

Hydatid disease in New Zealand / by R. Gordon MacDonald.

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HYDATID DISEASE

IN

NEW ZEALAND.

BY R. GORDON MACDONALD,

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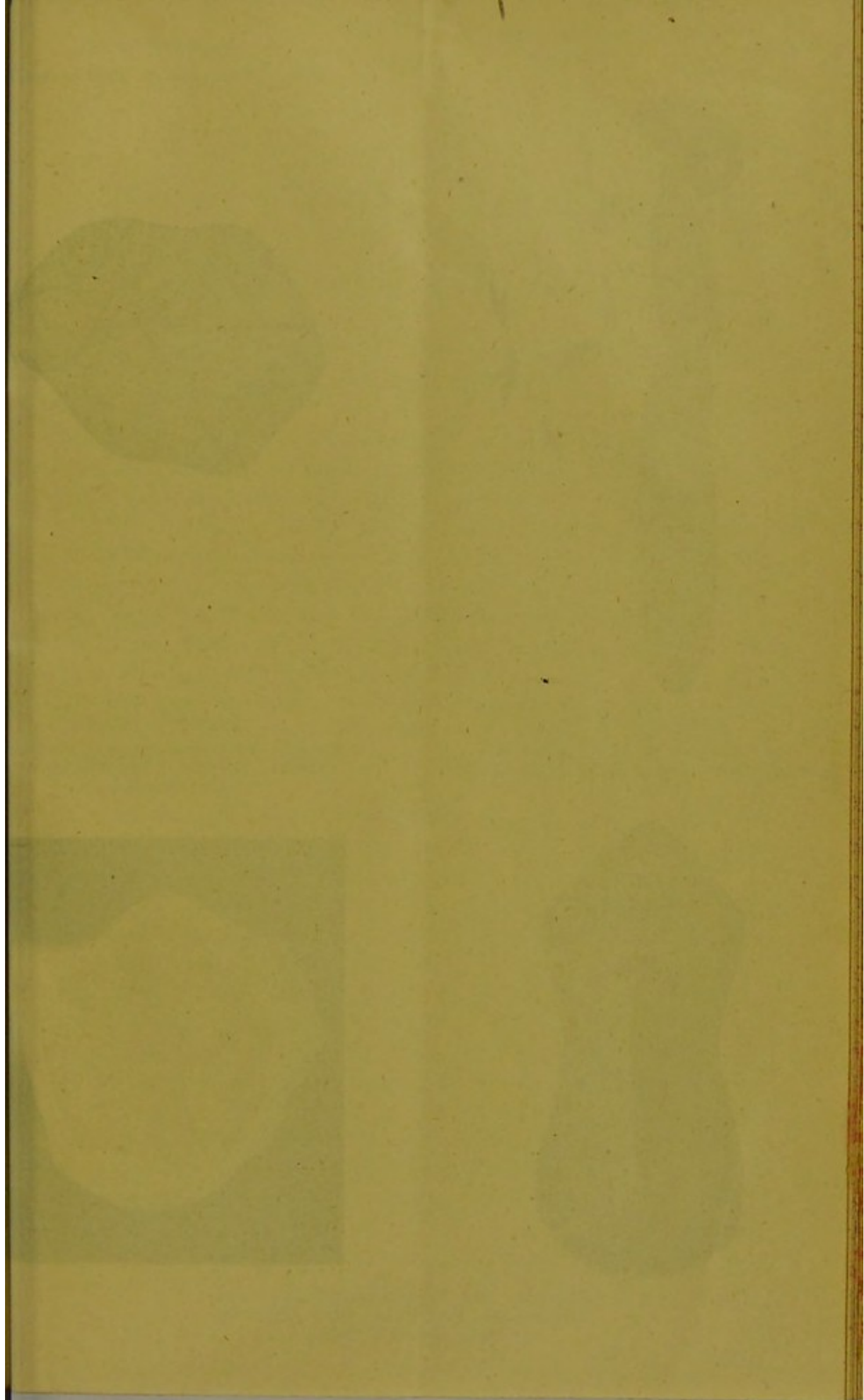


Diagram No. 1.

- A Mature Worm (natural size.)
- B " (magnified)
- C Hooklets



Diagram No. 2.

Hydatid Cyst, shewing Scolices inside



Diagram No. 4.

Head of Scolex (further magnified), shewing four Suckers, and the double row of Hooklets.



Diagram No. 3.

Hydatid Cyst opened, shewing numerous Scolices, or Hydatid heads adherent to wall of mother cyst.



Diagrams Nos. 3, and 4 taken from a preparation made by Prof. Parker, Otago University (from Rabbit Hydatid).

HYDATID DISEASE

IN NEW ZEALAND.

By R. GORDON MACDONALD, L.R.C.P. (EDIN.), L.F.P.S. (GLASGOW),

Honorary Surgeon Dunedin Hospital.

