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Intravenous Micronutrient Infusion Therapy in Aesthetic and Preventive Medicine: A Narrative Review

Dr. Pruthvi Vaity

[1]Medical Director, HealRx Aesthetics, Mumbai, India

[2]Professor & Trainer, M.A.C International Academy, Mumbai, India

Abstract: ***Background: Intravenous (IV) micronutrient infusions are increasingly offered in aesthetic, preventive and wellness practice, although the evidence base differs markedly by ingredient and indication. Objective: To synthesize the pharmacologic rationale, clinical evidence, safety issues and responsible-practice principles for outpatient IV micronutrient therapy. Methods: Human studies, systematic reviews and safety guidance relevant to IV vitamins, minerals, glutathione and nicotinamide adenine dinucleotide (NAD+) were prioritized. Results: The strongest support for parenteral micronutrients concerns documented deficiency, malabsorption, parenteral nutrition and selected acute-care indications. IV vitamin C achieves plasma concentrations unattainable orally, but this pharmacokinetic advantage does not establish benefit for skin rejuvenation, nonspecific fatigue or longevity. Evidence for multinutrient cocktails is limited; IV magnesium may benefit selected acute migraine presentations. Evidence for IV glutathione as a skin-lightening agent is inadequate, and human evidence for IV NAD+ remains preliminary. Major risks include sterility failure, infusion reactions, phlebitis, fluid or electrolyte imbalance, renal complications and inappropriate patient selection. Conclusion: IV micronutrient therapy should be indication-led, consent-based and delivered under standardized medical governance. Marketing claims should not exceed clinical evidence.***

Keywords: Intravenous therapy, Micronutrients, Aesthetic medicine, Preventive medicine, Patient safety

1. Introduction

Intravenous infusion is indispensable in modern medicine for resuscitation, electrolyte correction, parenteral nutrition, antimicrobial therapy and delivery of medicines that cannot be given effectively by another route. In parallel, outpatient aesthetic and preventive practices have adopted IV formulations containing vitamins, minerals, antioxidants, amino acids and metabolic cofactors. These services are promoted for fatigue, immune support, skin radiance, recovery, athletic performance and healthy ageing. Their visibility has expanded faster than the supporting clinical literature. The attraction of IV administration is intuitive: it bypasses intestinal absorption and can produce rapid, predictable plasma exposure. That premise is valid pharmacologically, but it is frequently extended into a second, unproven premise - that a higher blood concentration must produce a superior clinical outcome in a person without a deficiency. The distinction is crucial. Route-dependent pharmacokinetics, biological plausibility and patient-reported improvement are not interchangeable with evidence of efficacy. Aesthetic medicine creates a particularly sensitive setting because treatment is often elective, patients are generally ambulatory, and endpoints such as 'glow', energy or detoxification may be subjective and poorly standardized. The procedure itself also creates risks that do not exist with oral supplementation, including vascular injury, contamination, infusion reactions, volume overload and errors in compounding or compatibility. Responsible practice therefore requires an indication-first framework rather than a menu-first framework. This narrative review evaluates the mechanistic rationale, evidence and safety of commonly marketed IV micronutrients, with emphasis on aesthetic and preventive practice. It separates established medical replacement from context-dependent use and unsupported wellness claims, and proposes a practical governance pathway for outpatient clinics. It is not a dosing or compounding manual; dose selection must follow licensed product information, local regulation, patient factors and condition-specific guidance.

2. Literature Survey

2.1 Evolution from replacement therapy to wellness infusions

Parenteral micronutrients were developed to treat clearly defined problems: deficiency, inability to use the gastrointestinal tract and the metabolic demands of critical illness. Thiamine given parenterally to patients at risk of Wernicke encephalopathy and trace elements supplied during parenteral nutrition are examples in which route and indication are linked to pathophysiology and clinical urgency [12]-[14]. In such settings, the objective is restoration of normal physiology, not supraphysiologic optimization. The modern multinutrient infusion is often associated with the 'Myers' cocktail', a mixture generally described as magnesium, calcium, B vitamins and vitamin C. The published literature includes descriptive reports and small studies, but the original formula was not standardized [7]-[9]. In a placebo-controlled pilot trial in fibromyalgia, both active treatment and placebo groups improved; between-group differences were not statistically significant, although feasibility and short-term safety were demonstrated [7]. This study is important because it illustrates how the procedure context, saline hydration, expectation and repeated clinical contact can contribute to perceived benefit. Commercial outpatient infusions now extend beyond

conventional micronutrients to glutathione and NAD+. These agents have compelling biochemical narratives, but human outcome data for cosmetic or anti-ageing use are sparse. The scientific task is therefore not to dismiss all IV therapy, nor to accept all claims, but to match each ingredient and indication to the highest available level of evidence.

