Medical Sciences

Epidemiological evidence and future perspective in kidney diseases

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Epidemiological studies have been advanced in medicine including kidney diseases. We updated epidemiological evidence in kidney diseases. For acute kidney injury, although Kidney Disease: Improving Global Outcome criteria was developed, further studies on the effects of fluid balance adjusted creatinine, minimum versus most recent baseline serum creatinine and the best surrogate baseline serum creatinine are required. For chronic kidney disease, we recently found a significant increased risk of chronic kidney disease in patients consuming sugar-sweetened soda, but not in patients consuming artificially sweetened soda. Interestingly, we found an inverse association between high alcohol consumption and risk for developing CKD in males. There is no significant association between high alcohol consumption and the risk for developing proteinuria or end-stage renal disease (ESRD). Future studies to identify these underlying mechanisms should be conducted. *Journal of Nature and Science, 1(1):e28, 2015.*

kidney disease | proteinuria | end-stage renal disease

Introduction

Epidemiological studies have been advanced in medicine including kidney diseases. We updated our findings in epidemiological evidence in kidney diseases including acute kidney injury (AKI), chronic kidney disease (CKD), acid-base abnormalities and glomerulonephritis.

Acute kidney injury Definition

Since Kidney Disease: Improving Global Outcome (KDIGO) criteria, a revised definition of acute kidney injury (AKI) was developed [1], we now have a standard criteria to compare the outcomes of AKI[2-4] between studies. However, it was unknown whether the influence of differing weights (actual body weight (ABW) and ideal body weight (IBW)) would affect the diagnosis of AKI and clinical outcomes. Recently our study[5] found that using ABW to diagnose and stage AKI by UO criterion is more sensitive and less specific than IBW. Different BW types should be utilized based on the application of the definition. Further studies on the effects of fluid balance adjusted creatinine, minimum versus most recent baseline serum creatinine and the best surrogate baseline serum creatinine are required.

The vasopressor use in intensive care unit

Vasopressor was commonly used in intensive care unit (ICU). Due to the lack of conclusive evidence in superiority in efficacy among various types of vasopressors, the choice of vasopressor use mainly depends on the physician preference.[6] The study to demonstrate the trend of vasopressor use and the patient outcomes are needed.

Contrast associated acute kidney injury

Currently hydration is a mainstay preventive method to prevent contrast associated acute kidney injury (CIAKI).[7] The effectiveness of oral hydration regimen in the low risk patients to prevent CIAKI is still unclear.[8] Interestingly, statin treatment has been found as an effective therapy to prevent CIAKI. The future studies to confirm this finding are warranted.[9]

The associations between chronic kidney disease and the consumption of beverage and alcohol

We recently found a significant increased risk of chronic kidney disease (CKD) in patients consuming sugar-sweetened soda,[10, 11] but not in patients consuming artificially sweetened soda. Interestingly, we found an inverse association between high alcohol consumption and risk for developing CKD in males. There is no significant association between high alcohol consumption and the risk for developing proteinuria or end-stage renal disease (ESRD). Future studies to identify these underlying mechanisms should be conducted.

Electrolyte and acid-base abnormalities

Pathophysiology of electrolyte imbalance[12-16] and medication related electrolyte abnormalities have been currently more reported. The association between proton pump inhibitors and hypomagnesaemia is currently more clear.[17] Hypocalcemia has been reported in denosumab use for patients with chronic kidney disease (CKD).[18, 19] The use of the Stewart (or strong ion) model for acid-base approach has recently been reviewed,[20] the application of this model vs. traditional method[21-24] in clinical practice especially in ICU setting is a fascinating topic to anticipate.

Calcium and bone metabolism

Fibroblast growth factor- 23 (FGF 23) has been recognized as a culprit for increased cardiovascular mortality in patients with CKD and end-stage renal disease.[25-28] Future studies to identify whether reduction of FGF-23 is associated with reduced cardiovascular mortality in human are required.

Anemia and Vitamin D deficiency

Vitamin D deficiency is not only associated with cardiovascular outcomes.[29] Recently, vitamin D treatment was found to reduce hepcidin level in healthy adults.[30] The future study need to confirm if lowering hepcidin with vitamin D can help improve anemia of CKD.