THIS disease may well be described as one dependent upon the penetration of an animal parasite into the tissues. Whence comes this parasite, and what is its history?

It was first recognised as a separate living creature by Pallas in 1766, but its effects were known since the time of Hippocrates. It may be described as the larval condition of the *Tænia Echinococcus*, a small tapeworm about four millimeters (about $\frac{1}{4}$ in.) in length, whose favourite haunt is the small intestine of the dog (*see diagram of mature worm, Fig. 1*).

The larvae usually consist of a rounded sac, in size, varying from that of a pin head to a child's head, which is enclosed in a connective tissue capsule formed from the surrounding tissues (*see Fig. 2*).

This sac is generally filled with a clear and slightly alkaline fluid, varying in specific gravity from 1007 to 1015. The fluid usually contains no albumen, or at most, in rare cases, only a trace of it. Of the other bodies present, chloride of sodium seems to be the commonest, but in some cases even a trace of this substance cannot be found.

Succinic acid, inosite, grape sugar, leucine, and, in liver echinococcus, crystals of hæmatoidin are among the substances found in it in small quantities. Its chemistry, however, is exceedingly complicated, and no one test can be relied upon as proving its identity.

The sac is lined internally with a germinative layer, and, as is exceedingly well seen in *Diag. No. 3*, numerous little mounds appear on its surface, in each of which a little vacuole-like cavity is formed. Upon the inner surface of these cavities, brood-capsules, tape worm heads, or scolices originate. The older helminthologists taught that these heads ruptured their

capsules or became detached, and so roamed about freely in the fluid; but Leuckart denies this. He states that the brood-capsules in their normal state never rupture nor allow the contained heads to escape. In a subsequent paragraph, however, he states—"I do not deny that one may often observe burst brood-capsules and isolated heads; but I have only observed these conditions in encysted worms which were investigated some time after the death of their host." Parallel with this statement may be placed the experiments of other observers who assert that they have fed healthy dogs on the fluid taken from an hydatid sac in the living subject, and produced in due time an abundant crop of worms. It therefore appears that this point is still a little uncertain, but we may reasonably conclude from observation and experiment that in some cases the heads do not become detached, whilst in others they undoubtedly become so, and roam about in the fluid. Before leaving this part it may be stated that the parasite is somewhat similar to a plant, possessing the power of budding, and so reproducing itself indefinitely along the cyst wall, as is well seen in *Diag. No. 3*.

Having thus described the hydatid sac, its mode of growth and appearance, we may as well return to consider its source. In Europe, the dog and the wolf are the only animals known to harbour the *Tænia Echinococcus*. Some authorities state that the cat is also its common host, but Leuckart says "our cats are not adapted for its growth." For all practical purposes, therefore, so far as New Zealand is concerned, we may give the dog all credit for being its only host, and therefore its only propagator.

The adult worm is of comparatively small size, consisting of only three, or at most four, joints. Its total length varies from four to five millimeters ($\frac{1}{4}$ inch). The head is characterised not only by its small size, but also by the possession of a prominent crown which surrounds the bulging rostellum (*see Fig. 4*). The hooks borne by the rostellum form two series of from 14 to 25 each. The hooks of the front row are much thicker and more solid at their roots than those of the second row, and by this means they are recognised.

Behind the series of hooklets come the suckers (*see Fig. 4*). They are four in number, and I cannot do better than quote Leuckart's description of them—"The formation of the suckers

is most striking. It is introduced by a change in the form of the inner space which is produced inwards to form little pockets in the substance of the head walls. These occur at four points at equal distance from one another. They become more and more markedly distinct from the rest of the internal space, and represent, of course, the cavities of the suckers. The musculature, which forms an important part of the apparatus, then arises; the subcuticular sheath, with its radiately arranged cells, surrounds each pocket like a hood, and becomes an independent structure, in which the characteristic arrangement of the muscular fibres very soon appears."

Immediately behind the suckers the head narrows to a neck, which gradually passes without distinct boundary into the unsegmented anterior part of the body. The first segment is not at all characteristic, being almost as broad as it is long. In the second the breadth has doubled and the length increased four times, whilst in it the male and female reproductive organs can easily be distinguished. The third and last segment presents all the peculiarities of maturity. It is by far the largest segment, and contains hard-shelled eggs, which enclose the embryos. Küchenmeister reckons the average number of eggs in this segment at 500, whilst Leuckart places the number considerably above that.

Before this last segment is liberated a new joint appears, and it is impossible to state how many mature segments one worm is capable of producing, so that with a dog having a number of worms, as is usually the case, the number of eggs being dispersed is simply appalling.

