

VERMINOUS ANEURYSM IN EQUINES OF PANAMA¹

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Verminous aneurysm is a disease peculiar to equines and caused by the immature stages of a common nematode parasite, *Strongylus vulgaris*. This worm was first seen in arterial lesions by Ruysch in 1665 (10), but its specific identity and constant association with arteritis were first demonstrated by Looss in 1901 (9). Almost invariably it is the anterior mesenteric artery which is affected. In its adult stage, *S. vulgaris* is typically localized in the cecum, although it may occur in any part of the large bowel, and, like the hookworms, it is a violent blood-sucker. In Panama, this appears to be the most frequently occurring parasite of both native (4) and imported equines (5, 7). The extent to which parasitism of the mesenteric artery is a normal part of the life-history is still unsettled. There is some evidence that this occurrence may be somewhat fortuitous. Animals become infected by the ingestion of infective larvae during grazing and in many respects the life-history of *S. vulgaris* parallels that of the human hookworms.

MATERIAL AND METHODS

The data of this report are based upon 202 autopsies, which included 116 horses, 84 mules, and 2 burros. Of these, there were 105 native animals from different parts of the Republic and 97 imported animals which were owned by the Panama Canal

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Department of the United States Army. The methods of autopsy have been described elsewhere (5), although it has seemed advisable to emphasize at this time that an aneurysm of considerable size, unless looked for, may be missed because of its location dorsally in the body cavity where, as a rule, there is a large amount of fatty tissue.

OBSERVATIONS AND DATA

Incidence of arterial disease. Of the 202 animals in this series, 161 were found to harbor larvae of *S. vulgaris* in arterial lesions—an incidence of about 80 per cent. Arterial infestation may be regarded, however, as a conservative index of this disease for the reason that some animals not having active lesions show evidence of earlier injury. On the other hand, the severity of the condition as seen at autopsy is highly variable. This figure, then, represents the *active* cases of arteritis or aneurysm but tells nothing of the functional damage involved.

It has seemed natural to inquire into the relative occurrence of arterial infestation among different kinds of equines and in native and imported stock. These data have been summarized in table 1. It may be noted that the native animals included a majority of horses, while the imported ones were largely mules. Although the rates of infestation for horses and mules were not greatly different, it has been interesting to find that in both groups the horses showed the lower incidence. Also the figures for both horses and mules were slightly higher for the native stock. Considered as a group, arterial infestation was encountered in 73 per cent of the 116 horses and in 89 per cent of 84 mules. A study of table 1 emphasizes a similarity in this respect among the different kinds of equines and between the native and imported stock. It should be added, however, that the severity of the disease was markedly greater in the native stock, and that this is a consideration of importance.

When these data are analyzed with respect to the ages of the animals, as has been done in table 2, it becomes apparent that all ages are affected. The finding of arterial infestation in 2 of 5 foals under 1 month of age has suggested that there may exist

the possibility of intra-uterine infestation (3). It is unfortunate that a larger series of very young animals was not available, yet in so far as the present data indicate, it appears that after 1 or 2 months of age the incidence of infestation rapidly reaches its standard level. This is evidenced by the fact that in the present

TABLE 1

Incidence of arterial infestation with larvae of S. vulgaris in different kinds of equines

KIND	NUMBER AUTOPSIED			NUMBER INFESTED			PERCENTAGE		
	Native	Imported	Total	Native	Imported	Total	Native	Imported	Total
Horses.....	81	35	116	62	23	85	77	66	73
Mules.....	22	62	84	20	55	75	91	88	89
Burros.....	2	0	2	1	0	1	50	0	50
Total.....	105	97	202	83	78	161	79	80	80

TABLE 2

Incidence of arterial infestation with larvae of S. vulgaris in different age-groups

AGE-GROUP	NUMBER AUTOPSIED			NUMBER INFESTED			PERCENTAGE		
	Native	Imported	Total	Native	Imported	Total	Native	Imported	Total
Under 1 month	5	0	5	2		2	40		40
1 month to 6 months	12	0	12	11		11	91		91
7 months to 1 year	6	0	6	6		6	100		100
1 year to 5 years	10	0	10	8		8	80		80
6 years to 15 years	72	63	169	56	53	134	78	84	79
Over 15 years		34			25			74	
Total.....	105	97	202	83	78	161	79	80	80

series there were 18 animals between 1 month and 1 year of age, 17 of which were infested (94 per cent). It has seemed, then, that infection is acquired at a very early age, and that throughout the life of the animal there is constant superinfection. This is a particularly plausible view since *S. vulgaris*, unlike the other

Strongylid species, has been found to occur as frequently and as abundantly in the older animals as in the younger (6). Such circumstances cast doubt upon any hypothesis which would explain the few unparasitized cases on the basis of an absence of exposure. On the other hand, if a natural immunity is operating, it would be indicated as a control measure to breed the immune stock.

