AKI/CKD 住院病人照護重點

制定部門：腎臟內科
制訂日期：2016年 09月 21日
修訂日期：2018年 10月 17日

AKI Definition

- AKI：短期快速的腎功能損傷 (GFR下降)
  - 代謝廢物(ex: Urea/Cr)累積、水分/電解質/酸鹼失調
  - 病程病因多變/可能多病因; 最大risk是CKD
  - **KDIGO AKI Clinical Practice Guideline 2012**
    - UOP < 0.5ml/kg/hr x 6 hr ("oligouria 持續6hr")
    - Cr 上升 >/= 0.3mg/dL in 48hrs
    - Cr 上升 >/= 50% in 7 days (變成原本的1.5倍)
  - ARF = AKI & need RRT
- AKI常見尿量減少但並非絕對(減少者預後差)
  - Oligouria = UOP < 400ml/24hr or <0.5ml/kg/hr
  - Anuria = UOP < 100ml/24hr
  - Polyuria = UOP > 3000ml/24hr (AKI+部分阻塞可見)

AKI Categories (KDIGO 2012)

	Serum Creatinine Criteria			
	RIFLE	AKIN	KDIGO	Urine Output Criteria
Definition	Increase in serum creatinine of >50% developing over <7 days	Increase in serum creatinine of 0.3 mg/dL or >50% developing over <48 hours	Increase in serum creatinine of 0.3 mg/dL developing over 48 hours or >50% developing over 7 days	Urine output of <0.5 mg/kg/hour for >6 hours
Staging				
RIFLE–Risk AKIN/KDIGO Stage 1	Increase in serum creatinine of >50%	Increase in serum creatinine of 0.3 mg/dL or >50%	Increase in serum creatinine of 0.3 mg/dL or >50%	Urine output of <0.5 mg/kg/hour for >6 hours
RIFLE–Injury AKIN/KDIGO Stage 2	Increase in serum creatinine of >100%	Increase in serum creatinine of >100%	Increase in serum creatinine of >100%	Urine output of <0.5 mg/kg/hour for >12 hours
RIFLE–Failure AKIN/KDIGO Stage 3	Increase in serum creatinine of >200%	Increase in serum creatinine of >200%	Increase in serum creatinine of >200%	Urine output of <0.3 mg/kg/hour for >24 hours or anuria for >12 hours
RIFLE–Loss	Need for renal replacement therapy for >4 weeks			
RIFLE–End Stage	Need for renal replacement therapy for >3 months			

Also RIFLE-F or AKIN/KDIGO stage 3
-if SCr >4mg/dL&↑>0.5mg/dL or initiation of RRT
-if eGFR to <35ml/min/1.73m^2 in <18 y/o (KDIGO)

AKI Etiology

	Prerenal AKI 50~60%	Intrinsic AKI 35~40%	Postrenal AKI 5%
機轉	.Renal effective hypoperfusion ↓ .No renal parenchymal damage	Parenchymal disease (parenchymal involved)	Obstructed urinary outflow tract
次分類	**Intravascular volume ↓** -bleeding, GI/Renal/insensible loss -Nephrotic/Cirrhosis/capillary leak	**Tubular injury** -Ischemic (hypoperfusion) -Endogenous/Exogenous toxin (Hb/myoglobin,U.A, Ig, drug)	**Upper tract** -Retroperitoneal -Intraabdominal -Pelvic lesions -Ureter trauma -Hematoma -Fibrosis/granuloma -Stone, stricture, etc
	Cardiac output ↓ -CHF, VHD, cardiogenic shock -Pericardial dx, pulm HTN/embolism -Sepsis	**Tubulointerstitial** -Allergic interstitial nephritis -Infection & infiltration -Allograft rejection	
	Systemic vasodilatation (EAV ↓) -Sepsis, cirrhosis, drug/anaphylaxis	**Glomerular disease** -Inflammation dx, TTP/HUS	**Lower tract** -Prostate -Bladder -Functional (ex: DM) -Urethra
	Renal vasoconstriction -Early sepsis, HRS, Ca ↑, CIAKI/drug	**Renal microvascular** -HTN, preeclampsia, Ca ↑ -Scleroderma, CIAKI/drug	
	Abdominal compartment syndrome	**Large vessel dx (a. or v.)**	

Lab Index for Prerenal vs ATN

"Prerenal pattern" in prerenal & postrenal, GN, renal vascular dx

Diagnostic Index	Prerenal Acute Kidney Injury	Acute Tubular Necrosis
Fractional excretion of sodium (%)	<1 *	>2 *
U_{Na} (mmol/L)	<20	>40
Urine creatinine/plasma creatinine ratio	>40	<20
Urine urea nitrogen/plasma urea nitrogen ratio	>8	<3
Urine specific gravity	>1.018	≈1.010
Urine osmolality (mOsm/kg H_2O)	>500	≈300
Plasma BUN/creatinine ratio	>20	<10-15
Renal failure index, $U_{Na}/(U_{Cr}/P_{Cr})$	<1	>1
Urine sediment	Hyaline casts	Muddy-brown granular casts

