

Case reports of genital tract tumours in cows

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Abstract: The goal of this report is to analyse the incidence of genital tumours in cattle referred to the Clinic between 2016 and 2019 and to describe the outcome after the surgical tumour resection. All cattle with a confirmed diagnosis of a genital tumour ($n = 3$) were included in the study. The breed, age, tumour localisation and type of treatment were considered. Telephone interviews were used to ask owners about the integration of the cows into the herd after discharge, the survival, the reason for leaving the herd, wound complications and tumour recurrence. Three genital tumours including a vaginal fibrosarcoma, vaginal leiomyosarcoma and luteoma were diagnosed. A tumour recurrence or metastasis did not occur. In conclusion, the tumour resection was successful in all three cases. To our knowledge, this is the first clinical description of a cow with a luteoma.

Keywords: neoplasm; mass; cow; reproductive tract; ovary

Reports of tumours in cattle are relatively rare compared with other domesticated animals. One likely reason is that most cattle do not reach an age old enough to predispose them to the development of tumours (MacLachlan 1987; Gruber and Klopfeisch 2020; Vries and Marcondes 2020).

Tumours of the genital tract are classified as ovarian, fallopian tube, uterine, cervical, vaginal and vulvar tumours (Agnew and MacLachlan 2016). The yearly incidence of bovine genital tract tumours appears to vary widely with a reported range of 0.003% to 0.250% (Misdorp 1967; Naghshineh et al. 1991; Yeruham et al. 1999; Lucena et al. 2011). Yeruham et al. (1999) reported that 14.8% of the diagnosed vaginal and vulvar tumours were fibropapillomas. A fibropapilloma is the most common neoplasm of the vulva in cattle and can be caused by the bovine papillomavirus (Agnew and MacLachlan 2016). Another study reported that

39% of all diagnosed vaginal and vulvar tumours were fibropapillomas (Naghshineh et al. 1991). Other vaginal and vulvar tumours include leiomyomas, leiomyosarcomas, fibromas, fibrosarcomas, fibroleiomyosarcomas and squamous cell carcinomas (McEntee and Nielsen 1976; Naghshineh et al. 1991; Yeruham et al. 1999; Musal et al. 2007; Timurkaan et al. 2009; Avci et al. 2010).

Ovarian tumours are essentially divided into epithelial, gonadal stromal and germ cell tumours (McEntee and Nielsen 1976). Gonadal stromal tumours may be hormonally active producing steroid hormones (MacLachlan 1987), while ovarian tumours without endocrine activity are of little clinical significance in cattle (Grunert 1999). Gonadal stromal tumours include granulosa cell tumours, thecomas and luteomas and occur in cattle of all ages (Grunert 1999; Agnew and MacLachlan 2016). A granulosa cell tumour is the most common

ovarian tumour in cattle and is usually unilateral (Norris et al. 1969; Dukes et al. 1982; McEntee 1990; Trosch et al. 2015). McEntee (1990) reported that 60.4% of post-mortem diagnosed ovarian tumours were gonadal stromal tumours, whereas 8.6% were thecomas and 2.2% were luteomas. A thecoma is generally a benign tumour that can potentially produce oestrogens, and a luteoma is a benign tumour that may also be hormonally active (McEntee 1990; Agnew and MacLachlan 2016).

This case series examines the incidence of genital tumours in cattle and also describes the clinical findings, the diagnostic procedures and the outcome after a tumour resection in three cows.

The medical records were searched for bovine patients with histologically-confirmed genital tumours admitted to the clinic between January 2016 and January 2019. Three patients were identified with a confirmed tumour of the genital tract. All the cattle had undergone a clinical examination. Information that was analysed included the breed, age, sex, admission and discharge dates, tumour localisation, type of the treatment and results of the histological examination. Information about the survival, the reasons for leaving the herd, integration of the cattle into the herd after discharge, wound complications and tumour recurrence were obtained via a telephone interview and added into the medical records.

CASE REPORTS 1+2 – VAGINAL TUMOURS

CASE 1

History

A 3-year-old German Holstein cow, 18 days in milk, was referred to the clinic with a tentative diagnosis of right displaced abomasum. The cow had not been treated.

