

INSTANTANEOUS DEATH FROM AIR ENTERING
THE UTERINE VEINS DURING A VAGINAL
DOUCHE IN THE FOURTH MONTH OF
PREGNANCY.

BY LUDWIG HEKTOEN, M. D.

Instances of sudden death from air entering the circulation through the sinuses of the pregnant uterus are, fortunately, so infrequent that the following case of this accident, occurring while a woman about four months pregnant was taking a vaginal douche, merits report.

History of the Case: H. L., a married woman, 40 years old, in humble circumstances, died suddenly April 7, 1892, at 10 P. M., having retired to her room for the purpose of taking a vaginal douch of warm water. The following facts in regard to her past were obtained from her husband, and a licensed midwife near by whom she had consulted shortly before her death. She had given birth to six children, four of which are still alive, the eldest being 13½ years old, the youngest 5½. Her first child was "taken from her side" by a physician in Austria, but whether this child was dead or alive could not be learned. The woman herself always maintained that the operation was a Cæsarean section; and said she remained in the hospital nine months after the operation. After the birth of her last child she had been poorly; she always, however, had some difficulty after child-bed. Four weeks previous to her death she consulted the midwife for pains in the abdomen. Upon request the midwife made a vaginal examination, but was unable to determine whether pregnancy existed or not, and recommended vaginal douches in the belief that the menopause was about to be established.

At 10 P. M., April 7, she left the family circle and went to her own room with the customary amount of warm water, and in a few moments she was heard to fall heavily upon the floor; where she was found dead; blood coming from the vagina, and the syringe—a so-called Davidson's—lay on the

floor beside her. Part of the water had been used, and evidently she had assumed a sitting or half recumbent posture on the edge of the bed while taking the douche.

The Autopsy: This was made twelve hours after death; the weather was cool; the body had been placed in a cool room away from the kitchen. Inspection showed the body to be only fairly nourished; there was a hernial protrusion in the right inguinal region; there was a large radiating cicatrix below the ensiform cartilage, appearing like a scar after a burn, and having a diameter of about four inches; there was a bloody fluid in the vagina; the napkin placed over the vulva by the undertaker being wet through. There was no subcutaneous emphysema. The abdominal cavity was empty; the peritoneum smooth and shining; the subserous vessels contained columns of blood separated by clear spaces, which to and fro movement showed to consist of gas. The pericardial and the pleural cavities were also empty. The coronary vessels also contained blood separated by clear spaces movable *in toto*. The heart seemed of about the normal size; the right side was distended, and on incision the right ventricle was found to contain a mass of frothy blood; there were no clots; the contents were so thoroughly mixed with gas as to present the appearance of a mass of reddish froth, with some quite large, but a majority of small, bubbles. The right auricle showed a similar condition of affairs. The left side of the heart contained a small amount of blood mixed with a number of small bubbles of air. There were no endocardial changes, and no signs of decomposition or post-mortem solution of blood pigment.

The blood in the pulmonary arteries and veins was intimately mixed with a large number of clear bubbles. The lungs were filled with a frothy, bloody fluid.

The uterus, which filled the pelvic cavity, was removed intact, and the escape of the contents of its cavity, as well as of the vessels in the broad ligaments, prevented by suitable ligatures. The uterus measured 10 inches in length (body $7\frac{1}{2}$, cervix $2\frac{1}{2}$), 7 inches across the broadest portion, and $3\frac{1}{2}$ inches in thickness; the body was oval in outline; on palpation it gave the impression of being filled with gas; the veins in the broad ligaments were also filled with columns of blood, be-

tween which were large, clear spaces. On incising the uterus underneath the surface of water, air escaped with a whizzing noise, and a large number of small and large bubbles came to the surface and collapsed. The cavity of the uterus contained a large amount of frothy blood; also a mass of blood-clot, and an intact amniotic sac in which floated a fœtus about seven inches long. The decidua covering the wall of the uterine cavity had been peeled off, as it were, and there was much separation of the margins of the placenta which was situated upon the posterior and upper part of the fundus. The left ovary contained a corpus luteum of pregnancy. There were no marks of violence upon the vulva or vagina. Careful examination failed to reveal any cicatrix that might indicate the performance, years ago, of a Cæsarean section.

