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Autohemotherapy in veterinary clinical practice: An update

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Abstract
Autohemotherapy, primary or adjuvant to the conventional treatment regimens, is highly beneficial in the large and small animal veterinary clinical practice because of the low cost combined with manipulative convenience and bio-safety. Autohemotherapy promotes the sick animal's health status by subsiding purulent biodegradation of the soft tissues, improved cell metabolism, potentiated immune system and accelerated restoration of homeostasis with improved blood/ lymph circulation. Ozone autohemotherapy is the best option in high incidence foot rot disease in large commercial dairy farms with advanced diagnostic and veterinary medical care facilities.

Keywords: autohemotherapy, ozonated autohemotherapy, immune mechanisms, animal diseases

1. Introduction
Autohemotherapy, a proven therapeutic strategy against wide ranging disorders in animals primarily aims to boost the innate immune system with the patient's own blood (Griffin and Hiller, 2001) [7]. Aseptically collected blood sample is injected IM/SC/ID. The IM route is often preferred. Prolonged IV infusion in cows (Scrollavezza *et al.*, 2002) [19] was found beneficial. Wide ranging biochemical entities in the patient's own blood, namely antigens, hormones, antibodies, and biodegradation products of metabolism are re-administered to provide a quantum boost to the immune system (Leung, 2001) [12]. Recognising the circulatory biomarkers of disease, the immune system launches an intense counter-attack (Norman *et al*., 1978) [16]. Therefore, autohemotherapy *per se*, or complimentary therapy is highly beneficial in the treatment of wide ranging autoimmune and infectious diseases in livestock. This cost-effective, multi-action protocol can be conveniently applied in the field.

2. Biomechanisms
2.1 Cell-mediated Immune Response
Animals are protected against the potentially hazardous microbial infection induced foreign antigens by the triggering mechanism in the built-in immune system. The cascading bio-bioresponse involves synergy between the macrophages and B and T lymphocytes. Phagocytic neutrophils and monocytes are the first line of defence against pathogenic bacterial infection. Autohemotherapy provides the stimulus to the neutrophils, monocytes (activated and transformed in the tissue cells→macrophages) and lymphocytes. Emigrating into the affected site through chemotaxis, these specialized cells are involved in scavenging the deleterious blood clots and decaying bacterial and tissue debris. Cleansing, in turn, promotes accelerated antibodies biosynthesis and release targeting the microorganisms, potentiating tissue antigens and cell-mediated defence mechanisms (Martini and Bernardes, 2018) [13]. Autohemotherapy stimulates the reticulo-endotheIial system (RES), now named the phagocytic mononuclear system (PMS). Autohemotherapy also activates the patient's hemopoietic tissues in the red bone marrow in long bones (Mettenleiter, 1936) [14].

2.2 Endocrine Immune Response
Adrenocortical stimulation, following autohemotherapy, is clearly evidenced by eosinopenia. Concurrent marked increase in the absolute count of neutrophils is noteworthy. In this context it is pertinent to recall the characteristic changes in the leukocyte profile induced by experimental injection of the primary stress hormone, epinephrine. The biomechanisms were deciphered with well-designed experimental models (Sauer and Simm, 1951) [18].

3. Autohemotherapy procedures

After proper preparation with shaving and cleaning of the area, the patient's own blood is collected through IV puncture and injected through the selected route, the dose and frequency based on the clinical judgment. In canine parvovirus infection, for example, body weight up to 5 kg, 2.5 ml; 5-10 kg, 5 ml; 10-15 kg, 7.5 ml; over 15 kg weight, 10 ml (Borges *et al*., 2014a) [4].

