Acute kidney injury in patients with COVID-19

By T. Jardine

Outline

- Definitions
- Literature review
- Implications for practice

Definitions

- NB – recently revised 2020 KDIGO definitions
- Changes to terminology (eg. “renal” -→ “kidney”; ESRD-→”kidney failure,)
- Precision in language is important when consulting

Definitions

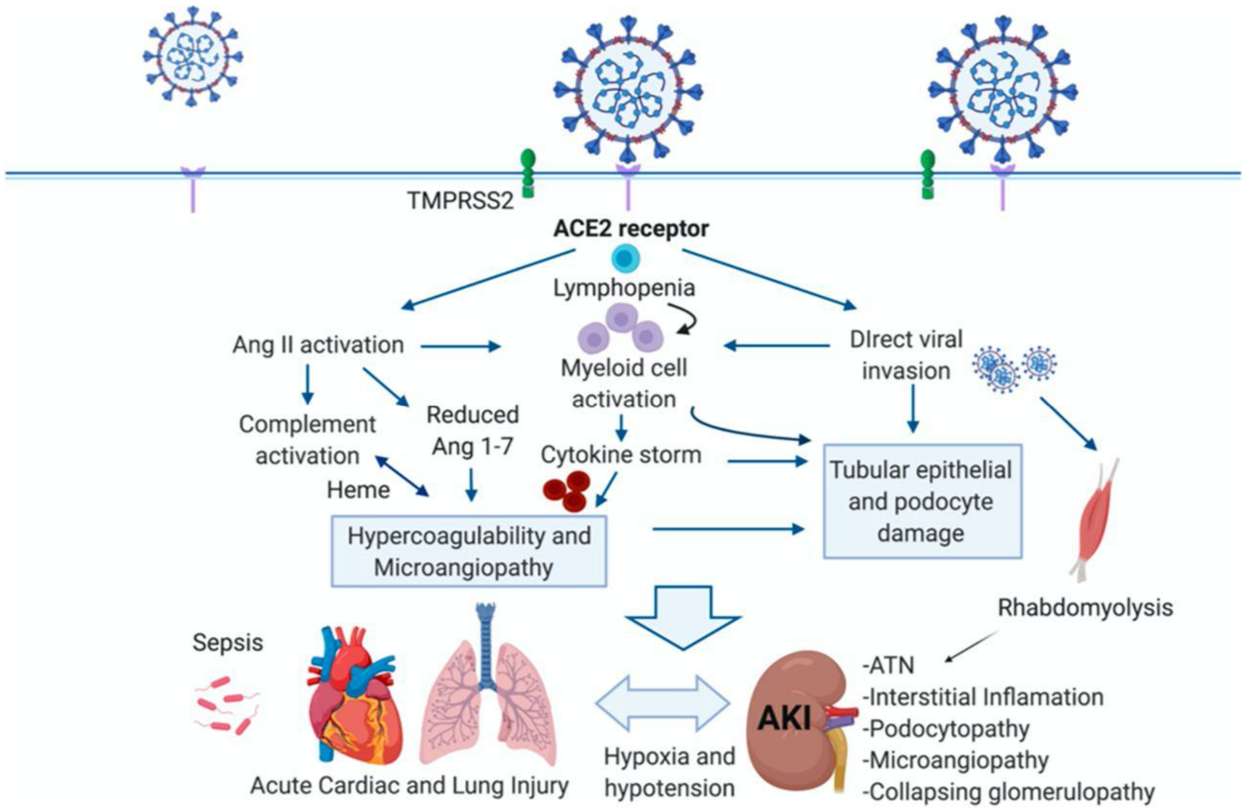
Preferred term	Suggested abbreviations[a]	Rationale/explanation	Terms to avoid
Part 3. Acute kidney diseases and disorders (AKD) and acute kidney injury (AKI)		Disease duration $\leq$3 mo; conceptually different from initial recognition of CKD	Acute renal failure (ARF); acute renal insufficiency (ARI)
Acute kidney diseases	AKD[c]	KDIGO definition: AKI, or GFR $<$60 ml/min per 1.73 m^2, or markers of kidney damage for $\leq$3 mo, or decrease in GFR by $\geq$35% or increase in serum creatinine by $>$50% for $\leq$3 mo	ARF, ARI
Acute kidney injury	AKI	KDIGO definition (AKI is a subcategory of AKD): oliguria for $>$6 h, rise in SCr level by $>$0.3 mg/dl in 2 d or by $>$ 50% in 1 wk	ARF, ARI
AKI classification		KDIGO classification by cause and stage preferred rather than stage alone; e.g., a patient with AKI stage 3 due to ATN; classification applies to all AKI stages	Previous classifications, including RIFLE and AKIN (the KDIGO classification harmonized these prior definitions)
AKI stages		KDIGO definition (applicable only to people with AKI)	
	AKI stage 1	Serum creatinine and/or urine output criteria	
	AKI stage 2	Serum creatinine and/or urine output criteria	
	AKI stage 3	Serum creatinine and/or urine output criteria	

includes disorders characterized by markers of kidney damage, eg. Albuminuria,proteinuria, haematuria, electrolyte abnormalities/acid base disturbance, urinary tract obstruction

