Bulgarian Journal of Veterinary Medicine (2002), 5, No 2, 119 – 126

POSITIVE CONTRAST SHOULDER ARTHROGRAPHY IN DOGS WITH UROPOLIN

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Summary

Goranov, N., J. Philipov and Y. Stamoulis, 2002. Positive contrast shoulder arthrography in dogs with Uropolin. *Bulg. J. Vet. Med.*, **5**, No 2, 119 – 126.

Positive contrast radiography of both shoulder joints with different concentrations of Uropolin (containing 1.6 g sodium amidotrizoate and 10.4 g meglumine amidotrizoate in 20 ml ampules; Polfa, Poland) has been performed in six dogs, divided into 3 groups. The first group was injected with 20% Uropolin, the second - with 30% Uropolin and the third – with 30% Uropolin and 0.2 ml 0.1% adrenaline hydrochloride. Shoulder radiographs were performed 2, 5 and 10 min after the injection of the contrast medium in mediolateral and craniocaudal views. The quality of radiographs was assessed visually using a four score system for five independent parameters in both views. The results showed a better quality of mediolateral radiographs 5 minutes after injection of 30% Uropolin (average score 12.5) compared to 20% Uropolin (average score 8.5), at $p<0.05$.

The addition of 0.1% adrenaline hydrochloride to 30% Uropolin resulted in a better quality of arthrographs up to 10 minutes following the administration (average score 10 compared to 8.5 in the group with independent application, $p<0.01$).

Key words: dog, positive contrast arthrography, shoulder joint

INTRODUCTION

The conventional radiography does not provide adequate information in cases of lameness due to soft tissue damage, intraarticular ligaments or cartilage lesions. The application of a contrast medium improves significantly the visualization of those elements (Philipov, 1995). The positive contrast arthrography in dogs with iodine compounds has been used to evaluate osteoarthritis (Caring, 1997), osteochondral shoulder lesions (Van Bree, 1990; Kippenes and Johnson, 1998), femoral condyle (Oates et al., 1995) and elbow lesions (Poulos, 1982; Nixon et al., 1984; van Bree, 1988; van Bree and van Rijssen, 1998). The contrast radiological study contributes to the detection of structural joint damage following a gunshot trauma (Maarshalkerweerd and Boroffka, 1996). The method is widely used in a screening programme for study and control of canine elbow dysplasia (Read et al., 1996; Snaps et al., 1997; Kirberger and Fourie, 1998). Positive contrast media are used for identification of sclerotic and osteophyte foci in the intertubercular sulcus in a chronic bicipital shoulder tenosynovitis in a dog (Stobbie et al., 1995; Lincoln and Potter, 1984) as well as for evaluation of the integrity of elbow collateral ligaments (Montavon and Savoldelli, 1995).

The application of non-ionic water-soluble polymer contrast substances results in a relatively bigger duration of arthrographic image quality and lower irritation of the joint (Laasonen and Lindholm, 1983). Van Bree et al. (1991) have compared the quality of arthrograms and the inflammatory response obtained after the

use of Urovison (40 % sodium amidotrizoate + 18 % meglumine amidotrizoate*) and Hexabrix (39.3% meglumine ioxaglate + 19.6% sodium ioxaglate*), stating that the second preparation was more appropriate. In another study, van Bree and van Rijssen (1995) discussed the properties of Urografin (sodium amidotrizoate/meglumine amidotrizoate 10:66 in aqueous solution*) and Ultravist (0.623 g/ml iopromide in aqueous solution*) concluding that the latter was more advantageous for practical application, preserving the quality of radiographs for a longer period of time.

The good-quality arthrography requires optimal volume and iodine concentration and a suitable technique of injection. The data about the concentration of used contrast media are variable, the tendency being towards the use of minimal concentrations and volumes (Poulos, 1982). The higher concentrations decrease the visibility of joint structures (van Bree, 1992).

One of the limitations when using a positive contrast medium is the worsening of the image with time because of the penetration of fluid into the joint and/or absorption of the contrast medium itself. In cases of inflammations and hyperaemia, the absoption occurs faster (Hudson, 1981). There is a correlation between the persistence of the good-quality image and the physicochemical properties of the contrast substance (molecular mass, viscosity etc.) that is however poorly studied. In humans, contrast arthrography is routinely performed with an addition of 0.1% adrenaline hydrochloride to the contrast medium (Braunstein et al., 1982; Pavlov et al., 1983) in order to slow down the absorption because of the vasoconstrictive effect of adrenaline upon the synovial membrane. The experimental data of this mode of application of contrast media in the dog are few and imprecise.