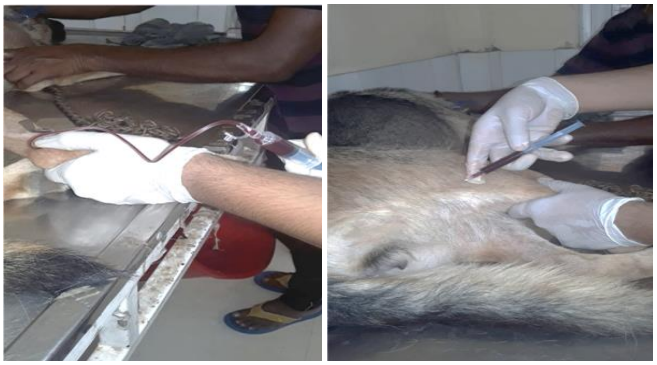

Fig 1: Intramuscular injection of freshly collected autoblood in a dog patient.

Table 1: Resume' of the autohemotherapy protocols in the scanned literature (Borges *et al*., 2014a) [4]

Species	Diseases	AHT/ AHTO	Blood dose (ml)	Ozone (µg/ml)	Route	Frequency
Bovine	Papillomatosis	AHT	10	-	IM	Weekly/ 3 weeks
	Immunological response	AHTO	25-100	10	IV	Single dose
	Acute interdigital phlegmon	AHTO	1000	30	IV	Single dose
	Inflammatory diseases	AHTO	25-100	10	IV	Single dose
Canine	Hemoparasitosis	AHT	4	-	IM	Weekly/ 4 weeks
	TVT	AHT	5	-	IM	Weekly/ 2 weeks
	TVT	AHT	10	-	IM	Weekly/ 7 weeks
	Parvovirus	AHT	According to weight	-	IM	Single dose
	Mastocytoma	AHT	10	-	IM	Weekly / 20 weeks
Equine	Post-surgical orchiectomy	AHT	30	-	IM / PA	Single dose
	Habronemosis	AHTO	200	200	IV	Twice a week/ 8 weeks

Note: AHT : Autohemotherapy ; AHTO : Ozonated autohemotherapy ; IM : Intramuscular IV : Intravenous ; PA : Acupuncture points ; - Not used

Table 2: Comparative features of autohemotherapy *vs*. blood transfusion.

No.	Autohemotherapy	Blood transfusion
1.	No prior screening/ typing involved	Prior screening/ blood group typing mandated
2.	Application modes (Whole blood) (i) Direct administration (ii) Modified first (oxygenation)	Whole blood/Fraction transfusion :Whole blood Washed red blood cells, Washed platelets
3.	Specialized processing modes (i) Ozonation (ii) UV irridiation	No processing involved
4.	Routes of administration (i) IM (ii) SC (iii) ID	(i) IV
5.	Complications/ side effects: pyrexia, hyper-sensitivity, haemolytic reactions (acute/ delayed) blood reactions	pyrexia, hypersensitivity reactions, haemolytic reactions (acute/chronic)

4. Autohemotherapy applications

4.1 Companion Animals

4.1.1 Canine ehrlichiosis

The high-risk clinical syndrome in the companion dogs, canine ehrlichiosis often leads to mortality even after costly treatment. However, early ozonated-autoblood therapy effectively restored the pathoclinical profile to near normalcy. This break-through is, indeed, a landmark in the treatment of a disease, considered by the veterinary fraternity as 'incurable' till now (Garcia *et al*., 2010) [6].

4.1.2 Canine oral papillomatosis

Autologous blood was injected SC directly at the base of the papillomas (warts) and the surrounding areas without concurrent use of any antibiotic preparation, systemic or topical. The quantity of injected fresh blood (0.5 ml -1.0 ml) was adjusted by the clinician's spot decision, according to the size of the individual papilloma. During the entire procedure, the pet was kept sedated. By the end of the scheduled 5 applications in 24 days, the masses had regressed completely (Bambo *et al*., 2012) [1]. According to Borges *et al*. (2017) [2] autohemotherapy promotes emigration of thrombocytes into the affected sites, modulates the immune response and facilitates tissue repair through local inflammatory processes leading to involution or shedding of the dried papillomas. In view of the scanty literature on the treatment protocols in the companion dogs, clinical experience documented in the bovine case reports provided useful leads (John *et al*., 2019) [9].