There is relatively little about the occurrence of verminous arteritis which has become a matter of scientific record, yet there is nothing new or unusual in the data which have been presented above. As far back as 1870, Bollinger (1) estimated that probably 90 to 94 per cent of horses in Europe were affected. Smith's "Manual of Veterinary Physiology" contains the following statement: "Parasitic trouble of the vessels is very common, the main seat being the anterior mesenteric artery, which is rendered rigid and aneurysmal, and has its lumen obliterated by *Strongylus armatus*." It is remarkable how very little interference with the intestinal circulation occurs in consequence of this parasitic invasion and it is equally astonishing how few horses are free from this infection. It is probably the most widespread equine parasite" (12, p. 100). In Sisson's "Anatomy" occurs this footnote: "In the majority of subjects this vessel (the anterior mesenteric artery) and some of its branches are the seat of more or less extensive verminous aneurysm produced by the *Sclerostomum vulgare*." In the author's experience an entirely normal specimen is quite unlikely to be encountered, except in very young foals" (11, p. 665). From these statements it is apparent that there are authoritative workers who recognize verminous aneurysm of equines as a very common condition. It does not appear, however, that they are agreed upon its importance except, perhaps, to wonder that more functional damage is not done.

Localization of arterial disease. Hutyra and Marek (8) summarized this phase of the subject, and it is clear from their review that a number of different arteries may be involved in the

² *S. vulgaris*.

process. Our findings, however, have impressed us with the fact that seldom is a lesion present in any artery when there is not also some involvement of the anterior mesenteric artery, and most often this affects the region where this artery bifurcates to form the dorsal and middle colic arteries. Other arteries which were involved during the present survey, listed in order of frequency, were the mesenteric "stub," the right mesenteric, the dorsal and middle colic arteries, the posterior mesenteric, renal, coeliac, and aorta.

Nature of the lesion. Some attention has been given to the nature of the lesion because it is this which suggests the extent of real functional injury. Grossly there are three main types: (a) Frank aneurysms (plate 1); (b) thick-walled vessels with some dilation (plate 2), and (c) tortuous, sclerotic vessels of diminished caliber (plate 3). The first is often clean and probably not functionally serious. The second is common enough but not particularly serious unless there is a marked mural thrombosis. A number of our cases have suggested, however, that these aneurysms tend to thrombose rapidly and throw off emboli when a cachetic or overworked condition is superimposed. In 1933, Clark *et al.* directed attention to the risk constituted by this condition in cases where tartar emetic and other intravenous drugs were administered (2, pp. 377-8). Animals dying under such conditions show marked ascites and edema of the intestinal tract. The third type is probably the most serious and certainly the most common. Pathologically these lesions are quite typically characterized by sclerosis, thickening of the wall, and mural thrombosis. In consequence, there is loss of elasticity and diminished caliber. Although arteries affected by *S. vulgaris* tend toward fibrosis and thickening, for which reason they infrequently rupture, we have noted several instances of incipient perforation, one of these cases evidencing a clear break through all of the vascular coats, the blood being retained only by a layer of fibrotic fatty tissue.

The causative agent. Prior to 1901, the intra-arterial parasites were thought to be distinct from those of the intestine. In that year, Looss (9) established that the former was only a develop-

mental stage of a common intestinal form and stated that he did not observe any species other than *S. vulgaris* infesting the arterial lesions. Examinations of the larvae collected during our studies have supported Looss' view that no other species is associated with the condition.