2.2 Oral and intravenous pharmacokinetics

Oral bioavailability of water-soluble nutrients is influenced by transporter saturation, intestinal disease, food, adherence and renal handling. Vitamin C is a well-characterized example. Controlled pharmacokinetic work showed tight regulation of plasma ascorbate after oral dosing, whereas IV administration produced substantially higher transient concentrations [1], [2]. Later pharmacokinetic evaluation confirmed dose-dependent exposure and rapid renal elimination after high-dose infusions [3]. These observations justify IV use when high plasma exposure is itself part of a studied therapeutic hypothesis or when oral absorption is inadequate. They do not demonstrate that healthy individuals require or benefit from repeated high concentrations. In fact, rapid renal clearance means that a striking post-infusion laboratory concentration may be brief. Clinical decisions must therefore be based on outcomes, not on bioavailability alone.

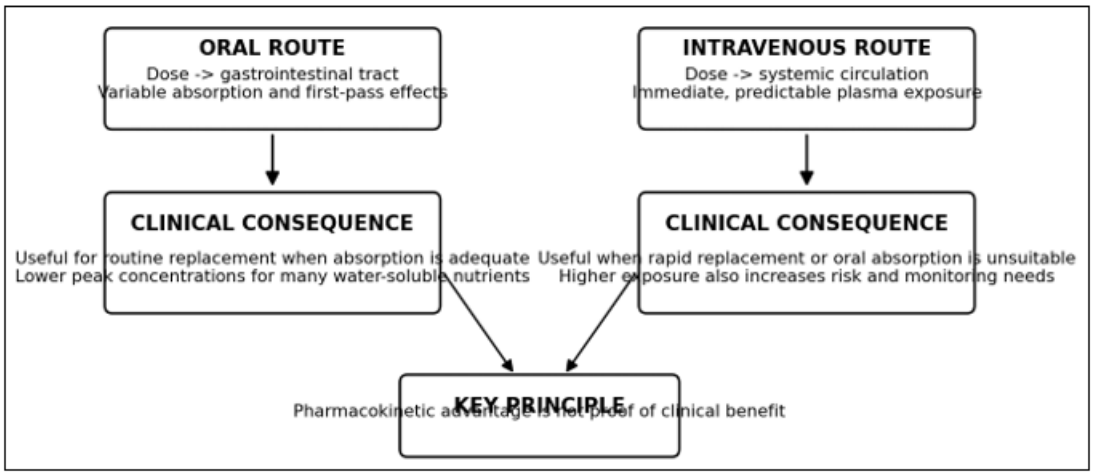

Figure 1: Oral and intravenous delivery - pharmacokinetic differences and their clinical interpretation

2.3 Biological rationale relevant to skin and preventive medicine

Micronutrients participate in redox regulation, collagen synthesis, mitochondrial metabolism, neurotransmission, immune function and DNA maintenance. Vitamin C is a cofactor for prolyl and lysyl hydroxylases required for collagen maturation and contributes to antioxidant defense. Reviews of skin biology support the importance of adequate vitamin C status for normal skin function [4]. However, most clinical evidence for visible skin outcomes concerns dietary status or topical application, not IV infusion in nutrient-replete patients. Magnesium acts in hundreds of enzyme systems and influences neuromuscular excitability and vascular tone. B-group vitamins function as coenzymes in energy metabolism and hematopoiesis. Zinc and selenium support enzymatic and immune pathways, while glutathione is a major intracellular redox buffer. NAD+ is central to redox reactions and serves as a substrate for enzymes involved in DNA repair and cellular signaling [20]-[22]. These mechanisms create hypotheses, but a mechanism becomes a clinical indication only after efficacy, dose, route and safety have been tested in humans.

3. Problem Definition

The central problem is an evidence-governance gap. Outpatient IV services often combine established medical concepts - hydration, deficiency correction and monitored infusion - with broad claims that have not been validated. Product names may imply detoxification, immunity, anti-ageing, fat burning or skin whitening without defining a measurable diagnosis or endpoint. This makes meaningful consent difficult and encourages treatment packages that continue regardless of objective response. A second problem is formulation heterogeneity. Studies of one ingredient, dose or patient population cannot be transferred automatically to a proprietary cocktail containing several agents. Mixing also introduces questions of compatibility, pH, osmolarity, stability, light sensitivity and sterility. Even when every ingredient is familiar, the final admixture is a new clinical exposure. A third problem is risk asymmetry. A small or uncertain benefit may not justify an invasive route in a healthy person, particularly when oral therapy is effective. Conversely, withholding a necessary parenteral nutrient from a deficient or malabsorptive patient can cause harm. A rational framework must therefore consider indication, evidence, route necessity, alternatives, patient vulnerability and the clinic's capacity to manage complications.

