Needle tract implantation after fine needle aspiration biopsy (FNAB) of transitional cell carcinoma of the urinary bladder and adenocarcinoma of the lung

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Summary

This paper reports three clinical cases of needle tract implantation of neoplastic cells on the abdominal and thoracic wall after ultrasound (US) fine needle aspiration biopsy (FNAB). Primary tumors were two transitional cell carcinomas of the urinary bladder (2 dogs) and one pulmonary adenocarcinoma (1 cat). All three masses grew up along the needle tract. To our knowledge, the seeding of pulmonary adenocarcinoma cells after FNAB on the thoracic wall has never been reported in veterinary medicine.

Keywords: tumoral seeding, dog, cat, carcinoma, fine needle biopsy

Stichkanal-Implantation eines Übergangzellkarzinoms der Harnblase und eines Adenokarzinoms der Lunge nach Feinnadel-Aspirationsbiopsie (FNAB)

In dieser Arbeit wird über drei klinische Fälle einer Stichkanal-Implantation von neoplastischen Zellen in die Bauch- und Brustwand nach sonografischer Feinnadel-Aspirationsbiopsie (FNAB) berichtet. Die Primärtumoren waren ein Übergangszellkarzinom der Harnblase (2 Hunde) sowie ein Lungenadenokarzinom (1 Katze). Das Wachstum aller drei Tumoren erfolgte entlang des Stichkanals. Unseres Wissens wurde die Streuung von Zellen eines Lungenadenokarzimoms nach FNAB in der Brustwand in der Veterinärmedizin noch nie beschrieben.

Schlüsselwörter: Tumorstreuung, Karzinom, Feinnadelbiopsie, Hund, Katze

Introduction

The hypothesis of possible spreading of neoplastic lesions during surgical procedures was first suggested by human surgeons (Gerster, 1885). Abdominal wall metastasis after resection of a gastric carcinoma was reported by Mayo in 1913. In the following years, many authors stated that biopsy procedures of neoplastic lesions could be a cause of local recurrence because of malignant cell dissemination by the needle into the surrounding tissue (Ochsner et al., 1947; Crile, 1956).

In human medicine, dissemination of neoplastic cells after ultrasound-guided fine needle aspiration biopsy (FNAB) has been referred following percutaneous aspiration of different lesions of the head, neck, thorax and abdomen. Carcinomas of the lung, liver, pancreas and prostate are over represented. The incidence of this complication seems to be low. For hepatic carcinomas, needle tract implantation has been reported to occur in 1.6% (Kosugi et al., 2004). In a study including 4365 FNAB of lung lesions, dissemination of neoplastic cells was considered an extremely rare event (Kim et al., 2003). In veterinary medicine, post-surgical recurrence at the abdominal wall of a transitional cell carcinoma of the urinary bladder was described by Anderson et al. (1989). In small animals, only three cases of needle tract implantation after FNAB have been published (Nyland et al., 2002). All three cases were carcinomas of the urinary bladder, urethra and prostate, respectively .

This paper reports three cases (two dogs and one cat) of neoplastic cells spreading to the abdominal and thoracic wall after ultrasound-guided FNAB of two transitional cell carcinomas of the urinary bladder and one adenocarcinoma of the lung.

Case 1

A 10 year old male, crossbreed dog was presented because of macrohematuria. Blood work and standard radiographs of the chest were normal. Ultrasound examination of the abdomen showed an irregular, inho-

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mogeneous thickening of the urinary bladder wall in the area of the trigone with loss of normal wall layering. A free-hand FNAB was performed using a 22G hypodermic needle connected to a 5 ml syringe. Cytological analysis revealed a transitional cell carcinoma of the bladder. The owner of the dog decided for a palliative chemotherapy protocol with meloxicam (Metacam, Boeringher Ingelheim) 0.1 mg/kg/s.i.d.. After 10 months, the dog was again referred because of a large ulcerated para-penile mass. This lesion was about 6 cm in diameter and involved the subcutaneous tissue of the abdominal wall in the same area where the FNAB needle was performed (Fig. 1). The ultrasound examination showed a diffuse, hyperechoic thickening of the urinary bladder wall up to 1 cm of thickness. There was complete loss of normal wall layering and irregular mucosal surface. In the bladder lumen some hyperechoic structures were visible and interpreted as blood clots (Fig. 2). In the area of the subcutaneous mass, the abdominal wall appeared thickened up to 3 cm with a complex mass appearance. A Tru-cut biopsy sample from the abdominal wall lesion was taken for histhopathology and examined with Hematoxylin-Eosin as well as by immunohistochemistry using Ck pool (Dako) as primary antibody. Tissue sections were immersed in 0.01 M buffered citrate (pH 6.0) and microwaved at 600 W for 20 minutes to retrieve antigens. All slides were rinsed with 0.05 M tris Buffered Saline (TBS pH 7.6) and 0.01 % Tween 20, treated with 1% hydrogen peroxide and again rinsed with TBS and Tween 20. Slides were incubated with the primary antibody overnight at 4°C and rinsed whit TBS and Tween 20. After treatment for 30 minutes at room temperature whit ENVISION, they were incubated with diaminobenzidine solution containing 0.015 hydrogen peroxide for the peroxidase coloring reaction and counterstained whit Mayer's hematoxylin.