The number of larvae infesting injured vessels is not large; in our series, there were usually from 5 to 10. Rarely there occurred over 30 and in a very few instances where the entire lesion was kept for demonstration the number could have been safely estimated at more than 50. The larvae from arterial lesions varied in size from 8 to 22 m., many of them approaching the size of the adult worm. They are of a creamy color, nearly translucent, different markedly in this respect from the adult worms which are generally dark blue. Not infrequently these larvae are found in small "whip-socket" tunnels in and beneath the intima of the vessel. When a thrombus is present, this appears to be the part in which the majority of larvae are located. It may be added at this point that the mature worm is also a very dangerous parasite because of its blood-sucking habits and its very common occurrence.

DISCUSSION

It may be reviewed that, on the basis of our autopsies, active verminous aneurysm or arteritis appears to affect about 4 out of 5 equines on the Isthmus of Panama; that the lesion normally involves only the larger mesenteric arteries; that the cause of this disease is *Strongylus vulgaris*, which is the most frequently occurring parasitic species of Isthmian equines and one of the most abundant.

In the face of these considerations, one's interest naturally turns to the importance of the disease. In view of what has already been demonstrated, it might seem that the importance of this condition is evident, yet there are some marked differences of opinion. Many argue that a large aneurysm or one throwing out a thrombotic embolus, or one obliterating the lumen of a large artery, may lead to colic. This is probably true, but to persist in emphasizing such a view is, so it seems to us, to miss

the point. It is important to add that the 97 army animals of our series had almost no histories of colic. Likewise, intermittent lameness is a symptom which has been emphasized, and this also undoubtedly occurs from this condition. But the animals of our series did not show intermittent lameness. A large proportion did have "equine osteomalacia," believed to be a deficiency disturbance, yet no one should discard without investigation the possibility that the nutritional disturbances are the local result of diseased arteries. Indeed it has seemed that no one understands the importance of verminous aneurysm. Certain viewpoints have impressed us as being conservative and virtually inescapable. In the first place, it can scarcely be doubted that severe arteritis or an aneurysm are bad functional units. In human medicine an analogous condition is viewed with some alarm. Furthermore, it is reasonably clear that animals, even when severely affected, appear to thrive if granted freedom from hard work and access to good food. It does not seem to be mere coincidence that the army equines turned over to us were condemned upon the general grounds of unserviceableness. The fact that verminous arterial disease in equines is characterized most often by effusion of fluid into the body cavity and intestinal walls and by an inability to do hard work has precluded an adequate diagnosis of this condition.

Finally, if the disease is economically important because of its deleterious effect upon the efficiency of equines, the objective of research upon the condition must be directed toward prevention and control. It is not yet apparent how these may be accomplished under the conditions where they are most needed. In so far, at least, as the situation in Panama is concerned, these conditions imply that the methods employed shall be (a) applicable to large herds where equines cannot be individually handled, (b) effective in open, unrestricted pasture areas where the number of animals and the extent of their grazing areas are only vaguely known, even by the owners, and (c) inexpensive and requiring a minimum of effort. Under such conditions, it is apparent that methods necessitating isolation of animals, manure-storage, pasture-rotation, stable-cleaning, individual drug treat-

ments, and the like, are not feasible. In the last analysis, however, it is probably true that expense alone is the factor preventing the proper control of verminous aneurysm at the present time.

SUMMARY

Postmortem studies of over two hundred equines in Panama revealed active verminous arteritis or aneurysm in about 80 per cent of the cases. The disease was encountered in animals of all ages, in both native and imported stock, and in horses, mules, and burros. The typical lesion affected the anterior mesenteric artery and was characterized by tortuosity, sclerosis, thrombosis, and diminished caliber. Usually there were less than ten worms—larvae of *Strongylus vulgaris* (Looss, 1900)—in the lesions. Many of the animals covered in this survey were condemned because of unserviceableness, although a larger proportion was reasonably representative stock of this locality. The probable effect of verminous arteritis upon the efficiency of equines was emphasized and the prerequisites for the type of control needed in this region were outlined.

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PLATE 1

VERMINOUS ANEURYSMS ("TYPE 1") AFFECTING (A) THE AORTA, (B) THE ANTERIOR MESENTERIC ARTERY, AND (C) THE AORTA AND THE MESENTERIC "STUB"

These lesions were relatively clean at autopsy and probably constituted more of a potential than actual source of functional damage. Frank aneurysms of this nature are relatively uncommon.

