

VACCINATION.

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With the Author's respect
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A TREATISE

ON

VACCINATION;

BEING

A DESCRIPTION OF ITS NATURE, ITS ORIGIN,
AND PROGRESS AMONGST THE POPULATION OF INDIA.

BY

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MADRAS PRESIDENCY.

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TO
THE PAST AND PRESENT PROFESSORS
OF

The Madras Medical College,

THE
FOLLOWING PAGES
ARE RESPECTFULLY DEDICATED

BY
A FORMER STUDENT.

PREFACE.

THERE can be no question that Vaccination has, of late years, attracted more than an ordinary degree of attention from the local Government and the head of the Madras Medical Department, as is evidenced by the many and laudable efforts made to further its progress amongst all classes of the community, but chiefly among the large bulk of the native population, and although these latter are, as a rule, strongly opposed to the practice, still, from the figures exhibited in the various Vaccination Returns, it may not be too much to hope that as its benefits are more widely observed, the prejudices which now exist will, in the course of a few years, be overcome.

As the working establishment of the Vaccine Department is shortly to be placed on a more efficient and liberal footing, and as I am anxious that many points regarding Vaccination, which are still undecided, may obtain a clear solution, I have put together in the following remarks the result of constant observations made during my daily visits in the several Districts of Madras, with the hope that those who may be chosen hereafter to work in the same useful and extensive field may test their practical value, and thus make this branch of Medical Science a little more complete and defined than it now appears to be.

But as there are also those, still in their Studentship, who will probably be eligible as Vaccinators in their future career in the service, I am hopeful that they will find in these few pages something that will guide them in their work,—something that will encourage them while battling with the obstinate resistance they must expect to meet from the lowest classes of the population,—and something that will give a

clearer conception of the importance and usefulness of Vaccination than they can glean from the necessarily meagre accounts of it in the standard text-books on Medicine.

It is with much diffidence that I advance the doctrine that Vaccination is merely a local disease up to a certain period; but I have arrived at this conclusion, only after much and careful thought; and as I have shewn in the following pages that such a view has an important *practical* bearing on the subject, I shall only be too grateful should a candid discussion of the subject hereafter prove the fallacy of such a theory, and substitute a more reasonable one.

VACCINATION.

Synonyms.—Vaccinia (from *Vacca*, a Cow); Variola Vaccinia; Variolæ Vaccinæ; Vaccine, Vaccination, Cow-pox.

Definition.—Variola Vaccinia.—A vesico-pustuloid disease produced by the inoculation of Cow-pox *virus* in the human subject, and developed locally in the form of vesicles up to about the seventh evening, at about which period the absorption of the specific matter from the vesicles protects the system from Small-pox.

History.—In searching out the history of Vaccination, I find it nowhere recorded except in Dr. Copland's "Dictionary of Practical Medicine," where it is said that it was practised by other nations before it was known in Europe. Dr. Copland appears to have believed that it was known and practised in the East before Dr. Jenner introduced it into England. But from all that can be gleaned on this subject from works treating of Hindoo Medicine, as also from translations of the ancient Sanscrit writings, no proof can be adduced to substantiate this statement.

There is not the slightest doubt, however, that Inoculation was practised in India from a very early period, and that the natives had recourse to it as a preventive of the attacks of the natural disease, because they were well aware that, in whatever way it was produced, it attacked the human body but once during life.

To prove that Inoculation and not Vaccination was in use among the Hindoos, as well as to shew that to Dr. Jenner alone is due the honor of conferring so great a boon on mankind, it would be well to refer to certain reliable records regarding it. And the most prominent proof is that afforded by the traditionary account of the natives themselves, and their present belief that it is the small-pox inoculation which is still carried on, and which they designate *Ummay*, which in the English language is literally *Small-pox*. And not a single fact can be advanced to shew that, prior to 1804, when it was introduced from England, vaccination was practised in any part of this Presidency ; but, on the contrary, inoculation was the universal practice.

The Rev. Mr. Ward, a Missionary of Serampore, in his almost exhaustive and comprehensive work on the Customs, Religion, and Literature of the Hindoos, has the following passage corroborative of *Inoculation* having been in use among the natives of India :—“ Inoculation for the small-pox seems to have been known among the Hindoos from time immemorial. The method of introducing the *virus* is much

the same as in Europe, but the incision is made just above the wrist, in the right arm of the male, and the left of the female. Inoculation is performed in general in childhood, but sometimes in riper years : some few die after inoculation, but where the disorder is *received naturally*, multitudes perish. A few Hindoos do not submit to inoculation, because it has not been customary in their families. At the time of inoculation, and during the progress of the disease, the parents daily employ a Brahmin to worship *Streetula*, the goddess who presides over this disease."

In another work by James Moore, M. R. C. S., of London, on the "History of Small-pox," printed in 1815, it is clearly shewn that *Inoculation* was practised in the East Indies from the remotest periods of antiquity, and that a particular class of Brahmins were the operators : and further, that the practice spread gradually from the East until it was introduced into England by Lady Mary Wortley Montagu. With these facts before us, I think we may safely conclude that Dr. Jenner was the first and sole originator of the practice of Vaccination.

It was while Dr. Jenner was engaged as a general practitioner in Berkley in the year 1775, and when inoculation was pretty freely practised in Europe, that he found there were in the county of Gloucestershire a number of individuals who could not be inoculated with small-pox. This led him to enquire into the cause of such a strange immunity

from the disease enjoyed by some, and he discovered that there existed a belief among the people of that locality that those persons who became accidentally inoculated with the Cow-pox whilst engaged in milking cows, were protected from small-pox. And this no doubt was the clue to all his other investigations, the first of which, apparently, were directed to the kinds of eruption to which the teats of the cow were susceptible: and by overcoming all the difficulties which attended a research prolonged over nearly twenty years, he succeeded in establishing the opinion that the Cow's teats were subject to a variety of eruptions, which were indiscriminately called "cow-pox;" and in learning to distinguish between these, he ascertained that one variety alone possessed the specific character of protecting the human body from small-pox, and this he called the "True Cow-pox."

