Original article

Effectiveness of the rhabdomyolysis treatment protocol in critically ill trauma patients at the level I trauma center

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Objective Rhabdomyolysis and its consequence, acute renal failure, is a serious complication with high mortality rate. However, its treatment differs among individual physicians. Therefore, the rhabdomyolysis treatment protocol was established by the multidisciplinary experts' consensus in July 2008. The objective of this study was to evaluate the effectiveness of the rhabdomyolysis treatment protocol after implementation in critically ill trauma patients.

Material and methods A retrospective chart review on rhabdomyolysis patients was performed between 1st January 2006 and 31thDecember 2010, and defined as total creatine phosphokinase (CK) of more than 3,000 U/L. The patients admitted before and after July 2008 were defined as the pre- and post- protocol group, respectively. The demographic data, disease severity, fluid administration, and outcomes were recorded. Statistical significance was defined as $p<0.05$.

Results A total of 659 patients was admitted into this study, with investigation of CK being made during the study period. Of these patients, 267 had rhabdomyolysis (29 and 238 in the pre- and post-protocol group, respectively). There was a statistically significant difference in the occurrence of acute kidney injury (pre-protocol group vs. post-protocol group: 51.7% vs. 29.4%; $p=0.015$), and acute dialysis requirement (13.8% vs. 3.6%, $p=0.01$). The mortality rate of patients requiring long term dialysis, and the creatinine level at discharge were no different between the two groups. Mixed model analysis of the clinical and laboratory parameter, during 14 days of admission, showed a significant decrease of CK ($p<0.001$), decrease of creatinine ($p<0.001$), higher urine pH monitoring ($p=0.005$), less mannitol administration ($p<0.001$), and higher administration of sodium bicarbonate ($p=0.006$) in the post-protocol group

Conclusion The rhabdomyolysis treatment protocol is effective in terms of acute renal failure, acute dialysis, and decreasing CK and serum creatinine level in rhabdomyolysis post-trauma patients**.**

Limitation This was a retrospective study. The data recorded in the pre-protocol period were incomplete, and the CK was not investigated routinely during this time. **Chiang Mai Medical Journal 2016;55(3):95-106.**

keywords: Rhabdomyolysis, acute renal failure, acute dialysis, mortality

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Introduction

Rhabdomyolysis occurs due to destruction or disintegration of the striated muscle,[1] which breaks down and crushes and necrosis occurs, resulting in leakage of intracellular muscle into extracellular fluid, and leading to clinical complications. The most common cause of rhabdomyolysis is by direct physical trauma to the skeletal muscle[1-3]. Less common causes include muscle enzyme deficiencies, electrolyte abnormalities, some infections, drugs, toxins and endocrinopathies[1,4,5]. The most sensitive indicator of muscle damage is serum creatinine phosphokinase (CK), which elevates in rhabdomyolysis[1,6,7]. In addition, the urine and serum myoglobin concentration also increased[1,6,7].

Rhabdomyolysis occurs within a wide spectrum of signs and symptoms, ranging from asymptomatic cases with isolated increasing CK plasma[5,6. In the case of severe morbidi-ty, massive increases of CK are associated with acute renal failure (ARF), severe alterations in electrolytes and finally disseminated intravascular coagulation[1,5,8]. Of these, ARF is the most important complication of rhabdomyolysis[5,9,10]. The incidence of ARF ranges 10-50% in patients with rhabdomyolysis[1,2,7]. Three treatment strategies are usually instituted: vigorous hydration to maintain renal perfusion and promote dilution of myoglobin; alkalization of the urine with bicarbonate to prevent myoglobin precipitation in the renal tubules; and administration of mannitol for a variety of effects, including osmotic diuresis, vasodilatation of renal vasculature, and free-radical scavenging[11].

Diagnosis and treatment of rhabdomyolysis were managed in the trauma center by individual physicians. Under-detected results of rhabdomyolysis and its treatment lead to ARF and other complications. Therefore, a multidisciplinary expert panel comprising trauma surgeons, nephrologists, intensivists and intensive care nurses performed the consensus of a rhabdomyolysis treatment protocol (Figure 1), which was established on 1st July, 2008, as a treatment guideline for critically ill trauma patients. The objective of this study was to evaluate effectiveness of the rhabdomyolysis treatment protocol after implementation in critically ill trauma patients.

Patients and methods

Retrospective chart reviews of all trauma patients were used, with documentation of total CK levels from electronic hospital medical records and patients admitted to the trauma intensive care unit (ICU) at Maharaj Nakorn Chiang Mai Hospital (a tertiary university based level I trauma center in northern Thailand) between January 2006 and December 2010. The rhabdomyolysis threshold was defined as a CK level of more than or equal to 3,000 U/L. The rhabdomyolysis patients were divided into 2 groups depending on the period of protocol implementation (pre-protocol group, 1st January 2006–30th June 2008, and post-protocol group, 1st July 2008–31st December 2010) (Figure 2). Patients with elevated CK levels, due to other causes, such as myocardial infarction and cerebrovascular accident, were excluded from this study. ARF was defined by Morris's criteria of acute post-traumatic renal failure[12,13] (an increase in serum creatinine levels to greater than 2 mg/dL or more than 20% with respect to basal values that were already greater than 2 mg/dL). The Chiang Mai University Ethic Committee approved this study.

