

Korean Society for Health Promotion and Disease Prevention

2020년 대한임상건강증진학회 동계학술대회

2020. 12. 6 (일)

흔한 증상 및 질환에 대한 경정맥 영양치료

김 규 남 (아주대의대)




Agenda

- IVNT rationale
- 증상 또는 질환별 IVNT
- 개인별 필요한 영양소 평가
- 케이스

Definition

- **INTRAVENOUS NUTRITIONAL THERAPY(IVNT)?**

-  **Vitamins, minerals, amino acids and other nutrients delivered directly into the circulation going to all parts of the body within seconds.**

IVNT rationale

- One national survey conducted between 2003 and 2006 which assessed 16 thousand Americans and 19 micronutrients
 - The US adult population has depleted levels of essential vitamins and minerals ranging from Vitamin B6 and niacin to copper, selenium and vitamins A, C, D, and E.
- These deficiencies can lead to
 - increased inflammation, surgical complications, decreased immunity and impacted post-surgery recovery.
 - contribute to rising levels of chronic disease.
 - ☞ According to the Center for Disease Control (CDC), over half of the US population in 2012 suffered from one or more chronic conditions such as diabetes and obesity, while over 50 million Americans suffered from an autoimmune disease.

현대사회에서 영양 불균형이 생기는가?

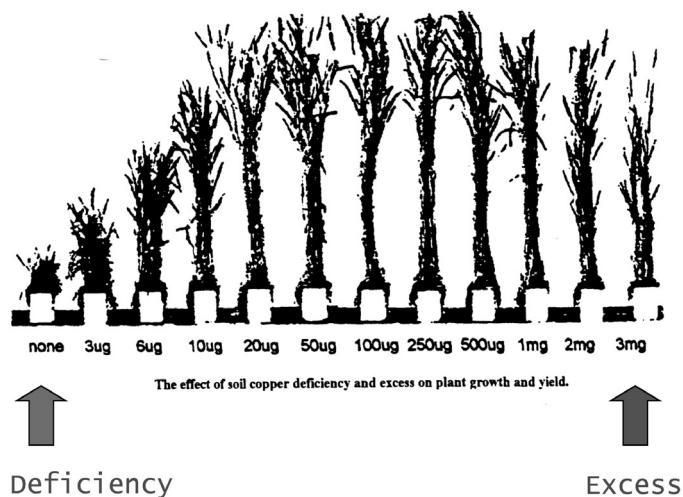


IVNT rationale

- 대기오염, 자동차 배기 가스, 각종 공해물질
- 각종 식품첨가물, 중금속, 환경호르몬
- 흡연, 음주, 과로, 스트레스
- 카페인, 청량음료
- 노화; 음식 섭취량이 줄고 소화 흡수능력 감소
- 각종 약물; 비타민 미네랄의 흡수 방해
- 현대인들이 섭취하는 채소, 과일의 영양소 함량 미달
- 50년 전에 비해 채소의 비타민과 미네랄 손실량은 20-30%, 심지어 50%에 이른다는 보고
- 도정한 곡물, 세척, 가공 ; 90%까지 영양소 파괴

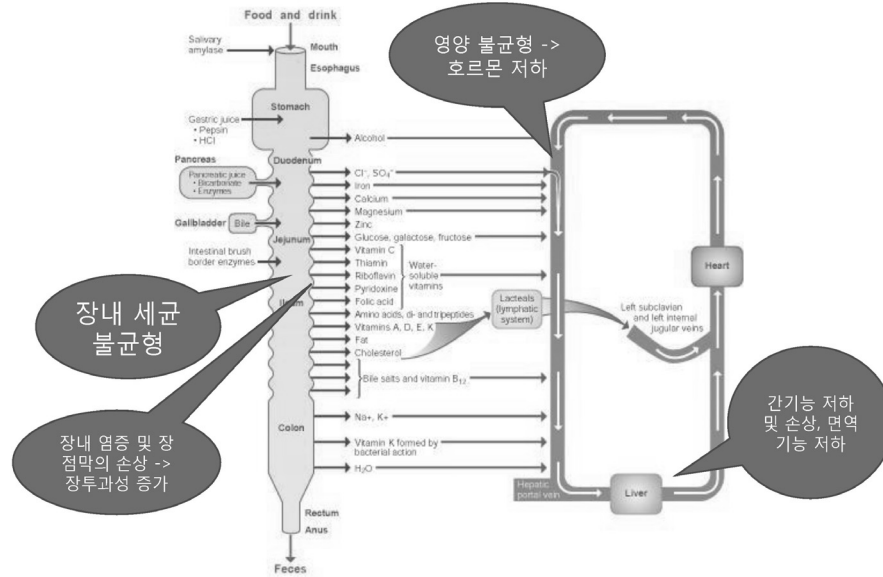
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Deficiency/Excess mineral Imbalance



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영양 불균형의 원인



Sites of Secretion and Absorption into Gastrointestinal Tract

Carbohydrate

glucose

pyridoxin

Fat

triglyceride

Niacin

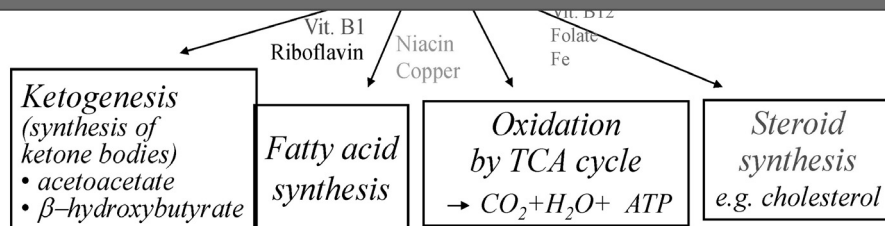
Protein

Amino acids
(ketogenic)