He next saw that this "True Cow-pox" passed through regular and progressive changes, and that it was only at one period of its progress—when fully developed—that the *virus* within gained its specific character as a prophylactic agent against small-pox. It was whilst he was thus engaged, that he was struck with the idea of propagating the disease in man by inoculation of *virus* from the cow, and of then transferring it from one man to another; but it was not until a little more than twenty years after he first commenced his investigations, that he obtained the opportunity of submitting his ideas to a practical test. His first case which was publicly vaccinated, is recorded to have been on 14th May

1796 ; the subject of it was James Phipps, who was inoculated with lymph taken from the arm of Sarah Nelms, and who is stated to have passed through the various stages of the disease satisfactorily, and to have been subjected to the test of Variolous inoculation in the month of July following, which had no effect upon him.

Dr. Jenner appears at this time to have been prepared to make known his investigations, but delayed the publication of his work until he could bring forward a greater number of such practical illustrations as that afforded in the case of James Phipps. He published his first Essay entitled “An Enquiry into the Causes and Effects of the Variolæ Vaccinæ, a disease discovered in some of the Western Counties of England, particularly Gloucestershire, and known by the name of Cow-pox.” From this book we find that Dr. Jenner believed from the very first, that Cow-pox inoculation, if properly performed, leaves the constitution for ever after secure from the infection of small-pox : and he enumerates four classes of persons to whom Cow-pox inoculation holds out the prospect of great benefit :—

1st. Those who, from family predisposition, may be presumed to take small-pox unfavorably. 2nd. Persons of a scrofulous diathesis. 3rd. Those who, from idiosyncrasy, resist small-pox inoculation in early life, and 4th, Those who are laboring under chronic forms of disease, in which counter-irritation is desirable.

Mr. Cline made the first experiment in London with Cow-pox, at the end of July 1798, (about a month after the publication of Dr. Jenner's first Essay), and this having proved successful, vaccination began so to spread in all directions that, in 1801, upwards of six thousand persons were vaccinated, the greater number of whom were subjected to the test of Variolous inoculation. From 1800 to 1802, Vaccination was introduced into France, Italy, Spain, and the East Indies. In 1808, it was taken under the protection of the Government,—Parliament having previously voted Dr. Jenner the sum of £30,000 for being the discoverer and promoter of Vaccination.

In 1804, vaccination made its way into Madras.

Description.—There are two kinds of Cow-pox observed in man ; there is the “Casual Cow-pox,” caught by milkers of Cows, and the “Inoculated or regular Cow-pox.”

Casual Cow-pox appears on the hands and wrists of those affected with the disease, these being the parts exposed to the contagion. It is seen at, first, as small inflamed spots, not much unlike those of the inoculated Cow-pox as observed on the second day : these spots are developed into pustules of a circular form with elevated edges and depressed centres, having a congested bluish appearance. After a time, fever, headache, swellings in the axillæ, and other symptoms indicating the absorption of the *virus*, shew themselves, and

usually disappear in three or four days ; but the sores on the hands often remain for a considerable period, causing great pain. This is no doubt occasioned by the accidents to which a working person's hands are subject, and is similar to what I have observed in the subjects vaccinated here, when the vesicles are in any way injured, which is not an uncommon circumstance among the poorer classes of the people.

Inoculated or regular Cow-pox.—After a successful operation properly performed, *i. e.*, after the lymph has been introduced carefully beneath the cuticle and laid on the surface of the true skin, the irritation produced by the lancet subsides, and the small particle of blood which had exuded, dries on the part. Early on the second day a minute, hardened point is felt, quite distinguishable, after a little practice, from the impression imparted to the finger by the particle of dried blood which continues to cling to the wound. When this hardened point is examined by a magnifier, a slight efflorescence is distinctly seen around it, except when the skin is very dark.

On the third day it is raised into a reddened pimple. On the fifth day, this pimple is surmounted by a small vesicle with elevated edge and depressed centre. On the evening of the seventh day this vesicle is usually at its height of perfection, and its margin is then rounded, fully distended, and feels quite elastic, whilst its centre presents a clear dent or depression, occupied—when the vesicle has

not been interfered with—by the crust of dry blood seen on the first day. On some part of the eighth, sometimes late on the seventh day, we observe a change: the elevated edge of the vesicle subsides to a level, sometimes even to a lower level than the depressed centre, and loses its elasticity; the cuticular covering is slightly wrinkled, and the vesicle looks broader than it did previously. Corresponding to this period, which is generally on the early part of the eighth day, an inflamed ring begins to form around the base of the vesicle; it is at this period also that the constitutional symptom—fever—appears. The areola continues gradually to spread until about the tenth day, when its extent usually bears a proportion to the size of the vesicle which it surrounds. At this period also, there is considerable swelling and hardness of the subjacent cellular tissue. The areola begins to subside on the eleventh day, leaving on the arm of a fair-skinned child two or three concentric circles of a bluish tinge. The vesicle during this time has re-filled, the walls of the cells in the interior break down, and, becoming disintegrated, mix with the lymph, which is now opaque, and soon concretes. And if the vesicle is carefully preserved from injury, it becomes, at about the end of the second week, a dry, hard, round scab of a reddish-brown color: more usually, however, the vesicle gets broken, a portion of the lymph exudes, the remaining portion concretes and forms the scab. This scab contracts, dries, and blackens, and on about the twenty-first day drops off, leaving a circular and slightly-depressed mark indented with minute points, varying in number according to

the size of the vesicle and the consequent number of cells of which it was composed.