The authors collected data on age, gender, date of admission and discharge, mechanism of injuries, associated organ injuries, traumatic severity scoring, and all procedures as well as CK and creatinine levels during admission. The primary outcome was occurrence of acute renal failure and secondary outcomes were the need for acute kidney dialysis and mortality.

The data were analyzed by STATA software (version 12.0, STATA Inc., College Station, TX, USA). The difference in all continued variable data was tested by using the Student's t test. Normal distribution data were reported as mean±SD or the median (25-75 interquartile range [IQR]) for non-parametric distribution, and tested using the Mann-Whitney U test. Pearson's chi-square test was used for categorical variables, but small sizes required the Fisher's exact test. Adjusted odds ratio values, with 95% confidence interval (95%CI), were reported for comparison between the two groups. Longitudinal data were analyzed by a mixed model and reported as coefficient with 95%CI. Statistical differences were considered to be statistically significant at p<0.05.

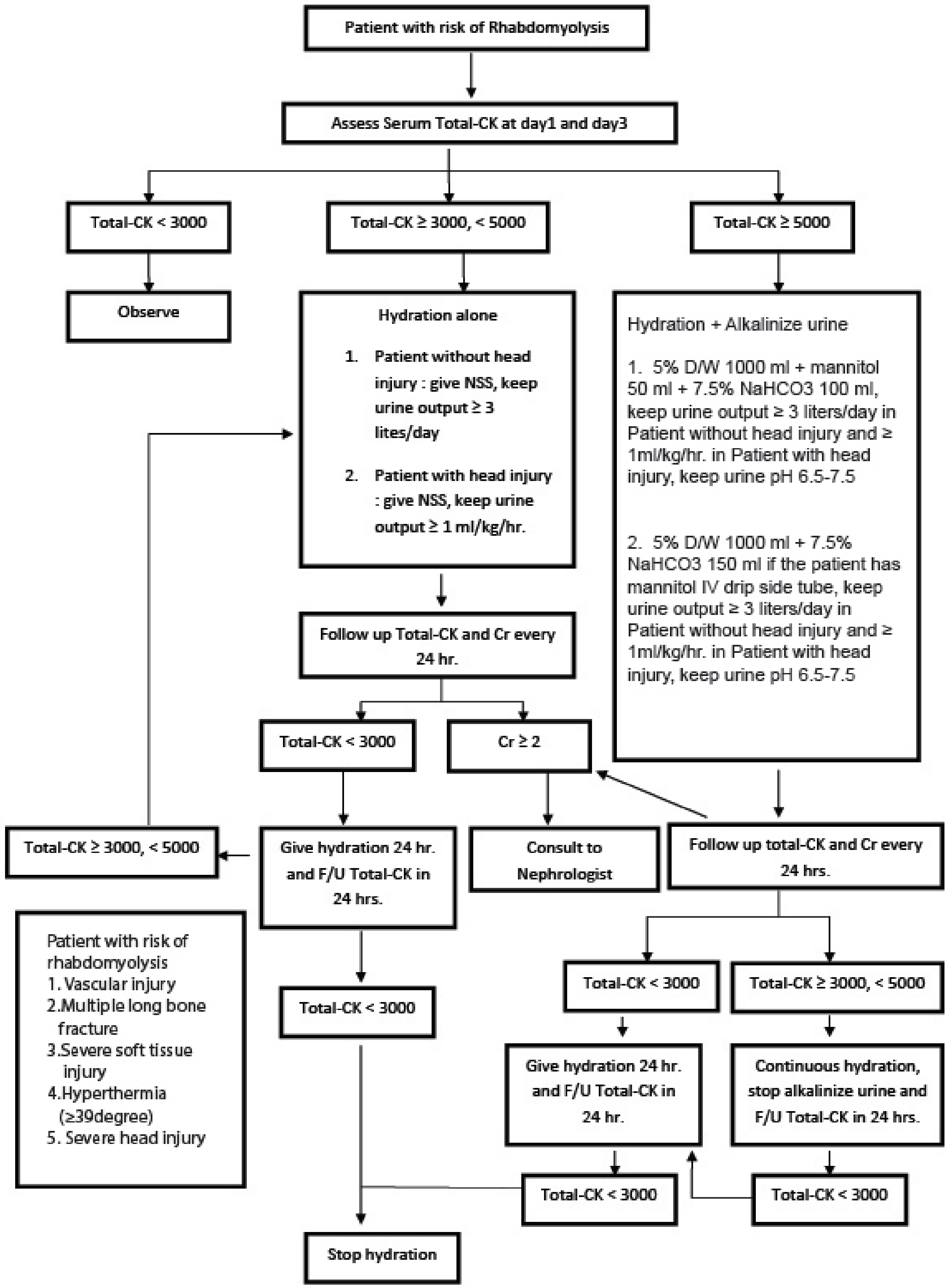

Figure 1. The rhabdomyolysis treatment protocol

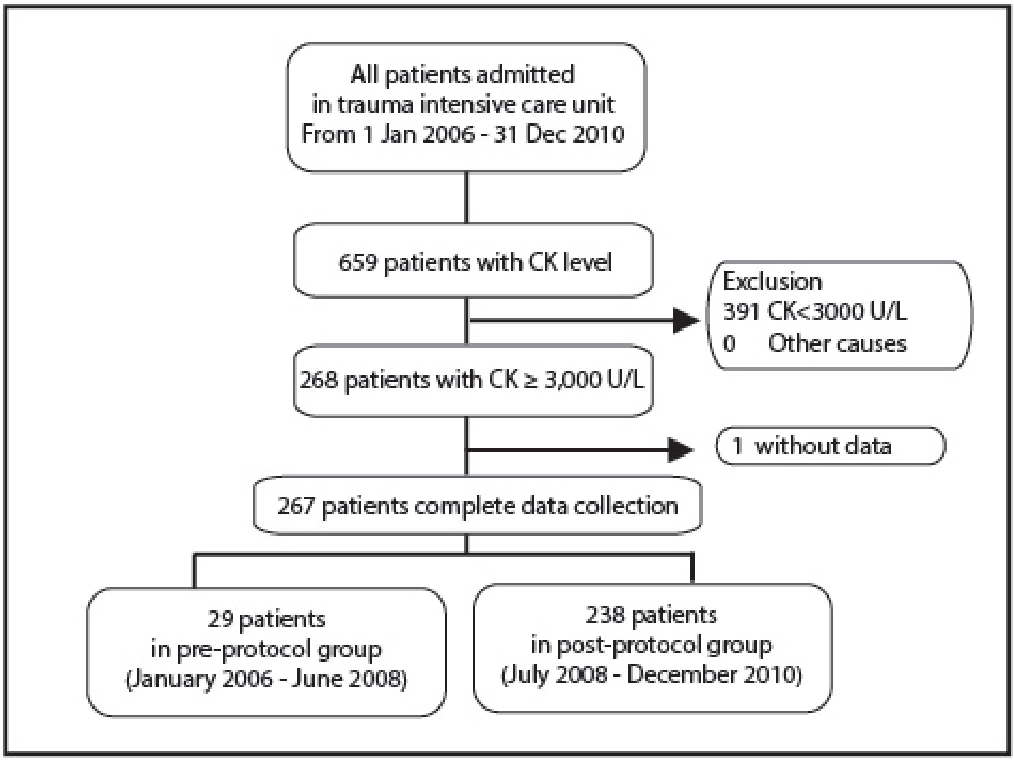

Figure 2. The study flow

Results

A total of 659 patients had their CK levels documented during admission in the trauma ICU. Of these, only 268 had a CK level higher than 3,000 U/L, and one was excluded from the study, due to the lack chart records. Therefore, 267 patients were reviewed by dividing them into 2 groups, as mention previously (29 and 238 in the pre- and post- protocol group, respectively) (Figure 2).

