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Variola.—The history of smallpox in its relations to pregnancy is full of

interest. The disease presents two distinct varieties for study: 1. The confluent, or pure variola. 2. The discrete, or modified variola. Then we have 3. The influence of vaccination simple.

Dr. Gayton, Superintendent of the Homerton Smallpox Hospital, has given us the statistics of this institution. He saw 9671 cases. Of this number 95 were in pregnant women. Of 29 women gravid at different stages, from 3 to 8 months, taken with confluent, semiconfluent, or hemorrhagic smallpox, 22 recovered, 7 died. Of 30 women taken with discrete smallpox, all recovered. Of 26 women with confluent, semiconfluent, or hemorrhagic variola, abortion took place in every case, 21 of the women perished, 5 recovered. Of 10 cases of discrete smallpox all aborted, 1 only died.

As to the offspring: In one case, in which the mother died undelivered at 8 months, the fœtus on autopsy showed no mark of smallpox.

Twins at 8 months, born of a woman who died, were stillborn, showing no mark of the disease; one child at 6 months was born alive, but quickly died, it bore doubtful marks; one child of 8½ months, born alive, quickly became cyanosed and died, it bore no evidence of smallpox; in one fœtus of 4 months, doubtful vesicles were seen on the chest; one child born at 8 months, lived 5 hours, bore no marks. Of the children of the 10 women affected with the discrete form, one of 8 months lived 24 hours, no evidence of smallpox; one of 8½ months lived 4 days, died of convulsions, no marks; one at 8 months, whose mother died of metritis, lived 8 hours; one child of 9 months at term showed no evidence of smallpox; it was vaccinated the day after birth, and again on the fifth day, both attempts unsuccessful; it stayed in hospital a month exposed to risk, and left with its mother quite well.

Serres¹ observed 23 abortions in 27 cases of variola. Chambrelent noted 4 abortions in 5 cases.

1. What is the effect of variola upon the gravida? *a.* The *confluent*, or hemorrhagic form, is, Gayton says, likely to be fatal whether the subject be pregnant or not. But we think the mortality is almost certainly greater than it would be in non-pregnant women. *b.* The *discrete* form seems scarcely more dangerous in pregnant than in non-pregnant women. It seems that the period of greatest danger is that of puerpery. It is probable that pregnancy tends to impart the hemorrhagic character to the disease.

2. What is the effect upon the pregnancy? Abortion is almost constant. Non-viable children aborted of course are lost, and so a large proportion of the total of embryonic lives perish. In others the child is stillborn, dying under influences which will be discussed hereafter. Some few, born at a viable age, die soon after birth. The children that survive are rare exceptions.

3. Are the children affected by the disease *in utero*? In an unknown proportion of instances the child is certainly attacked. Some resist vaccination and exposure to smallpox; some are born bearing vesicles or scars, showing that they have gone through the disease *in utero*.

Desnos, cited by Chambrelent, relates that a pregnant woman took smallpox. The stage of desiccation reached, she brought forth a healthy child which showed no trace of eruption. It resisted vaccination with lymph that succeeded with other children. Chambrelent relates a similar instance from his own experience. But Fumée, of Montpellier, relates a more remarkable case. The woman bore twins; one child only showed variolous pustules.

It is desirable to record examples observed by classic authorities in the prevaccination era, since in the present era simple cases cannot be frequent.

¹ Gazette Médicale, 1832.

In John Hunter's works (vol. iv.) is a very full account of the subject down to his time. He relates the following: "Mrs. Ford had been seized with shivering and the other common symptoms of fever, on December 5, 1776. She was considered to be in the sixth month of pregnancy. In the 8th smallpox appeared. She passed through the disease well, and was delivered on the 31st. An eruption was observed all over the body of the child, and several of the pustules were filled with matter. Dr. Leake had observed that it might be necessary to inquire whether those adults who are said totally to escape the smallpox have not been previously affected with it in the womb. The child was, therefore, seen by Dr. Leake, the two Hunters, Cruikshank, and Mr. Falconer, who all concurred that the eruption was the smallpox. Dr. Hunter said that in all the other cases of the same kind that he had met with the child *in utero* had escaped the contagion. Sir George Baker mentions¹ the case of two pregnant women who were inoculated at Hertford. They both had the smallpox favorably, and afterwards brought forth children perfectly healthy. Both children were inoculated at the age of three with effect. Dr. Watson relates² the following deeply interesting case: "A woman big with child, having herself long ago had variola, assiduously nursed her servant during the whole process of this disease. At the proper time she brought forth a healthy female child, on whose body Dr. Watson discovered evident marks of variola, which she must have gone through in the womb; he pronounced that this child would be free from infection. After four years her brother was inoculated, and also this girl, at the same time with the same pus. The boy had the regular eruption, and got well; the girl's arm did not inflame; on the tenth day she suddenly turned pale, was languid for two days, and got well. This case shows that the mother may carry the variolous poison to her child, herself being unaffected by it. She may be a simple carrier."

