EXPERIMENTAL STUDY

Is there a renal protective role for gelsolin treatment in crush syndrome? An experimental study

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ABSTRACT

BACKGROUND: This study aims to investigate the impact of combining crush fluid resuscitation with gelsolin treatment on renal function in a rat model of crush syndrome.

METHODS: Twenty-four adult female Wistar albino rats were randomly assigned to one of three groups for crush syndrome treatment: Control (C) group, gelsolin + crush fluid (gel) group, and crush fluid only (CF) group, each containing eight rats. Sedated rats underwent unilateral hind limb compression of 2 kg using a compression device, maintained for five hours. The control group received no treatment post-compression. After removing the tourniquet, rats in the gelsolin group received an intravenous administration of recombinant human gelsolin at a dose of 2 mg/kg in 0.1 ml sterile saline, along with crush fluid. The CF group received only the crush solution.

RESULTS: At 24 hours, creatine kinase (CK) levels in the CF group were lower compared to those in the control and gelsolin + CF groups (132 IU vs. 630 IU [p=0.004] and 519.5 IU [p=0.014], respectively). By 48 hours, CK levels in both CF and gelsolin + CF groups were lower than in the control group (p<0.001 and p=0.014, respectively), with no significant difference between the CF and gelsolin + CF groups (p=0.773). At 72 hours, CK levels in the gelsolin + CF group were lower than in the control group (p=0.023) but comparable to the CF group (p>0.05). Blood urea nitrogen (BUN) levels at 24 and 72 hours were similar in the control and gelsolin + CF groups (p>0.05). At 48 hours, BUN levels in both CF and gelsolin + CF groups were lower than in the control group (p=0.001 and p=0.003, respectively), with no significant difference between the CF and Gelsolin + CF groups (p>0.05). At 24 hours, creatinine levels in the gelsolin + CF group were lower than in the control group (p=0.017), while levels in the CF and gelsolin + CF groups were similar (p>0.05). By 48 and 72 hours, creatinine levels in both CF and gelsolin + CF groups were similar but lower than in the control group (p<0.05). Changes in creatinine levels were comparable across all groups (p>0.05).

CONCLUSION: This study marks the first instance in literature where it has been demonstrated that administering gelsolin along with crush solution does not yield superior results compared to crush solution alone in treating crush syndrome. Nonetheless, further research utilizing varying doses of gelsolin is warranted.

Keywords: Wistar; crush syndrome; gelsolin; rhabdomyolysis; creatine kinase.

INTRODUCTION

A crush injury refers to the compression of body parts, typically extremities, resulting in muscle edema and/or nerve damage in the affected areas. Such injuries commonly occur during earthquakes, vehicle accidents, and in industrial, mining, and agricultural settings. The physical forces causing compression trigger an influx of sodium and calcium into the myocyte cytosol, leading to cell swelling and cytosolic autolytic processes.[1,2] Even after decompression and restoration of blood flow, pathological changes often persist. During reperfusion, intracellular substances from crushed fibers enter the bloodstream.

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[3] This circulating debris can lead to fracture syndrome, also known as traumatic rhabdomyolysis, potentially resulting in life-threatening acute renal failure hours or days after the initial crush injury.[4]

Crush syndrome arises from rhabdomyolysis and ischemia-reperfusion (I/R) injury. Ischemia-reperfusion injury refers to the pathological condition that occurs when blood flow is restored to previously ischemic tissue. This restoration can initiate a cascade of acute inflammatory events, ultimately resulting in cell death, tissue necrosis, and dysfunction.[5,6]

Gelsolin, also known as GSN, actin-depolymerization factor/ADF, actin-gelsolin complex (AGEL), and Brevin, is a member of the villin/gelsolin family, weighing 90-95 kDa. Gelsolin is widely expressed and binds to actin and fibronectin. It is found both in the cytoplasm and secreted in plasma.[7-9] The cytoplasmic form of gelsolin lacks the first 51 N-terminal amino acids present in the secreted version. Gelsolin functions by severing actin filaments in the presence of submicromolar concentrations of calcium and plays a role in ciliogenesis.[10]