As shown in Table 1, there were no differences between the groups in gender, age, comorbidity, mechanism of injury, site of injury (except vascular injury), shock index, revised trauma score, exposure of contrast study at the emergency room, cardiopulmonary resuscitation before admission, embolization, or exposure to nephrotoxic agents. The pre-protocol group had a significantly higher proportion of vascular injury (41.38% vs 16.39%, p=0.001), higher injury severity score (ISS) (30.55±15.49 vs. 23.89±12.89, p=0.011), higher amputation rate (13.79% vs 2.10%, p=0.001), and higher vascular repair (31.03% vs 14.71%, p=0.025) than the post-protocol group. It also had a significantly higher level of creatinine at admission (p=0.005), rhabdomyolysis diagnosis (p<0.001) and peak serum (p=0.001), as well as a higher CK level at admission (p<0.001), and rhabdomyolysis diagnosis (p<0.001).

According to the outcomes in Table 2, there were no significant differences between the pre- and post- protocol groups in hospital mortality, number of dialyses (dialysis time), and long term dialysis requirement. However, there was a significantly lower occurrence of acute kidney injury during the post-protocol period (pre-protocol vs post-protocol: 51.72% vs 29.41%, p=0.015), which required all modes of acute dialysis (13.79% vs 3.6%, p=0.010) and low creatinine level at discharge (1.59±1.50 mg/dL vs 1.12±1.34 mg/dL, p=0.085). In order to avoid over fitting of the model, due to the small sample size in the pre-protocol period, all significant variables such as vascular injury, GCS score, vascular repair, and amputation were not included in the prediction model, although there were difference in some baseline characteristics. In addition, a variable in the diagnostic criteria, i.e., alteration of creatinine, also was not included in the model. Whereas, although the shock index was no different between the two groups, this variable was added, due to clinical relevance to the theoretical assumption of both mortality and kidney injury. Therefore, the