The aim of the present study was the determination of the optimal amounts and concentrations for the performance of positive contrast arhtrography in dogs using Uropolin, that would result in the best arthrographic picture for the longest possible period of time; to define the best moment for obtaining a joint radiograph with the best contrast, including via the use of pharmacological agents, providing the longest time of intraarticular contrast medium residence.

MATERIALS AND METHODS

The positive contrast medium, used in our studies, was Uropolin (Uropolin 60% with active substances 1.6 g sodium amidotrizoate and 10.4 g meglumine amidotrizoate in 20 ml ampules; Polfa, Poland) with iodine content of 293 mg/ml, applied by other authors too (Barret, 1981). Two working concentrations were used: 20% (iodine content 97.6 mg/ml) and 30% (iodine content 146.5 mg/ml). 30% Uropolin was applied independently or in combination with adrenaline hydrochloride – 0.1% solution in 1 ml ampules (Sopharma, Bulgaria).

The studies were performed on 6 mixed-breed dogs aged 2-5 years, divided into 3 groups:

- Group I: 2 dogs injected with 20% Uropolin (15 mg iodine/kg b.w.);
- Group II: 2 dogs injected with 30% Uropolin (22 mg iodine/kg b.w.);
- Group III: 2 dogs injected with 30% Uropolin (22 mg iodine/kg b.w.) + 0.2 ml 0.1% adrenaline hydrochloride.

The contrast medium was injected in both shoulder joints.

* Notice of papers' authors: the constitution is according to data from the manufacturers.

Prior to the arthrography, the animals were *i.m.* injected with 0.1 mg/kg xylazine (Rometar, Spofa, Czech Republic). The approach to the shoulder joint was 1 cm below the acromion process. After an aseptic preparation, the needle was directed caudomediodistally towards the joint cavity. Radiographs were obtained 2, 5 and 10 minutes in mediolateral and craniocaudal views with a fixed X ray unit (TUR-800, Germany), at 60 kV and 10 mAs on 24 ×30 and 30 ×40 x-ray films (Kodak, USA). In each animal, for each time interval, 2 radiographs in each view were performed.The visualization of joint structures on radiographs was visually assessed using a four-score scale: score 0 – unsatisfactory; score 1 – satisfactory; score 2 – good and score 3 – excellent. As a basis for comparison we used the normal radiological anatomy and radiological nomenclature (Smallwood et al., 1985). The evaluated parameters were: 1. quality of the picture as a whole; 2. visualization of joint cartilage surface; 3. visualization of *vagina synovialis intertubercularis*; 4. visualization of *bursa subtendinea musculi infraspinati* and 5. visualization of the enlargement of *stratum synoviale* around *musculus supraspinatus*.

Each parameter received a separate score and they were summarized to form the total subjective score. The maximum possible score was 20. The average scores of all four radiographs for each groups were statistically compared by the Student's t–test.

RESULTS

Arthrographic picture after the intraarticular injection of 30% Uropolin

On the mediolateral view (Fig. 1), 2 minutes after Uropolin administration, the surfaces of joint cartilages of *cavitas glenoidalis* and *caput humeri* were distinct. Cranially, in *sulcus intertubercularis*, *vagina synovialis intertubercularis* was visible between *tuberculum majus* and *tuberculum minus*. From both sides, two enlargements were visible in its middle, where a bigger amount of the contrast medium was accumulated. In the caudal part of the shoulder joint, there was an enlargement of *stratum synoviale* as a continuation of the joint surface shadow with dimensions 15 × 3 mm.

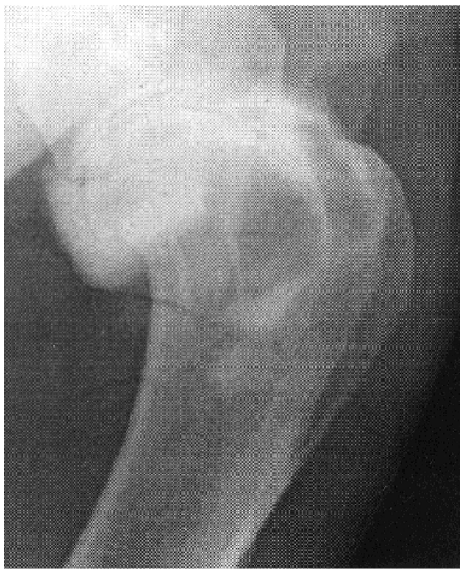

Fig. 1. Mediolateral radiograph of the shoulder joint 5 minutes after the intraarticular injection of 20% Uropolin.