Clinical examination

The body condition score and the rumen fill and stratification were moderate and the rumen motility was decreased. Auscultation and simultaneous percussion were positive on the right side and there was considerable abdominal guarding. The faeces were loose and of normal colour, and a taut vis-

cus could be felt with the fingertips in the upper right quadrant confirming the tentative diagnosis of a right displaced abomasum.

The vaginal examination revealed a pedunculated, soft and slightly fluctuating, non-ulcerated, $5.5 \times 3.0 \times 2.5$ cm mass with a cauliflower-like appearance, attached to the hymeneal ring at approximately the 10 o'clock position (Figure 1). Introduction of a speculum was accompanied by an influx of air, which was indicative of the intact hymeneal closure of the vagina.

Tentative diagnosis and prognosis

The history and clinical findings suggested a right displaced abomasum and vaginal tumour. Surgical correction of the displacement was advised because the medical treatment alone carries a hopeless prognosis. Vaginal tumours may be benign or malignant (McEntee 1990; Agnew and MacLachlan 2016) and malignant tumours have a guarded prognosis because of the risk of metastasis (Agnew and MacLachlan 2016).

Treatment

The right flank was clipped, cleaned and aseptically prepared for a laparotomy and the abomasal



Figure 1. Slightly fluctuating, pedunculated, cauliflower-like, non-ulcerated mass measuring $5.5 \times 3.0 \times 2.5$ cm in the vestibule of a 3-year-old German Holstein cow. The mass was attached at the hymeneal ring at approximately the 10 o'clock position, and the hymeneal closure of the vagina was intact

displacement was surgically corrected. On the following day, the tail head, the perianal and perivulvar regions were cleaned and the vaginal mass was resected. An epidural anaesthesia using 5 ml of procaine hydrochloride (Procasel-2%®; Selectavet Dr. Otto Fischer GmbH, Weyarn-Holzolling, Bavaria, Germany) was administered and the tail was tied to the side.

Additionally, 10 ml of a local anaesthetic was injected into the vaginal/vulvar mucosa around the pedicle of the mass, and the pedicle and the mass were excised *in toto* along with a margin of the healthy tissue (Figure 2).

The mucosal defect was closed with three horizontal mattress sutures using a monofilament USP 2/0 suture material. The mass was fixed in 4% formaldehyde and submitted to the Institute of Pathology, for examination. The cow received trimethoprim-sulfadimidine (Trimethosel®, 24 mg/kg BM i.v.; Selectavet Dr. Otto Fischer GmbH, Weyarn-Holzolling, Bavaria, Germany) for four days and metamazole (Metapyrin®, 40 mg/kg BM i.v.; Serumwerk Bernburg AG, Bernburg, Germany) for two days.

The wound healed without complications (Figure 3), and the cow was discharged three days after surgery. The cow had two more lactations and was later slaughtered because of poor production.

Pathological findings

The cut surface of the tumour was tan coloured and firm. The histological diagnosis was a leiomyosarcoma (Figure 4).

CASE 2

History

A 12-year-old open and non-lactating cow from a hobby farm was referred to the clinic in 2018 because of a mass protruding from the vulva.

The prolapsed mass had been present for five years and remained unchanged until a few weeks before referral when it had become more pronounced prompting the owner to request the removal of the mass.

There days before the referral, the vulva was closed using a Buhner purse string suture to protect the tissue from injury.



Figure 2. Longitudinal section of the resected tumour shown in Figure 1



Figure 3. Vaginal view of the cow shown in Figure 1 two days after the tumour resection showing normal wound healing

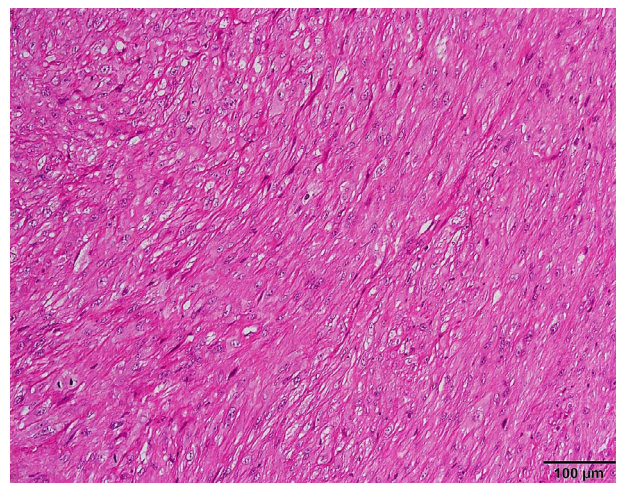


Figure 4. Histological section of the tumour shown in Figure 1, H&E stain. Leiomyosarcoma characterised by elongated tumour cells with abundant cytoplasm

