

Refeeding syndrome



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26 Sedm pěkných krav, to je sedm let. Také sedm pěkných klasů je sedm let. Je to jeden sen.

27 Sedm vychrtlých a šeredných krav, vystupujících za nimi, je sedm let, stejně jako sedm prázdných a východním větrem sežehlých klasů; to bude **sedm let hladu**.

28 Když jsem faraónovi řekl: Bůh faraónovi ukázal, co učiní, mínil jsem toto:

29 Přichází sedm let veliké hojnosti v celé egyptské zemi.

30 Po nich však **nastane sedm let hladu a všechna hojnost v egyptské zemi bude zapomenuta. Hlad zemi úplně zničí.**

31 V zemi nebude po hojnosti ani potuchy pro hlad, který potom nastane, neboť bude velmi krutý.





Hladomor v Irsku 1271



HOLODOMOR

1932-34

APPROXIMATELY 4 MILLION DEATHS
ARE ATTRIBUTED TO STARVATION
WITHIN THE BORDERS OF SOVIET
UKRAINE



Ebensee, Mauthausen, Rakousko, 6.5.1945



Bergen-Belsen, duben 1945



Bergen-Belsen, duben 1945

Mortalita až 20%

Hladovění

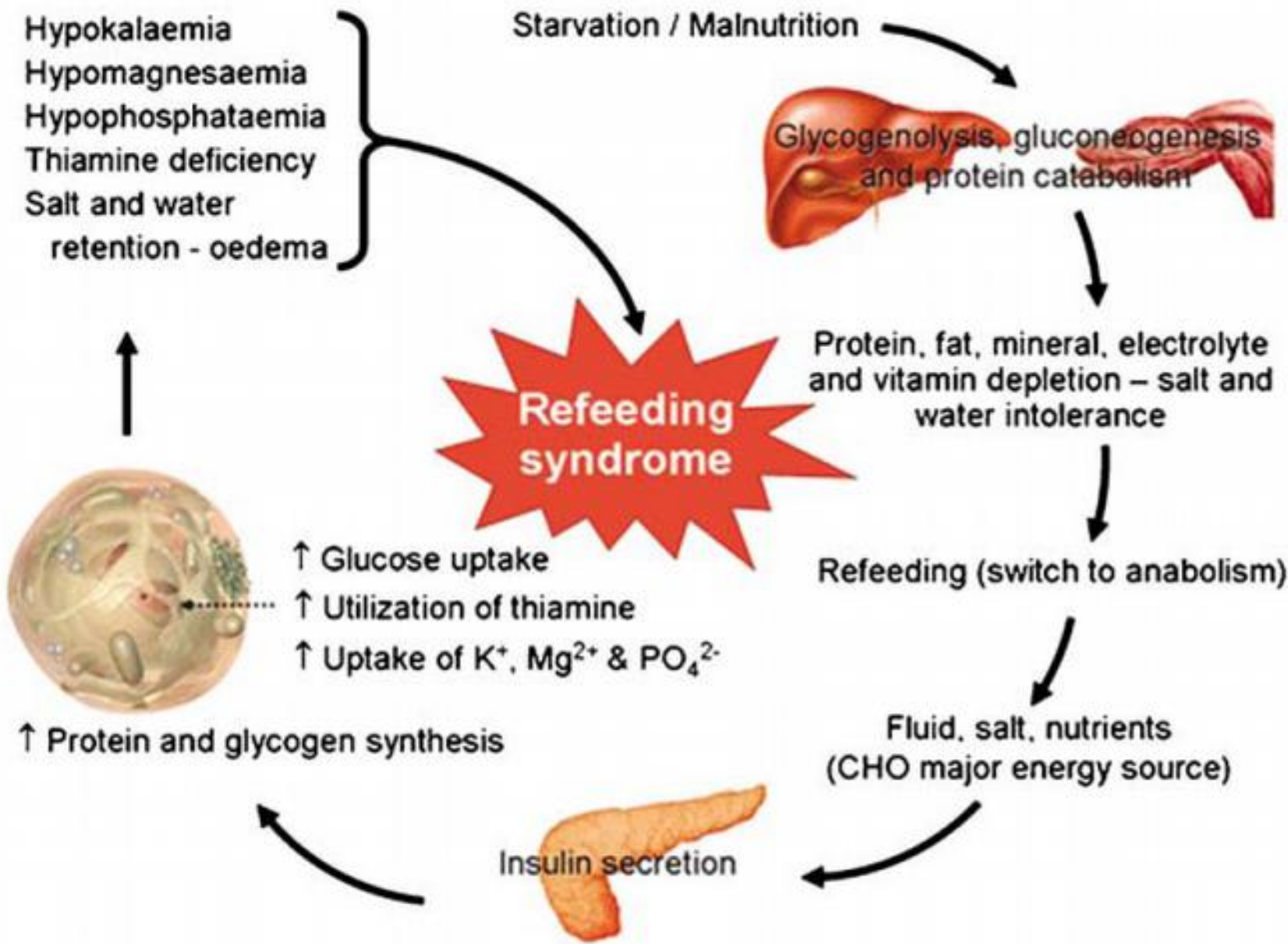
- Deplece glykogenu
- Glukoneogeneze (aminokyseliny – alanin)
- Ketogeneze
- ↓ inzulin, ↑ glukagon