At about the seventh day, slight symptoms of constitutional disturbance will be observed, which manifest themselves earlier in the hot weather ; but whether sooner or later, its appearance is synchronous with the development of an *areola*, or congestive ring. It is characterized by a hot skin and other marks of fever, with slight derangement of the bowels, which invariably, except in a very few instances, requires no treatment. A papular eruption sometimes appears on the extremities, more especially on the upper arms in the vicinity of the vesicles. The fever sometimes continues even after the scab has fallen off, but requires little or no interference.

The above are the phenomena observed in children. In adults, they are slightly modified. The vesicles are thinner, more easily ruptured, and do not possess the same elasticity. The lymph soon becomes yellowish, and the areola is more extensive : the glands of the *axillæ* frequently swell, which is not observed in children, and the constitutional symptoms are more severe. Some are of opinion that the lymph of adults is more energetic than that of children.

Anomalous Varieties.—The two kinds most frequently to be seen in the Presidency, are the following :—1st, an imperfectly-developed vesicle, small and flabby, but running its course pretty regularly except at its termination ; the scab

forms more quickly and falls off before the twenty-first day ; the characteristic appearances, as the raised edge and depressed centre, are not well defined, and, on the whole, the vesicle appears abortive. The subjects of this variety are usually found among the very poorest classes, who subsist on very little and live in the midst of almost every kind of filth,—their abodes being the “chuckler’s huts” and low parcherries of the Presidency. With reference to these subjects, it is of the gravest importance to remark that, as the greatest difficulty we have to contend against in the spread of vaccination is a want of sufficient lymph to carry out the arm-to-arm operation, we are therefore compelled to make use of such vesicles, because the parents of these children only consent to take them about in consideration of the trifling presents they get from those who receive the lymph ; but it is necessary that we should be exceedingly careful when choosing our subjects from among them, and observe whether or not the parents are afflicted with any constitutional malady. In my daily itinerations in these localities, I have very frequently found that many of the parents of these children are affected either with leprosy or loathsome syphilitic sores, or both ; whilst the children, though they doubtless inherit the constitutional depravity of their parents, shew no other sign of it at the time than a weakened frame. Since my appointment as Superintendent of Vaccination, I have met with two cases where the children, to all appearances, were healthy when operated upon, but who, after the sore on the arm had existed for a month, broke out with syphilis, which ended fatally in one of

them. The safest plan would be, not to use lymph from these subjects at all ; but until we are enabled to procure better, it behoves Vaccinators and their Superintendents to be, as I have said, exceedingly careful.

The annexed painfully-interesting case, published in the *Lancet* of July 18th, 1863, No. 3, Vol. II, page 86, by Mr. H. Hodson Rugg will, I am sure, shew how really particular we must be in choosing our subjects for lymph. "I may mention a case," says Mr. Rugg, "reported by Mr. Robert B. Carter, of Stroud, of 'Probable Vaccino-Syphilitic Inoculation.' " He states—"In August last, my attention was called to a little girl eleven years old, who presented the characteristics of inherited syphilis in a very marked degree. She was undersized and feeble, with mis-shapen extremities, earthy complexion, senile aspect, prominent frontal eminences, and depressed *ossa nasi*, giving to the face a peculiar look of concavity. Her teeth were dwarfed and laggy ; the upper central incisors with marked crescentic notches. Her eyes had suffered severely from iritis and interstitial keratitis, and the lymphatic glands of the neck were enlarged. Altogether her appearance was so striking, that no one conversant with the matter could have passed her in the street without observation. The parents of this child and her brothers and sisters are not only healthy, but are positively exceptional specimens of vigour and good condition. It is nothing to the purpose to say that the father is a magnificent animal, who will not admit having had any illness of any kind within

his own memory. The mother is a robust, active woman, who has had no abortions and no ailments during pregnancy. The other children, taken collectively, form about as fine a family as I ever saw, and one of them is, I think, the finest child I ever beheld. The syphilitic one is the eldest, and the next, eighteen months younger, presents no trace of contamination. She is strong, well-formed, active, with pretty features, good teeth, clear complexion, plenty of red blood, firm muscles, and well-shaped extremities—a general description that would apply to all the rest. The mother states that the eldest child was in perfect health, and as fine a baby as the others have been, until at between six and seven months old she was vaccinated. From that time forward she has never been free from a succession of syphilitic ailments, and before that time she shewed no sign of any thing amiss.”

2nd. The other anomalous variety is a vesicle of a conical shape, surmounted by a small scab, having a pustular appearance, surrounded by a slight areola, and frequently, though not always, placed on a hardened base : it slightly resembles an itch pustule, from which it differs in always having a scab on its top, and its contents not being so clearly yellow. This is strictly a spurious variety, and is the result of bad lymph being used, or when too many have been vaccinated from a single vesicle, or when the lymph is taken from a vesicle which was used the previous day.

Prejudices of the people.—There are a few amongst

the ignorant of the native population who still oppose our practice, on the grounds that it is an infringement upon the rights of one of their presiding goddesses : and there are others who ask us to put off the operation until what they consider a "good day." These, and other still more trivial excuses, often cause a great deal of inconvenience to the Vaccinators, and is one source of difficulty in obtaining lymph for the arm-to-arm operation. The Vaccinators overcome this by fixing certain days for the operation, being aware, of course, that they will have mature lymph on these days ; and to make it still more secure they never leave the house until they have made three punctures on each arm, which they make the people believe is a preparatory and essential step in the operation. With even these shifts and precautions, it is no uncommon thing for the Vaccinator to be told on the day fixed for the operation, that he must come on some more propitious occasion, and the lymph he has had the trouble in securing is thus rendered useless ; so that the young Vaccinator will thus see that there is no other alternative, than steady and unremitting patient working before him. If he fails in getting their consent to-day, he must go again to-morrow, and if need be, again and again, until he succeeds.