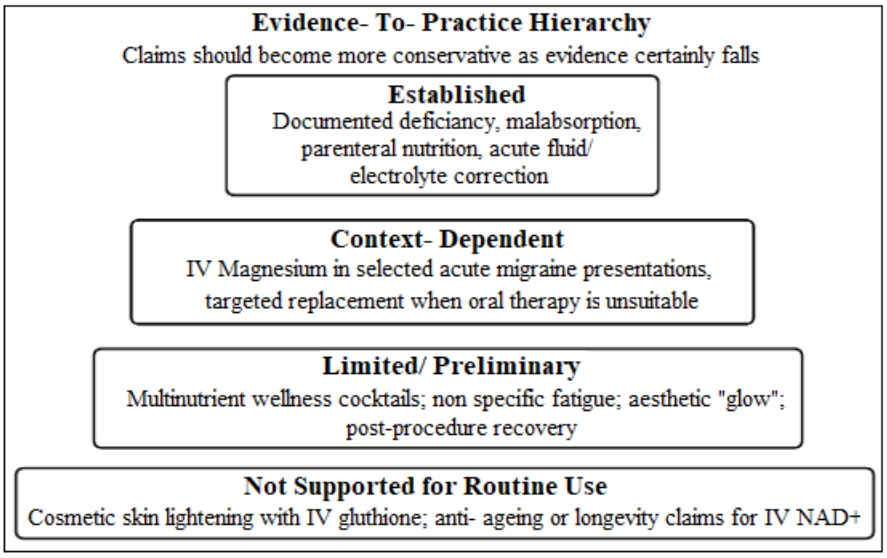

Figure 2: Evidence-to-practice hierarchy for outpatient IV micronutrient therapy

4. Methods / Approach

A structured narrative review was undertaken to map the evidence rather than to calculate a pooled treatment effect. PubMed/MEDLINE, guideline repositories and official regulatory or infection-prevention communications were searched for literature available through 30 June 2026. Search concepts included combinations of 'intravenous', 'infusion', 'micronutrient', 'vitamin C', 'magnesium', 'Myers cocktail', 'glutathione', 'NAD+', 'skin', 'fatigue', 'migraine', 'safety', 'compounding' and 'injection practice'. Reference lists of key reviews and trials were also examined. Priority was given to human randomized or controlled studies, systematic reviews, clinical guidelines, pharmacokinetic studies and official safety communications. Preclinical evidence was used only to explain biological plausibility. Studies of oral or topical administration were not treated as direct evidence for IV administration. Evidence was interpreted in four practice categories: established, context-dependent, limited/preliminary and not supported for routine use.

Because the review is narrative, no formal meta-analysis or risk-of-bias score was performed. Heterogeneity in formulations, outcomes and populations precluded direct quantitative comparison. The conclusions therefore emphasize consistency of evidence, clinical relevance, route-specific safety and the difference between replacement and enhancement.

5. Results and Discussion

5.1 Evidence map of commonly used agents

Table 1: Evidence-based interpretation of commonly administered IV agents

Agent / category	Evidence position	Practical interpretation
Crystalloid fluids/ electrolytes	Established for diagnosed dehydration or electrolyte disturbance	Avoid using hydration as a proxy for treating undiagnosed fatigue; assess cardiac and renal reserve.
Thiamine	Established for deficiency and urgent Wernicke-risk settings	Parenteral route is appropriate when urgency or absorption requires it [12].
Vitamin B12	Established replacement for deficiency, but IV is rarely necessary	Oral or intramuscular routes are usually sufficient; route should follow cause and guideline.
Magnesium	Context-dependent; evidence varies by indication	May help selected acute migraine presentations, but trials and systematic reviews are heterogeneous [10], [11].
Vitamin C	Pharmacokinetic advantage established; wellness/aesthetic outcomes unproven	High-dose use requires renal and G6PD-related risk assessment and awareness of laboratory interference [1]-[3].
Multinutrient cocktails	Limited evidence	Small studies do not establish superiority over placebo or saline for nonspecific symptoms [7]-[9].
Glutathione	Not supported for routine cosmetic IV skin lightening	No adequate chronic safety evidence; regulatory concerns and serious reactions have been reported [16]-[19].
NAD+	Preliminary human evidence	Metabolomic and small observational studies do not establish anti-ageing or wellness efficacy [20]-[24].

5.2 Vitamin C

Vitamin C is the most extensively discussed component of outpatient antioxidant infusions. It is essential for collagen biosynthesis, carnitine production, catecholamine metabolism and antioxidant recycling. Oral absorption is saturable, while IV administration bypasses this control and can generate millimolar plasma concentrations [1]-[3]. This difference is clinically meaningful for research questions involving pharmacologic ascorbate, but it should not be used to imply that IV delivery is superior for every purpose. In aesthetic practice, claims include improved glow, collagen support, wound recovery and reduced oxidative stress. Adequate vitamin C is unquestionably necessary for normal

collagen formation, and deficiency can impair wound healing [4]. Evidence that intermittent IV vitamin C improves wrinkles, pigmentation or skin quality in vitamin-C-replete adults is, however, insufficient. Aesthetic outcomes are also vulnerable to confounding from hydration, concurrent procedures and skincare. High-dose IV vitamin C is not physiologically equivalent to routine replacement. Important concerns include renal impairment, oxalate accumulation or nephropathy, iron overload states, sodium load in some formulations and hemolysis in susceptible patients with glucose-6-phosphate dehydrogenase deficiency. High circulating ascorbate can interfere with some point-of-care glucose meters and other assays [29]. Patients receiving oncology treatment require specialist coordination because potential drug interactions and the evidence for benefit are condition-specific [28]. A responsible clinic should therefore distinguish low-dose replacement from high-dose pharmacologic infusion, define a measurable indication, screen risk appropriately and avoid using the phrase 'immune booster' as a substitute for diagnosis.