At minute 5 after the injection, the shadow of *vagina synovialis intertubercularis* was fading, while the shadow of both enlargements - no more visible. The shadows of the synovial bump around *musculus supraspinatus* and that of *bursa subtendinea musculi infraspinati* were intensive. At post injection minute 10, the shadow of *vagina synovialis intertubercularis* was significantly fading distally. The

shadow over the joint was intense and 10 mm wide. Proximally, over the joint surface, the shadow of *vagina synovialis intertubercularis* was well visible. The shadows of *bursa subtendinea m. infraspinati* and the enlargement of *stratum synoviale* of *m. supraspinatus* were stronger as well.

Arthrographic picture after the intraarticular injection of 20% Uropolin

Two minutes after the injection of 20% Uropolin (Fig. 2), the cartilagineous surface of the humeral head and the distal part of *vagina synovialis intertubercularis* were well visible on the mediolateral view. *Bursa subtendinea m. infraspinati* was defined and large.

By the 5th minute, the shadow of *vagina synovialis intertubercularis* and *bursa subtendinea m. infraspinati* were less distinct and the dimensions of the enlargement of *stratum synoviale* around *m. infraspinati* – lower. By minute 10 after the administration, the shadows of all joint elements filled with contrast medium, were significantly less clear.

Arthrographic picture after the intraarticular injection of 20% Uropolin + 0.2 ml 0.1% adrenaline hydrochloride

The shadows of the cartilagenous joint surface and the distally enlarged *vagina synovialis intertubercularis* were very distinct in mediolateral projection (Fig. 3). The shadow of *bursa subtendinea m. infraspinati* was well defined and elongated along *spina scapulae*. The enlargement of *stratum synoviale* was very well visible as well. By post treatement minute 5, the cartilagenous joint surface was distinct and those of *bursa subtendinea m. infraspinati* and the enlargement of *stratum synoviale* - less visible.

Fig. 2. Mediolateral radiograph of the shoulder joint 5 minutes after the intraarticular injection of 30% Uropolin.

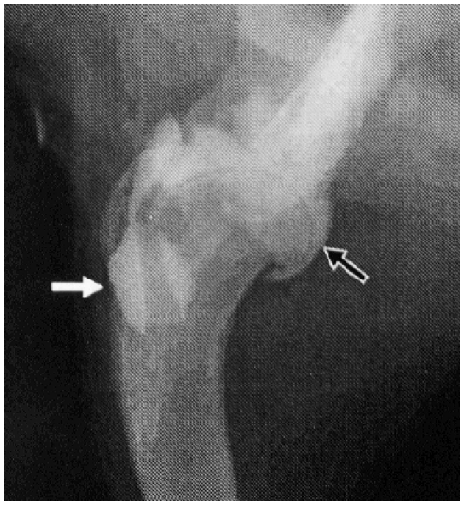

Fig. 3. Mediolateral radiograph of the shoulder joint 5 minutes after the intraarticular injection of 30% Uropolin and 0.2 ml 0.1% adrenaline hydrochloride. The white arrow shows *vagina synovialis intertubercularis*, filled with contrast medium, and the hollow arrow outlines the joint cartilage.

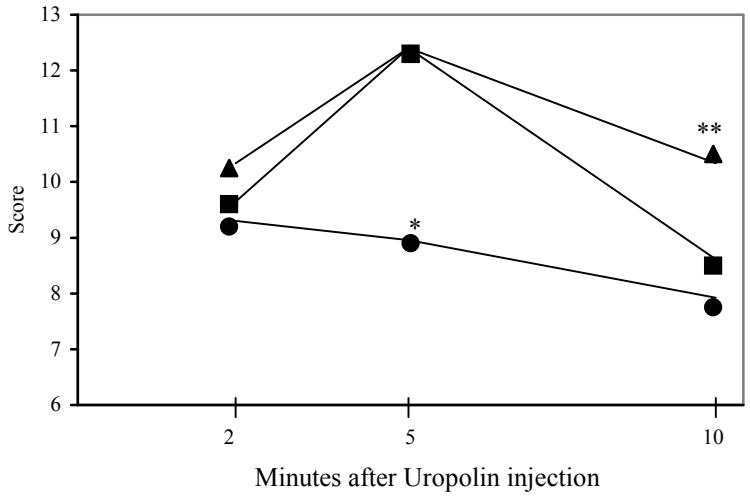

Fig. 4. Average total score from the subjective evaluation of the quality of shoulder arthrograms performed with 20% Uropolin (– –); 30% Uropolin (– –) and 30% Uropolin and 0.2 ml 0.1% adrenaline hydrochloride (– –) in dogs (n=4). * $p<0.05$; ** $p<0.01$ vs 30% Uropolin.

