Actual Versus Ideal Body Weight For Acute Kidney Injury Diagnosis In Critically Ill Patients

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Background

- Acute kidney injury (AKI) is a common clinical problem in critically ill patients.
- Kidney Disease: Improving Global Outcomes (KDIGO) criteria was developed and validated to standardize the diagnosis and disease severity of AKI based on change in serum creatinine and urine output (UO).
- According to UO definition in KDIGO criteria, it is unclear which body weights (BW) (actual versus ideal BW), should be used to diagnose and stage AKI, leading to heterogeneity across research studies.

KDIGO criteria for AKI

Stage	Serum creatinine	Urine output
1	1.5–1.9 times baseline OR ≥0.3 mg/dl (≥26.5 µmol/l) increase	<0.5 ml/kg/h for 6–12 hours
2	2.0–2.9 times baseline	<0.5 ml/kg/h for ≥12 hours
3	3.0 times baseline OR Increase in serum creatinine to ≥4.0 mg/dl (≥353.6 µmol/l) OR Initiation of renal replacement therapy OR, In patients <18 years, decrease in eGFR to <35 ml/min per 1.73 m^2	<0.3 ml/kg/h for ≥24 hours OR Anuria for ≥12 hours

Objective

- To evaluate and compare the incidence of AKI diagnosis and staging according UO criterion, calculated based on actual versus ideal BW.
- To investigate the effect of BW types (actual versus ideal BW) on the predictive ability of UO definition for 90-day mortality.

Study Design

- A single-center, retrospective study.
- All adult patients admitted to ICU at Mayo Clinic, MN between January – February 2010 were eligible.
- Inclusion criteria :
  - ICU length of stay ≥ 6 hours
  - Indwelling urinary catheter for hourly UO monitoring
  - ≥ 18 years
- Exclusion criteria :
  - ESRD or dialysis within 14 days before ICU admission
- AKI diagnosis and staging based on only UO definition was assessed by calculating UO per kilogram per hour, with actual versus ideal BW.
- Primary outcome: 90-day death from ICU admission.
- Difference in AKI diagnosis was assessed using McNemer's test.
- Time-to-AKI diagnosis was tested using paired t-test.

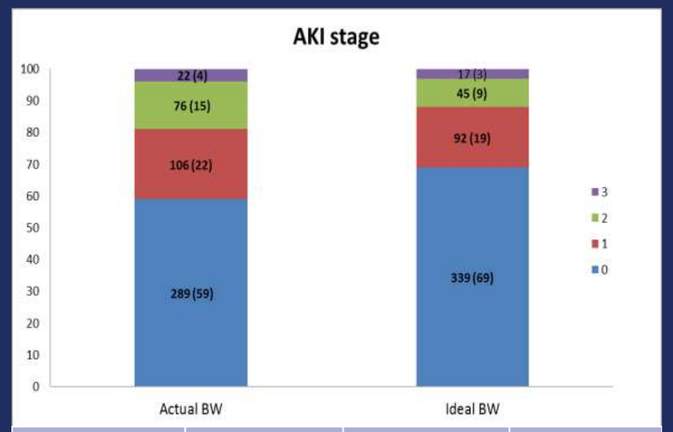
Result

- Of 639 patients screened, a total of 493 patients were analyzed.
- Baseline characteristics were shown in table 1
- The median actual and ideal BW were 82 (IQR 68-96) and 70 (IQR 60-77) kg respectively (p < 0.001).
- AKI was identified in 154 (31.2%) patients, using ideal body weight, versus 204 (41.4%) using actual body weight (p < 0.001).
- In comparison with patients who did not have AKI, AKI patients had relative risk for 90-day mortality of 1.68 (95%CI 1.12-2.54), regardless of BW calculation methodology.
- Patients who had AKI according to actual BW but not by ideal BW had a non-significant decreased relative risk of 90-day mortality (0.74; (95%CI 0.31-1.79) when they were compared with patients who had no AKI.

Baseline Characteristics

Characteristics	Total (n=493)
Age, year	67 (54-77)
Male gender	264 (54)
APACHE III	44 (32-59)
SOFA	4 (2-7)
Baseline SCr, mg/dl	1 (0.8-1.3)
BMI, kg/m2	28 (24-33)
Weight, kg - Actual BW - Ideal BW	 82 (68-96) 70 (60-77)
Outcome - ICU LOS, hour - 90-day mortality	 28 (20-55) 79 (16)

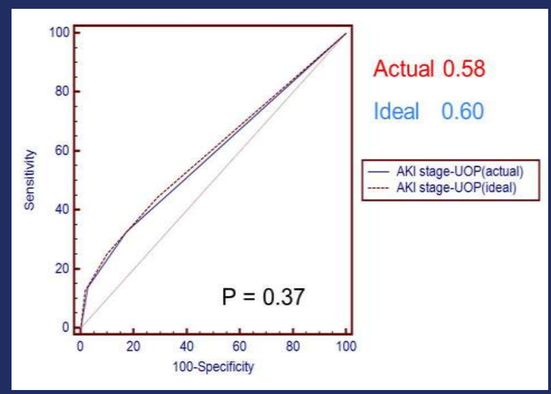
AKI diagnosis and staging



	Actual	Ideal	P-value
AKI	204 (41.1)	154 (31.2)	<0.001
Time-to-AKI diagnosis, hr	19 (15-23)	23 (17-29)	0.04*

*Paired mean diff = 4.0 hours (95%CI 0.2-7.7)

C-statistic



Risk for 90-day mortality

Actual BW	Ideal BW	N	RR (95% CI)
AKI	AKI	154	1.68 (1.12-2.54)
AKI	No AKI	50	0.74 (0.31-1.79)
No AKI	No AKI	289	Ref

Conclusions

- Using actual BW for UO criterion for AKI definition increases its sensitivity and allows earlier diagnosis of AKI; however it does not add any value to the prediction of 90-day mortality when compared with ideal BW.
- Based on our data, we suggest actual body weight to be called "sensitivity BW" for risk stratification and early diagnosis purposes, whereas ideal body weight to be called "specificity BW" for enrollment in more invasive diagnostic and therapeutic measures.

References

1. Mehta RL. Acute kidney injury: Urine output in AKI--the canary in the coal mine?. Nat Rev Nephrol. 2013 Oct;9(10):568-70.
2. KDIGO Clinical Practice Guidelines for Acute Kidney Injury. Kidney International 2012;suppl 2(1):1-138.