→ ztráta tuku a proteinu, tělesné hmoty

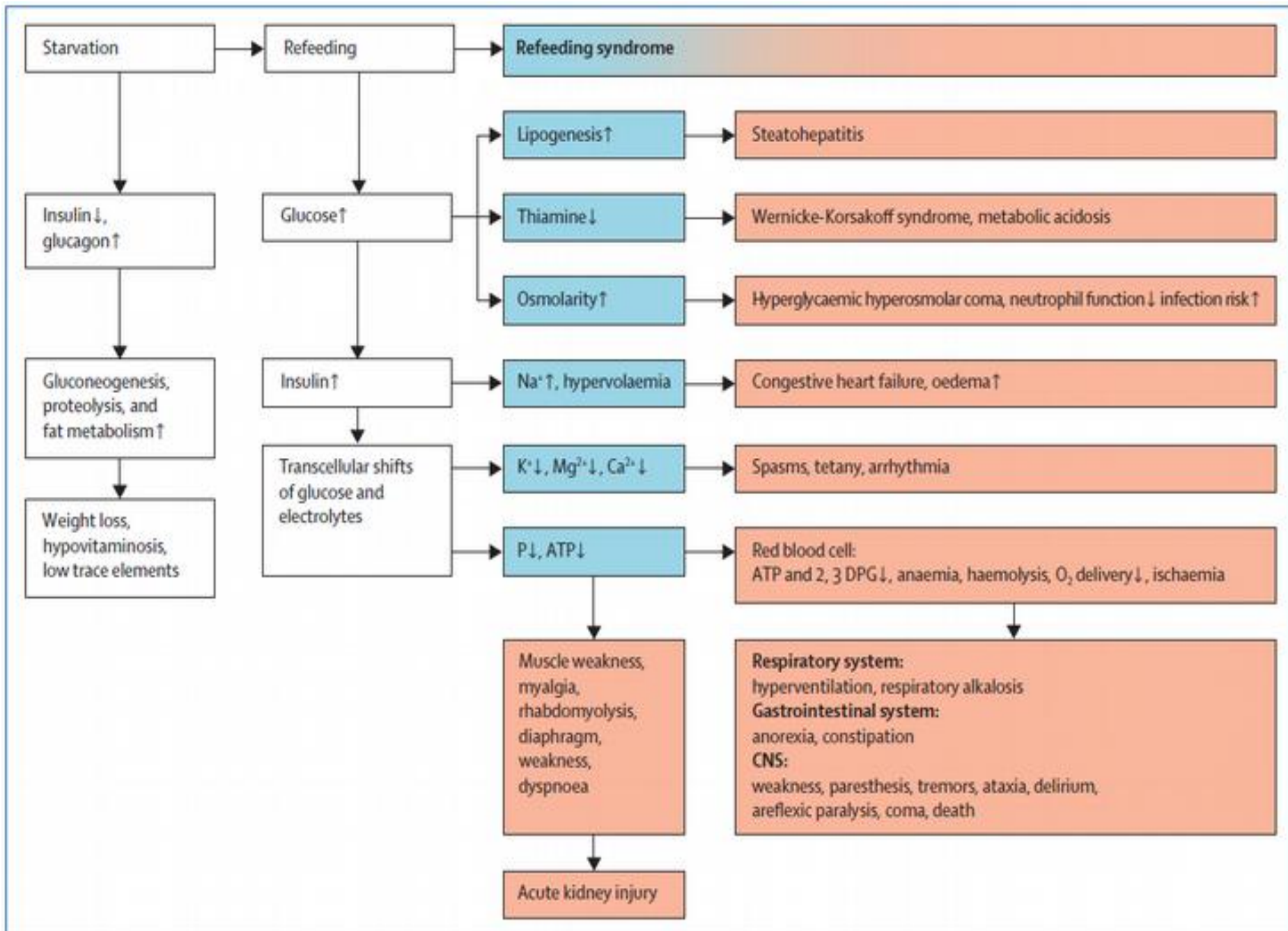
→ ztráty draslíku, fosfátů, hořčíku

Refeeding syndrome

- rychlý přívod živin (cukry)
- vstup minerálů do buněk
 - hypokalemie
 - hypofosfatemie
 - hypomagnesemie
- vysoká potřeba kofaktorů (thiamin)
 - Wernickeova encefalopatie
 - kardiomyopatie
 - laktátová acidosa
- retence vody a sodíku
 - otoky
 - srdeční selhání



Klinický obraz



Klinický obraz hypofosfatemie

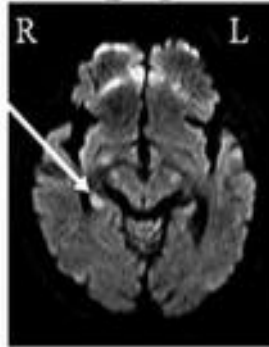
- parestézie, křeče
- svalová slabost vč. dýchacích svalů (respirační insuficience) až rhabdomyolýza
- snížená kontraktilita myokardu, srdeční selhání
- arytmie (KES, SVT, VT)
- alterace vědomí, zmatenost, koma, polyneuropatie, pontinní myelinolýza
- trombocytopenie, poruchy koagulace, funkce leukocytů, hemolýza, zhoršené uvolňování kyslíku
- Inzulinová rezistence

A Case of Central Pontine Myelinolysis Caused by Hypophosphatemia Secondary to Refeeding Syndrome

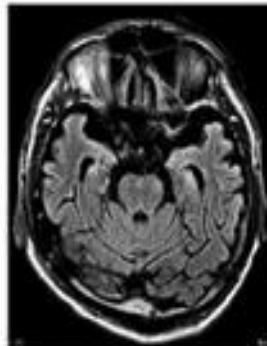
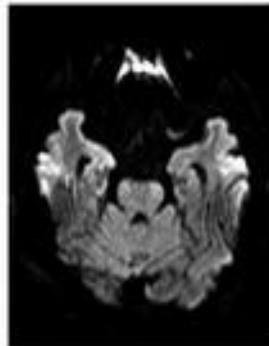
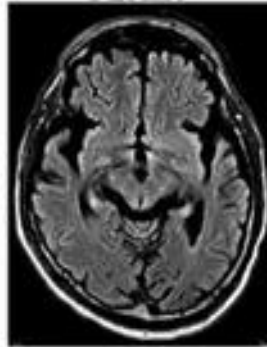
Chikara Yamashita^a Hiroshi Shigeto^a Norihisa Maeda^a Takako Torii^a
Yasumasa Ohyagi^a Jun-ichi Kira^a

On admission

DWI

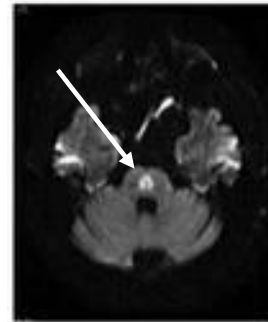


FLAIR

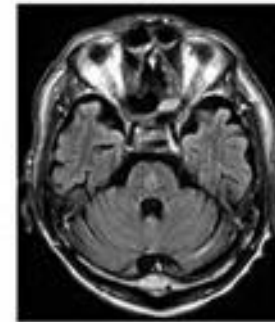


Day 7

DWI

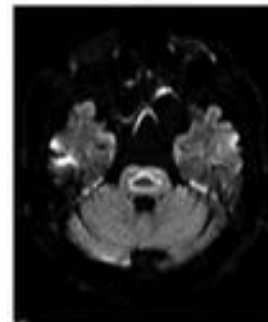


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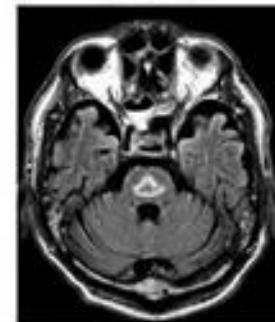


Day 33

DWI



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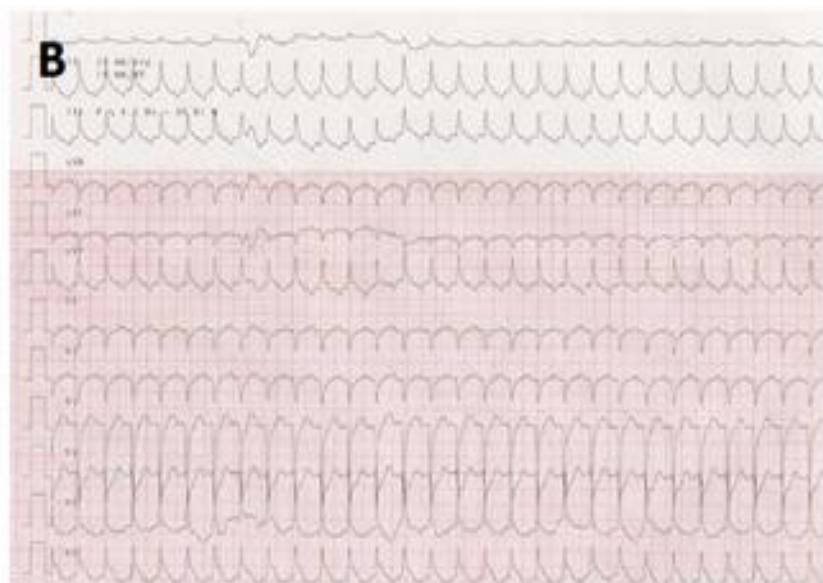
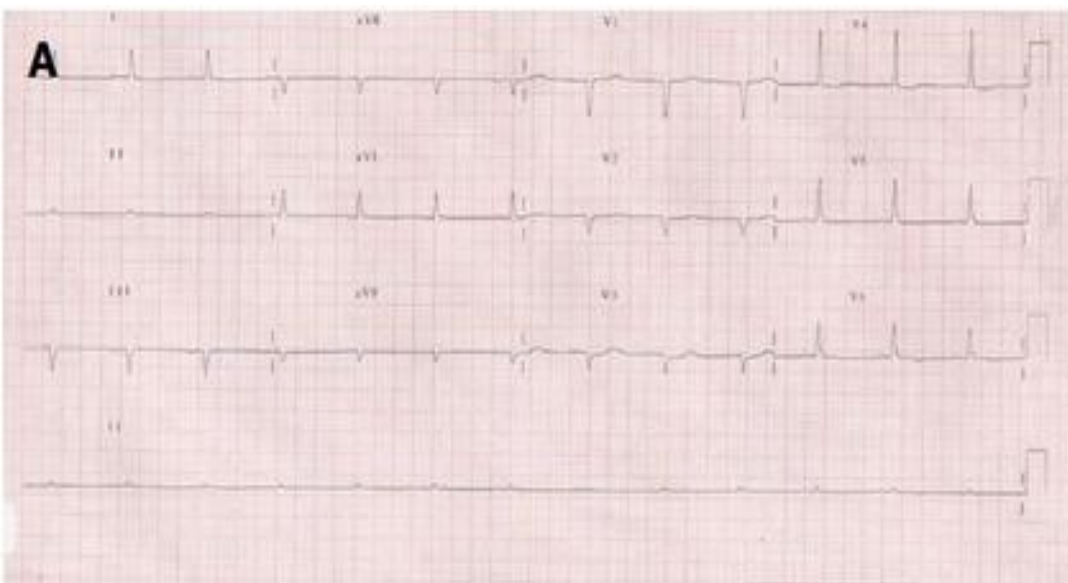
Hyperintenzní ložiska v thalamech,
hippocampu vpravo a nově ve
středním pontu