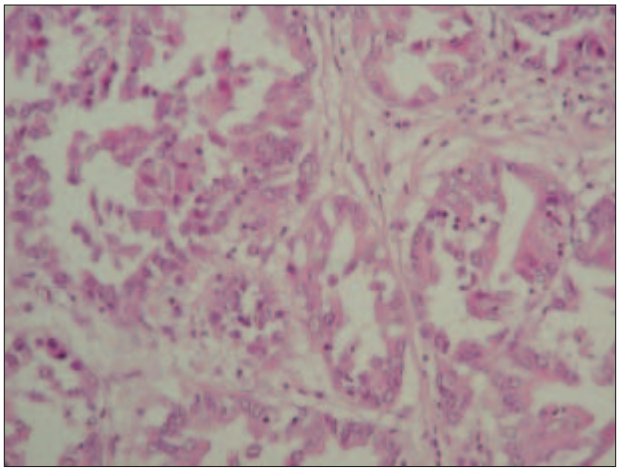

Figure 3. Microscopic sections of the subcutaneous mass, HE. In the peritoneal serosa, proliferations of anomalous transitional epithelial cells of the urinary bladder are visible. The cells show irregular margins, large nuclei, with evident nucleoli, and eosinophilic cytoplasma.

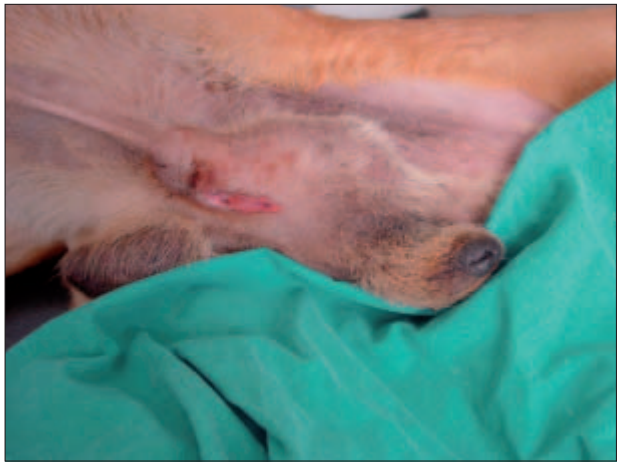

Figure 1. Large ulcerated mass in the parapenile area 10 months after fine needle aspiration biopsy of the urinary bladder transitional cell carcinoma.

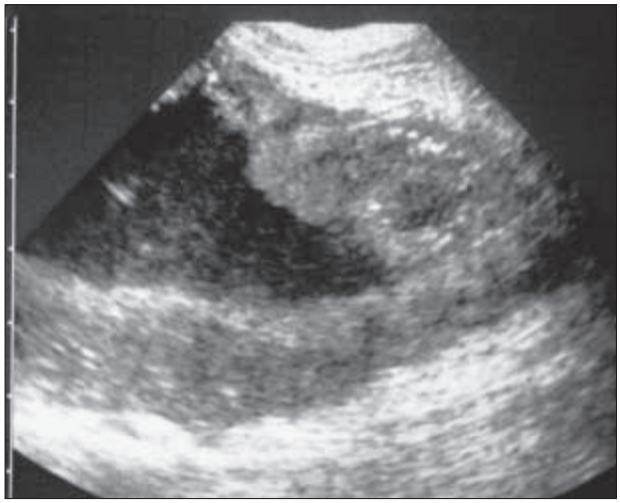

Figure 2. Ultrasonographic examination of the urinary bladder. There is diffuse, hyperechoic thickening of the urinary bladder wall. In the bladder lumen, some hyperechoic structures are visible and referred to blood clots.