Table 1. Patient characteristics

Variables	Pre-protocol (n=29)	Post-protocol (n=238)	*p* value
Male (%)	26 (89.66)	215 (90.34)	0.907
Mean age ± SD	30.93±11	32.29±13	0.571
Comorbidity (%)			
Diabetic mellitus (%)	2 (6.9)	4 (1.68)	0.074
HIV infection (%)	0 (0)	1 (0.42)	0.727
Hypertension (%)	1 (3.45)	4 (1.68)	0.507
Mechanism of injury (%)			
Blunt	26 (89.66)	226 (95.76)	0.342
Stab wound	1 (3.45)	4 (1.69)	
Shot wound	2 (2.69)	6 (2.54)	
Major site of injury (%)			
Neurosurgery	15 (51.71)	145 (60.92)	0.340
Chest	7 (24.14)	50 (21.01)	0.698
Heart	0 (0)	3 (1.26)	0.543
Abdomen	6 (20.69)	47 (19.75)	0.904
Maxillofacial	5 (17.24)	44 (18.49)	0.870
Burn	0 (0)	6 (2.52)	0.387
Fracture	18 (62.07)	136 (57.14)	0.612
Vascular	12 (41.38)	39 (16.39)	0.001
Others	1 (3.45)	8 (3.36)	0.980
Trauma severity scoring SD			
Mean GCS ± SD	11±4	9±4	0.026
Mean Shock index ± SD	1.05±0.08	1.26±0.43	0.868
Mean ISS ± SD	30.55±15.49	23.89±12.89	0.011
Mean RTS ± SD	10.97±1.30	10.44±2.28	0.221
ER management			
Contrast study (%)	7 (24.14)	87 (36.55)	0.186
CPR (%)	1 (3.45)	8 (3.36)	0.980
Embolization	1 (3.45)	2 (0.86)	0.216
Operative treatment (%)			
Cranio-/craniectomy	4 (13.79)	73 (30.67)	0.058
Thoracotomy	1 (3.45)	3 (1.26)	0.360
Cardiac surgery	0	3 (1.26)	0.543
Laparotomy	4 (13.79)	32 (13.45)	0.959
Vascular repair	9 (31.03)	35 (14.71)	0.025
Orthopidic surgery	12 (41.38)	98 (41.18)	0.983
Amputation	4 (13.79)	5 (2.10)	0.001
Nephrotoxic agents (%)			
Gentamicin	5 (17.24)	40 (16.81)	0.953
Colistin	1 (3.45)	3 (1.26)	0.360
Vancomycin	2 (6.90)	5 (2.10)	0.127
Creatinine level (mg/dL)			
Adjusted Cr baseline ± SD	1.20±0.90	1.18±0.12	0.391
Cr at admission ± SD	1.66±1.89	1.22±0.60	0.005
Cr at rhabdomyolysis ± SD	2.52±3.05	1.37±0.96	0.000
Peak Cr ± SD	3.68±4.25	1.80±2.68	<0.001
Total CK level (U/L)			
At admission	39,190±56,392	7,389±11,265	<0.001
At Rhabdomyolysis	45,189±52,113	9,838±11,412	<0.001

SD, standard deviation; GCS, Glasgow Coma Score; ISS, Injury Severity Score; RTS, Revised Trauma Score; CPR, cardiopulmonary resuscitation; Cr, creatinine; CK, creatine kinase

Table 2. Outcomes

	Pre-protocol	Post-protocol	*p* value
Hospital mortality (%)	5 (17.24)	38 (16.03)	0.868
Acute kidney injury (%)	15 (51.72)	70 (29.41)	0.015
Requiring acute dialysis (%)	4 (13.79)	8 (3.6)	0.010
Dialysis times ± SD	5.33±1.53	7.2±6.14	0.634
Long term dialysis (%)	0 (%)	1 (0.42)	0.726
Cr at discharge (mg/dL)	1.59±1.50	1.12±1.34	0.085

Cr, creatinine

Table 3. Multivariable analysis

Outcomes	Adjusted odd ratio*	95% confidence interval	*p* value
Acute kidney injury	0.32	0.11-0.93	**0.037**
Hospital mortality	1.24	0.39-3.91	**0.0.713**

*The models were adjusted by shock index and creatinine level at admission

Table 4. Analysis of changing clinical and laboratory parameters during 14 days of admission after protocol implementation (post-protocol group)

Outcomes	Coefficient	95% confidence interval	*p* value
Creatine phosphokinase	-26586	-33618 to -19553	<0.001
Creatinine	-0.74	-1.12 to -0.36	<0.001
Arterial pH	-0.003	-0.06 to 0.053	0.914
Phosphate	0.136	-0.40 to 0.68	0.621
Calcium	0.182	-0.14 to 0.50	0.266
Urine pH	0.378	0.12 to 0.64	0.005
Daily fluid intake (mL)	-169.9	-629 to 289	0.468
Daily urine output (mL)	187.7	-165 to 540	0.297
Mannitol administration	-48.1	-69.5 to -26.7	<0.001
Sodium bicarbonate administration	123.4	35 to 211	0.006

adjusted variables in the final model were ISS, shock index and creatinine level on admission to hospital (Table 3). Although there was no significant mortality in the hospital, a significantly lower odds ratio for acute kidney injury occurred in the post-protocol group, based on the adjusted model in the multivariable logistic regression analysis (Table 3) (adjusted OR 0.32, 95% CI 0.11–0.93, p=0.037).