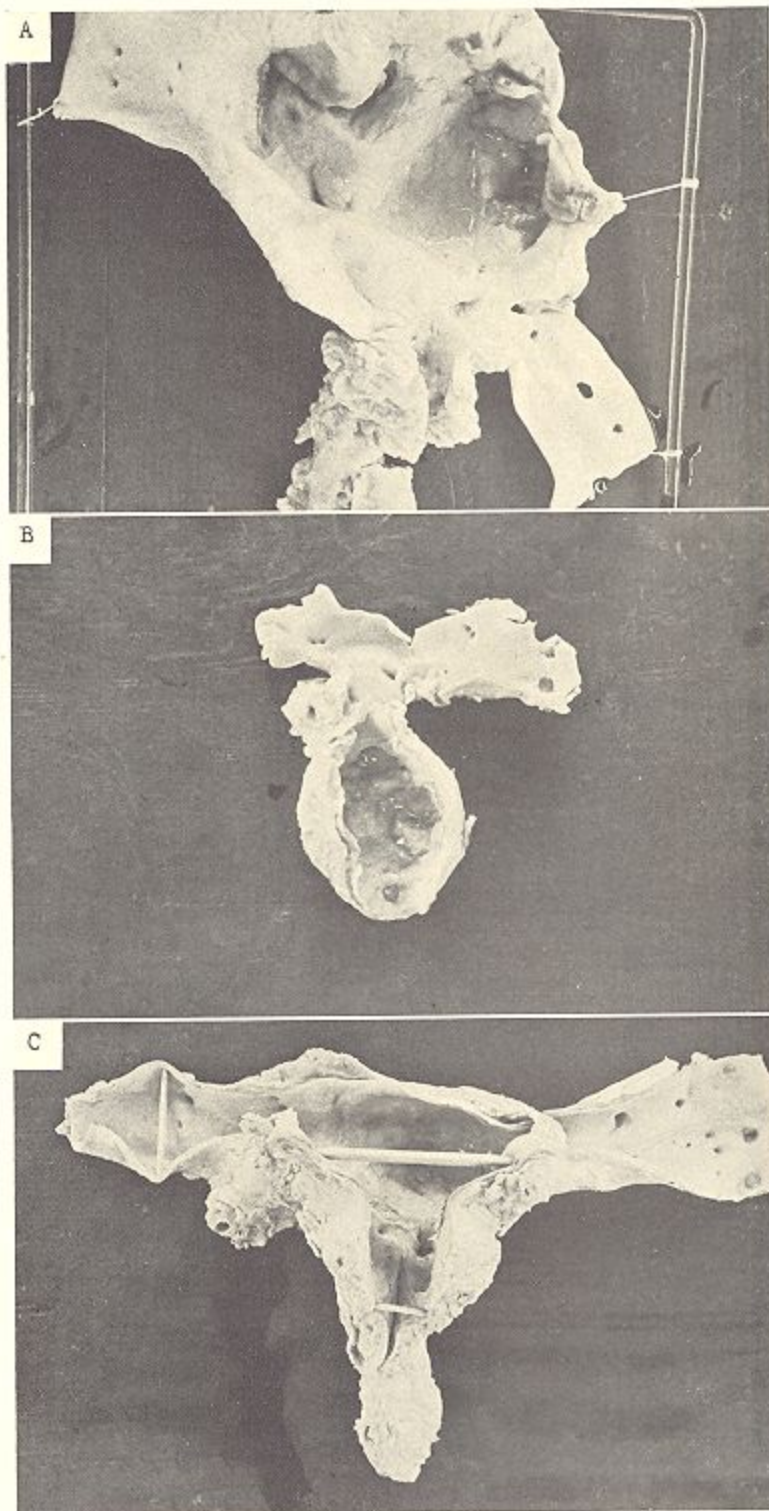


PLATE 2

THICK-WALLED VESSELS SHOWING SOME COMPENSATORY DILATION ("TYPE 2")

To the right of *A* is a nearly normal vessel for comparison. In the lower arteries of *B* and *C* some worms can be seen (*Strongylus vulgaris*), and in these views also the thickened and damaged vascular walls are fairly prominent. Lesions of this nature are common.