In the peritoneal serosa, proliferation of anomalous transitional epithelial cells of the urinary bladder were visible, organized in a tubular and papillo-tubular well differentiated pattern (Fig. 3). The cells had irregular margins, large nuclei with evident nucleoli and eosinophilic cytoplasma. Moderate fibroplasia of the serosa was also present confirming spreading of carcinomatous cells to the abdominal wall. Due to a poor prognosis, the owner requested euthanasia.

Case 2

A 12 year old castrated male, crossbreed dog underwent cystotomy to remove bladder stones. Forty days after surgery, the dog was presented because of pollakiuria and hematuria. The ultrasound examination showed multiple hyperechoic areas in the wall of the

urinary bladder and a hyperechoic irregular, broad-based mass protruding into the lumen from the ventral wall of the bladder neck. An ultrasound-guided FNAB of the urinary bladder mass was performed using a 22G needle connected to a 5 ml syringe. Cytology confirmed the diagnosis of a transitional cell carcinoma of the bladder. The dog was treated with 1 mg/kg/s.i.d. piroxicam (Feldene, Pfizer) and 5 mg/kg b.i.d. cimetidine (Zytac, Intervet) per os.
After three months, an irregular, ulcerated, 5 cm large mass was present in the abdominal wall along the tract where the FNAB has been taken. Because of worsening of the clinical condition of the dog, the owner requested euthanasia. A post-mortem FNAB of the ulcerated mass was taken and the spreading of tumoral cells was confirmed.

Case 3

A 12 year old Persian female cat, was presented because of lameness of the right forelimb. The cat was in good body condition. Both forelimbs were radiographically normal but lung abnormalities were detected, and therefore a complete x-ray examination of the thorax was performed. Two round, well defined lung nodules, about 2 cm in diameter, were visible in the right middle and left caudal lung lobes. (Fig. 4). It was possible to visualize one of the lung nodules with ultrasound and an ultrasound guided FNAB was performed with a 22G needle connected to a 5 ml syringe. Cytologically a lung adenocarcinoma was diagnosed. Two weeks later, a 1 cm large mass was present on the thoracic wall, in the same area of the ultrasound-guided aspiration. Cytology of the mass confirmed needle tract implantation of the lung adenocarcinoma to the thoracic wall (Fig. 5). After ten days, the clinical condition of the cat worsened because of hemesis and anorexia. The owner elected euthanasia and did not allow necropsy.

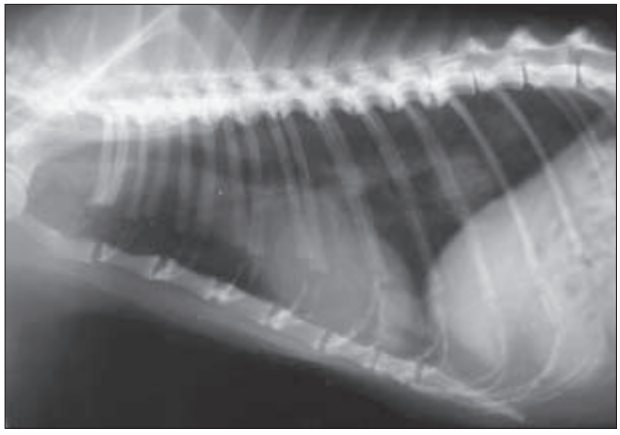

Figure 4. Right lateral radiographic view of the thorax. Persian female cat. There are two lung nodules in the right middle and left caudal lung lobes. Mutlifocal ventral spondiloses are visible.

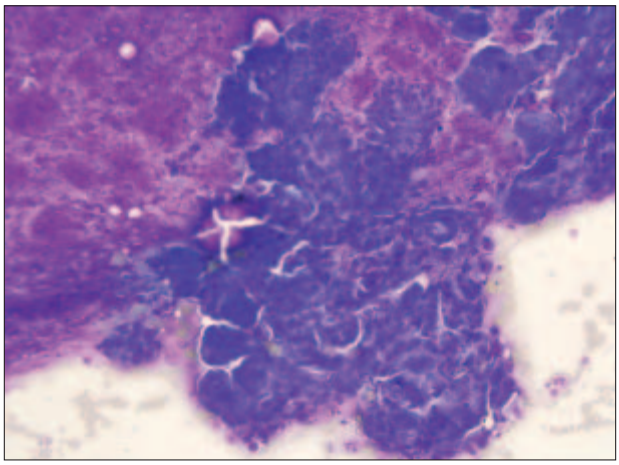

Figure 5. Fine needle aspirate from one of the pulmonary nodules: a large, three-dimensional cluster is surrounded by pinkish necrotic debris. Note the strongly cohesive arrangement of pleomorphic epithelial cells having high nuclear-to-cytoplasmic ratios. (MGG-40x) (a).

