THE EFFECT OF DIFFERENT INTRAVENOUS CRYSTALLOID SERUM INFUSIONS ON CLINICAL DEHYDRATION PARAMETERS IN ARABIAN HORSES WITH SPASMODIC COLIC

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ABSTRACT

Most cases of colic that develop in horses are defined as simple colic. When these cases are not treated in a timely and effective manner, it can cause dehydration and threaten the horse's life by causing disruptions in the blood circulation. Considering the necessity of applying crystalloid to colic horses to relieve dehydration, it was hypothesized that different fluid-electrolyte treatment may have different clinical effects in simple colic cases. The aim of this study is to compare the effectiveness of intravenous (i.v.) physiological saline (0.9 NaCl), lactated Ringer's and lactated Ringer's + 5% dextrose use in improving clinical dehydration parameters in the acute period in the treatment of horses diagnosed with spasmodic colic. The material of the study consisted of 24 Arabian horses diagnosed with spasmodic colic in Adana, Kocaeli and Kayseri provinces. The horses were divided into three groups with eight horses in each group. In the examination performed to determine clinical dehydration, values between 1 and 3 (1: mild, 2: moderate, 3: severe) were assigned to each parameter according to the severity of the case. As a result of the study, it was determined that the efficacy of the crystalloid serum used in the acute period was similar in eliminating the symptoms of dehydration and providing rehydration. It can be stated that the crystalloid type to be used in the treatment of acute spasmodic colic in horses has similar effects in clinical success and treatment should be started as soon as possible.

Key Words: Horse, Colic, Spasmodic colic, Fluid therapy

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Spazmodik Kolikli Arap Atlarında Damar İçi Farklı Serum Uygulamalarının Klinik Dehidrasyon Parametreleri Üzerine Etkisi

ÖZET

Atlarda gelişen kolik vakalarının çoğu basit kolik olarak tanımlanır. Bu vakalara zamanında ve etkili sağaltım yapılmadığında dehidrasyona sebep olarak kan dolaşımında aksamalara yol açarak atın hayatını tehdit edebilir. Kolikli atlara dehidrasyonu gidermek için kristalloid uygulaması gerektiği dikkate alındığında, basit kolik vakalarında farklı sıvı-elektrolit tedavisinin klinik olarak değişik etkiler gösterebileceği hipoteze edildi. Yapılan bu çalışmanın amacı spazmodik kolik teşhisi konulan atların tedavisinde damar içi (i.v.) fizyolojik tuzlu su (0,9 NaCl), laktatlı ringer ve laktatlı ringer + %5 dekstroz kullanımının akut dönemde klinik dehidrasyon parametrelerini düzeltmedeki etkinliğinin karşılaştırılmasıdır. Çalışmanın materyalini Adana, Kocaeli ve Kayseri illerinde spazmodik kolik teşhisi konan 24 adet Arap atı oluşturdu. Atlar her grupta sekiz at olacak şekilde üç gruba ayrıldı. Klinik dehidrasyonun belirlenmesi amacıyla yapılan muayenede her bir parametreye klinik tabloyu belirtmek için vakanın şiddetine göre 1 ile 3 arasında (1: hafif, 2: orta şiddet, 3: şiddetli) değer verildi. Araştırma sonucunda akut dönemde uygulanan kristalloid serum türünün, dehidrasyon belirtilerinin ortadan kaldırılmasında ve rehidratasyonun sağlanmasında etkinliklerinin benzer olduğu belirlendi. Sonuç olarak atlarda akut spazmodik kolik tedavisinde kullanılacak kristalloid türünün klinik başarıda benzer etkiler gösterdiği ve tedaviye en kısa sürede başlanması gerektiği ifade edilebilir.

