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ORIGINAL ARTICLE

A Retrospective Evaluation of Intravenous Fluid Usage in Animal Patients Treated at Veterinary Teaching Hospital Nsukka, 2005-2015

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SUMMARY

This study evaluated intravenous fluid usage in patients presented for treatment at the Veterinary Teaching Hospital, Nsukka between January 2005 and June 2015. A total of 1854 (1743 medical and 111 surgical) case files were studied. Results showed that of this number, 89 patients received intravenous fluid during treatment. Out of the 89 patients, 86 patients were treated for medical conditions while 3 patients underwent surgery. Out of the medical cases given fluid, 30 were diarrheic, 10 were vomiting while 8 were diarrheic and vomiting. Anorexia, lethargy, salivation, cornea opacity, haematuria and convulsion were observed in 20, 8, 2, 4, 1 and 3 of the patients respectively. Vulval discharge was noted in 1 surgical case while 2 patients had skin wound. The proportion of cases presented with indication for fluid therapy varied significantly ($P<0.05$) between the species studied. The proportion of medical (4.90%) and surgical (2.70%) cases given fluid were not significantly different ($P>0.05$). The proportion varied insignificantly ($P>0.05$) between male (2.10%) and female (2.69%) animals and also between young (3.07%) and older (1.73%) animals. Dextrose saline was used in majority of the patients (63 out of 89). Other fluid used were 50% dextrose (n=10), 5% dextrose (n=5), lactated ringers (n=5), isoplasma (n=3), darrows solution (n=2) and 10% dextrose (n=1). In conclusion, this study revealed that indication for IV fluid usage in VTH, Nsukka was strongly associated with the species and health status of the animals. Also, some choices of intravenous fluid made were not based on the presenting clinical, but on the judgment of the clinician.

Key words: Intravenous fluid, Usage, Animal Patients, Retrospective study.

INTRODUCTION

When primitive marine unicellular organisms evolved into multicellular organisms, and emerged onto land, they faced several physiologic challenges including the maintenance of water and salt balance in an environment low in both

(Lobo *et al*., 2013). These animals, rather than being surrounded by an external sea, they carried with them their own internal sea or extracellular fluid (ECF), in which their cells could bathe in a constant chemical environment, which the great French physiologist, Claude Bernard called the 'milieu interieur' (Lobo *et al*., 2013; Wingfield, 2013). Therefore, the cells of an animal body are suspended in a sea of fluid composed principally of water and solutes such as electrolytes, proteins and minerals (Wingfield, 2013; Savigny, 2014). The body fluid serves as a depot for the nutrients on which the survivability of the cells is dependent. According to Kirby and Rudloff (2006) and Savigny (2014), this fluid is dispersed between the extracellular (interstitial and intravascular) and intracellular compartments. In the extracellular compartment, exchange of water takes place across cell membranes due to osmotic difference between the extracellular compartments (Woo *et al*., 2007). The fluid in both extracellular and intracellular compartments is maintained in equilibrium (homeostasis) such that there is a constant movement and composition of fluid in both compartments (Edwards and Mythen, 2014). The rate and volume of fluid distribution within these compartments depend on membrane permeability, capillary dynamics (Starling's law) and osmotic forces (Kirby and Rudloff, 2006).

Body fluid equilibrates between the two compartments by diffusion or specifically, osmosis especially for water and by membranes pumps for electrolytes (Rassam and Counsell, 2005). Diffusion occurs by one of several mechanisms either directly through the lipid bilayer of the cell membrane, through protein channels within the cell membrane or by reversible binding to a carrier protein that can traverse the membrane (Rassam and Counsell, 2005).

Disturbances of the body fluid homeostasis occurs as in major surgery, sepsis and trauma will have adverse effects on the structural integrity and functionality of the cells and invariably the organs, producing symptomatic effects depending on the degree (Edwards and Mythen, 2014). These symptomatic effects provide the basis for intravenous fluid administration either for resuscitation, rehydration or maintenance (Savigny, 2014). Fluid therapy is indicated in animals to replace fluid deficits (dehydration), meet maintenance in anorexic patients, replace ongoing losses, fluid diueresis to eliminate toxins, for anaesthetic and surgical support, and replacement of specific components (Wingfield, 2013).