Brenner & Rector's The Kidney, 10th ed. Ch. 31

Urinalysis Findings

	Prerenal AKI	ATN (ischemic/nephrotoxic)	Acute glomerular injury	Postrenal AKI
表現	1.通常無 cell/cast ("bland") 2.有時有透明 hyaline cast ✓ 是尿液正常成分在濃縮的尿液中聚集而成 ✓ 主成分是 Tamm-Horsfall protein，是一種由 loop of Henle 的 epithelial cell 製造的 mucoprotein	1.會看到小管上皮細胞和其聚成的 epithelial cell cast (= pigmented muddy-brown granular casts). 2.有 20~30% ATN 可能沒有 Cast (故不是診斷必要條件) 3.有半定量評分系統，藉由評估上皮細胞和 cast 的有無和數量，輔助 ATN 的診斷和 clinical course correlation	1.RBC Cast 暗示小球性疾病(少數 AIN 也有) 2.Dysmorphic RBC 用 Phase contrast microscope 最好觀察，是小球損傷者更常見的尿液表現，但專一性較 RBC Cast 低	1.也可能是"bland" 2.前列腺或使尿路管腔內堵塞疾病 (stone, blood clot, sloughed papilla)常見有血尿
備註		常併顯微血尿和輕微小管性 Proteinuria (<1 g/day)	常合併 Overt proteinuria (>1g/day)	RBC 和 GN 的差別是血球不會變形
	Pre-glomerular vessel dx	**Interstitial nephritis**	**Crystal related AKI**	
表現	1.Variable 2.Benign to overt nephritic	1.White blood cell casts 2.Nonpigmented granular cast 3.Drug-induced allergic AIN 通常會有 Eosinophiluria (~90%)	1.Urine uric acid crystals (pleomorphic)可以出現在prerenal AKI，但若量多時須注意可能是acute urate nephropathy(如 Tumor lysis syndrome) 2.Oxalate crystalluria ✓ Needle/dumbbell shaped monohydrate cristal ✓ Envelope-shaped dihydrate crystals ✓ 暗示 ethylene glycol toxicity (Serum O.G.高)	
備註	血尿和蛋白尿都可出現	部分藥物因引起的 AIN 可以合併 Heavy proteinuria		


腎衰竭
急性或
慢性併急性或
慢性
過去腎功能檢查
腎臟大小 (超音波)
腎後性 (阻塞)
無尿 (<50 mL/day) (若阻塞是雙側)
膀胱漲
腎水腫 (超音波)
腎前性 (體液容積不足)
姿態性血壓和心跳
頸靜脈
BUN/Cr > 20
大血管栓塞或梗塞
動脈硬化血管疾病
腎臟大小不一 (超音波)
腰痛
肉眼可視血尿
無尿 (若阻塞是雙側)
腎實質性病變
缺血、毒藥物、或腎絲球傷害

腎衰竭之鑑別診斷流程

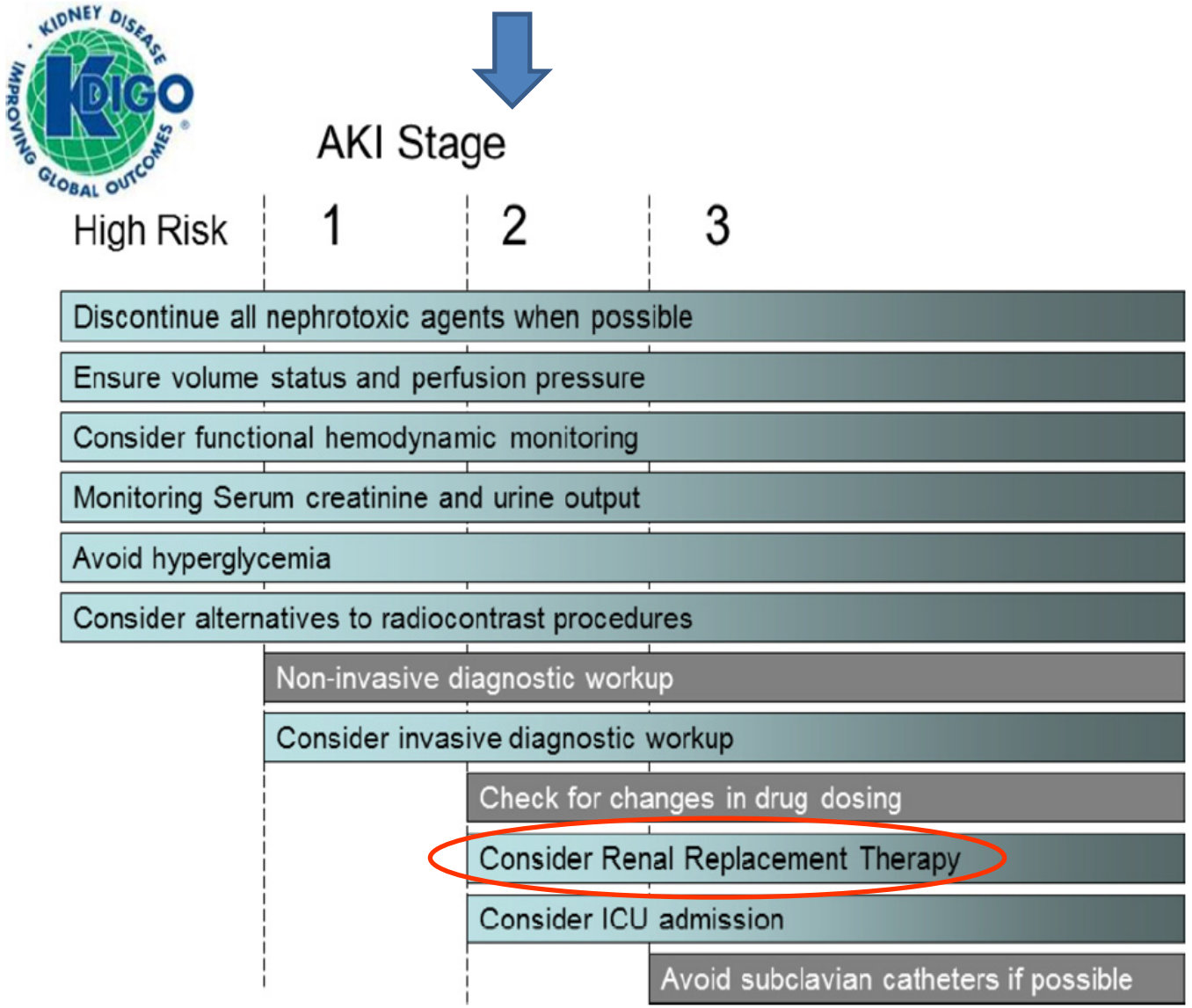
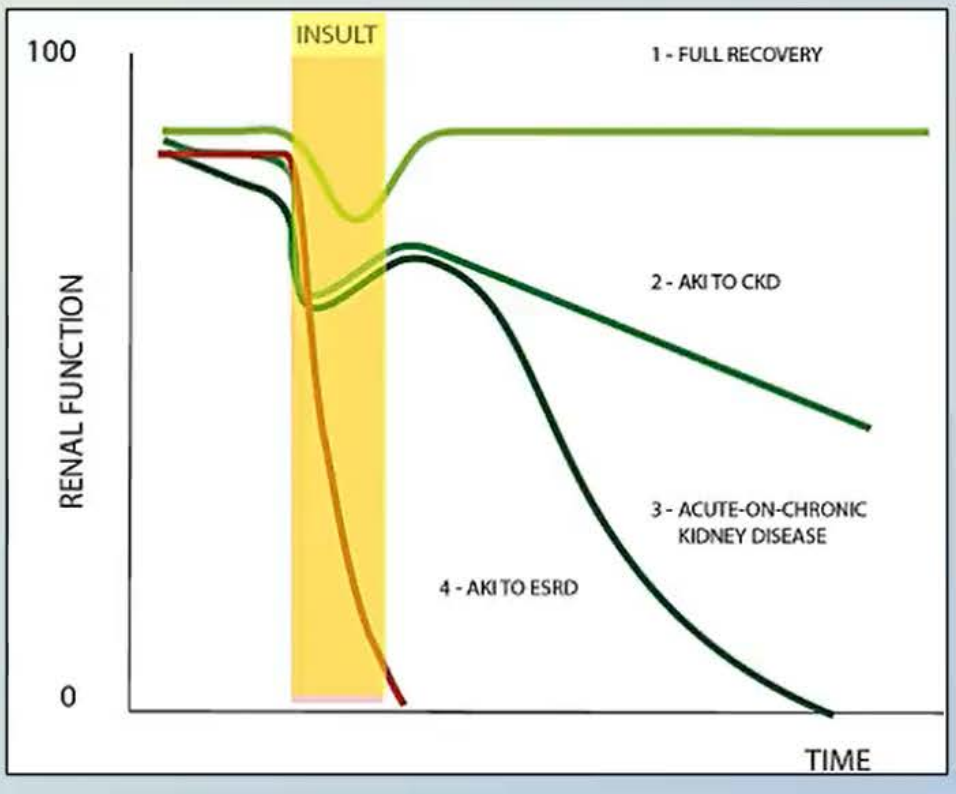
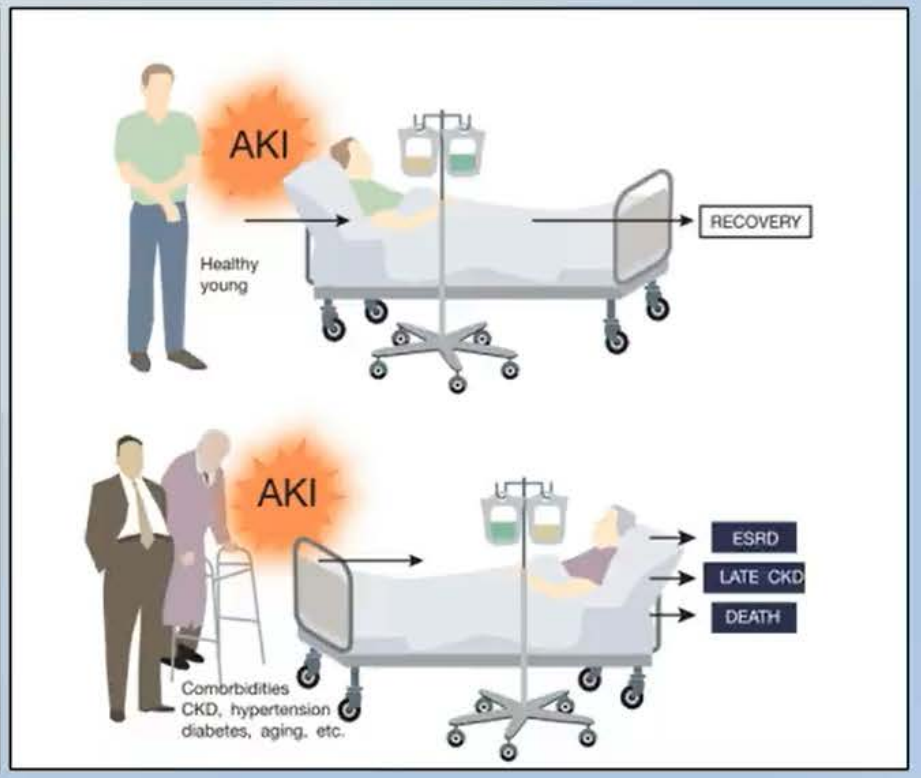


