Comparative Study of Non-Ionic Contrast Agents Optiray 350 and Ultravist 370 in Myelography in Dogs

Radu LĂCĂTUȘ¹, Robert Cristian PURDOIU^{1*}, Filip ARDELEAN², Ileana MATEI², Maximilian MUNTEAN³, Ionel PAPUC¹

¹ University of Agricultural Sciences and Veterinary Medicine, Faculty of Veterinary Medicine
Department of Semiology, Radiology and Medical Imaging, Mănăştur, no. 3-5, Cluj Napoca, Romania;

² Department of reconstructive surgery. Recovery Clinical Hospital Cluj-Napoca.

³ Department of Anatomy and embryology, University of Medicine and Pharmacy "Iuliu Hațiegan" Cluj Napoca

*corresponding author: robert.purdoiu@usamvcluj.ro

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Abstract

An essential quality of non-ionic contrast agents is that of containing in their chemical composition, elements with high atomic weight, which determine an increasing absorption of the X-ray beam and this will cause intense radiopacity. The possibilities for radiological exploration with non-ionic contrast agents are very wide. Currently the radiological examination with contrast agent no longer constitutes a risky step in medical diagnosis. To highlight the importance of using the non-ionic contrast agents Optiray 350 and Ultravist 370 in dog's myelography and to compare the changes induced in cerebrospinal fluid and blood biochemical constituents by the administration of those non-ionic contrast substances. In order to determine the influence of non-ionic preparations Optiray 350 and Ultravist 370 on cerebrospinal fluid and on some hematological parameters were included in the study a total of 10 dogs. Myelographies with Optiray 350 and Ultravist 370 in dogs with severe spinal condition negatively influence biochemical and hematological blood status, being necessary to take preventive measures. Optiray 350 and Ultravist 370 administration cause a slight sensitization of liver with blood biochemical parameters return to normal within 24-48 hours. Non-ionic contrast agents Optiray 350 and Ultravist 370 offer a very good opacification of the subarachnoid space, but because it causes liver sensitization, we recommend using them with caution and only after a prior check of liver function.

Keywords: *contrast agent, dog, myelography, non-ionic, radiology*

INTRODUCTION

An essential quality of non-ionic contrast agents is that of containing in their chemical composition, elements with high atomic weight, which determine an increasing absorption of the X-ray beam and this will cause intense radiopacity. The possibilities for radiological exploration with non-ionic contrast agents are very wide.

Myelography is the introduction of contrast into the subarachnoid space, allowing the study of the spinal canal. It have been used in researching,

tracking and tracing of spinal pathological processes and / or disc, congenital malformations, post-traumatic symptoms and changes resulting from spinal compressions (Katzberg, 1998).

Subarachnoid space exploration was a technic related to the use of iodized oil such as Lipidol, Pantopac, and Durolipac. Due to the very low resorption of these substances in the subarachnoid space and risk of chronic complications (chronic arachnoiditis), they were removed from usage. There were also used organo

iodinated substances but they had a highly toxic component (Methiodol). A product of superior quality in terms of the image and the toxicity of was the product Dimer X, which was used in France. Recently it was introduced organo-iodine compound, non-ionic, low-osmolarity (Ultravist, Isovist, Omnipaque, Iopamidol, Iohexol). They show very good tolerance and elimination from cerebrospinal fluid is very fast (Ulici-Petruț, 1996).

Myelography can be defined as a technique to visualize the subarachnoid space, in order to study spinal cord (myelography) and outlines the spinal nerve roots (radiculography). These techniques are possible by introducing into the subarachnoid space radiopaque or radiolucent substances.

Another possibility to highlight the spinal canal is pneumomyelography, which consists of blowing air into the subarachnoid space. Air is radiolucent, allowing delimitation of the marrow of the spinal canal walls. This technique has the disadvantage that carried a lower contrast than the actual myelography (Kealy and McAllister, 2000)

Currently the radiological examination with contrast agent no longer constitutes a risky step in medical diagnosis.

The aim of this study is to highlight the importance of using the non-ionic contrast agents Optiray 350 and Ultravist 370 in dog's myelography and to compare the changes induced in cerebrospinal fluid and blood biochemical constituents by the administration of those non-ionic contrast substances.

MATERIAL AND METHOD

To establish the influence of non-ionic agents Optiray 350 and Ultravist 370 on the cerebrospinal fluid and the hematological and biochemical blood parameters were included in the study a total of 10 dogs. Contrast agents used in research were Optiray 350 and Ultravist 370 used in undiluted form.

Before myelography examination the dogs were subjected to 12 hours diet and clinical examination, physiological parameters were monitored (temperature, pulse, respiration) and blood samples have been taken before and after the procedure.