Fluids are increasingly being seen as drugs with specific indication, contraindication and dose ranges (Davis *et al*., 2013). Fluid selection is, therefore, dictated by the patient's need, including volumes, rate, and fluid composition. Hence, fluid therapy must be individualized and tailored to each patient and constantly re-evaluated and reformulated according to changes in patients' health status. Fluid administration may increase the survival rate of patient that underwent the treatment. In routine veterinary practice, fluids may be administered to patients without proper evaluation of the hydration status of the animal. Also, volume of fluid administered is mostly dependent on the judgment of the clinician and not on the basis of calculated fluid deficit. In addition, most often, selection of intravenous fluid to be administered may not be based on the presented clinical condition rather it may depend on the availability of the fluid. These factors have often times led to non-responsiveness of critically ill patient to the fluids administered.

This present study was designed to evaluate the rate, choice and factors that dictate the use of intravenous fluids in patients presented at the Veterinary Teaching Hospital (VTH), Nsukka from January, 2005 to June, 2015.

MATERIALS AND METHODS

This research was a retrospective study of case files of patients presented and treated at the Veterinary Teaching Hospital (VTH), University of Nigeria (UNN) between January, 2005 and June, 2015. During this period, a total of 2043 animals comprising of canine, feline, ovine, caprine, and bovine species were treated. Of this number, a total of 1854 case files were studied while the remaining 189 case files were excluded from the study due to incomplete patient profile. For each case file, data on the age, sex, species, type of case and treatment were collected as follows:

Age

The patients were separated into two age groups; the young (≤ 1 year old) and the adult (> 1year old). The total number of each age group was noted. Also, the proportions of each group that received intravenous fluid were calculated.

Sex

The patients were separated into male and female with the total number of each sex noted. The proportion of male and female patients given intravenous fluid were calculated.

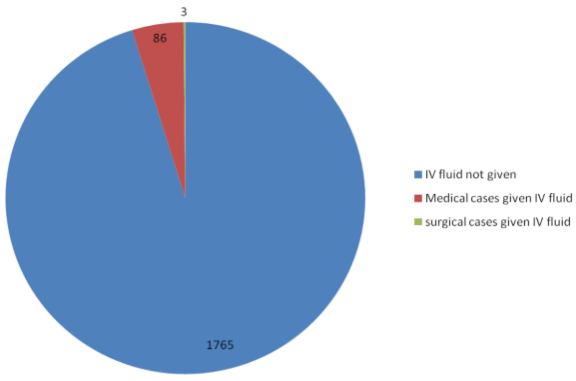

Figure I: Distribution of cases presented to VTH, Nsukka (Jan. 2005-June, 2015)

Species

The patient species considered include canine, feline, bovine, ovine, and caprine with the total number of each species noted. The proportions of each species given intravenous fluid were calculated.

Type of Cases

Patients were separated into two categories viz; surgical and medical cases, based on the treatment needed. In each category, the clinical manifestation of disease such as diarrheoa, anorexia, emaciation, dehydration, vomiting, salivation, etc were noted. The total number of patients showing these clinical signs were calculated and recorded. The proportions of both surgical and medical cases given intravenous fluid were calculated.

Treatment

Those patients given fluid therapy were selected and counted, taking note of the type and volume of intravenous fluid administered. Other medications given to those treated with intravenous fluid were recorded as in the case file. Noted also was the outcome of the treatment, whether the patient survived or not, as recorded in the patient's file. The outcome of the fluid administration was also evaluated on basis of laboratory findings.

Data Analysis: Out of the total population studied, percentages of case type (medical, surgical), age (< 1 year, > I year), sex (male, female) and species (canine, feline, ovine, caprine, bovine) given fluid were calculated. The association between type of case, age, sex and species and the rate of their being given IV fluid was analysed using Chi square. Probability less than 0.05 was considered significant.

RESULTS

A total of 1854 (1743 medical and 111 surgical) case files were studied. Of this number, 89 patients received intravenous fluid during treatment. (Figure 1).The study showed that of the 89 patients given fluid, 86 patients were treated for medical conditions while 3 patients underwent surgery (Fig. 1). Out of the presented medical cases given fluid, 30 patients were diarrheic, 10 patients were vomiting, and 8 patients were diarrheic and vomiting. Anorexia, lethargy, salivation, cornea opacity, haematuria and convulsion were observed in 20, 8, 2, 4, 1 and 3 patients respectively (Table 1). Dystocia and vulval discharge were noted in 1 surgical case while 2 patients had skin wound (Table 1).