The longitudinal data during 14 days of hospital admission (Table 4) showed no significant difference in arterial pH (p=0.914), serum phosphate (p=0.621), serum calcium (p=0.266), daily fluid intake (p=0.468) (Figure 3, Table 4), or daily urine output (p=0.297) (Figure 4, Table 4), but serum creatinine, (Coefficient -0.74, 95%CI -1.12 to -0.36, p<0.001) (Table 4, Figure 5) and serum CK (Coefficient -26586, 95%CI -33618 to -19553, p<0.001) reduced significantly in the post-protocol group (Table 4, Figure.6). It was interesting that while the post-protocol group had significantly lower mannitol administration (p<0.001), its sodium bicarbonate administration was significantly higher (p=0.006), which might result in significantly higher urine pH in this group (p=0.005) (Table 4).

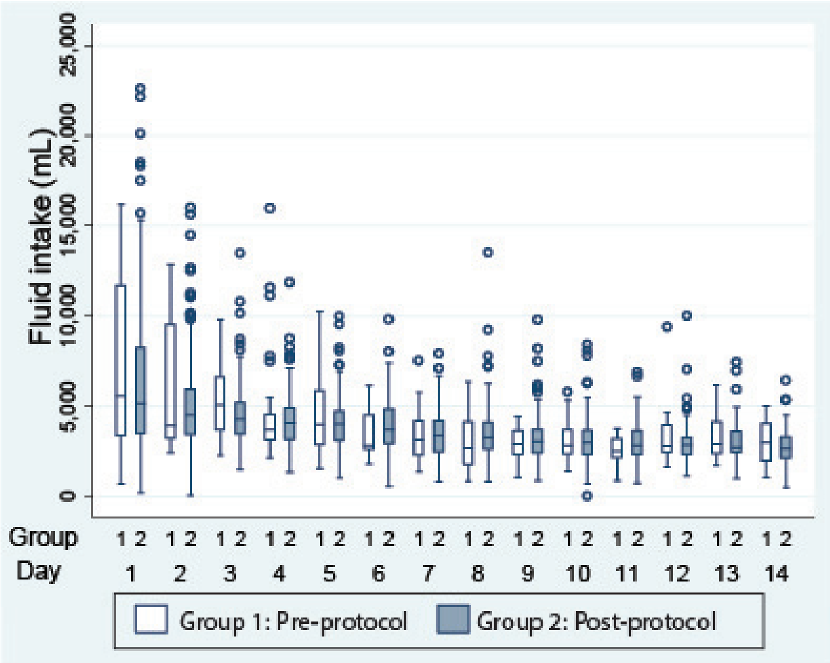

Figure 3. Box plot of fluid intake comparison between pre- and post-protocol on the first 14 days after admission

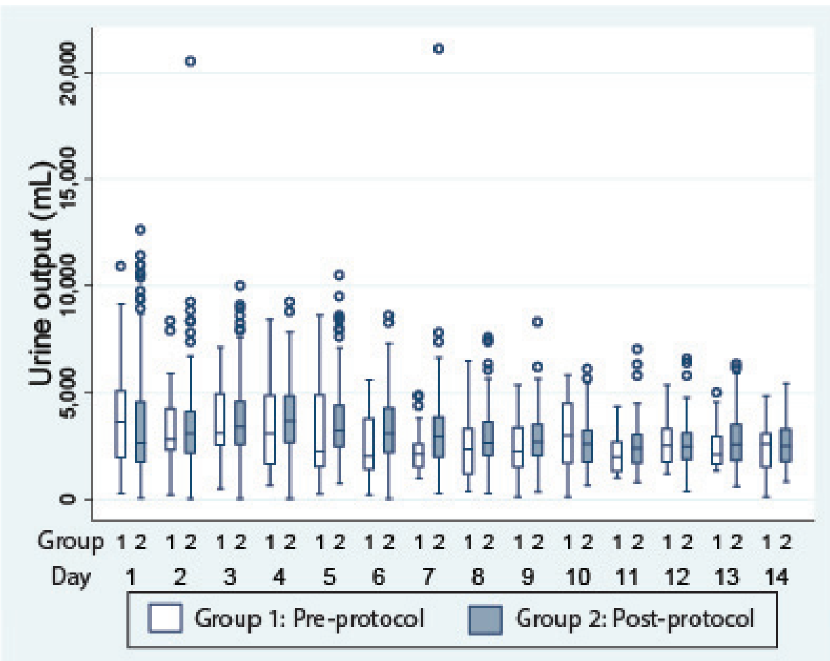

Figure 4. Box plot of urine output comparison between pre-and post-protocol on the first 14 days after admission