The worm being bi-sexual, its powers of reproduction are enormous, and in the mature segment the eggs can easily be recognised as sharply defined balls about 0.01 mm. in size. Its habitat is the small intestine, and usually many thousands of them can be seen between the villi. We do not know what is the average duration of its life, though Siebold places it at two months. This, however, is disputed by others, who state that other worms live much longer, and, reasoning from analogy, the *Tænia Echinococcus* should live longer than an average of two months.

From experiments made on sheep and pigs, it is found that they are particularly susceptible of becoming infected with

the eggs, which are scattered broadcast wherever infected dogs exist, and soon find their way into the food and drink of these animals. The warmth and moisture in the intestines of their new host are sufficient to dissolve the egg-capsule, and the young giant emerges to penetrate its unfortunate friend's bowels, and begin its destructive cystic life. The experiments made by Haubner and Leuckart on pigs disclose the fact that in four weeks from date of feeding, the young Echinococci can easily be seen as small tubercles on the surface of the liver and kidneys. Its rate of growth is very uncertain and irregular. Sometimes a number of years (ten or more) may elapse before it causes much annoyance to its new host. A good deal will doubtless depend upon the vitality of the egg, and the locality in which it fixes itself. Neisser is of opinion that the embryos are quite passive in their transmission through the tissues; but Cobbold, Leuckart, and others state that they are by no means motionless, and that they bore their way through the intestines to reach their final destination. Their internal wanderings may be effected through the bloodvessels or lymphatics, and this view is supported by the preference of the parasite for the liver, which is rendered easily accessible through the portal circulation. That all Echinococci are not found in the liver is easily accounted for by the circumstance that the embryos readily pass by the lymphatics into the venous system.

The Echinococcus of man and other animals produces in the dog's intestines a similar worm to the one whose eggs infected them. Finsen, of Iceland (where this disease kills one-sixth of the population), made the following experiments:—He fed healthy dogs on liver containing Echinococci, and in 35 days the dogs passed large numbers of mature worms. The same results were obtained by giving dogs the hydatid fluid taken from the sac by means of tapping. From inquiries recently made by myself I find that rabbiters taking healthy dogs from the towns, and feeding them upon rabbits, soon begin to notice signs of uneasiness in them. In about a month they become very dry in the hair, and loose condition; and in about six weeks pass large numbers of worms, which they evidently acquired from the rabbit Echinococcus. It is thus absolutely certain that the dog is the propagator of the disease, and that the mature worm is only to be found in the intestines of the dog. There is no

evidence whatever to show that man is the host of the *Tænia Echinococcus*, or that he is adapted for its growth. Küchenmeister, however, states that he believes there is a *Tænia Echinococcus* common to man, but produces no evidence in support of his belief. During the early part of the year a case of some interest, and bearing upon this point, was under my care in the Dunedin Hospital. A young man was admitted suffering from hydatids. The sacs were scattered over the whole of the abdominal organs, and also in both lungs. He stated that during the paroxysms of cough, gushes of clear fluid came up his throat; that sometimes he was forced to swallow part of the fluid; at other times small bladders were coughed up, and these also he sometimes was forced to swallow; yet, on careful inquiry and examination, this man never showed any signs of worms having passed from his bowels. Since then I have had two other cases, both of whom swallowed hydatid fluid and bladders, yet presented no signs of worms. Davaine also cites 40 cases of *Echinococci* opening into the intestines, and in no one instance were *Tæniæ* found.

There are three forms of the *Echinococcus* peculiar to man. Two of them—*Echinococcus-granulosus* and *Echinococcus-hydatidosus*—are common, whilst the third—*Echinococcus-multilocularis*—is uncommon. The simple *Echinococcus*, or *Echinococcus-granulosus*, is commonest amongst domestic animals; and when it occurs in man is principally seen in the omentum and in the bones. It does not, however, represent any distinct species, and its principal distinguishing feature is that it never has daughter bladders in the interior of the mother sac, but is attached externally. Frequently also the fluid in this form becomes a solid, granular, and calcareous mass, killing the parasite, and so effecting a natural cure.

Echinococcus-hydatidosus is the commonest of all forms in man. Like the *Echinococcus-granulosus*, it produces daughter bladders, but the daughter bladders are always within the mother bladder. These daughter bladders very often produce themselves daughter bladders, or what may be called grand-daughter bladders, and the whole mass frequently grows to an enormous size. Cases are recorded in which the mass weighed thirty pounds' weight, and therefore exceeded by far the largest *Echinococcus-granulosus* ever observed. The daughter bladders

grow by a process of proliferation from the wall of the mother sac. At a definite spot we may notice between the two lamellæ a little heap of granular substance, which gradually pushes aside the adjacent layers, and after some time becomes surrounded by a special cuticle. It gradually emerges until, when mature, it bursts and sets free its inmate. By the same process grand-daughter bladders are produced; but the daughters are able to produce grand-daughters much sooner than their mothers produced daughters.

