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ACUTE KIDNEY INJURY IN A DOG DIAGNOSED WITH LEISHMANIASIS: CASE REPORT

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Abstract

A 3 years old, 40.8 kg, intact male American Bully, diagnosed with acute kidney injury in a private clinic in Serbia was referred for hemodialysis therapy. The dog was presented with the following symptoms: lethargy, appetite loss, vomiting, diarrhea, weight loss, dehydration (8-10%, Considerable loss of skin turgor), rectal temperature of 38.8ºC and dry mucous membranes. Arterial blood pressure was elevated 218-220 mmHg systolic, using Doppler method. The biochemistry revealed elevated ALT 191 (RR: 10-118 U/L), AMY 1390 (RR: 200-1200 U/L), BUN 94 (RR: 7-25 mg/dL), CREA 3.6 (RR: 0.4-1.2 mg/dL), PHOS 9.8 (RR: 2.9-6.6 mg/dL), GLU 121 (RR: 60-110 mg/dL), K 3.3 (RR: 3.4-5.6 mmol/L). Urine analysis was performed with UPC 0.2-0.5 (borderline proteinuric), pH 5.5, microalbumin >25 mg/L, creatinine >26.4 mmol/L. The infestation with Leishmania infantum was confirmed using quantitative PCR. The patient was stabilized using fluid therapy and parenteral feeding. Hemodialysis was decided as an extracorporeal replacement therapy for sustaining renal function. A central venous catheter was placed under a light sedation with oxygen therapy. Hemodialysis was performed for three times in a period of 11 days.

A key treatment for acute kidney injury in canine patients is represented by intensive care, fluid therapy and hemodialysis therefore, the values were reduced in BUN from 94 mg/dL to 30 mg/dL and CRE from 3.6 mg/dL to 1.8 mg/dL. The BUN and CREA reached normal values 39 days after that the patient was discharged.

Key words: hemodialysis, canine, Leishmania, BUN, CREA

Leishmania is a genus of parasitic protozoa (family *Trypanosomatidae*) that has significant attention in the field of infectious diseases, particularly due to its complex life cycle and diverse clinical manifestations. This intracellular parasite is responsible for causing a group of diseases konwn as leishmaniasis. *Leishmania infantum* has a biphasic life cycle, alternating between two main forms – visceral and cutaneous.

Transmission to mammalian hosts primarily occur through the bite of infected sandflies, which convey the promastigotes into the host's bloodstream. These promastigotes are subsequently phagocytosed by macrophages, converting into the amastigote form and establishing infection. [Gharbi M. *et al*, 2015]

Visceral leishmaniasis caused by *Leishmania infantum* is characterized by a wide spectrum of symptoms, often manifesting as prolonged fever, splenomegaly, hepatomegaly, anemia, glomerulonephritis, interstitial nephritis, amyloidosis, weight loss and compromised immune function.

Leishmaniasis is a serious medical condition that affects the body through acute complications to the renal and hepatic function. Left untreated, leishmaniasis can be fatal, making early diagnosis and treatment, crucial for the patient with acute kidney injury. [Mann S. *et al*, 2021]

Hemodialysis is a therapeutic procedure that uses the extracorporeal circulation of a patient's blood to improve azotemia, fluid overload, electrolyte and acid-base abnormalities characteristic of the uremic syndrome. Hemodialysis is used for the management of acute and chronic renal injury that is refractory to

conventional medical therapy. Additional applications include acute intoxications (e.g. ethylene glycol poisoning) and preoperative conditioning of renal transplant recipients. [Ștefănescu, A. *el al*, 2017, 2018]

Hemodialysis is a special procedure that requires an extensive array of sophisticated delivery equipment and specifically trained and dedicated staff to perform, monitor and ensure the integrity and safety of the procedure in critically ill patients. [Elliott D.A., 2000]

For the moment, there are two types of hemodialysis: intermittent and continuous hemodialysis. Intermittent hemodialysis (IHD) is a renal replacement therapy that is defined by short and efficient hemodialysis sessions with the goal of removing endogenous or exogenous toxins from the bloodstream. IHD is indicated in cases of acute azotemia, electrolyte abnormalities or acidosis unresponsive to medical management. When patients undergo IHD, their blood is removed from their bodies and run through an extracorporeal circuit. The slow and gradual nature of the technique provides better control of electrolytes and acid-base balance. [Bellomo R. *et al*, 1995]

The goal of IHD is to make big changes in a patient's uremia, acid-base and fluid status over short periods using diffusion.