5.3 Magnesium

Magnesium is relevant to ATP-dependent reactions, membrane stability, muscle contraction and neuronal excitability. IV magnesium is well established in several conventional indications, but evidence cannot be generalized across all headache, fatigue or muscle-pain presentations. Systematic reviews of IV magnesium for acute headache have produced mixed findings. Some trials suggest benefit in migraine with aura or in subgroups with low ionized magnesium, while others show no advantage or less benefit than comparator therapy. A 2019 systematic review concluded that results for clinically important pain reduction were conflicting and that heterogeneity limited meta-analysis [10]. An earlier meta-analysis reported short-term benefit but also combined studies with varied designs [11]. Thus, magnesium may be considered in selected acute migraine settings, but it should not be presented as a universal migraine infusion. Rapid or excessive magnesium administration can cause flushing, hypotension, nausea, weakness, loss of reflexes, bradyarrhythmia and respiratory depression, particularly in renal impairment. Rate control, medication review, renal assessment and observation are essential.

5.4 B-group vitamins, trace elements and amino acids

B vitamins are central to carbohydrate, fatty-acid and amino-acid metabolism. Their role in deficiency is established, but the assumption that more cofactor necessarily produces more energy is incorrect once enzyme systems are replete. Thiamine is a notable exception in urgent deficiency-risk settings, where delayed treatment can lead to irreversible neurologic harm [12]. Vitamin B12 deficiency also requires treatment, but oral or intramuscular administration is generally preferred [30]; routine IV administration adds invasiveness without a clear advantage. Trace elements are essential during long-term parenteral nutrition and should be individualized because deficiency and toxicity are both possible [13], [14]. Zinc is often marketed for hair and skin, yet diffuse hair loss should trigger diagnostic assessment rather than empirical infusion. Iron, zinc, selenium, vitamin D, B12, folate and protein status may be relevant in selected hair disorders, but supplementation is most defensible when a deficiency or clinical indication has been identified [15]. Amino-acid infusions belong primarily to parenteral nutrition or specialist metabolic care. Commercial 'recovery' mixtures may contain arginine, carnitine, taurine or branched-chain amino acids, but evidence for intermittent IV use in healthy adults is limited. Osmolarity, venous irritation, metabolic disease and drug interactions must be considered.

5.5 Multinutrient cocktails and nonspecific fatigue

Fatigue is a symptom, not a single disease. Anemia, thyroid disease, sleep disorders, infection, depression, medication effects, cardiopulmonary disease, nutritional deficiency and overtraining may present similarly. Infusing a standardized cocktail before defining the cause can delay diagnosis and create a misleading sense of treatment response. The placebo-controlled pilot trial of IV micronutrient therapy in fibromyalgia is frequently cited in marketing. Although participants receiving active therapy improved from baseline, the active regimen was not statistically superior to placebo, and the sample was too small to establish efficacy [7]. Earlier reports were uncontrolled [8], [9]. These data support further research, not routine claims that cocktails treat fibromyalgia or chronic fatigue. Hydration, rest in a clinical setting, expectation and supportive interaction can produce genuine short-term symptomatic improvement. Ethical practice does not deny these effects; it explains that they are nonspecific and avoids attributing them to a particular micronutrient without evidence.

5.6 Glutathione and cosmetic skin lightening

Glutathione participates in cellular redox control and can influence melanogenesis in experimental systems. This has led to oral, topical and injectable products marketed for skin lightening. Route-specific evidence is essential: studies of topical or oral glutathione cannot establish the safety or efficacy of repeated IV administration. Reviews have concluded that evidence for IV glutathione skin lightening is inadequate and that long-term safety has not been established [16]-[19]. Davids and colleagues found no studies supporting chronic IV glutathione for cosmetic lightening and called for regulatory assessment [17]. Reported or warned-about risks include severe cutaneous reactions, renal and hepatic injury, thyroid disturbance, infection and complications related to unregulated products or infusion practice. These concerns are particularly important because the indication is elective and non-medical. On current evidence, IV glutathione should not be recommended as a routine skin-lightening treatment. Clinicians should instead diagnose pigmentary disorders, use evidence-based dermatologic therapy, address photoprotection and discuss the ethical and psychosocial dimensions of color-based cosmetic pressure.