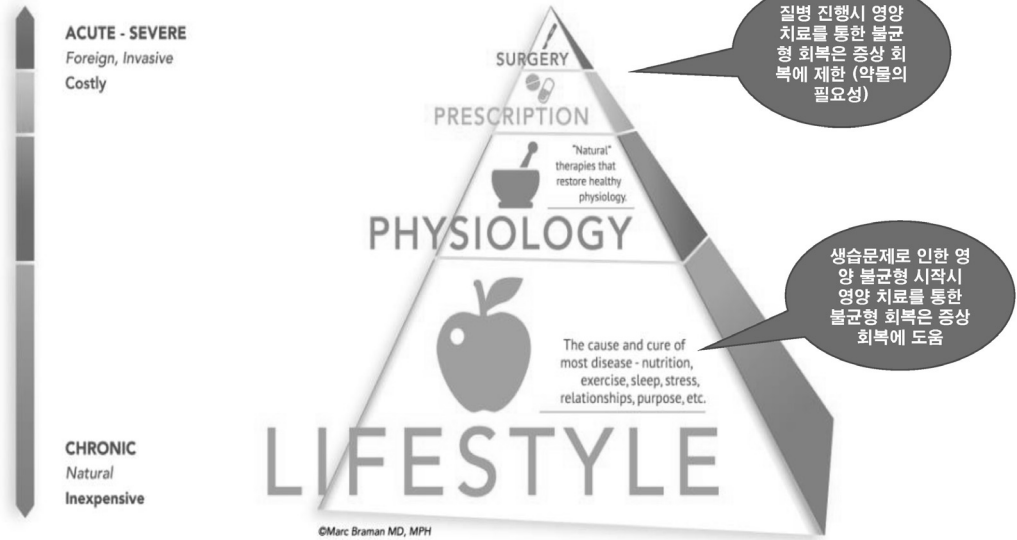
Niacin

Pyridoxin

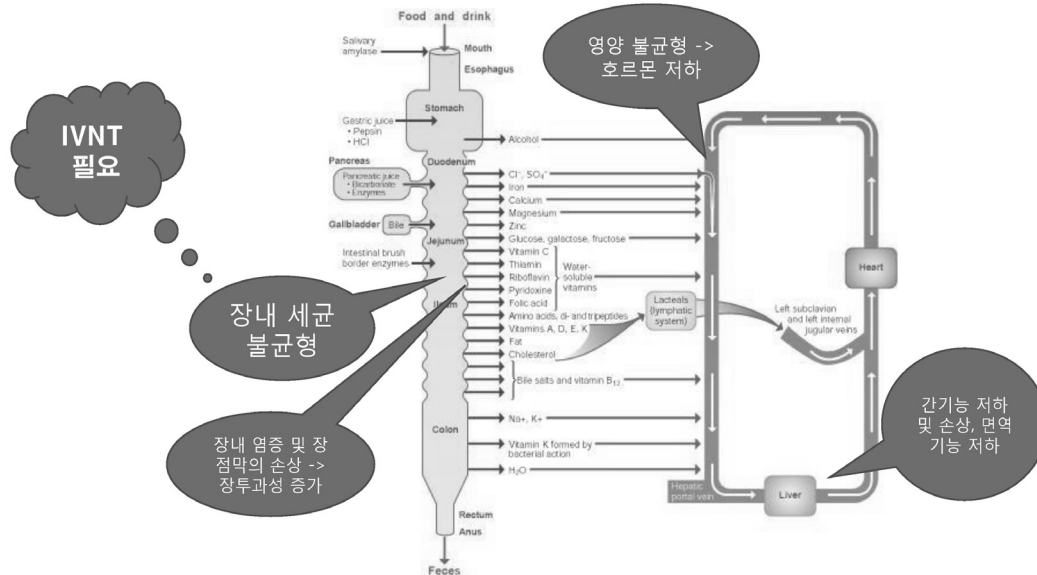
체내 내/외부의 스트레스 및 독소는 세포내에서 이에 대응하기 위한 호르몬이나 항산화 물질을 만들면서 조효소인 영양소들을 소모시킴.



WHOLE HEALTH - TREATMENT



IVNT rationale



Sites of Secretion and Absorption into Gastrointestinal Tract

증상 또는 질환별 IVNT

Indications

- Adrenal Fatigue/Stress
- Chronic Fatigue Syndrome
- Migraine
- Fibromyalgia
- 알레르기 질환
- Toxic hepatitis
- Toxic heavy metal
- Weak Immune Response

Contraindications

- Allergy to a nutrients; impossible
- Severe red cell fragility disorders that present a theoretical risk with hypotonic solutions
 - Thalassemia Major
 - Sickle cell anemia
 - G6PD deficiency

Safe Osmolarity Limits

- IV Push (mOsm/ml)
 - Large vein 1.40
 - Medium vein 0.950
 - Any vein 0.400
- IV Infusion (mOsm/ml)
 - Large vein 1.20
 - Medium vein 0.700
 - Any vein 0.400
- The longer the infusion and the smaller the vein, the more conservative you should be with the osmolarity

Adverse Reactions

- Anaphylaxis; theoretically possible
 - You need to be equipped to treat it
- Sepsis from contaminated solutions
 - Usually seen as chills during the infusion
- Urticaria
- Vasovagal reactions
 - Careful with any IV 'push' containing Mg
 - Can be a cause of fainting, by far most common reaction you will see

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만성 피로의 기능의학적 접근

- 피로 : 생체에서 에너지 불균형을 가장 잘 나타내는 기본적 지표 -

영양소들의 소모 및 체내 흡수 감소는 궁극적으로 세포내의 에너지 생성장소인 미토콘드리아에서의 ATP생성을 저하시킴



Int J Clin Exp Med (2009) 2, 1-16
www.ijcem.com/IJCEM812001

Original Article

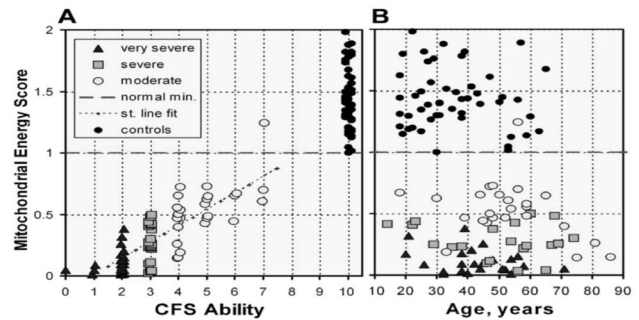
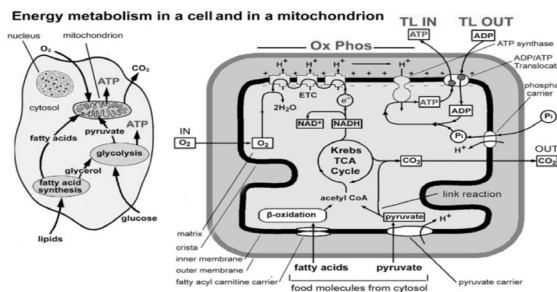
Chronic fatigue syndrome and mitochondrial dysfunction

Sarah Myhill¹, Norman E. Booth², John McLaren-Howard³

¹Sarah Myhill Limited, Llangunllo, Knighton, Powys, Wales LD7 1SL, UK; ²Department of Physics and Mansfield College, University of Oxford, Oxford OX1 3RH, UK; ³Acumen, PO Box 129, Tiverton, Devon EX16 0AJ, UK

Received December 2, 2008; accepted January 12, 2009; available online January 15, 2009

- The “ATP profile” test yields 5 independent numerical factors from 3 series of measurements, (A), (B), and (C) on blood samples (neutrophils).



Vitamin C

- **Highest concentrations in the cortex and the medulla of the adrenal gland.**
- **It is a cofactor in the production of both catecholamines and adrenal steroids.**
- **↓ oxidative stress upon the mitochondria**
- **↓ electron leakage which has been associated with fibromyalgia & CFS**

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Intravenous Vitamin C administration reduces fatigue in office workers: a double-blind randomized controlled trial

Sang-Yeon Suh^{1,2}, Woo Kyung Bae³, Hong-Yup Ahn⁴, Sung-Eun Choi⁵, Gyou-Chul Jung⁶ and Chang Hwan Yeom^{7*}

Table 2 Comparison of fatigue, plasma vitamin C levels, and oxidative stress between the two groups

	Vitamin C Group (n = 70)			Placebo Group (n = 71)			p value [‡]
	Baseline	2 hours after intervention	1 day after intervention	Baseline	2 hours after intervention	1 day after intervention	
Fatigue (right now)*	5.64 ± 2.02	5.10 ± 2.04	4.97 ± 2.33	5.54 ± 2.07	5.31 ± 2.00	5.66 ± 2.16	0.004
Usual fatigue during the previous 24 hours	5.59 ± 1.56	-	5.37 ± 2.06	5.77 ± 1.73	-	5.55 ± 1.79	0.870
Worst fatigue during the previous 24 hours	7.16 ± 1.83	-	6.47 ± 2.13	7.14 ± 1.77	-	6.82 ± 1.97	0.202
Plasma vitamin C level (µmol/l)	12.66 ± 6.50	267.90 ± 141.83	-	12.13 ± 4.99	12.52 ± 5.70	-	< 0.001
Oxidative stress (nmol/dl H ₂ O ₂) [†]	311.76 ± 74.15	184.46 ± 59.41	296.11 ± 64.37	310.89 ± 74.90	327.21 ± 78.80	303.72 ± 81.26	< 0.001

*Fatigue was measured using a numeric rating scale 0-10.

[†]Oxidative stress was measured using the Free Oxygen Radicals Test (FORT).

[‡]p value from ANCOVA.

- **A group of 141 healthy (aged 20 to 49 years)**
- **10 grams of vitamin C with normal saline intravenously**
- **intravenous vitamin C reduced fatigue at two hours, and the effect persisted for one day.**

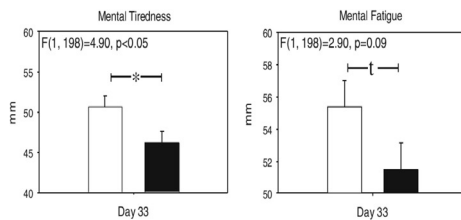
Nutr J. 2012 Jan 20;11:7.

