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Contrast radiographic study of venous drainage of the corpus cavernosum and the corpus spongiosum of the cat penis

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Abstract

The aim of this study was to determine the drainage routes of the corpus cavernosum penis and the corpus spongiosum penis in the cat using contrast cavernosography. Five male cats, 1.5-2.5 years old, weighing between 4.5 and 5.5 kg were investigated. The cats were anesthetized and the root and the proximal part of the penis were exposed by an incision on the perineum reaching the scrotum. Each cat was radiographed in lateral and dorsal recumbency before and during injection of contrast medium into the erectile bodies. The corpus spongiosum penis was injected at the bulb of the penis and the corpus cavernosum penis at the root. Injection of contrast media into the cavernous bodies showed that both the external and internal iliac veins drain the erectile bodies into the caudal vena cava. Drainage from the corpus spongiosum penis was from the bulb for the proximal part and from the glans for the distal part. The corpus cavernosum penis was drained only proximally, from the crura. There was a network of veins above the pelvic symphysis and the drainage of erectile bodies where through various routes into the internal and external iliac veins.

Key words

Penis, male cat, corpus cavernosum penis, corpus spongiosum penis, radiography, feline urologic syndrome.

Introduction

The venous drainage of the erectile bodies of the penis, i.e. corpus cavernosum penis and corpus spongiosum penis, has been the subject of various anatomical and radiographic studies in different animals.

Ashdown and Gilanpour (1974) described the importance of venous drainage in bulls and demonstrated that abnormal drainage of the corpus cavernosum penis may contribute to impotency in bulls.

The importance of cavernosography to demonstrate impotency in bulls due to abnormal venous drainage and vascular shunt has been described (Young et al., 1977; Ashdown et al., 1979; Gilbert and van den Berg, 1990). Beckett et al. (1972) studied the drainage of corpus cavernosum penis during quiescence, erection and detumes-

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cence phases by serial angiography in goat. The blood flow into and out of the corpus cavernosum during the non-erect state of the penis in bulls and bucks was also investigated using contrast media injection into the dorsal artery of the penis and into the corpus cavernosum penis (Beckett et al., 1997). There seems to be no report on impotency in cat due to abnormal venous drainage of erectile bodies. However in some cases of feline urologic syndrome, which produces necrosis of the glans of penis, the circulation in the penis may be affected (Steyn and Lowry, 1991). Thus, knowledge of normal drainage of erectile bodies may provide useful information for diagnosing abnormalities.

The purpose of this study is to determine the drainage routes of the corpus cavernosum penis and the corpus spongiosum penis in cat using contrast cavernosography. To the best of our knowledge, no such a radiographic study has been carried out in cats. However, the characterization of the *os* penis in the cat has been the subject of a radiographic study by Piola et al. (2011).

Materials and methods

Five male cats 1.5-2.5 years old and weighing between 4.5 and 5.5 kg were examined. For animal welfare, the cats were anesthetized by injection of a combination of acepromazine (0.1-0.2 mg/kg) and ketamine (11 mg/kg). The root and the proximal part of the penis were exposed by an incision on the perineum distal to anus, reaching the scrotum. Each cat was radiographed in lateral and dorsal recumbency before and during injection of contrast media into the erectile bodies.

The corpus cavernosum penis was injected just distal to the root and the corpus spongiosum penis was injected at the bulb of the penis. The contrast material was based on amidotrizoate (meglumine amidotrizoate plus sodium amidotrizoate, Berli Med, Madrid, Spain), which was injected using a syringe connected to an angiocatheter. To fill the veins responsible for drainage of corpus cavernosum penis and corpus spongiosum penis, approximately 4-5 ml of contrast material was injected for each erectile body. The radiographs were taken in the middle of injection progress, and the cassettes were placed directly under the body of the cat. The interval between injections into each erectile body was approximately 20 minutes. The radiographic values were focal-film distance (FFD) = 100 cm and kilovolt peak (kVp) = 52 and milliampere-second (mAs) = 3.2.

Results

Injection of contrast media into the cavernous bodies of the penis showed that both the external and internal iliac veins drain the erectile bodies into the caudal vena cava.

Drainage of the corpus cavernosum penis

The radiographs obtained from the injection into the corpus cavernosum penis showed that the corpus cavernosum penis was filled with contrast medium. Drainage

of the corpus cavernosum penis was only from the crura, at the proximal level. From the crura, blood passed through various small vessels to drain into the internal and external iliac veins (Fig. 1).