5.7 NAD+ infusions and longevity claims

NAD+ is fundamental to cellular redox reactions and is consumed by sirtuins, poly (ADP-ribose) polymerases and

other enzymes involved in stress responses and DNA repair [21], [22]. Age-associated changes in NAD metabolism have generated interest in precursors such as nicotinamide riboside and nicotinamide mononucleotide, and more recently in direct IV NAD+ administration. Human IV evidence remains sparse. A 2019 pilot study characterized plasma and urinary metabolites during a six-hour NAD+ infusion but was not designed to demonstrate clinical anti-ageing efficacy [20]. A small 2026 retrospective comparison of IV NAD+ and IV nicotinamide riboside reported biochemical observations and frequent transient infusion-related symptoms in the NAD+ group; its sample size, observational design and commercial conflicts make it hypothesis-generating rather than practice-defining [23]. A recent review found no eligible outcome trials of IV or intramuscular NAD+ for anti-ageing or wellness [24]. Quality and sterility are additional concerns. The US Food and Drug Administration warned in 2024 about adverse events associated with compounded NAD+ products made from food-grade ingredients, including reactions consistent with endotoxin exposure [25]. At present, IV NAD+ should be described as investigational for longevity, energy or cognitive enhancement.

5.8 Applications in aesthetic and preventive practice

Table 2: Common proposed applications and an evidence-calibrated position

Proposed use	Evidence summary	Responsible position
Skin “glow” / hydration	Transient improvement may reflect fluids and rest; no validated IV micronutrient protocol for skin rejuvenation.	Do not promise collagen remodeling, pigment correction or anti-ageing without direct evidence.
Pigmentation / skin lightening	IV glutathione evidence and chronic safety are inadequate.	Do not offer as routine cosmetic lightening; evaluate the pigmentary diagnosis.
Hair fall	Treat identified nutritional deficiency; empirical cocktails are unsupported.	History, examination and selected laboratory testing should precede supplementation [15].
Post-procedure recovery	Biological rationale exists for adequate nutrition; IV superiority is unproven in routine patients.	Use standard wound care, hydration and procedure-specific guidance; reserve IV therapy for medical need.
Fatigue / “energy”	May help when deficiency, dehydration or a defined condition is present.	Investigate the cause; use objective endpoints and stop ineffective treatment.
Immune support	Micronutrients support normal immunity, but routine supraphysiologic infusion is not proven to prevent infection.	Correct deficiency and follow vaccination, sleep and infection-control guidance [5], [6].
Longevity / anti-ageing	No established clinical outcome evidence for IV NAD+ or cocktails.	Present as investigational, not as proven age reversal.

5.9 Patient selection and minimum assessment

The first question is not 'Which drip?' but 'What diagnosis or therapeutic objective is being treated?' The route should then be justified against oral or intramuscular alternatives. Patient selection must be stricter, not looser, when the expected benefit is uncertain. A pre-infusion assessment should identify cardiopulmonary or renal disease, pregnancy or lactation, previous infusion reactions, asthma or mast-cell disorders, medication and supplement use, bleeding risk, glucose-meter dependence, kidney stones, iron overload and relevant genetic or metabolic risks. Laboratory testing should be indication-specific rather than a universal commercial panel. High-dose vitamin C, for example, warrants particular attention to renal function and G6PD status. Informed consent should state the evidence level for the exact indication, alternatives, product status, cost, expected duration, stop rules and material risks. Terms such as detoxification, cellular reset and immune boost should be defined or avoided.

Table 3: Minimum pre-infusion safety checklist

Domain	Required action
Indication	Document diagnosis or measurable objective; record why an IV route is required.
History	Renal/cardiac disease, pregnancy, allergies, stones, iron overload, prior reactions, access problems.
Medication review	Diuretics, antihypertensives, anticoagulants, nephrotoxins, chemotherapy and interacting supplements.
Examination / observations	Hydration, weight when relevant, blood pressure, pulse, temperature, oxygen saturation and vascular access.
Laboratory assessment	Only tests relevant to the agent and indication; consider renal function, electrolytes, glucose and G6PD where appropriate.
Product verification	Licensed/authorized source, correct storage, expiry, lot, integrity, labeling and compatibility.
Consent	Evidence limits, alternatives, potential adverse events, cost and agreed outcome/stop rule.
Emergency readiness	Trained personnel, anaphylaxis protocol, oxygen, resuscitation equipment, transfer pathway and adverse-event reporting.