Effects of high-dose B vitamin complex with vitamin C and minerals on subjective mood and performance in healthy males

David O. Kennedy • Rachel Veasey • Anthony Watson •
Fiona Dodd • Emma Jones • Silvia Maggini •
Crystal F. Haskell

- Randomised, placebo-controlled, double-blind, parallel groups trial
- Cognitive & mood effects of High-dose B-complex vitamin & mineral
- 215 males
- 33-day treatment period

- The multi-vitamin/mineral Tablets
- B1 (15 mg),
- B2 (15 mg),
- B6 (10 mg),
- B12 (10 mcg),
- C (500 mg),
- biotin (150 mcg),
- folic acid (400 mcg),
- Nicotinamide (50mg)
- pantothenic acid (23 mg)
- minerals: calcium (100 mg), magnesium (100 mg) and zinc (10 mg).



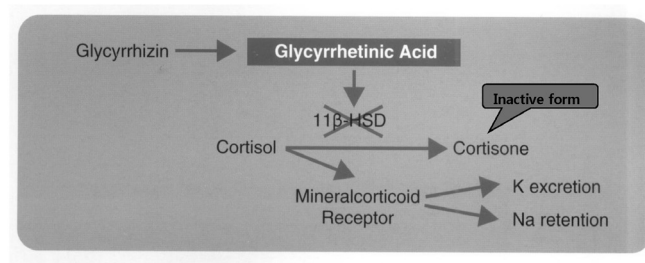
Psychopharmacology (Berl). 2010 Jul;211(1):55-68. Epub 2010 May 8.

Glycyrrhizic acid

- Component of licorice root
- Reduce AST, ALT in serum
- Inhibits immune-mediated cytotoxicity against hepatocytes and NF-kappa B
- powerful antiviral effects particularly against hepatitis C
- Lower estrogen, raise progesterone
- aldosterone-like effects
 - Licorice root >3g/d or glycyrrhizin acid >100mg/d, >6 weeks
 - Na and water retention, HTN, hypokalemia, renin-aldosterone inhibition
 - BP, electrolyte monitoring
 - Recommend potassium intake

Glycyrrhizic acid for adenal function

- Inhibit dehydrogenation of cortisol
- Prolong the life of progesterone, exert a weak amphoteric estrogenic action and improve general gonadotropic rhythms in body



Korean Integrative Medicine Institute 14th International Symposium on Functional Medicine

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Glycyrrhizic acid for adenal function

- Supports the adrenal gland
- ↑ cortisol availability
- Effects of glucocorticoids & mineralocorticoids by slowing the rate of their catabolism

Arzneimittelforschung 1979;29(94):647-649
Clin Sci(Colch)2002;102:203-211

Endocrinol Jpn 1990;37:331-341
Arzneimittelforschung 1979;29(94):647-649
J Clin Endocrinol Metab 1956;16:338-349
Endocrinol Jpn 1957;4:17-27

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Magnesium

- A cofactor for most enzymatic activity in the body
- Essential for metabolism of carbohydrates and protein
- Regulate the acid-base balance
- Regulate calcium and potassium uptake and balance – maintains vascular tension
- Act as a potent vasodilator
 - ☞ Lowers BP – careful !!

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Migraine

- Beneficial effect of IVNT in treatment of migraine has been demonstrated in some clinical trials

1. Mauskop A, Altura BT, Cracco RQ, Altura BM. Intravenous magnesium sulphate relieves migraine attacks in patients with low serum ionized magnesium levels: a pilot study. Clin Sci 1995;89:633-636.
2. (29.) Demirkaya S, Vural O, Dora B, Topcuoglu MA. Efficacy of intravenous magnesium sulfate in the treatment of acute migraine attacks. Headache 2001;41: 171-177.
3. (30.) Mauskop A, Altura BT, Cracco RQ, Altura BM. Intravenous magnesium sulfate relieves cluster headaches in patients with low serum ionized magnesium levels. Headache 1995;35:597-600.

Meta-Analysis

Effects of Intravenous and Oral Magnesium on Reducing Migraine: A Meta-analysis of Randomized Controlled Trials

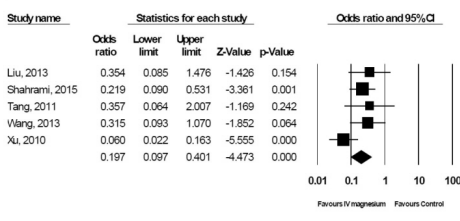
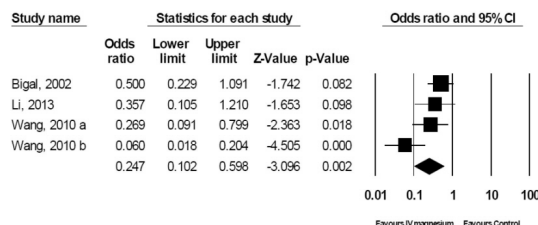
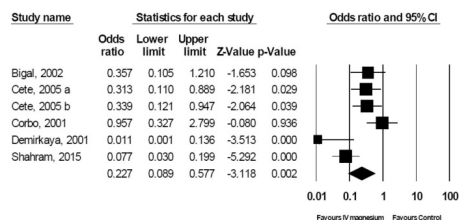
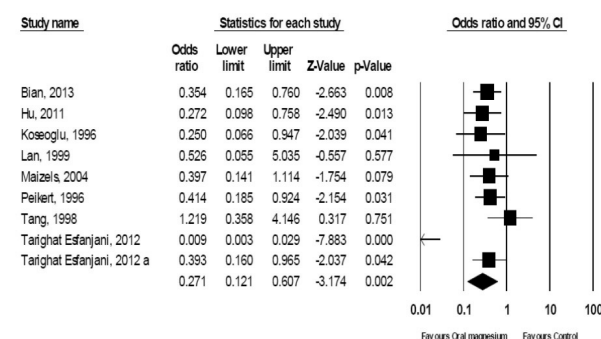
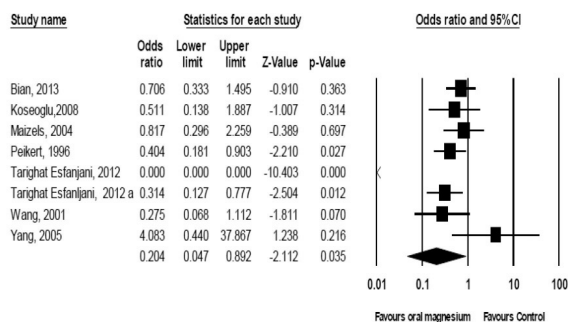


Fig. 3. Forest plots for studies measuring the effect of intravenous magnesium on acute migraine attacks in the time frames of 15–45 min (A), 120 min (B), and (C) 24 h (D) following the initial infusion.

Chiu HY et al. Pain Physician. 2016 Jan;19(1):E97-112.



Forest plot for studies measuring the frequency of migraine (A), and the intensity of migraine (B).

We confirmed that intravenous magnesium has beneficial effects in relieving acute migraine attacks and that oral magnesium supplements alleviate the frequency and intensity of migraine. Thus, we suggest that intravenous and oral magnesium should be considered as adjunctive therapies for managing acute migraine attacks and the prophylaxis of migraines, respectively.

Chiu HY et al. Pain Physician. 2016 Jan;19(1):E97-112.