MISHAPS TO THE VESICLE.

- (a.) Destruction, partial or entire.
 - (b.) The universal habit of bathing the vaccinated child on the third or fifth day.
 - (c.) The application of remedies,—as a poultice of the Margosa leaf, ashes of cow-dung, or powdered galls.
- (A.) Destruction, partial or entire.

Before describing how this affects the success of vaccination, I have to mention that I consider vaccination to be an entirely *local disease* up to the seventh or eighth day, or to the period that the areola is formed. It has occurred to me that immediate absorption does not take place, but that the lymph is detained in the part where it has been introduced, and develops a vesicle from which absorption takes place when the vesicle is matured, and not before. This seems to me to take place as follows:—The lymph or morbid matter is deposited on the *cutis vera* with the point of the lancet, where, from the combined effects of the eliminative property of the skin and its naturally slow absorbing power, the superficial position of the part, the contracted state of the capillaries which have been wounded, the sensitive quality of the *cutis vera* occasioning a temporary congestion incompatible with absorption, and perhaps also the viscid state of the lymph, act in preventing immediate absorption. The particle of blood which has exuded now begins to dry, and in doing so robs the lymph of its fluidity, and thus renders its condition still more opposed to absorp

tion : the result is that it has become localized, and being morbid, sets up irritation, causes effusion, changes the effused material into a substance identical with itself, and of which a vesicle possessing specific characters is developed.

The vesicle next increases in size and in intensity, as regards the nature of its contents, until it arrives at maturity, which generally is on the evening of the seventh day. Maturation being established, no further exudation takes place, but a reverse action seems to follow. Absorption now begins, clearly and unmistakably evidenced by the areola or congestive ring and swelling of the surrounding part, which, doubtless, is no more than Nature's never-failing attempt either to localize or entirely prevent, when she is able, the absorption of morbid matter into the system. In these cases, however, absorption does take place, and simultaneously we have the constitutional symptom—fever—present : and I am of opinion that this fever is an essential element in the disease, clearly indicating that the constitution has been affected, though it is said not to be ; because hitherto the vesicle was supposed to be a proof that the constitution was under the full influence of the disease, and, therefore, one well-formed vesicle was deemed sufficient.

In order to prove that cow-pox in the human being is a local disease up to the seventh day, I shall state the results of certain experiments which have been made to explain other views bearing on vaccination.

1st.—“It has been proved that when a child is sometimes vaccinated after having been infected by measles or scarlatina, and before their respective eruptions have appeared, the cow-pox is generally retarded.” Here we have a proof that the vaccine *virus* remained localized in the part where it was laid, up to at least the period that the system was under the influence of the measly poison :* for, if it was absorbed the moment it was introduced into the wound, what became of it? No one would for a moment suppose that it remained floating about in the blood, until it got a chance to make its way out again by the punctures through which it had entered. No, the only reasonable conclusion to be arrived at is, that it remained localized until the skin was freed from the congested influence of the measly poison, and rendered susceptible to the irritation which it was capable of producing, and then the vesicle developed itself.

2nd.—“Again, it has been observed that if vaccination is performed during the incubative stage of casual small-pox, this latter being yet latent, the vaccine vesicle either does not advance, or advances tardily and imperfectly.” Here we see that, if the incubative stage is so far advanced as to have influenced the whole body, the vaccine inoculation has no effect. If the incubative stage is only of recent duration, then the vaccination advances, though tardily ; but certainly not by first entering the constitution and then arriving at the

* A case is given by Dr. Gregory, where this lasted for sixteen days.

spots through which the *virus* was introduced, for if it did enter the constitution, it would there meet with variolous influence, and be rendered powerless.

3rd.—“ When vaccination precedes variolous inoculation by a period not exceeding four days, both diseases advance locally. Sometimes, an eruption of small-pox papulæ follows ; at other times the variolous fever is slight and unaccompanied by eruption.” It is necessary to remember that the vaccine vesicle is not matured until the end of the seventh day, and that the small-pox vesicle does not arrive at this stage until the *fifth day*. So that we have in this experiment the vaccine operation preceding the variolous by four days, and as the vaccine lymph is still localized, there is nothing to prevent variolous matter taking effect locally also,—there being the three full days to be completed before the system can be brought under the influence of the vaccine matter ; consequently the variolous inoculation does take effect, and as it is the more powerful of the two diseases, it sometimes (as it were) takes the lead, and establishes an eruption of small-pox *papulæ*, which is characteristic of variolous inoculation.

4th.—It has also been proved that variolous inoculation will rise when performed even at so late a period as the seventh morning ; but after this time no effect is produced, which clearly proves that vaccination is a local disease until about the evening of the seventh day.

5th.—Mr. Bryce's test,—the so-long extolled and highly valued suggestion, to which such honor has been bestowed by some as to consider that even the noble discovery of Dr. Jenner is incomplete without it,—instead of establishing the notion that it is a test which proves the constitutional effects of the first operation, simply and clearly proves, if it is successful, that the constitution is not affected by the first operation until the evening of the seventh day. In other words, that the lymph introduced by the first operation remains localized until the evening of the seventh day : for, observe—

(a.) If Bryce's test is employed before the seventh day, it rises, because the constitution is unaffected, and there is therefore nothing to resist its development.

