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Review Article

" UTILITY OF ZINCUM METALLICUM AND OTHER HOMOEOPATHIC REMEDIES IN CHRONIC LEAD POISONING: A REVIEW"

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ABSTRACT

Background: Chronic lead poisoning (plumbism) remains a significant global public health concern, particularly in populations exposed to industrial, occupational, and environmental lead sources. Conventional chelation therapy, while effective in reducing blood lead levels, is associated with adverse effects and incomplete reversal of neurological and systemic sequelae. Homoeopathic medicine, particularly Zincum Metallicum and related remedies including Plumbum Metallicum, Natrum Sulphuricum, and Causticum, offers an integrative therapeutic lens for managing chronic lead toxicity by addressing the totality of symptoms.

Objective: To critically review and compile available evidence — classical, clinical, and experimental — on the utility of Zincum Metallicum and other homoeopathic remedies in the management of chronic lead poisoning.

Methods: A comprehensive literature review was conducted across PubMed, Google Scholar, Cochrane Library, AYUSH Research Portal, and classical homoeopathic repertories and materia medica texts. Search terms included 'homoeopathy lead poisoning', 'Zincum Metallicum toxicology', 'Plumbum Metallicum chronic poisoning', and related terms. Primary homoeopathic materia medica sources (Clarke, Kent, Boericke, Allen) were analysed for lead-symptom cross-references.

Results: Zincum Metallicum addresses a characteristic cluster of neurological suppression, motor weakness, restlessness, and cognitive decline that mirrors the neuropathological profile of chronic lead exposure. Plumbum Metallicum directly prepared from lead exhibits homeopathic symptom similarity with plumbism.

Supporting remedies including Natrum Sulphuricum, Causticum, and Belladonna address overlapping organ-specific manifestations.

Conclusion: Homoeopathic remedies, particularly Zincum Metallicum and Plumbum Metallicum, demonstrate significant symptom-totality overlap with the clinical picture of chronic lead poisoning. Controlled clinical trials are warranted to validate these classical clinical observations.

Keywords: *Zincum Metallicum; chronic lead poisoning; plumbism; Plumbum Metallicum; homoeopathic materia medica; integrative toxicology; heavy metal toxicity*

1. INTRODUCTION

Lead (Pb), a heavy metal with no known biological function, is one of the most extensively documented environmental toxicants in human history. The World Health Organization (WHO) considers lead poisoning a major preventable cause of neurological damage in children and adults globally. [1] Chronic exposure occurs through multiple pathways including occupational contact (battery manufacturing, smelting, painting), environmental contamination (lead-based paints, leaded petrol residues, contaminated water pipes), and dietary routes (adulterated spices, traditional cosmetics, certain Ayurvedic compounds improperly prepared). [2,3]

Chronic lead poisoning (plumbism) presents a complex multi-system syndrome. Unlike acute toxicity, chronic plumbism insidiously damages the nervous system, haematopoietic system, kidneys, cardiovascular system, and reproductive organs over years of exposure. [4] The neurological manifestations — peripheral neuropathy, cognitive impairment, encephalopathy — are of particular concern, as they may persist even after cessation of exposure and removal of lead via chelation therapy. [5]

Conventional management centres on reducing exposure and administering chelating agents such as EDTA (ethylene diamine tetraacetic acid), DMSA (dimercaptosuccinic acid), and D-penicillamine. While these drugs reduce blood lead burden, they carry significant adverse effects — nephrotoxicity, essential mineral depletion, and haematological disturbances — and demonstrate limited efficacy in reversing established neurological sequelae. [6,7] This creates a therapeutic gap that integrative and complementary medicine systems are well-positioned to address.

Homoeopathic medicine, based on the principle of *similia similibus curentur* (like cures like), utilises ultra-dilute preparations of substances that in their crude form would produce symptoms similar to those of the disease being treated. [8] Zincum Metallicum (potentised zinc) and Plumbum Metallicum (potentised lead) occupy prominent positions in homoeopathic materia medica for conditions bearing striking resemblance to the clinical presentation of chronic plumbism. Several other remedies — Natrum Sulphuricum, Causticum, Belladonna, Alumina — address specific subsymptom clusters that form part of the plumbism syndrome.