Figure 2. Stage-based management of acute kidney injury (AKI). Shading of boxes indicates priority of action—solid shading (with white lettering) indicates actions that are equally appropriate at all stages whereas graded shading (with black lettering) indicates increasing priority as intensity increases. Abbreviation: ICU, intensive care unit. Reproduced with permission of KDIGO from the *KDIGO Clinical Practice Guideline for Acute Kidney Injury.*[1]

Kidney International Supplements (2012)

Consequence of AKI





Clin J Am Soc Nephrol 3: 881-886, 2008

Kidney International (2017) 92, 1071–1083

CKD & ESRD Definition

- CKD：**3個月以上**
  - GFR下降(至**60ml/min**以下)
  - GFR **> 60ml/min + 病理/影像/實驗室證據慢性腎臟損傷**
- ESRD/ESKD：End-stage renal (kidney) disease
  - CKD + accumulation of toxins/fluid/electrolytes

  → **Uremia & death unless RRT** (和CKD stage 5不同)

Criteria for CKD (either of the following present for >3 months)	
Markers of kidney damage (one or more)	Albuminuria (AER ≥30 mg/24 hours; ACR ≥30 mg/g [≥3 mg/mmol]) Urine sediment abnormalities Electrolyte and other abnormalities due to tubular disorders Abnormalities detected by histology Structural abnormalities detected by imaging History of kidney transplantation
Decreased GFR	GFR <60 ml/min/1.73 m^2 (GFR categories G3a-G5)

CKD Categories (KDIGO 2012)

Table 5 | GFR categories in CKD

GFR category	GFR (ml/min/1.73 m^2)	Terms
G1	≥90	Normal or high
G2	60–89	Mildly decreased*
G3a	45–59	Mildly to moderately decreased
G3b	30–44	Moderately to severely decreased
G4	15–29	Severely decreased
G5	<15	Kidney failure