Clinical examination

An $18 \times 11 \times 7$ cm mass attached to the vaginal mucosa on a 3 cm stalk prolapsed from the vulva upon removal of the suture (Figure 5). The mass had a firm elastic consistency, was dark red and non-ulcerated. The faeces were normal in consistency and colour and contained poorly digested fibres. The claws were overgrown.

Tentative diagnosis and prognosis

The history and clinical examination suggested a vaginal tumour. The prognosis is good for benign tumours, but guarded for malignant tumours because of the possible metastasis (Agnew and MacLachlan 2016). Surgical removal was elected as although a tumour recurrence was possible, it is rare (Musall et al. 2007; Timurkaan et al. 2009; Avci et al. 2010).

Treatment

An epidural and local anaesthesia were administered as in Case 1. The dorsal wall of the vulva was pulled dorsally and attached to the perineum using horizontal mattress sutures for a better visualisation of the surgical field. The tumour was excised along with the margins of the healthy surrounding connective tissue, and the wound was closed with

four horizontal mattress sutures using an absorbable monofilament USP 2 suture material. The tissue was fixed in 4% formaldehyde and submitted to the Institute of Pathology, for examination. The cow received amoxicillin (Betamox[®], 7 mg/kg BM s.c.; Bayer Vital GmbH, Leverkusen, Germany) for six days and meloxicam (Metacam[®], 0.5 mg/kg BM s.c.; Boehringer Ingelheim Vetmedica GmbH, Ingelheim, Germany) for three days. The wound healed without complications and the cow was discharged four days after surgery. A tumour recurrence has not occurred as of the time of writing.

Pathological findings

The tumour was tan coloured and ranged in consistency from soft to firm. The histological diagnosis was a fibrosarcoma (Figure 6).

CASE REPORT 3 – OVARIAN TUMOUR

History

A five-year-old German Holstein cow was referred to the clinic with a tentative diagnosis of a caecal dilatation or torsion. The cow had been five days in milk and for the previous four days had been treated with antibiotics and nonsteroidal anti-inflammatory drugs (NSAIDs) by the referring veterinarian due to retained foetal membranes.

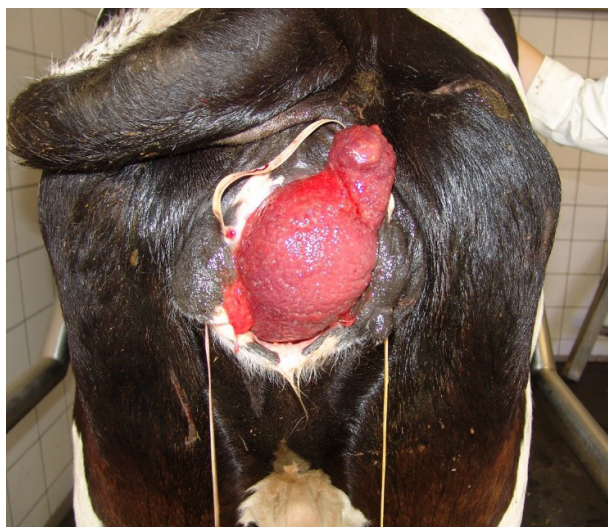


Figure 5. Vaginal tumour measuring $18 \times 11 \times 7$ cm that prolapsed after the removal of the Buehner purse string suture