The mean percentages of medical cases (4.64%) was significantly ($P< 0.05$) higher than the mean percentage number (0.16%) of surgical cases (Table 2). There was no significant difference between the proportion of medical and surgical cases given intravenous fluid ($P>0.05$)

The number of male and female patients presented within this period, for treatment were 770 and 1084 respectively (Table 3). The number (percentage) of male patients with indication for fluid therapy was 39 (2.10%). The number (percentage) of female patients presented with indication for fluid therapy was 50 (2.69%). There was no significant association ($P>0.05$) between the sex of animal patients and their being given intravenous fluid (Table 3).

In this study period the number of young (≤ 1 year) and older (> 1 year) animals presented for treatment was 1127 and 727 respectively. Of this number, the number (percentage) of young animals (≤ 1 year) which received intravenous fluid during treatment was 57 (03.07%). Also, the number (percentage) of older animals given intravenous fluid was 32 (1.73%). There was no significant association ($P>0.05$) between the age of the patients and their being given intravenous fluid (Table 4).

On the basis of species studied, canine was 1494 in number. Other species treated were feline, ovine, caprine, and bovine which numbered 13, 63, 283, and 1 respectively. The number (percentage) of canine, feline, caprine, and bovine species which received intravenous fluid were 78 (4.20%), 2

Table 1: Presented clinical signs of medical and surgical cases given IV fluid in VTH, Nsukka (Jan.2005-June 2015)

Presented clinical signs	Number of cases	Percentage
Medical cases		
Diarrhoea	30	33.71
Vomitting	10	11.24
Diarrhea and vomitting	8	8.99
Anorexia	20	22.47
Lethargy	8	8.99
Salivation	2	2.25
Cornea opacity	4	4.49
Haematuria	1	1.12
Convulsion	3	3.37
Surgical cases		
Dystocia and vulval discharge	1	1.12
Skin wound	2	2.25
Total cases	89	100

Table 2: Distribution of medical and surgical cases presented for treatment and those given intravenous fluid

Year	Number of cases studied	Medical cases studied	Surgical cases studied	Medical cases given fluid	Surgical cases given fluid	Percentage medical cases given fluid	Percentage surgical cases given fluid
2005	183	163	20	19	1	1.02	0.05
2006	115	102	13	8	0	0.43	0
2007	147	136	11	11	0	0.59	0
2008	83	78	5	9	1	0.49	0.05
2009	98	94	4	11	1	0.59	0.05
2010	187	169	18	4	0	0.22	0
2011	167	157	10	3	0	0.16	0
2012	227	219	8	5	0	0.27	0
2013	268	257	11	2	0	0.11	0
2014	237	231	6	5	0	0.27	0
2015	142	137	5	9	0	0.49	0
Total	1854	1743	111	86	3	4.64	0.15

Table 3: Sex distribution of patients presented for treatment and those given intravenous fluid

Year	Number of cases studied	Male animals studied	Female animals studied	Male animals given fluid	Female animals given fluid	Percentage male given fluid	Percentage female given fluid
2005	183	72	111	3	2	0.16	0.11
2006	115	42	73	0	3	0	0.16
2007	147	63	84	2	2	0.11	0.11
2008	83	36	47	2	2	0.11	0.11
2009	98	48	50	2	2	0.11	0.11
2010	187	93	94	8	3	0.43	0.16
2011	167	71	96	7	8	0.38	0.43
2012	227	80	147	5	8	0.27	0.43
2013	268	105	163	3	9	0.16	0.49
2014	237	100	137	4	5	0.22	0.27
2015	142	60	82	3	6	0.16	0.32
Total	1854	770	1084	39	50	2.11	2.7
Mean						0.192	0.246

(0.10%), 8 (0.43%) and 1 (0.05%). No ovine species treated received intravenous fluid. There was a significant ($P< 0.05$) difference between the rate of use of intravenous fluids between the species (Table 5).

