AN ADDRESS ON IMMUNISATION AGAINST SERPENTS' VENOM,

AND THE
TREATMENT OF SNAKE-BITE WITH ANTIVENENE.

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[ABSTRACT.]

WHILE medical science and practice have hitherto failed to discover any certain means for protecting man against the effects of serpents' bites, or for preventing death from serpents' venom, it is strongly suggested by traditions as well as by the narratives of travellers that some success in attaining these objects may actually have been obtained by the members of uncivilised tribes and sects. Many of these traditions and narratives are of great significance, and in connection with facts derived from experiment, which will to-night be described, they possess a deep interest. We learn from them that from a remote period the belief has existed that a power may be acquired by man of freely handling venomous serpents, and even of successfully resisting the poisonous effects of their bites. In more modern times, and, indeed, at the present day, the same belief is stated in the writings of many travellers, and passages confirmatory of this statement are found in the published works of William Bosman, the Rev. John Campbell, Drummond Hay, Honigberger, Nicholson, and Richardson. With this belief may be associated the further belief that venomous serpents are themselves protected against the effects of bites inflicted upon them by individuals both of their own and other species.

This and other evidence pointing to the existence of protection against venom not only in serpents themselves, but also, in certain exceptional circumstances, in human beings, several years ago originated the wish to investigate the matter. It was obviously suggested that if protection occurs it must be caused by some direct result of the absorption of venom, and, therefore, that its existence could be proved or disproved by experiment. In the former event, the first steps would already have been taken to obtain, by further experiments, results likely to be of value in the treatment of poisoning by serpents' venom, and, indeed, likely to be of importance in even the wider field of general therapeutics.

The general plan to be followed in the investigation was obviously suggested by some of the statements that have been referred to, for they indicate that individuals may become accustomed to, or protected against, the effects of serpents' bites by the introduction into their own bodies of a succession of doses of venom, no one of which, necessarily, at the beginning of the process was so large as the minimum lethal. A consideration also of the facts proving the possession of protection on the part of venomous serpents themselves indicated the same plan of procedure, for, equally obviously, these serpents from an early period of their existence must absorb venom from their own gradually developing poison glands, until, in the course of time, they had acquired sufficient protection to remain unaffected by the larger quantities which the now fully developed glands would introduce into their bodies.

My first supplies of cobra venom were obtained in 1869, from the late Dr. Shortt, of Madras, and, in 1879, from Surgeon-Colonel Moir, of Meerut. They were in very small quantity, but with them I was able to satisfy myself that, by a succession of minute doses, animals became able to receive the minimum lethal dose without any distinct injury. At this point, however, the supply of venom failed, and the observations could not then be carried further. It became evident until large quantities of venom had been obtained definite results could not be hoped for.

It was not until several years afterwards that a sufficient supply had been gradually accumulated, by further small supplies received from Sir Joseph Fayrer, the Thakore of lecturer, Dr. Phillips; and by larger quantities from Sir

William Mackinnon, Director-General of the Army Medical Department, and, especially, from Surgeon-Colonel Cunningham, of Calcutta, who for many years has been engaged with much success in the study of venoms and their antidotes. Within the last few months, and subsequent to the publication of some of the experimental results which had by this time been obtained, the India Office has also placed at my disposal a considerable quantity of venom, which had been collected by Dr. Hankin, of Agra, at the request of Dr. Cleg-horn, Surgeon-General with the Government of India.

But besides these specimens of the venom of the cobra of India, I have obtained specimens of the venoms of several serpents of America, Australia, and Africa, with which, also, experiments have been made.

In the meantime, however, the results of experiments on the inoculation of the toxins of disease, as well as of proteid toxins of vegetable origin, had suggested to several observers that serpents' venom, because of its chemical analogies with several of these substances, might possibly be found capable, like them, of producing immunity against the effects of poisonous doses; and further evidence was thus obtained in favour of the reality of the protection to which I have referred.

Sewall, in 1886, undertook an investigation with the object of determining if immunity against the fatal effects of rattlesnake venom could be produced by the inoculation of repeated doses, each too small to produce ill effects. The experiments were made on pigeons, and he succeeded in proving that immunity can be secured to the extent, at least, of protection against seven times the minimum lethal dose.

Kanthack made a similar series of experiments in 1891, which led him to conclude that rabbits may be accustomed to resist lethal doses of cobra venom.

Working with the venom of vipers, Kauffmann in 1891, and Phisalix and Bertrand in 1893, obtained experimental evidence of the possibility of producing a definite, though not high degree, of resistance against the toxic effects of this venom.