(b.) But if it is employed after the seventh day, or, in other words, after the constitution has been affected by the previous operation, no attempt at rising takes place.

6th.—“When small-pox inoculation precedes by three or four days (not *five* days), the insertion of vaccine lymph, the vaccination advances ; but after the tenth day, the fluid in the vaccine vesicle becomes purulent, and in that state will communicate small-pox.” Here we see that variolous inoculation is also a local disease for a certain period, viz., up to the fifth day, for this reason that, if vaccination is performed at any time before the fifth day of the previous inoculation of small-pox, it rises, but if performed after that time, it does not.

Having, I trust, clearly established the fact that vaccina-

tion is a local disease up to the evening of the seventh day, it may be well to enquire of what use this knowledge is, in a practical point of view.

(a.) It is of the greatest practical value, because, by it, we are induced to use all the means in our power to preserve the vesicles from injury, for if they are injured before the seventh day, the lymph, which otherwise would be absorbed, is allowed to escape from the vesicles, and the irritation occasioned by the injury sets up a degree of inflammatory action, which, if it does not terminate in ulceration, is sufficient to change the condition of the part so as to prevent absorption.

(b.) When the vesicles have thus been destroyed, it points out the absolute necessity for a second operation at a short interval after the first, and the operator has good grounds for urging upon the parents the necessity for a second operation.

(c.) All statistical reports bearing upon the prophylactic power of vaccination must necessarily be incorrect, when a consideration of this particular point is neglected.

(d.) If this "*local theory*" be admitted, we see the necessity for permitting the vesicles to pass through all their stages unmolested ; but if the other view holds good, I am of opinion that it is an unjustifiable act of cruelty to let the vesicles pass on to maturation, with the attendant inconvenience and suffering, when the "*second day pimple*" is sufficient to shew that the constitution has been affected : for, at this stage it can be suppressed, and a single pimple would be sufficient.

(B.) The universal habit of bathing the vaccinated child on the third or fifth day.

It was an ancient rule amongst a particular class of Brahmins who were permitted to perform the operation of inoculation (the operation being generally performed on the right or left wrist), to order that the child should have cold water poured on its head and shoulders morning and evening until the fever set in, and then discontinued for a while. This practice seems to have been handed down to the present generation and is still scrupulously followed, but greatly modified: for, instead of cold water being poured on the head and shoulders, as was formerly the case, the child gets a general warm bath on the third or fifth day, as one or the other may be deemed the more propitious. The child is bathed for such a long time that, before the bath is completed, a large quantity of water soaks into the vesicle, so that I have often seen a fifth-day vesicle as large as a fully matured seventh-day one. Thus, not only is the lymph largely diluted with fluid from an external source, but this is often the cause of destruction to the vesicle also, by softening the crust of dry blood which hermetically sealed the vesicle, as it were, at the central depression, and formed the weak point in it. When it is softened it often gives way at this point, and the vesicle is emptied of its contents, which gradually ooze out.

(C.) The application of remedies,—as a poultice of the Margosa leaf (*Melia Azidarachta*), ashes of Cow-dung, or powdered galls,

The poultice acts in the same way as the warm bath, and the acrid juice of the leaves, no doubt, sets up a degree of irritation and inflammation, for I have seen large ulcers resulting from its use. The ashes are employed generally after the bath has done its mischief, when it is sprinkled on the vesicle to absorb the fluid which oozes out.

These practices must be prevented by serious and patient instructions given to the parents *after* the operation ; for if they are made aware of the consequences before the operation, they will very often object to the performance of it. The lymph being inserted, they must then be made to believe (which you are justified in doing,) that these practices will likely cause such mischief as to endanger the child's life, as extensive ulcerations often follow which materially affect the child's health, and sometimes terminate fatally.

Besides these instructions, they must be warned not to hold the child by that part of the arm operated upon, and if the child is old enough to run about, it should not be permitted to be out in the rain during the rainy season, or be permitted to scratch the vesicles.

Re-vaccination.—By this is meant a repetition of the operation of vaccination, after a period when the system is supposed to have worn out (so to speak) the influence of the previous operation. No fixed period is given for this ; but some have supposed that ten years is about

the limit of time. Dr. Gregory appears to think that, after ten years, the skin begins to be susceptible to the irritation of the *virus*. My own opinion of the matter is, that if vaccination is properly performed, the vesicles permitted to mature unmolested, the lymph genuine and undiluted with *serum* or other matter, and absorption thoroughly ensured with lymph from a large number of vesicles, it is a protection for life against small-pox ; but that re-vaccination is necessary, when, after vaccination, the individual suffers from a full effect of measles, or from a severe attack of secondary or tertiary syphilis. The system in these instances undergoes such a thorough change, as to yield a turning point to any previously-established influence or state of the body. I would, therefore, in every such instance, advise re-vaccination.

To obtain any really reliable statistics in Madras, which would shew whether or not re-vaccination is necessary, I would suggest that the names of all individuals vaccinated be arranged alphabetically in a Register, which should be kept by some responsible officer, as indicated in the form annexed, and when any death from small-pox occurs, a certificate in the form as below be filled in by the Police or other responsible party, and forwarded to the officer in charge of the Register, to note whether or not the name of the deceased was recorded. The results of these entries will, in the course of a few years, give a pretty accurate idea as to whether re-vaccination is necessary or not.

FORM I.

	NAME.	
	Years.	AGE.
	Months.	
	Place of residence.	
	House No.	
	Name of street.	
	Sex.	
	Father's name.	
	Mother's name.	
	Father's occupation.	
	No. of vaccinated points.	
	No. of successful vesicles.	
	No. of vesicles destroyed.	
	REMARKS.	