The third form—*Echinococcus-multilocularis*—differs from the above two in being composed not of a simple bladder, but of a group of very small bladders. It is almost exclusively found in man, and, with few exceptions, in the liver. Usually it appears as a hard, round mass, varying in size from that of a marble to a child's head, and having more the appearance of a neoplastic growth than an animal parasite. The earlier observers mistook it for colloid growths, and to Virchow belongs the credit of having first established its true nature. During its growth it completely destroys the liver tissue as far as it extends, and its removal, though easy in itself, is most uncertain, owing to the offshoots which make their way into the adjoining tissue, becoming new centres of infection. No case of it has been observed in New Zealand so far as my inquiries have gone.

It frequently happens that *Echinococci* appear in different centres of the body, constituting what is called multiple hydatids. Here the question arises, has this resulted from an external infection, or is it an auto-infection? Two views are held on this point. Waunyn and Rasmussen both state that heads and brood-capsules do sometimes change into hydatids. In order that this can happen, we must first suppose that the primary *Echinococcus* has burst into a bloodvessel, and liberated its brood-capsules or its heads into the blood, which then transports them hither and thither throughout the body. A case occurred some time ago in Dunedin, in which the medical attendant thought this was the probable mode of infection. A small tumour was observed in the abdominal cavity some considerable time before, and for diagnostic purposes a small quantity of the fluid was withdrawn. In 24 hours the tumour disappeared, the fluid having evidently escaped into the peritoneal cavity. No ill effects followed, but sometime thereafter multiple hydatids

appeared in the abdominal cavity. In conjunction with the above case, I may relate the following:—Three years ago the same medical man saw, in consultation with me, a young married woman with a tumour over the spleen. For diagnostic purposes a hypodermic needle was inserted into the tumour, which felt remarkably hard, and withdrew hydatid fluid. Next day she got up and resumed her usual duties, when suddenly she felt something give way, and the tumour disappeared. A mild attack of peritonitis followed, but no multiple hydatids, for to-day the original tumour is refilling.

Leuckart says—"It seems to me probable that multiple Echinococci, or at least the great majority of them, are the result of a single infection, but of one which furnished not one but many embryos. The differences in size and development are easily explained by remembering that the embryos are exposed to diverse external conditions, so that some grow more rapidly and to a larger size than others. This idea is confirmed by experience, as in examining animals upon which I experimented I have often found considerable difference in the size and development of the bladders which originated from the same feeding."

There is an element of uncertainty as to the origin of multiple hydatids. Several cases recorded point to an auto-infection; but if it does arise from auto-infection, the cases from this source are comparatively few considering the number of sacs from which the fluid or contents escape in the track of the exploring needle. Among the parasites common to the human body, none are so common or so deadly as the Echinococci. Though they show a decided preference to locate themselves in the liver and lungs, yet as a matter of fact no organ in the body is exempt from their inroads. Occasionally they locate themselves in the eye, brain, or bone, where their destructive cystic life so disturbs the part that the life of the individual is immediately endangered. They share the position of frequency with the *Cysticercus Cellulosae* (measley pork), with this difference, that it is much more easy to protect oneself from acquiring the *Cysticercus Cellulosae* than the *Echinococcus*. The former may be killed in the process of cooking, and so may the latter, but we generally acquire it from articles of food we do not cook. Then, too, no age or condition of life is exempt from it, but

generally speaking it is commonest between the ages of 20 and 40, as between these ages people are generally more exposed to the chances of infection.

In March last I issued a circular to every practitioner in New Zealand whose address I could find, and the result, so far as numbers who replied, is most gratifying, though the information conveyed in some of them is a little meagre.

The following were the questions asked:—(1) Is the disease common in your district? Give the probable percentage of cases to your population. (2) Do you find that occupation (*e.g.*, butchers, shepherds, &c.) or state of persons' general health predisposes to it? (3) What do you think is the most common source? And name others. (4) Name the organs of the body (in the order of frequency) in which you have diagnosed it? (5) Is there anything you can suggest as preventive measures: as to medicine; method of cooking, or eating; or drinking water, &c.? (6) *Treatment*—What is your practice: tapping, or cutting down upon the cyst, or cysts? Give results.

Almost every practitioner in the South Island states he has seen cases of it. Some have had several cases to deal with, whilst others had only seen one or two cases during their experience. Judging from the replies sent in from the South Island, the disease must be pretty common. Some districts appear to be much more liable to it than others, or else the diagnosing powers of some men are much keener than of others. Be that as it may, Otago and Southland are the chief breeding-grounds of hydatids in New Zealand. Why this should be is a little difficult to say. Perhaps the humidity of our climate may have something to do with it; also, no doubt our larger population must influence the question. Finsen and others remark that a moist climate is favourable to their growth. It appears from the writings of Australian authors that a dry climate is equally good. Seeing, therefore, that they thrive equally well in a very cold (Iceland), a very hot (Australia), and a temperate climate (New Zealand), it is difficult to believe that climate has much, if anything, to do with its frequency. One of my correspondents remarked that possibly the flesh-eating propensities of the South Islanders was a probable cause. In one sense this is true, but in another untrue. Where flesh-eating is common, the number of men, dogs, and slaughter-yards are naturally