The liver and spleen contained much frothy blood. The kidneys showed an adherent capsule, a granular surface, a thin cortex, irregular cortical markings, increased consistence and prominent vessels which contained blood mixed with small bubbles. The brain and spinal cord were quite healthy. Lastly, it may be said, that there were no signs of decomposition in any of the organs examined.

Recapitulation: Here was a woman about three months advanced in her seventh pregnancy; while taking a vaginal douche she died instantaneously, or very nearly so: the autopsy showed a partial detachment of the placenta, open uterine sinuses and intra-uterine hemorrhage; there was also gas present in the cavity of the uterus, in the veins, in the broad ligaments, in the heart and in the vessels generally; there were no signs of decomposition and no evidence of dissolution of the blood, the endocardium and vascular endothelium being free from all post-mortem discoloration. The diagnosis of air embolism from the open uterine sinuses is consequently warranted. It is probable that the air was accidentally injected into the uterine cavity by the woman herself, the syringe leaking, or, perhaps, due care was not exercised in keeping the inlet below the surface of the water. It is difficult to believe that the woman could, unaided, by mere accident introduce the point of the syringe into the cervical canal, but then such an occurrence is not at all impossible, and, on the other hand, it is not necessary that it should have

been done, because the placing of the point of the syringe against the cervix uteri in such a way as to bring the orifice of the point in a direct line with the cervical canal would result in the intra-uterine injection of the contents of the syringe. Immediately following this injection intermittent uterine contractions commenced, causing a partial separation of the placenta and some hemorrhage, the large vascular spaces in the muscular wall being torn open. The uterus in relaxing would aspirate the air in its interior into the wide open sinuses, subsequent contractions would force it onward, more air being sucked into the veins during each relaxation, until finally death results from paralysis of the heart, either from over-distension of some of its cavities, or from coronary obstruction, due to impaction of the air bubbles.

Remarks: In its general features this case does not differ in any essential from quite a number of similar cases, reported from time to time,¹ of death during vaginal douches, and other manoeuvres in pregnant women, the apparent cause of death being air embolism, because the autopsy would show gas in the heart, the blood vessels and the uterine cavity as well as partial placental detachment with open uterine sinuses.

The recent discovery of Prof. W. H. Welch and George Nuttall² of a gas-producing bacillus, capable of rapid development in the blood-vessels after death, throws some doubt upon the authenticity of some of the cases of death from air embolism, no matter whether the air was supposed to come from the pregnant or puerperal uterus, during surgical operations, or under other circumstances. The main facts in the case which forms the starting point of the investigations of Welch and Nuttall are as follows: A man with pulmonary tuberculosis and an aortic aneurism, with two external ruptures, died suddenly after copious hemorrhages, but not after immediate loss of blood. Eight hours after

1 Hektoen: Instantaneous death from the entrance of air into the uterine veins during a vaginal douche in the fourth month of pregnancy. *North American Practitioner*, 1891.

2 A Gas-Producing Bacillus (*Bacillus Erogenes Capsulatus*, Nov. Spec.) Capable of Rapid Development in the Blood Vessels after Death, by Wm. H. Welch and Geo. H. F. Nuttall, *Bulletin of the Johns Hopkins Hospital*; Vol. III, No. 24, Aug. 1892.

death gas was found in the heart, the blood-vessels, the subcutaneous tissue and the internal organs; solution of blood coloring matter was evident. A non-motile, capsulated bacillus, and no other organisms, was found in the blood and gas-containing cavities. Isolation in pure culture showed it to be an obligatory anærope; ante-mortem injection into rabbits resulted in rapid development of gas after death. The gas was not air because ignition showed the presence of hydrogen. Introduced into rabbits after death the gas appeared much later than when the bacilli were introduced before killing the animals.