FORM II.

CERTIFICATE OF DEATH.

	NAME.	
	Years.	AGE.
	Months.	
	Sex.	
	Place of residence.	
	Name of street.	
	House No.	
	Mother's name.	
	Father's name.	
	Father's occupation.	
	If vaccinated.	
	REMARKS.	

FORM III.

It would also be well if the following kind of Certificate could be obtained from those who have had attacks of small-pox, and recover from it.

NAME.	Age.	Sex.	Place of residence.	Street.	House No.	Mother's name.	Father's name.	If vaccinated.	When vaccinated.	REMARKS.

Surgery of the operation.—If possible, fresh lymph must be employed in all cases, and the arm-to-arm operation is preferable. The lymph must always be taken on or before the seventh morning, or before the *areola* forms, at which period it is clear, limpid, and unadulterated. The eighth day lymph may be used in cases of urgent necessity with very nearly equal success ; but after this it is not to be depended on, not only as regards its propagatory power, but because it becomes diluted with the *serum* of the blood, and adulterated with the disintegrated particles of the cell-walls.

The vesicle which is to be punctured for its lymph must be treated with the greatest gentleness and care : the punctures should be made with a narrow, sharp-pointed lancet in the rounded elevated margin, and the lancet must not enter any deeper than through the cuticle. I have found a good sharp clean sewing-needle answer the purpose best, the vesicle being simply pricked with the needle all around its margin : through these minute punctures nothing more than the genuine morbid matter immediately exudes, and forms a circle of small globules. These globules must be carefully taken up on the point of the lancet which the operator is about to operate with, no pressure being made on the vesicle at the time. By this means, I think we are sure of using the specific matter unadulterated and undiluted, and as many as can be vaccinated with this lymph should be the *decided* limit to the number of individuals who ought to be vaccinated from a single vesicle. If any more forcible means of obtaining lymph be employed, the danger of transferring constitutional taints from one individual to another must inevitably be incurred, as effusion of fresh serum from the blood is sure to take place. It, of course, will be admitted that the fresh serum of the blood will more surely communicate a constitutional disorder by inoculation, than a specific morbid matter when employed alone, although generated in the same individual : and less so certainly, when that morbid fluid is developed locally, as is the case with vaccine matter.

As a rule, in operating, let your punctures be of the sim-

plest and smallest kind possible, so that the congestive or sub-inflammatory sequel of maturation may be so mild as to ensure complete absorption. Many varieties of punctures are advised, and if any be deserving of preference, it is the simple oblique one directed from above *downward*, and into which the lymph, as it were, gravitates ; but the most convenient and, perhaps, equally as successful, is that which is directed from without *inward* on the left arm, and from within *outward* on the right arm of the child. This is the method practised by the Vaccinators in the Presidency.

The lancet used should be perfectly clean, and free from rust ; it should have a sharp point and a shoulder just broad enough to retain the *virus* on it ; it should be held firmly between the thumb and the fore and middle fingers of the right hand, at about the point of union of the middle and extreme third of its length : its point then being charged with the lymph in the manner already described, we proceed to operate. The child's upper arm is grasped firmly by the left hand of the operator, in such a manner as to make the skin on the anterior and upper part quite tense ; the point of the lancet is now lightly but steadily made to pierce the cuticle and slipped under it, so as to lie between it and the *cutis vera* ; after retaining it in this position a moment or two, the lancet is then raised a little, so as to tilt up the cuticle with its point, and then depressed to restore the point to its former position. Having repeated this twice or thrice, the lymph becomes deposited on the *cutis vera*, and.

the lancet is then withdrawn and re-charged with lymph for the next operation.

It does not at all matter whether much or little blood follows the operation, provided the lymph has been properly deposited on the *cutis vera*; but I would advise that beginners should, in order to ensure success, when they see much blood flow from the operation, wipe it off and re-introduce, very carefully, the point of the lancet into the wound charged with lymph. When they become expert operators, this will be entirely unnecessary.

Vaccination should be delayed if the child is not in health; if suffering from diarrhœa or other derangement of the digestive canal; during the period of dentition; and particularly when "cutting" a tooth, and when the skin is affected with an eruption. If the child is merely suffering from itch confined to the hands or feet, I would not advise any delay in the operation on this account. Psoriasis is so common amongst the poorer natives, that you cannot put it down as an objection, unless it is extensively spread over the body,—as when the head, hands, calves, &c., are covered with it. Dr. Jenner always laid particular stress on this point, and the annexed extract, from an original letter of his, sufficiently shews his anxiety regarding it:—

BERKLEY, *December 4th*, 1817.

* "SIR,—I was absent from home when your obliging letter

* *The Lancet*, No. 18, Vol II, October 31st, 1863.

of the 24th of November arrived ; but I do not think that this is likely to occur again for some time, and shall, therefore, be very happy to take your little family under my care at the time you mention—the latter end of January.

“ Our arrangements must be carefully made, as the children must be met here by proper subjects for transferring the vaccine lymph, for on the accuracy of this part of the process much depends. It may be necessary to observe also, that amongst the greatest impediments to vaccination (*indeed the greatest*), is an eruptive state of the skin on the child intended to receive the infection.

“ On this subject I wrote a paper so long ago as 1804, and took much pains to circulate it ; but I am sorry to say that the attention that has been paid to it by the Faculty in general has been by no means equal to its importance. This is a rock on which vaccination has been often wrecked ; but there is no excuse, as it was so clearly laid down in the Chart.

“ I am, Sir,

“ Your obdt. and very humble servant,

“ EDWARD JENNER.

To W. J. DENBY, Esq., St. James Square, London.”