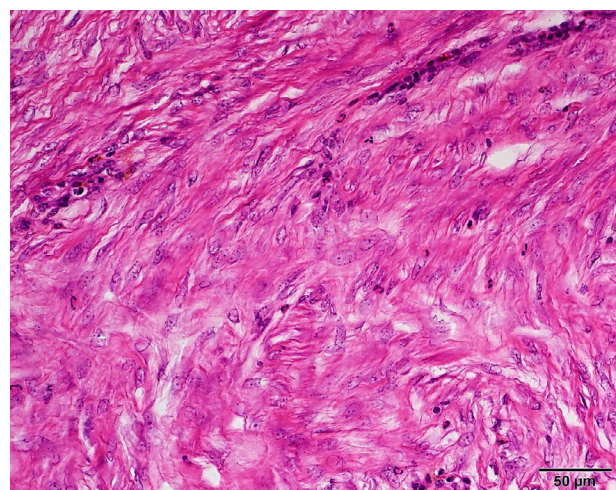


Figure 6. Histological section of the tumour shown in Figure 5, H&E stain. Fibrosarcoma characterised by cells with large round to oval nuclei and a considerable amount of matrix rich in collagen fibres

Clinical and laboratory findings

The cow had a poor appetite, and the rumen fill, stratification and motility were reduced. Auscultation and simultaneous percussion were positive in the dorsal right flank producing high-pitched tympanic and splashing sounds. There was a mild abdominal guarding. The tip of a taut, thin-walled and gas-filled viscus was palpated in the right dorsal abdomen during the transrectal examination. The viscus extended cranially and was easily differentiated from the uterus and other organs, and was identified as the caecum. The ileocaecal ligament appeared as a taut, fleshy structure on palpation, which supported the tentative diagnosis of a caecal torsion. The uterus was poorly demarcated, could not be retracted and had little contractility. A firm, poorly defined structure with an irregular bumpy surface was palpated deep in the abdomen on the right side; this structure had soft fluctuant areas and was thought to be an ovary. This was considered a possible cause for the gas-filled viscus that could be palpated. The rectum contained small

amounts of poorly digested, loose, foul-smelling faeces of normal colour, and the vaginal discharge was dark brown and malodorous.

Examination of a jugular blood sample showed leukopenia (3.4×10^9 leukocytes/l; normal $5\text{--}10 \times 10^9$ leukocytes/l). The serum biochemical examination showed an increased concentration of the total bilirubin ($17.3 \mu\text{mol/l}$, normal $\leq 8.5 \mu\text{mol/l}$) and a decreased concentration of calcium (1.86 mmol/l , normal $2\text{--}3 \text{ mmol/l}$). The glutaraldehyde clotting time decreased at 7 minutes.

Tentative diagnosis and prognosis

The history and clinical findings were suggestive of a caecal torsion and a unilateral ovarian tumour. The prognosis of a caecal torsion is poor to hopeless without surgical treatment and, therefore, surgical correction was recommended. Also, due to the possibility of the hormonal activity of the ovarian tumour affecting the fertility of the cow (MacLachlan 1987), the surgical removal of the ovary was indicated. The prognosis is favourable in cows with unilateral ovarian tumours.

Treatment

A laparotomy in the standing cow was carried out on the day of admission. One hour before the operation, the cow received antibiotics along with an NSAID and the cow was fitted with an indwelling catheter in a lateral ear vein. The right flank was prepared aseptically, and a distal paravertebral anaesthesia and an infiltration anaesthesia of the incision line were administered. There was severe dilatation and tympany and a counter-clockwise torsion (as viewed from behind) of the caecum, but there was no retroflexion and the apex pointed caudally. The right ovary was located caudoventrally and presented as a large firm structure measuring $35 \times 20 \times 25 \text{ cm}$ with enlarged functional stages (Figure 7). The caecum was exteriorised and incised releasing about 5 litres of a foul-smelling content. The incision was cleaned and sutured in two layers using an absorbable monofilament USP 2/0 suture material in a Cushing suture pattern. The caecum was then replaced into the abdominal cavity with the apex pointing caudally. The right ovary was exteriorised and removed *in toto* by cutting the mes-



Figure 7. Right ovary measuring $35 \times 20 \times 25 \text{ cm}$ exteriorised during ovarioectomy in a 5-year-old German Holstein cow. Prominent enlarged functional ovarian stages can be seen

ovarium between two transfixing ligatures made with a USP 2 absorbable suture material (Figure 8). The entire ovary was fixed in 4% formaldehyde and submitted to the Institute for Pathology, for examination.