Albuminuria categories in CKD

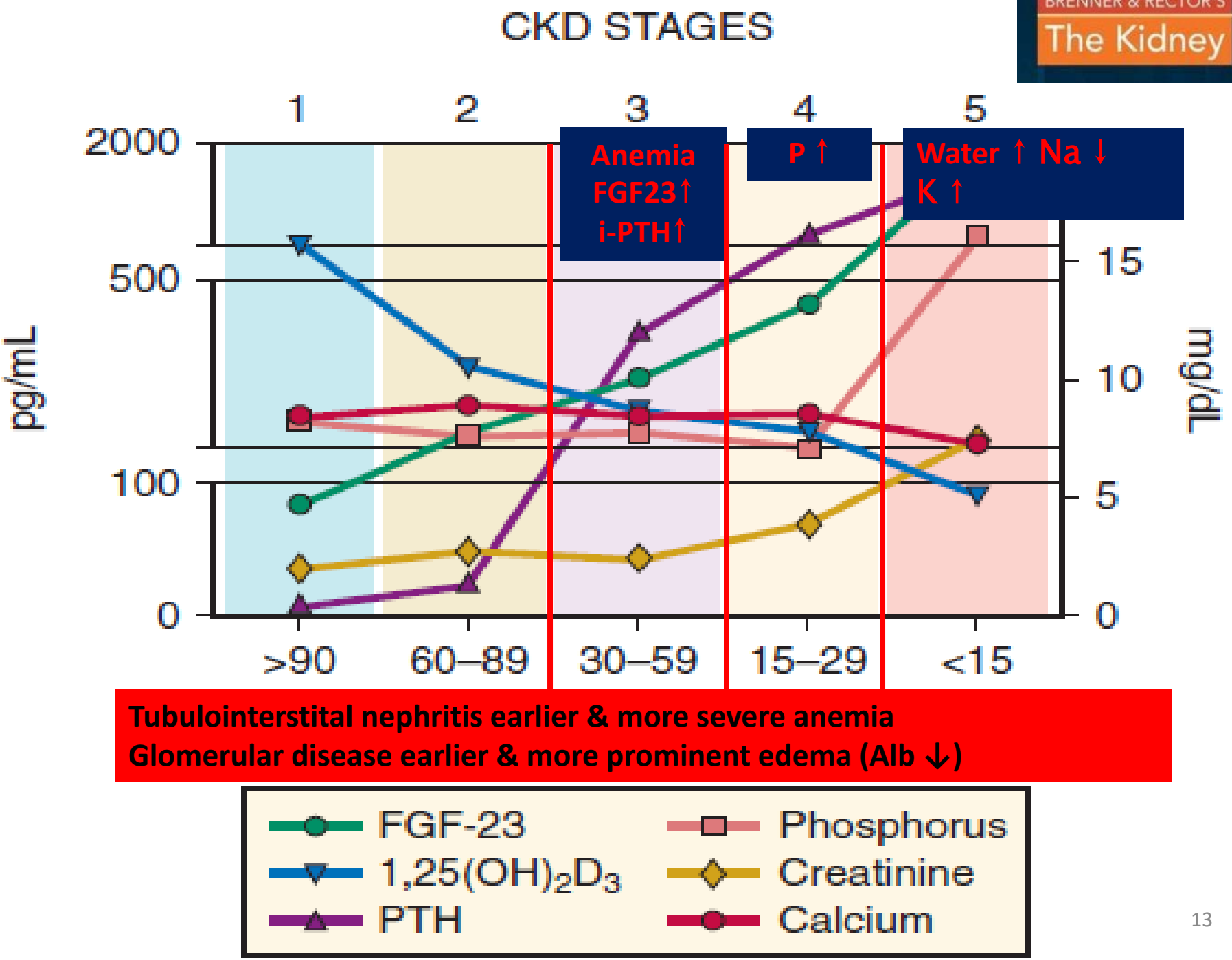
Category	AER (mg/24 hours)	ACR (approximate equivalent) (mg/mmol)	ACR (approximate equivalent) (mg/g)	Terms
A1	<30	<3	<30	Normal to mildly increased
A2	30-300	3-30	30-300	Moderately increased*
A3	>300	>30	>300	Severely increased**

CKD Categories (KDIGO 2012)

Prognosis of CKD by GFR and Albuminuria Categories: KDIGO 2012

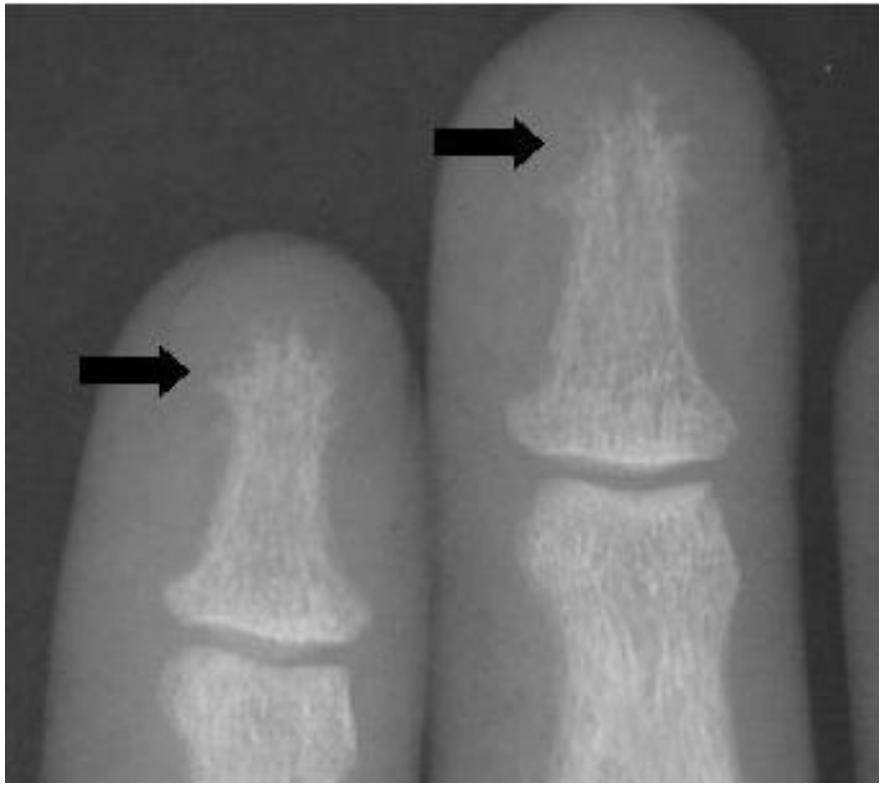
GFR categories (ml/min/ 1.73 m²) Description and range				Persistent albuminuria categories Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30-300 mg/g 3-30 mg/mmol	>300 mg/g >30 mg/mmol
	G1	Normal or high	≥90			
	G2	Mildly decreased	60-89			
	G3a	Mildly to moderately decreased	45-59			
	G3b	Moderately to severely decreased	30-44			
	G4	Severely decreased	15-29			
	G5	Kidney failure	<15			