In the following year Calmette, continuing some earlier observations which had led him to express the opinion that protection against snake venom could not be produced, published evidence confirming the results of previous investigators, but also showing that a higher degree of protection could be secured than they had obtained; for he succeeded in administering to each of several rabbits, within a period of eight months, a total quantity of from 30 to 35 milligrammes of cobra venom.

In 1894 also, both Phisalix and Bertrand and Calmette obtained evidence of the power of the blood serum of protected animals to counteract the effects of venom. Calmette, at the same time, claimed that hypochlorite and chloride of calcium were antidotes of considerable value; and, in a later publication, he showed that the blood serum of animals immunised by the administration of venom, possesses a certain degree of antidotal efficacy against the toxins of several diseases.

[Proceeding to describe his own investigation, the Lecturer stated that his experiments had been chiefly made with the venom of the cobra, although the more important of them had been repeated with the venoms of the crotalus of America, the sepedon hamachates of Africa, and a large serpent of undetermined species from the Diamantina district of Queensland.]

The minimum lethal dose for several species of animals was first defined, and then protection was produced by the administration of a series of gradually-increasing doses—until, for instance, with cobra venom, rabbits became so far protected as to be able to receive in a single dose a quantity sufficient to kill fifty animals, and, in the course of five or six months, a total quantity sufficient to kill 370 animals of the same species and weight.

A description having previously been published of the antidotal properties of the blood serum of protected rabbits, the Lecturer mainly described experiments since made with the blood serum of a horse, which had last received a dose of cobra venom estimated to represent twenty times the minimum lethal. This blood serum, like that of rabbits and of other animals, is fluorescent, and when dried it yielded about 10 per cent. of a solid residue, which retains unchanged its

antidotal properties for an indefinite period of time, and can readily be restored to its original liquid state by dissolving it in water. To it, whether in the dry or liquid form, the name "antivenene" has been given a name which, notwithstanding etymological objections, has the great advantages of brevity and freedom from ambiguity.]

The experiments were so planned as to obtain in several conditions of administration as exact a definition as possible of the antidotal power of the antivenene. In one series of experiments cobra venom was mixed outside of the body with this antivenene, and within a few minutes thereafter the mixture was injected under the skin of the animal; in a second series the venom and antivenene were separately and nearly simultaneously injected into opposite sides of the body; in a third series antivenene was injected thirty minutes before the venom; and in a fourth series the venom was first injected, and thirty minutes afterwards the antivenene.

In the first series, it was found that 0.0004 ($\frac{1}{2500}$) c.cm. per kilo. was a sufficient quantity of antivenene to prevent the lethal effect of slightly more than the minimum lethal dose of venom; that 0.24 c.cm. per kilo. of antivenene was required for one and a-half the minimum lethal dose; that 0.35 c.cm. per kilo. was required for twice the minimum lethal dose; that 0.65 c.cm. per kilo. was required for thrice the minimum lethal dose; that 1.2 c.cm. per kilo. was required for four times the minimum lethal dose; that 1.5 c.cm. per kilo. was required for five times the minimum lethal dose; that 2.5 c.cm. per kilo. was required for eight times the minimum lethal dose; and that 3.4 c.cm. per kilo. was required for ten times the minimum lethal dose.

These results show that there is a remarkable accordance in the increment required in the dose of antivenene for each increment in the dose of venom. Indeed, from twice the dose of venom upwards, the addition of little more than 0.3 c.cm. per kilo. represents the addition in the quantity of antivenene required for each additional minimum lethal dose of venom. Apparently, when mixed *in vitro*, antivenene in this proportion is able to prevent death from almost any dose of venom, however large it may be. The results are in marked contrast with those that occur when an antidote acts because of its physiological properties, and they alone suggest that the antidotism is rather the effect of a chemical than of a physiological reaction.

In the second series, experiments with the antivenene from the horse have been completed only with one and a-half the minimum lethal dose of venom. When this dose was injected into the subcutaneous tissues at one side of the body, and immediately thereafter a dose of antivenene, at the opposite side, it was found that the smallest dose of antivenene capable of preventing death was 3.5 c.cm. per kilo.

In the third series, experiments have been made with the minimum lethal, one and a-half the minimum lethal, and twice the minimum lethal. With the first of these doses recovery occurred with 0.42 c.cm. per kilo. of antivenene; with the second, with 2.7 c.cm. per kilo.; and with the third, with 4.0 c.cm. per kilo.