The continuous operation more closely approximates the functioning of a normal kidney. [Clark W.R. *et al*, 1994]. Continuous renal replacement therapy (CRRT) is a continuous process and once it begins, therapy continues until renal function is restored or the patient is transitioned to intermittent dialysis. The most common indication for CRRT is the treatment of acute kidney injury (AKI) in which renal function is expected to return in the near future or for patients who are to be transitioned to IHD.

Vascular access is the first and the most basic requirement of successful extracorporeal renal replacement therapy (ERRT). An adequately functioning dialysis catheter allows for smooth and efficient patient management. Various materials can be used to make a catheter that is minimally thrombogenic, flexible, and non-irritating to the vessel wall. [Chalhoub S. *et al*, 2011]

IHD is designed as a more efficient modality than continuous renal replacement therapy (CRRT), meaning that IHD sessions remove small dialyzable molecules (blood urea nitrogen [BUN], creatinine, phosphorus, electrolytes, and certain drugs and toxins) from the bloodstream more rapidly than CRRT. [Bloom C.A. *et al*, 2011]

MATERIAL AND METHOD

A 3 years old, 40.8 Kg, intact male American Bully, diagnosed with acute kidney injury was referred to a private clinic for hemodialysis therapy on June the 4th, 2023. The dog was presented with the following symptoms: lethargy, appetite loss, vomiting, diarrhea, weight loss, dehydration (8-10%, considerable loss of skin turgor), rectal temperature of 38.8^{o}C and dry mucous membranes. Results from a complete blood cell count (CBC), biochemistry, and urine analysis submitted at that time were abnormal.

Abdominal ultrasound showed mild modification in kidneys, a regular shape, altered corticomedullary ratio, slightly hyperechogenic appearance, renal pyramids highlighted with no microlithiasis or dilatation of the renal pelvis. The immunofluorescence antibody test (IFAT) was performed for detection of anti-Leishmania antibodies (*figure1*). [Proverbio D. *et al*, 2014]

Hemodialysis, hydro-electrolytic rebalancing and partial parenteral nutrition were the main goals of the complex therapy. Rehydration was established by fluid therapy with Ringer continous rate of infusion (CRI), (rate and dosage: 7 ml/kg/h) for rebalancing and partial parenteral micronutrition based on levo-microamino acids (rate and dosage: 6 ml/kg/24 h). Enteric dialysis supplements, calcium based phosphorus binders, renal diet and nutritional supplements were introduced as adjuvants in the therapy for supporting kidney functions. Telmisartan was used in the treatment of hypertension.

After 24 hours biochemistry showed the following results: BUN 88 mg/dL, CREA 3.6 mg/dL and PHOS 3.6 md/dL.

Hemodialysis was decided in order to improve and support renal function. A central venous *Joline High Flow Double Lumen ST 13 Fr* catheter was placed under a light sedation with alfaxalone (dosage: 3mg/kg) which was administered intramuscularly and butorphanol (dosage: 0.3 mg/kg) administered intravenously. Intermittent hemodialysis was performed with an A/V set and a high flow dialyzer with a surface of 1.5 m^2. The volume of the circuit was 232 ml. Urea reduction ratio was calculated for 50% and the duration of therapy was 6 hours.

After the first hemodialysis session the pacient had BUN 43 mg/dL, CREA 3.2 mg/dL and phosphorus 7.2 mg/dL. After 9 days, with 3 hemodialysis sessions, blood biochemistry showed the followings: BUN 30 mg/dL, CREA 1.8 mg/dL and Phosphorus 6.4 mg/dL. Hemodialysis therapy was withholded for 72 hours between the 2nd and the 3rd session. During hospitalization, the adjuvant therapy was never suspended and was prolonged and adjusted in correlation with the subsequent analyses. BUN (9.8 mg/dL), CREA (0.9 mg/dL) and phosphorus (4.6 mg/dL) reached normal values

within 39 days after that the patient was discharged.