Bone marrow puncture site preparation in both the cervical and lumbar was conducted within the rules of antisepsis (trimmed, washed,

shaved) and local asepsis. Patients entering the study were subjected to neuroleptanalgesia with Acepromazine in association with Ketamine (10 mg / kg), premedication with atropine 1% was administered at a dose of 0.02 ml / kg.

Spinal needles of 20 to 22 G with stiletto were used to minimize tissue damage. The dose of contrast medium injected into the subarachnoid space ranged from 0.2 to 0.45 ml/kg for Optiray 350 and 0.3-0.5 ml / kg for Ultravist 370.

Cerebrospinal fluid (CSF) was collected from 10 dogs, before and after administration of contrast agent Optiray 350 and Ultravist 370 to determine the changes that can occur at this level. In a number of five dogs was tested the effect of the non-ionic agent Optiray 350, and the remaining five individuals were tested for the effects of Ultravist 370. The amount of CSF taken from dog's ranges from 1 to 5 ml, depending on the size of the animal, the collection of CSF was done before Optiray 350 and Ultravist 370 administration and at 1 hour after administration of contrast agents. Cerebrospinal fluid collected was subjected to haematological, biochemical and cytological examination, being determinate a number of 6 CSF biochemical constant.

To highlight the changes that occur in the vascular bed after myelographies with Optiray myelographies 350 and Ultravist 370, blood was collected at 6 hours and at 24 hours after contrast agent's administration. Blood was subjected to physical and biochemical examination, determining a number of 16 biochemical blood constituents.

RESULT AND DISCUSSION

Character of CSF's collected was that of a clear, transparent, colourless fluid without clotting tendency. In some cases the samples were contaminated with a small amount of blood, resulting from performing puncture, but that did not affect other determinations.

This method consisted of counting the cellular elements of the CSF and biochemical examination was carried out, given a number of 6 constituents (Table 1 and Table 2).

Two dogs were diagnosed with spine problem after mielography, one dog was diagnosed with Wobler syndrome and the other one with intervertebral disk herniation.

Tab. 1. CSF cell counting after 1 hour from Optiray 350 myelography

Cell count	Result	Limits [‡]
Case 1		
WBC (X 10 mil./L)	1,6	≤3
RBC (X 10 mil./L)	1,82	≤30
Case 2		
WBC (X 10 mil./L)	1,7	≤3
RBC (X 10 mil./L)	1,2	≤30
Case 3		
WBC (X 10 mil./L)	1,5	≤3
RBC (X 10 mil./L)	1,9	≤30
Case 4		
WBC (X 10 mil./L)	2,2	≤3
RBC (X 10 mil./L)	1,7	≤30
Case 5		
WBC (X 10 mil./L)	2,9	≤3
RBC (X 10 mil./L)	10,2	≤30

[‡] Faculty of Veterinary Medicine Cluj Napoca, Laboratory of Biochemistry reference values

Tab. 2. CSF cell counting after 1 hour from Ultravist 370 myelography

Cell count	Result	Limits [‡]
Case 1		
WBC (X 10 mil./L)	2,0	≤3
RBC (X 10 mil./L)	1,82	≤30
Case 2		
WBC (X 10 mil./L)	1,8	≤3
RBC (X 10 mil./L)	1,3	≤30
Case 3		
WBC (X 10 mil./L)	1,9	≤3
RBC (X 10 mil./L)	1,7	≤30
Case 4		
WBC (X 10 mil./L)	2,4	≤3
RBC (X 10 mil./L)	1,82	≤30
Case 5		
WBC (X 10 mil./L)	2,91	≤3
RBC (X 10 mil./L)	9,2	≤30

[‡] Faculty of Veterinary Medicine Cluj Napoca, Laboratory of Biochemistry reference values

Cytological examination of cerebrospinal fluid after myelography, conducted in patients diagnosed with wobbler syndrome and herniated intervertebral disc, highlights neutrophil and lymphocytosis (Table 3).

Following the cerebrospinal fluid biochemical examination, at 1 hour post contrast, may notice a decrease in calcium and an increase in albumin in

both contrast agents, which shows a low hepatic synthesis and a state of fluid overload possible following administration of fluids (Table 4).

