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BLOOD METALS LEVELS IN PATIENTS WITH RETAINED MISSILE

Thamer A Hamdan* & Jawad K Mehdi#

*FRCS, FACS, FICS, Professor, Orthopaedic Surgery, Basrah Medical College, Basrah-Iraq.

#BSc (Chemistry), MSc (Clinical Biochemistry), PhD(Biochemistry), Assistant Professor, Department of Pharmacy, Basrah Technical Institute, Basrah-Iraq.

Abstract

Our aim is to investigate the levels of blood lead, serum copper, zinc and iron in patients with retained missile. Blood lead, serum copper, zinc and iron concentrations were measured in 54 patients with retained missile and compared with 60 control apparently healthy individuals by flame atomic absorption spectrophotometry technique. Blood lead levels were significantly higher in the patients than in the controls, while no significant differences in serum copper, iron and zinc concentrations were noticed. There were significant positive correlations between blood lead levels and duration of exposure of the retained missile, as well as the size of retained missile, but insignificant correlation between (copper, iron and zinc) with either the size or the duration of exposure of retained missile was observed. These findings suggest that the patients with retained missile had higher blood lead level and consequently undergoes lead poisoning when compared to the control individuals. Also this data indicates an involvement of size and duration of exposure of retained missile as important factors to lead poisoning.

Introduction:

Retained metals fragments is a common problem faced by war surgeons.

There is diversity in opinions regarding removal or ignorance, but the consensus is to remove when there is a good reason behind removal.

Usually the human body surrounds the retained metallic fragments by a strong fibrous tissue (foreign body granuloma) this fibrous or scar tissue barrier prevent the migration and the leakage of metal to the circulation. This is true for retained metallic fragments in soft tissue, muscle, and bone, but encapsulation does not usually happen inside the neural tissue and joints where destructive (chemical arthritis) with pain and limitation of movements or, very rarely, systemic lead toxicity may develop. Despite capsulation there are many reports of systemic lead toxicity, due to high blood lead levels (BPb)[1]. Copper fragments may lead to local neural toxicity involving as much as 10% of the spinal cord area[2].

The degree of intra-articular fragmentation of the bullet and the surface area of lead exposed to synovial fluid are emphasized as decisive factors with respect to appropriate therapy[3]. Intra-dural copper fragmentation may indicates urgent removal to prevent progressive damage of the neural tissue[4]. However, other reports suggest that retained bullets that have penetrated the colon do not contribute to local septic complications[5].

Another rare problems of retained metallic fragments are arterial embolisation[6] or local migration inside the spinal canal or surrounding soft tissue[7]. Despite all the complications of retained metal some authors believe that the removal of metallic fragments can very often cause more damage to tissue than the original injury[8]. The objective of this article is to estimate the blood levels of different metals in patients who harbor retained missile for a variable period of time.

Up to our knowledge there is no report about this matter, in the English literature.

Materials and Methods

Subjects

This study was conducted during the period of January 2000 until 2003. Fifty four patients suffering from retained missile aged between 16 and 58 years were included in this study. They attended the private clinic for proper follow up and treatment. Also 60 healthy subjects aged between 18 and 55 years were use as control group. None of these healthy subjects had history of anemia, infection or any acute or chronic diseases state. Patients completed a questionnaire regarding age, address, social class, educational level, time since gunshot or retained missile injury, type, position and size of metallic fragments.

Sample preparation:

About 5 ml venous blood samples were collected in Iben Al-Bettar medical laboratory from all patients and control subjects. Two ml was added to EDTA anticoagulant tubes for lead level estimation and delivered to the laboratory for immediate acid digestion. Lead estimation was carried out by the method of Dale et al, 1976[9] with the use of Atomic Absorption Spectrophotometer, (Pye, Unicam model SP 2900). The reminder was allowed to clot in a clean plain tube for 20-30 minutes at room temperature. The serum was recovered by centrifugation and then transferred into another plastic plain tube for measuring copper, zinc and iron. The tubes were stored at -20°C until analysis. Serum copper (S Cu), zinc (SZ) and iron were measured using flame atomic absorption spectrophotometer Pye-Unicam series 2900 by direct aspiration of the serum after being diluted with de-ionized water (1/10)[10].