Number of Vesicles to be raised.—It was usually considered that one vesicle on each arm of an infant, and two on each arm of an adult, were sufficient for a thorough consti-

tutional effect, and, in fact, one well-formed vesicle was all that was looked for and deemed necessary. Following in the beaten track, I too thought so for some time after being nominated Superintendent of Vaccination ; but soon after, forming the idea that vaccination was a local disease for a certain period, I considered that the larger the quantity of vaccine fluid received into the system, the more certain would be its effects, and as this could only be accomplished by increasing the number of vesicles, I carefully considered the subject in all its bearings, and being convinced of the necessity of it, I resolved upon putting it into practice by ordering three vesicles to be raised on each arm of every individual vaccinated. Having fully established this in the districts,—which was slightly opposed for a while,—particularly when very young infants were concerned, I made it known to the Principal Inspector-General of the Medical Department, in my Annual Report, dated 1st January 1863, fully setting forth my reasons in that Report for having adopted it. After this, I felt I could do no more than wait patiently until time should disclose whether or not it was a more beneficial practice, when, to my great satisfaction, I found, on looking over the *Lancet* for June 13th of the same year (1863), a lecture on Vaccination by Dr. Graily Hewith, of London, in which he gives an account of the very remarkable facts observed and recorded by Mr. Marson, which bear directly on the utility of the practice which I introduced. I cannot, therefore, do better than give a correct copy of it here.

"During the sixteen years ending 1851," records Mr. Marson, "there were admitted into the small-pox hospital, 3,094 individuals protected by vaccination. There were 1,357 persons with one cicatrix ; 888 with two cicatrices ; 274 were admitted with three cicatrices ; and 268 were admitted with four cicatrices. The mortality in these different cases was, as shewn by the following figures :

MORTALITY.			
With 1 Cicatrix.	{ Good... ..	768.....	4.23 per cent.
1,357 Cases.	{ Indifferent... ..	589.....	11.95 "
„ 2 Cicatrices.	{ Good... ..	608.....	2.68 "
888 Cases.	{ Indifferent... ..	280.....	7.29 "
„ 3 Cicatrices.	{ Good... ..	187.....	1.63 "
274 Cases.	{ Indifferent... ..	87.....	2.32 "
„ 4 Cicatrices.	{ Good... ..	202.....	0.99 "
268 Cases.	{ Indifferent... ..	66.....	0.00 "

We need only inspect the first and last of these numbers. In the 768 individuals who had only one good cicatrix, the deaths were four out of every hundred, and of those who had an indifferent cicatrix, the mortality was 11 per cent. With regard to those admitted with four cicatrices, the number of deaths was excessively small, being not one in a hundred.

Here we see facts corroborative of the correctness of my supposition, viz., that the greater the number of vesicles raised, the more certain will be the constitutional effects produced, which originated from the idea regarding the local condition

of the disease, and which is borne out by the statistical facts recorded by a gentleman of such experience as Mr. Marson, of the London Small-pox Hospital. If, then, I am so clearly borne out in my suggestion regarding the quantity of lymph and the number of vesicles required to ensure a good effect—which suggestion, as I have stated, originated from the previously formed idea of the local nature of the disease—it is quite reasonable to conclude that, if what was begotten was correct as proved by statistical facts, that also which begat must be correct.

Preservation of vaccine lymph.—This is a point of no small importance, involving several nice questions, which will be alluded to in considering each method. Of course, fresh lymph is preferred when procurable, the arm-to-arm operation being the best and safest ; but as preserved lymph has occasionally to be used, it is necessary that the best method should be adopted to keep lymph in a perfect state of preservation.

Lymph preserved in glass capillary tubes, appears to have been most successful in this Presidency. The objection I have to it is, that the fluid in the tube is largely diluted with the *serum* of the blood. The quantity of genuine lymph in each vesicle is so small, that it would be impossible to procure enough of it by this method to supply the demands constantly made for lymph from Mofussil stations ; so that, in order to meet them in this way, we are obliged to resort to the very

objectionable plan of removing the surface-covering of the vesicle to get to the lymph. By this means, abundance of fluid exudes, because the base of the vesicle is exposed to external agency, and from this part the fluid is poured out which is nothing more than the serum of the blood ; this mixes with the lymph, and is drawn into the capillary tube.

Now, I contend that it is not possible that lymph thus diluted can have the same intensity of action as genuine undiluted lymph : the crop raised from it may have all the appearance of good vesicles, but I am sure that the lymph which is absorbed from them cannot have that intensity of action on the system as a prophylactic, as when the lymph is generated from that of a genuine quality. Then, again, another equally valid objection to it is, the probability of inoculating the child with syphilis or leprosy,—a contingency which is not of very rare occurrence, and ought decidedly to be avoided, if possible.

I may add here that the method of removing the surface-covering of vesicles to obtain lymph has been, and is still, employed in the Presidency in our every-day work, because it is so difficult to get lymph to perform the arm-to-arm operation. I mentioned this and my objections to it, in my Report in 1863, in a letter to the Principal Inspector-General subsequently, and in my Report at the beginning of this year ; and I know that the Principal Inspector-General is giving the subject his best consideration, and

that some means will soon be adopted to remedy this, at present, unavoidable practice. I mention this in order to shew how necessary it is to choose a healthy child to obtain lymph from, and to know for a certainty also that the parents are not afflicted with any disease,—a circumstance on which I have laid particular stress in another part of this work.

The next method of preserving lymph is by means of ivory points, shaped like the teeth of a comb. By this contrivance, the small globules of lymph which exude from a vesicle after it is pricked with a needle in the manner before described, are picked up by the smaller end of the ivory point, and allowed to dry on it. This, in my opinion, is the *safest*, and if properly and patiently used, is equally as successful as the capillary tube plan. By this method, we can secure the genuine lymph, and if it is carefully put up, can be kept good for any length of time, as no decomposition can take place when in this dry state.