An antibiotic treatment with amoxicillin (Beta-mox®, 7 mg/kg BM s.c.; Bayer Vital GmbH, Leverkusen, Germany) was continued until day 6 after the operation, at which time the cow developed toxic mastitis caused by *E. coli*. An antibiotic treatment with enrofloxacin (Baytril®, 5 mg/kg BM i.v.; Bayer Vital GmbH, Leverkusen, Germany) was given for 10 days combined with an intramammary treatment with a cephalosporin (Cobactan LC®, 75 mg; MSD, Animal Health, Unterschleißheim, Germany) for five days. The affected quarter was stripped three times daily, meloxicam (Metacam®, 0.5 mg/kg BM s.c., Boehringer Ingelheim Vetmedica GmbH, Ingelheim, Germany) and an intravenous 0.9% sodium chloride drip as well as a 5% glucose solution drip was administered as needed.

By day 16 after the surgery, the demeanour and appetite of the cow, as well as the mastitis, had improved, the surgical wound had healed and the daily milk production increased to 18 kg. Five days lat-

er, the cow was discharged in a healthy condition. Ten days after the initial discharge, the cow was readmitted due to a poor appetite, and suffering mastitis and a fever, and underwent clinical, haematological and ultrasonographic examinations. The recurrence of the mastitis and thrombotic valvular endocarditis were diagnosed and the cow was euthanised because of a hopeless prognosis.

Pathological findings of the ovary

The majority of the cut surface of the ovary was yellow, bulging and soft with a greasy appearance. A diagnosis of a luteoma was made based on the histological examination of the hematoxylin and eosin (H&E) and Sudan III-stained sections (Figure 9), which confirmed our tentative diagnosis.

DISCUSSION

In the genital tract of cattle, fibropapillomas and squamous cell carcinomas occur most commonly in the vulva (Meyers and Read 1990; Agnew and MacLachlan 2016), whereas smooth muscle tumours are most common in the vagina (Valentine and Barrell 2017). The latter include leiomyomas and leiomyosarcomas, but fibromas and fibrosarcomas may also occur in the vagina. Vaginal tumours are often found incidentally during artificial insemination or obstet-

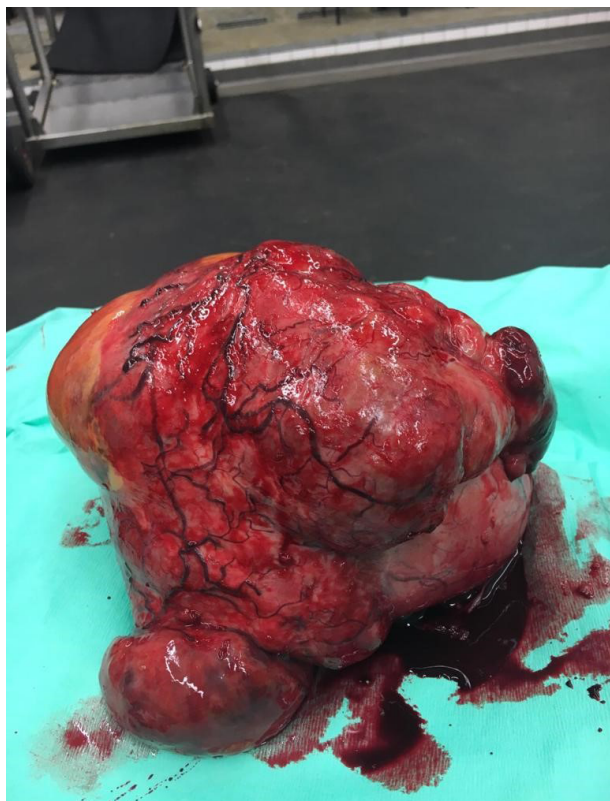


Figure 8. Ovarian tumour shown in Figure 7 after extirpation

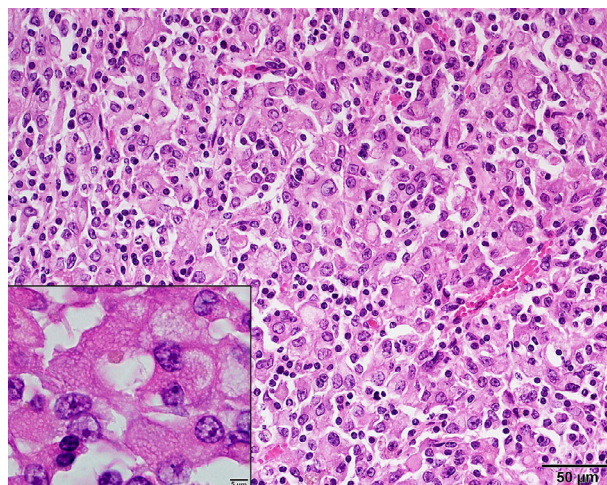


Figure 9. Histological section of the tumour shown in Figure 7, H&E stain. Luteoma with moderately pleomorphic tumour cells. Because of the lipid content, the cytoplasm of the majority of the cells had a honeycomb-like or vacuolated appearance (inset)

rical procedures unless they are large and externally visible (Meyers and Read 1990).