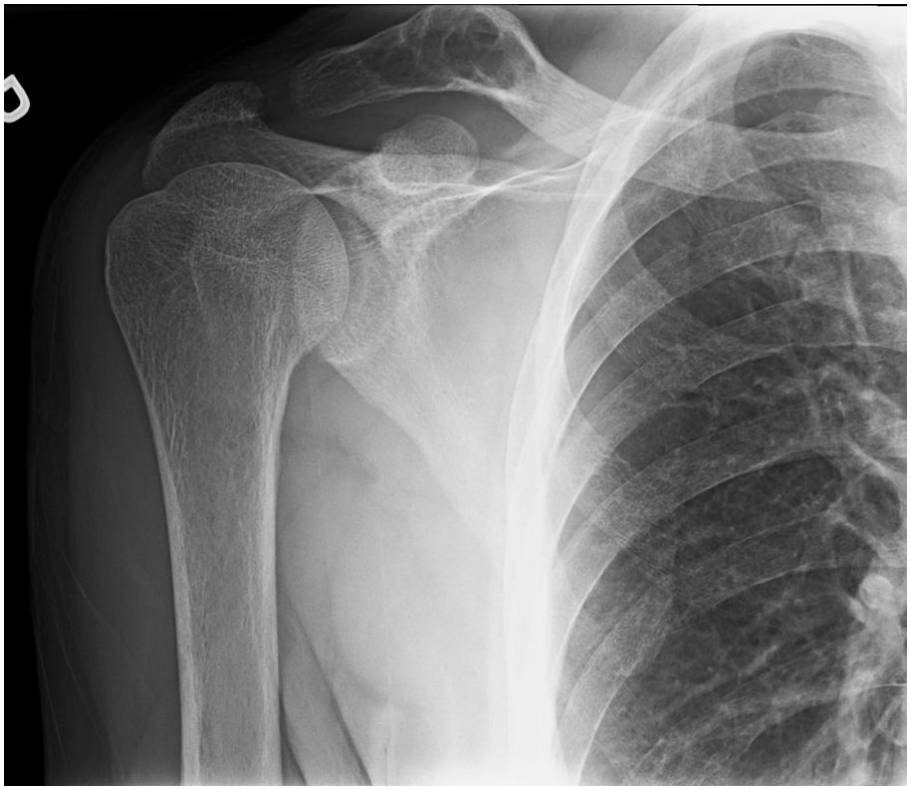
Green: low risk (if no other markers of kidney disease, no CKD); Yellow: moderately increased risk; Orange: high risk; Red, very high risk.

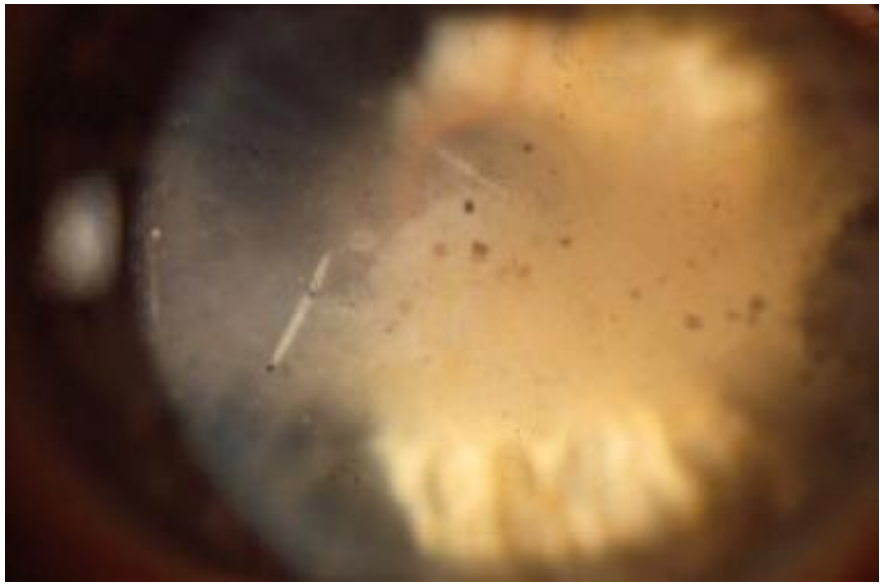

CKD STAGES
1
2
3
4
5
Anemia
FGF23↑
i-PTH↑
P ↑
Water ↑ Na ↓
K ↑
2000
500
100
0
pg/mL
15
10
5
0
mg/dL
>90
60–89
30–59
15–29
<15
Tubulointerstital nephritis earlier & more severe anemia
Glomerular disease earlier & more prominent edema (Alb ↓)
FGF-23
1,25(OH)2D3
PTH
Phosphorus
Creatinine
Calcium