The points, after being charged, should be rolled up separately in tissue paper, next in blotting paper, and then put into a small stoppered phial, previously heated sufficiently to drive out all moisture. When required for use, the lymph must be scraped off very carefully in its *dry state* by a sharp lancet, and several pieces of this dry lymph must be introduced into each wound, and the blood allowed to dry upon it unmolested. By this means a good crop of vesicles is sure to be raised.

I have a slight objection, however, to the points being made of ivory, because, when scraping off the lymph, small particles of ivory come away with it, and being introduced into the wound, produce more irritation than is necessary. I would, as a substitute for the ivory, recommend the points to be made of blown glass. We cannot be too particular with so important an operation as vaccination.

Another method is, that of putting the lymph between pieces of glass. I cannot say much in favour of this plan. Whether from the pressure it is subjected to, or from some other cause, I find that we are not so sure of raising a vesicle from lymph so preserved, as from the ivory points. In fact, the failures from it have been so frequent that we have abandoned its use.

Crust.—The use of crusts, in my opinion, is the worst of all practices, made up as the crust is of all the products of the desquamated vesicle, viz., the cell-walls, turbid lymph, external cuticle, and, in many instances, when the part has been irritated, of a small quantity of blood. It is not to be wondered at, if, in the use of this, the patient suffers from Pyæmia, or the less fatal but loathsome diseases—syphilis or leprosy. There can be no more fruitful method of propagating such diseases, than by crusts. I am astonished that they have been used at all, when so much has been said against the use of turbid or ninth-day lymph. Crusts, however, are of great value in estimating the genuineness of the vesicle from which

it has been produced. A good crust is slightly bi-convex ; the greatest convexity being on the under-surface, where are to be seen with a glass, small rounded elevations corresponding to the depressions in the cicatrices on the arm. Its circumference should be fringed with a thin whitish cuticle.

The last method of preserving lymph is that of dipping fine cotton into the fluid, and allowing it to dry immediately. This is not noticed in any work on Vaccination that I have read, nor have I tried it ; but it was the practice among the ancient Brahmins who performed the operation of inoculation, and was the only method in use among them of preserving the small-pox lymph : and they considered that the lymph of small-pox ought to be a year old before it could be fit for use, and the lymph thus preserved was almost invariably effective. It is worthy of trial in preserving vaccine lymph.

Renewal of Lymph.—It is supposed by many that the vaccine virus deteriorates after it has passed through a large number of individuals, or that it becomes less and less effective as it is perpetuated through a succession of subjects from the first transfer from the cow. That this is the case with regard to the mere appearances of the vesicles thus perpetuated, is very doubtful : for Dr. Copland states that a very recent writer remarks, “ so far from believing in any deterioration of *virus* from successive inoculations, there is reason to believe that, by a careful selection of well-predisposed children, the pox may even be restored from an imperfect to a

perfect state, and by proper care, therefore, may be retained indefinitely in that condition."

I have often witnessed, in my daily routine, that the virus taken from an abortive kind of vesicle, in poorly-fed, weakly children, will develop, to all appearances, a well-formed vesicle in another but healthy and robust child ; but that the lymph which is thus renewed can have the same intensity of influence as that which has never deteriorated, appears to me to be almost impossible. And I have here to shew that, either from the lymph which we use being so diluted with serum (consequent on the difficulty in obtaining fresh lymph, as already described in these pages, and in my Annual Reports to Government) or from the destruction to the vesicles which in so many instances takes place before the constitution is protected, we find that small-pox is no uncommon occurrence at Madras amongst those who have been vaccinated, and amongst those too who have recently gone through the operation,—a circumstance which is often pointed out to me by the parents of children thus affected. Now, it appears to me, that both the circumstances above-mentioned contribute largely to the non-success of vaccination in the instances alluded to, and we should, therefore, do all in our power to overcome them. We have already had suggestions regarding the destruction to vesicles ; but in order that the lymph be not allowed to run into a useless condition, or be too long employed in a weakened and diluted state, we should, as frequently as it is practicable, renew it fresh from the cow. This must be done accord-

ing to the plan adopted by Mr. Ceely, of inoculating the cow with small-pox matter when procurable, and transferring the lymph generated in the inoculated spots into man ; which lymph, in fact, is no more than genuine cow-pox. I may here add that, in both my Annual Reports, I suggested that this should be done, and was about to put it into practice on one occasion, but, unfortunately, the cow was placed at my disposal when the lymph was not fit for use. Others have, I believe, endeavoured to accomplish this, but have failed—perhaps from not having done it properly. The plan I intend pursuing may not be out of place if mentioned here. The cow must not be a milch one ; she must be well washed and dried, and then thrown on a bed of straw : the teats are then to be inoculated with the small-pox matter as we do in the operation of vaccination ; three or four punctures must be made on each teat, and she must be kept down on the straw until the little punctures are dried, when she can be allowed to get up. But she must be prevented, in some manner, from reaching her teats with her tongue, and, perhaps, some weight attached to her neck will be the best contrivance to use : without this precaution, the whole process will be rendered ineffectual. Her stall should have a bed of straw in it during the whole period, and she must be walked about in the open air, morning and evening. These measures are to be continued until the vesicles are matured and the Lymph they contain is considered fit for use.

In conclusion, I have only to add, that should the foregoing

brief observations be the means of inducing the subject of Vaccination—a subject of the most paramount importance and vital consequence to the community at large—to be thoroughly ventilated, my object will have been fully attained.