Anahtar Kelimeler: At, Kolik, Spazmodik Kolik, Sıvı Tedavisi

INTRODUCTION

It is known that cases of colic are one of the most important causes of death in horses (Turgut and Ok, 1992; van der Linden et al, 2003) and the most common type of colic is spasmodic colic (Bihonegn and Bekele, 2018). Many environmental factors such as intestinal parasites, sudden dietary changes, alterations in training patterns and transport can cause spasmodic colic (White, 2005). Cases with mild symptoms at the beginning can be exacerbated and life-threatening as a result of not being able to provide timely and effective treatment (Scantlebury, 2014; Kaufman et al, 2020).

Fluid therapy is the most important issue along with controlling the pain in colic cases (Fielding, 2015). Some researchers argued that meeting the water needs of the horse is a priority when planning this treatment, and revealing the etiological origin of the colic and considering different treatment options is the next step (Fehr and Southwood, 2013). In cases where dehydration is not corrected, endotoxin accumulation, acid-base balance disorders and ischemic necrosis occur in many tissues with disruption of systemic circulation. Thus, the clinical situation gets worse (Navarro et al, 2005). Based on this idea, it has been reported that it is appropriate to use balanced crystalloid fluids while meeting the horse's fluid requirement and that the intravenous fluid to be administered to an adult horse should be at least 10 liters in total (Fielding, 2015). After starting fluid therapy, the patient should be constantly monitored in terms of vital parameters and the treatment should be discontinued when physiological values are achieved. In field conditions where laboratory measurements are not possible, there are some parameters used to evaluate the dehydration caused by colic, to define the severity of the case and to monitor the response to treatment. These can be listed as heart rate (HR), skin turgor (ST), capillary refill time (CRF), mucous membrane color (MM), negative venous stasis (NVS), and gastrointestinal sounds (GS) (Er, 2020). The severity of deviation from the physiological value in these parameters is directly proportional to the severity of colic and dehydration.

Although crystalloid applications are recommended in the treatment of colic in horses (Er, 2020), there is no information about the clinical success of different crystalloids. In this study, it was hypothesized that different crystalloids used in the treatment of colic cases (physiological saline (0.9 NaCl), lactated Ringer's, lactated Ringer's + 5% dextrose) may have different effects on vital and physiological parameters in patients.

The aim of the study is to compare the effects of different isotonic crystalloid (physiological saline (0.9 NaCl), lactated Ringer's, lactated Ringer's + 5% dextrose) use on clinical dehydration parameters (HR, ST, CRF, MM, NVS, GS) in the early period of spasmodic colic, which is one of the most common causes of colic in horses, regardless of the metabolic picture.

MATERIALS AND METHODS

The material of the study consisted of 24 Arabian horse in both sexes (stallions, mares and geldings) (7-14 years) diagnosed with spasmodic colic. All horses were endurance horses and stationed in Turkish Equestrian Federation accredited farms in Adana, Kayseri and Kocaeli provinces. All clinical examinations were carried out post-training or post-race period, under

the permission and supervision of the horse owners. In the clinical examination, HR, ST, CRF, MM, NVS and GS parameters were evaluated for the definition and classification of dehydration and were observed during the treatment. Physiological values of clinical parameters and the grading of dehydration severity due to changes in these values are presented in Table 1.

Table 1. Grading of clinical parameters according to severity of dehydration.

	DD	HR (bpm)	ST	CRF	MM	NVS	GS (1 min.)
Physiological	0	24-40	1 sec	2 sec	Moist pink	2 sec	3
Mild dehydration	1	40-60	2 sec	<2 sec	Reddened or Pale,	3 sec	2
Medium dehydration	2	60-80	3 sec	3 sec	Pale, anemic and dry	4 sec	1
Severe dehydration	3	>80	>3 sec	>3 sec	Cyanotic	>4 sec	0

DD: degree of dehydration. bpm: beat per minute, HR; heart beat rate, ST; skin turgor, CRF; capillary refill time, MM; mucous membranes, NVS; negative venous stasis, GS; gut sounds.