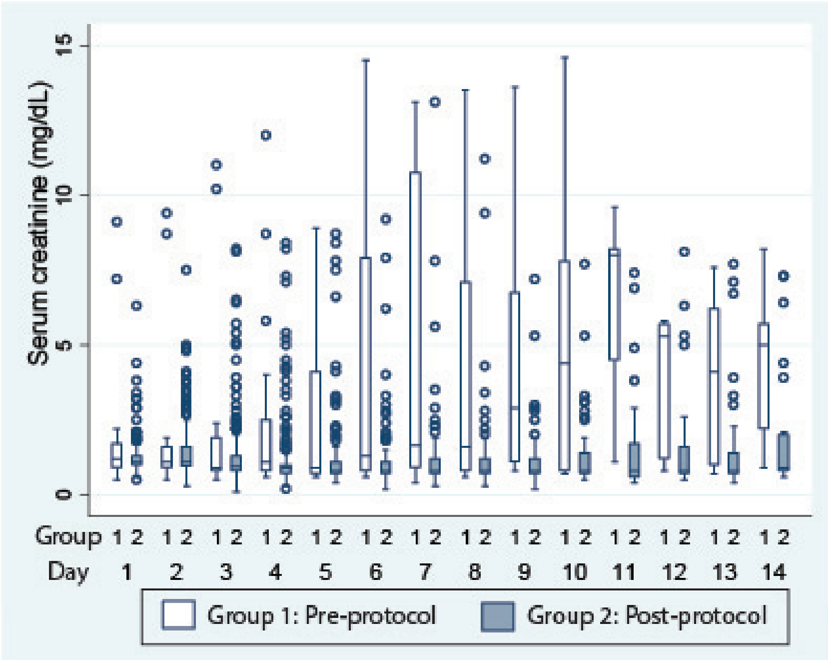

Figure 5. Box plot of serum creatinine comparison between pre-and post-protocol on the first 14 days after admission

Discussion

This study demonstrated effectiveness of the rhabdomyolysis treatment protocol in critically ill trauma patients with rhabdomyolysis. The results of the study demonstrated that protocol based treatment improved the outcomes of acute kidney injury that required acute kidney dialysis, decrement rate of CK and alteration of serum creatinine. Although the cutoff point value of rhabdomyolysis was not mentioned in previous studies, the value of more than 5,000–10,000 U/L is associated with acute renal failure[1,11,13]. Vivino *et al*. observed 153 trauma patients prospectively[13], and reported CK >10,000 U/L as a risk factor of acute renal failure. Brown *et al*. investigated 2,083 trauma patients in an ICU[11], and found the rate of mortality, renal failure and dialysis no different between those who received sodium bicarbonate and mannitol and those who did not in a group of patients with CK greater than 5,000 U/L[11]. However, this study did not show a guideline or protocol for giving both sodium bicarbonate and mannitol, and the timing of their administration also was not demonstrated. The group with a high level of CK had a significantly higher severity score. Based on the fact that mannitol is an osmotic diuretic agent, experimental studies have shown that it has a protective effect on the kidney during rhabdomyolysis[1]. However, misuse of this agent might be harmful, especially in patients who are in a hypovolemic state. This study showed that significantly less mannitol was used in patients during the post-protocol period. However, sodium bicarbonate administration was significantly higher in the post-protocol group than that in the pre-protocol group, resulting in higher urine pH during the post-protocol period. Alkalinization of urine is still a controversial issue. On the one hand, rhabdomyolysis produces acid load that leads to acidic urine, and patients in this condition may be unable to alkalinize their urine without sodium bicarbonate administration[1]. The increased risk of tubular cast formation finally turns to renal failure[14]. On the other hand, some studies do not support these hypotheses by arguing that large-volume infusion of crystalloid alone is sufficient for solute diuresis[15,16].