In the fourth series, where the results give the truest indications of the antidotal value of antivenene in the actual treatment of snake bite, it was found that the smallest quantity of antivenene that could prevent death when injected thirty minutes after slightly more than the minimum lethal dose of venom was 0.65 c.cm. per kilo.; when injected thirty minutes after one and a-half the minimum lethal dose it was 3.2 c.cm. per kilo.; and when injected thirty minutes after twice the minimum lethal dose of venom it was 5 c.cm. per kilo.

It is impossible to consider the great difference between the dose of antivenene required when the two substances, though in each case simultaneously administered, are, in the one case, mixed together before injection, and, in the other, not so mixed, without having the suggestion again raised that the antidotism is the result of chemical and not of physiological reactions.

In the experiments which I have hitherto described, and, indeed, apparently in all others made in this new subject of serum therapeutics, protection has been produced and the antidotal properties of the antitoxic blood serum have been tested by the subcutaneous, or less frequently by the intra-

venous, injection of the venom or other toxic substances. No endeavour seems to have been made to discover how far the same effects, or what effects, may be produced by stomach administration.

Anticipating that results of an interesting nature might be obtained by this method of administration, I have adopted it for the introduction of both antivenene and venom into the body, and the results have exceeded my anticipations.

Among other experiments with antivenene, single doses of 7 and of 10 c.cm. per kilo. were introduced into the stomach of white rats, in some instances three hours, in others two days, and in others three days before one and a-half the minimum lethal dose of venom was subcutaneously injected, and in all cases the animals recovered.

As antivenene is itself almost devoid of physiological action, how is the operation of this physiologically inert substance to be explained? When an answer has been attempted to be given to this question in discussions in the wider field of the serum therapeutics which deals with the toxins of disease, the answer has been found either in the destructive power of phagocytes upon microbes and their toxins, or in the theory that the toxins elaborate from the blood the antidotal antitoxins, which, whether thus originated or separately introduced into the body, confer upon the body a resisting power which enables it to oppose successfully the injurious action of the toxins.

These answers do not solve the problem in so far as snake venom is concerned. Phagocytosis cannot, of course, operate *in vitro* in solutions which are free from organised structures. Even when solutions of venom and antivenene, mixed together *in vitro*, have been inserted into the body, it is incredible that the increase in the quantity of antivenene by the $\frac{1}{2500}$ part of a cubic centimetre could cause such an increased proliferation of leucocytes as to prevent a lethal dose of venom from producing death, whereas a dose of antivenene $\frac{1}{1000}$ part of a cubic centimetre smaller would be unable to do so. Further, there is no observable increase of leucocytes when much more than these infinitesimal quantities of antivenene have been administered to an animal.

In view of many of the facts that have to-night been stated, the "resistance of tissues" theory is also untenable. It is opposed, for instance, by the fact that so great a quantity as 0.42 c.cm. per kilo. of antivenene is required to prevent death when given thirty minutes before a lethal dose of venom, whereas, for the same dose of venom, only 0.0004 c.cm., or the $\frac{1}{2500}$ part of a cubic centimetre, or nearly the $\frac{1}{1000}$ part of the former dose, is sufficient, provided it be mixed with the venom before administration, and in circumstances therefore which are much less favourable for the production by the antivenene of this supposed increase in the "resistance of tissues."

A chemical theory, implying such a reaction between antivenene and venom as results in a neutralisation of the toxic activities of the venom, is, however, entirely compatible with the observed facts.

Definitions arrived at by experiment of the antidotal value of the blood serum of animals protected against different quantities of venom indicate, with some limitations in the largest quantities, that the greater the quantity of venom that has been introduced into the body within any given time, in the process of producing this protection, the greater is the antivenomous power of the blood serum, and therefore the larger is the production of the antivenene. While not an actual proof, this circumstance at the same time is in harmony with the supposition that the antivenene may after all be a constituent part of the venom itself.

The difficulties encountered in the separation by chemical methods of the several constituents of venom are so great that it is not probable that the only proof or disproof of this supposition will soon be obtained by chemical analysis. Some physiological experiments which I have made seem, however, to go a long way in supplying the demonstration which in the meantime has not been obtained from chemistry.

