



BOVINE PYELONEPHRITIS

ETIOLOGY

Pyelonephritis is an inflammation of the renal pelvis and renal from an ascending bacterial urinary tract infection. ***Corynebacterium renale* and *Escherichia coli* are the pathogens most commonly isolated from cattle with pyelonephritis.** Other bacteria that have been associated with bovine pyelonephritis include *C. pilosum*, *C. cystitidis*, *Trueperella* (formerly ***Arcanobacterium*) pyogenes**, ***Proteus* spp.**, α -hemolytic *Streptococcus* spp., and *taphylococcus*. *C. pilosum* and *C. cystitidis* are commonly isolated in conjunction with *C. renale* but are **considered part of the normal flora of the vulva.** Infection with *C. renale* may stimulate production of an antibody that causes cross reactions with the complement-fixing test for **Johne's disease.**

EPIDEMIOLOGY

Occurrence

Clinical cases are **sporadic**, even in herds found to harbor a significant number of carriers. Differences in disease prevalence can probably be explained by differences in predisposing management factors. **Chronic cystitis and pyelonephritis** (etiology unstated) have been found in 5.3% and 0.2% of cattle at slaughter. Although pyelonephritis is considered to be a predominantly a bovine disease, sheep are occasionally affected.

Source of Infection and Transmission

-Both *C. renale* and *E. coli* pertain to the resident flora of the lower urogenital tract of cattle. *C. renale* can be isolated from urine of affected or **carrier** animals **Clinically and subclinically infected cattle can shed *C. renale* with urine for prolonged periods into the environment,** in which it can survive for over 50 days. The incidence of cows excreting *C. renale* in their urine is higher in herds where the disease occurs than in herds where the disease is unknown.



- **In cattle, infection can be transmitted** by direct contact, by the use of contaminated brushes, or by the careless use of **catheters**. **Venereal transmission** of ***C. renale*** infection has also been proposed. This is suggested by the occasional occurrence of a series of cases in a herd, usually related to the use of a particular bull, and the cessation of cases when artificial insemination is used. -The organism can often be isolated from the prepuce, urethra, and semen of bulls that have no detectable lesions in the prepuce. ***C. renale*** can be a cause of **balanoposthitis** in bulls. Ascending infection of the urinary tract with *E.coli* has generally attributed to fecal contamination of the urinary tract, frequently in association with impaired urinary tract defense.

Animal Risk Factors

-**Pyelonephritis** is most common in **adult cows** in the weeks to months following parturition.

-**In young calves** pyelonephritis can often be traced back to an **ascending umbilical infection**.

- **Female cattle are more susceptible to** ascending urinary tract infections than males presumably because of a shorter and wider urethra.

- In **bulls and steers pyelonephritis** may occur as a complication of a urinary tract obstruction.

- Approximately 75% of clinical cases occur in **postparturient cows** following **abortion ,dystocia, or puerperal infection**, suggesting that inflammation and infection of the lower urogenital tract presents as an important predisposing factor.

Pathogen Risk Factors

C. renale and ***E.coli*** are normal inhabitants of the lower urogenital tract of ruminants ,but certain strains possess **pili**, a virulence factor facilitating the colonization of the mucosa of the urinary tract and the progression of the infection. **Piliated strains** of both bacteria occur and have a greatly enhanced ability to adhere to epithelial cells of the urinary tract.

Environmental Risk Factors

An increase in clinical cases is usually found in the **colder seasons** of the year and heavily fed, high-producing dairy herds appear to show an increased susceptibility. The systematic use of urinary catheters to collect urine from cows



in early lactation with **suspect ketosis** has been associated with increased occurrence rates of pyelonephritis.

Economic Importance

Unless appropriate treatment is instituted early, **the disease is highly fatal** and economic loss is mainly caused by the deaths of affected Animals .

PATHOGENESIS

Pyelonephritis usually develops as an **ascending urinary tract infection** involving successively the bladder, ureters, and kidneys. Trauma to the urethra, urine stasis, or a patent urachus in calves may facilitate ascending infection. The destruction of renal tissue and obstruction of urinary outflow ultimately result in uremia and the death of the animal .Piliated and non piliated forms of *C. renale* are present in infected animals, but their relative importance to the pathogenesis of the disease is uncertain. Piliated forms of ***C. renale* and *E. coli*** have a greater ability to attach to urinary tract epithelium, are **more resistant to phagocytosis**, and are probably important to the carriage of the organism and to the initial ascending infection.

