroups	2984.217	25	119.369		
Total	4794.539	29			

The P value in sub group 2 was 0.015 which was significant as in table 3. In comparison of subgroups with control, the P value of A2 to B2 is 0.002 which was significant while A2 to C2 0.123, A2 to D2 0.365 and A2 to E2 is 0.869, they were insignificant as in table 4. The P value of all the subgroups was insignificant except A2 to B2.

The volume of the testes was reduced when compared with control subgroup A2 to medicated subgroup B2 while the volume had increased in subgroup C2, D2 and E2 figure 1.

The mean volume of the testes and P value in group 3 was given in table 5 which is 0.002 and significant. In comparison of subgroups with control, the P value of A3 to B3 was 0.000. A3 to C3 0.070, A3 to D3 0.208 and A3 to E3 is 0.845 (table 6). The P value of all the subgroups was insignificant except A3 to B3.

In multiple comparison the P values in B3 to C3 0.030, B3 to D3 0.008 and B3 to E3 0.001 were significant while in all other subgroups the P was insignificant (table 6).

The volume of the testes was grossly reduced when compared with control subgroup A3 to medicated subgroup B3 while the volume had increased in subgroup C3, D3 and E3 (fig 1).

Table No.4: Multiple Comparisons of Volume of Testes in mm^{3}of subgroup 2

I	J	(I-J)	Std. Error	P value	95% Confidence Interval	
					Lower Bound	Upper Bound
A2	subgroup B 2	21.450	6.307	0.002	8.458	34.441
	subgroup C 2	10.066	6.307	0.123	-2.924	23.058
	subgroup D 2	5.816	6.307	0.365	-7.174	18.808
	subgroup E 2	1.050	6.307	0.869	-11.941	14.041
B2	subgroup C 2	-11.383	6.307	0.083	-24.374	1.608
	subgroup D 2	-15.633	6.307	0.020	-28.624	-2.642
	subgroup E 2	-20.400	6.307	0.003	-33.391	-7.408
C2	subgroup D 2	-4.250	6.307	0.507	-17.241	8.741
	subgroup E 2	-9.016	6.307	0.165	-22.008	3.974
D2	subgroup E 2	-4.766	6.307	0.457	-17.758	8.224

Table No. 5: Mean Volume of Testes in mm^3 of subgroup 3

Sub group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
A 3	6	224.383	6.975	2.847	217.063	231.703	215.00	233.30
B 3	6	196.133	14.886	6.077	180.511	211.755	182.70	223.60
C 3	6	211.650	16.550	6.756	194.281	229.018	192.80	233.30
D 3	6	215.683	9.992	4.079	205.196	226.170	197.60	226.20
E 3	6	223.050	6.066	2.476	216.683	229.416	212.40	230.70
Total	30	214.180	14.979	2.7348	208.586	219.773	182.70	233.30

ANOVA

	Sum of Squares	Df	Mean Square	F	P value
Between subgroups	3102.768	4	775.692	5.697	0.002
Within subgroups	3404.140	25	136.166		
Total	6506.908	29			

Table No. 6 Multiple Comparisons of Volume of Testes in mm^3 of subgroup 3

I	J	(I-J)	Std. Error	P value	95% Confidence Interval	
					Lower Bound	Upper Bound
A3	B 3	28.250	6.737	0.000	14.374	42.125
	C 3	12.733	6.737	0.070	-1.142	26.608
	D 3	8.700	6.737	0.208	-5.175	22.575
	E 3	1.333	6.737	0.845	-12.542	15.208
B3	C 3	-15.516	6.737	0.030	-29.392	-1.641
	D 3	-19.550	6.737	0.008	-33.425	-5.674
	E 3	-26.916	6.737	0.001	-40.792	-13.041
C3	D 3	-4.033	6.737	0.555	-17.908	9.842
	E 3	-11.400	6.737	0.103	-25.275	2.475
D3	E 3	-7.366	6.737	0.285	-21.242	6.508