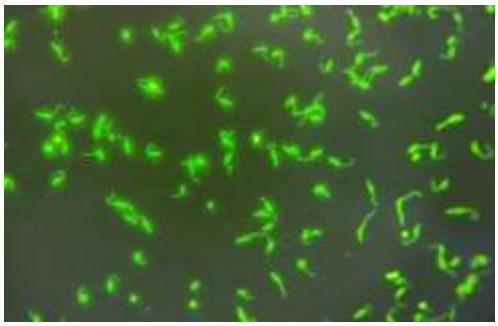

Figure 1. Immunofluorescence antibody test (IFAT), on optic-microscopy, technique for detection of anti-Leishmania antibodies. (by courtesy of Exavet)

RESULTS AND DISCUSSIONS

On 4th of June 2023, the patient had elevated blood biochemistry and grade 3 acute kidney injury CREA 3.6 (RR: 0.4-1.2 mg/dl), BUN 94 (RR: 7-25 mg/dl), phosphorus 9.8 (RR: 2.9-6.6 mg/dl), mild hypokalemia K^+ 3.3 (RR: 3.4-5.6 mmol/L) and elevated liver transaminase ALT 191 (RR: 10-118 U/L). Mild elevated GLU 121 (RR: 60-110 mg/dL). The AMYL was 1390 (RR: 200-1200 U/L), Total Protein 8.6 (RR: 5.4-8.2 mg/dL), Globuline 5.8 (RR: 2.3-5.2 mg/dL). Results from complete blood cell count (CBC) showed MCHC 29.7 (RR: 31-39 g/dl) and RDWc 20.3 (RR: 14-20%). Urine analysis was carried out from urine obtained through echo-guided cystocentesis and showed UPC ratio of 0.2-0.5 (borderline proteinuric), pH 5.5, microalbumin >25 mg/L, creatinine >26.4 mmol/L. Abdominal ultrasound revealed a small amount of free fluid in the hepato-diaphragmatic quadrant, moderate modification in kidneys, hepatomegaly, splenomegal and mild inflammation of small intestines. The patient was presented with the following symptoms: lethargy, appetite loss, vomiting, diarrhea, weight loss, dehydration (8-10%, considerable loss of skin turgor), rectal temperature of 38.8^{o}C and dry mucous membranes. Arterial blood pressure was elevated 218-220 mmHg systolic, using Doppler method.

In the first day, 24 hours prior intermittent hemodialysis (IHD) session, the patient was submitted to intravenous fluidotherapy for electrolyte rebalancing and partial parenteral micronutrition based on levo-microamino acids. Calcium based phosphorus binders, renal diet and nutritional supplements were introduced as adjuvants in the therapy in order to support kindey functions. Telmisartan was used in the treatment for hypertension and border-proteinuria.

After 24 hours of therapy, the blood biochemistry was: CREA 3.6 (RR: 0.4-1.2 mg/dl), BUN decreased to 88 (RR: 7-25 mg/dl), phosphorus slightly increased to 10.1 (RR: 2.9-6.6 mg/dl), K^+ increased to a normal value of 3.5 (RR: 3.4-5.6 mmol/L), elevated liver transaminase ALT decreased to 178 (RR: 10-118 U/L) and GLU increased to 125 (RR: 60-110 mg/dL).

Hemodialysis was decided as an extracorporeal renal replacement therapy. After 24 hours of fluidtherapy, a central venous catheter was placed under a light sedation and supplimented with oxygen, using aseptic technique (the use of surgical scrub and sterile surgical technique during catheter placement, as well as the use of sterile gloves, surgical scrub, and the careful handling of catheter line during the procedure).

After the first IHD session, on 5th of June the blood tests were: CREA decreased to 3.2 (RR: 0.4-1.2 mg/dl), BUN decreased to 43 (RR: 7-25 mg/dl), phosphorus decreased to 7.2 (RR: 2.9-6.6 mg/dl), K^+ increased to a normal value of 4.4 (RR: 3.4-5.6 mmol/L), ALT decreased to 163 (RR: 10-118 U/L) and GLU decreased to a normal value of 101 (RR: 60-110 mg/dL). During the IHD, the patient was stable with no notable clinical event and he received continuous sustaining therapy until the next IHD session. The arterial blood pressure was still high - mildly decreased: 170-180 mmHg systolic, using Doppler method.

After the second session of IHD on 6th of June, blood work were: CREA decreased to 3.1 (RR: 0.4-1.2 mg/dl), BUN decreased to 35 (RR: 7-25 mg/dl), phosphorus increased to 8.0 (RR: 2.9-6.6 mg/dl), K^+ slightly decreased still to a normal value of 4.0 (RR: 3.4-5.6 mmol/L), ALT decreased to 141 (RR: 10-118 U/L) and GLU remain to a normal value of 106 (RR: 60-110 mg/dL).