Statistical analysis

All results were expressed as mean ± SD. The data were analyzed statistically by one-way analysis (ANOVA) while the correlation between the data was tested statistically by simple linear regression test by using computer SPSS program. The criterion for significance was $p<0.05$.

Results

Table I shows all the biochemical characteristics which were investigated in this study for patients with retained missile and control groups.

The blood levels of lead were increased in retained missile patients group as compared with control group. This increases was statistically significant ($p<0.001$).

The same table shows that serum levels of iron, copper and zinc were insignificantly higher in patients with retained missile group as compared with control group ($p> 0.05$).

In order to study the metals levels changes in retained missile patients with respect to the duration of the retained missile in patients were classified into two groups:

1- Those with ≤ 3 years duration.

2- Those with > 3 years duration.

No significant changes in all parameters investigated were observed between the two patients groups in relation to the duration ($p>0.05$) except blood lead levels ($p<0.001$) (Table II).

Table III describes correlation between duration of the retained missile (years) and metals levels in two groups of patients. There was a significant positive correlation in two groups of patients when lead level was correlated with duration of the retained missile (years) ($P<0.01$).

The retained missile in the patients were classified into two groups, those with (≤0.5 cm) and those with (>0.5 cm) in size (Table IV).

No significant differences in zinc, iron and copper were observed, in relation to the size of retained missile groups (Table IV) , but there was significant increase in blood lead level ($p<0.001$) in two groups of patients.

The correlations between blood lead, serum zinc, copper, iron and the size of the retained missile are illustrated in Table V, which shows significant positive correlation in the two groups of patients with lead. While, there was insignificant correlation between serum copper, iron and zinc with lead.

Discussion

The presence of metallic fragments in the body of our patients were due to the injury during the war which happened during Iraq-Iran and Gulf wars. They are usually represent entire bullets or fragments of shells bombs or mines. Metallic fragments are usually incorporated in strong, fibrous, avascular scar tissue which prevents further mechanical trauma and leak. This is true for metallic fragments retained in soft tissue, muscle or bone[11].

Bullets and metallic fragments are usually of a lead core and a copper or brass jacket[12].

Lead toxicity may affect virtually any organ from the central and peripheral nervous system[13] or renal tissue[14], the gastrointestinal system[15] or the hematological one (microcytic anemia)[16]. A suspension of lead toxicity can be proved directly by a blood lead measurement or indirectly, by bone marrow aspiration to assess haematopoietic system. The surgical removal of the source lead poisoning should not be performed before blood lead levels have been reduced, to avoid acute lead poisoning[12].

Excessive amount of copper is toxic. Acute poisoning resulting from high level of copper may lead to death. Copper overload in newborn period may establish a vicious cycle of copper accumulation and liver damage[17]. Also copper toxicity can cause severe local necrotic reaction[18].

The significantly high mean blood lead level in patients with retained missile group in comparison to healthy control was noticed in this study. It has been postulated that high levels of lead in patients may be due to high lead content in retained missile which is absorbed by tissues and will lead a raised blood lead level[19]. There is association between duration of exposure and blood lead level[20,21]. The effect of exposure time is to increase the duration of exposure and to reduce recovery time. There is direct relationship of half life of lead and duration of exposure[22] Thus, the present study documented an elevated blood lead level in patients with (≤3 years) exposed retained missile group as compared to the patients with (>3 years) exposed retained missile group (Table II). Also , the strong positive correlation of Pb a with duration of the retained missile (Table II&III) which was found in the present study and confirms the effect of exposure time on elevated blood lead level[23].

