

Rhabdomyolysis and Acute Kidney Injury: 10-year Retrospective Observational Study in Dumfries and Galloway Royal Infirmary

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Introduction

Rhabdomyolysis occurs following the breakdown of muscle tissue which releases intracellular products into the bloodstream. Acute kidney injury (AKI) is known to be one of the most common life-threatening complications of rhabdomyolysis¹.

Our study looked at the retrospective data of all patients above 18 years of age who were admitted to Dumfries and Galloway Royal Infirmary (DGRI) over a 10-year period with CK values over 1,000 IU/L to evaluate the cause of rhabdomyolysis, incidence of AKI and associated clinical outcomes.

Methodology

An observational retrospective cohort study was conducted among all adult patients (age >18) admitted between 1st January 2009 to 31st December 2019 (over 10 years) to DGRI with peak CK values above 1,000 IU/L on admission bloods.

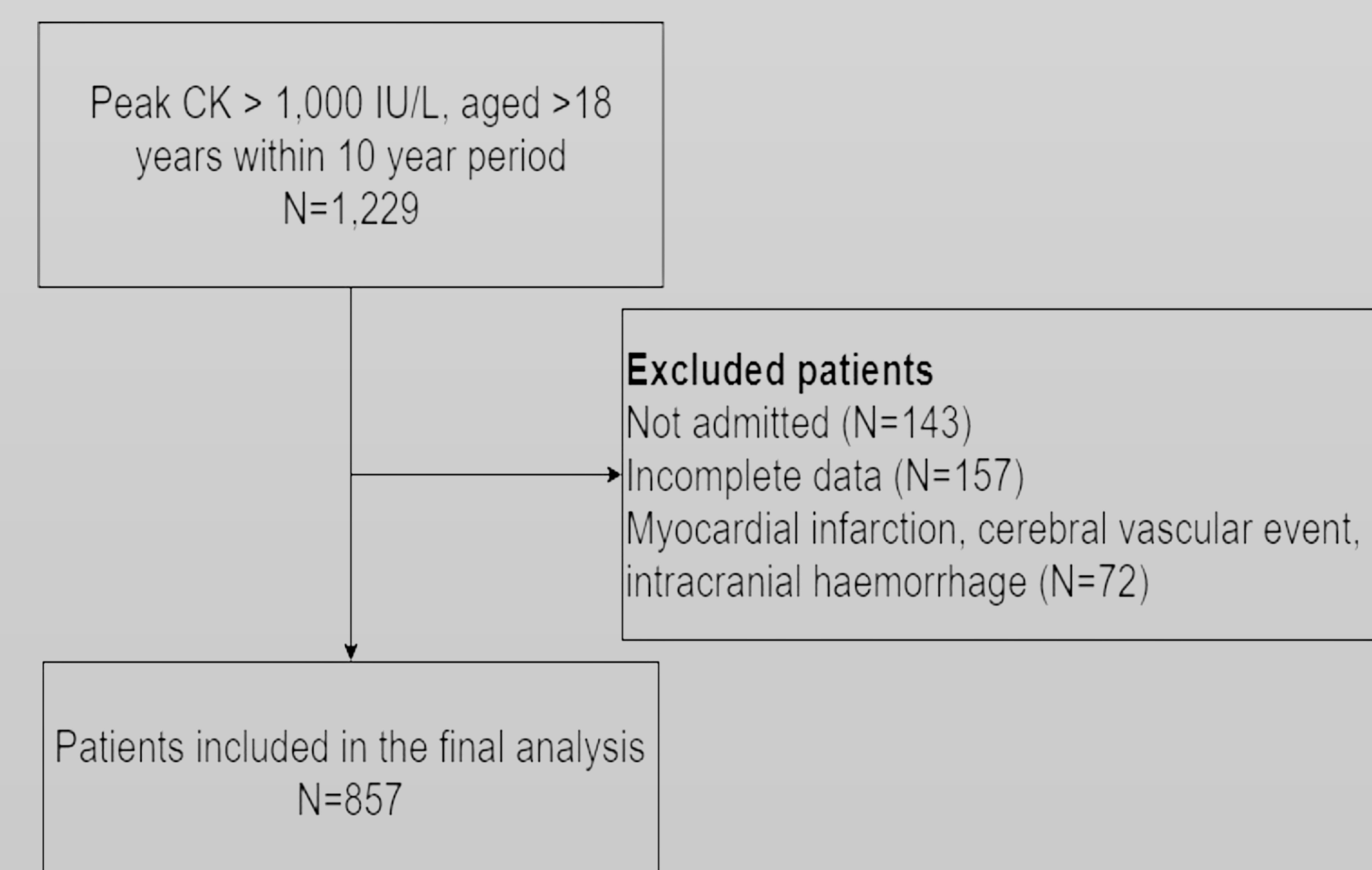
All patients' blood results and medical records were retrieved from the DGRI laboratory database and Clinical Portal, respectively. Patients with incomplete information or had raised CK secondary to medical conditions other than rhabdomyolysis were excluded.

