

## **Urinary calculi in the lower animals / by E. Crisp.**

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1. *Urinary calculi in the lower animals.*

By E. CRISP, M.D.

The calculus exhibited was recently taken from the urinary bladder of a Japanese dog that had been a short time only in this country, and but little is known of its history. The animal was of the female sex. The stone is of a white colour; of a rounded form; smooth externally; weighs 400 grains, and measures four and a half inches in its largest circumference. Internally it is laminated, of a white colour, of a friable structure, and judging from others examined, consists chiefly of carbonate of lime.

I have formed a table of the various calculi from the lower animals that I have examined in different museums, and seen described in museum catalogues and in the works of English veterinary writers, for the purpose of ascertaining the nature of the food of these animals and the chemical composition of the calculi, so that I may compare them with the like products in man, and I shall endeavour by this means to throw some light on the origin of these urinary concretions in the human subject.

One of the most interesting and practical matters connected with these formations in the lower animals is the occurrence of urinary deposit in male sheep when fed on saccharine and carbonaceous food. I have had an opportunity of seeing many examples. My brother, the late Mr. Thomas Crisp, of Butley Abbey, Suffolk, lost several of his best rams from this cause, and I have known many celebrated breeders of sheep that have suffered similar losses. The obstruction occurs only in rams and in wether sheep, and is clearly traceable to the nature of the food. I may observe that the formation of the extremity of the penis in the male sheep tends also to favour these obstructions, the urethral canal in the vermiform appendix being small and contracted. The urethra is blocked up with a gravelly deposit, the particles of which vary in size from those of fine sand to a mustard seed. Sometimes the deposit is confined to the urethra, where it may become hard, and cylindrical in form; in other instances the bladder and pelves of the kidneys are the seats of the sediment. There is great straining, bloody urine, and sometimes rupture of the



bladder. The sabulous matter is composed chiefly of the ammoniaco-magnesian phosphate. I believe that I could produce this deposit at pleasure in male sheep by feeding them on saccharine roots and oil-cake, so that here we have positive evidence that one form of concretion in a lower animal depends upon the nature of the food. The sheep is, moreover, subject to small compact calculi in the bladder and kidneys, but these are composed generally of carbonate of lime, and are comparatively rare.

The largest and best collection I have met with of urinary calculi in the lower animals is in the Hunterian Museum. At the Veterinary College Museum, there are several from the horse and ox, but there is no proper account of these in the catalogue. In other museums, as St. Bartholomew's, Fort Pitt, Irish College of Surgeons, and the Boston Museum, specimens are met with. The collection in the Hunterian Museum is thus classified, and the analysis of the calculi will enable us to form an interesting comparison of the composition of human urinary calculi and those of the lower animals :

*Uric acid*.—Ostrich, and bladder of iguana.

*Urate of ammonia*.—Kidney of sheep, rectum of fowl, eagle, and boa constrictor.

*Oxalate of lime*.—Two, ureter of hog.

*Uric oxide* (xanthic oxide).—Guano.

*Phosphate of lime*.—Ureter of sturgeon, beluga, mosco, and rabbit.

*Phosphate of magnesia and ammonia*.—3 dog, 1 hog, and 1 whale.

*Mixed phosphates* (fusible calculus).—3 dog, 1 monkey (probably from the kidney), 3 horse, 6 ox, and 2 hog.

*Carbonate of lime, or carbonate of lime and magnesia*.—Horse 19, ass 1, hog 5, rhinoceros 1, ox 13, and tortoise 1.

It will be seen by the above analysis that the carbonate of lime calculus, so rare in man, is the most frequent among the lower animals, and that the uric acid calculus, so common in the human subject, is comparatively infrequent in the lower mammals.