Prior to these small vessels, there seemed to be a plexus of veins inside the pelvis above the ischiatic symphysis. From this plexus, two veins drained into the internal iliac and one vein, the obturator vein, passed through the obturator foramen and joined the external iliac vein. During the injection into the corpus cavernosum penis the penis became erect and protruded out from the prepuce (Fig. 2).

Drainage of corpus spongiosum penis

The radiographs based on the injection of contrast medium into the bulb of penis revealed that the corpus spongiusum penis is drained proximally from the bulbus penis and distally from the glans. The radiographs showed that the bulb, the corpus spongiusum penis and the glans were filled with contrast medium. The vascular layer surrounding the pelvic urethra also contained contrast medium (Fig. 3). Distal drainage from the glans passed into the vena dorsalis penis. This vein entered the pelvic cavity to join the plexus inside the pelvic cavity.

Proximal drainage from the bulb passed through various veins into the external and internal iliac veins (Fig. 4). These veins seemed to be the bulbar vein, which drained the bulb, and the prostatic vein which drained the vascular layer of the pel-

Figure 1 – X-ray upon injection of contrast media into the corpus cavernosum penis (lateral view). 1: Body of the corpus cavernosum penis. 2: Crura of the corpus cavernosum penis. 3: Plexus. 4: Obturator vein. 5: External iliac vein. 6: Internal iliac vein.

Figure 2 – X-ray upon injection of contrast media into the corpus cavernosum penis (ventro-dorsal view). 1: Crura. 2: Plexus. 3: Obturator vein. 4: Left external iliac vein. 5: Left internal iliac vein.

vic urethra. Both veins joined the internal pudendal vein which drained into the internal iliac vein. From the plexus ventral to the pelvic urethra, there were veins which joined the external iliac vein, passing through the obturator foramen (Fig. 5).

Discussion

Using cats as an animal model to study penile erection (Hellstrom, 2001) and the effect of different compounds on induction of erection (Usta et al., 2004) requires to study the erectile bodies of the penis and their related structures in more detail. Drainage of the cavernous bodies of the penis in different domestic animals has been

Figure 3 – X-ray upon injection of contrast media in to the corpus spongiosum penis (lateral view). 1: Bulb of penis. 2: Corpus spongiosum penis. 3: Glans of penis. 4: Dorsal veins of penis. 5: Vascular layer. 6: Obturator vein. 7: External iliac vein. 8: Internal iliac vein.

the subject of various anatomical (Ashdown, 1973, 2006; Ashdown and Gilanpour, 1974; Ardalani, 1980; Gilanpour, 1984) and radiographic studies (Beckett et al., 1972, 1997; Gilanpour, 1972).

These studies have indicated that the corpus covernosum penis is a closed system, which drains only at a proximal level from the crura. There is no drainage at a distal level or from the glans. Ashdown and Gilanpour (1974) found that any distal drainage from the corpus covernosum penis may contribute to impotency in bulls. Our findings in cats agree with this view since also in cats the corpus cavernosum penis is drained only from the crura and there is no drainage of the corpus cavernosum penis at a distal level. Drainage from the crura is into a plexus of vein at the ventral aspects of the pelvic urethra and from there, through various routes, into the internal and external iliac veins. Studies in bulls and camels (Gilanpour, 1972; Ardalani, 1980; Beckett et al., 1997) demonstrated a proximal plexus which drains only into the internal iliac vein, with no connection with the external iliac vein.

Drainage of the corpus spongiosum penis in cat occurs from the bulb of the penis and from the glans, which is similar to what has been described in other animals (Gilanpour, 1972; Ardalani, 1980; Beckett et al., 1997). The bulb is drained through various routes namely bulbar veins and the prostatic vein, which drains the vascu-

Figure 4 – X-ray upon injection of contrast media into corpus spongiosum penis (ventro-dorsal view). 1: Bulb. 2: Vascular layer. 3: Obturator vein. 4: External iliac vein. 5: Internal iliac vein.

lar layer. Both veins finally join the internal iliac vein. Drainage from the glans is through the dorsal vein of the penis. The dorsal vein joins the proximal plexus inside the pelvic cavity and then drains into the external and internal iliac veins through various routes.

In conclusion, our study indicates that the general arrangement of draining system of the erectile bodies in cat is similar to that of other domestic animals. Further studies on larger samples may lead to recognize possible variations.

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Figure 5 – X-ray injection of contrast media in the corpus spongiosum penis (lateral oblique view). 1: Bulb. 2: Glans. 3: Dorsal vein. 4: Plexus. 5: Vascular layer. 6: Obturator vein. 7: Internal iliac vein. 8: External iliac vein.

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