For all those who met the inclusion criteria, further information, including demographics, co-morbidities, usage of nephrotoxic medications, precipitating factors of rhabdomyolysis, need for in-hospital dialysis and clinical outcomes, were obtained from their electronic medical records. Patients with incomplete information from their records were again excluded from the study.

Statistical analysis

IBM SPSS software was used for statistical analysis. Categorical variables are described in n (%) and continuous variables are described as mean (range). Categorical values were compared using chi-square test. Continuous variables were compared using either independent t-test or one-way ANOVA. For multivariate analysis, logistic regression has been used. Kaplan Meier analysis has been used to analyse the survival of patients with AKI compared to those without AKI.

Fig 1. Study flow diagram



References

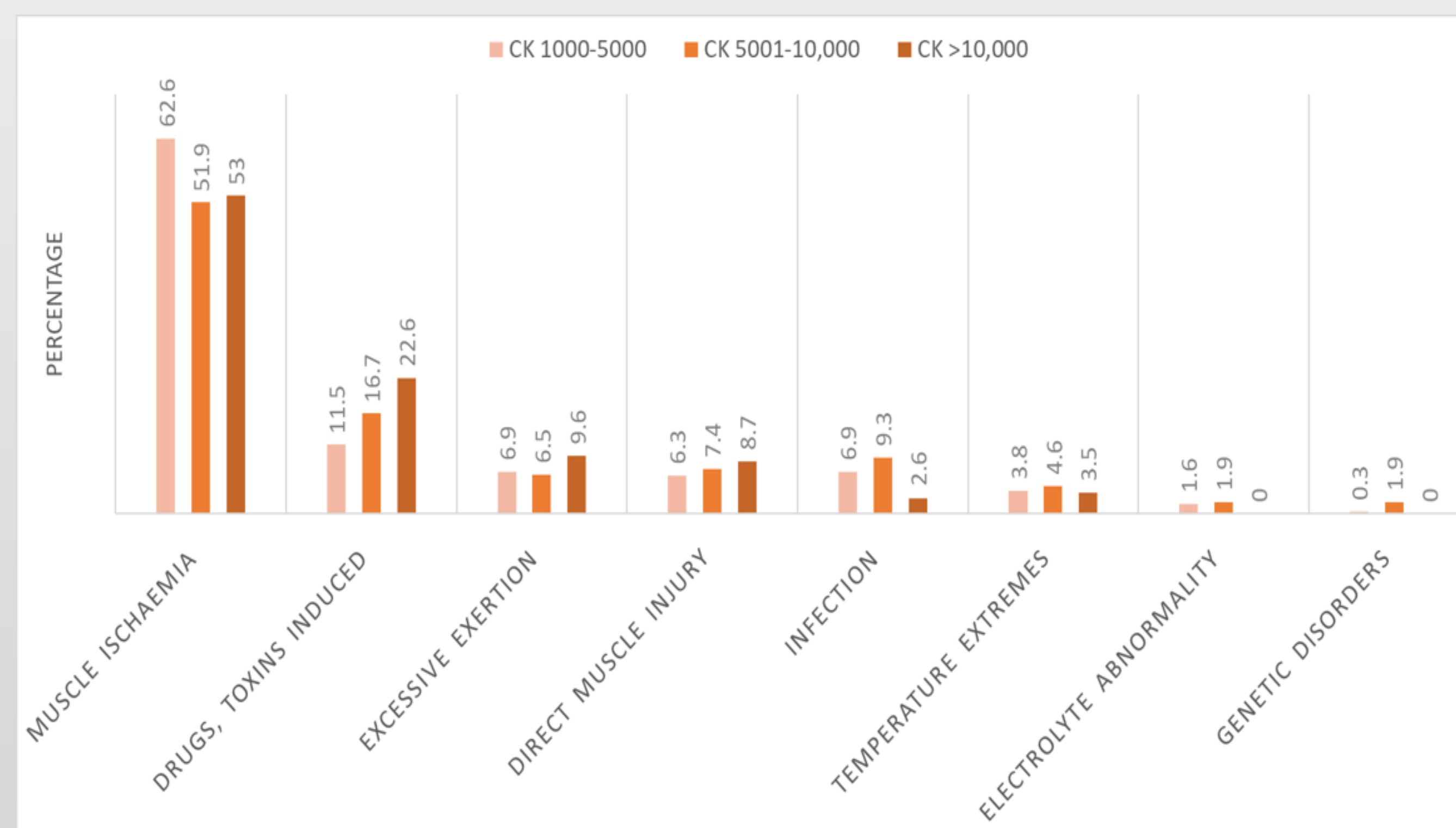
1. Bosch X, Poch E, Grau JM. Rhabdomyolysis and acute kidney injury. N Engl J Med. 2009;361:62-72.