Gelsolin, an actin-binding protein, is found in both the cytoplasm and extracellular fluids, including blood plasma. It works in conjunction with calcium to regulate actin levels within the circulatory system.[11] When activated by calcium, gelsolin depolymerizes and coats filamentous actin (F-actin) released into the plasma during cell death. Thus, any condition causing a sudden increase in F-actin results in reduced levels of plasma gelsolin.[12] Research indicates that gelsolin expression increases during oxidative stress, due to its antioxidant properties within cells.[13] Consequently, recombinant gelsolin replacement therapy is being explored as a potential treatment for sepsis, aiming to dissolve circulating actin aggregates and modulate cytokine levels towards an anti-inflammatory profile.[14]

In this study, our objective was to assess the protective effects of gelsolin treatment on renal function in a rat model of crush syndrome.

MATERIALS AND METHODS

Animals

We obtained 12-week-old female Wistar rats, weighing 450-500 grams, from Nihon SLC, Inc. (Hamamatsu, Japan), bred under specific pathogen-free conditions. Ethical approval for all experiments was granted by the Local Ethics Committee of the Faculty of Medicine at Health Science University of Konya Education and Research Hospital (2015-97/9). The rats were housed in cages with unrestricted access to food and water, in a room maintained at 22 °C and 55% relative humidity, following a 12-hour light-dark cycle.

Crush Syndrome Model

We induced the crush injury using the method outlined by Murata et al.,[15] with previously described modifications, as shown in Figure 1.[16,17] We used a specially designed device

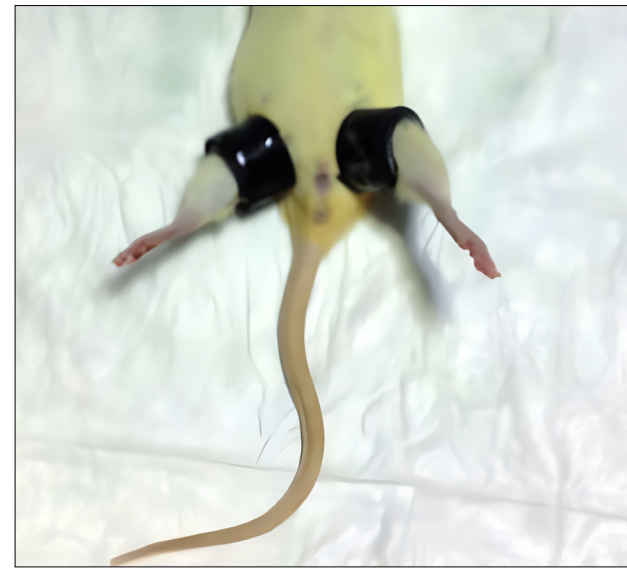

Figure 1. Tourniquet designed to compress the hind leg of a rat.

to compress the bilateral hind legs of the rats. Rubber tourniquets, measuring 2.4 cm in width and 1 mm in thickness, were prepared for this purpose. These tourniquets were wrapped around a metal cylinder (22 mm outer diameter, 20 mm inner diameter, 70 mm length) with five turns under a 2 kg weight load. Each rat was positioned with its abdominal surface elevated, and its foot placed inside the metal cylinder. Compression of the hind limbs was achieved by upward pressure of the tourniquet against the rat's thigh. After 5 hours of compression, the tourniquet was cut and removed. All procedures were conducted under general anesthesia using a mixture of intraperitoneal ketamine hydrochloride (80 mg/kg) and xylazine (5 mg/kg). Compression was applied to all experimental groups. Animals were then returned to their respective cages with unrestricted access to food and water.

Study Groups

The rats were randomly assigned to one of three groups: Control (C) group, Gelsolin + Crush Solution (Gel) group, and Crush Solution Only (CF) group. The Control group received no treatment after compression. Following tourniquet removal, a 20% mannitol solution (crush solution) was administered intravenously at a dose of 1 g/kg, equivalent to 2 mL/400 g of body weight. The CF group received only the crush solution. Gelsolin (Gsn-H, Sigma-Aldrich, Shanghai, China) was added to the crush solution at a dose of 2 mg/kg. A catheter was inserted into the tail vein for intravenous (IV) fluid infusions. The infusion rate for the crush solution was set at 1 ml/100 g body weight per hour. The fluid volume was calculated and administered as an IV bolus at the 0th, 2nd, 4th, and 6th hours after compression removal.