As shown in Table 6, the study of the fluid usage showed that dextrose saline was used in the majority of the patients (60 medical and 3 surgical patients). Of the 60 medical patients, 30 patients were diarrheic while 19 patients were anorexic. Other medical patients which received dextrose saline presented signs of vomiting (n=5), diarrhea and vomiting (n=8), lethargy (n=2), salivation (n=2) cornea opacity (n=3), haematuria (n=1) and convulsion (n=1).

Also as shown in Table 6, other fluid used were 50% dextrose (n=10), 5% dextrose (n=5), lactated ringers (n=5), isoplasma (n=3), darrows solution (n=2) and 10% dextrose (n=1).

DISCUSSION

The outcome of this study showed that the percentage of patients presented on the study period treated for medical conditions was more than that of those treated for surgical conditions. This finding is in tandem with the result of a retrospective study of clinical cases presented at Veterinary Hospital in Sudan (Abusara and Abdelgadir, 2014). The findings that intravenous (IV) fluid was administered to a higher proportion of medical cases (86 out of 1854) compared to surgical cases might imply that the health status of the former patients category

Table 4: Age distribution of patients presented for treatment and those given intravenous fluid

Year	Number of cases studied	Young animals (≤ 1 year)	Older animals (>1year)	Young animals given fluid	Older animals given fluid	Percentage young animals given fluid	Percentage older animals given fluid
2005	187	95	88	1	4	0.05	0.22
2006	115	54	61	1	2	0.05	0.11
2007	147	83	64	2	2	0.11	0.11
2008	83	51	32	4	0	0.22	0
2009	98	55	43	3	1	0.16	0.05
2010	187	102	85	5	6	0.27	0.32
2011	167	100	67	9	6	0.49	0.32
2012	227	160	67	10	3	0.54	0.16
2013	268	180	88	10	2	0.54	0.11
2014	237	145	92	5	4	0.27	0.22
2015	142	102	40	7	2	0.38	0.11
Total	1854	1127	727	57	32	3.08	1.73
Mean						0.28	0.157

Table 5: Species distribution of patients presented for treatment and those given intravenous fluid

Year	Number of cases	Total number of species studied					Number(%) given fluid				
		Canine	Feline	Ovine	Caprine	Bovine	Canine	Feline	Ovine	Caprine	Bovine
2005	183	133	1	5	43	1	3(0.16)	0(0)	0(0)	0(0)	1(0.05)
2006	115	78	0	3	34	0	2(0.11)	0(0)	0(0)	1(0.05)	0(0)
2007	147	112	0	3	32	0	4(0.22)	0(0)	0(0)	0(0)	0(0)
2008	83	67	0	2	14	0	4(0.22)	0(0)	0(0)	0(0)	0(0)
2009	98	68	1	5	24	0	3(0.16)	0(0)	0(0)	1(0.05)	0(0)
2010	187	142	1	6	38	0	9(0.49)	1(0.05)	0(0)	1(0.05)	0(0)
2011	167	138	0	7	22	0	13(0.70)	0(0)	0(0)	2(0.11)	0(0)
2015	227	189	3	9	26	0	13(0.70)	0(0)	0(0)	0(0)	0(0)
2013	268	241	0	13	14	0	11(0.59)	0(0)	0(0)	1(0.05)	0(0)
2014	237	195	3	10	29	0	7(0.38)	1(0.05)	0(0)	2(0.11)	0(0)
2015	142	131	4	0	7	0	9(0.49)	0(0)	0(0)	0(0)	0(0)
Total	1854	1494	13	63	283	1	78(4.22)	2(0.1)	0(0)	8(0.42)	1(0.05)
Mean							0.384	0.055	0.0	0.038	0.005

Table 6: Fluids used in the management of medical and surgical cases presented to VTH, Nsukka

Presented clinical signs	Number of cases	10% dextrose	50% dextrose	5% dextrose	Dextrose saline	Lactated ringers	Isoplasma	Darrows
Medical cases								
Diarrhoea	30	0	7	3	14	4	2	0
Vomitting	10	0	1	2	5	1	1	0
Diarrhoea and vomiting	8	0	0	0	8	0	0	0
Anorexia	20	0	0	0	19	0	0	1
Lethargy	8	0	0	0	7	0	0	1
Salivation	2	0	0	0	2	0	0	0
Cornea opacity	4	1	0	0	3	0	0	0
Haematuria	1	0	0	0	1	0	0	0
Convulsion	3	0	2	0	1	0	0	0
Surgical cases	1	0	0	0	1	0	0	0
Dystocia and vulval discharge								
Skin wound	2	0	0	0	2	0	0	0
Total cases	89	1	10	5	63	5	3	2