Both of the vaginal tumours described in this report occurred in Holstein cows and both were surgically removed. The leiomyosarcoma, which was an incidental finding in Case 1, may be associated with a tumour recurrence or peritoneal metastasis after the surgical removal (Valentine and Barrell 2017). However, this cow remained productive for a period of time and the tumour recurrence or metastasis were not evident at slaughter.

The fibrosarcoma described in Case 2 was externally visible and did not interfere with urination. It had a dry smooth surface and no evidence of haemorrhage or necrosis, which was in contrast to reports, in which this tumour is described as a mostly haemorrhagic structure with a necrotic surface (Musal et al. 2007; Hamali and Helan 2010). A tumour protruding from the vulva may be replaced into the vagina temporarily using a Buhner purse string suture to protect it from mechanical injury. At the time of this writing, a tumour recurrence had not occurred in this cow.

Gonadal stromal tumours may become endocrinologically active and cause nymphomania or anoestrus in affected cattle (Grunert 1999; Agnew and MacLachlan 2016). Metastasis is possible in cattle, but a luteoma is usually a benign tumour (Norris et al. 1969; Sartin et al. 1996; Grunert 1999; Agnew and MacLachlan 2016). To the best of our knowledge, there have been no clinical descriptions of bovine luteomas or metastasis of this tumour in cattle. The bovine luteomas described by McEntee (1990) measured from $3 \times 3 \times 1.5$ cm to $10.2 \times 9.4 \times 7.8$ cm, which was considerably smaller than the tumour in the present case (Case 3). Most luteomas are unilateral and cows are anoestrous because of the progesterone secretion by the tumour (Grunert 1999). Cows with a unilateral luteoma with little or no hormonal activity may conceive, and, therefore, those tumours may evade detection (Grunert 1999).

The differential diagnosis of luteoma includes endocrinologically inactive tumours, ovarian abscess and a haematoma. Cows in prolonged anoestrus should undergo ovarian palpation, and an ovary with a diameter of 7 cm or greater should raise the suspicion of a tumour (Grunert 1999). Additional diagnostic procedures include ultrasonography and the centesis of the ovary using ovum pick-up equipment (Herzog et al. 2008); however, caution is advised when a transrectal punc-

ture of the ovary is attempted because of the risk of haemorrhage. Rupturing the capsule of an ovarian tumour may cause a fatal haemoabdomen if a surgical treatment is not instituted immediately (Tontis et al. 1982; Masseau et al. 2004; Trosch et al. 2015). Surgical excision is the treatment of choice in unilateral luteomas as well as in other ovarian tumours (Leder et al. 1988; Herzog et al. 2008). Cows may resume normal cyclicity and become pregnant after the surgical removal of a unilateral ovarian tumour (Tontis et al. 1982; Grunert 1999; Herzog et al. 2008), but the owner should be warned that this is not guaranteed. In Case 3, it was not possible to detect any cyclic activity or heat after ovariectomy, as the cow was euthanised a month after surgery.

A surgical treatment may not be indicated in cows with bilateral ovarian tumours. In the present case, a right flank laparotomy was elected because the principal clinical problem was a caecal torsion. The right ovary was difficult to palpate transrectally because of its low abdominal position. Initially, the enlarged right ovary was thought to be involved in the aetiology of the caecal torsion, but this notion was rejected because there was no retroflexion and the caecum was not in direct contact with the ovary.

The prognosis and outcome of genital tumours in cattle depend on the stage of the tumour at diagnosis, the occurrence of metastases and the type and timing of the treatment. The surgical resection of vaginal tumours is always indicated.

Conflict of interest

The authors declare no conflict of interest.

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