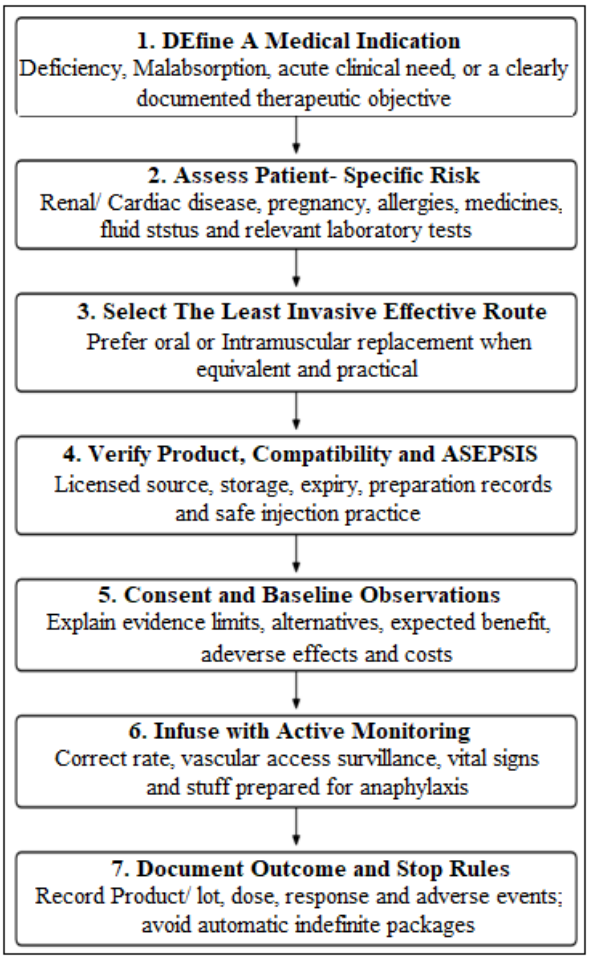

Figure 3: Indication-led patient selection, preparation and monitoring algorithm

5.10 Infusion safety, asepsis and governance

An outpatient infusion service is a medical procedure area, not a hospitality service. Standard precautions, hand hygiene, aseptic medication preparation, single-use devices and correct vial practice are mandatory. The Centers for Disease Control and Prevention emphasizes that a new sterile needle and syringe must be used for every patient and that single-dose containers must not be shared [26]. Infusion standards also require competency assessment, vascular access surveillance, documentation and adverse-event systems [27]. Phlebotomy, outpatient infection prevention and IV medication procedures should follow established best-practice guidance [31]-[33]. Clinic governance should cover procurement, cold chain where applicable, stock rotation, segregation of look-alike products, calculation checks, compatibility references, environmental cleaning, waste disposal and recall procedures. Immediate-use preparation should not become an informal substitute for pharmacy-grade sterile compounding. Aseptic technique cannot correct contaminated source material.

During infusion, staff should confirm patient identity, product, dose, route, rate and allergies; obtain baseline observations; inspect the site; and remain able to recognize early hypersensitivity, extravasation or hemodynamic change. The patient should not be left unattended in a setting without rapid clinical response. Post-infusion instructions should include delayed reaction symptoms and a contact pathway.

5.11 Adverse events and response

Table 4: Principal complications of outpatient IV micronutrient therapy

Complication	Early clues	Immediate response
Infiltration / extravasation	Pain, swelling, coolness, slowing of infusion	Stop infusion, disconnect as appropriate, aspirate if indicated, elevate and manage according to the agent-specific protocol.
Phlebitis	Pain, erythema, warmth, palpable vein	Stop and remove catheter; assess for thrombosis or infection; document and follow up.
Vasovagal episode	Pallor, sweating, nausea, bradycardia, hypotension	Stop procedure, position safely, monitor and exclude anaphylaxis or arrhythmia.
Hypersensitivity / anaphylaxis	Urticaria, wheeze, airway symptoms, hypotension	Stop infusion and activate the emergency protocol; intramuscular adrenaline is first-line for anaphylaxis.
Fluid overload	Dyspnea, crackles, edema, hypertension, reduced oxygen saturation	Stop infusion, provide supportive care and escalate urgently, especially in cardiac/renal disease.
Electrolyte toxicity	Weakness, hypotension, arrhythmia, neurologic change	Stop infusion, monitor ECG and electrolytes, and institute agent-specific emergency management.
Infection / contamination	Local infection, fever, rigors, sepsis	Urgent clinical assessment, cultures and treatment; quarantine product and initiate incident investigation.
Laboratory interference	Discordant point-of-care glucose or other results	Use validated laboratory methods and alert treating teams after high-dose ascorbate.

Documentation should include the exact formulation, manufacturer or compounding source, lot and expiry, diluent, final volume, route, vascular access site, start and finish times, rate, observations, staff, patient response and any intervention. Adverse events should be reported through applicable pharmacovigilance and regulatory pathways. Repeated minor reactions are signals to reassess the indication, not merely to slow the drip indefinitely. Packages that pre-purchase multiple infusions can undermine clinical reassessment. Every repeat session should confirm ongoing indication, benefit, interval events and new medicines. Lack of objective improvement should trigger discontinuation.

5.12 Evidence grading and communication

Evidence communication should be ingredient-specific, route-specific and indication-specific. 'Vitamin C supports collagen' is a biological statement; 'an IV vitamin C infusion rejuvenates skin' is a clinical claim requiring direct trials. 'NAD+ participates in energy metabolism' does not mean an

NAD+ infusion improves energy or lifespan. This distinction should appear in consultations, consent documents, training materials and advertising. Clinics can use a simple evidence label: established, context-dependent, preliminary or unsupported. The label should be reviewed when new evidence or safety communications emerge. Patient testimonials may describe experience but should not be used as proof of causation or to replace adverse-event disclosure. Research priorities include standardized formulations, credible control groups, validated patient-reported and objective outcomes, adequate follow-up, transparent conflicts of interest and active safety surveillance. Aesthetic studies should measure specific endpoints such as colorimetry, transepidermal water loss, validated skin-quality scales or procedure recovery time rather than vague terms such as glow.