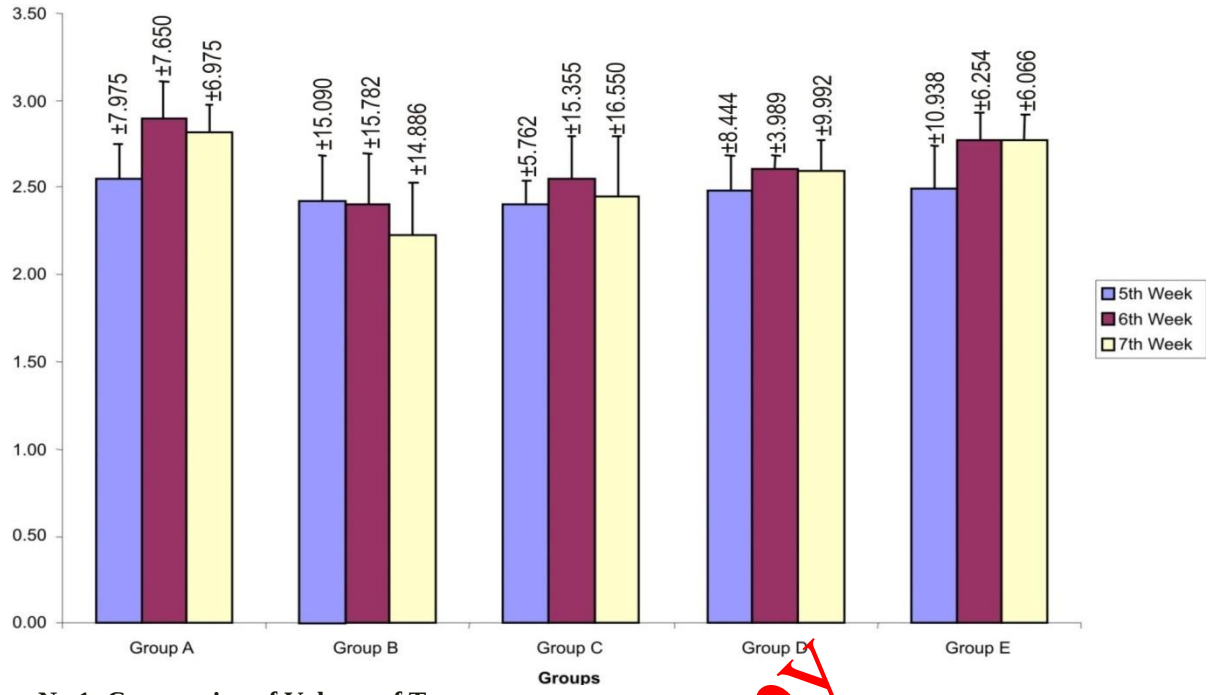

Figure No.1: Cpmparsion of Volume of Testes

DISCUSSION

Sub group A was given only normal saline intraperitoneally and worked as control. Sub group B was given only lead and created toxicity, reduced the volume of testes. When heavy dosages of vitamin C was added in lead toxicity, the volume of the testes becomes normal. Imran et al given the lead to the albino rats and observed the atrophy of the testes.[7]Biswass observed that the neither only the size of the testes reduced but the gonadal activity also decreased due to lead toxicity.[10] Lead toxicity reduced the body weight and reduced the weight of testes with the reduction of volume of the testes.[11] If the lead has been given pups of mice, the size of the testes reduced and the function became abnormal.[12]Lead induced the oxidative stress which reduced the spermatogenesis and the volume of the testes with the reduction of the size of the diameter of seminiferous tubules.[13]In lead toxicity, ascorbic acid and thiamin increased spermatogenesis and the volume of testes.

CONCLUSION

Lead toxicity reduced the volume of the testes with the reduction of spermatogenesis and diameter of seminiferous tubules while high dosages of ascorbic acid (vitamin C) eliminate the toxic effect of lead and kept the volume of testes normal.

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