By post treatment minute 10, the shadow of joint surface was less evident, the enlargement was little and filled with contrast medium.

The average total scores of the radiographs from all three groups are presented on Fig. 4. The quality of radiographs was better when a higher (30%) concentration of Uropolin was used, especially at minute 5 (average score 12.5 vs 8.75 when 20% solution was administered, $p<0.05$). Afterwards, the quality of arthrographic images deteriorated in both concentrations used. The addition of 0.2 ml 0.1% adrenaline hydrochloride to 30% Uropolin prolonged significantly the duration of the good radiographic image – up to 10 minutes. The average total score by minute 10 was 10 vs 8.5 when only 30% Uropolin was injected and 7.75 when 20% Uropolin was used ($p<0.01$).

DISCUSSION

Our results suggested that Uropolin was suitable for obtaining good-quality arthrographs. The use of 30% Uropolin was more beneficial compared to 20% Uropolin. The best image was observed 5 minutes after the intra-articular injection of the contrast medium. Van Bree (1992) recommends 25% solution as optimal concentration for visualization of bursae and when a joint capsule tearing is suspected; for visualization of osteochondral lesions the recommended concentration is 20% .

The time of persistence of the good-quality image is directly related to the rate of decrease of iodine concentration within the joint. It depends on several factors: dilution of the contrast medium from joint fluids, direct absorption through the synovial membrane and dilution as result of

the osmotic effect of the contrast medium (Nielsen et al., 1984; De Crvalho and Jurik, 1985). According to van Bree and van Rijssen (1995), radiographs have to be taken not later than the 5th minute after the injection and when hyperaemia was present - even earlier. In our studies, the optimal radiographs were obtained 5 minites after 30% Uropolin was used and afterwards, the quality deteriorated rapidly. After the 5th minute, the contrast medium was rapidly evacuated from *bursa subtendinea m. infraspinati* and *bursa synovialis intertubercularis*. When the lower concentration (20%) was applied, the sharpness decreased as early as minute 2, and by minute 10, the picture was hardly inerpreted.

The addition of 0.2 ml 0.1% adrenaline hydrochloride to the contrast medium delayed its absorption because of the vasoconstrictive effect (Hall, 1974; Spataro et al., 1978). In our studies, a relative increase of the contrast of the overall radiological image was noticed and particularly, of joint structural elements. The visible difference in the quality of the image obtained with 30% Uropolin and 0.2 ml 0.1% adrenaline hydrochloride by minute 10 was further evidenced by the total score – 10 vs 8.5, when no adrenaline hydrochloride was added.

Our data helped to establish the parameters for the best visualization of shoulder joint structures in the dog, when Uropolin was used as positive contrast medium and the time, when the best possible radiograph could be obtained.

CONCLUSIONS

For arthrographic purposes, the most suitable concentration of Uropolin was 30% (22 mg iodine/kg b.w.). Its application resulted in the best sharpness of radiographic image without camouflaging of the structural elements of the joint.

The most suitable moment for arthrography with 30% Uropolin was 5 minutes after the injection. Afterwards, a quick deterioration of the radiological picture was observed.

The addition of 0.2 ml 0.1% adrenaline hydrochloride to 30% Uropolin resulted in better contrast of the radiograph as a whole and delayed the deterioration of its quality up to 10 minutes after the injection.

REFERENCES

Barret, R. and J. Owens, 1981. Clinical evaluation of a new contrast agent: ditrizoate meglumine 60%. *Veterinary Medicine and Small Animal Clinician*, **76**, 1285–1289.

Braunstein, E., G. O'Connor and A. Arbor, 1982. Double-contrast arthrotomography of the shoulder. *Journal of Bone and Joint Surgery*, **64a**, 192–195.

Carring, B., 1997. Diagnostic imaging of osteoarthritis. *Veterinary Clinics in North America, Small Animal Practice,* **27**, No 4, 777–814.

De Carvalho, A. and A. Jurik, 1985. Joint fluid after aspiration – a distrubing factor to knee arthrography. *Acta Radiologica Diagnostica*, **26**, 715–717.

Hall, F., 1974. Epinephrine-enhanced knee arthrography. *Radiology*, **111**, 215–217.

Hudson, T., 1981. Elbow arthrography. *Radiology Clinics in North America,* **19**, 227–241.

Kippenes, H. and G. Johnston., 1998. Diagnostic imaging of osteochondrosis. *Veterinary Clinics in North America. Small Animal Practice*, **28**, No 1, 137–160.

Kirbergerm, R. and S. Fourie, 1998. Elbow dysplasia in the dog: pathophysiology, diagnosis and control. *Journal of South Africa Veterinary Association,* **69,** No 2, 43–54.