A double-blinded randomised controlled study of the value of sequential intravenous and oral magnesium therapy in patients with chronic low back pain with a neuropathic component

A. A. Yousef¹ and A. E. Al-deeb²

- Evaluated the therapeutic role of sequential intravenous and oral magnesium therapies in patients with chronic low back pain with a neuropathic component.
- Design
 - All patients
 - ☞ Received gabapentin 300mg orally three times daily, amitriptyline hydrochloride 25 mg orally at bedtime, and, celecoxib 200mg orally twice daily.
 - The 40 patients in the treatment (magnesium) group
 - ☞ iv infusion of magnesium sulphate 1g in 250ml saline 0.9% for 2 weeks.
 - ☞ after 2 weeks, the infusion was replaced by oral magnesium therapy twice daily for 4 weeks using capsules containing magnesium oxide 400mg and magnesium gluconate 100mg.

Anaesthesia. 2013 Mar;68(3):260-6.

Table 2 Comparison of Numeric Rating Scale pain scores for patients in the control and magnesium groups. Values are mean (SD).

	Control	Magnesium	p value		
			Between groups	Within control group	Within magnesium group
Pre-treatment	7.4 (2.4)	7.5 (2.2)	0.62		
2 weeks	3.6 (1.4)	3.4 (1.15)	0.28	0.036	0.022
6 weeks	6.6 (1.7)	3.9 (1.4)	0.003	0.26	0.029
3 months	6.8 (2.2)	4.4 (1.6)	0.045	0.51	0.016
6 months	7.2 (2.45)	4.7 (1.8)	0.027	0.25	0.034

Our findings show that a 2-week intravenous magnesium infusion followed by 4 weeks of oral magnesium supplementation can reduce pain intensity and improve lumbar spine mobility during a 6-month period in patients with refractory chronic low back pain with a neuropathic component.

Anaesthesia. 2013 Mar;68(3):260-6.

original research

REDUCTION OF FIBROMYALGIA SYMPTOMS THROUGH INTRAVENOUS NUTRIENT THERAPY: RESULTS OF A PILOT CLINICAL TRIAL

Patrick B. Massey, MD, PhD

- There is anecdotal evidence that a specific combination of both intravenous vitamins and minerals (modified Myers' formula) may reduce pain and increase energy in patients with FM.
- However, documentation of any benefit of this specific intravenous nutrient combination, for any medical condition, is limited to a clinical report of intravenous nutrient therapy.

Altern Ther Health Med. 2007 May-Jun;13(3):32-4.

- Seven women between the ages of 38 and 65 with a diagnosis of therapy-resistant FM

TABLE Modified Myers' Intravenous Nutrient Formula

Vitamin/Mineral	Dose
Magnesium chloride hexahydrate	400 mg
Calcium gluconate	40 mg
Vitamin C	3000 mg
Hydroxocobalamin (B ₁₂)	1,000 µg
Pyridoxine hydrochloride (B ₆)	100 mg
Dexpanthenol (B ₅)	250 mg
Riboflavin (B ₂)	2 mg
Thiamine (B ₁)	100 mg
Niacinamide	100 mg

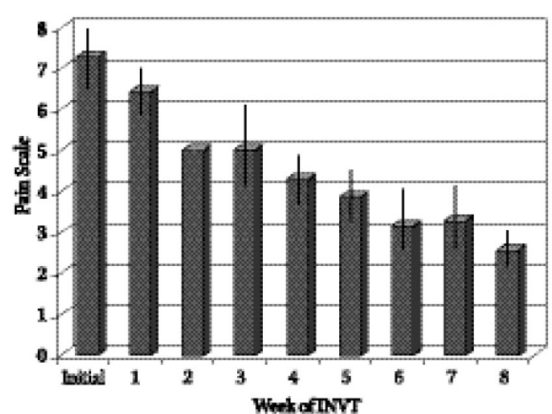


FIGURE 1 Pain Levels Initially and During Intravenous Nutrient Therapy

Weekly averaged pain levels of participants initially and during INVT. Pain levels were measured using a numeric analog pain scale (0=no pain, 10=severe pain). Significant improvement in pain from initial assessment to week 8 ($P=.005$; t test).

Altern Ther Health Med. 2007 May-Jun;13(3):32-4.

본원 IVNT formular for fatigue

Mega C	10g
Mg	2g
B-com	2ml
B5	2g
B12	2.5mg
Kyominotin (Glycyrrhizic acid (106mg) + glycine 800mg)	40ml
Thiamine	50mg
Water	250ml

구리 축적

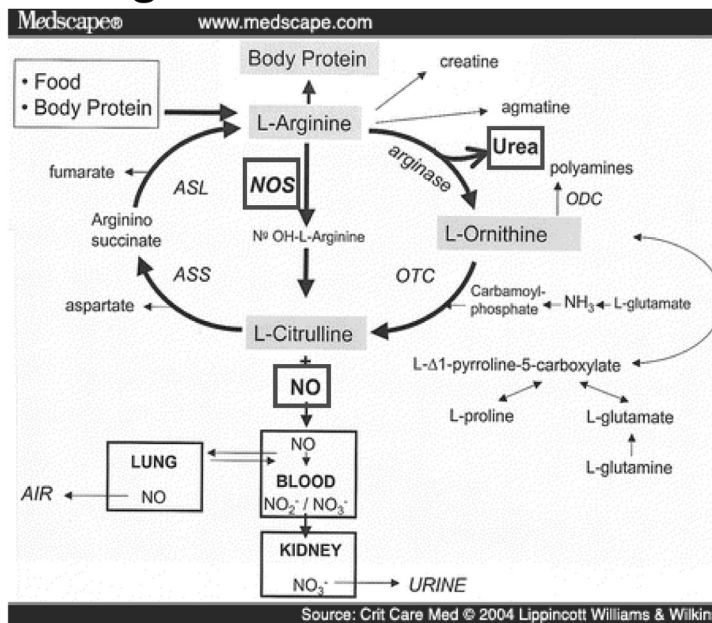
- 태반을 통해 구리가 높은 엄마에서 자식으로의 유입
- 변비
- 스트레스: 아연을 떨어뜨림
- 채식주의자
- 증상 : 멍 잘 듦, 알레르기 질환, 손톱 깨짐, 모발 빠짐.

Table 3. Pharmacological Therapy for Wilson Disease

Drug	Mode of Action	Neurological Deterioration	Side Effects	Comments
D-Penicillamine	General chelator induces cupruria	10%-20% during initial phase of treatment	<ul style="list-style-type: none"> Fever, rash, proteinuria, lupus-like reaction Aplastic anemia Leukopenia Thrombocytopenia Nephrotic syndrome Degenerative changes in skin Elastosis perforans serpiginosa Serous retinitis Hepatotoxicity 	<p>Reduce dose for surgery to promote wound-healing and during pregnancy</p> <p>Maximum dose 20 mg/kg/day; reduce by 25% when clinically stable</p>
Trientine	General chelator induces cupruria	10%-15% during initial phase of treatment	<ul style="list-style-type: none"> Gastritis Aplastic anemia rare Sideroblastic anemia 	<p>Reduce dose for surgery to promote wound-healing and during pregnancy</p> <p>Maximum dose 20 mg/kg/day; reduce by 25% when clinically stable</p>
Zinc	Metallothionein inducer, blocks intestinal absorption of copper	Can occur during initial phase of treatment	<ul style="list-style-type: none"> Gastritis; biochemical pancreatitis Zinc accumulation Possible changes in immune function 	<p>No dosage reduction for surgery or pregnancy</p> <p>Usual dose in adults: 50 mg elemental Zn three times daily; minimum dose in adults: 50 mg elemental Zn twice daily</p>
Tetrathiomolybdate	Chelator, blocks copper absorption	Reports of rare neurologic deterioration during initial treatment	<ul style="list-style-type: none"> Anemia; neutropenia Hepatotoxicity 	Experimental in the United States and Canada

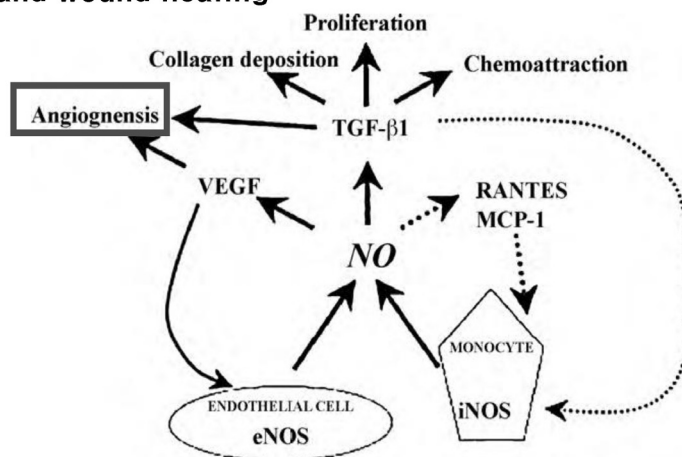
Roberts EA, Schilsky ML; American Association for Study of Liver Diseases (AASLD). Diagnosis and treatment of Wilson disease: an update. *Hepatology*. 2008;47(6):2089-2111.