Klinický obraz

- **Hypomagnezémie (< 0,5 mmol/l), hypokalémie (<3,0mmol/l)**
 - arytmie
 - srdeční zástava
 - svalová slabost
 - parestézie
 - zmatenost
 - rhabdomyolýza
 - zvracení, průjem
 - útlum dýchání
- **srdeční atrofie, selhání (beri-beri)**
- **zmatenost (Wernickeova encefalopatie – beri-beri)**

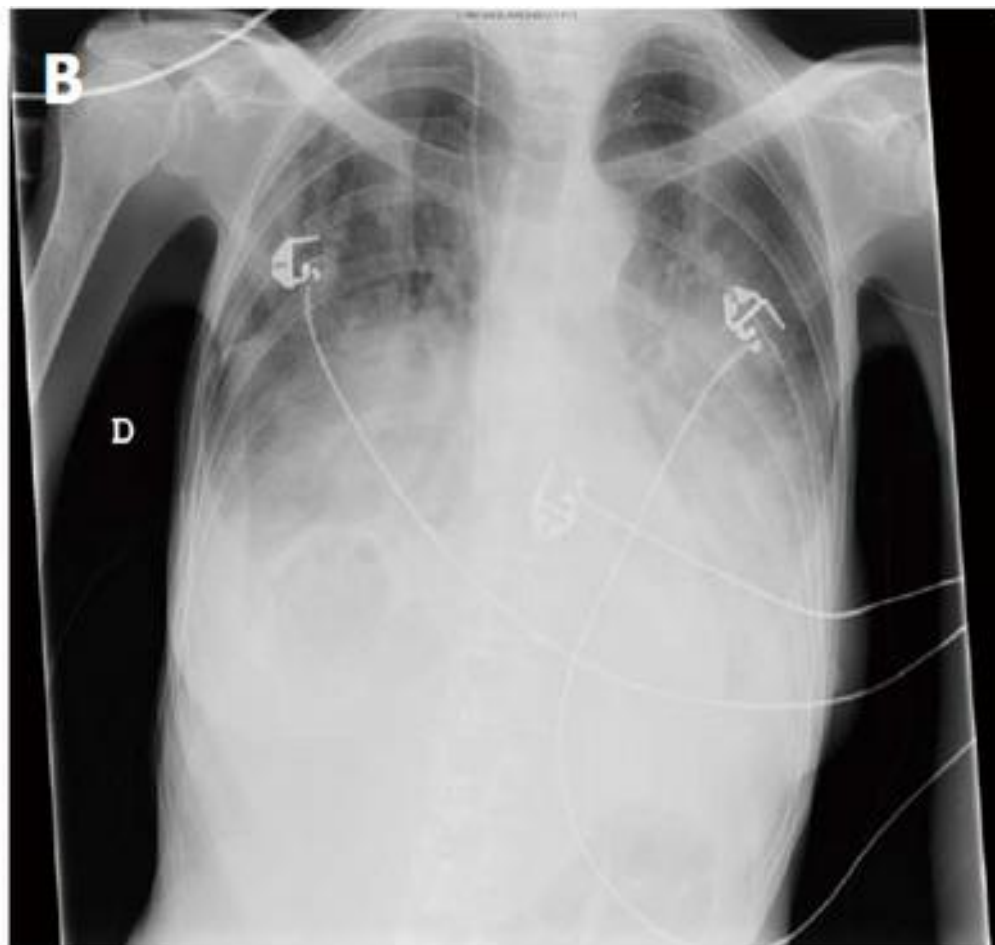
Reverse or inverted apical ballooning in a case of refeeding syndrome

Pablo Robles, Isabel Monedero, Amador Rubio, Javier Botas



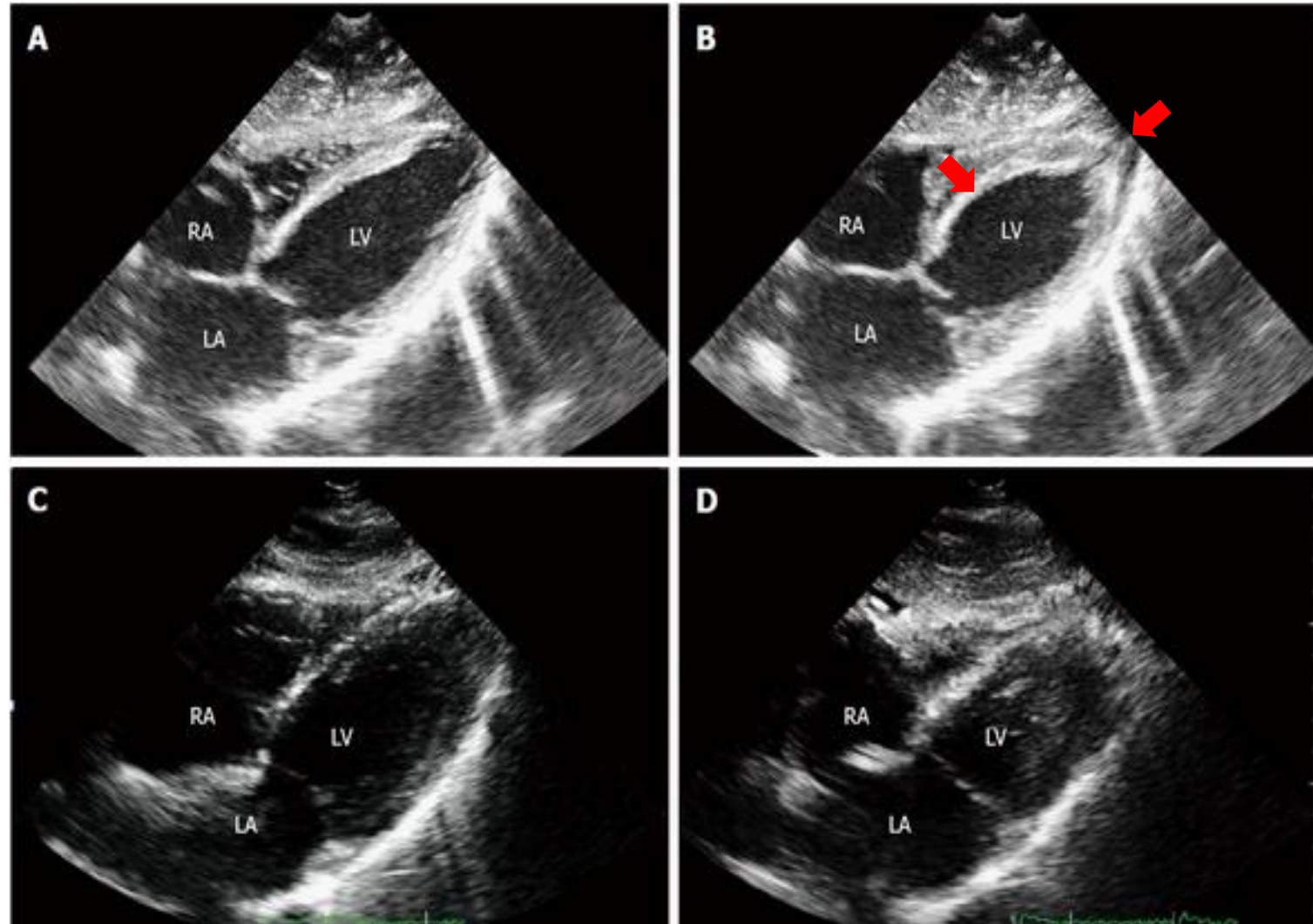
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Reverse or inverted apical ballooning in a case of refeeding syndrome

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Rizikové faktory

Unintentional weight loss

- Loss of >5% of body weight in 1 month
- Loss of >7.5% of body weight in 3 months
- Loss of >10% of body weight in 6 months

Low nutrient intake

- Patients starved for >7 days
- Prolonged hypocaloric feeding or fasting
- Chronic swallowing problems and other neurological disorders
- Anorexia nervosa
- Chronic alcoholism
- Depression in the elderly
- Patients with cancer
- Chronic infectious diseases (AIDS, tuberculosis)
- During convalescence from catabolic illness
- Postoperative patients
- Diabetic hyperosmolar states
- Morbid obesity with profound weight loss
- Homelessness, social deprivation
- Idiosyncratic/eccentric diets
- Hunger strikers