With the object of determining, in the first place, if the disputed statement is correct that serpents' venom is inert, or nearly so, when introduced into the stomach of an animal, some cobra venom was administered, in a series of gradually-increasing doses, to a cat, until finally it had received a single

dose 80 times larger than the minimum lethal, and to each of six white rats single doses corresponding to 10, 20, 40, 300, 600, and 1,000 times the minimum lethal if given by subcutaneous injection. Although no definite poisonous symptoms were produced by even the largest of these enormous quantities, it was found that the cat had so far been protected that it could afterwards receive by subcutaneous injection one and a-half the minimum lethal dose of cobra venom without any other injury than some localised irritation at the seat of injection, and that the white rat into whose stomach 1,000 times the minimum lethal dose had been introduced by one administration survived perfectly when, seven days afterwards, the minimum lethal dose of venom was injected under the skin. It was also found that the blood serum of the cat was definitely antivenomous, and the curious fact, further, was ascertained that her progeny had acquired protection through the milk supplied by the protected mother, thus supplying a scientific foundation for the half-admitted conviction expressed by Wendell Holmes throughout his *Romance of Destiny* in regard to the heroine, Elsie Venner.

These significant facts have been extended by a number of other experiments on white rats. In one series of experiments each animal received by stomach administration 500 times the minimum lethal dose if given subcutaneously, and, as before, no definite toxic symptoms were observed. On the day following this administration, three of the animals received subcutaneously one and a-half the minimum lethal dose of the same cobra venom, and they all recovered.

In a second series of experiments a dose of cobra venom equivalent to 1,000 times the minimum lethal, if subcutaneously injected, was introduced into the stomach. On several occasions in which this had been done, a subsequent injection under the skin of one and a-half the minimum lethal dose, made in some experiments two days and in others three days afterwards, resulted in the recovery of the animals. The extraordinary result was thus obtained that serpents' venom introduced into the stomach in large quantity, in a quantity which if injected under the skin would be sufficient to kill 1,000 animals of the same species and weight, while it failed to produce any definite symptoms of poisoning, nevertheless produced in a few hours complete protection against the lethal effect of a dose of venom more than sufficient to kill the animal. There is a probable significance, also, in the general resemblance between the results of these experiments and of those already described in which antivenene and not venom was introduced into the stomach. They are suggestive not only in regard to serpents' venom, but also to wider questions bearing upon protection against the toxins of diseases and the origin of the antitoxins used as curative agents in the treatment of these diseases.

It is difficult to account for them otherwise than by supposing that the venom while in the stomach had been subjected to a process of analysis, by which the constituents which are poisonous had failed to be absorbed into the blood, or had been destroyed in the stomach or other part of the alimentary canal, while the constituent or constituents which are antivenomous, or rather antidotal, had passed into the blood in sufficient quantity to protect the animals against otherwise lethal administrations of venom. I confidently anticipate that this natural process of analysis will by-and-bye be successfully repeated outside of the body by chemical methods.

Early this evening I had occasion to point out that the leading facts connected with immunisation or protection, now being advanced as scientific novelties, had apparently been ascertained and practically applied for centuries by savage and uncultured tribes and sects in various parts of the world. In regard to the results I have last described also, I discover that I have been anticipated by a long-existing and even now prevailing practice of unlearned savages.

In the *Lancet* of 1886 Mr. Alfred Bolton, L.R.C.P., states that "the natives in Bushmanland, Namaqualand, Damara-land, and the Kalakari are in the habit of extracting the poison gland from the snake immediately it is killed, squeezing it into their mouths and drinking the secretion, and they thereby appear to acquire absolute immunity from the effects of snake bites.....Having a month ago seen a native named Snellsteve, who is a snake-poison drinker and a snake collector, put his hand into a box containing two yellow cobras

and several horn and night adders, in doing which he was severely bitten, and has never since suffered anything more than a little pain, such as might be caused by any trivial mishap, I feel I can no longer refuse to believe in the efficacy of the snake virus itself as a remedy against snake poison."

Among several communications on this subject which I have recently been favoured with is one from Dr. Knobel, of Pretoria, who writes that when a boy he came into frequent association with a shepherd, who informed him that for years he had been in the habit of swallowing small quantities of the dried venom glands of serpents, and he averred that by doing so he obtained protection against serpents' bites, for he had often been bitten without any other ill-effect than that an irritable wound was produced. He stated that the swallowed venom of the cobra produced greater protection than the venoms of less poisonous serpents, and that not only was this benefit produced, but there was also produced an exciting intoxication, differing from that of Indian hemp in so far that the venom always produced the same degree of intoxication with a definite quantity however frequently it was taken, whereas the effects of the Indian hemp were gradually lessened by repetition.