6. Conclusion

IV micronutrient therapy spans a wide spectrum, from evidence-based replacement to commercially promoted enhancement. The route is appropriate when a documented deficiency, malabsorption, acute clinical need or validated treatment protocol justifies rapid or reliable systemic delivery. It is not automatically superior for a nutrient-replete person simply because bioavailability is higher. For aesthetic and preventive practice, evidence for routine skin rejuvenation, nonspecific fatigue, immune enhancement, detoxification and longevity remains limited. IV glutathione should not be recommended as a routine skin-lightening treatment, and IV NAD+ remains investigational for anti-ageing or wellness. Multinutrient cocktails require better controlled trials. The defensible model is indication-led, patient-specific and safety-governed: diagnose first, choose the least invasive effective route, verify products and compatibility, obtain evidence-calibrated consent, use strict asepsis, monitor actively and stop treatment that does not produce a meaningful outcome. This approach protects patients while allowing legitimate research and carefully selected clinical use to develop.

7. Future Scope

Future research should move from branded cocktails toward reproducible interventions. Multicenter randomized trials should specify formulation, dose, infusion rate, comparator and clinically important outcomes. Studies in aesthetic medicine require objective imaging or biophysical measurements and sufficient follow-up to separate hydration effects from durable tissue change. Biomarker-guided treatment may improve precision, but biomarkers must be clinically validated and linked to outcomes. Digital monitoring, standardized registries and interoperable adverse-event reporting could identify safety signals earlier. Pharmacokinetic studies should be paired with pharmacodynamic and patient-centered endpoints rather than being presented as efficacy studies. Professional education should integrate venous access, sterile preparation, emergency medicine, evidence appraisal, consent and advertising ethics. The future of IV medicine will be credible only when innovation is matched by the same governance expected for any invasive medical therapy.

Declarations

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References

[1] Sun H, Wang Y, et al. Vitamin C pharmacokinetics: implications for oral and intravenous use. Ann Intern Med. 2004;140(7):533-537. doi:10.7326/0003-4819-140-7-200404060-00010.
[2] Levine M, Conry-Cantilena C, Wang Y, et al. Vitamin C pharmacokinetics in healthy volunteers: evidence for a recommended dietary allowance. Proc Natl Acad Sci U S A. 1996;93(8):3704-3709. doi:10.1073/pnas.93.8.3704.
[3] Chen Q, Polireddy K, Chen P, et al. Pharmacokinetic evaluation of intravenous vitamin C in healthy volunteers and cancer participants. Clin Pharmacokinet. 2022;61(9):1237-1249. doi:10.1007/s40262-022-01142-1.
[4] Pullar JM, Carr AC, Vissers MCM. The roles of vitamin C in skin health. Nutrients. 2017;9(8):866. doi:10.3390/nu9080866.
[5] Carr AC, Maggini S. Vitamin C and immune function. Nutrients. 2017;9(11):1211. doi:10.3390/nu9111211.
[6] Gombart AF, Pierre A, Maggini S. A review of micronutrients and the immune system-working in harmony to reduce the risk of infection. Nutrients. 2020;12(1):236. doi:10.3390/nu12010236.
[7] Ali A, Njike VY, Northrup V, et al. Intravenous micronutrient therapy (Myers' cocktail) for fibromyalgia: a placebo-controlled pilot study. J Altern Complement Med. 2009;15(3):247-257. doi:10.1089/acm.2008.0410.
[8] Gaby AR. Intravenous nutrient therapy: the 'Myers' cocktail'. Altern Med Rev. 2002;7(5):389-403.
[9] Massey PB. Reduction of fibromyalgia symptoms through intravenous nutrient therapy: results of a pilot clinical trial. Altern Ther Health Med. 2007;13(3):32-34.
[10] Miller AC, Pimentel L, Moledina DG, et al. Intravenous magnesium sulfate to treat acute headaches in the emergency department: a systematic review. Headache. 2019;59(10):1674-1686. doi:10.1111/head.13648.
[11] Chiu HY, Yeh TH, Huang YC, Chen PY. Effects of intravenous and oral magnesium on reducing migraine: a meta-analysis of randomized controlled trials. Pain Physician. 2016;19(1): E97-E112.
[12] Galvin R, Brathen G, Ivashynka A, et al. EFNS guidelines for diagnosis, therapy and prevention of