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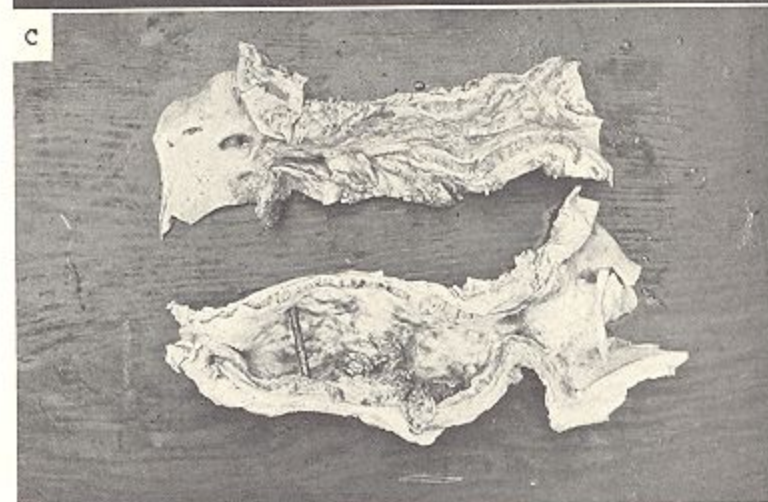
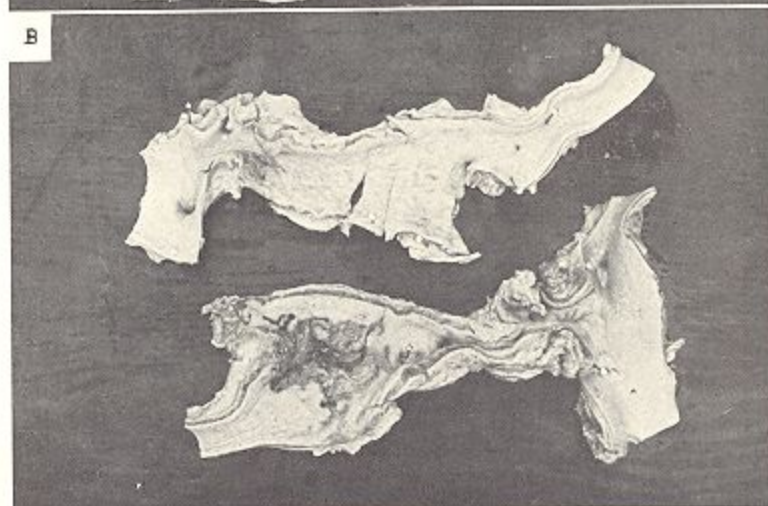
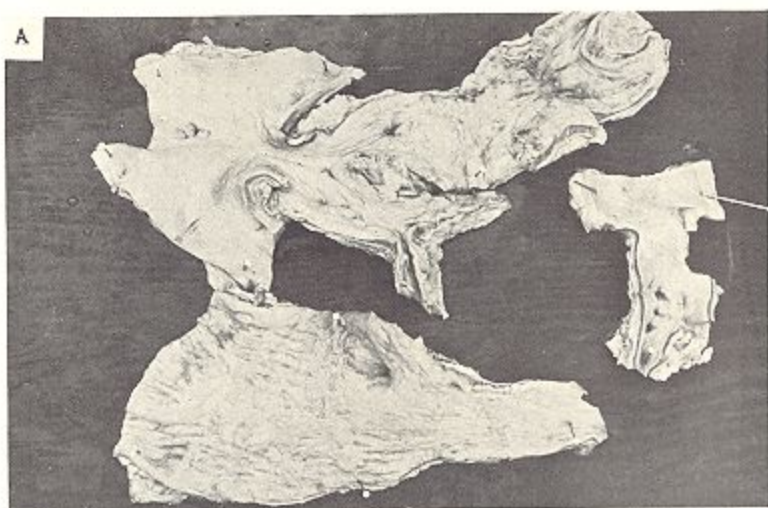


PLATE 3

TORTUOUS SCLEROTIC VESSELS OF DIMINISHING CALIBER ("TYPE 3")

In most cases it was necessary to dissect away the wall of the vessel in order to expose the lumen. On the right of *A* is a normal vessel for comparison. Conditions such as shown to the right of *B* and *C* suggest that the three "types" of veninuous arterial lesions discussed in this report are somewhat arbitrary. Note that each of these vessels shows stenosis or almost complete obliteration of the lumen. This type of lesion is very common and is regarded as functionally serious.

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