It was decided to pause hemodialysis for 72 hours and give the patient an intensive and specific intravenous therapy with fluids for electrolyte rebalancing and partial parenteral micronutrition based on levo-microamino acids. Calcium based phosphorus binders and nutritional supplements were given as adjuvants in the therapy for supporting kidney functions.

Blood biochemistry through this 72 pause were: on 7th of June - CREA increased to 3.4 (RR: 0.4-1.2 mg/dl), BUN increased to 37 (RR: 7-25 mg/dl), phosphorus remain the at the same value of 8.0 (RR: 2.9-6.6 mg/dl), K^+ increased but still to a normal value of 3.8 (RR: 3.4-5.6 mmol/L), ALT decreased to a value of 132 (RR: 10-118 U/L) and GLU remains to a normal value of 109 (RR: 60-110 mg/dL). The complete blood count (CBC) showed: mild decrease in RBC to 5.43 (RR: 5.5-8.5 10^12/L), a decrease in HGB to 14.36 (RR: 12-

18 g/L) and PLT decreased to 54 (RR: 150-500 10^9/L). A recheck of abdominal ultrasound was taken and the morphological changes found in the first ultrasound check, were still noticed, but without free fluid in the abdominal cavity and the inflammatory reaction of intestines was mildly decreased. On 8th of June - CREA increased to 3.6 (RR: 0.4-1.2 mg/dl), BUN increased to 39 (RR: 7-25 mg/dl), phosphorus decreased to 7.4 (RR: 2.9-6.6 mg/dl), K^+ slightly decreased still to a normal value of 3.5 (RR: 3.4-5.6 mmol/L), ALT decreased to a normal value of 108 (RR: 10-118 U/L) and GLU remain into the normal range reference. On 9th of June - CREA decreased to 3.0 (RR: 0.4-1.2 mg/dl), BUN decreased to 38 (RR: 7-25 mg/dl), Phosphorus increased to 7.7 (RR: 2.9-6.6 mg/dl), K^+ slightly decreased to 3.2 (RR: 3.4-5.6 mmol/L), ALT and GLU remain into the normal range reference. During 72 hours of intravenous intensive therapy and oral medication, the patient was stabile, normothermic, with good urinary output, arterial blood pressure with values within 150-160mmHg, systolic, using Doppler method, with the appetite partialy recovered and good general status.

It was decided to take the 3rd session of hemodialysis on 10th of June and the blood parameters were decreased as follows: CREA 2.7 (RR: 0.4-1.2 mg/dl), BUN 34 (RR: 7-25 mg/dl), phosphorus 7.6 (RR: 2.9-6.6 mg/dl), K+ 2.8 (RR: 3.4-5.6 mmol/L), ALT and GLU remain into the normal range reference.

The patient's general condition has improved significantly and continued with the fluid therapy and partial parenteral nutrition among the adjuvant therapy for supporting kidney functions until the patient was discharged.

On the 13th of June 2023, when the patient was discharged the blood biochemistry were: CREA decreased to 1.8 (RR: 0.4-1.2 mg/dl), BUN decreased to 30 (RR: 7-25 mg/dl), phosphorus decreased to a normal value of 6.4 (RR: 2.9-6.6 mg/dl), K^+ decreased to 3.3 (RR: 3.4-5.6 mmol/L), ALT increased to a value of 139 (RR: 10-118 U/L) and GLU remains to a normal value. The CBC showed mild decrease in RBC to 5.23 (RR: 5.5-8.5 10^12/L), a decrease in HGB to 10.3 (RR: 12-18 g/L) and HCT 35.24% (RR: 37-55%); MCHC 29.3 (RR: 31-39 g/dl) and NEUT 14.83 (RR: 3-12 10^9/L) with WBC 18.57 (RR: 6-1710^9/L).

The decrease in BUN, CREA and phosphorus were quite remarkable, the BUN decreasing from 94 mg/dL to 30 mg/dl, CREA from 3.6 mg/dl to 1.8 mg/dl and phosphorus from 9.8 mg/dl to 6.4 mg/dl in 3 sessions of hemodialysis and adjuvant therapy in 9 days, the time that patient was hospitalized to the clinic (*figure 2*, *figure 3*, *figure 3*).