Blood serum biochemical examination, carried out following Optiray 350 and Ultravist 370 myelography reveals a sensitization of the liver, and a fluid infusion overload or possible undiagnosed cardiac problems. The administration of contrast

Tab. 3. CSF cytology after 1 hour of contrast agent's administration

Cytology	Optiray 350					Limits [‡]	Ultravist 370				
	Case 1	Case 2	Case 3	Case 4	Case 5		Case 1	Case 2	Case 3	Case 4	Case 5
neutrophils	2	1	0	7	4	3	3	2	2	13	10
lymphocytes	2	1	0	6	5	4	3	2	3	20	11
monocytes	50	25	30	50	45	87	60	40	35	60	55
eosinophils	1	0	0	3	2	0	2	0	0	2	2
macrophages	1	2	3	8	7	6	3	2	3	5	7

[‡] Faculty of Veterinary Medicine Cluj Napoca, Laboratory of Biochemistry reference values

Tab. 4. CSF biochemistry at 1 hour post contrast

Test	Min [‡]	Optiray 350	Ultravist 370	Max [‡]
Ca	4.5	2.57±0.54	2.6±0.76	5.5 mEq/L
Mg	1.7	1.93±0.34	2±0.51	2.4 mEq/L
Gluc_Kin	50	97±3	100±2	100 mg/dL
Total proteins	2.5	3.3±0.87	3.9±0.42	4.5 g/dL
Albumins	1	2.5±0.92	2.8±0.55	2 g/dL
Globulins	0.7	0.7±0.11	0.8±0.1	2.5 g/dL

[‡] Faculty of Veterinary Medicine Cluj Napoca, Laboratory of Biochemistry reference values

Tab. 5. Mean values and standard deviation of the blood parameters after myelography

PARAMETERS	MIN [‡]	Optiray 350		Ultravist 370		MAX [‡]	Units
		6 hours	24 hours	6 hours	24 hours		
Cholesterol	133	270.6±2.4	269.2±1.6	285.1±1.3	270.1±2.1	367	mg/dL
Ttriglycerides	10	85.4±2.3	119.2±2.5	86.3±1.4	118.4±1.6	150	mg/dL
Ca	4.5	4.60±0.4	4.6±0.3	4.6±0.3	4.9±0.6	10	mg/dL
Mg	1.5	1.70±0.13	1.84±0.24	1.7±0.21	1.9±0.23	4	mg/dL
ALK	10	500.3±4.1	520.2±2.2	514.2±1.4	589.1±3.2	100	U/L
Gamma GT	0	100.6±1.2	98.2±2.27	125.12±1.31	108.21±1.2	9	U/L
Ureea	10	23.8±2.8	50.12±1.1	23.8±2.21	59±1.23	30	mg/dL
Gluc Kin	62	81.22±1.31		82.12±1.45		110	mg/dL
Creatinine	0.5	0.55±0.34	2.1±0.24	0.54±0.37	2.2±0.45	1.3	mg/dL
AST	10	80.21±1.44	78.34±1.8	89.26±1.3	87.48±1.7	50	U/L
ALT	0	279.1±1.36	189.3±1.34	290.23±2.26	199.16±1.32	55	U/L
ISE – Na	140	153.2±1.43	140.3±1.24	155.5±2.21	145.54±1.3	155	mg/dL
ISE – K	3.5	8.98±0.89	7.05±0.78	9.3±0.89	7.38±0.37	5.5	mg/dL
Total Proteins	6.0	5.7±0.67	6.7±0.34	5.8±0.28	6.9±0.47	8.0	g/dL
Amilase	260	594.2±2.45	703.21±2.76	600.3±1.33	687.4±2.31	1500	U/L
Total bilirubine	0	0.28±0.36	0.38±0.1	0.3±0.2	0.5±0.21	1.00	mg/dL

[‡] Faculty of Veterinary Medicine Cluj Napoca, Laboratory of Biochemistry reference values

agents for myelography adversely affect blood constituents, resulting in decreased erythrocytes, haemoglobin, haematocrit and platelets.

After 24 hours from myelography with Optiray 350 and Ultravist 370, there have been an increasing in serum potassium, urea and creatinine, increased catabolic processes (fever, trauma), decreased glomerular filtration, but with a gradual return to their physiological state.

CONCLUSION

Cytological examination of cerebrospinal fluid after myelography, conducted in patients diagnosed with wobbler syndrome and herniated intervertebral disc, highlights neutrophil and lymphocytosis. Decrease in calcium and increase in albumin values of CSF biochemistry correlated with modified values of Alkaline phosphatase, gamma-glutamyltransferase and hepatic transaminases indicate an irritative and inflammatory effect on the liver and biliary ducts suggesting a possible cholestasis (Bain, 2003, Vaden *et al.*, 2009). Increase value of Urea and Creatinine indicate a renal reaction due to renal filtration of the

contrast agents (Fettman and Rebar, 2004). Even if the values of those parameters were modified the clinical symptoms were not presented in dogs. The values of changed biochemical parameter show a tendency toward normal range.

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