increased. The refuse from the slaughtered animals is likely to be plentiful and cheap, therefore the residents are likely to feed their dogs largely upon it. Granting that the animals are infected with hydatids, we have here an excellent cause to account for its frequency in the inhabitants. The dogs are fed on liver, lungs, &c., containing hydatids, which produces *Tænia* in them. The *Tænia* produce millions of eggs, which the dogs scatter broadcast wherever they go. Some are blown into the water tanks, wells, streams, and some on the grass, vegetables, and fruit, and so are partaken of by man and beast. The eggs produce hydatids, the hydatids *Tænia*, and so the circle is completed, *ad infinitum*.

It is not true, however, that man acquires hydatids from eating flesh containing the parasite in its cystic stage. Man, according to the best evidence, is not a suitable host for the *Tænia Echinococcus*, and even if he were, it would not be the hydatid or cystic form of the parasite that eating hydatid flesh would produce, but the worm—*Tænia Echinococcus*. The parasite when in the flesh has already passed through its cystic stage of existence, and its next stage is to develop into the mature worm in the dog's intestines.

Davaine and others cite numbers of cases in which the parasite in its cystic stage found its way into the human bowels and produced no result, as the conditions for its growth were not favourable. I have already mentioned two cases which lately came under my own notice in which the same thing occurred.

From inquiries made from the local butchers and slaughtermen, I find that hydatids are exceedingly common in our domestic animals. Sheep and pigs seem to be much more commonly affected than cattle, and doubtless they acquire it through the eggs of the *Tænia* finding their way into their food and drink, just as in our own case. As in man, so in the other animals, hydatids may locate themselves anywhere in their bodies; but by far the largest number, according to the inquiries made, locate themselves on the surface of the liver, peritoneum, and under surface of the diaphragm.

The disease is not common in the North Island; many of the practitioners there stating that they have never seen a case of it. The records of the Wellington and Auckland Hospitals show

remarkably few cases, so that we may fairly conclude the disease is uncommon in that Island. Here is a little puzzle again: The disease is common in the South Island, and uncommon in the North Island. The conditions of life are much the same in both places, and the surrounding circumstances equally favourable for the growth and spread of the parasite. It is curious, too, that the disease is apparently unknown amongst the Maoris, several practitioners stating that they have never heard of it occurring in that favoured race. This is not as one would expect, for they are reputedly very fond of dogs, and rear them in large numbers. They are also stated not to be careful in the feeding of their dogs, or, indeed, attaining to a high standard of hygiene in any direction. The conditions, therefore, are favourable for hydatid growth, yet it is stated they are not found among the Maoris. Local reasons, however, such as the kind of food, &c., which man and beast consume, must regulate this immunity.

I am unable to give any reliable information as to the percentage of cases to the population, as the majority of my correspondents could offer no opinion on the point. As far, however, as I have been able to judge from the information sent me, the percentage is about 1 in 20,000 for the North Island, and 1 in 7000 for the South Island. It is common in and around Dunedin, and the Hospital statistics, together with the experience of the medical men, show it to be slightly on the increase. Christchurch is not nearly so much troubled with it as Dunedin, and probably local reasons may account for the difference. It behoves the community, therefore, to interest themselves in the matter; and as the disease is one which can be almost completely eradicated, efforts should be made to study the best modes of suppressing it as far as practicable.

In reply to the second question, the majority of my correspondents are unanimous in expressing the opinion that occupation has little or nothing to do with its occurrence, and that the state of the person's health at the time of infection influences it very little if anything. Given two persons, the one a strong and robust man, the other a weak or sickly one, both are equally liable to contract the disease, provided they swallow parasites of the same vitality. Several of my correspondents remarked that possibly this was an explanation of the frequency of the disease in women and children; but in opposition to this view is the

fact that children are less able to protect themselves, are apt to eat and drink articles of questionable cleanliness, whilst they fondle dogs in their own peculiar manner. Again, women in their domestic duties, and especially those of them fond of pet dogs, run risks which few men subject themselves to, or are otherwise exposed to, so that upon the whole the question of age or health or sex influences the matter very little, provided the same precautions be taken in the different conditions.