After 39 days since the patient was discharged with all the recommendation for a sustained therapy at home, it was observed a decrease to a normal value of CREA to 0.9 (RR: 0.4-1.2 mg/dl), BUN to 9.8 (RR: 7-25 mg/dl) and Phosphorus to 4.6 (RR: 2.9-6.6 mg/dl).

Canine leishmaniasis is expanding to countries where it was previously unknown due to a number of factors, such as climate change and the import of dogs from endemic areas. Leishmaniasis is a serious condition that generates kidney and liver impairment. Kidney involvement appears in infected dogs with glomerulonephritis which is associated with immune complexes and can progress to acute kidney injury. Renal injury is the main death cause in canine leishmaniasis.

The sooner the patient is submitted to hemodialysis therapy, the sooner it will recover. Hemodialysis also has the benefit of correcting other metabolic disturbances and supporting the kidney function during recovery.

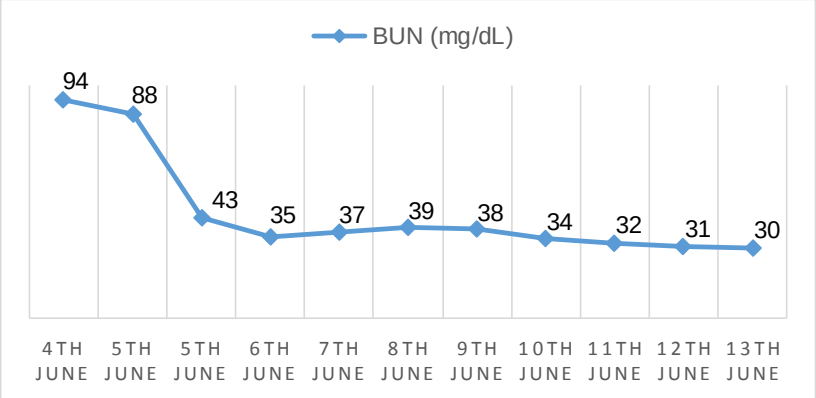

Figure 2. Evolution of BUN during hospitalization period. (original)

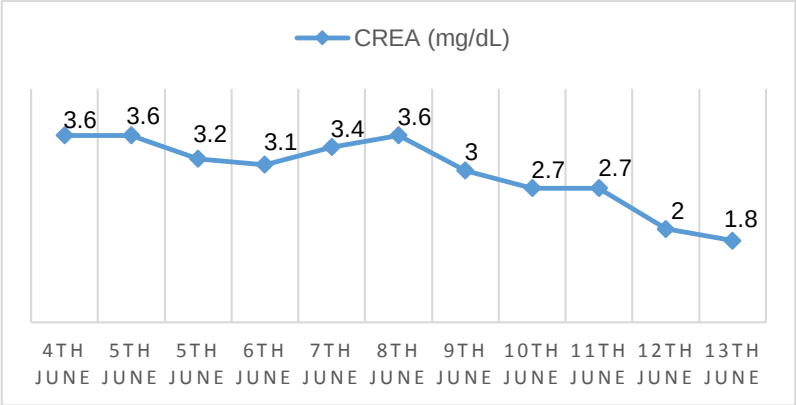

Figure 3. Evolution of CREA during hospitalization period.(original)

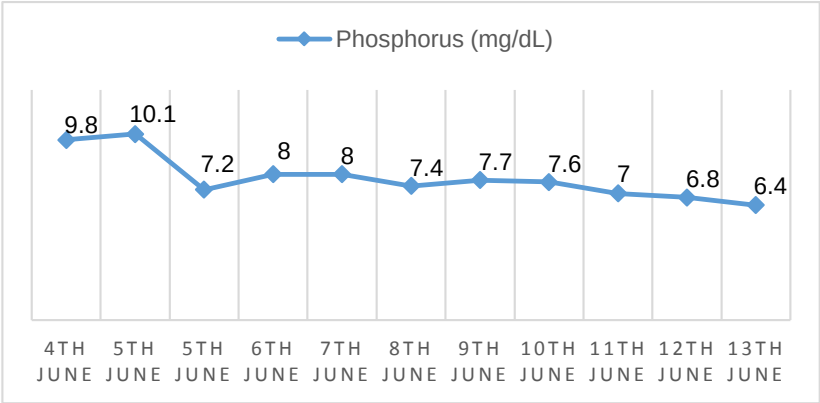

Figure 3. Evolution of Phosphorus during hospitalization period.(original)

CONCLUSIONS

In critical ill patients (especially in patients diagnosed with Leishmaniasis and acute renal injury) intensive care therapy should be initiated as soon as possible and urea and phosphorus levels should be decreased quickly.