Invasive treatment was initiated by randomly selecting colic horses with dehydration in one of three different treatment groups. Each group consisted of 8 horses. In forming the treatment groups, physiological saline (0.9% NaCl) (Group 1), lactated Ringer's (Group 2) and lactated Ringer's + 5% dextrose (1/1) (Group 3) solutions were preferred. Vascular access was established for each horse who was treated via 12 and 14gauge teflon catheters through the vena jugularis in accordance with the rules of asepsis - antisepsis, and was fixed during fluid therapy. An initial infusion of 10 liters of intravenous fluid was given to each horse. Fluid therapy was continued in the horses whose clinical parameters did not reach physiological values and did not fully recover after the first infusion. During the fluid therapy, painkillers, antispasmodic drugs and vitamin-mineral applications were not applied to the horses. With the clinical parameters reaching physiological values, fluid therapy and the study was terminated. Other necessary drug treatments were made after that. Horses showed severe pain symptoms at the examination and during treatment were excluded from the study and included in colic treatment, including pain control.

STATISTICAL ANALYSIS

The parameters obtained from this study were analyzed with nonparametric Kruskal-Wallis test to evaluate the differences amongst the groups (IBM SPSS 22.0 statistics program). $p < 0.05$ level was accepted as statistically significance level.

RESULTS

After the treatment, dehydration parameters disappeared completely and physiological values were reached in all horses that were treated. The degree of dehydration before treatment and the findings for each group are presented in Tables 2, 3 and 4.

Table 2. Clinical grading of the physiological saline (0.9% NaCl) group (group 1) and the amount of fluid used.

Variable	PS 1	PS 2	PS 3	PS 4	PS 5	PS 6	PS 7	PS 8
HR	1	1	2	1	1	1	2	2
ST	2	1	2	1	2	1	2	2
CRF	2	2	2	1	2	1	2	2
MM	2	1	2	2	1	1	2	2
NVS	2	2	3	1	1	1	3	2
GS	1	1	2	1	1	1	2	1
TAF	15	10	24	10	10	10	33	21

TAF: Total amount of intravenous fluid infused during treatment (liter). DD: degree of dehydration. bpm: beat per minute, HR; heart beat rate, ST; skin turgor, CRF; capillary refill time, MM; mucous membranes, NVS; negative venous stasis, GS; gut sounds.

Table 3. Clinical grading of the lactated Ringer's group (group 2) and the amount of serum used

Variable	Lac 1	Lac 2	Lac 3	Lac 4	Lac 5	Lac 6	Lac 7	Lac 8
HR	1	1	1	2	2	2	1	1
ST	2	1	1	2	2	1	2	1
CRF	2	1	2	2	2	2	2	2
MM	1	1	2	2	2	2	2	1
NVS	1	1	2	2	1	3	2	1
GS	1	1	2	1	1	2	2	2
TAF	10	10	24	20	24	24	10	10

TAF: Total amount of intravenous fluid infused during treatment (liter). DD: degree of dehydration. bpm: beat per minute, HR; heart beat rate, ST; skin turgor, CRF; capillary refill time, MM; mucous membranes, NVS; negative venous stasis, GS; gut sounds.

Table 4. Clinical grading of lactated Ringer's + 5% dextrose group (group 3) and the amount of fluid used.

Variable	LD 1	LD 2	LD 3	LD 4	LD 5	LD 6	LD 7	LD 8
HR	2	2	2	3	2	2	1	1
ST	2	2	3	3	2	2	1	2
CRF	2	2	2	2	2	2	1	2
MM	1	2	2	2	2	1	1	1
NVS	2	2	3	3	2	1	1	1
GS	2	3	2	3	3	2	2	3
TAF	10	16	24	34	20	10	10	18

TAF: Total amount of intravenous fluid infused during treatment (liter). DD: degree of dehydration. bpm: beat per minute, HR; heart beat rate, ST; skin turgor, CRF; capillary refill time, MM; mucous membranes, NVS; negative venous stasis, GS; gut sounds.