+-26umol/L

Definitions

GFR categories		For use in describing GFR level irrespective of the presence or absence of kidney disease; GFR units are ml/min per 1.73 m^2 for these categories; multiple categories can be collapsed (e.g., G3–G5)
Normal to increased GFR	G1	GFR $\geq$90 ml/min per 1.73 m^2
Mildly reduced GFR	G2	GFR 60–89 ml/min per 1.73 m^2
Moderately reduced GFR	G3a	GFR 45–59 ml/min per 1.73 m^2
	G3b	GFR 30–44 ml/min per 1.73 m^2
Severely reduced GFR	G4	GFR 15–29 ml/min per 1.73 m^2
Kidney failure	G5	GFR $<$15 ml/min per 1.73 m^2 or treated by dialysis



From Acute Kidney Injury in COVID-19: Emerging Evidence of Distinct Pathophysiology. *Journal of the American Society of Nephrology. By Batlle et al*

Literature review

SARS-CoV-2 infection does not significantly cause acute renal injury: an analysis of 116 hospitalized patients with COVID-19 in a single hospital, Wuhan, China

By Lunwen Wang, Xun Li, Hui Chen, Shaonan Yan, Yan Li, Dong Li, Zuojiong Gong (23 Feb 2020, medRxiv, later published in American Journal of Nephrology)

METHODS: Single centre, prospective, observational. Measured urea, Cr, dipstix

RESULTS:

- 116 patients admitted between 14 Jan 2020 to 13 Feb 2020
- Median age 54 (IQR 38-69), 57% male, comorbidities: hypertension (37%), diabetes (18%), malignancy (10%), stroke (7%), CKD (4.3%)
- 40% severe pneumonia, 11% required ICU

Literature review

SARS-CoV-2 infection does not significantly cause acute renal injury: an analysis of 116 hospitalized patients with COVID-19 in a single hospital, Wuhan, China

By Lunwen Wang, Xun Li, Hui Chen, Shaonan Yan, Yan Li, Dong Li, Zuojiong Gong (23 Feb 2020, medRxiv, later published in American Journal of Nephrology)

RESULTS:

- 10.8% patients showed mild increase of blood urea nitrogen or creatinine (<26 μmol/L within 48 h), and 7.2% patients showed trace or 1+ albuminuria. Gradually returned to normal at follow up

CONCLUSIONS:

- AKI uncommon in COVID-19

Literature review

SARS-CoV-2 infection does not significantly cause acute renal injury: an analysis of 116 hospitalized patients with COVID-19 in a single hospital, Wuhan, China

By Lunwen Wang, Xun Li, Hui Chen, Shaonan Yan, Yan Li, Dong Li, Zuojiong Gong (23 Feb 2020, medRxiv, later published in American Journal of Nephrology)

Problems with study

- Definitions used now outdated; AKD vs AKI
- Follow-up period not clearly stated

Literature review

Caution on Kidney Dysfunctions of COVID-19 Patients

By Zhen Li, Ming Wu, Jiwei Yao, Jie Guo, Xiang Liao, Siji Song et al (27 March 2020, medRxiv)

METHODS: Multi-centre, retrospective, observational. Studied kidney function (traditional measures of AKI) as well as CT of renal parenchyma (was compared to 110 healthy subjects/control)

RESULTS:

- 193 patients admitted between 6 Jan 2020 to 21 Feb 2020
- Median age 57 (IQR 46-67), +- equal sex distribution, 56% had comorbidities, most commonly cardiovascular and ”endocrine” disease (likely hypertension and DM)
- 34% severe disease

Literature review

Caution on Kidney Dysfunctions of COVID-19 Patients

By Zhen Li, Ming Wu, Jiwei Yao, Jie Guo, Xiang Liao, Siji Song et al (27 March 2020, medRxiv)

RESULTS:

- 28% of patients developed AKI, 60% had proteinuria, 48% had haematuria
- More common in patients with severe COVID-10
- Hazard ratio indicates that the mortality risk for patients with AKI was significantly higher than (~5.3 times, $P < 0.001$) the mortality risk for patients without AKI
- 106/110 (96%) of patients had abnormal CT texture analysis of renal parenchyma.

CONCLUSIONS

- AKI and AKD common in COVID-19. Associated with higher mortality.