(medical cases) at presentation was more debilitating compared to that of the latter category (surgical cases). This might have necessitated fluid administration during treatment to enable faster recovery of these patients. According to Wingfield (2013), fluid therapy is indicated in animals to replace fluid deficit (dehydration), meet maintenance in anorexic patients, replace ongoing losses, and for surgical support. The finding that less number of surgical cases (3 out of 1854) received IV fluid during treatment is in line with best practices. Earlier, Shires *et al*. (1961) postulated a decrease in extracellular fluid volume after surgery due to internal redistribution of fluids (third space losses) and advocated replacement of these losses by additional fluid infusion. Clinical practices have been largely influenced by these recommendations, thus leading to large amounts of fluid being administered to elective surgical procedures. However, a recent study showed that IV fluid usage in the preoperative period lead to postoperative weight gain, poor survival as well as fluid overload (Brandstrup *et al*., 2003). This finding advocates caution in use of IV fluid in surgical patients. Thus, our finding suggests that most patients that underwent surgery did not have a need for IV fluid administration. However, patients presented during dystocia and following extensive wounding, were given fluid since both conditions caused massive fluid loss.

Fluids are increasingly being used as drug with specific indication, contraindication and dose ranges (Davis *et al*., 2013). Fluids used in clinical practice are usefully classified as crystalloid, colloid and blood

products (Woo *et al*., 2007). Crystalloids such as dextrose saline, 5% dextrose, 10% dextrose, 50% dextrose, lactated ringers and Darrow's solution are similar to plasma water in composition (Savigny, 2014). These fluids are thus, often used in dehydrated patients with history of diarrhea, vomiting, and vomiting/diarrhea to correct fluid deficit. According to Davis *et al*. (2013), fluid selection in these patients should be dictated by the patient's need, and must be individualized and tailored to each patient. However, the finding of this study on fluid usage contravened this suggestion since fluid choices were in some cases not appropriately made. For example, this study showed that some diarrheic animals (14 out of 30), those showing signs of diarrhea and vomiting (8 out of 8), and vomiting patients (5 out of 10) received IV infusion of dextrose saline. According to Wingfield (2013), dextrose saline should be used in patients with anorexia and hypoglycemia. The fluids of choice for vomiting patients are normal saline and Ringer's solution while diarrheic patients require lactated Ringers (Hartman's solution) and Darrow's solution (Wingfield, 2013).

The number of canine presented for treatment and given IV fluid was noted to be significantly higher than the number of other species presented for treatment. Earlier, Rainger and Dart (2006) documented that animal species dictate need for fluid therapy. The reason for this statement was not proffered by these authors. However, we suggest that while other species (ovine, caprine and bovine) which are food animals are kept in our locality by low income household. These animals are not usually presented for treatment when severely ill instead they are sold off for slaughter. Canines and felines are however mostly used as pet and are well cared for, thus are brought to hospital for immediate medical care when they are seriously sick.

Total body water is consistently 60% of the lean body weight varying across age and sex ranges (Rassam and Counsell, 2005). Total body water is approximately 75%, 70%, and 45% of the total body weight in neonates, infants and elderly respectively (Rassam and Counsell, 2005). The body water content of an average adult male and adult female are 60% and 55% of the total body weight. Thus, the finding that more females received fluid compared to males is in accordance with this earlier documentation. This suggests that female animals are more prone to dehydration since the fluid content of their body is lesser than that of males. Also, contrary to this earlier documentation, instead of the older animals, more young animals received fluid. The reason for this is not clear since young animals are expected to have more fluid volume than older animals. It is thought that these young animals due to their immature state might have been overwhelmed by disease states compared to the older animals.

CONCLUSION

This study established that in Verinary Teaching Hospital, Nsukka, indication for intravenous fluid therapy was strongly associated with species with canine ranking highest and ovine ranking lowest. Also, some choices of intravenous fluid made were not based on the presenting clinical, but on the judgment of the clinician.

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