Table 1. Baseline characteristics

	Total (n=857)
Age	66.6 (18-101)
Male gender	505 (58.9)
CKD	175 (20.5)
DM	149 (17.4)
Statins	271 (31.6)
Nephrotoxics	401 (46.8)
Length of stay (days)	16.1 (1-307)

857 patients were included in the study. The mean age was 66.6 years; 58.9% were male; 20.5% were diabetic; and 17.4% had prior CKD. Mean length of hospitalisation was 16.1 days (range 1-307). (see tab 1)

Fig 2. Association between precipitating factors for rhabdomyolysis and mean peak CK



Muscle ischaemia and drugs/toxins were the commonest causes of rhabdomyolysis, (see Fig 2) where the former accounts for 60% and the latter 13.7%. Muscle ischaemia included patients with major artery occlusion and limb compression by head or torso during prolonged immobilisation. Drugs and toxins-induced rhabdomyolysis was significantly associated with the group of CK >10,000 IU/L (p=0.004) comparing to other aetiologies.

Table 2. Association of AKI and clinical outcomes with peak CK values

	CK 1000-5000 (n=634)	CK 5001-10,000 (n=108)	CK >10,000 (n=115)	Total (n=857)	P value
AKI ¹	223 (35.2)	57 (52.8)	68 (59.1)	348 (40.6)	<0.001
Stage 3 AKI ²	78 (35.0)	25 (43.9)	38 (55.9)	141 (40.5)	0.007
Dialysis	16 (2.5)	11 (10.2)	13 (11.3)	40 (4.7)	<0.001

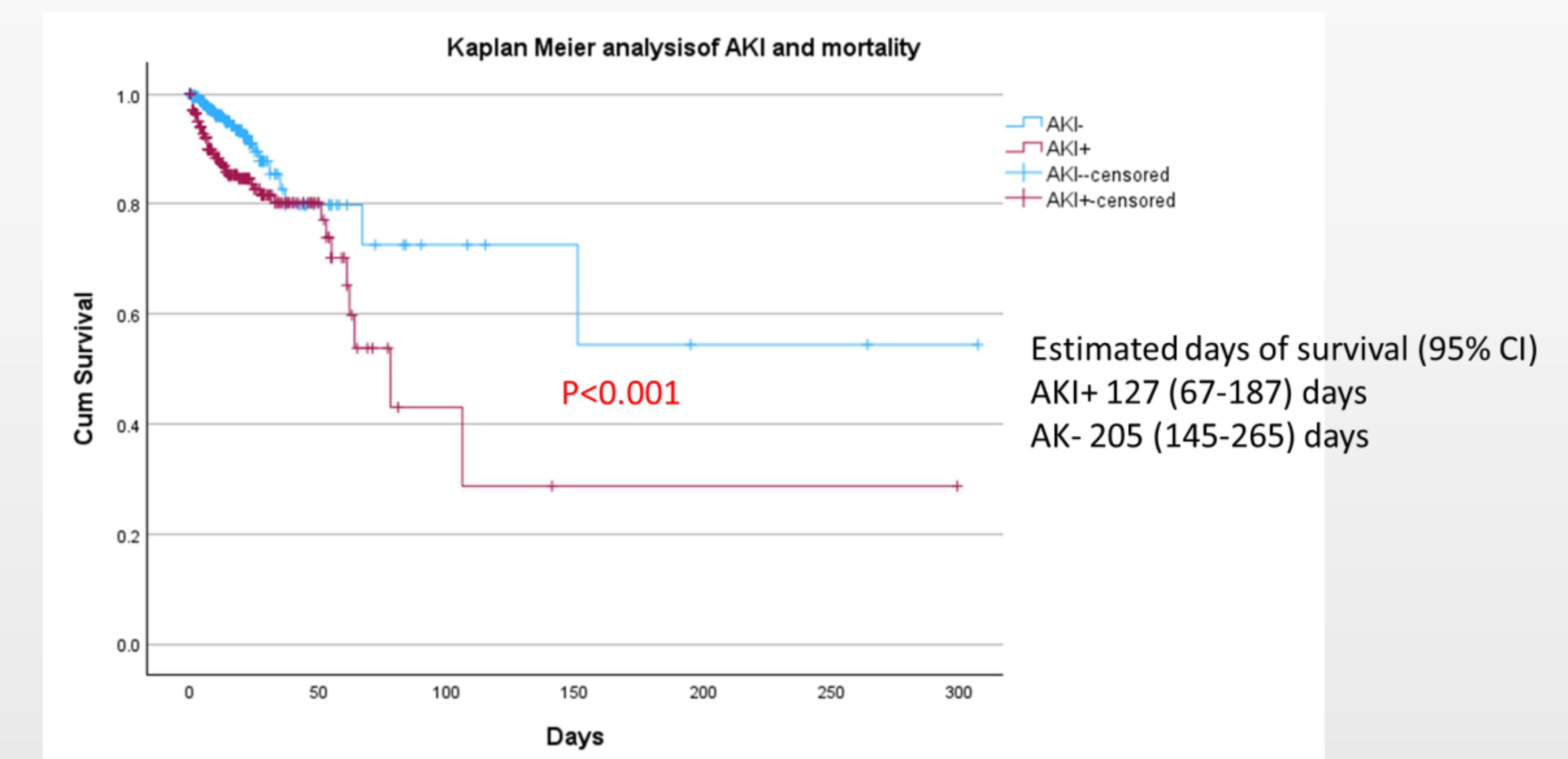
¹ Comparison of patients who developed AKI versus did not develop AKI.