Overview of arginine metabolism



The clinical pharmacology of l-arginine

• l-Arginine and wound healing



Journal of Advanced Research (2010) 1, 169-177



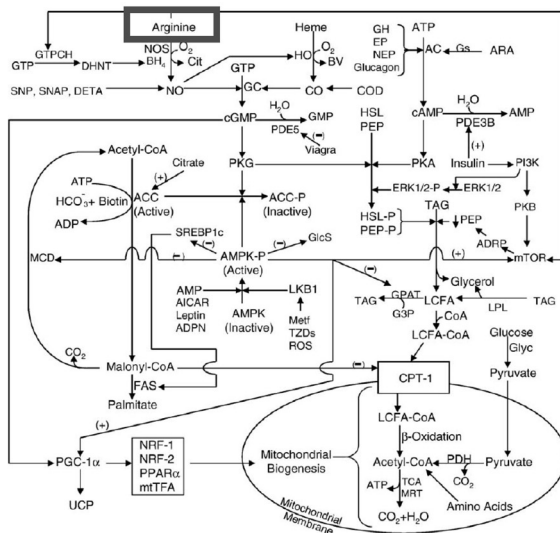
Available online at www.sciencedirect.com
ScienceDirect

Journal of Nutritional Biochemistry 17 (2006) 571-588

REVIEWS: CURRENT TOPICS

Regulatory role for the arginine-nitric oxide pathway in metabolism of energy substrates

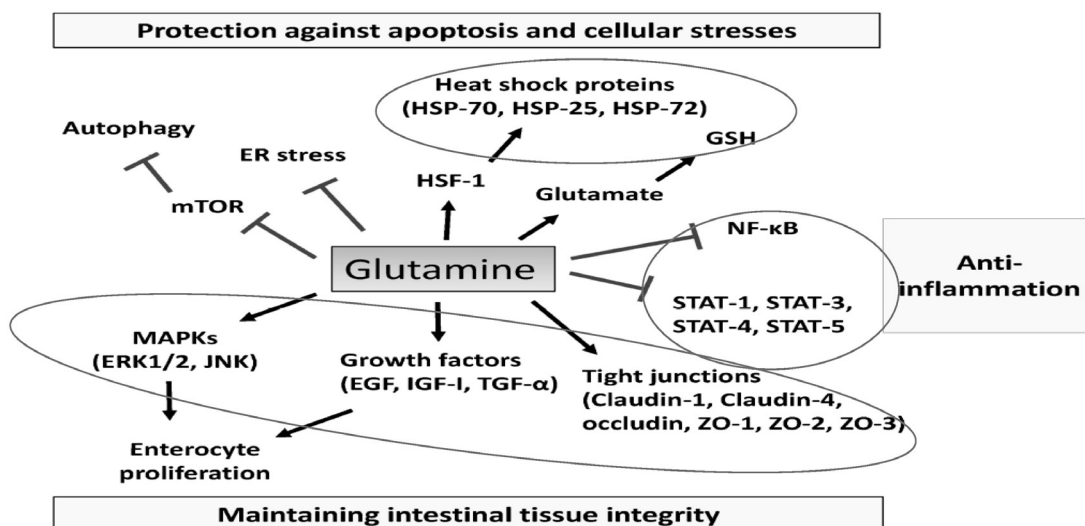
Wenjuan Shi Jobgen^a, Susan K. Fried^b, Wenjiang J. Fu^c, Cynthia J. Meininger^d, Guoyao Wu^{a,b,d,e}



Indication of arginine

1. The observed safe level for oral administration of Arg is ~20 g/d, but higher levels have been tested in short-term studies without serious adverse effects
2. 피로를 호소하는 환자에서 암모니아 제거능력이(유기산 검사) 부족한 경우.
3. 장점막 손상 (장투과성 증가)
4. 산화 스트레스가 증가한 경우
5. 손발이 찬 경우 및 대사적으로 살이 잘 안 빠지는 경우
6. 발기부전

Repair : 글루타민



mitogen-activated protein kinases (MAPKs), transforming growth factor (TGF)-α, epidermal growth factor (EGF), zonula occludens (ZO), signal transducers and activators of transcription (STAT)

The Roles of Glutamine in the Intestine and Its Implication in Intestinal Diseases. Int. J. Mol. Sci. 2017

Repair : 글루타민

- ✓ 글루타민은 신체에 가장 많은 아미노산이며, 인체에서 생합성 된다.
- ✓ 1) 장점막 세포, 면역 세포의 주요 대사 에너지원이며,
2) 항산화 작용을 하는 글루타치온의 전구체,
3) 신장에서 산-염기 평형 유지 → 체내 항상성 유지
4) 질소평형유지 → 근육 성장과 회복 도움을 줌
- ✓ 스트레스 상황(격렬한 운동, 다양한 질환 등) 에서 결핍이 발생되고
이로 인해 근육생성이 억제되고, 장점막 위축 및 면역세포 활성 억제
→ General condition 저하
- ✓ 글루타민은 장누수 증후군 및 이화상태 환자에게 필요한 "조건부 필수아미노산".

0148-8071/02/2704-0241\$03.00/0
JOURNAL OF PARENTERAL AND ENTERAL NUTRITION
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Vol. 27, No. 4
Printed in U.S.A.

Original Communications

The following article is one of two articles offered for continuing education credit in this issue. Please see page 304 for details.

The Effect of Supplemental Enteral Glutamine on Plasma Levels, Gut Function, and Outcome in Severe Burns: A Randomized, Double-Blind, Controlled Clinical Trial

Ye-Ping Zhou, MD[†]; Zhu-Ming Jiang, MD^{*}; Yong-Hua Sun, MD[†]; Xiu-Rong Wang^{*}; En-Ling Ma, MD^{*}; and Douglas Wilmore, MD[‡]

From the ^{*}Departments of Surgery, Peking Union Medical College Hospital, and the [†]Beijing Burns Institute, Beijing, China, and the [‡]Brigham and Women's Hospital, Boston, MA

TABLE II
Plasma glutamine concentration, $\mu\text{M/L}$

	Control group (n = 20)	Gln group (n = 20)	p value
PBD +1	381.1 \pm 36.4	357.5 \pm 55.4	.18
PBD +12	399.7 \pm 40.6	591.0 \pm 74.5	.048

postburn day (PBD)

TABLE III
 L/M ratio

	Control group (n = 20)	Gln group (n = 20)	p value
PBD +1	0.221 \pm 0.169	0.268 \pm 0.202	.538
PBD +3	0.049 \pm 0.016	0.025 \pm 0.008	.001
PBD +6	0.051 \pm 0.013	0.018 \pm 0.003	.034
PBD +12	0.036 \pm 0.021	0.018 \pm 0.013	.23

TABLE IV
Endotoxin concentration, EU/mL

	Control group (n = 20)	Gln group (n = 20)	p value
PBD +1	0.089 \pm 0.023	0.103 \pm 0.037	.27
PBD +3	0.107 \pm 0.038	0.061 \pm 0.017	.021
PBD +6	0.166 \pm 0.013	0.145 \pm 0.016	.18
PBD +12	0.155 \pm 0.035	0.162 \pm 0.032	.35

- Enteral glutamine supplementation improved gut permeability, and initially decreased plasma endotoxin levels in severely thermally injured patients.