Clinical improvement seen in patients after treatment was evaluated using the non-parametric Kruskal-Wallis test (IBM SPSS 22.0 statistical program) and the results are presented in Table 5.

Table 5. The effects of physiological saline (0.9% NaCl), lactated Ringer's and lactated Ringer's + 5% dextrose on clinical ratings (median, min-max).

	Group 1	Group 2	Group 3	P value*

Parameter	(0.9% NaCl)	(Lactated Ringer's)	(Lactated Ringer's + 5% dextrose)	
HR	1 (min:1-max:2)	1(min:1-max:2)	2(min:1 – max:3)	>0.05
ST	2 (min:1-max: 2)	1.5(min: 1-max:2)	2 (min: 1-max:2)	>0.05
CRF	2 (min:1-max: 2)	2 (min: 1-max:2)	2 (min:1 – max:3)	>0.05
MM	2 (min:1-max: 2)	2 (min: 1-max:2)	1.5 (min: 1-max:2)	>0.05
NVS	2 (min:1-max: 3)	1.5 (min: 1-max:3)	2 (min:1 – max:3)	>0.05
GS	1 (min:1-max: 2)	1.5 (min: 1-max:2)	2.5 (min:2 – max:3)	>0.05

DD: degree of dehydration. bpm: beat per minute, HR; heart beat rate, ST; skin turgor, CRF; capillary refill time, MM; mucous membranes, NVS; negative venous stasis, GS; gut sounds. *There is no statistical difference between the values in the same row.

According to the results of the analysis, no significant difference was determined within and between groups ($p>0.05$). It was concluded that the fluids applied in the three groups were equally effective in eliminating the clinical parameters of dehydration.

DISCUSSION

With the progression of simple colic cases that are delayed in treatment, the severity of dehydration increases and many metabolic problems that can threaten the horse's life may occur. For this reason, many researchers reported that correction of dehydration is a top priority in the acute phase of colic cases. (White, 2009; Chrsitophersen et al, 2014; Desrochers and White, 2017). The data obtained as a result of this study (Table 5) confirms the conclusion that when starting fluid therapy in colic horses, the need for fluid should be met first, and it overlaps with previous studies (White, 2009; Chrsitophersen et al, 2014; Desrochers and White, 2017). At the same time, it supports the view that in field conditions where electrolyte balance cannot be established and emergency intervention is required the use of 0.9% NaCl, lactated Ringer's and 5% dextrose solutions can provide effective rehydration and prevent exacerbation of the case, as some researchers have argued before (Fielding, 2018). Researchers reported that the gastrointestinal system needs a large amount of fluid to maintain its normal function, so fluid therapy should be applied even if there are no signs of dehydration in horses with colic, and this fluid should be at least 20 ml per kilogram of body weight. (Fielding, 2015; Freeman and Curtis, 2015; Fielding, 2018; Freeman, 2018). In this study, at least 10 liters of fluid was infused, assuming that horses weigh an average of 500 kg (Table 2, Table 3, Table 4). The results obtained confirmed that the administration of at least 10 liters of fluid was also beneficial, and clinical improvement was seen after this amount. This finding is in line with previous researches. (Table 5).

CONCLUSION

All this information has shown that in horses with colic, it is vital to start fluid therapy as soon as possible regardless of the severity of the colic, and to administer at least 10 liters of intravenous fluid to each horse regardless of the severity of colic and dehydration. In eliminating clinical dehydration, 0.9% NaCl, lactated Ringer's alone and lactated Ringer's + 5% dextrose, which are widely used in the field, were equally effective. This supports the view that choosing fluid therapy from isotonic crystalloid liquids is the most reliable way in field conditions where laboratory facilities are not available (Fielding, 2018). Although painkillers, antispasmodic and homeopathic medications were not applied to horses during the treatment, pain symptoms disappeared after fluid therapy. This situation can be suggested as a new research topic in terms of the pain relief effects of fluid therapy in the future studies.

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