Despite centuries of empirical homoeopathic clinical use, the systematic correlation of homoeopathic remedy profiles with the toxicological and clinical picture of chronic lead poisoning remains underexplored in contemporary literature. This review seeks to fill that gap by presenting a comprehensive, evidence-informed analysis of homoeopathic remedies relevant to chronic lead poisoning, with special emphasis on Zincum Metallicum.

2. PATHOPHYSIOLOGY OF CHRONIC LEAD POISONING

2.1 Mechanisms of Lead Toxicity

Lead exerts toxicity through multiple overlapping mechanisms. At the molecular level, Pb^{2+} mimics calcium and zinc ions, disrupting enzyme systems and neurotransmitter signalling that depend on these physiological cations. [9] Key pathophysiological processes include:

(a) **Oxidative Stress Induction:** Lead catalyses the generation of reactive oxygen species (ROS), depletes antioxidant enzymes (superoxide dismutase, catalase, glutathione peroxidase), and induces lipid peroxidation, particularly in neural membranes. [10]

(b) **Haem Synthesis Inhibition:** Lead inhibits delta-aminolevulinic acid dehydratase (ALAD) and ferrochelatase, key enzymes in haem biosynthesis, resulting in microcytic hypochromic anaemia and accumulation of free erythrocyte protoporphyrin (FEP). [11]

(c) **Calcium Dysregulation:** By substituting for Ca^{2+} in intracellular signalling, lead disrupts neurotransmitter release, synaptic plasticity, and protein kinase C activation, underpinning cognitive deficits and neurobehavioural changes. [12]

(d) Zinc Displacement: Lead competitively inhibits zinc-dependent enzymes, including ALAD, DNA repair enzymes, and transcription factors. Zinc deficiency synergistically worsens lead toxicity and is frequently documented in chronically exposed populations. [13]

(e) Mitochondrial Dysfunction: Lead accumulates in mitochondria, disrupting electron transport chain activity and increasing apoptotic signalling, particularly in renal tubular cells and neurons. [14]

2.2 Clinical Manifestations of Chronic Lead Poisoning

The clinical syndrome of chronic plumbism is characterised by insidious onset and multi-organ involvement, summarised as follows [15,16]:

System	Clinical Features
Neurological	Peripheral motor neuropathy (wrist drop, foot drop), cognitive impairment, irritability, insomnia, tremors, encephalopathy (in severe cases), headache
Haematological	Microcytic hypochromic anaemia, basophilic stippling, elevated FEP, inhibition of haem synthesis enzymes
Renal	Fanconi syndrome (proximal tubular dysfunction), interstitial nephritis, hypertension, gout (saturnine gout)
Gastrointestinal	Lead colic (intermittent colicky abdominal pain), constipation, anorexia, metallic taste, Burton's line (blue-black gingival pigmentation)
Musculoskeletal	Muscle weakness, myalgia, arthralgia, dense lead lines in metaphyses (on X-ray)
Cardiovascular	Hypertension, increased risk of coronary artery disease, peripheral vascular disease
Reproductive	Reduced sperm motility, spontaneous abortion, foetal neurodevelopmental toxicity, menstrual irregularities

Table 1: Systemic manifestations of chronic lead poisoning

3. THE ZINC-LEAD NEXUS: BIOLOGICAL RATIONALE FOR ZINCUM METALLICUM

The biological antagonism between zinc and lead provides a compelling scientific rationale for considering Zincum Metallicum in lead toxicity. This relationship operates at multiple levels:

Competitive Ionic Antagonism: Zinc (Zn^{2+}) and lead (Pb^{2+}) share similar ionic radii and charge, enabling lead to displace zinc from zinc-finger proteins, metalloenzymes, and transport proteins. Restoration of zinc sufficiency has been demonstrated to competitively reduce lead absorption at intestinal level and attenuate lead-induced ALAD inhibition. [17]

Antioxidant Restoration: Zinc is a critical cofactor for superoxide dismutase (SOD) and plays a structural role in protecting thiol groups from oxidative damage. Zinc supplementation has been shown to restore antioxidant defences compromised by lead exposure, reducing oxidative stress markers. [18]

Metallothionein Induction: Zinc induces metallothionein, a cysteine-rich metal-binding protein that sequesters lead and other heavy metals, reducing their bioavailability and organ distribution. [19]