The late Mr. Streeter held that the fœtus, taking the disease from its mother, went through it at a distinct period—that is, the disease in the fœtus had its stages of incubation and eruption after the corresponding stages in the mother. He observed that the fœtus had only arrived at the incubative stage, whilst the mother was already maturing the vesicles.

Chambrement's investigations³ on the passage of figured elements through the placenta are of extreme physiological and pathological interest. He found that the microbe of the "choléra des poules" inoculated in pregnant animals passed to the fœtus, and that the blood of the fœtus, cultivated in Pasteur's fluid, and then inoculated into other animals, produced the disease in a fatal form.

"How is it," asks Chambrement, "that in some cases the variola affects the fœtus *in utero* and fails in others?" He contends that the variolous microbe passes through the placenta, but that in some cases it finds in the fœtal blood a congenial medium for culture, in which cases the disease is produced, whereas in other cases the microbe finds a soil not suitable for culture, and then the disease is not produced.

THE EFFECT OF VACCINATION UPON PREGNANT WOMEN AND THE FŒTUS.—Precise data are not so copious as might be expected. Behm reports⁴ 33 vaccinations of women pregnant in the eighth, ninth, and tenth months. Humanized lymph, for the most part, was used. In 4 cases the operation failed, in 22 it succeeded completely, in 7 partially. Of the 33 children, 25 were vaccinated successfully, the rest without success, but in 6

¹ Med. Trans., vol. ii.

² Phil. Trans., vol. xlvi.

³ Recherches sur le passage des éléments figurés à travers le placenta, 1882.

⁴ Centralbl. f. Gynäk. 1882.

of these the lymph was not good; one, on whom good lymph was used, failed. This is the only instance of presumed protection from intrauterine action. New-born infants, he says, experience less constitutional disturbance from vaccination than at a later period.

In 1870, Thorburn vaccinated several pregnant women successfully, and found no insusceptibility in their infants.

It has been proved by fairly numerous experiments that many of the children born of women who went through smallpox when pregnant resist vaccination, although they show no mark of having gone through the disease *in utero*. Thus there may be acquired immunity without having had the disease in its ordinary form.

Again, vaccination practised upon pregnant women presents analogous phenomena. Burkhard, of Bâle, revaccinated 28 pregnant women. In 4 of 8 cases tested the infants resisted vaccination.

Rikett and Roloffs, operating on sheep, inoculated variola in 700 sheep in the later weeks of gestation. Their young were inoculated four or five weeks after birth with the lymph of sheep-pox; the inoculation failed in every case, whilst it succeeded fully in thirty-six lambs whose mothers had not been inoculated.

M. Masse¹ states the following problem: "The species which now appear to enjoy a certain immunity may owe it to the fact that their ancestors have all been affected by the disease. Their actual immunity may be due to a vaccination which they enjoy by heredity."

Thus it may well be that the almost universal practice of vaccination through successive generations has been and is telling in (1) lessening the susceptibility of our children, (2) in diminishing the virulence of the smallpox—that is, in substituting a modified disease for the virulent disease which afflicted our non-vaccinated ancestors.

It is very interesting to examine *by what process smallpox excites abortion and kills the fœtus*.