Water is the principal carrier of the pest, and many of my correspondents instance cases in which they distinctly traced it to this source. A case was admitted into the Hospital recently whose history pointed very closely to infected water as the bearer of the parasite. A young man was sent from town to do some work at a sheep station. He lodged in the "hut," and drew his water supply from a well close by, which was common to man and dog. Six months thereafter he was admitted into the Hospital with a small hydatid tumour in his liver, and also one in the left lung. Two other cases were admitted during the year under my own care with a somewhat similar history, and altogether the evidence is conclusive as to water being its commonest carrier. We are pretty certain to have a plentiful supply of hydatids from stations where in many instances managers and shepherds chain up their dogs close to their doors, and drink from a common water supply. In some parts of the country the risk is lately increased owing to the fact that rabbits have become infected with the disease. Rabbiters roam the country all the year round, and feed their dogs on rabbits, sheep, or whatever else comes in the way. The dogs are certain to acquire worms from the diseased rabbits or sheep, and in their turn are equally certain to spread innumerable numbers of eggs wherever they go.

Salads, uncooked vegetables, and some ground-fruits are the next most common carriers. The eggs when blown about get entangled amongst vegetables, and these, unless very carefully washed in filtered water, are a source of considerable danger. Of course this only applies in districts where the disease is common, but generally speaking it applies with considerable force to vegetables grown on the outskirts of towns, where dogs are numerous, and the chances of infection correspondingly increased. It must be remembered that these eggs are exceedingly tenacious of life,

and live for many months tossed about in water, carried about in dust storms, or deposited on the earth's surface, and only await an opportunity to be deposited in suitable soil to begin a life of activity.

Too familiar association with dogs is also a fruitful source. Our friend's unhappy knack of searching for another parasite in the neighbourhood of his tail adds to the danger, as frequently he carries the more dangerous parasite on his nose or lips to deposit it on his master or mistress' hand at the next caress. In Iceland, where the disease is endemic, Finsen gives this as a very common cause, and very probably it is the reason why women and children fond of pet dogs are frequently the subjects of the disease.

Dust storms in towns come in for a share of attention, and several correspondents remark that this is doubtless one of the carriers. It cannot be denied but that this is one of the modes of infection. The eggs are light and easily blown about in the mud of towns, which is constantly being pulverised. How to avoid dust-storms in our towns is a matter of some difficulty, as it is impossible to carry about air filters, and thorough street watering is impracticable.

The liver is by far its commonest seat. Seventy per cent. of all the cases met with by my correspondents occurred in that organ, whilst the balance is divided between the lungs, spleen, kidneys, and peritoneum. Two cases are stated as having occurred in the eye, and three in the brain. It frequently happens that the liver and lungs are simultaneously affected, and in cases of multiple hydatid it sometimes happens that the lungs and the whole of the abdominal organs are diseased. In a case of multiple hydatids lately under my care in the Hospital, cysts were located in the lower lobe of the right lung, and in the apex of the left lung. On making an abdominal section to remove those in the peritoneal cavity, innumerable cysts, in size varying from a pin head to a large-sized orange, some solid, some liquid, were found attached to the capsule of the liver, diaphragm, spleen, kidneys, bladder, around neck of bladder, bowels, peritoneum, &c. The case looked so desperately hopeless that my colleagues suggested removing a few of the larger fluid sacs and leaving the others alone. This was done, and the patient made an unexpected and excellent recovery. Those

in the lungs suppurated and were expectorated, whilst the interference with the abdominal cavity seemed to arrest and destroy the vitality of such as were left there. The young man, a blacksmith, contracted the disease on the Otago Central Railway, and three months after the operation he was sufficiently well to return to work. In June, when he last reported himself, he stated that he felt as well as ever he did. This case is particularly interesting owing to the different stages of development of the various sacs. Some of them were quite juvenile, whilst others were hoary with age. The date of infection was about twelve months prior to admission into the Hospital; but it is an open question whether the disease resulted from one infection or several. Or again, did it result from an auto-infection or an external infection. On this point, as already stated, there are differences of opinion.

Only one case is mentioned as having occurred amongst the muscles, and that in the neck. Though no organ can claim exception, the great majority of cases occur in one or other of the abdominal organs. Hitherto the lower lobes of the lungs were stated to be its commonest seat in those organs, but the statistics of the Dunedin Hospital point to the apices as its favourite locality. Looking upon the parasite as a minute foreign body, it is natural to suppose it would locate itself in the least used portions of the organ, just as in the case of the tubercle bacillus.

It is curious to remark that in the rabbit the sac or sacs are rarely found in any of the internal organs, but amongst the muscles on the inner surface of the thigh. Why it should locate itself here in preference to the internal organs, as in the other animals, is difficult of explanation. That the parasite is the same is a matter of certainty, as is shown by the accompanying diagrams taken from the rabbit echinococcus, and prepared by Professor Parker, of Dunedin. In sheep, cattle, and pigs it is located much the same as in man, sometimes amongst the muscles, but in the great majority of instances in one or other of the abdominal organs. Horses, as far as I have been able to ascertain, are peculiarly exempt from it; but it is probable that if put under the same conditions as the other domestic animals their exemption would diminish.