Biochemical Markers

Arterial blood samples of 1.5 mL were collected from all rats to assess biochemical markers including creatinine (CREA),

creatine kinase (CK), blood urea nitrogen (BUN), lactate dehydrogenase (LDH), and myoglobin at baseline, and at 24, 48, and 72 hours after the crush injury. An equivalent amount of saline (1 ml/100 g body weight per hour) was administered intravenously into the jugular vein of each rat. Measurements were taken at four time points for all rats: before the crush

Table 1. Creatine kinase (CK), blood urea nitrogen (BUN), and lactate dehydrogenase (LDH) follow-up results in the crush syndrome model

	Control (I)	CF (II)	Gelsolin+CF (III)	p	Pairwise Comparison		
	(n=8)	(n=8)	(n=8)		I vs. II	I vs. III	II vs. III
	Median (Min/Max)	Median (Min/Max)	Median (Min/Max)				
CK (IU/L)							
24 h	630 (342/999)	132 (104/379)	519.5 (190/2158)	<0.001[k]	0.004	0.999	0.014
48 h	1055 (876/9456)	85 (39/100)	128.5 (52/387)	<0.001[k]	<0.001	0.014	0.773
72 h	978.5 (109/1681)	321 (163/506)	226.5 (143/671)	0.015[k]	0.137	0.023	0.999
Change in CK							
(48-24 h)	501 (224/8457)	-56 (-340/-10)	-374.5 (-2054/-138)	<0.001[k]	0.036	<0.001	0.231
(72-24 h)	348.5 (-235/847)	140.5 (-216/402)	-278.5 (-1995/481)	0.023[k]	0.999	0.030	0.183
(72-48 h)	-330 (-7775/247)	230.5 (124/412)	69.5 (-126/619)	0.002[k]	0.003	0.198	0.472
p (Within Groups)	0.019[fr]	<0.001[fr]	<0.001[fr]				
p (24 h vs. 48 h)	0.018	0.073	0.008				
p (24 h vs. 72 h)	0.952	0.401	0.401				
p (48 h vs. 72 h)	0.240	0.001	0.401				
BUN (mg/dL)							
24 h	260 (235/338)	189.5 (45/434)	215 (18/287)	0.025[k]	0.020	0.078	0.999
48 h	516.5 (304/954)	168.5 (142/224)	179 (137/199)	<0.001[k]	0.001	0.003	0.999
72 h	439 (193/908)	207 (184/226)	222 (178/278)	0.017[k]	0.018	0.708	0.359
Change in BUN							
(48-24 h)	221 (5/719)	-0.5 (-275/128)	-33 (-91/150)	<0.001[k]	0.014	0.003	0.999
(72-24 h)	172 (-68/652)	30 (-227/161)	20.5 (-58/160)	0.413[k]	ns	ns	ns
(72-48 h)	-123 (-531/151)	37.5 (-25/62)	37.5 (10/141)	0.554[k]	ns	ns	ns
p (Within Groups)	0.048[fr]	0.286[fr]	0.021[fr]				
p (24 h vs. 48 h)	0.037	ns	0.240				
p (24 h vs. 72 h)	0.634	ns	0.952				
p (48 h vs. 72 h)	0.634	ns	0.018				
LDH (IU/L)							
24 h	1231 (1023/3530)	440 (188/650)	1203 (425/2450)	<0.001[k]	0.002	0.999	0.014
48 h	1116.5 (457/5837)	142.5 (48/211)	354 (76/717)	<0.001[k]	<0.001	0.022	0.688
72 h	696.5 (108/1423)	235 (144/442)	190 (112/233)	0.066[k]	ns	ns	ns
Change in LDH							
(48-24 h)	-114.5 (-1646/2433)	-317.5 (-563/-34)	-811 (-2014/-112)	0.036[k]	0.999	0.044	0.214
(72-24 h)	-987 (-2371/35)	-204.5 (-424/-8)	-1016 (-2259/-195)	0.009[k]	0.102	0.999	0.017
(72-48 h)	-883.5 (-4678/634)	87 (-4/243)	-143 (-503/147)	0.023[k]	0.024	0.999	0.269
p (Within Groups)	0.080[fr]	<0.001[fr]	0.001[fr]				
p (24 h vs. 48 h)	ns	0.001	0.037				
p (24 h vs. 72 h)	ns	0.073	0.001				
p (48 h vs. 72 h)	ns	0.401	0.952				