Neuroprotection: Zinc supports neuronal zinc-dependent signalling pathways (NMDA receptor modulation, glutamatergic synapse regulation) that are disrupted by lead. Experimental studies demonstrate neuroprotective effects of zinc in lead-exposed rodent models, including preservation of hippocampal function and cognitive performance. [20]

This zinc-lead biological antagonism is not merely metaphorical in homoeopathic terms — it represents a measurable, biochemically documented relationship that gives Zincum Metallicum a dual rationale: both isopathic-adjacent (addressing the depleted mineral that lead displaces) and homoeopathic (the symptom-totally of zinc toxicosis mirrors plumbism).

4. ZINCUM METALLICUM: HOMOEOPATHIC MATERIA MEDICA ANALYSIS

4.1 Source and Preparation

Zincum Metallicum is the homoeopathic preparation derived from metallic zinc (Zn), atomic number 30, belonging to the transition metals group. Prepared through trituration of pharmaceutical-grade metallic zinc according to homoeopathic pharmacopoeial standards, it is used in potencies ranging from 6C to 200C and above, with 6C, 30C, and 200C being most clinically employed for the type of systemic, chronic presentations seen in toxic exposure syndromes. [21]

4.2 Constitutional Picture and Keynote Symptoms

The constitutional picture of Zincum Metallicum as described in classical materia medica (Clarke, Kent, Boericke, Allen's Keynotes) features a distinctive triad: nervous exhaustion, motor restlessness with suppression, and functional depression of the nervous system. [22,23,24] Key characteristics include:

Neurological Keynotes: Extreme nervous debility and irritability; fidgety feet (restless leg syndrome-equivalent), worse in the evening and at rest; twitching of muscles; tremors; convulsions from suppressed eruptions; slowness in cerebration with difficulty in thinking; brain fog from mental overwork; numb, weak extremities; wrist drop and foot drop (extensor muscle paresis). These neurological features map precisely onto the peripheral motor neuropathy and encephalopathy of chronic plumbism. [25]

Gastrointestinal Symptoms: Colicky abdominal pain; constipation with hard, small stools; nausea; inability to digest properly; aversion to meat; marked sensitiveness of the epigastrium. The abdominal colic and constipation mirror saturnine colic of lead poisoning. [26]

Haematological Correlation: Pallor, weakness, and anaemia feature prominently in Zincum Metallicum pathogenesis — paralleling the microcytic anaemia of lead-induced haem synthesis disruption. [27]

Mental Symptoms: Melancholy, timidity, depression, poor memory, inability to concentrate, aversion to conversation. Chronic lead exposure produces measurable IQ reduction, depression, and cognitive deficits — all addressed within Zincum Metallicum's mental keynote sphere. [28]

Modalities: Symptoms worse from wine, mental exertion, afternoon (3–5 PM), and from suppression of discharges; better from motion, eating, and from appearance of discharges (eruptions, menses). The aggravation from suppression is particularly relevant as homoeopathic theory understands toxic metal accumulation as a form of systemic suppression. [29]

Sleep disturbances: Jerking and twitching during sleep; somnolence with inability to remain asleep; sleeplessness with restlessness. These are consistent with the sleep pathology of chronic lead toxicity. [30]

4.3 Repertorial Analysis

Repertorisation of the plumbism symptom complex using Kent's Repertory and the Complete Repertory (Murphy's) reveals Zincum Metallicum as a consistently high-scoring remedy across the following rubrics [31]:

Repertory Rubric	Grade	Source
Extremities, weakness, lower limbs	3	Kent
Extremities, restlessness, feet	3	Kent
Nervous exhaustion, mental fatigue	3	Murphy
Convulsions from suppressed eruptions	2	Kent
Abdomen, colic, colicky pain	2	Kent
Trembling of limbs	2	Murphy
Constipation, difficult stool	2	Kent
Memory weakness, poor concentration	2	Murphy
Wrist drop, paralysis extensors	3	Kent
Sleep, restless, jerking in sleep	2	Kent

Table 2: Key repertory rubrics for Zincum Metallicum with grades (1=minor, 2=moderate, 3=major)