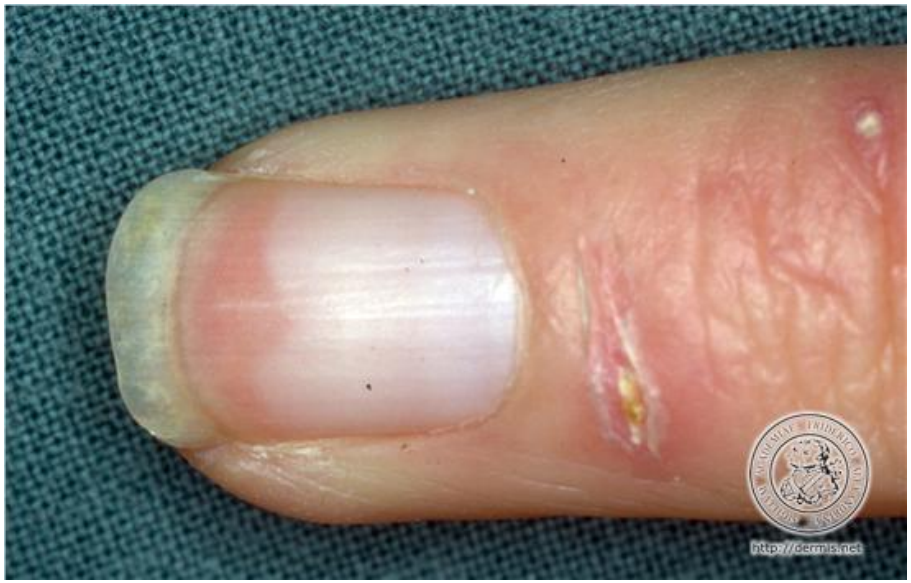
區分AKI vs CKD的線索

- History: onset timing & possible precipitants
- Baseline renal function level
- Other evidence of "chronicity" (特別是無basal BUN/Cr時)
  - Hyperparathyroidism/renal osteodystrophy (stage 3)
  - → **Distal phalangeal tufts/lat. clavicle resorption**
  - → **Skull "Pepper on salts"** (低血Ca/高血P可參考但有例外)
  - **Band kerotapathy** (鈣沉積於角膜)
  - **Half-and-half nail** (Lindsay's nail, 尿毒刺激黑色素細胞增生)
  - Small & increased echogenic renal image
  - → Except DKD, HIV, amyloidosis, PKD, renal v. thrombosis
  - Anemia可參考但有例外(may in some AKI, ex: GIB)








http://dermis.net

腎功能不全者常見住院原因

- 腎功能惡化(AKI or AKI on CKD) + 併發症(AEIOU)
  - Hyperkalemia → weakness, arrhythmia, etc
  - Metabolic acidosis → SOB, conscious/BP change, etc
  - Fluid overload → leg edema, pulm. edema, etc
  - Uremia → consciousness change, pericarditis, etc
- 敗血症/心血管疾病等 + CKD Hx or inducing AKI
- 不管是哪一種都需注意
  - 找出腎功能惡化原因並移除(改善腎功能唯一方法)
  - 避免產生腎功能惡化相關的Complication
  - 進入腎衰竭者評估是否需進入透析

Renal Insufficiency Evaluation

- 有腎功能惡化S/S (AEIOU…)/相關問題 → **BUN/Cr/eGFR**
  - 注意干擾(ex: high protein diet, steroid/GIB, muscle, etc)
- 分辨AKI/CKD/AKI on CKD & Cause of renal injury
  - Careful Hx/PE & review chart/lab/UA/renal image (Echo/CT)
  - **Serial SCr review very important**
  - If no basal GFR → **clues of CKD ? (ex: parathyroidism)**
  - AKI → causes ? ; CKD +/- AKI → precipitants & underly ?
  - **排除Post-renal** (摸膀胱/ICP/echo) & **prerenal** (ex: shock)
  - **血管性問題**不常見但危險(ex: Ao. dissection, renal infartion)
- Exam → **eGFR(MDRD), FeNa, U/A, renal echo, ACR**
  - 24hr CCr/DPL in CKD progression or AKI on CKD if eGFR<30
  - Other specific tests & consider renal biopsy in selected group

腎功能不全者照護重點

- Uremia
  - 疾病表現不典型, 症狀模糊, 意識/判斷也易受影響
  - 作 Procedure 須小心 bleeding tendency
- Urine amount & solute clearance decreased
  - 謹慎考慮是否 run IVF (避免醫源性肺水種) & I/O & BW
    - 較難判斷者先on lock (有明確適應症才run IVF)
    - 感染+低血壓 → 請盡早考慮 CVP 的放置(check level)
  - 考慮給的藥是否有需要調整Renal dose
    - 查明腎功能劑量後再給(ex: 抗生素) & 注意藥物交互作用
    - 不知道的如非必要先不給(但不可延誤該用的藥,如抗生素)
- 病情複雜度高共病多
  - 處置前思考適應症/禁忌症 & 是否可能是醫療處置造成?

Diet Control

- Low salt diet (目標 = Na 2~4g/d) for most CKD patients
  - Salt = NaCl → 經驗上開Salt<3~5g/d (水腫者3g/d, HD/一般5g/d)
  - NG diet都是low salt diet故不用特別開
- Low water diet for edema patients (or high risk)
  - 維持體液之水量 = Urine amount/d + 500ml/d
  - 限水 → <1000~1500 ml/d (包含水和含水多的餐食)
- Low K diet (<40meq/d) for CKD stage 4~5 or HD patients
  - PD反而容易Hypokalemia (PDF K = 0)
- Low protein diet for CKD stage 3a~5且未RRT者
  - 3a = 0.8g/kg/d ; 3b~5 = 0.6~0.8g/kg/d (ex: 40g/d)
  - 3b~5可併用ketosteril並將蛋白量降到0.3~0.6g/kg/d
  - RRT反而要增加: HD 1.1~1.4g/kg/d, PD 1.2~1.5g/kg/d
- P: 5~10mg/kg/d, Ca: diet (~500mg/d) + drug <2000mg/d

腎功能不全者照護重點

- 血液透析 (HD, 俗稱洗腎)
  - 病人洗腎的途徑為何?
    - D/L
    - Shunt (AVF or AVS) → 哪一手或雙手禁治療
    - Permcath
  - 洗腎(HD)頻率
    - QW135, QW246 or other (要聯絡HDR Tel: 2540/2539)
- 腹膜透析(PD)
  - 換液頻率/濃度 & 腹膜透析紀錄本
- Routine Lab/Study
  - CXR, CBC(DC), BUN, Cr, Na, K, Ca, P 在CKD大多都需要
  - ABG/VBG/CO2, i-PTH, Ferritin or serum Iron & TIBC視情況
  - 規則透析患者：CBC/DC/Na/K/Ca/P (BUN/Cr/CO2視情況)