IgA Nephropathy and Henoch-Schönlein purpura in elderly

IgA nephropathy is the most common glomerulonephritis and a recent meta-analysis found that IgA nephropathy in elderly is different from adults.[31] Future studies with international classification, Oxford classification for IgA nephropathy[32] should be conducted for elderly patients with primary IgA nephropathy and Henoch-Schönlein purpura.[33-35]

Malignancy and Glomerular diseases

Membranous nephropathy has been reported association with solid organ tumors. Conversely minimal change disease is associated with

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hematologic malignancies. Interestingly, minimal change disease has also been reported in patients with solid organ tumors.[36] The use of PLA2R to differentiate between primary membranous nephropathy and each particular cancer related membranous nephropathy is also an interesting investigational topic.

Atypical hemolytic uremic syndrome and monoclonal gammopathy

Atypical hemolytic uremic syndrome (HUS) is a rare disease and could be genetic, acquired, or idiopathic. Recently, we presented a case of aHUS with monoclonal gammopathy refractory to eculizumab and later cyclophosphamide and prednisone treatment. The patient responded well with bortezomib-based regimen.[37] The future study need to confirm the efficacy of this therapy in this rare presentation.

1. Group., KDIGOKAKIW: KDIGO Clinical Practice Guidelines for Acute Kidney Injury. *Kidney International,* suppl 2**:** 1-138, 2012.
2. Cheungpasitporn, W, Suksaranjit, P, Chanprasert, S: Acute kidney injury from bilateral ureteral calcium stones in the setting of primary hyperparathyroidism. *Am J Emerg Med,* 30**:** 383-384, 2012.
3. Thongprayoon, C, Spanuchart, I, Cheungpasitporn, W, Kangwanpornsiri, A: Idiopathic retroperitoneal fibrosis: A challenging case in a rare disease. *N Am J Med Sci,* 6**:** 237, 2014.
4. Cheungpasitporn, W, Horne, JM, Howarth, CB: Adrenocortical carcinoma presenting as varicocele and renal vein thrombosis: a case report. *J Med Case Rep,* 5**:** 1-5, 2011.
5. Thongprayoon, C, Cheungpasitporn, W, Akhoundi, A, Ahmed, AH, Kashani, KB: Actual versus ideal body weight for acute kidney injury diagnosis and classification in critically Ill patients. *BMC Nephrol,* 15**:** 176, 2014.
6. Srivali, N, Thongprayoon, C, Kittanamongkolchai, W, Cheungpasitporn, W, Erdogan, A, Carrera, P, Kashani, K: 372: CHANGING TRENDS IN THE USE OF VASOPRESSORS IN INTENSIVE CARE UNIT: A 7-YEAR STUDY. *Critical Care Medicine,* 42**:** A1450, 2014.
7. Brar, SS, Aharonian, V, Mansukhani, P, Moore, N, Shen, AY, Jorgensen, M, Dua, A, Short, L, Kane, K: Haemodynamic-guided fluid administration for the prevention of contrast-induced acute kidney injury: the POSEIDON randomised controlled trial. *Lancet,* 383**:** 1814-1823, 2014.
8. Srivali, N, Cheungpasitporn, W, Thongprayoon, C, Edmonds, P, O'Corragain, O, Kittanamongkolchai, W, Brabec, B, Erickson, S: 935: HYDRATION FOR CONTRAST-INDUCED ACUTE KIDNEY INJURY PREVENTION: A META-ANALYSIS. *Critical Care Medicine,* 42**:** A1585, 2014.