[k]Kruskal-Wallis Test (Monte Carlo); Post Hoc Test: Dunn's Test; frFriedman Test (Monte Carlo); Post Hoc Test: Stepwise step-down comparisons; ns: Not Significant.

injury, and 24, 48, and 72 hours post-crush. At the 72-hour mark, blood collection was performed intracardially under general anesthesia, and the rats were then euthanized.

Statistical Analysis

The statistical analysis was performed using SPSS version 26.0 (IBM Corporation, Armonk, New York, United States) and PAST 3 (Paleontological statistics software by Hammer, Ø., Harper, D.A.T., and Ryan, P.D., 2001). The Mardia test (Dornik and Hansen omnibus) assessed the normal distribution of multivariate data, while the Box-M test evaluated the homogeneity of variances. For comparing independent multiple groups based on quantitative variables, the Kruskal-Wallis H Test, a nonparametric test, was employed, followed by post hoc analysis using Dunn's Test with results validated by the Monte Carlo simulation technique. To examine the interaction of more than two repeated measurements of variables across groups, Friedman's Two-Way Analysis of Variance and Cochran's Q Tests were conducted, with post hoc comparisons analyzed using Stepwise step-down comparisons for significant Friedman's test results. Categorical variables were compared using the Fisher-Freeman-Halton test, validated by the Monte Carlo Simulation technique. Quantitative variables were presented as Median (Minimum/Maximum) in the tables, while categorical variables were represented as n (%). Statistical significance was considered at a 95% confidence level, with p-values less than 0.05 deemed significant.

RESULTS

All rats completed the study with a 100% survival rate. The mean results of the groups at 24, 48, and 72 hours are summarized in Table 1 and Table 2. Renal function and muscle enzymes showed significant improvement in both treatment groups; however, no significant difference was observed between the treatment groups.

Change in CK Levels

At 24 hours, CK levels in the CF group were lower compared to both the control and Gelsolin + CF groups (132 IU vs. 630 IU [p=0.004] and 519.5 IU [p=0.014], respectively). By 48 hours, CK levels in both the CF and Gelsolin + CF groups were lower than in the Control group (p<0.001 and p=0.014, respectively), with no significant difference observed between the CF and Gelsolin + CF groups (p=0.773). At 72 hours, CK levels in the Gelsolin + CF group were lower than those in the Control group (p=0.023), but similar to the CF group (p>0.05) (Table 1).

Change in BUN Levels

At 24 and 72 hours, BUN levels in the Control and Gelsolin + CF groups showed no significant difference (p>0.05). By 48 hours, BUN levels in both the CF and Gelsolin + CF groups were lower than those in the Control group (p=0.001 and p=0.003, respectively), with no significant variance observed between the CF and Gelsolin + CF groups (p>0.05) (Table 1).

Change in LDH levels

At 24 hours, LDH levels in the CF group were lower than those in the Control and Gelsolin + CF groups (p=0.002 and p=0.014, respectively). By 48 hours, LDH levels in both the CF and Gelsolin + CF groups were lower than in the Control group (p<0.001 and p=0.022, respectively), with no significant difference observed between the CF and Gelsolin + CF groups (p>0.05). LDH levels measured at 72 hours showed similarity across all groups (p>0.05) (Table 1).

Change in Myoglobin Levels

Myoglobin levels remained consistent across all groups at 24, 48, and 72 hours. Additionally, the change in myoglobin levels during the follow-up period was similar (p>0.05) (Table 2).

Change in Creatinine Levels

At 24 hours, creatinine levels in the Gelsolin + CF group were lower than in the Control group (p=0.017), while creatinine levels in the CF and Gelsolin + CF groups showed no significant difference (p>0.05). Creatinine levels measured at 48 and 72 hours in the CF and Gelsolin + CF groups were similar but lower compared to the Control group (p<0.05). The changes in creatinine levels were consistent across all groups (p>0.05) (Table 2).