4.1.3 Canine parvovirus

Autohemotherapy promoted uneventful recovery, without any serious adverse side effects, of the parvovirus-infected dogs. This low-cost tool can be conveniently used as an adjunct/ alternative therapy in the treatment of this challenging disease (Borges *et al*, 2014b) [3]

4.1.4 Tansmissible venereal tumour

Autohemotherapy induced a marked regression of the transmissible venereal tumour (TVT) mass in nearly 50% of

the in-treatment dog patients, presumably because of enhanced body resistance. The need for in-depth research was emphasized for improved recovery rate (Drumond *et al*., 2013) [5].

4.1.5 Canine dermatitis
A favourable response to auto-hemotherapy was noticed in severely distressed dog patients exhibiting extensive itching; within 3 weeks time the animals recovered completely. Autohemotherapy stimulates the innate immune system significantly, increasing both humoral and cell-mediated immunity (Kumar, 2018) [11].

4.1.6 Canine atopic dermatitis
Autohemotherapy was used in the treatment of a chronic case of canine atopic dermatitis. Initially, the animal did not reveal any visible signs of recovery, but after the third auto-blood dose, the response was positive. Further, uneventful recovery occurred after the fourth and final dose (Gupta *et al*., 2017) [8].

4.2 Farm animals
4.2.1 Foot rot in cow
Interdigital phlegmon, results from pathogenic bacterial/ fungal infection. In a clinical trial in Italy, 60 dairy cows for cheese production were subdivided into three equal treatment groups (n=20). Ozonated autohemotherapy, efficacy rated at par with the proven antibiotics Ceftiofur and Oxytetracycline, proved better from the farm economics standpoint because the livestock products (milk and meat) were not subjected to statutory withdrawal time restrictions. Ozone (60 mg) was mixed in 1 litre freshly collected, machine-homogenized autoblood and administered (intravenous infusion) every 24 hr. The results revealed that Ceftiofur (1.0 mg/kg body weight IV, every 12 hr) and Oxytetracycline (6.0 mg/ kg IV, every 24 hr) resolved the lameness in 1½ and 3 days, respectively, *vs*. 1 day with ozone (O_3) [30 µg/ml blood] therapy with better healing outcome, evidenced by normal walking. Increased availability of nascent oxygen with high germicidal potency in the cells facilitated wound healing (Scrollavezza *et al*., 2002) [19].

4.2.2 Bovine papillomatosis
In a clinical case of papillomatosis (warts) in cow's udder and teats, the maximum recovery rate, recorded with autohemotherapy (92%) was followed by anthiomaline (81%), Thuja-30 extr., PO (70%) and Thuja ointment, topical (57%) at weekly intervals for 4 weeks. After the final round, signs of wart regression were clearly discernible (Kavithaa *et al*., 2014). A multipara Holstein Friesian cross-bred cow was presented with pedunculated cutaneous warts on the udder and teats, pain, bleeding, and difficult milking. Based on anamnesis and clinical profile, the case was diagnosed as bovine papillomatosis. The cow was given autohemotherapy (10 ml fresh venous blood, injected SC in the lateral cervical region, and 10 ml injected IM, deep in the gluteal region), repeated regularly once every week. The warts progressively regressed, dried and peeled off partially in 4 weeks. By the end of the 6th week, all growths had completely dropped leaving only light black scars in the udder and teats (Nehru *et al*., 2017) [15].

4.2.3 Caprine keratoconjunctivitis
In affected goats, autohemotherapy was scheduled at 5-day intervals, totalling 3-5 doses. Oxytetracyline was injected IM, and Dexamethasone in the sub-conjunctival space. The problem was resolved, in most cases, within 2 weeks, evidenced by visibly reduced corneal opacity, attributable to enhanced cell-mediated and humoral immunity (Rahaman *et al*., 2018) [17].

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