Product Information



“ 디펩티벤 주 ” 국내 유일의 비급여 글루타민 단독제제

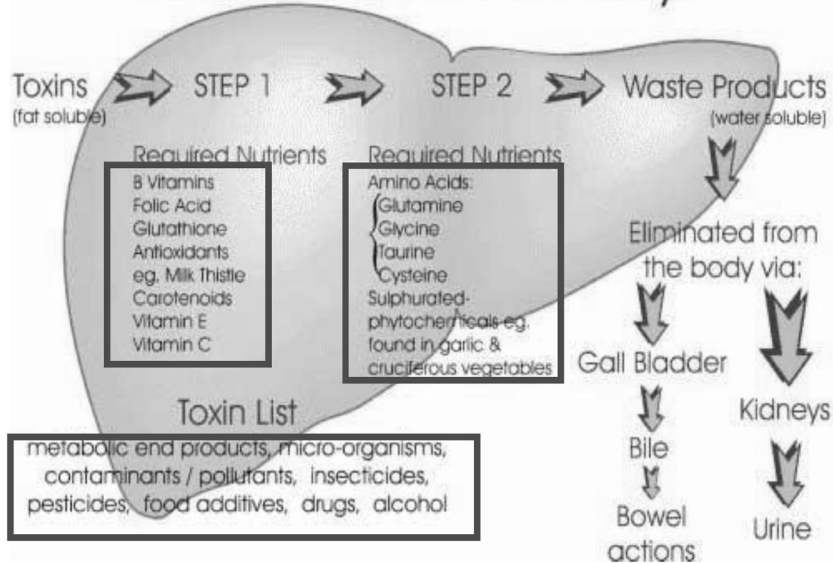
구분	디펩티벤 주(50ml)
규격	50ml
성분	N(2)-L-알라닐-L-글루타민
함량	10g(글루타민: 6.73g)
식약처분류	대사성 의약품 > 자양강장변질제* > 단백아미노산제제
구분	전문의약품
보험정보	비급여
효능효과	정맥영양요법을 실시하는 경우 아미노산 수액이나 아미노산 함유 수액에 보충하여 글루타민 보급
용법용량 (허가사항)	<ul style="list-style-type: none"> - 성인 : N(2)-L-알라닐-L-글루타민으로서 1일 체중 kg당 0.3~0.4 g을 아미노산 수액 또는 아미노산 함유 수액에 첨가하여 점적 정맥주사한다. - 보통 성인은 총 아미노산으로서 1일 체중 kg당 2 g을 초과하지 않는다. - 투여속도는 시간당 0.1 g 아미노산/kg 체중을 초과하지 않는다.
제조사	Fresenius Kabi (독일)
판매사	녹십자 웰빙
오스몰, Ph	(921 mosmol/l, pH : 5.4 - 6.0)
채널	클리닉 & 100 bed 이하 병원

글루타민 자체로는 안정성과 수용성(최대 3.5%) 이 낮아 기타 아미노산 수액제제에 성분이 포함되어 있지 않음
디펩티벤은 글루타민을 알라닐-글루타민 디펩타이드형태로 제공된다.

GC Wellbeing

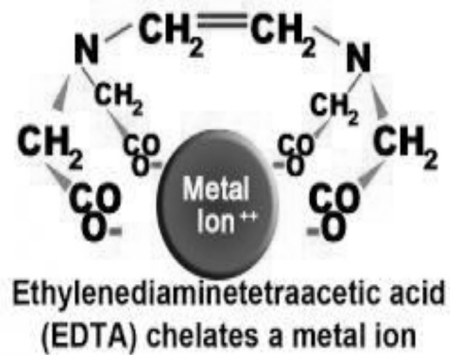
THE LIVER DETOX PATHWAYS AND ESSENTIAL NUTRIENTS

Detoxification Pathways



Chelation: Concept and Chemistry

- Completely removes specific toxic metal from desired site in the body.
- Chelating agents are organic or inorganic compounds capable of binding metal ions to form complex ring-like structure called 'chelates' .
- Chelating ligand, like EDTA^{4-} , which is a hexadentate ligand is most commonly used.



Int J Environ Res Public Health. 2010 Jul;7(7):2745-88.

EDTA-metal complex stability constants.

Metal	Na	Li	Ba	Sr	Mg	Ca	Mn	Fe	Co	Zn	Cd	Pb	Ni
K (log)	1.7	2.8	7.8	8.6	8.7	10.6	13.4	14.4	16.1	16.1	16.4	18.3	18.4

A metal with higher k constant competes for the chelating agent with a metal of lower stability value and ultimately removes the latter.

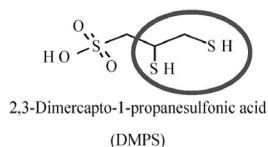
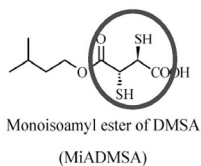
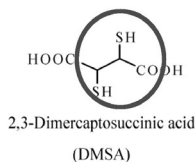
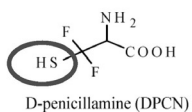
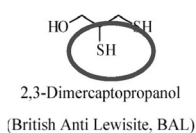
Int J Environ Res Public Health. 2010 Jul;7(7):2745-88.

Cadmium

- In acute toxicity, while no definitive chelation benefit is described, practitioners have considered DMSA, DTPA, and potentially EDTA.
 - However, EDTA
 - ☞ may increase renal cadmium burden and renal damage.
 - ☞ Therefore, antioxidant such as N-Acetylcysteine administration
 - : may improve oxidative stress markers with a concomitant chelator
- In chronic toxicity, chelation is unsupported, which is consistent with the Agency for Toxic Substances and Disease Registry guidelines for cadmium.

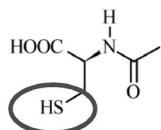
J Med Toxicol.2013 Dec;9(4):355-69

Structures of common substrates chelating mercury

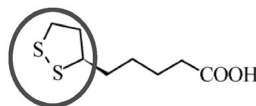


- Mercury
 - ☞ high affinity for sulfhydryl groups (-SH)
- BAL, DPCN, DMSA, MiADMSA, and DMPS
 - ☞ promotes the excretion of methylmercury and inorganic mercury in urine.

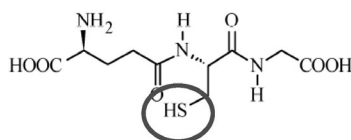
Antioxidants such as *N*-acetylcysteine (NAC), α -lipoic acid (ALA), and glutathione (GSH).