CLINICAL FINDINGS

Early signs vary considerably from case to case. The first sign observed may be the passage of **bloodstained or cloudy urine** in an otherwise normal cow. In other cases, the first sign may be an attack of **acute colic**, manifested by **swishing of the tail, treading of the feet and kicking at the abdomen, and straining to urinate**. The attack passes off in a few hours. Such attacks are caused by obstruction of a ureter or renal calyx by pus or tissue debris and may be confused with acute intestinal obstruction. More often the onset is gradual with a **fluctuating temperature**(about 39.5°C), **capricious appetite**, loss of condition, and **drop in milk yield** over a period of weeks. Other than this, there is little systemic reaction, and the diagnostic signs are associated with the urinary tract. The most **obvious sign** is the presence of **blood, pus, mucus, and tissue debris in urine**, particularly in the last portion voided. Urination is frequent, may occur in a dribble rather than a stream, and may be painful. In the early stages, The palpable left kidney may **show enlargement, absence of lobulation, and pain on palpation**; the right kidney may be palpable in small ruminants if it is significantly enlarged.



CLINICAL PATHOLOGY

-**Urine analysis reveals proteinuria and hematuria**, and the latter is grossly apparent in most cases. **Urine pH is greater than 8.5** in most but not all cases, whereas the specific gravity has been recorded between 1.008 and 1.021.2 Microscopic examination will show **pyuria**. The presence of bacteria in suspected murine can be confirmed by culture, specific immunofluorescence, or direct microscopic examination.

- **Hematologic and blood biochemical examination** reveals **hypo albuminemia** and **hyper gammaglobulinemia** in advanced cases. **Neutrophilia** may be present but is not constant in all cases. **Serum creatinine and BUN are elevated in advanced and severe cases**, but these parameters are not reliable indicators for the presence of pyelonephritis in mild or early cases.

-**Serum creatinine and BUN concentrations** above 1.5 and 100 mg/dL, respectively, carry a grave prognosis.

- **Ultrasonography** was found useful to confirm the diagnosis and determine the extent of the disease. In particular this allows examination of the right kidney, which is not accessible by rectal examination. Ultrasonography may demonstrate cystic changes in the affected kidney, dilated renal sinuses and ureters, and a thickened echogenic bladder.

NECROPSY FINDINGS

With pyelonephritis, the kidneys are usually **enlarged and the lobulation less evident than normal**. **The renal calyces and grossly enlarged ureters contain blood, pus, and mucus**. Light-colored necrotic areas may be observed on the kidney surface. Changes visible on the cut surface include excavation of papillae, abscessation, and wedge-shaped areas of necrosis that extend from the distal medulla into the cortex. **The bladder and urethra are thick walled and their mucous membranes are hemorrhagic, edematous**.

DIFFERENTIAL DIAGNOSIS

Cases characterized by acute colic

- **Acute intestinal obstruction**
- **Urinary tract obstruction in bulls and steers**



Chronic cases

- Traumatic reticulitis Blood in urine
- Cystitis
- Urolithiasis
- Enzootic hematuria
- Postparturient hemoglobinuria
- Anaplasmosis/Babesiosis
- Leptospirosis

TREATMENT

Common wisdom holds that pyelonephritis caused by *C. renale* is best treated with **penicillin** administered parenterally daily for at least 2 to 3 weeks. For cases of suspected or confirmed infection with *E. coli* a broad spectrum antimicrobial should be chosen. A number of **antimicrobials, including ampicillin, amoxicillin, tetracycline, trimethoprim- sulfas, ceftiofur, and gentamycin** have been proposed. In early cases where little structural damage has occurred, permanent recovery can be expected following such a course of treatment. Generally, a good prognosis is suggested by an improvement in condition, appetite, and milk yield and clearing of the urine.

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References:

Constable PD, Hinchcliff KW, Done SH, et al. (2017). Veterinary Medicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs, and Goats. 11th ed. Elsevier, St. Louis, Missouri, USA.