The bacilli are non-pathogenic; they are anærobic and not capable of development in the circulating blood. In the patient in whose blood they were first demonstrated it was thought that development had taken place to a certain extent before death in the extensive, laminated, aneurismal clot which the autopsy found riddled with gas. Here oxygen would be present in a very limited quantity; entrance from the intestinal tract could not, however, be excluded. Dead tissue, coagula, cavities such as the uterine and others are mentioned as very likely capable of presenting conditions suitable for the development of the gas-producing bacillus during life, and if such places should communicate with the circulating blood gas and bacilli might enter and result in the formation of gas in large quantity soon after death.

It will be seen at once that this discovery of a gas-producing bacillus capable of developing rapidly in the vessels after death, complicates the question of death from air embolism very much, because it has been shown that gas found in the heart and vessels after death, without any signs of cadaveric decomposition, need not, as heretofore quite generally believed, be atmospheric air, but may result from the development of the *bacillus aerogenes capsulatus*; which entered the blood either before or after death. All cases of air embolism described in medical literature, in which the entrance of air was not, so to speak, demonstrated at the time of entrance and followed by instantaneous death and presenting characteristic post-mortem findings without decomposition or blood dissolution, will be looked upon as doubtful and uncertain on account of this intensely interesting demonstra-

tion of Welch and Nuttall. Cases of death from air embolism during surgical operations in which the entrance of air was evident to the surgeon, will, without doubt, retain the stamp of authenticity; cases of the injection of air into the pregnant uterus, followed by instantaneous death, like the one here recorded, as well as a few similar cases scattered through literature, also seem to be genuine cases of air embolism. In such cases the autopsy revealed gas or air in the heart and vessels as the only cause of death: the possibility of an ante-mortem development of the gas-producing bacillus in the uterine cavity, and of death occurring as the result of the entrance into the circulation of the gas thus formed *in loco*, seems very remote, because the conditions in the cavities of the pregnant uteri in these cases¹ were not such as could well be conceived would favor the growth of the *bacillus aerogenes capsulatus*; before death. Welch and Nuttall state that the evidence is strongly in favor of the view that some of the sudden deaths in the puerperal state which have been attributed to air embolism, are in fact due to the assigned cause, especially in those cases in which death followed injections of air and fluid into the cavity of the uterus.

On the other hand, cases such as 26 of the 43 reported by Lauff² in which the entrance of air is described as spontaneous, or as following the formation of gas in the uterine cavity, invite the explanation offered by the discovery of the existence and mode of development of the *bacillus aerogenes capsulatus* and the cases following the development of gas in the uterine cavity suggest that the gas-producing bacillus might develop *in loco*, and that the gas might enter the circulation and cause death in the same way as air does, and that subsequently after death the bacillus might multiply in the blood.

1 The following authors have reported cases of entrance of air into the uterine veins and sudden death during vaginal injections in pregnant women. In some of the cases the injections were given in order to produce abortion. The autopsies are as a rule satisfactory, and some, like Drapers, unimpeachable: Swinburne—*Medical and Surgical Reporter*; Philadelphia, 1859. Greve—*De casu, quo aer in parte praemature instituendo, injectionibus in vaginam in venas uterinas intravit*, Killae, 1863. Braun—*Wien. Med. Wochenschrift*, 1883. Draper—*Boston Medical and Surgical Reporter*, 1883. Hektoen—*North American Practitioner*, 1891.

2 Lauff's Ueber eintritt von Luft in die Venen der Gebarmutter bei und nach der Geburt.

Finally it cannot be denied that hereafter in all cases of supposed air embolism. "a careful bacteriological examination, including anærobic cultures, must be made before it can be admitted that the gas in the vessels has not been generated by micro-organisms. Time only can determine whether such examinations will show that the explanation found in our case to be correct is exceptional or is applicable to many other cases which might otherwise be interpreted as due to the entrance of air into the vessels."¹ It can also be added that while there may be no doubt whatsoever in the mind of the observer as to the nature of such cases as the one described in this report, yet every case of this particular kind with a medico-legal bearing will hereafter require a bacteriological examination in order that an absolutely definite conclusion may be reached.

119 Loomis Street.

1 Welch and Nuttall, *loc. cit.*