Increased nutrient losses/decreased nutrient absorption

- Significant vomiting and/or diarrhoea
- Dysfunction or inflammation of the gastrointestinal tract
- Chronic pancreatitis
- Chronic antacid users (these bind minerals)
- Chronic high-dose diuretic users
- After bariatric surgery

Definice refeeding syndromu

	First author	Year	N	Population	Definition of RFS	Incidence (%)	When did it occur?	
Hypophosphatemia as definition criteria	Goyale [27]	2015	52	Patients receiving PN	PO4 drop of >30% during first 36 h of PN administration	62	NR	
	Coskun [23]	2014	117	ICU patients receiving EN or PN	PO4 <0.78 mmol/L	52.14	NR	
	Gaudiani [24]	2012	25	AN patients	PO4 < 0.87 mmol/L	45	3.4 d	
	Gaudiani [25]	2014	132	AN patients	Hypophosphatemia	37	NR	
	Marik [26]	1996	62	ICU patients starved for ≥48 h	Drop of PO4 by >0.16 mmol/L to <0.65 mmol/L accompanied by possible other electrolyte disturbances	34	1.9 ± 1.1 d	
	Marvin [27]	2007	250	Patients receiving PN	PO4 drop of ≥0.15 mmol/L to <0.80 mmol/L from baseline in the first 7 d of PN in patients with a period of >48 h without food	34	3 d	
	Brown [28]	2015	123	Female AN patients	PO4 <0.87 mmol/L	33	2 d	
	Lubart [29]	2009	40	Frail elderly patients with feeding problems >72 h	PO4 <0.52 mmol/L	25	2-3 d	
	González Avila [30]	1996	106	Cancer patients receiving EN or PN	PO4 <0.81 mmol/L	24.5	Within 72 h	
	Zeki [31]	2011	321	Patients receiving PN or EN	PO4 <0.6 mmol/L	15	NR	
	Garber [32]	2012	56	AN patients	Shifts in electrolytes	0	NR	
	Grasso [33]	2013	34	Patients with cancer of the upper aerodigestive tract, doing a 12-h overnight fast	HP and/or other shifts in electrolytes during RF	NR	NR	
	Terlevich [34]	2003	30	Patients with RFS	PO4 <0.50 mmol/L	NR	NR	
	Nagata [35]	2015	356	AN patients	PO4 <0.97 mmol/L	NR	NR	
	Kagansky [36]	2005	651	Patients age >65 y with ≥1 episode of HP compared with patients without HP	PO4 <0.77 mmol/L	NR	10.9 ± 21.5 d after hospitalization	
	Shift in electrolytes	Marvin [37]	2008	140	Patients receiving PN	PO4 drop of ≥0.15 mmol/L to <0.80 mmol/L from baseline in the first 7 d of PN in patients with a period of >48 h without food	NR	NR
		Doig [38]	2015	339	ICU critically ill adult patients	PO4 drop of >0.16 mmol/L to <0.65 mmol/L within 72 h after starting nutritional support	NR	Within 72 h
Hernández-Aranda [39]		1997	50	Patients with mild and severe malnutrition receiving EN or PN for >7 d	Drop of any electrolyte value under the reference range	48	3 d	
Redgrave [40]		2015	461	AN patients	PO4 <0.87 mmol/L, for patients age ≤16 y <1 mmol/L, hypomagnesaemia, hypokalaemia, and hypoglycemia	18.5	NR	
Manning [41]		2014	36	Alcoholic patients	Changes in fluid and electrolyte balance in malnourished receiving intensive feeding	0	NR	
Clinical symptoms	Luque [42]	2007	11	Malnourished patients receiving PN	Severe shifts in electrolytes in patients who are underweight, severely malnourished, or starved and started on refeeding	0	NR	
	Whitefaw [43]	2010	46	AN patients	Electrolyte and fluid shifts during refeeding	NR	NR	
	Flesher [44]	2005	51	Malnourished patients receiving EN	Shifts in electrolytes associated with complications during early EN	80	NR	
	Chen [45]	2014	56	Patients at high risk for RFS according to NICE guidelines admitted for RF	Shifts in electrolyte and clinical symptoms	20	NR	
	Vignaud [46]	2010	68	AN patients	All adverse events occurring during nutritional rehabilitation of malnourished patients or having undergone a prolonged fast	10	NR	
	Fan [47]	2004	15	Patients with gastrointestinal fistula	Shifts in electrolytes and clinical symptoms	9.4	within 24 h	
	Saito [48]	2014	111	AN patients	Cardiovascular, respiratory, neurologic, or psychological changes with HP during RF	3.6	NR	
	Eichelberger [49]	2014	37	Hunger strike patients	Electrolyte disturbances (K < 2.5 mmol/L, PO4 <0.32 mmol/L, Mg < 0.5 mmol/L) AND clinical symptoms (peripheral edema or acute circulatory fluid overload) AND disturbance to organ function (respiratory failure, cardiac failure, or pulmonary edema)	3	NR	

(Continued)

First author	Year	N	Population	Definition of RFS	Incidence (%)	When did it occur?
Rio [50]	2013	243	Patients on artificial nutrition support	Electrolyte disturbances (K < 2.5 mmol/L, PO4 < 0.32 mmol/L, Mg < 0.5 mmol/L) AND clinical symptoms (peripheral edema or acute circulatory fluid overload) AND disturbance to organ function (respiratory failure, cardiac failure, or pulmonary edema)	2	NR
Heimbürger [51]	2010	142	HIV-infected patients	HP and clinical symptoms	0.7	NR
Herranz [52]	2013	312	Patients receiving PN	Shifts in electrolytes (PO4, K, Mg) AND edema AND impaired carbohydrate metabolism during PN	0	NR
Faintuch [53]	2001	8	Hunger strike patients	Relevant shifts in electrolytes and clinical symptoms	0	NR
Elnenaï [54]	2011	35	Patients admitted for PN	Clinical features	0	NR
Leclerc [55]	2013	29	AN patients	Signs and symptoms of shifts in fluid and electrolytes (particularly phosphate)	0	NR
Gentile [56]	2010	33	Very severe AN patients	Clinical signs and symptoms of water retention, HP, or depletion of other electrolytes or the thiamine cofactor of glycolysis	0	NR
Hofer [57]	2014	65	AN patients	Electrolyte disturbances (K < 2.5 mmol/L, PO4 < 0.32 mmol/L, Mg < 0.5 mmol/L) AND clinical symptoms (peripheral edema or acute circulatory fluid overload) AND disturbance to organ function (respiratory failure, cardiac failure, or pulmonary edema)	0	NR
Golden [58]	2013	310	AN patients	HP associated with possible hypomagnesemia and hypokalemia and clinical features	0	NR
Raj [59]	2012	541	AN patients	Metabolic and clinical changes under RF	NR	4.9 ± 5.5 d
Garber [60]	2011	40	AN patients	NR	0	NR
Hoffmann [61]	2008	621	Patients with moderate or severe HP	NR	10	NR

Revisiting the refeeding syndrome: Results of a systematic review

Natalie Friedli M.D.^a, Zeno Stanga M.D.^b, Lubos Sobotka M.D.^c, Alison Culkin R.D.
Jens Kondrup M.D.^c, Alessandro Laviano M.D.^f, Beat Mueller M.D.^d,
Philipp Schuetz M.D., M.P.H.^{a,*}

- 38 definic refeeding syndromu
- Hypofosfatemie
 - Absolutní $<0,32-1,0$ mmol/l
 - Relativní (pokles) $>30\%$ n. $> 0,16$ mmol/l
- Změny v ostatních elektrolytech (P,K,Mg)
- Klinické příznaky
- Kombinace
- Incidence refeeding syndromu 0-80%

Throw caution to the wind: is refeeding syndrome really a cause of death in acute care?