Urinary calculi in wild animals are probably very rare. Sir D. Gibb ('Trans.,' vol. vii, p. 401) showed a urinary calculus weighing three grains, and composed of oxalate and carbonate of lime, from the bladder of a field mouse (*A. arvalis*). This animal was found by my brother, Dr. Henry Crisp, on the wall of a salt-water river in Suffolk. But the most remarkable example is described in the 'Boston Museum Catalogue.' Calculi weighing 86 lbs. were taken from the urinary bladder of an old "bull" sperm whale; one of these



was double the size of a man's fist (a calculus from this animal is in the Hunterian Museum). These calculi were composed of carbonate of lime and ammonia, with some phosphate of lime. With the exception of the hare, rabbit, and rat (which can scarcely be considered wild animals, or animals living in a state of nature), I am unacquainted with other examples. The largest urinary calculus that I know of, is the one I exhibited at the Society from the urinary bladder of the horse ('Trans.,' vol. xv, p. 256); it weighed 20 lbs.

The following is the summary of a table I have made of urinary calculi from the lower animals, with the exception of those in the whale. The cases have all occurred in the United Kingdom. I have placed them in systematic order:

Monkey (kidney) 1, dog 10, mouse 1, rat 2, hare 1, rabbit 1, ass 1, horse 46, hog 15, rhinoceros 1, sheep 6, goat 1, whale 2. The sedimentary deposits in the sheep are not included.

It will be seen that, with the exception of the whales, none of these animals are carnivorous. The domesticated dog is a mixed feeder, many of these animals getting a large amount of vegetable food. As regards the size of these calculi, they are much larger in the horse than in any other animal. In the ox and sheep they are generally small, in the hog of larger size, and in the dog larger than in any of the above-named animals with the exception of the horse. In the Hunterian Museum there is a calculus from the bladder of a mastiff weighing 12 oz.

In birds I have often found concretions in the cloaca, and these are all taken from the carnivorous and piscivorous species; they contain a large proportion of urate of ammonia. Although the alvine and urinary evacuations in the bird are mixed in the cloaca, these concretions are evidently connected with an abnormal condition of the kidney, as the ureters are generally distended with the calcareous deposit.

The composition of the calculi found in the tortoise, iguana, and in the ureter of the sturgeon, has been already spoken of.

Can we draw any useful deductions from the above evidence, imperfect as it is, respecting the origin of urinary calculus in the human subject?

But little is said about the supposed causes of calculus in man, and it has been erroneously assumed by nearly all writers upon the subject that it is scarcely known in tropical climates. Mr. Erichsen says, in his work on surgery, "he believes that in tropical climates



the disease is scarcely known," but in some tropical climates it is far more frequent than in the temperate zones. It prevails more in Norfolk and Suffolk, where there are more examples than in any four counties in England and Wales, although I have reason to believe that in these counties it is less frequent than formerly. The constant use of the Norfolk and Suffolk dumplings as articles of diet has been assigned as one cause of the greater prevalence of this affection, and I think it is not an unlikely one. Next to these localities, urinary calculi are more frequent in the north midland counties. In Scotland and Ireland it is comparatively infrequent. But the interesting revelations recently made in the 'Indian Annals of Medical Science' are likely hereafter, when the diet and other matters connected with the habits of the people, and the localities they inhabit, are more fully investigated, to throw much light upon the subject. Dr. Greenhow, 'Annals,' 1866, wrote to forty different surgeons in the north-west provinces of India for the purpose of ascertaining "the nature of the operation, amount of division of the prostate, use of tubes, the comparative success of lithotomy and lithotripsy, and the effect of chloroform?" From twenty surgeons he received answers, and these gentlemen, most of them attached to dispensaries, had operated upon 1851 patients, including 91 females. Dr. Courtney had 201 cases in twelve years, Dr. Keernander 28 cases in one year, Mr. Gorgaon 143 cases in six years, Mr. Newton 48 cases in four years, and the cases of the remainder occurred within a short period. Of these 1851 examples 1160 occurred among Mussulmans, and 551 were Hindoos. Taking the population into account, the numbers are about equal; the youngest patient was one and a quarter years; the largest stone weighed 11 oz., the smallest 3 grains, and the largest number of stones was 12; the mortality after operation 1—6·93. Scurvy prevailed to a great extent both among Hindoos and Mussulmans. An interesting statement is made respecting the analysis of a collection of calculi from this district of India; only two kinds were found, bone calculus and earthy phosphates and ammonia (p. 14). *No lithic acid nor triple phosphate calculi were found.*