Literature review

Caution on Kidney Dysfunctions of COVID-19 Patients

By Zhen Li, Ming Wu, Jiwei Yao, Jie Guo, Xiang Liao, Siji Song et al (27 March 2020, medRxiv)

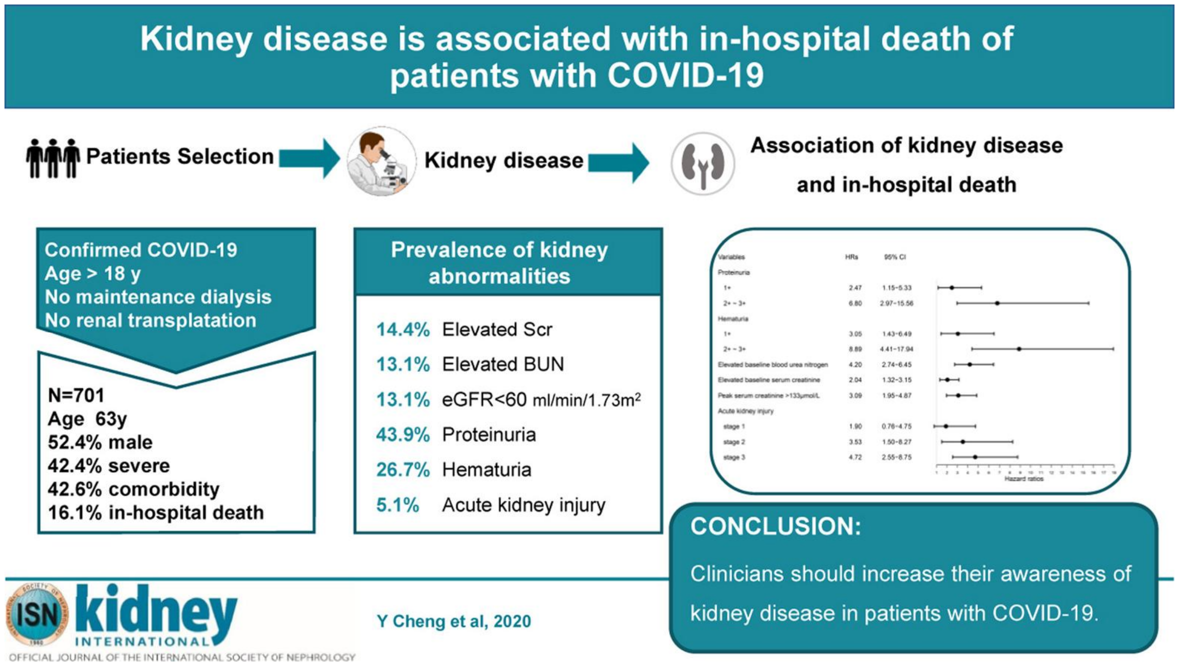
PROBLEMS

- Minimum follow-up period not stated
- CT scan does not constitute part of traditional evaluation of AKI. Limited usefulness and practicality.

Literature review

Kidney impairment is associated with in-hospital death of COVID-19 patients

By Yichun Cheng, Ran Luo, Kun Wang, Meng Zhang, Zhixiang Wang, Lei Dong, et al (20 Feb 2020, medRxiv, later Kidney International)



Literature review

Kidney impairment is associated with in-hospital death of COVID-19 patients

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PROBLEMS

- Once again, minimum follow-up period not stated…

Implications for practice

- Clinicians must be vigilant about AKI in patients with COVID-19
- All admitted patients warrant kidney function tests and dipstix
- Allows us to risk stratify, since AKI/AKD may be associated with higher mortality
- Close monitoring for for escalation (incl. HD)
- No specific therapy

References

- 1. Nomenclature for kidney function and disease: report of a Kidney Disease: Improving GlobalOutcomes (KDIGO) Consensus Conference, 2020.
- 2. Batlle D, Soler MJ, Sparks MA, Hiremath S, South AM, Welling PA, et al. Acute Kidney Injury in COVID-19: Emerging Evidence of a Distinct Pathophysiology. *Journal of the American Society of Nephrology.* 2020:ASN.2020040419. https://jasn.asnjournals.org/content/jnephrol/early/2020/05/04/ASN.2020040419.full.pdf.
- 3. Wang L, Li X, Chen H, Yan S, Li Y, Li D, et al. SARS-CoV-2 infection does not significantly cause acute renal injury: an analysis of 116 hospitalized patients with COVID-19 in a single hospital, Wuhan, China. *medRxiv.* 2020:2020.2002.2019.20025288. https://www.medrxiv.org/content/medrxiv/early/2020/02/23/2020.02.19.20025288.full.pdf.
- 4. Li Z, Wu M, Yao J, Guo J, Liao X, Song S, et al. Caution on Kidney Dysfunctions of COVID-19 Patients. *medRxiv.* 2020:2020.2002.2008.20021212. https://www.medrxiv.org/content/medrxiv/early/2020/03/27/2020.02.08.20021212.full.pdf.
- 5. Cheng Y, Luo R, Wang K, Zhang M, Wang Z, Dong L, et al. Kidney disease is associated with in-hospital death of patients with COVID-19. *Kidney International.* 2020;97(5):829-838.
- 6. Ronco C, Reis T, Husain-Syed F. Management of acute kidney injury in patients with COVID-19. *The Lancet Respiratory Medicine.* https://doi.org/10.1016/S2213-2600(20)30229-0.