KL Matthews¹, SM Capra¹ and MA Palmer²

- Retrospektivní analýza úmrtí v nemocnicích v Queenslandu za 18 let (1997 – 2015)
- Dg. v úmrtním listě „refeeding sy“
- 260 000 úmrtí
- Refeeding sy n = 5
 - nenalezen příjem > 3400kcal/d
 - normalizace minerálů před úmrtím
- **Refeeding je velmi vzácná příčina úmrtí (1:50 000)**

The Refeeding Syndrome revisited: you can only diagnose what you know

G. Janssen¹ · M. Pourhassan¹ · R. Lenzen-Großimlinghaus² · M. Jäger³ · R. Schäfer⁴ · C. Spamer⁵ · I. Cuvelier⁶
D. Volkert⁷ · R. Wirth¹ · on behalf of the working group on nutrition and metabolism of the German Geriatric Society (DGG)

- Průzkum vědomostí o refeeding sy mezi německými lékaři a posluchači posledního ročníku medicíny
- n = 281
- dotazník – kazuistika
- 14% správných diagnóz + 8% téměř správných
- **Většina dotazovaných refeeding sy nepoznala**

Refeeding syndrom

- Anabolická reakce
 - způsobená přívodem živin
 - spojená s přesuny elektrolytů
 - s klinickými příznaky nebo bez nich
- přechod z katabolismu do anabolismu
 - fyziologická reakce
 - může být život ohrožující u těžce malutričních pacientů nebo při rekonvalescenci z těžké nemoci

Prevence a léčba refeeding syndromu

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	First author	Year	N	Preventive medication	Therapeutic medication	Effective?
Hypophosphatemia as definition criteria	Terlevich [34]	2003	30	NR	50 mmol PO4 over 24 h	Yes
	Gonzalez Avila [30]	1996	106	PO4 supplementation	NR	Yes
	→ Marvin [37]	2008	140	During the first 24 h slow PN regimen providing <70% of protein and calories but >12 mmol PO4	NR	Yes
	→ Garber [60]	2011	40	No effective preventive measures found	NR	No
	→ Coskun [23]	2014	117	Lower energy intake	NR	No
Shift in electrolytes	Doig [38]	2015	339	NR	Lower caloric intake	Yes
	→ Whitelaw [43]	2010	46	Prophylactic administration of PO4		No
	Luque [42]	2007	11	Lower initial energy intake, monitoring of PO4	Supplementation of PO4	Yes
Clinical symptoms	Manning [41]	2014	36	PO4 supplementation, thiamine 3.51 mg/d	NR	Yes
	Fan [47]	2004	158	Repeated electrolyte testing	NR	No
	→ Gentile [56]	2010	33	PO4 supplementation	NR	Yes if PO4 <0.30
	→ Vignaud [46]	2010	68	Prophylactic administration of PO4 and K, cautious nutritional rehabilitation	NR	Yes
	→ Chen [45]	2014	56	For patients at risk for initial nutritional support 10 kcal/kg/d falling to as low as 5 kcal/kg/d	NR	Yes
	→ Chen [45]	2014	56	Thiamine and multivitamin supplementation, 15 kcal/kg/d	NR	Yes
	→ Golden [58]	2013	310	Lower caloric intake	NR	No
	→ Leclerc [55]	2013	29	Hypocaloric feeding	NR	No
→ Flesher [44]	2005	51	Thiamine supplementation, cautious feeding	NR	No	
→ Rio [50]	2013	243	Hypocaloric feeding	NR	No	

Prevence – kalorická restrikce: 5 studií s efektem, 6 studií bez efektu

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	Leclerc [55]	2013	29	Hypocaloric feeding	NR	No
	Flesher [44]	2005	51	Thiamine supplementation, cautious feeding	NR	No
Rio [50]	2013	243	Hypocaloric feeding	NR	No	

Léčba – dodávka fosfátu: 2 studie, kalorická restrikce: 1 studie, s efektem.

Restricted versus continued standard caloric intake during the management of refeeding syndrome in critically ill adults: a randomised, parallel-group, multicentre, single-blind controlled trial

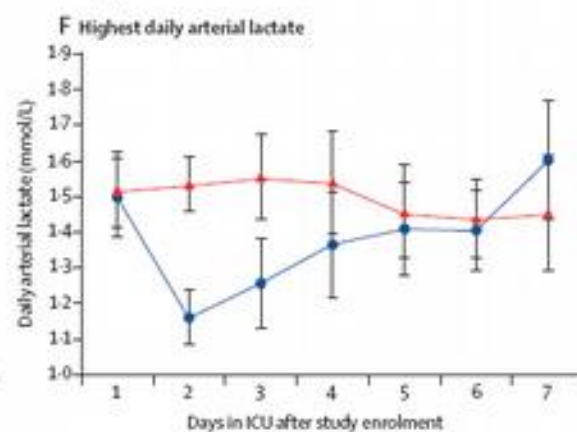
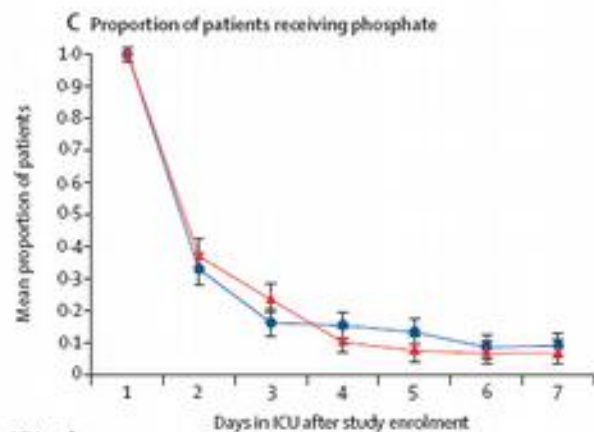
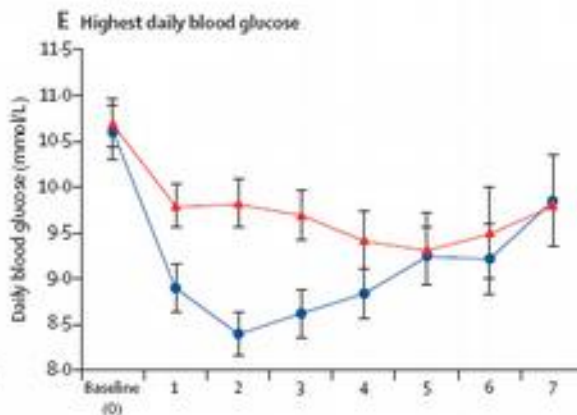
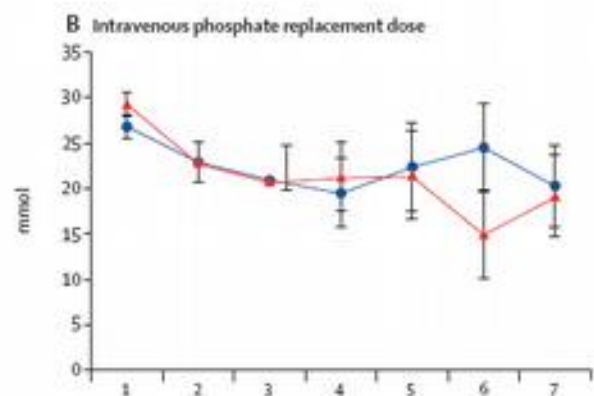
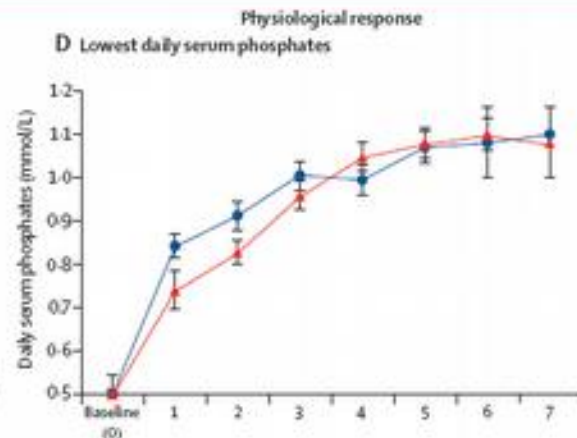
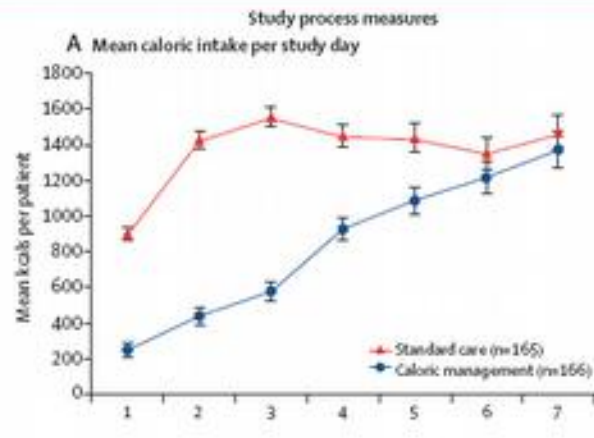
*Gordon S Doig, Fiona Simpson, Philippa T Heighes, Rinaldo Bellomo, Douglas Chesher, Ian D Caterson, Michael C Reade, Peter W J Harrigan, for the Refeeding Syndrome Trial Investigators Group**