N-acetylcysteine
(NAC)



α -lipoic acid
(ALA)



glutathione
(GSH)

Summary of Various chelating agents

Aluminum	DFO (deferoxamine), L1 (deferiprone)
Arsenic	DMPS, <i>meso</i> -DMSA
Cadmium	In acute toxicity, DMSA, DTPA, and potentially EDTA.
Iron	DFO, L1, CaNa ₃ DTPA, Dexrazoxane
Lead	DMPS, <i>meso</i> -DMSA, BAL, CaNa ₂ EDTA, DPA
Mercury	DMPS, <i>meso</i> -DMSA, DPA, NAPA, BAL
Uranium	Thiophene-bridged, bis (3-hydroxy-N-methyl-pyridine-2-one) (L1H2), and bis (methyl-terephthalamide) (TAM)

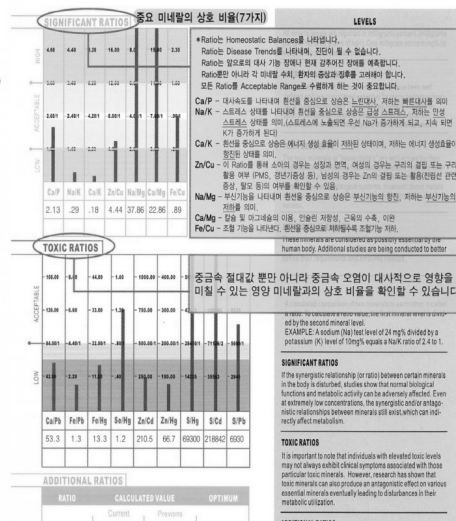
Antioxidants for nonspecific toxic metal chelation

- *N*-acetylcysteine
- α -lipoic acid
- Selenium
- Glutathione

개인별 필요한 영양소 평가

- ✓ 샘플 채취 : 간단, 비침습적
- ✓ 높은 미네랄 농도
: 혈액의 약 10배
- ✓ 독성 중금속
: 연조직에 우선 축적

검사해석

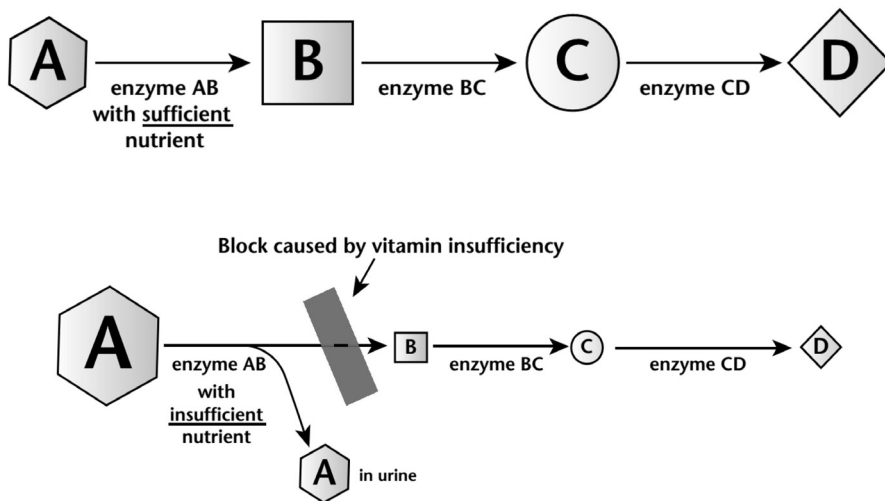


검사해석 - Nutritional Elements Ratio

SIGNIFICANT RATIOS							
HIGH	4.60	4.40	8.20	16.00	8.00	15.00	2.30
	3.80	3.40	6.20	12.00	6.00	11.00	1.60
	2.60/1	2.40/1	4.20/1	8.00/1	4.00/1	7.00/1	.90/1
ACCEPTABLE	1.60	1.40	2.20	4.00	2.00	3.00	.20
LOW							
	Ca/P	Na/K	Ca/K	Zn/Cu	Na/Mg	Ca/Mg	Fe/Cu

- Ca/P = 2.6 : 1 (대사속도)
- Na/K = 2.4 : 1 (스트레스)
- Ca/K = 4.2 : 1 (갑상선 기능)
- Zn/Cu = 8.0 : 1 (면역/알러지)
- Na/Mg = 4.0 : 1 (부신 기능)
- Ca/Mg = 7.0 : 1 (인슐린 이용성)
- Fe/Cu = 0.9 : 1 (철 이용률)

Urinary organic acid analysis for metabolic profiling



Case 1

초진기록 [2019-10-30]

나이 47(세) 4(개월) 성별 여 진료과 가정의학과
진료의사 김규남

신체계측 키 163(cm) 활력징후 혈압 (mmHg) 133 98
체중 65(kg) BMI 24.4 맥박 (회/분) 85

Pain ☒ N ☐ Y

주호소

R/O	주증상 및 내원사유	duration	onset	기타
	만성 피부염증 및 피로			

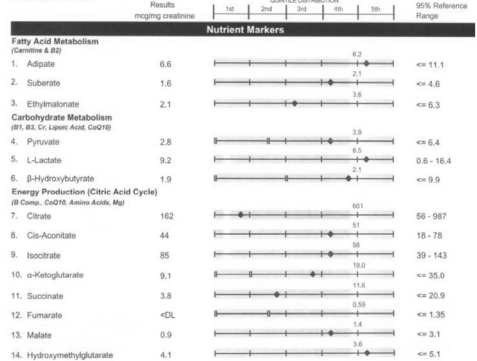
현병력

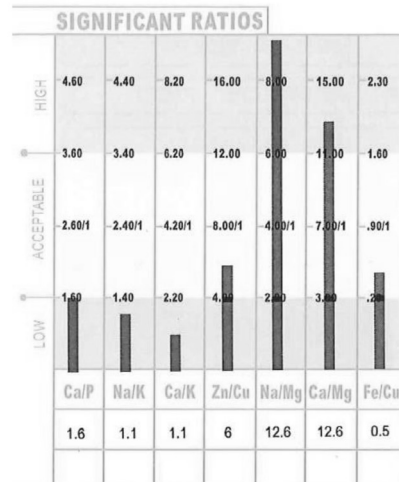
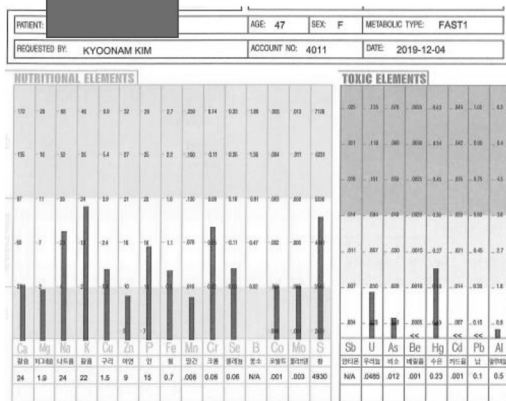
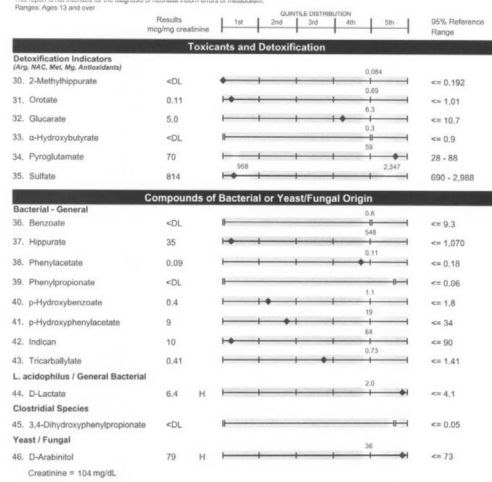
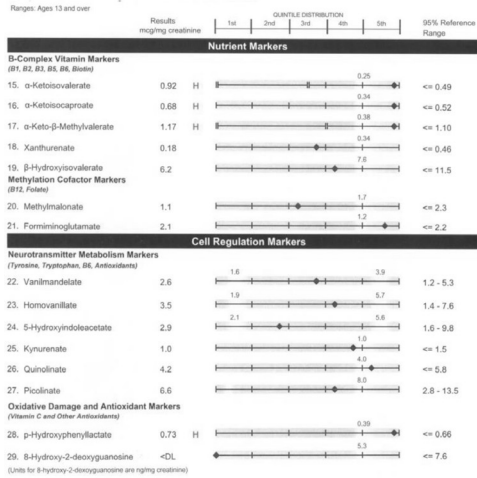
피부 알레르기 3년전 (수원 이사후)

변 배설 1-3회, Poorly : formed = 7-3, 색다양, p-bloating (+++) :pds
트림
a fatigue sx (+)
common to the rest

Patient: DONG HUI
JANG
DOB: June 20, 1972
Sex: F
MRN: 0001920659
Order Number: N9290552
Reported: December 12, 2019
Received: November 28, 2019
Collected: November 28, 2019
Green Cross Laboratories
Song Yang
187, Byeongno 30beon-gil
Yongin-si
Gyeonggi-do, 446-913
Korea, Republic of