Wernicke encephalopathy. Eur J Neurol. 2010;17(12):1408-1418. doi:10.1111/j.1468-1331.2010.03153.x.
[13] Vanek VW, Borum P, Buchman A, et al. A.S.P.E.N. position paper: recommendations for changes in commercially available parenteral multivitamin and multi-trace element products. Nutr Clin Pract. 2012;27(4):440-491. doi:10.1177/0884533612446706.
[14] Jin J, Mulesa L, Carrilero Rouillet M. Trace elements in parenteral nutrition: considerations for the prescribing clinician. Nutrients. 2017;9(7):653. doi:10.3390/nu9070653.
[15] Almohanna HM, Ahmed AA, Tsatalis JP, Tosti A. The role of vitamins and minerals in hair loss: a review. Dermatol Ther (Heidelb). 2019;9(1):51-70. doi:10.1007/s13555-018-0278-6.
[16] Sonthalia S, Daulatabad D, Sarkar R. Glutathione as a skin whitening agent: facts, myths, evidence and controversies. Indian J Dermatol Venereol Leprol. 2016;82(3):262-272. doi:10.4103/0378-6323.179088.
[17] Davids LM, van Wyk J, Khumalo NP. Intravenous glutathione for skin lightening: inadequate safety data. S Afr Med J. 2016;106(8):782-786. doi:10.7196/SAMJ.2016.v106i8.10878.
[18] Sonthalia S, Jha AK, Lallas A, Jain G, Jakhar D. Glutathione for skin lightening: a regnant myth or evidence-based verity? Dermatol Pract Concept. 2018;8(1):15-21. doi:10.5826/dpc.0801a04.
[19] Sitohang IBS, Farida S, Fajriyah SN. Systemic glutathione as a skin-whitening agent in adults. J Clin Aesthet Dermatol. 2020;13(4):21-28.
[20] Grant R, Berg J, Mestayer R, et al. A pilot study investigating changes in the human plasma and urine NAD+ metabolome during a 6- hour intravenous infusion of NAD+. Front Aging Neurosci. 2019; 11: 257. doi:10.3389/fnagi.2019.00257.
[21] Radenkovic D, Reason, Verdin E. Clinical evidence for targeting NAD therapeutically. Pharmaceuticals (Basel). 2020;13(9):247. doi:10.3390/ph13090247.
[22] Covarrubias AJ, Perrone R, Grozio A, Verdin E. NAD+ metabolism and its roles in cellular processes during ageing. Nat Rev Mol Cell Biol. 2021;22(2):119-141. doi:10.1038/s41580-020-00313-x.
[23] Reyna K, Heinzen G, Patel N, Ritter M, Siojo A, Legere H, Pojednic R. Intravenous infusion of nicotinamide adenine dinucleotide (NAD+) versus nicotinamide riboside (NR): a retrospective tolerability pilot study in a real-world setting. Front Aging. 2026; 7: 1652582. doi:10.3389/fragi.2026.1652582.
[24] Gallagher C, Emmanuel OO. NAD+ supplementation for anti-aging and wellness: a PRISMA-guided systematic review of preclinical and clinical evidence. Ageing Res Rev. 2026; 116: 103057. doi: 10.1016/j.arr.2026.103057.
[25] US Food and Drug Administration. FDA reminds compounders to use ingredients suitable for sterile compounding. Silver Spring, MD: FDA; October 30, 2024. Accessed June 30, 2026.
[26] Centers for Disease Control and Prevention. Preventing unsafe injection practices. Atlanta, GA: CDC; updated March 26, 2024. Accessed June 30, 2026.
[27] Gorski LA, Hadaway L, Hagle ME, et al. Infusion therapy standards of practice, 8th edition. J Infus Nurs. 2021;44(1S Suppl 1):S1-S224. doi:10.1097/NAN.0000000000000396.
[28] National Cancer Institute. Intravenous vitamin C (PDQ): health professional version. Bethesda, MD: National Cancer Institute; updated periodically. Accessed June 30, 2026.
[29] Padayatty SJ, Sun AY, Chen Q, Espey MG, Drisko J, Levine M. Vitamin C: intravenous use by complementary and alternative medicine practitioners and adverse effects. PLoS One. 2010;5(7):e11414. doi:10.1371/journal.pone.0011414.
[30] National Institute for Health and Care Excellence. Vitamin B12 deficiency in over 16s: diagnosis and management. NICE guideline NG239. London: NICE; 2024.
[31] World Health Organization. WHO guidelines on drawing blood: best practices in phlebotomy. Geneva: World Health Organization; 2010.
[32] Centers for Disease Control and Prevention. Guide to infection prevention for outpatient settings: minimum expectations for safe care. Atlanta, GA: CDC; 2016.
[33] Institute for Safe Medication Practices. ISMP safe practice guidelines for adult IV push medications. Horsham, PA: ISMP; 2015.

Author Profile

Dr. Pruthvi Vaity is an aesthetic physician and medical educator based in Mumbai, India. His clinical and teaching interests include aesthetic medicine, metabolic medicine, regenerative approaches and patient-safety systems for outpatient intravenous & regenerative therapies.