² Comparison of AKI stage 3 (severe AKI) versus AKI stage 1 and 2 (non-severe AKI)

348 (40.6%) of rhabdomyolysis patients developed AKI. A higher proportion of AKI or severe AKI respectively were significantly associated with peak CK values >10,000 IU/L. Also, the proportion of patients requiring dialysis is higher among those with CK >10,000 IU/L. (see tab 2)

Results

Fig 3. Analysis of survival rates between patients with and without AKI



The overall mortality was 81/857 (9.5%) whereas AKI contributed to 6.4% of the death from rhabdomyolysis and the complications. AKI had higher mortality overtime compared to patients without AKI (p<0.001). Mean time to death for AKI was 127 days (95% CI 67.3-187.2) compared to 205 days (95% CI 144.4-263.9) for non-AKI.

Table 3. Multivariate analysis for prediction of mortality

Variables in the Equation						
	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a Dialysis_yesno(1)	.830	.454	3.342	1	.068	2.293
AKI_yesno(1)	1.310	.261	25.179	1	<.001	3.705
Age	-.034	.008	17.540	1	<.001	.967
Blood Results	.000	.000	2.890	1	.089	1.000
Constant	3.126	.724	18.661	1	<.001	22.780

a. Variable(s) entered on step 1: Dialysis_yesno, AKI_yesno, Age, Blood Results .

In univariate analysis, age, AKI, dialysis and CK value were found to be significantly associated with the mortality on the same admission (see table 3). Adjusting the cofounders, it was found that there was a three-times increase in mortality in patients developing AKI compared to those without AKI (OR 3.75, p value <0.001, see table 3).

Table 4. Overall renal outcomes of patients

	No AKI (n=509)	AKI 1 (n=139)	AKI 2 (n=68)	AKI 3 (n=141)	Total (n=857)
Complete recovery	483 (94.9)	112 (80.6)	55 (80.9)	89 (63.1)	739 (86.2)
Partial recovery	0 (0)	12 (8.6)	4 (5.9)	15 (10.6)	31 (3.6)
RRT dependence	0 (0)	3 (2.2)	0 (0)	3 (2.1)	6 (6)
Deceased	26 (5.1)	12 (8.6)	9 (13.2)	34 (24.1)	81 (9.4)

Conclusion

1. Our study showed **muscle ischaemia** was the **most common cause** for rhabdomyolysis among the patients over 10 years. **Drugs and toxins-induced** rhabdomyolysis is associated with a **higher rise in peak CK** than other precipitating factors.
2. **Higher peak CK value** (>10,000 IU/L) is also significantly associated with development of **AKI or stage 3 AKI** (severe AKI). Similarly, more patients with peak CK > 10,000 IU/L **required dialysis** during hospital admission.
3. Mortality was 9.5% among all rhabdomyolysis patients. AKI contributed to 6.4% of the mortality. Patients with AKI had higher mortality over time compared to patients without AKI.
4. Multivariate analysis revealed that **AKI results in a three-times increase in mortality rate** compared to those without AKI, after adjusting the co-founders.