5. PLUMBUM METALLICUM: THE ISOPATHIC SIMILLIMUM

Plumbum Metallicum — the homoeopathic preparation of metallic lead itself — occupies a special position as both an isopathic agent (prepared from the causative toxin) and a classical homoeopathic remedy whose proving picture closely mirrors the toxicological profile of lead. [32] Its classical materia medica profile includes:

Neurological Sphere: Progressive peripheral motor neuropathy with extensor paralysis; wrist drop; difficulty in swallowing; loss of sexual power; sclerosis and atrophy of spinal cord segments; anaesthesia and paraesthesia of extremities. The neurological keynote — 'paralysis of single muscles, especially extensors' — is pathognomonic of lead neuropathy, making Plumbum Metallicum a remedy of precise symptom-totality match. [33]

Gastrointestinal Sphere: Violent colicky pain radiating to spine and lower back; obstinate constipation with hard, black balls; sensation of abdominal constriction as if pulled inward by a string; nausea and vomiting; metallic taste. These symptoms correspond precisely to saturnine colic. [34]

Renal Sphere: Albuminuria; contracted granular kidney; hypertension. Plumbum Metallicum has been specifically indicated in lead nephropathy in several classical homoeopathic clinical records. [35]

Mental Sphere: Memory loss; slowness of thought and speech; melancholy; depression with suicidal ideation; loss of perceptive power. Consistent with the neuropsychiatric manifestations of chronic plumbism documented in epidemiological studies. [36]

The principle of isopathy — treating with the potentised form of the causative agent — has precedent in homoeopathic practice (e.g., Carcinosis in oncological constitution management, potentised allergens in allergy). Plumbum Metallicum operationalises this principle for lead toxicity, offering both symptom-matching and the hypothesised regulatory benefit of potentised lead in stimulating the organism's innate detoxification capacity. [37]

6. SUPPORTING HOMOEOPATHIC REMEDIES IN CHRONIC LEAD POISONING

Clinical individualisation requires consideration of several additional remedies whose symptom pictures overlap significantly with specific aspects of the plumbism syndrome:

6.1 Natrum Sulphuricum

A prime liver and gallbladder remedy with documented affinity for sequelae of injuries to the head and for conditions arising from living in damp environments. Natrum Sulphuricum has been noted in homoeopathic literature for its role in conditions associated with toxic metal accumulation and liver congestion. In lead poisoning, where hepatic biotransformation pathways are overloaded, Natrum Sulphuricum (Na_2SO_4) may support hepatic detoxification through its sulphate component's role in phase II conjugation. Symptoms: yellowish coating of tongue; loose morning stools; mental depression with suicidal thoughts post-head injury; sensitive to music; aggravation in damp weather. [38]

6.2 Causticum

Causticum (Hahnemann's Tinctura acris sine Kali — potassium hydrate) addresses the progressive motor paralysis and muscular weakness characteristic of chronic plumbism. Its materia medica features: drooping of eyelids; wrist drop; progressive paralysis of single muscles with tearing pains; trembling of hands; great sympathy and sadness. It is distinguished from Plumbum Metallicum by its greater affinity for right-sided paralysis and for conditions arising after suppression of skin disease. Causticum serves as a complementary remedy when motor deficits dominate the clinical picture. [39]

6.3 Belladonna (Atropa belladonna)

In acute exacerbations of encephalopathy in lead-exposed individuals, Belladonna covers the intense cerebral congestion, throbbing headache, delirium, hypersensitivity to light, noise, and jarring that characterise lead encephalopathic episodes. Its rapid onset, congestive picture, and central nervous system focus make it a critical acute prescription within the broader chronic management strategy. [40]

6.4 Alumina

Alumina shares with chronic lead poisoning the features of extreme constipation (no urge to defecate for days; soft stool requires great straining), progressive motor incoordination, and mental slowness. In populations with concurrent aluminium and lead exposure — common in certain industrial settings — Alumina may address the combined toxic picture. [41]

6.5 Gelsemium Sempervirens

For the tremors, motor weakness, heaviness, and muscular incoordination of chronic lead neuropathy, Gelsemium addresses the picture of motor paralysis from functional nervous system depression — 'paralysis from fright or bad news' in classical terms, but more broadly any state of motor depression without organic lesion. It is indicated particularly when trembling, heaviness, and incoordination predominate without the colicky pain and constipation of Plumbum or the restless feet of Zincum. [42]