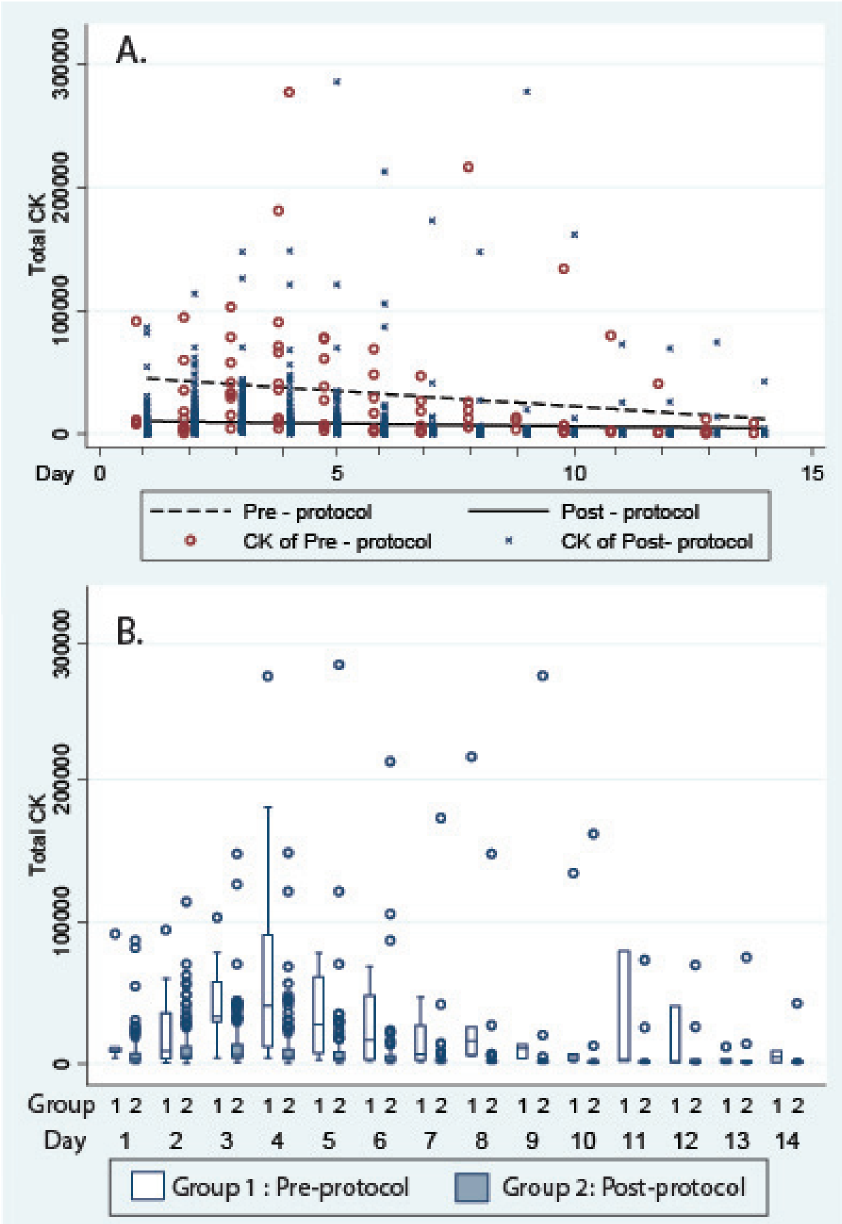

Figure 6. The alteration of total CK comparison between pre-and post-protocol on the first 14 days after admission. A. Demonstrate the scatter plot and median-SP-line estimation. B. Demonstrate the box plot.

However, this retrospective study of the pre- and post- protocol found that a combination of these issues in a high level of CK>5,000 U/L reduced the occurrence of acute kidney injury and need for acute dialysis. However, a future randomized control trial should be initiated in these groups of patients.

Although the normal value of CK is 45-260 U/L,[1] the threshold in the rhabdomyolysis patients in this study was defined at a CK level of more than 3,000 U/L during trauma ICU admission. A higher cutoff was used for comparison of the lowest threshold values for starting the therapy in the treatment protocol. The type of fluid, rate of administration, combination of sodium bicarbonate and mannitol in the protocol of this study had dynamic changes, based on the level of CK during treatment of rhabdomyolysis and prevention of its complications, which might be different from previous study observations[11].

Although setting different criteria, such as AKIN or RIFLE, has been proposed for severity grading of acute kidney injury[17,18], currently modified AKIN and RIFLE criteria was recommended as KDIGO criteria[19], which use glomerular filtration, alteration of creatinine level, timing of alteration, and urine output for classification. However, this study used the post-traumatic acute renal failure criteria, as proposed by Morris e*t al*[12] because of its simplicity and inaccuracy of time frame records in the retrospective review. The difference of criteria might lead to the difference of acute renal failure occurring in this study. Morris et al define the occurrence of ARF at 31.8% in post-traumatic rhabdomyolysis patients. The post-protocol group had a significantly lower occurrence of ARF than the pre-protocol one.

Although the standard recommendation for a rhabdomyolysis treatment guideline has not been established yet, this study showed evidence of the effectiveness of the rhabdomyolysis protocol, which was organized by multidisciplinary experts at the Faculty of Medicine, Chiang Mai University. The primary target for this protocol was post trauma rhabdomyolysis patients. Furthermore, this protocol could be used and modified for other surgical patients. There were some limitations in this study. Firstly, it was a retrospective study of before and after protocol implementation. The data on the pre-protocol group were very limited, due to the different system for electronic medical records in the hospital. Secondly, the awareness of post-trauma rhabdomyolysis was higher in post-protocol period than in the pre-protocol one. This was observed from the difference in frequency of CK investigations and number of rhabdomyolysis patients during those periods. Thirdly, inequality of the populations in those periods might lead to selection bias, especially in the pre-protocol period, and in detecting the degree of rhabdomyolysis patients. Finally, this study did not compare the difference in incidence of acute kidney injury in all of the admitted patients, but it proved the treatment protocol in patients diagnosed as rhabdomyolysis. Therefore, the results of this study did not demonstrate the overall incidence of acute kidney injury during the two periods. However, it did demonstrate the usefulness and effectiveness of the protocol in post-trauma patient care.