Discussion

Fine needle aspiration is a commonly used procedure both in human and veterinary medicine to obtain samples for cytological or bacteriological examination. This technique is easy to perform, quick, minimally invasive and inexpensive. Because of small size of the needle, complications related to organ damage or post-procedure haemorrhage are rare (Leveille et al., 1993). However, needle tract implantation of neoplastic cells has been reported in humans and in dogs (Nyland et al., 2002). Dissemination of neoplastic cells in the surrounding tissue by ultrasound-guided aspiration can occur during retraction of the needle. Nevertheless, tumor autotransplantation studies indicate that at least one million cells are necessary for successful implantation (Southam and Brunschwig, 1961). It is known that only few cells can survive because of local protective mechanisms and the host immune response wich are able to destroy abnormal cells (Smith, 1981). Moreover, Weiss et al. (1988) estimated that only one of 100'000–1'000'000 neoplastic cells entering the circulation may eventually produce metastasis. It has been stated that during FNAB the number of disseminated tumor cells are normally less than that required for successful implantation (Glasgow et al., 1988) explaining why needle tract implantation is rarely observed (Kosugi et al., 2004).
Factors which can influence implantation of neoplastic cells include specific features of the tumor and technical aspects of the procedure. Cell implantation is related to tumor aggressiveness (Sacchini et al., 1989). In veterinary medicine, seeding of transitional cell carcinoma of the urinary tract (bladder or urethra) has also been reported by Nyland et al. (2002) indicating that this tumor type is more prone to spread compared to others. One of the two dogs with tran-

sitional cell carcinoma of the urinary bladder (case 2) underwent cystotomy forty days before FNAB: it is not completely excluded that tumor spread occurred during surgery. However, the abdominal mass was located on the opposite side of the surgical scar and this suggests that the FNAB was the cause of the seeding. To our knowledge, the Persisan cat of this report (case 3) is the first published case of needle tract seeding of a lung adenocarcinoma following FNAB in veterinary medicine. Unfortunately, no data is available about biological behavior of lung adenocarcinoma in small animals. Lung biopsies are not routinely performed in clinical practice because pulmonary lesions are often difficult to reach. If the lesion has contact with the thoracic wall, ultrasound-guided aspiration or biopsy can be performed, otherwise only fluoroscopy or CT-guided procedures are possible. It could be hypothesized that lung adenocarcinoma in cats may have high propensity to spread to the thoracic wall after FNAB. However, in a recent study including 39 cases of CT–guided FNAB of the lung (30 dogs and 9 cats) this complication has not been reported (Vignoli et al., 2004). In this cat, the time between the aspiration procedure and the development of the chest wall mass was only two weeks. Recent published data in humans (Kim et al., 2003) has shown a recurrence time between 2 and 16 months. This could confirm a possible high aggressiveness of the lung adenocarcinoma in this cat.

In humans, it has been assessed that the risk of tumor seeding increases with the size of the needle and the number of passes. To reduce this complication, small diameter needles (22 G or smaller) have been suggested (De May, 2000). Injection of foreign material into the lesion, e.g. ethanol, saline solution, contrast medium or local anaesthetics, may promote dissemination of cells increasing the pressure inside the mass (De May, 2000). The best way to avoid the risk of needle tract implantation is to change the technique of sampling, if possible. If a malignant neoplasia of the urinary tract and prostate is suspected, cytological samples can be obtained by urethral catheterisation. This procedure consists of an external manipulation of the bladder and urethra during suction by an urethral catheter. A similar ultrasound-guided procedure (Lamb et al., 1996) offers the advantages to guide the tip of the catheter into the lesion. With this technique, the probability to obtain a diagnostic result is higher and the captured sample can be large enough to permit histological examination.

In conclusion, even if needle tract implantation after FNAB is a rare event in small animals, it should be considered, especially if a FNAB of carcinomas of the urinary tract is performed. However, on the basis of only one case it cannot be stated that lung adenocarcinoma in cats has a higher risk of neoplastic dissemination.

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