腎功能不全者照護重點

- Check I/O Q8H and/or body weight qd
  - 視病人監控水分需求/活動力&照護者配合度選擇
- Check 24hr CCr and daily protein loss (if need & 3月內無)
  - 24hr CCr主要for CCr<30者GFR評估&RRT重大申請
  - 24hr urine TP/Cr主要for CCr <30 (spot urine不準確)
  - 如是蛋白尿篩檢+CCr>30: spot urine ACR (Alb/Cr)
  - 已知嚴重蛋白尿+CCr>30: spot urine PCR (TP/Cr)
- Check VDRL, HBsAg, Anti-HCV Ab, HIV test (if need)
  - For HDR分類 & glomerular disease
- Renal echo (if 3~6月內沒做 & need) (Tel: 2437)
  - 排除Obstructive uropathy & structural disease
  - 無特別懷疑膀胱疾病 → 不要開Kidney & bladder(需脹尿)

CKD常用藥物

- EPO/DPO → Hb<9 + HD/PD or CKD + eGFR <15 可健保
  - RRT目標Hb 9~11 (CKD>10); >11考慮減量或停用; >13需停
  - 原則上<12可先照長期劑量開
  - 研究都是做SC, 如要在洗腎室順便給則途徑要改IV
  - EPO 2000U (開IRRE & 首日量領一周用量)
    - TIW if Hb<10；BIW if Hb 10~11；QW if Hb 11~13
  - 長效 = Darbepoetin (DPO) 1PC QW or EPO 5000U 1PC QW
    - 效果和EPO 2000U 1PC TIW差不多
    - 現在有Mircera (MPEG) 1PC Q month (限門診使用, SC in CKD)
- 鐵劑 → CKD + Anemia + Fe/TIBC <30% or Ferritin <300
  - 有原料EPO才有用 & 要找IDA原因

CKD常用藥物

- 降磷藥物→ CKD stage 3~5D + P个 or i-PTH个 (+/-飲食控制)
  - 要配飯吃("CC")才是降P (鈣片如AC吃則是補鈣)
  - Ca. acetate (667mg/pc, 25%) = 元素鈣 167mg (上限9pc/d)
    - Potency較強(1PC結合30mg P), 但有苦味, 住院可健保
  - Ca. carbonate (500mg/pc, 40%)= 元素鈣 200mg (上限7pc/d)
    - Potency較弱(1PC結合19.5mg P), 住院需自費2元/tab (OPD不用)
  - Al. hydroxide (324mg/tab) → potency最強(1PC結合30mg P)
    - 長期使用造成Osteomalacia → 建議使用不超過2~3月
  - 其他: Sevelamer, Lanthanum carbonate, ferric citrate
- Vit. B complex (OPD不用自費;住院一律開Hi-Beston, 需自費)
- Folic acid, Sennoside (不要長期MgO)

Target in Current CKD Guideline

Start to check Ca/P/i-PTH/ALK-P since CKD stage 3/GFR<60 (Child: stage 2)
& Check 25(OH)-Vit.D in CKD stage 3-5D (especially in i-PTH > target range)

	stage	KDOQI 2003	KDIGO 2009	TW CKD 2015
P. (mg/dL) *<2.5 → abnormal mineralization	3 4 5(D)	2.7~4.6 2.7~4.6 **3.5~5.5**	**Normal range (to normal in high P with RRT)**	**Normal range(3~5)** **3-4: 2.7~4.6** **5(D): 3.5~5.5**
i-PTH. (pg/dL)	3 4 5(D)	35~70 70~110 **150~300**	3~5 < Upper normal **5D: Upper normal x 2~9**	
Corrected total Ca. (mg/dL)	3 4 5(D)	Normal range Normal range **8.4 to 9.5** (lower end of normal)	**Normal range**	**Normal range (5D: 8.4~9.5)**
Ca. x P. (mg^2/dL^2)	3-5D	**< 55**	NA (No role)	**3~4: <55**
Element Ca. intake (non-drug 500mg/d)	3-5D	**≦ 2000mg/d** (Drug ≦ **1500mg/d**)	NA (Not mentioned)	**≦ 2000mg/d** (Drug≦ **1500mg/d**)
Dialysate Ca (meq/L)	5D	**2.5** (1.5~2 if persisted Ca. ↑)	**2.5~3**	NA
25(OH)-Vit.D (ng/ml)	3-5D	**≧ 30**	**Normal range**	**≧ 30**

種類/成分	吸P效價	用量(257mg P)/費用	優點	缺點
Ca.acetate (667mg/tab) (25% = Ca. 167mg per dose)	30mg/pc	**8.5~9 pc/d** /健保給付 (~Ca 1425~1500mg)	有效, 便宜, 比碳酸鈣強&Ca少	高鈣, 血管/軟組織鈣化, PTH過低,CV risk; GI S/E ; 醋酸苦味; 碳酸鈣量大
Ca.carbonate (500mg/tab) (40% = Ca. 200mg per dose)	19.5mg/pc	**13pc/d** /自費13元 (但**7.5pc**就達Ca上限)	有效, 最便宜, 使用廣泛	
Al(OH3) (324mg/tab) (Al ~112mg per dose)	30mg/pc	**8.5~9pc/d** / 自費9元	**效果最強**, 便宜 劑型多,不含鈣	Al: Osteomalacia, dementia; GI S/E
Sevelamer HCl (800mg/tab)	64mg/pc	**4pc/d** / 自費140元	**無金屬**; 少鈣化, **降脂**; 新透析死亡<CBB(整體 ?)	花費高, 量大; S. HCl ↑酸血; GI S/E; ↓D3吸收+/-須補鈣
S. carbonate (800mg/pk)		**4pc/d** / 自費156元		
Ferric citrate (500mg/cap) (Fe 105mg per dose)	效價 as sevelamer	**6.5pc/d** / 自費227.5元	**降ESA/IV鐵用量**, 改善貧血,無鈣	GI S/E; 研究較少 單次花費較高
Lan. CO3 (Lan. 1000mg/tab)	效價 as Al(OH)3	**3pc/d** /自費450元	**效果很強,** 無鈣, 需咀嚼, **顆數少**	花費高, GI S/E Lan.累積問題(?)
Mg/Ca.CO3(300/400mg/ tab) (Mg 28% =85mg per dose) (Ca 25% =100mg per dose)	資料較少	資料少, **約2~6pc/d** 達1500mg Ca的用量 Mg/Ca.CO3 300/400 = 15pc Mg.CO3/Ca acetate 300/300 or 200/450 = 13pc or 20pc	有效, 便宜 降低鈣用量	GI S/E(Diarrhea) Hypermagnesemia (可導致呼吸抑制) Hyperkalemia 研究較少, 於降磷使用未廣泛接受
Mg.CO3/Ca.acetate (300/300 or 200/450mg/tab) (Mg 28% = 57mg or 85mg) (Ca 25% = 75mg or 112.5mg)				
Nicotinamide (B3 500mg/tab)	非此機轉效果類似	**1pc/d**, 4.3元	有效, **無金屬** **藥丸顆數少**	Flush, 血小板低 Intolerance多