9. Singh, N, Lee, JZ, Huang, JJ, Low, SW, Howe, C, Pandit, A, Suryanarayana, P, Lee, KS: Benefit of statin pretreatment in prevention of contrast-induced nephropathy in different adult patient population: systematic review and meta-analysis. *Open Heart,* 1**:** e000127, 2014.
10. Cheungpasitporn, W, Thongprayoon, C, OA, OC, Edmonds, PJ, Kittanamongkolchai, W, Erickson, SB: Associations of Sugar and Artificially Sweetened Soda and Chronic Kidney Disease: A Systematic Review and Meta-analysis. *Nephrology (Carlton),* 2014.
11. Cheungpasitporn, W, Thongprayoon, C, Kittanamongkolchai, W, Brabec, BA, O'Corragain, OA, Edmonds, PJ, Erickson, SB: High Alcohol Consumption and The Risk of Renal Damage: A Systematic Review and Meta-analysis. *QJM,* 2014.
12. Cheungpasitporn, W, Suksaranjit, P, Chanprasert, S: Hypercalcemia in human immunodeficiency virus-related lymphoma and valacyclovir toxicity. *Am J Med Sci,* 342**:** 539, 2011.
13. Cheungpasitporn, W, Suksaranjit, P, Chanprasert, S: Pathophysiology of vomiting-induced hypokalemia and diagnostic approach. *Am J Emerg Med,* 30**:** 384, 2012.
14. Srivali, N, Ratanapo, S, Cheungpasitporn, W, Chongnarungsin, D, Bischof, EF: Hyperkalemia-induced pacemaker dysfunction. *Am J Emerg Med,* 31**:** 879, 2013.
15. Ungprasert, P, Kue-A-Pai, P, Permpalung, N, Kittanamongkolchai, W, Cheungpasitporn, W: Toluene-induced renal tubular acidosis: an easily missed cause of hypokalemic paralysis. *Am J Emerg Med,* 30**:** 1309, 2012.
16. Leeaphorn, N, Kittanamongkolchai, W, Thongprayoon, C, Cheungpasitporn, W, Beechy, C: " MALNUTRITION AND LOW SOLUTE INTAKE": AN OVERLOOKED CAUSE OF REFRACTORY HYPONATREMIA IN A PATIENT WITH SIADH. *AMERICAN JOURNAL OF KIDNEY DISEASES.* WB SAUNDERS CO-ELSEVIER INC 1600 JOHN F KENNEDY BOULEVARD, STE 1800, PHILADELPHIA, PA 19103-2899 USA, 2014 pp A72-A72.
17. Perazella, MA: Proton pump inhibitors and hypomagnesemia: a rare but serious complication. *Kidney Int,* 83**:** 553-556, 2013.
18. Ungprasert, P, Leeaphorn, N, Kittanamongkolchai, W, Cheungpasitporn, W: Safety profile of denosumab. *Journal of Symptoms and Signs,* 2**:** 504, 2014.
19. Ungprasert, P, Cheungpasitporn, W, Srivali, N, Kittanamongkolchai, W, Bischof, EF: Life-threatening hypocalcemia associated with denosumab in a patient with moderate renal insufficiency. *Am J Emerg Med,* 31**:** 756. e751-752, 2013.
20. Seifter, JL: Integration of acid-base and electrolyte disorders. *N Engl J Med,* 371**:** 1821-1831, 2014.
21. Cheungpasitporn, W, Cordes, SF, Thongprayoon, C, Sugeir, SH, Qian, Q: LACTIC ACIDOSIS IN CYTOKINE STORM. *AMERICAN JOURNAL OF KIDNEY DISEASES.* WB SAUNDERS CO-ELSEVIER INC 1600 JOHN F KENNEDY BOULEVARD, STE 1800, PHILADELPHIA, PA 19103-2899 USA, 2014 pp A38-A38.
22. Permpalung, N, Cheungpasitporn, W, Chongnarungsin, D, Hodgdon, TM: Bilateral putaminal hemorrhages: Serious complication of methanol intoxication. *N Am J Med Sci,* 5**:** 623, 2013.
23. Cheungpasitporn, W, Jirajariyavej, T, Kangwanpornsiri, A: Role of sodium bicarbonate in the treatment of methanol-induced acidosis. *The American journal of medicine,* 125**:** e15, 2012.
24. Cheungpasitporn, W, Ungprasert, P, Srivali, N, Bischof, EF: Acid Base: Back to the Basics of Henderson-Hasselbalch. *The American Journal of Medicine,* 125**:** e13, 2012.