- Randomizovaná, multicentrická, jednou zaslepená
- 13 JIP v Austrálii a na N. Zélandu
- kriticky nemocní s refeeding sy do 3. dne od počátku výživy
- $n = 339$

Restricted versus continued standard caloric intake during the management of refeeding syndrome in critically ill adults: a randomised, parallel-group, multicentre, single-blind controlled trial

*Gordon S Doig, Fiona Simpson, Philippa T Heighes, Rinaldo Bellomo, Douglas Chesher, Ian D Caterson, Michael C Reade, Peter W J Harrigan, for the Refeeding Syndrome Trial Investigators Group**

- Refeeding sy = hypofosfatemie $<0,62\text{mmol/l}$ do 72h po začátku výživy
- Studijní skupina
 - kalorická restrikce na 20kcal/h aspoň 2 dny + fosfát, K, ...
 - po normalizaci fosfátu návrat k nutričnímu cíli během 3 dnů
- Kontrolní skupina
 - výživa bez omezení + suplementace P dle protokolu
- Cíl: mortalita při propuštění z JIP, za 60 dní, infekce, antibiotika, glykemie, potřeba minerálů, inzulinu...



Patients in ICU each study day

	1	2	3	4	5	6	7
Standard care	165	165	157	138	123	110	95
Caloric management	166	166	159	141	126	114	97

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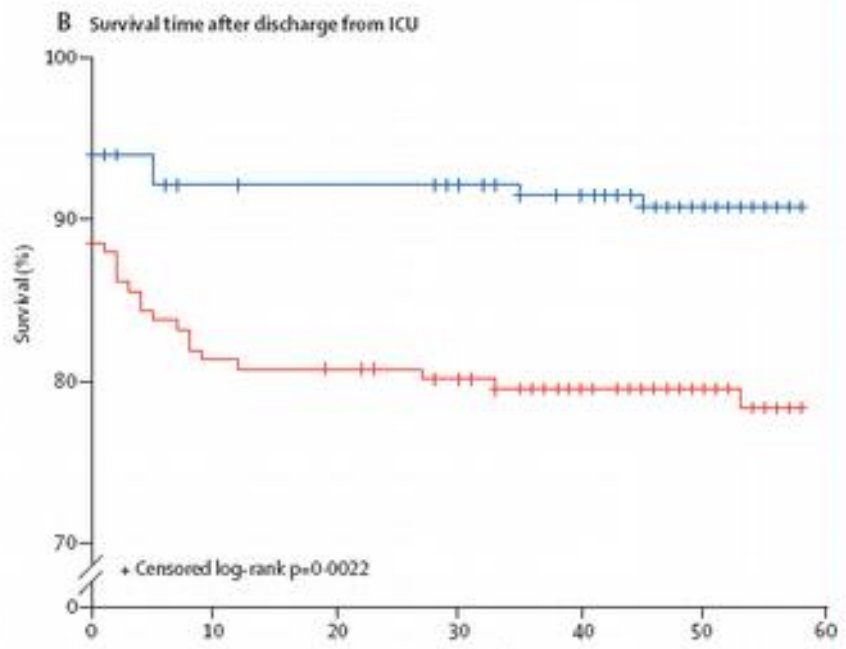
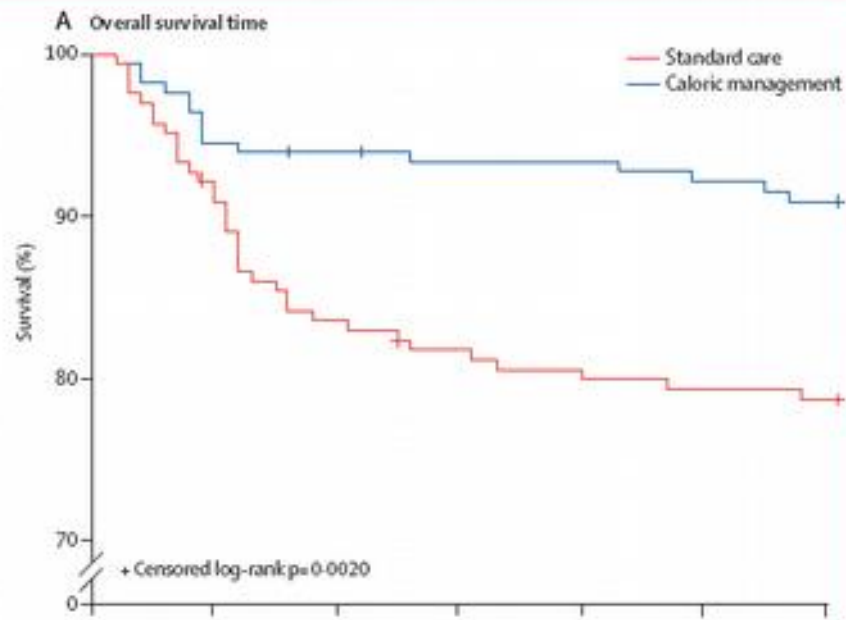
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	Standard care (n=165 patients)	➔ Caloric management (n=166 patients)	Risk difference (95% CI)	p value
Vital status (% alive)				
ICU discharge status	150/165 (91%)	157/166 (95%)	3.7% (-5.3 to 12.7)	0.20
Hospital discharge status	135/165 (82%)	151/166 (91%)	9.2% (0.7 to 17.7)	0.017
➔ Day 60 status	128/163 (79%)*	149/164 (91%)*	12.3% (3.9 to 20.7)	0.002
➔ Day 90 status	128/163 (79%)*	143/164 (87%)*	8.7% (0.04 to 17.0)	0.041
Length of stay (days)				
ICU	10.0 (9.2 to 10.9)	11.4 (10.5 to 12.4)	1.4 (-0.42 to 3.5)	0.14
➔ Hospital	21.7 (20.0 to 23.5)	27.9 (25.7 to 30.3)	6.2 (2.0 to 11.2)	0.003

Kalorická restrikce asociována s lepším přežitím ale delší dobou hospitalizace.



Day	Number of patients												
	1	5	10	15	20	25	30	35	40	45	50	55	60
Standard care	165	158	149	140	136	133	131	129	129	128	128	128	128
Caloric management	166	163	157	156	155	155	154	154	154	153	152	151	149

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Quality of life and physical function scores† (n responses available for analysis)				
RAND-36 general health	53.4 (22.6; n=124/128)	46.0 (26.0 n=136/143)	-7.5 (-13.4 to -1.5)	0.014
ECOG performance status	1.3 (1.0; n=125/128)	1.5 (1.1; n=135/143)	0.18 (-0.08 to 0.43)	0.18
RAND-36 physical function	47.3 (35.0; n=123/128)	40.9 (33.4; n=135/143)	-6.4 (-14.8 to 2.0)	0.13

Kalorická restrikce asociována po 90 dnech se *statisticky horším* výsledkem dotazníku na obecné zdraví, *klinicky nevýznamným*.

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	Standard care (165 patients)	Caloric management (166 patients)	Risk difference (95% CI)	p value
Catheter*	4 (2%)	4 (2%)	0.0% (-10.7 to 10.7)	1.00
Catheter tip*	4 (2%)	4 (2%)	0.0% (-10.7 to 10.7)	1.00
Surgical wound	4 (2%)	1 (0.6%)	-1.8% (-12.5 to 8.9)	0.21
Bloodstream	8 (5%)	2 (1%)	-3.6% (-7.1 to 0.0)	0.06
Abdominal	1 (0.6%)	0	-0.61% (-1.8 to 0.6)	0.50
Clinically significant UTI	1 (0.6%)	0	-0.61% (-1.8 to 0.6)	0.50
→ Airway or lung†	52 (32%)	35 (21%)	-10.4% (-19.8 to -1.1)	0.0342
CPIS probable‡ pneumonia	34 (21%)	25 (15%)	-5.5% (-13.8 to 2.7)	0.20
CPIS confirmed§ pneumonia	22 (13%)	14 (8%)	-4.9% (-11.6 to 1.2)	0.16
→ Any major infection¶	27 (16%)	13 (8%)	-8.5% (-15.5 to -1.6)	0.0187

Kalorická restrikce asociována s **nižším výskytem infekcí**, zejména respiračních.