Hemodialysis is a highly effective treatment in patients with acute kidney injury, being able to remove the toxin and certain metabolites from the blood. IHD is a useful and feasible modality to improve outcome in dogs with acute kidney injury that do not respond adequately to medical management. The decision to pursue hemodialysis in patients with acute or acute on-chronic kidney injury should be made as quickly as possible to improve the likelihood of a successful outcome. IHD requires thorough understanding of renal physiology, as well as the principles and machinery involved in dialysis. If it is used properly, hemodialysis is a life-saving procedure.

Elevated levels of creatinine and urea, hyper-/hypokalemia, hyperphosphatemia, or metabolic acidosis can be solved using hemodialysis and adjuvant treatment. Also, it has a good therapeutic effect in acute liver failure, cleaning the high levels of transaminase.

In conclusion, based on all data presented above, the process of decreasing BUN, CREA, ALT and phosphorus consisted in 48 days and 3 sessions of hemodialysis from the first day of hospitalization in the clinic, until the parameters were within range references.

For this case, a key treatment for acute kidney injury was represented by intensive care, fluid therapy and hemodialysis which stands for a good prognosis and maintaining a positive evolution for this patient.

Patients should be discharged when all intravenous support was tapered out and they are stable under oral treatments. Follow-up blood, urine and serology tests are mandatory in the next 6 months after hospital discharge.

REFERENCES

Bellomo R., Farmer M., Parkin G., Wright C., Boyce N., 1995 - *Severe acute renal failure: A comparison of acute continuous hemodiafiltration and conventional dialytic therapy. Nephron, 71(1), 59-64.*

Bloom C.A., Labato M.A., 2011 - *Intermittent hemodialysis for small animals. Veterinary Clinics of North America: Small Animal Practice, 41(1), 115133.*

Chalhoub S., Langston C.E., Poeppel K., 2011 - *Vascular access for extracorporeal renal replacement therapy in veterinary patients. Veterinary Clinics of North America: Small Animal Practice, 41(1), 147161.*

Clark W.R., Mueller B.A., Alaka K.J., Macias W.L., 1994 - *A comparison of metabolic control by continuous and intermittent therapies in acute renal failure. Journal of The American Society of Nephrology, 4(7), 1413-1420.*

Elliott D.A., 2000 - *Hemodialysis. Clin Tech Small Anim Pract. 2000;15: 136–148.*

Gharbi M., Mhadhbi M., Rejeb A., Jaouadi K., Rouatbi M., Darghouth M.A., 2015 - *Leishmaniosis (Leishmania infantum infection) in dogs. Rev Sci Tech.,34(2):613-26.*

Mann S., Frasca K., Scherrer S., Henao-Martínez A.F., Newman S., Ramanan P., Suarez J.A., 2021 – *A Review of Leishmaniasis: Current Knowledge and Future Directions. Curr Trop Med Rep., 8(2):121-132.*

Proverbio D., Spada E, Bagnagatti de Giorgi G., Perego R., Valena E., 2014 - *Relationship between Leishmania IFAT titer and clinicopathological manifestations (clinical score) in dogs. Biomed Res Int.,2014:412808.*

Ștefănescu A., Viţălaru, B.A., Bîrţoiu, I.A., 2017 - *Hemodialysis in veterinary medicine. Scientific Works. Series C, Veterinary Medicine, 63(2).*

Ștefănescu A., Viţălaru B.A., Bîrţoiu I.A., 2017- *Hemodialysis in veterinary medicine: review. Agriculture for life, life for agriculture.*

Ștefănescu A., Viţălaru B.A., 2018 - *"RESEARCHES REGARDING THE CENTRAL VENOUS CATHETER MANAGEMENT IN DOGS UNDERGOING HEMODIALYSIS." Scientific Works. Series C, Veterinary Medicine 64, no. 2.*

Viţălaru B.A., Ștefănescu A., 2016 - *"Researches regarding the correlation between renal parameters and the evolution of electrolytes in renal failure in dogs, Scientifical Papers Veterinary Medicine, vol." XLIX, Timișoara.*