Another correspondent, Dr. Laurence, of Cape Colony, writes that "a Kaffir boy, aged about 25 years, frequently brings me for sale snakes of all kinds. . . . I have frequently seen this boy take hold of some most deadly snakes, especially the well-known puff-adder, which he will allow to bite him with impunity. Yesterday, I obtained from him what he states as the reason why the poison did not harm him. When a little boy, while walking in the veldt, a puff-adder fastened on his leg. He shook it off, calling to his father, who, a few minutes after, killed the puff-adder and removed the poison-glands. He then made small paper pellets and dipped them in the poison, and administered one occasionally to the boy, who stated that that cured him."

Some other letters I have received describe similar events, and also confirm the statement of Dr. Knobel that serpents' venom produces intoxicating effects, evidences of which have also been observed in many of the experiments made by me on the lower animals.

The results of the experiments in which the venom was introduced into the stomach probably afford an explanation of the protection enjoyed by certain snake-charmers, as well as by other individuals who claim to be protected, whether members of special sects or not; for although inoculation of the venom is apparently sometimes practised by them, and protection is no doubt assisted and maintained by the bites which, with impunity, they frequently receive, they are known also to swallow venom or the poison glands containing it.

These experiments also seem to throw a new light upon the clearly-established protection possessed by venomous serpents against their own venom. They suggested the importance of determining if the blood serum of venomous serpents contains, as does that of artificially-protected animals, an actual substance possessing antivenomous properties.

In order to arrive at some definite conclusions on this subject, I last year obtained from India several living specimens of the hamadryad (*Ophiophagus elaps*), a serpent of greater size and more aggressive disposition than the cobra, and reputed to be as deadly as it. From the blood of several of these serpents a serum was separated which, when dried, gave a product having the same physical characters as the antivenene from artificially protected animals. It was tested against cobra venom, both when mixed with rather more than a minimum lethal dose and also when injected thirty minutes after this lethal dose of cobra venom. In the former case, 0.25 c.cm. per kilo. of this antivenene prevented death; and, indeed, so perfectly antagonised this certainly lethal dose that no decided symptoms of poisoning were manifested. In the latter case, 5 c.cm. per kilo. was found to be a sufficient quantity to prevent death.

I hope by-and-bye to extend these observations by testing the antidotal power of this serum against the venom of the actual hamadryad, from whose blood it had been separated. A determination of this kind has, however, been made with the blood serum and venom of the Australian black snake (*Pseudechis porphyriacus*), a deadly serpent whose bite produces intense destructive changes not only at the place

where it has been inflicted, but also in the blood and in many of the organs of the body. When the blood serum and the venom of this serpent were mixed together outside of the body and then injected under the skin of a rabbit, it was found that half a cubic centimetre per kilogramme of the blood serum was sufficient to prevent death from rather more than the minimum lethal dose of the venom.

Notwithstanding the obliging co-operation of the India Office, I have not yet succeeded in obtaining the blood serum of the cobra, but it may safely be anticipated that it also will be found to possess antivenomous properties.

The foregoing statements, although referring mainly to observations on the lower animals, have probably in every particular a very direct bearing on both the prophylaxis and treatment of snake poisoning in man.

In the meantime I cannot adduce any actual experience of its use in human beings, as although a considerable quantity, both in the liquid and dry state, was last summer sent to India, and a smaller quantity to Africa, no opportunity for using it as an antidote has as yet occurred in the districts to which it had been sent. In regard to the altogether unsatisfactory experience of the use of medicines, ordinarily so called, I am not prepared to take the extreme position that no good can be done by their employment. While the evidence shows that no one of the very large number of those that have been recommended as antidotes is able, in any conditions of administration, to prevent death after the reception of even the smallest lethal dose of venom, it still may be that, by the physiological effects which they produce, they may assist any efficient antidote, such as antivenene, in preventing death; and also by prolonging life, increase the opportunity for a more thorough use of this antidote. In this category I would especially place medicines which increase secretion, such as diaphoretics and diuretics; many of the rapidly acting stimulants of the circulation, such as alcohol and the old snake remedy, ammonia; and stimulants of respiration such as atropine and strychnine, the latter of which is enthusiastically championed by Dr. A. Mueller of Sydney. And not only medicines, but also any measures that are available for these purposes, including artificial respiration, so distinctly indicated as probably a valuable therapeutical application in snake-bite by Fayrer and Brunton, which, though shown by the Indian Commission to be incapable of preventing death when alone trusted to, was also shown to possess the valuable auxiliary power of prolonging life.