DISCUSSION

The primary goal of this study was to explore the impact of adding gelsolin to crush solution in a rat crush model. However, we found no additional benefit from gelsolin treatment when compared to crush solution alone in managing crush syndrome.

Crush syndrome is a life-threatening condition often triggered by major earthquakes, with fracture-crush injuries ranking as the second most common cause of death following these events. In recent years, there has been a growing global awareness of the health challenges posed by large earthquakes, which have been occurring with increasing frequency in our country.[18]

In the acute phase of crush syndrome, patients typically present with hypovolemia, fatal arrhythmias, and acute renal failure. Despite adequate fluid volume restoration and renal replacement therapy, patients often progress to systemic inflammatory response syndrome (SIRS), which may lead to multiple organ failure (MOF) and death. The mortality rate in crush syndrome patients is high, approximately 13-14% according to previous reports, making it a serious and life-threatening condition that requires careful management. Various factors contribute to the development of acute kidney injury (AKI) during rhabdomyolysis. Hypovolemia secondary to compartment syndrome, which reduces renal blood flow, is a significant factor. Additionally, myoglobin contributes to AKI by exerting direct toxic effects and causing tubular obstruction. Ischemia-reperfusion injury may further contribute

Table 2. Myoglobin and creatinine follow-up results in a crush syndrome model

	Control (I)	CF (II)	Gelsolin (III)	p	Pairwise Comparison		
	(n=8)	(n=8)	(n=8)		I vs. II	I vs. III	II vs. III
	n (%)	n (%)	n (%)				
Myoglobin (<8)							
24 h	7 (87.5)	8 (100)	8 (100)	0.999[f]	ns	ns	ns
48 h	8 (100)	7 (87.5)	8 (100)	0.999[f]	ns	ns	ns
72 h	6 (75)	8 (100)	8 (100)	0.310[f]	ns	ns	ns
Change in Myoglobin							
(48-24 h)						0.999[f]	
Unchanged	7 (87.5)	7 (87.5)	8 (100)		ns	ns	ns
Decreased	1 (12.5)	0 (0)	0 (0)		ns	ns	ns
Increased	0 (0)	1 (12.5)	0 (0)		ns	ns	ns
(72-24 h)						0.999[f]	
Unchanged	7 (87.5)	8 (100)	8 (100)		ns	ns	ns
Decreased	0 (0)	0 (0)	0 (0)		ns	ns	ns
Increased	1 (12.5)	0 (0)	0 (0)		ns	ns	ns
(72-48 h)						0.999[f]	
Unchanged	7 (87.5)	7 (87.5)	8 (100)		ns	ns	ns
Decreased	0 (0)	1 (12.5)	0 (0)		ns	ns	ns
Increased	1 (12.5)	0 (0)	0 (0)		ns	ns	ns
p (Within Groups)	0.668q	0.999q		-			
	Median (Min/Max)	Median (Min/Max)	Median (Min/Max)				
Creatinine (mg/dL)							
24 h	63.5 (34/65)	42.5 (13/72)	39 (4/48)	0.011[k]	0.148	0.017	0.999
48 h	85 (27/87)	28 (4/39)	32.5 (24/38)	0.001[k]	0.005	0.028	0.999
72 h	80.5 (25/88)	31 (3/36)	29.5 (2/37)	0.010[k]	0.049	0.032	0.999
Change in Creatinine							
(48-24 h)	22.5 (-38/51)	-13 (-46/16)	-7.5 (-18/32)	0.366[k]	ns	ns	ns
(72-24 h)	17.5 (-40/53)	-12.5 (-41/12)	-9 (-40/20)	0.356[k]	ns	ns	ns
(72-48 h)	0 (-52/49)	3 (-36/27)	-2.5 (-22/7)	0.581[k]	ns	ns	ns
p (Within Groups)	0.726[fr]	0.077[fr]	0.120[fr]				

[f]Fisher-Freeman-Halton Test (Monte Carlo), q Cochran's Q Test (Monte Carlo); [k]Kruskal-Wallis Test (Monte Carlo); Post Hoc Test: Dunn's Test; [fr]Friedman Test (Monte Carlo); Post Hoc Test: Stepwise step-down comparisons; ns: Not Significant.

to the release of cytokines, endotoxins, and metabolic abnormalities such as hyperphosphatemia and hyperuricemia, leading to a systemic inflammatory response. Experimental animal studies investigating the pathogenesis of crush syndrome have demonstrated increased levels of inflammatory cytokines and oxidative stress, particularly in the heart, liver, and kidneys.