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Závěry:

Kalorická restrikce asociována s

- lepším přežitím 60 a 90 dní po propuštění
- delší dobou hospitalizace
- nižším výskytem infekcí, zejména respiračních

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- Pacienti měli velmi nízké nutriční riziko, nepřítomny známky ztráty svalů nebo tuku.
- Protokol replece fosfátů
 - Validován pro
 - Chirurgicky nemocné
 - S nízkým nutričním rizikem
 - Neznámo na jaké výživě, pravděpodobně málo účinné
 - Cílen na korekci hladin nikoliv repleci zásob
 - Není informace o ztrátách fosfátu
 - Množství fosfátů v obou skupinách bylo stejné, tj. kontrolní měla 4x méně/kcal
- Rozporné závěry:
 - Pacienti v hypokalorické větvi měli delší dobu hospitalizace
 - Vyšší počet infekcí u standartně živených, ale stejně dní systémových antibiotik

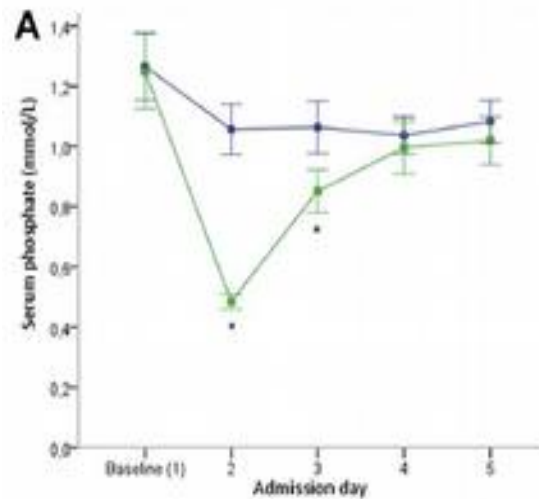
Impact of caloric intake in critically ill patients with, and without, refeeding syndrome: A retrospective study

Laura E. Olthof^a, W.A.C. Kristine Koekkoek^b, Coralien van Setten^a, Johannes C.N. Kars Dick van Blokland^a, Arthur R.H. van Zanten^{a,*}

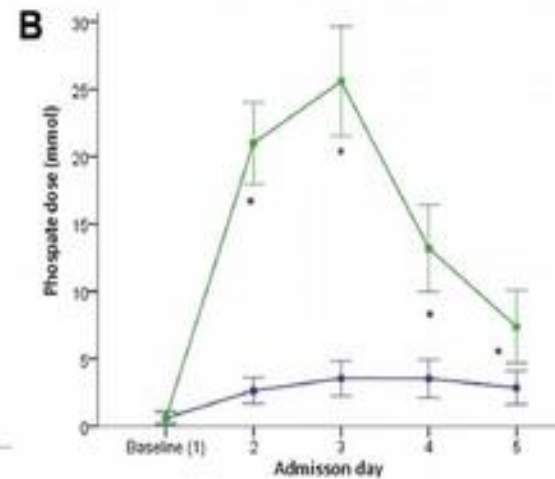
- retrospektivní
- ventilovaní, >7 dní na JIP
- refeeding sy = $P < 0,65$ mmol/l
- mortalita za 3, 6 měs., JIP, nemocnice, LOS
- podskupiny dle splnění nutričního cíle
 - <50% kalorického cíle do dne 3 (součet dnů 1-3)
 - >50% kalorického cíle do dne 3 (součet dnů 1-3)

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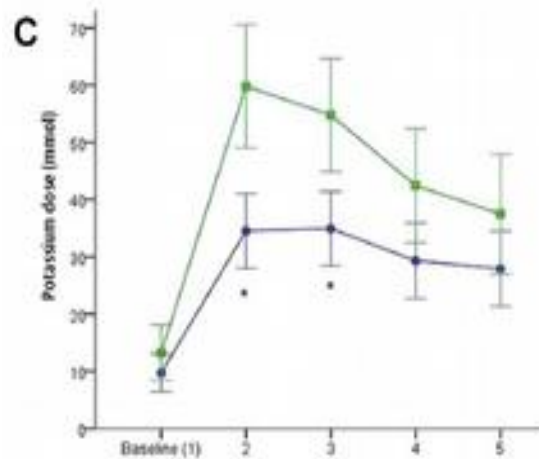
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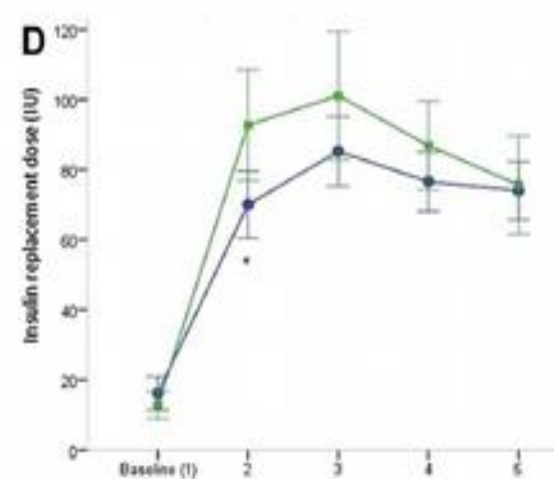
■ Population with RFS ● Population without RFS



■ Population with RFS ● Population without RFS

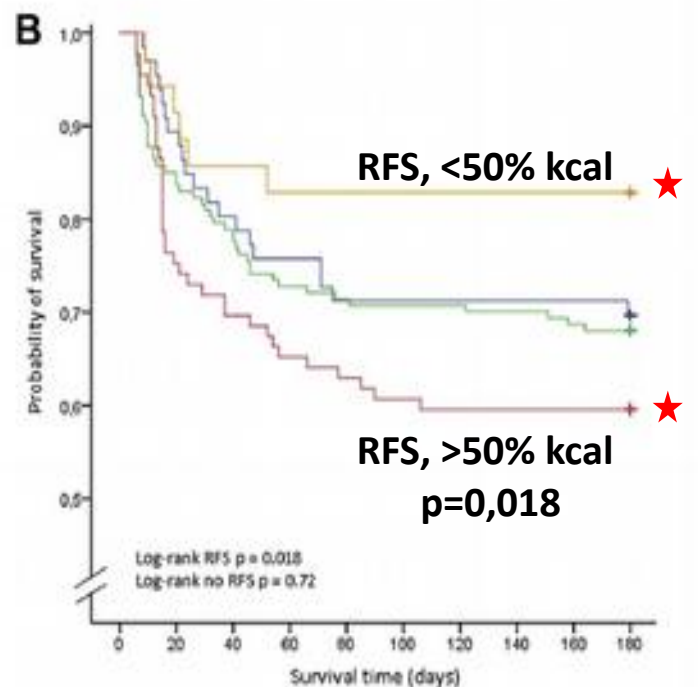
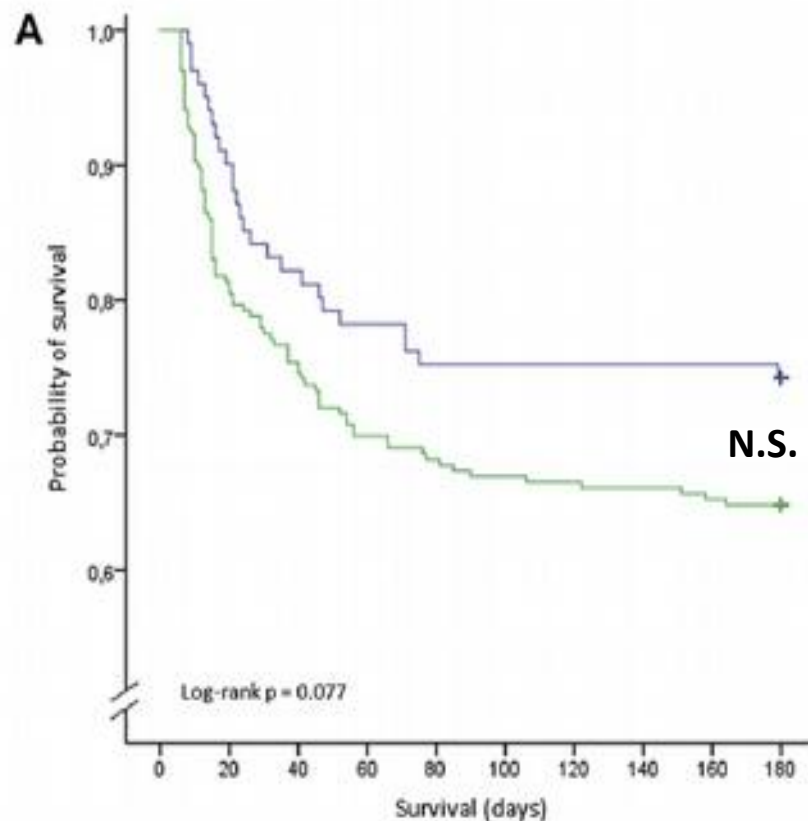