In another communication in 1868, by Dr. Garden, an analysis is given of 831 cases of urinary calculus (including 7 females) which occurred at the Saharunpore Dispensary (Calcutta pres.) during a period of eighteen years; the mortality after operation was 1—7·63, two or three per cent. less than the mortality in the United



Kingdom. Of these, 577 were Hindoos and 254 Mussulmans, forming, as in the example already quoted, but a slight difference when the number of the two castes is taken into account. The chief causes assigned by Dr. Garden are exposure, bad grain, bad digestion, and rheumatic complaints. An analysis of 250 calculi examined forms a remarkable contrast with that already quoted :—15 were fusible, 1 triple phosphate, 3 phosphate of lime, 81 uric acid, 55 urate of lime, 23 urate of ammonia, 72 oxalate of lime. Of these, 58 were pure calculus, uric acid 26, fusible 10, oxalate of lime 10, urate of lime 5, urate of ammonia 1, triple phosphate 1.

In the Museum of the College of Surgeons of Edinburgh there are 95 urinary calculi, of which the analysis is given :—Uric acid 29, cystic oxide 2, oxalate of lime 5, phosphates 20, alternating 26, mixed 11, carbonate of lime 2.

Dr. Prout quotes the analysis of 823 calculi examined by Brande, Henry, Marcet, himself, and others ; 294 of these were lithic acid (98 nearly pure, 151 mixed with a little oxalate of lime), 113 oxalate of lime, 3 of cystic oxide, 202 phosphates, 186 alternating.

I have not mentioned the various combinations, as my object is only to show the difference between the general composition of urinary calculi in Europeans ; in those found among some of the natives of India ; and in the lower vertebrates.

As I have said before, calculous disorders are far more frequent in some districts of India than in European countries, but in other parts of our Indian possessions the natives are comparatively exempt. Why is this ? Are the domesticated animals in the districts I have mentioned also more liable to these formations ? These questions will not be solved till many important matters have been more minutely studied, but three important facts are learnt from this investigation. Firstly, that the composition of calculi in the lower animals differs materially from that of human calculi ; secondly, that urinary calculi are seldom or never met with in the purely animal feeders ; and, thirdly, that sedimentary and gravelly deposit may be produced almost at will in the sheep, by the food named. I venture, in conclusion, to express my belief that hereafter, by careful and well-directed experiments on the lower animals, that much light may be thrown on the origin of calculous disorders in man.

*December 7th, 1869.*



2. *Calculus from the cloaca of a brown Pelican (Pelicanus fuscus).*

THE calculus taken from the cloaca of this bird weighs 2 oz. 200 grs. ; it measures  $3\frac{3}{4}$  inches in length, and its largest circumference is 5 inches. It is tolerably smooth on its surface, of a cylindrical form, hard consistence, and of a laminated structure, and appears to be composed chiefly of lime and urate of ammonia, although no analysis has been made. Unfortunately I had not an opportunity of examining the bird, but I ascertained that it was emaciated, and that its death was gradual. I have met with many concretions of a smaller size in the cloaca of birds, especially in the accipitrine and palmipede divisions, but I have never before seen or heard of a calculus of this size in a bird. In my recent communication, at this Society, on calculi in the urinary bladder of quadrupeds, I stated that these calculi were chiefly confined to the vegetable feeders and to the mixed feeders, and that they were rarely found in the bladders of purely carnivorous animals. In birds they are more common in carnivorous and piscivorous feeders. In every instance where these calculi existed I have found the kidneys mottled in appearance, fatty, and enlarged.

May 3rd, 1870.

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(*Proceedings of the Pathological Society,* 1870.)

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