7. COMPARATIVE REMEDY DIFFERENTIATION

Feature	Zincum Met.	Plumbum Met.	Causticum	Nat. Sulph.	Gelsemium
Motor paralysis	++	+++	++	+	++
Wrist/foot drop	++	+++	++	-	+
Restless feet	+++	+	+	-	-
Lead colic	+	+++	-	-	-
Constipation	++	+++	+	+	-

Cognitive decline	++	++	+	+	-
Anaemia	++	++	-	+	-
Renal involvement	+	+++	-	+	-
Depression	++	++	+	+++	-
Tremors	+++	++	++	-	+++

Table 3: Comparative symptom coverage of homoeopathic remedies in chronic lead poisoning (+++=major, ++=moderate, +=minor, -=absent)

8. EVIDENCE BASE: EXPERIMENTAL AND CLINICAL STUDIES

8.1 In Vitro and Animal Studies

Several preclinical studies have investigated homoeopathic potencies in heavy metal toxicity models. Khuda-Bukhsh et al. conducted a series of controlled experiments demonstrating that homoeopathic potencies (6C, 30C, 200C) of arsenic-based remedies significantly reduced oxidative stress markers, restored antioxidant enzyme activity, and improved haematological parameters in arsenic-intoxicated mice — providing a research model applicable to lead toxicity investigations. [43] A study by Sukul et al. demonstrated that potentised *Plumbum Metallicum* 200C produced measurable effects on membrane fluidity and enzyme activity in rat erythrocytes, suggesting that ultra-dilute preparations retain biologically relevant activity. [44]

Experimental studies on zinc supplementation in lead-exposed rodents consistently demonstrate: reduced blood and tissue lead levels; normalised ALAD activity; restored glutathione levels; and improved cognitive performance on maze tasks. While these employ pharmacological zinc rather than potentised *Zincum Metallicum*, they establish the mechanistic plausibility of zinc-based intervention in lead poisoning at multiple biological levels. [45,46]

8.2 Clinical Case Reports and Case Series

Classical homoeopathic literature contains several documented case records of successful *Plumbum Metallicum* and *Zincum Metallicum* prescription in lead poisoning. Clarke's Dictionary of Practical Materia Medica documents cases of lead colic and peripheral neuropathy responding to *Plumbum Metallicum* 30C. [47] Contemporary clinical case reports from India document the use of *Plumbum Metallicum* 200C and 1M in occupationally exposed lead workers with peripheral neuropathy, showing symptomatic improvement in grip strength, sensory symptoms, and constipation over 6–12 weeks. [48]

A retrospective series from a homoeopathic clinical centre in Maharashtra reviewed 18 patients with confirmed elevated blood lead levels (BLL >25 µg/dL) who received individualised homoeopathic treatment (*Plumbum Metallicum*, *Zincum Metallicum*, *Natrum Sulphuricum*) alongside exposure cessation for 6 months. Mean BLL reduction was 38% compared to 62% in the chelation therapy arm, but homoeopathically treated patients demonstrated superior improvement in neuropsychiatric symptom scores (MMSE, digit span, depression inventory) — suggesting complementary value beyond mere lead excretion. [49] (Note: this represents preliminary observational data requiring formal validation.)

8.3 Research Gaps and Future Directions

Despite the compelling theoretical and clinical rationale, the evidence base for homoeopathic remedies in chronic lead poisoning remains at an early stage. Critical research gaps include: (a) absence of randomised controlled trials (RCTs) specifically evaluating homoeopathic remedies in lead-poisoned populations; (b) lack of standardised outcome measures incorporating both biomarkers (BLL, ALAD activity, oxidative stress indices) and clinical symptom scales; (c) limited mechanistic research on ultra-high dilution effects in heavy metal toxicity models; and (d) absence of pharmacokinetic studies comparing homoeopathic versus conventional intervention on lead tissue distribution.

Priority research recommendations include: (1) A double-blind, placebo-controlled RCT of *Zincum Metallicum* 30C vs. placebo as adjunct to chelation in lead-exposed workers, with primary endpoints of neuropsychiatric symptom scales and secondary endpoints of BLL and ALAD activity; (2) Systematic case series with standardised reporting (CARE guidelines adapted for homoeopathy) in occupationally exposed populations; (3) In vitro experiments studying the effect of potentised *Zincum Metallicum* and *Plumbum Metallicum* on lead-exposed cell cultures for oxidative stress and viability markers.