■ Population with RFS ● Population without RFS



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— RFS and <50% of caloric target

— RFS and >50% of caloric target

— no RFS and <50% of caloric target

— no RFS and >50% of caloric target

At risk	0	20	40	60	80	100	120	140	160	180
<50% of caloric target	101	91	83	79	76	76	76	76	76	75
>50% of caloric target	236	192	178	165	161	158	157	156	154	153

At risk	0	20	30	40	50	60	70	80	90	100
RFS and <50% of caloric target	35	32	30	29	29	29	29	29	29	15
RFS and >50% of caloric target	89	67	62	58	56	54	53	53	53	27
no RFS and <50% of caloric target	66	59	53	50	47	47	47	47	47	23
no RFS and >50% of caloric target	147	125	116	107	105	104	104	103	101	50

Management and prevention of refeeding syndrome in medical inpatients: An evidence-based and consensus-supported algorithm

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Reto W. Kressig M.D.^f, Jens Kondrup M.D.^g, Beat Mueller M.D.^h,
Philipp Schuetz M.D., M.P.H.^{h*}

1. Initial Risk Assessment

Minor risk factors

- BMI <18.5 kg/m²
- Unintentional weight loss >10% in the past 3–6 mo
- Little or no nutritional intake for >5 d
- History of alcohol abuse or drugs including insulin, chemotherapy, antacids, or diuretics

Major risk factors

- BMI <16 kg/m²
- Unintentional weight loss >15% in the past 3–6 mo
- Little or no nutritional intake for >10 d
- Low baseline levels of potassium, phosphate, or magnesium before feeding

Specific patient populations at high risk

- (careful assessment is recommended)
- Hunger strike, chronic severe dieting
 - History of bariatric surgery, short bowel syndrome
 - Tumor patients, frail elderly patients with chronic debilitating disease

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Prevenca refeeding syndromu

Preventive measures before/during nutritional therapy	Careful restoration of fluid balance to avoid fluid overload (see Table 1): % dehydration x BW (kg) = volume to be replaced in L (rough estimate of fluid loss)
	<p>No other preventive measures needed</p> <p><u>Depending on the risk, consider electrolyte substitution</u> if lower than normal/in low normal range* with daily adaption according to serum levels: 1–1.5 mmol/kg/d potassium, 0.2–0.4mmol/kg/d magnesium, 0.3–0.6 mmol/kg/d phosphate</p> <p><u>Depending on the risk, consider other measures:</u> use of thiamine (200–300 mg on days 1–5), Multivitamins during days 1–10, replace specific deficiency of trace elements, sodium restriction (<1 mmol/kg/d) for days 1–7</p>

Substituace kalia, magnesia, fosfátu, thiaminu, ostatních vitaminů a stopových prvků.
 Restrikce sodíku.

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	bez rizikových faktorů	malé riziko	střední riziko	vysoké riziko
Days 1–3 ^f	Energy (by all routes): Full requirements (40–60% carbohydrates, 30–40% fat, 15–20% proteins)	Energy (by all routes): 15–25 kcal/kg/d (40–60% carbohydrates, 30–40% fat, 15–20% proteins)	Energy (by all routes): 10–15 kcal/kg/d (40–60% carbohydrates, 30–40% fat, 15–20% proteins)	Energy (by all routes): 5–10 kcal/kg/d (40–60% carbohydrates, 30–40% fat, 15–20% proteins)
Day 4 ^f		Energy (by all routes): 30 kcal/kg/d (40–60% carbohydrates, 30–40% fat, 15–20% proteins)	Energy (by all routes): 15–25 kcal/kg/d (40–60% carbohydrates, 30–40% fat, 15–20% proteins)	Energy (by all routes): 10–20 kcal/kg/d (40–60% carbohydrates, 30–40% fat, 15–20% proteins)
Day 5 ^f		Energy (by all routes): full requirements (40–60% carbohydrates, 30–40% fat, 15–20% proteins)		
Day 6 ^f			Energy (by all routes): 30 kcal/kg/d (40–60% carbohydrates, 30–40% fat, 15–20% proteins)	
Days 7–9 ^f			Energy (by all routes): full requirements (40–60% carbohydrates, 30–40% fat, 15–20% proteins)	Energy (by all routes): 20–30 kcal/kg/d (40–60% carbohydrates, 30–40% fat, 15–20% proteins)
>10 d ^f		Energy (by all routes): full requirements (40–60% carbohydrates, 30–40% fat, 15–20% proteins)		

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bez rizikových faktorů

malé riziko

střední riziko

vysoké riziko

	bez rizikových faktorů	malé riziko	střední riziko	vysoké riziko
<i>Fluids</i>	No restriction in fluids	Fluids to maintain zero balance, approx. 30–35mL/kg/d	Fluids to maintain zero balance, days 1–3 25–30mL/kg/d, >days 4 30–35mL/kg/d	Fluids to maintain zero balance, days 1–3 20–25mL/kg/d, days 4–6 25–30mL/kg/d, >days 7 25–35mL/kg/d
<i>Salt</i>	No restriction in salt intake	No restriction in salt intake	Restrict Na to <1 mmol/kg/d (days 1–7)	Restrict Na to <1 mmol/kg/d (days 1–10)
<i>Iron</i>	No iron substitution within the first 7 d even if patients have iron deficiency			
<i>Monitoring</i>	<ul style="list-style-type: none"> • Assessment of serum electrolyte levels daily up to day 3, then every 2–3 d • Daily clinical examination focusing on hydration status (1–2 times per day) • Continuous monitoring of the cardiac rhythm or electrocardiogram daily in patients at very high risk for RFS 			

Refeeding syndrom

- U nemocných s refeeding syndromem (fosfatemie $<0,65\text{mmol/l}$)
 - měřit fosfatemii a ostatní elektrolyty 2-3x denně
 - substituovat deficiency
 - příjem energie by měl být snížen na 48 hodin, poté postupně navyšován (100% shoda)
 - *G. Doig, Lancet 2015*

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- Návrh definic refeeding syndromu:
- **Hrozící refeeding syndrom**
 - do 72 hodin po záchájení nutrice
 - pokles fosfatémie pod 0,6 mmol/l nebo o víc než 30%
nebo
 - pokles K n. Mg pod normu
- **Manifestní refeeding syndrom**
 - výše uvedené + klinické příznaky

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- Návrh definic refeeding syndromu:

- **Hrozící refeeding syndrom**

- do 72 hod:

bias analysis revealed high risks for performance, attrition, and reporting biases. Therefore, we cannot draw firm conclusions regarding the definition, prevention, risk factors, incidence, and treatment of RFS. There is currently a large, ongoing, multi-

o víc než 30%

- **Manifestní refeeding syndrom**

- výše uvedené + klinické příznaky

Závěry

- refeeding syndrom je v klinické praxi častý
- fyziologický projev anabolismu
- vystupňován může vést ke zhoršení stavu i smrti
- nutno na něj pomýšlet
- identifikovat rizikové pacienty
- monitorace klinická i laboratorní
- léčba – snížení intenzity výživy, replece minerálů a vitaminů
- potřeba dalšího výzkumu