Indication of HD

- Emergent indication: 通則 & 無大型Trial檢視
  - Hyperkalemia (E) → 需"絕急洗"的僅合併致命EKG變化時
    - ex: VT/VF, sine wave, bradycardia, etc
    - 一般 K > 6~6.5 可考慮洗(但不一定真的很急)
    - HD可有效移除鉀離子(2~2.5hr以上就足夠穩定病人)
    - 仍需密集監測K level並同時調整藥物治療, 以免relapse
  - Pulmonary edema (O) → RRT常被用來預防惡化到需呼吸器
    - APE較難靠藥物快速改善(不一定要CXR但要排除AMI)
    - 如果病人現在已經需使用呼吸器了 → 先用再洗以免CPCR
  - Meta. Acidosis (A)
    - AKI+代謝酸會影響生命者多是被其他問題所惡化(如敗血症)
    - RRT效果/角色取決於Underlying (無絕對標準 & 可先Jusomin)
    - 一般PH <7.0~7.2 & HCO3<8~10 (or 15)可考慮

Indication of HD

- Uremic complication → 嚴格來說不算急的Indication
  - 現在AKI已很少等有Uremic complication才開始RRT
  - 常見需RRT的Uremia = encephalopathy, pericarditis, bleeding; 其他如severe nausea/vomiting等可考慮
  - 需透析較多次之後才可以看見明顯改善(ex:一週後)
- Intoxification → 要看洗有沒有用(ex: BZD沒用)
- Non-emergent indication of HD
  - Fluid removal (決定RRT initiation的重要決定因子)
  - Correction of moderate ABG/electrolytes problems
- Renal support (=early intervention)
  - RRT作為Adjuvant Tx, 調整Fluid和控制Solute/營養等
  - 讓病人有更多空間治療underlying disease

聯絡血液透析注意事項

- 本科病人常規洗腎者直接聯絡HDR(Tel 2539/2540)排程
- 非腎臟科或非常規洗腎者須腎臟科VS/Fellow會診或醫囑
- 確認Access (DL, Perm. cath, AVS) & 功能(thrill/bruit)
- 確認有腎臟科VS/Fellow醫囑後
  - 開立血液透析同意書(每次住院都要重開)
  - 解釋醫師要簽名+蓋章; 執行醫師一律不用(給HDR簽)

  → 病患到HDR洗時由HDR duty R + Fellow雙人簽+蓋章
  - 聯絡HDR(Tel 2539/2540)排程並告知透析醫囑
- 需On DL者
  - 開立雙腔靜脈導管同意書&一律不簽(僅一欄,給HDR簽)
  - 部位選下肢或雙側大腿(特殊限定者Call Fellow/VS討論)

HD Order聯絡注意事項

- 必要項目(7項)
  - 床號/病歷號/姓名/Nephro. VS/Access (AVS要確認功能)
    - AVS(AVF/AVG), Perm. cath, Double lumen
    - 位置: femoral (left/right), internal jugular (left/right)
  - 頻率(stat/QW135/QW246), HBV/HCV/HIV/RPR&有無隔離
- 額外項目(如有特殊Order或特殊狀況)
  - Duration (透析時間)
    - Regular case ：照以往透析時間(除非有另外考量)
    - New case ： 2.5hr → 3hr → 3.5hr (要問VS)
  - UF (kg, 脫水量)：如VS有Order或有特殊考量需交代
  - Heparin (住院區常規Free = 5000U rinse AK); ICH可完全不加
  - BT, Mannitol(BUN>100+新透析者才要,和BUN約1:1), Ca/Na
  - 一般SBP<80mmHg不接受IHD → 問VS or fellow如何處理

其他注意事項

- 評估OPD長期藥物是否需開立或調整(ex: OAD, 血壓藥)
- 如非明確可在洗腎中給的藥物盡量不要開在洗腎室給
  - 較廣為接受可HD給的 = EPO/DPO, Vancomycin, 輸血
- HDR可接受順便抽當日常規抽血, 但不可太過
  - 有時效性的(ex:備血), 受Heparin影響的(ex:PT/APTT)不適合
  - HDR非病房單位, 該屬於病房先做的事情不應該因為HD改變
- 病人若出院後欲在本院接受HD者
  - 填寫"血液透析醫囑單"及"血液透析基本資料表"

  → 由家屬至洗腎室安排(Nephro VS開立或聯絡HDR找Fellow開)
- 出院後要到外院透析者

  → 寫"血液透析轉診單"(Nephro VS開或聯絡HDR找Fellow開)

腹膜透析室/慢性腎病衛教室

- PD換液、管路衛教問題、更換腹膜透析問題
  - 可連絡PD room 2547
  - 可和該單位護理師聯絡後，逕行至3F血液透析室旁見習衛教、PD procedure等事項

- 慢性腎病衛教室
  - CKD患者衛教資訊可提供諮詢 TEL 3076

Reference

1. 台灣慢性腎臟病指引2015
2. 血液透析手冊5/E(2015)
3. KDIGO Clinical Practice Guideline for Acute kidney injury 2012
4. Brenner & Rector’s The Kidney, 10th ed. Ch. 31


Thank You !