[Other auxiliary measures, such as the application of a ligature, and the removal, as far as possible, of the injected venom by the opening up of the wounds and the application of suction by the mouth, or preferably by a suction apparatus, such as that invented by Mr. Andrew Smith of Cape Colony, were described by the Lecturer. These steps having been taken, antivenene should be injected into the tissues at or near the wound, and also under the skin above the ligature, and the ligature should not be removed until at least half an hour after a sufficient quantity of antivenene has been injected under the skin above it.]

But the important question has yet to be answered: What is a sufficient quantity? The whole tenor of my remarks has been to show how necessary it is to bear in mind that there is a definite relationship between the dose of venom received and the dose of antivenene required to antagonise it, and that this relationship also varies with the conditions of the administration of the antivenene, and especially with the interval of time that elapses between the reception of the venom and the administration of antivenene.

In snake bite in man it is impossible to estimate the dose of venom that has been introduced, for the nature of the symptoms of the patient cannot give the information even approximately. In searching for a solution of this problem several facts were taken into consideration which led me to conclude that the smallest quantity capable of producing death in a man of 10 stones would, according to certain data, be about 0.0317 gramme. In order successfully to prevent death from this dose it is probable that 330 c.cm., or about 11½ ounces of antivenene would be required if injected not much longer than thirty minutes after the bite had been inflicted. This, though a large, is by no means an impossible dose, and it

could without much inconvenience be introduced under the skin at several parts of the body. On the other hand, by assuming other data, the dose would be found to be a considerably smaller one, and one indeed which in the same circumstances could be successfully antagonised by about 4 ounces of antivenomous blood serum. Each of these quantities, further, could be reduced in bulk to about one-half by dissolving dried antivenene in half the quantity of water required to restore it to its original bulk.

It must be admitted, however, that in both cases the quantity of antivenene required to prevent death is inconveniently large, especially if in the treatment reliance is placed solely upon the administration of antivenene to the exclusion of all or several of the auxiliary measures that have been described. It is clearly desirable, also, that the antivenene treatment should be a practical one, not only for doses of venom which do not much exceed the minimum lethal, but also for the considerably larger doses that are occasionally introduced in snake bite.

To attain this object further work is required in order that an antivenene may be produced even more powerful than that those antidotal capabilities have been described. I am not sanguine that this will be accomplished by carrying to a higher degree the process of artificial protection in animals. A comparison of the antivenene of rabbits, which had last received 30 times the minimum lethal dose of cobra venom with that of other rabbits which had last received 50 times that dose, has shown that the latter has but little antidotal advantage over the former, and has suggested that in the process of artificial protection the saturation point of the blood for antivenene is reached before the possible maximum dose of venom has been administered. I would anticipate with more hope the results of endeavours to separate the true antivenomous principles from the inert constituents of the blood serum with which they are mixed; and some degree of success has already been obtained in my endeavours to do so.

In the foregoing remarks it has, however, been shown that even with the antivenene whose properties have been described, human life may be saved in a considerable, if not in a large, proportion of the cases of snake bite which would otherwise terminate in death. The attainment of this result is a satisfactory one, for the mortality from snake bite is large and is not restricted to the 20,000 deaths which annually occur in India, but includes additional thousands in all the tropical and subtropical regions of the world. Against this ever-present and formidable enemy the inhabitants of these countries have awaited for centuries a remedy whose antidotal value and limits of curative power have been established by experimental demonstration.

CAPSULES, FALSE AND REAL, IN OVARIOTOMY : WITH NOTES OF SIX CASES.¹

By ALBAN DORAN, F.R.C.S.,
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AN operator little experienced in ovariectomy may come across a kind of case which causes him some apprehension. There is a cyst, it reaches to the umbilicus or higher, but it also descends well down into Douglas's pouch. The cervix lies very high in the pelvis, and the fundus can be felt above the pubes. All these appearances point to an intraligamentous or encapsuled cyst. The novice makes an exploratory incision. He sees the uterus lying ominously in front of the tumour. One tube turns sharply round inwards and backwards on to the surface of the tumour, which resembles that of a common ovarian cyst with a shiny surface. He taps the cyst. Ordinary ovarian fluid escapes, then as he pulls on the collapsing cyst the whole of it, including the pelvic portion, comes out of the abdominal wound. To his intense relief he detects a normal pedicle—that is to say, the cyst is connected to the uterus by the Fallopian tube and the

¹ Specimens exhibited before the West London Medical and Chirurgical Society, April 10th, 1896.