In regards to the size of retained missile, blood lead level was significantly higher in patients with (≤0.5 cm) retained missile than patient with (> 0.5 cm) retained missile (Table IV). This can be explained by that the large size of retained missile may contain high quantity of lead which may lead to a high absorption.

The finding of significant positive correlation between high retained missile size and blood lead levels (Table V), suggests that the large size of retained missile act as an important contributing factor to the higher concentrations of blood lead and further support a link between the size of missile and blood lead level.

This study has also illustrated no significant differences between patients with retained missile group in comparison to healthy control in relation to serum copper levels (Table I). This implies that the excretion of copper is mainly by bile[24] and also may be due to a small content of copper in missile, or poor absorption of copper in the systemic circulation, but certainly copper induce severe local reaction particularly in the neural tissue[2].

From this study, it can be concluded that patients with retained missile had higher blood lead level and consequently undergoes lead poisoning than in the control individuals. There is also a good relationship between blood lead levels with size and exposure time of retained missile. Those patients must visit the clinic periodically for follow up and proper treatment.

Personal observation

We have noticed the following during our practice:

1. One case of toxic neuropathy (Brachial plexuses (L)) after retained missile in the dorsal vertebrae.
2. Two cases of malignant lesion near by to a retained missile one intrathecal tumour. One case of giant cell lower end femur.

Several cases of chronic discharging sinuses.

Several cases of nerve palsies because of retained missile, near by to a peripheral nerve.

So we have personal tendency to remove retained missile for many reasons including psychological.

Table I: Metals levels in patients with retained missile and control groups

Parameter	patients with retained missile	Control	P-value
No.	54	60	
B Pb µg/dl	12.65 ± 4.24	8.12 ± 3.23	<0.001
S. Fe µg/dl	104 ± 18.07	94.40 ± 12.64	>0.05
S. Cu µg/dl	104.7 ± 13.6	102.1 ± 14.7	>0.05
S. Zn µg/dl	97.16±13.29	95.63±13.98	>0.05
Age	35.44 ± 12.01	34.06 ± 12.24	>0.05

Values were expressed as mean ± SD.

Table II: Metals levels in patients with retained missile according to duration.

Parameters	Duration of the retained missile (years)		P-value
	≤3	> 3	
No.	24	30	
B Pb µg/dl	9.36 ±2.77	15.04 ±3.40	0.001
S.Fe µg/dl	103.88±17.85	106.84±18.04	>0.05
S.Cu µg/dl	103.00±11.51	104.88±16.09	>0.05
S.Zn µg/dl	94.10±11.11	98.08 ±14.78	>0.05

Values were expressed as mean ± SD.

Table III: Correlation coefficient (r) between duration of the retained missile (years) and other metals levels in patients with retained missile group.

	Duration of the retained missile	
Parameters	≤3 years	> 3 years
Pb	0.778**	0.808**
Fe	-0.320	-0.154
Cu	0.402	0.392
Zn	0.023	0.303

Values expressed as correlation coefficient (r).
** correlation is significant at the 0.01 levels.

Table IV: Metals levels in patients with respect to size of retained missile

Parameters	Size of retained missile		P-value
	≤0.5 cm	> 0.5 cm	
No.	29	25	
B Pb µg/dl	9.29 ±1.85	16.55 ±2.41	0.001
S.Fe µg/dl	102.51±17.81	106.62±17.24	>0.05
S.Cu µg/dl	102.44±13.53	104.32±15.17	>0.05
S.Zn µg/dl	93.16±11.23	96.25 ±13.64	>0.05

Values were expressed as mean ± SD.

Table V: Correlation coefficient (r) between size of retained missile and other metals levels in patients with retained missile group.

	Size of retained missile	
Parameters	≤0.5 cm	> 0.5 cm
Pb	0.617**	0.728**
Fe	0.223	0.152
Cu	0.228	0.313
Zn	0.178	0.242

Values expressed as correlation coefficient (r).
** correlation is significant at the 0.01 levels.

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