The methods recommended for suppressing the disease are

numerous. First comes the opinion that our water should be filtered. This applies very forcibly to towns, and, indeed, to all public and private supplies in districts where hydatids are common. That a large population should be supplied with unfiltered water in a district where the parasite is common is nothing short of inviting disease and destruction. Lovers of salads, watercress, and uncooked vegetables generally are specially warned of the risks they run of acquiring hydatids in infected districts, unless the vegetables be very carefully washed in filtered water. Dwellers in towns and cities are recommended to avoid dust storms, or at least to acquire and practise the habit of breathing through the nose instead of the mouth. Several of my correspondents urge very strongly the desirability of erecting public abbatoirs, and having all the meat inspected, and where hydatids were observed, the parts should be destroyed. Here it may be remarked that in doing so it is not done to protect man directly, but to prevent dogs from eating the diseased parts, and so prevent their chances of acquiring the worm: the process of reasoning being—prevent dogs having worms by being careful as to their food, and as a sequence there will be no hydatids in man or other animals. This is doubtless the secret of the absence of the disease in Great Britain. There, meat is expensive, and dogs rarely taste raw flesh, unless it be that of some unfortunate horse, or if otherwise it has generally been cooked. If the owners of dogs gave their canine friends some little attention, the disease could be kept within very small limits. The worm is easily seen in the droppings of the dog, and if the owner on noticing it gave his friend some anthelmintic medicine, he would at once strike at the root of further trouble. Those keeping dogs as pets should avoid too friendly relations with them. Indeed, dogs known to have worms should not be allowed to enter the house on any condition, and should be looked upon as very dangerous companions. It is impossible to instruct or convince every one regarding those facts, and there will be people who, from carelessness or otherwise, endanger their own lives and those of the community by neglecting them, hence some general laws should be passed to inspect dogs and destroy all wanderers.

The diagnosis of hydatids in the various organs of the body is by no means easy. Murchison says: "It frequently happens

that echinococci exist in the liver, grow and degenerate, and are found after death without having betrayed any symptoms whatever of their presence during life. This is always the case when they are developed deep in the substance of the gland." If this be true, there are doubtless some unfortunate possessors of hydatids in our midst who harbour a most undesirable enemy. In most cases, however, changes occur which indicate the presence of some growth. A smooth globular tumour gradually develops, which is unattended by pain, fever, or any other noticeable disturbance of the general health. Oedema of the lower extremities, hæmorrhoids, enlargement of the superficial veins of the abdomen, and ascites are exceptional symptoms. Jaundice is rarely present, and, should it occur, it indicates pressure on the bile-duct, rupture of the cyst into the duct, or catarrh of the ducts. When the cyst becomes sufficiently large to be detected, "Briancon's" "hydatid vibration" can be detected, and is generally regarded as positive evidence of the presence of echinococci. It may be described as follows:—Grasp the hydatid tumour with one hand, exercising some slight compression, then on short, quick percussion a feeling of vibratory motion will be experienced. This symptom is most distinct when the mother sac contains numerous daughter vesicles, and little fluid between them. To-day, however, we are ahead of "Briancon" and his positive signs, as the exploring needle is by far the best diagnosing agent. It is most liable to be confounded with hepatic abscess, distended gall bladder, cystic or other soft tumours of the liver or kidney, and effusion into the right pleural cavity. Aneurism or ascites may occasionally complicate a diagnosis. I remember seeing one case operated upon in the Hospital in which the extraordinary hardness of the tumour led to a mistaken diagnosis. This hardness was due to the mother sac being stuffed with daughter and granddaughter vesicles. Nowadays the exploring needle is introduced with the greatest confidence into almost every organ of the body, so that with it, the test tube, and the microscope, a positive diagnosis is absolutely certain. Its insidious and painless growth serves to distinguish it from malignant or constitutional disease, and its shape and position from cysts in the kidney. Effusion into the pleura is attended with bulging of the ribs, and the absence of constitutional symptoms, whilst

pain, pulsation, and the bellows murmur distinguishes it from aneurism.

Pulmonary hydatids may be divided into two classes—*viz.*, ruptured and unruptured sacs. In the first class the nature of the disease can easily be ascertained by examining the sputum microscopically. In the second the diagnosis is much more difficult. Speaking generally, the symptoms are dullness (more or less absolute) over a certain limited area, usually presenting a rounded outline, and uninfluenced by the position of the patient; absence of the vocal fremitus, or, if any, only a feeble respiratory murmur is present; signs of pressure, as is shown by the tendency to displacement of the neighbouring organs, and deficiency of expansion.