9. INTEGRATIVE THERAPEUTIC FRAMEWORK

An integrative approach to chronic lead poisoning, incorporating homoeopathic remedies alongside conventional management, is proposed in the following framework:

Phase 1 — Exposure Cessation and Assessment: Complete cessation of lead exposure source; full clinical assessment including BLL, CBC, renal and liver function, neurological examination, and neuropsychiatric testing. Individualised homoeopathic case-taking to identify constitutional and acute prescriptions.

Phase 2 — Acute Management: When BLL >45 µg/dL or significant encephalopathy is present, conventional chelation (DMSA or EDTA) remains primary. Homoeopathic Belladonna or Plumbum Metallicum (acute potency 30C) may be co-administered for symptom management of acute presentations.

Phase 3 — Chronic Rehabilitation: Following acute management or in cases of chronic low-level plumbism (BLL 10–44 µg/dL with systemic symptoms), individualised homoeopathic prescription (Zincum Metallicum, Plumbum Metallicum, Natrum Sulphuricum, Causticum as indicated) forms the therapeutic core. Constitutional prescription according to symptom-totality is paramount — remedy selection must not be mechanical but individualised.

Phase 4 — Monitoring and Maintenance: Serial BLL testing at 3-month intervals; neuropsychiatric reassessment at 6 months; remedy adjustment based on clinical response and evolving symptom picture. Nutritional support emphasising zinc-rich dietary sources and antioxidant nutrients (vitamin C, E, selenium) as adjuncts.

10. DISCUSSION

This review demonstrates that Zincum Metallicum and Plumbum Metallicum occupy uniquely well-matched positions in the homoeopathic pharmacopoeia relative to the clinical syndrome of chronic lead poisoning. The correspondence is not merely analogical but is grounded in: (a) the established zinc-lead ionic antagonism in human biochemistry; (b) the extensive symptom-totality overlap in classical materia medica pathogenesis and toxicological clinical descriptions; (c) the principle of isopathy lending additional rationale to Plumbum Metallicum; and (d) emerging preclinical evidence supporting the biological activity of homoeopathic potencies in heavy metal toxicity models.

A critical strength of the homoeopathic approach in this context is its capacity to address the neuropsychiatric sequelae of lead toxicity — the symptom dimension most resistant to conventional chelation. Cognitive impairment, depression, peripheral neuropathy, and autonomic dysregulation are not only covered within the materia medica of Zincum Metallicum and Plumbum Metallicum but constitute their central keynotes. This suggests that homoeopathic treatment may be most valuable precisely where conventional medicine is weakest in managing chronic plumbism.

The limitations of this review must be acknowledged. The clinical case evidence cited remains largely observational and lacks the methodological rigour required for causal attribution. The mechanistic pathways by which ultra-dilute homoeopathic potencies might exert biological effects in vivo remain poorly understood, and the scientific community continues to debate the theoretical basis of homoeopathy beyond the dilution threshold of Avogadro's number. This review presents the evidence-base as it currently exists, without overstating its conclusions.

11. CONCLUSION

Chronic lead poisoning presents a complex, multi-system clinical challenge that conventional chelation therapy addresses incompletely, particularly regarding neuropsychiatric sequelae. Zincum Metallicum and Plumbum Metallicum emerge from classical homoeopathic materia medica as remedies with strong symptom-totality correspondence to the plumbism syndrome, supported by the established zinc-lead biological antagonism and preliminary experimental evidence. Supporting remedies including Natrum Sulphuricum, Causticum, Belladonna, Alumina, and Gelsemium address specific subsymptom clusters requiring individualised prescription.

The homoeopathic approach is best positioned as an integrative complement to conventional management — most valuable in the chronic rehabilitation phase where symptom management, neurological recovery, and quality of life improvement are the primary goals. Robust clinical trial evidence is urgently needed to elevate these observations from classical empiricism to contemporary evidence-based medicine standards. IRA Consultancy and Research Organisation recommends this as a priority area for AYUSH-funded research, given the occupational and environmental lead burden in India.

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