Conclusion

The rhabdomyolysis treatment protocol effectively reduces acute renal failure and acute dialysis, and decreases CK and serum creatinine level in rhabdomyolysis post-trauma patients

Acknowledgement

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ประสิทธิภาพของแนวทางการรักษาภาวะกล้ามเนื้อสลาย (Rhabdomyolysis) ในผู้ป่วยหนักอุบัติเหตุในโรงพยาบาลศูนย์อุบัติเหตุระดับที่ 1

ปริวรรต พรหมรัตน์, นเรนทร์ โชติรสนิรมิต, กำธน จันทร์แจ่ม, ธิดารัตน์ จิรพงศ์เจริญลาภ, และ กวีศักดิ์ จิตตวัฒนรัตน์
ภาควิชาศัลยศาสตร์ คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่

วัตถุประสงค์ ภาวะกล้ามเนื้อสลายและผลต่อเนื่องสู่ภาวะไตวายเฉียบพลัน เป็นผลข้างเคียงที่รุนแรงและมีอัตราการเสียชีวิตที่สูง อย่างไรก็ตาม การรักษาภาวะดังกล่าวยังมีความแตกต่างกันในแพทย์แต่ละคน ดังนั้นกลุ่มผู้เชี่ยวชาญสหสาขาจึงได้หาแนวทางการรักษาเพื่อเป็นแนวปฏิบัติและเริ่มใช้ในเดือนกรกฎาคม พ.ศ. 2551 วัตถุประสงค์ของการศึกษานี้เพื่อประเมินประสิทธิภาพของการรักษาด้วยแนวปฏิบัติดังกล่าวในผู้ป่วยหนักอุบัติเหตุ

วัสดุและวิธีการศึกษา ทีมผู้วิจัยได้ทำการศึกษาย้อนหลังจากการทบทวนเวชระเบียน ระหว่างวันที่ 1 มกราคม พ.ศ. 2549 ถึง 31 ธันวาคม พ.ศ. 2553 ผู้ป่วยที่มีภาวะกล้ามเนื้อสลายกำหนดไว้เมื่อระดับครีเอตีนฟอสฟอไคเนส มากกว่า 3000 ยูนิต/ลิตร กลุ่มผู้ป่วยที่เข้ารับการรักษาก่อนและหลังจากเดือนกรกฎาคม พ.ศ. 2551 จัดให้เป็นกลุ่มก่อนและหลังจากใช้แนวปฏิบัติ บันทึก ข้อมูลพื้นฐาน ความรุนแรงของโรค การให้สารน้ำและผลการรักษา ความแตกต่างอย่างมีนัยสำคัญทางสถิติเมื่อค่า $p<0.05$

ผลการศึกษา ผู้ป่วยจำนวน 659 ราย ได้เข้ารักษาในหอผู้ป่วยหนักอุบัติเหตุและได้รับการตรวจระดับครีเอตีนฟอสฟอไคเนส ผู้ป่วยจำนวน 267 ราย พบว่ามีภาวะกล้ามเนื้อสลาย (29 รายในกลุ่มก่อน และ 238 รายในกลุ่มหลังใช้แนวทางปฏิบัติ) มีความแตกต่างอย่างมีนัยสำคัญของการเกิดภาวะไตวายเฉียบพลัน (กลุ่มก่อนฯ และกลุ่มหลังฯ: ร้อยละ 51.7 และ ร้อยละ 29.4, $p=0.015$) ความจำเป็นต้องใช้เครื่องไตเทียม (ร้อยละ 13.8 และร้อยละ 3.6, $p=0.01$). อัตราการเสียชีวิต ความจำเป็นต้องใช้เครื่องไตเทียมในระยะยาว ระดับครีเอตินีนขณะจำหน่ายไม่มีความแตกต่างกันอย่างมีนัยสำคัญ ในการวิเคราะห์แบบจำลองพหุถดถอยแบบมิกซ์ (mixed model) ในตัวแปรทางคลินิกและผลตรวจทางห้องปฏิบัติการระหว่าง 14 วันแรกของการนอนโรงพยาบาล ในกลุ่มหลังฯ มีการลดลงของครีเอตีนฟอสฟอไคเนส ($p<0.001$) การลดลงของครีเอตินีน ($p<0.001$) การเพิ่มของระดับความเป็นด่างในปัสสาวะ ($p=0.005$) การใช้แมนนิทอลที่ลดลง ($p<0.001$) และมีการใช้โซเดียมไบคาร์บอเนตเพิ่มขึ้น ($p=0.006$)

สรุป แนวทางการรักษาภาวะกล้ามเนื้อสลายมีประสิทธิภาพในแง่ของการเกิดการลดการเกิดภาวะไตวาย ความจำเป็นของการใช้เครื่องไตเทียม การลดลงของระดับครีเอตีนฟอสฟอไคเนสและระดับครีเอตินีนในผู้ป่วยมี่มีภาวะกล้ามเนื้อสลายหลังจากอุบัติเหตุ

ข้อจำกัดของการศึกษา เป็นการศึกษาย้อนหลัง ข้อมูลก่อนแนวทางปฏิบัติส่วนใหญ่ไม่สมบูรณ์และการส่งตรวจครีเอตีนฟอสฟอไคเนสไม่ได้ทำอย่างสม่ำเสมอในแนวทางปฏิบัติ **เชียงใหม่เวชสาร 2559;55(3):95-106.**

คำสำคัญ: ภาวะกล้ามเนื้อมีการสลายตัว ภาวะไตวายเฉียบพลัน อัตราการเสียชีวิต