In some cases the abortion follows the death of the embryo, but in many cases the child is born alive. We shall examine presently the evidence proving that the embryo or fœtus almost necessarily perishes if the mother's temperature be long kept up to 41° C. or more. We will now discuss the causes of its premature expulsion alive. In this case the abortifacient influence must be mainly if not wholly exerted upon the mother. The following propositions were stated by Robert Barnes:²

a. Nature hardly tolerates the concurrent progress of an active disease and pregnancy.

b. If the disease be of zymotic character, the morbid poison, aggravated by the further blood-poisoning resulting from arrested or disordered secretory function—so important in pregnancy—acts upon the whole system, producing fever, increasing the irritability of the nervous system, impeding the nutrition of the muscular system, including the most important muscle of all, the uterus, and directly irritating this muscle. The influence of blood poor in oxygen and loaded with carbonic acid, in causing contraction of the involuntary muscles, has been well established by Marshall Hall, Brown-Séquard, and others. It is a matter of experience that pregnant women suffering from asphyxia, chronic or acute, are extremely apt to abort. The blood in fever wants oxygenation. In this respect it resembles the blood in asphyxia. But superadded to this condition are the *materies morbi*, and other consequent blood impurities, which it is probable act in a similar

¹ Des inoculations préventives dans les maladies virulentes.

² "The History of Smallpox complicated with Pregnancy." *Obst. Trans.*, 1868.

manner upon involuntary muscle. The result is that the uterus is directly stimulated to contract, and labor is induced.

c. There appears to be this difference between the action of acute and chronic blood-poisoning upon the embryo and pregnancy: in acute disease, where respiration is impeded and where the blood is rapidly poisoned, the first effect is upon the uterus. In chronic poisoning, as in the case of secondary syphilis, the embryo may be first attacked. Its nutrition is sapped, it perishes, and then, the uterine development being arrested, and involution taking its place, in the course of a period ranging from seven to twenty-one days contraction sets in, and the dead fœtus is expelled.

d. There is another way in which it is probable that abortion is produced in zymotic diseases. The blood is in a state favorable to extravasation. Apoplexy of the placenta or effusions between the placenta and the uterus take place, and thus uterine contraction is excited.

e. Abortion, or premature labor, may be excited in yet another way. The sudden impression upon the nervous system, or shock, may cause the uterus to expel its contents. We have seen this happen under the influence of an attack of apoplexy, and it is at least a principal factor in the causation of labor when uræmic convulsions break out during pregnancy.

THE EFFECT OF VACCINATION UPON PUERPERÆ.—This is a practical question. A woman was vaccinated¹ the day after labor. The milk dried up. The infant died from defective nutrition. A coroner's jury, reasoning that the sequence of events proved that they flowed as the effect of the vaccination, censured the doctor for vaccinating. Is there any danger in vaccinating or revaccinating a recently delivered woman? Without approving the censure of the jury, which was based upon entirely arbitrary assumptions, we believe there is. Any zymotic introduced into the working blood of the puerpera during the involution-process is likely to disturb the process and set up fever.

At the same time the question of vaccinating a puerpera must be governed by circumstances. If an epidemic of variola be raging, if the puerpera be living in a community herself exposed to risk of contagion, and thus liable to pass it on to others, vaccination may be justified.

Two practical questions arise—(1) Is it useful to induce abortion or premature labor in a woman suffering from smallpox, in the mother's interest? We think this must be answered in the negative. It is in a high degree probable that she will abort spontaneously. The process is in operation early, and there is no evidence to show that by precipitating the impending event any advantage is gained. (2) Does induction of labor offer a better chance of saving a child arrived at a viable age? We think the evidence of children born spontaneously and living, and of others in which the child is born dying or dies very soon after birth, lends weight to the opinion that timely induction of labor, by subtracting the child from lethal influences, would give it a better chance, and that without materially adding to the danger of the mother. In the section on the influence of high temperature on the fœtus *in utero* which follows, we shall find reasons strengthening this conclusion.

Is it useful to vaccinate pregnant women whom there is reason to think inadequately protected? This invokes the question: What is the effect of vaccination upon pregnant women? Dr. Yarrow, who has used good opportunities for testing this point, tells me that he never hesitates to vaccinate pregnant women, and that they experience no bad results. We cannot discover evidence of the mother being more prone to abort. Then, are the

¹ See Times, May 28, 1883.

children of mothers who were vaccinated when pregnant protected? The case is covered by that of smallpox. It has been found that some children thus born resisted vaccination; but, as might be inferred from the fact that some children whose mothers, when pregnant with them, were not thereby protected, so some children, probably most, of women vaccinated when pregnant will not be protected. The belief is, however, held by some physicians that the children born of mothers who were vaccinated whilst carrying them are protected. Still, vaccination may be properly applied as a test of protection; and for the public safety such children should not be exempted from the wholesome general law to vaccinate.