Of course it must be remembered that all those symptoms are only relative according to the size and position of the sac or sacs. Trousseau attaches considerable importance to a "peculiar arching of the thorax," but in the cases observed here, there has been little information derived from external appearances. The following were the signs in two typical cases which lately came under my notice:—Slight cough and feeling of fullness in the chest; little or no expectoration; can't lie as comfortable as usual on the affected side; general health very good; external appearances, *nil*; respiratory murmur absent over a roundish, limited area; at the outer edge of this space a few moist rales are heard on deep inspiration; and in the other case, tubular breathing; beyond this, the lung is normal. Percussion reveals complete dullness over a small space, and gradually passing to normal; expansion complete in one and slightly interfered with in the other; no displacement of any organs; date of infection six months prior to examination. The mode of infection was pretty certain in both cases.

In the case of multiple hydatids already referred to, all the signs of phthisis were present—flattening of chest walls, sweating, wasting, clubbing of nails, purulent expectoration, &c., but no tubercular bacilli. Indeed, it is reasonable to suppose that such cases are sometimes looked upon as genuine phthisis, and the patient left to die from an unrecognised disease. In persons having a tubercular tendency, it is of the utmost importance to them that an early and correct diagnosis should be made, and the reasons are obvious. The whole ques-

tion of the diagnosis of hydatids in the various organs of the body is one which is frequently surrounded with much difficulty, and as a sequence lamentable mistakes must result; but it is well for practitioners to keep steadily in view the possibility of hydatids in an otherwise obscure case.

Treatment.—The treatment of hydatids may be almost summed up in one word—Operation. Nearly the whole of my correspondents state that they believe medicines to be useless. In corroboration of this view, Pepper, in his *System of Medicine*, quotes the case of a sailor whose body he examined, and in which he found the living parasite, though the man had been dead several days, and the body injected with chloride of zinc solution for purposes of preservation.

Australian practitioners attach considerable importance to the use of the iodide and bromide of potassium, and kamela, also to the use of turpentine, santonin, perchloride of mercury, &c., and record cases in which this treatment effected a cure without other means. The evidence, therefore, on the value or non-value of medicines as a curative agent in this disease is a little conflicting, but I think we may take it for granted that the use of the trochar and canula, or the aspirator, is by far the shortest, equally safe, and best mode of treatment.

Two operations only are in vogue here—*viz.*, tapping and cutting down on the sac, and the results are very satisfactory. The old operation of slowly burning the tissues down to the sac by means of various caustics, with the hope of setting up adhesions, was rude and unsurgical. Listerism and increased knowledge has changed all this, and now we can operate with safety where lately it was holy ground. Electricity has been recommended and tried, but its results are not to be compared with that of the scalpel and needle. As to the fear of the fluid—especially pus—escaping from the sac in the track of the needle, experience shows us that this is unusual, and should it occur it generally ends as an abscess, without serious consequences. In old cases where there is a large and tough mother sac with pus, it is probably safer and better to cut down upon it, no matter where, and remove the whole mass, or else have the opening sufficiently large for the sac to extrude easily.

The following are short notes on two cases illustrating this point recently operated upon by me in the Hospital:—

Case I.—Male; shepherd, aet. 40; old sac in left lung. Consultation: Majority in favour of free incision into cavity; minority, continue use of aspirator or trochar. Operation performed; piece of rib removed; finger introduced into pleural cavity; pus and large, tough, foetid sac at once extruded; lung almost completely collapsed. Next day washed out cavity with carbolic solution; no bad symptoms whatever. Case did well. Here it is pretty certain that the man would never cough up all the sac if left, and treatment by aspirator would probably end in death from wasting if phthisis did not supervene, so that a free incision and drainage was certainly the proper treatment.

Case II.—Female, married, aet. 40. Diagnosis: Hydatid abscess of right lobe of liver. Consultation: Majority favoured incision, and at once open, or wait for adhesions; minority, try aspirator. Operation performed; peritoneum stitched to skin; waited four days for adhesions, but found adhesions bad, and so stitched wall of sac to skin. Case did well. In this case the wall of the sac was studded with innumerable colonies of heads, just like the clusters shown in Diagram No. 3. The sac was of enormous size, and judging from events, treatment by the aspirator would be useless, if not fatal.

As to the practice of injecting some irritating fluid into the sac I am unable to speak, but think it a little dangerous owing to the liability to suppuration.

Before closing my paper I may refer, for purposes of consideration, to the influence of hydatid disease upon prospective candidates for life insurance or benefit societies. Is the life of a person once having hydatids as good as one who never had them? and is it possible for a person once developing hydatids to retain the seeds of the disease, to develop years hence? In a monograph written by Dr. Dougan Bird, of Melbourne, on "Hydatids of the Lungs," there appears as an appendix a letter written by Dr. Ralph, President of the Microscopical Society of Victoria, in which a query enters as to whether hydatid disease may not arise from "fluke," or indeed other parasites; but on this point European helminthologists are silent, and it remains for Australasian investigators to enlighten us on this section of the parasites of man.

In conclusion, I have to thank the gentlemen who favoured me with replies, and I trust the information gathered will be of service to them.