3301 Organic® Comprehensive Profile - Urine
Metabolite(s) (GC/MS-based Spectrometry, Confirming)
This report is not intended for the diagnosis of neonatal inborn errors of metabolism.
Range: Ages 13 and over





김 규 남. 혼한 증상 및 질환에 대한 경정맥 영양치료

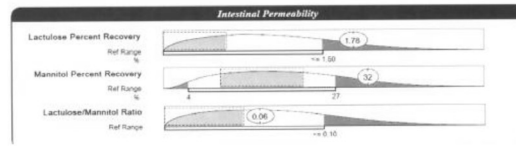
전체선택	채혈	2019/11/26 16:09	접수	11/26 20:59
누적	검사명	결과(수치)	단위	정상구 PANIC
<input checked="" type="checkbox"/>	Fecal Calprotectin	193.0	mg/kg	H



20191128-145-5074 관가도, 방진지, 가동수, 미연보, 2019년 11월 28일

의뢰기관	이주대학교병원	기관번호	31100473	주 치 의
성 명	장동희	의사번호	720620-2*****	김세희의원
등록번호	2203965	진 료 과	병 동	검사뢰의원
검사종류	Random Ur line	검 시 일	2019/11/29	김 시 의
임상정보/기타	191126100601	결과보고일	2019/12/26	김과보고일

검사종목 : Intestinal Permeability(Urine) 방법 : Enzymatic assay



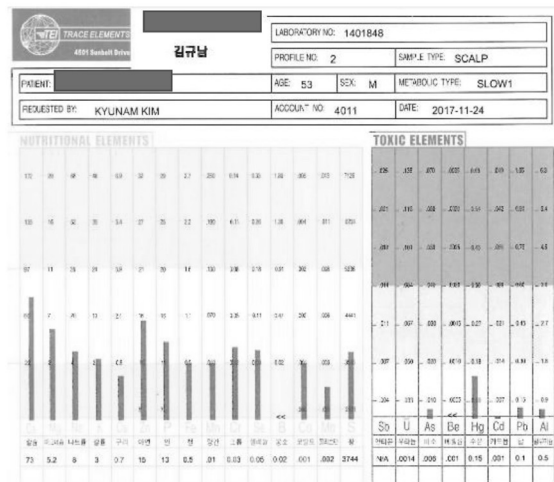
전체선택	채혈	2019/11/27 07:53	접수	11/27 08:56
누적	검사명	결과(수치)	단위	정상구 PANIC
<input checked="" type="checkbox"/>	Pepsinogen I	112.0	ng/mL	
<input type="checkbox"/>	Pepsinogen II	79.6	ng/mL	
<input type="checkbox"/>	Pepsinogen ratio	1.4		

전체선택	채혈	2019/11/27 07:53	접수	11/27 08:56
누적	검사명	결과(수치)	단위	정상구 PANIC
<input checked="" type="checkbox"/>	Cortisol(8AM)	11.6	ug/dl	

1	[Message] TEI Vita C-TA 1-1-1		김규남
2	[Message] PNP Mg CLT 1-1-1		김규남
	[RMK] (90T/39,000)		
3	[Message] 유니메디 케어맥스 1cap QD		김규남
	[RMK] thioticacid, N-acetylcysteine (60C/68,000)		
4	[Message] 2주		김규남
5	Hepa-Merz Pow 1Pack	2회 급여	처방 김규남
	복용 식후30분 x 0 days <약국용><원내>		
6	Godex Cap 2Cap	2회 급여	처방 김규남
	복용 식후30분 x 0 days <약국용><원내>		
7	Normix Tab 200mg 2Tab(400mg)	3회 급여	접수 김규남
	복용 식후30분 x 7 days <약국용><원내>		
	[RMK] 7일 까지 복용하세요		
8	Normix Tab 200mg 2Tab(400mg)	3회 비급여	접수 김규남
	복용 식후30분 x 8 days <약국용><원내>		
	Bi-doxin Inj 50mg/1ml 4Amp(200mg)	1회 비급여	처방 김규남
	Thiamine Inj 50mg/2ml 1Amp(50mg)	1회 비급여	
	MagneSIUM Inj 10x 2g/ 1Amp(2g)	1회 비급여	
	Megacorbin-C 10g/20ml 1Vial(10g)	1회 비급여	
	Sod. Bicarbonate Inj 8 0.4Amp(8mL)	1회 비급여	
	5% DW 200ml/BOT 1Bot(200mL)	1회 비급여	
	Tamipool Inj 1Vial	1회 비급여	
	Gulucolin S Inj 20ml 2Amp(40mL)	1회 비급여	
	DexTHEnol Inj 500mg/2m 4Amp(2000mg)	1회 비급여	
	정맥주사 하루에 한번 150 ml/hr x 1 day <가정의학과주사실><		
	<예약일:2020-01-10 미실시>		
	처음 L-Arginine HCl 10 1Bag(10g)	1회 비급여	실행 김규남
	정맥주사 하루에 한번 x 1 day <가정의학과주사실><원내>		
	<예약일:2020-01-02 실시>		
	L-Arginine HCl 10g/100 1Bag(10g)	1회 비급여	처방 김규남
	정맥주사 하루에 한번 x 1 day <가정의학과주사실><원내>		
	<예약일:2020-01-10 미실시>		
	0.9% NS 100ml/Bag 1Bag(100mL)	1회 비급여	처방 김규남
	Lypoaran Inj 25mg/5ml(8Amp(200mg)	1회 비급여	
	정맥주사 하루에 한번 100 ml/hr x 1 day <가정의학과주사실><		
	<예약일:2020-01-16 미실시>		

Case 2

TRACE ELEMENTS, INC.		LABORATORY NO: 1124258	
4801 Sandhill Drive • Austin, TX 78751 • USA		Patient's name: 김규남	
처음.0.9% NS 100ml/B	1 BAG 1 회/d FM 김규남		
처음.Lypoaran Inj 25	8 AMP 1 회/d		
sig IV ONCE 100 ml/hr x 1 day <가정의학과>			
<예약일:2016-03-31 실시>			
처음.Luthione Inj 60	1 VIA 1 회/d FM 김규남		
처음.0.9% NS 50ml/Ba	1 BAG 1 회/d		
sig IV ONCE 100 ml/hr x 1 day <가정의학과>			
<예약일:2016-03-31 실시>			
0.9% NS 100ml/Bag	1 BAG 1 회/d FM 김규남		
처음.Selenase T Pro	1 VIA 1 회/d		
sig IV ONCE 100 ml/hr x 1 day <가정의학과>			
<예약일:2016-03-31 실시>			
0.9% NS 100ml/Bag	1 BAG 1 회/d FM 김규남		
Lypoaran Inj 25mg/5m	8 AMP 1 회/d		
sig IV ONCE 100 ml/hr x 1 day <가정의학과>			
<예약일:2016-04-07 실시>			
Luthione Inj 600mg	1 VIA 1 회/d FM 김규남		
0.9% NS 50ml/Bag	1 BAG 1 회/d		
sig IV ONCE 100 ml/hr x 1 day <가정의학과>			
<예약일:2016-04-07 실시>			
0.9% NS 100ml/Bag	1 BAG 1 회/d FM 김규남		
Selenase T Pro Inj 5	1 VIA 1 회/d		
sig IV ONCE 100 ml/hr x 1 day <가정의학과>			
<예약일:2016-04-07 실시>			



20회 정도
주사

Take Home Message

- 경정맥 영양 치료는 고농도로 체내에 유입되어 약물과 같은 효과를 보임
- 경정맥 영양 치료는 장내 세균 불균형이 있는 환자에게 특히 필요.
- 가능하면 검사 결과를 바탕으로 증상 및 질환에 따른 미네랄 불균형 및 중금속 과다, 항산화제 치료를 개인에 따라 접근