Gelsolin is an actin-binding protein comprising six domains, and plasma gelsolin levels decrease as free actin increases.7 Elevated levels of F-actin can lead to increased blood viscosity and impaired blood flow. However, plasma gelsolin binds to F-actin, thus limiting damage caused by extracellular F-actin.[19] The antioxidant and antiapoptotic properties of gelsolin have been well-documented in previous studies.[20]

In this study, we evaluated serum markers of rhabdomyolysis including CK, myoglobin, LDH, BUN, and creatinine levels.[21] The untreated Control group exhibited an increase in CK levels, indicative of muscle damage. However, CK levels did not continue to rise in the groups treated with crush solution and gelsolin. Consequently, the rate of increase in BUN

and creatinine levels, markers of rhabdomyolysis-related renal damage, was slowed. LDH and myoglobin levels, other markers of rhabdomyolysis, showed no significant differences between the groups in our study. This lack of difference may be attributed to the limited frequency of measurements and short-term follow-up in the crush model.

Existing literature provides limited data on gelsolin levels in crush syndrome. A study by Suhler et al. reported a significant attenuation in mean gelsolin concentrations among 12 patients with polymyositis or crush injury-related myonecrosis compared to healthy controls. They also observed an inverse correlation between gelsolin concentration and disease severity.[22] Although the renal effects of gelsolin administration remain unclear, Lee et al. reported a negative correlation between plasma gelsolin (pGSN) levels and 1-year mortality in chronic hemodialysis patients.[10] Building upon this, our main goal was to explore the renoprotective role of exogenous gelsolin application in crush syndrome. However, our study found that adding gelsolin to crush solution did not yield positive results. Nevertheless, we believe that further studies examining different doses and application frequencies could provide valuable insights.

Damaged cell actin filaments are rapidly dispersed and transferred to the bloodstream primarily by gelsolin. Additionally, gelsolin binds to various biomolecules and serves as a mediator in numerous physiological reactions such as angiogenesis, wound healing, cancer progression, and neurological development.[19,23,24] Plasma gelsolin concentration typically decreases following a wide range of traumatic injuries.[25,26] Plasma gelsolin is an extracellular isoform of the gelsolin protein, categorized as a Ca21/phosphatidylinositol 4,5-bisphosphate-regulated actin-binding protein (ABP) expressed in most human cells.[27] Decreases in pGSN levels are well-documented in acute inflammation involving tissue damage.[8,28-30] Furthermore, cytoplasmic pGSN levels decrease in various inflammatory conditions associated with tissue damage and actin release, including hemorrhagic shock,[31] early sepsis, trauma, and rheumatoid arthritis.[32] Decreased plasma gelsolin levels are observed in major trauma, myocardial infarction, sepsis, lung injury, acute liver injury, rheumatoid arthritis, and end-stage renal failure.[9,32,33]

This study has several limitations that warrant acknowledgment. We did not assess whether plasma gelsolin levels were low or high before or during treatment, which could have aided in defining its therapeutic role. Additionally, histopathological and molecular studies were not conducted in our investigation, which focused solely on serum and plasma biomarkers. To our knowledge, this study represents the first attempt in the literature to evaluate the renoprotective effects of gelsolin treatment in a rat model of crush syndrome.

CONCLUSION

In conclusion, this study marks the first investigation in the literature into the impact of administering gelsolin alongside crush fluid in rhabdomyolysis. Our findings revealed no discernible effect from adding gelsolin to the crush solution compared to using the solution alone. It is suggested that future experimental studies explore various doses of gelsolin to further elucidate its potential efficacy.