25. Cheungpasitporn, W, Kue-A-Pai, P, Ungprasert, P, Kittanamongkolchai, W, Srivali, N, Ratanapo, S, Jirajariyavej, T, Chongnarungsin, D, Kangwanpornsiri, A: CHRONIC KIDNEY DISEASE-MINERAL BONE DISODER: FIBROBLAST GROWTH FACTOR-23 AND PHOSPHATE METABOLISM. *American Medical Journal,* 4**:** 105, 2013.
26. Kittanamongkolchai, W, Srivali, N, Ahmed, S, Cheungpasitporn, W, Chongnarungsin, D, Cooperstown, N: The role of fibroblast growth factor-23 in left atrial volume.
27. Ratanapo, S, Kittanamongkolchai, W, Srivali, N, Ahmed, S, Cheungpasitporn, W, Chongnarungsin, D: The role of fibroblast growth factor-23 in left atrial volume. *American heart journal,* 165**:** e21, 2013.
28. Ratanapo, S, Srivali, N, Kittanamongkolchai, W, Leeaphorn, N, Ahmed, S, Cheungpasitporn, W, Chongnarungsin, D: Metabolic acidosis may increase fibroblast growth factor-23 and cardiovascular mortality in the community. *Kidney international,* 84**:** 621, 2013.
29. Ahmed, S, Ratanapo, S, Kittanamongkolchai, W, Cheungpasitporn, W, Suksaranjit, P, Chongnarungsin, D: Vitamin D deficiency and cardiovascular disease. *Swiss Med Wkly,* 143**:** w13821, 2013.
30. Bacchetta, J, Zaritsky, JJ, Sea, JL, Chun, RF, Lisse, TS, Zavala, K, Nayak, A, Wesseling-Perry, K, Westerman, M, Hollis, BW, Salusky, IB, Hewison, M: Suppression of iron-regulatory hepcidin by vitamin D. *J Am Soc Nephrol,* 25**:** 564-572, 2014.
31. Duan, ZY, Cai, GY, Chen, YZ, Liang, S, Liu, SW, Wu, J, Qiu, Q, Lin, SP, Zhang, XG, Chen, XM: Aging promotes progression of IgA nephropathy: a systematic review and meta-analysis. *Am J Nephrol,* 38**:** 241-252, 2013.
32. Cattran, DC, Coppo, R, Cook, HT, Feehally, J, Roberts, IS, Troyanov, S, Alpers, CE, Amore, A, Barratt, J, Berthoux, F, Bonsib, S, Bruijn, JA, D'Agati, V, D'Amico, G, Emancipator, S, Emma, F, Ferrario, F, Fervenza, FC, Florquin, S, Fogo, A, Geddes, CC, Groene, HJ, Haas, M, Herzenberg, AM, Hill, PA, Hogg, RJ, Hsu, SI, Jennette, JC, Joh, K, Julian, BA, Kawamura, T, Lai, FM, Leung, CB, Li, LS, Li, PK, Liu, ZH, Mackinnon, B, Mezzano, S, Schena, FP, Tomino, Y, Walker, PD, Wang, H, Weening, JJ, Yoshikawa, N, Zhang, H: The Oxford classification of IgA nephropathy: rationale, clinicopathological correlations, and classification. *Kidney Int,* 76**:** 534-545, 2009.
33. Cheungpasitporn, W, Jirajariyavej, T, Howarth, CB, Rosen, RM: Henoch-Schonlein purpura in an older man presenting as rectal bleeding and IgA

mesangioproliferative glomerulonephritis: a case report. *J Med Case Rep*, 5**:** 364, 2011.
34. Srivali, N, Ungprasert, P, Ahmed, S, Cheungpasitporn, W, Bischof, EF: A case of childhood vasculitis presenting in adulthood. *Am J Emerg Med*, 31**:** 254-255, 2013.
35. Thongprayoon, C, Cheungpasitporn, W, Thamcharoen, N, Bruminhent, J: An Unusual Presentation of Childhood Vasculitis Presenting in Adulthood: A Challenging Diagnosis of Henoch-Schonlein Purpura. *N Am J Med Sci*, 6**:** 543-544, 2014.
36. Wisit, C: Acute Kidney Injury in Rectal Cancer-Associated Minimal Change Disease: A Case Report. *Journal of Nephrology & Therapeutics*, 2012.
37. Cheungpasitporn, W, Leung, N, Sethi, S, Gertz, MA, Fervenza, FC: Refractory atypical hemolytic uremic syndrome with monoclonal gammopathy responsive to bortezomib-based therapy. *Clin Nephrol*, 2014.