Laasonen, E. and A. Lindholm, 1983. Double-contrast arthrography of the knee: a comparison between three contrast media. A*cta Radiologica (Stockholm, Sweden)*, **24**, 225–229.

Lincoln, J. and K. Potter, 1984. Tenosynovitis of the biceps brachii tendon in dogs. *Journal of the American Animal Hospital Association*, **20**, 385–392.

Maarschalkerweerd, R. and S. Boroffka, 1996. Lameness in a dog following gunshot wound; case report and management protocol. *Diergeneeskundig Ortopedisch Centrum Amsterdam*, **121,** No 24, 712–715.

Montavon, P. and D. Savoldelli, 1995. Clinical and radiologic evaluation of the integrity of medial and lateral collateral ligament of the elbow in dogs. *Schweizer Archiv für Tierheilkunde*, **137,** No 10, 475–479.

Nielsen, F., A. De Carvalho and E. Madsen, 1984. Omnipaque and Urografin in arthrography of the knee. *Acta Radiologica Diagnostica*, **25**, 151–154.

Nixon, A., T. Stashak, C. McIIwraith, W. Aanes and G. Martin, 1984. A muscle separating approach to the equine sholder joint for the treatment of OCD. *Veterinary Surgery*, **13**, 247–256.

Oates, K., A. Chen, E. Young, M. Kwan, D. Amiel and F. Convery, 1995. Effect of tissue culture storage on the *in vivo* survival of canine osteochondral allografts. *Journal of Orthopedic Research*, **13**, No 4, 562–569.

Pavlov, H., R. Warren, M. Sherman, and P. Catya, 1983. The accuracy of double-contrast arthrographic evaluation of anterior crutiate ligament. *Journal of Bone and Joint Surgery*, **65A**, 175–183.

Philipov, Zh., 1995. Veterinary Radiology, Zemizdat, Sofia.

Poulos, P., 1982. Canine osteochondrosis. *Veterinary Clinics in North America*, **12**, 312–328.

Read, R., S. Armstrong, A. Black, G. Macpherson, J. Yovich and T. Davey, 1996. Relationship between physical signs of elbow dysplasia and radiografic score in growing Rottweilers. *Journal of the American Veterinary Medical Association*, **209**, No 8, 1427–1430.

Smallwood, J., M. Shively and V. Rendano, 1985. A standardized nomenclature for radiological projections used in veterinary medicine. *Veterinary Radiology*, **26**, 2.

Snaps, F., M. Balligand, J. Saunders, R. Park R. and R. Dondelinger, 1997. Comparison of radiography, magnetic resonance imaging and surgical findings in dogs with elbow dysplasia. *American Journal of Veterinary Research*, **58**, No 12, 1367–1370.

Sparato, R., R. Katzberg, F. Burgener and H. Fisher, 1978. Epinephrine enhanced knee arthrography. *Investigation in Radiology*, **13**, 286–290.

Stobie, D., J. Wallace, J. Lipowitz, V. King and M. Lund, 1995. Chronic bicipital tenosinovitis in dogs: 29 cases. *Journal of the American Veterinary Medical Association,* **207**, No 2, 201–207.

Van Bree, H., B. van Rijssen, K. Peremans and J. Peremans, 1991. A comparison of diatrizoate and ioxaglate in

positive contrast shoulder arthrography in dogs. *Veterinary Radiology*, **32**, 291–296.

Van Bree, H. and B. Rijssen B., 1995. Positive contrast shoulder arthrography with Iopromide and Diatrizoate in dogs with osteochondrosis, *Journal of Veterinary Medicine, A*., **3**, 203-206.

Van Bree, H. and B. van Rijssen, 1998. Diagnostic and surgical arthroscopy in osteochondrosis lessions. *Veterinary Clinics in North America. Small Animal Practice,* **28**, No 1, 161–189.

Van Bree, H., 1988. Prognostic value of shoulder arthrography in bilateral osteochondrosis lesions – a review of 40 cases. In: Proceedings of the 7th International Veterinary Radiological Conference, Australia, p.69.

Van Bree, H., 1990. Evaluation of prognostic value of positive contrast shoulder arthrography for bilateral osteochondrosis in dogs. *American Journal of Veterinary Research*, **51**, 1121–1125.

Van Bree, H., 1992. Positive contrast arthrography in the dog. The application in osteochondrosis lesions compared with other diagnostic imagin techniques. CIP gegevens Koninklike Bibliotheek, Den Haag, Nederlands.

Paper received 11.02.2001; accepted for publication 08.05.2002

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