Ethics Committee Approval: This study was approved by the Konya Training and Research Hospital Ethics Committee (Date: 12.02.2015, Decision No: 97-9).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: D.A., M.G., E.N.Ö.; Design: D.A., M.G., E.N.Ö.; Supervision: D.A., M.G., E.N.Ö.; Resource: D.A.; Materials: D.A.; Data collection and/or processing: D.A.; Analysis and/or interpretation: D.A., M.G., E.N.Ö.; Literature search: D.A.; Writing: D.A.; Critical reviews: D.A., M.G., E.N.Ö.

Conflict of Interest: None declared.

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DENEYSEL ÇALIŞMA - *ÖZ*

Crush sendromunda gelsolin tedavisinin böbrekleri koruyucu rolü var mı?: Deneysel bir çalışma

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AMAÇ: Bu çalışma, crush sendromu sıçan modelinde crush sıvısı resüsitasyonunun gelsolin tedavisi ile kombine edilmesinin böbrek fonksiyonu üzerindeki etkisini araştırmayı amaçlamaktadır.

GEREÇ VE YÖNTEM: Yirmi dört yetişkin dişi Wistar albino sıçanı, crush sendromu için üç tedavi grubundan birine rastgele atandı: Kontrol (C) grubu, gelsolin + crush sıvısı (Gel) grubu ve yalnızca crush sıvısı (CF) grubu ile bir kontrol grubu (n=8). Sedasyon uygulanan sıçanlara, 5 saat süreyle bir kompresyon cihazı kullanılarak 2 kg'lık tek taraflı arka ekstremite kompresyonu uygulandı. Kontrol grubuna kompresyon sonrası herhangi bir tedavi uygulanmadı. Turnike çıkarıldıktan sonra, gelsolin grubundaki sıçanlara 0.1 ml steril salin içerisinde 2 mg/kg dozunda rekombinant insan gelsolin ve crush sıvısı intravenöz olarak uygulandı. CF grubuna yalnızca crush solüsyonu uygulandı.

BULGULAR: 24. saatte CF grubunda CK düzeyleri kontrol ve gelsolin + CF gruplarına göre daha düşüktü (sırasıyla, 132 IU ve 630 IU [p=0.004] ve 519,5 IU [p=0.014]). 48. saatte hem CF hem de CF + gelsolin gruplarında CK düzeyleri kontrol grubuna göre daha düşüktü (sırasıyla, p<0.001 ve p=0.014), CF ve CF + gelsolin grupları arasında anlamlı fark yoktu (p=0.773). 72. saatte CF + gelsolin grubundaki CK düzeyleri kontrol grubuna göre daha düşüktü (p=0.023), ancak CF grubuyla karşılaştırılabilir düzeydeydi (p>0.05). Kontrol ve CF + gelsolin gruplarında 24. ve 72. saatteki BUN düzeyleri benzerdi (p>0.05). 48. saatte hem CF hem de CF + gelsolin gruplarında BUN düzeyleri kontrol grubuna göre daha düşüktü (sırasıyla, p=0.001 ve p=0.003), CF ve CF + gelsolin grupları arasında anlamlı fark yoktu (p>0.05). 24. saatte gelsolin + CF grubunda kreatinin düzeyleri kontrol grubuna göre daha düşüktü (p=0.017). CF ve CF + gelsolin gruplarında ise benzerdi (p>0.05). 48. ve 72. saatlerde kreatinin düzeyleri hem CF hem de CF + gelsolin gruplarında benzer ancak kontrol grubuna göre düşüktü (p<0.05). Kreatinin düzeylerindeki değişiklikler tüm gruplarda benzerdi (p>0.05).

SONUÇ: Bu çalışma, crush sendromunun tedavisinde gelsolinin crush solüsyonu ile birlikte uygulanmasının, tek başına crush solüsyonuna kıyasla üstün sonuçlar vermediğinin gösterildiği literatürdeki ilk örneği oluşturmaktadır. Bununla birlikte, değişen dozlarda gelsolin kullanan daha fazla araştırma yapılması gerekmektedir.

Anahtar sözcükler: Crush sendromu; gelsolin; kreatin kinaz; rabdomiyoliz; wistar sıçan.

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