MANAGEMENT OF THE UMBILICAL CORD.*

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The cutting of the cord is the first surgical operation to which most human beings are subjected and an operation to which all must submit. The management of the stump during its separation from the body and the care of the ulcer subsequently formed are surgical procedures upon which depend the health and perhaps the life of the infant. If the wound be improperly managed so that infection results the child comes into serious danger. Navel infection is indeed one of the greatest dangers to which the newborn is exposed.

This surgical operation has been done since time immemorial. It must also be performed by the lower animals. It was done for centuries and ages before there were surgical principles to determine its technic. It is done to-day in many, perhaps the majority of cases, by those who have no knowledge of surgical principles.

Yet in some way or other babies have generally overcome the dangers of hemorrhage and infection of the stump of the cord just as they have overcome the measles and chicken-pox and the other infantile diseases that overtake them a little later in life. Nature's protective arrangements provided for by natural selection in the ages of development are generally sufficient to overcome or ward off the dangers that confront the newborn. It is probably true that Nature's arrangements are more efficient with races in a state of nature than with highly civilized mankind. Just as plants cultivated in glass houses are not as hardy as those that grow out of doors, so people that bathe daily, live in evenly heated houses and protect themselves carefully with clothes are less capable of resisting hurtful influences than dirty and naked savages.

Nature's methods of ridding herself of offending matter and healing wounds are sloughing, suppuration, ulceration and inflammation. These suffice very well for natural conditions. In this way the stump of the cord is removed and the ulcer that is left is healed. These methods do not satisfy us entirely to-day in our civilized state. We have begun to control the processes of Nature which show in our bodies just as we have learned to control the forces outside of us. We can to some extent eliminate sloughing and inflammation from the healing process. This we do by the aseptic technic which follows from the applications of the discoveries of Pasteur and Lister. You know what a revolution the principles of asepsis have made in surgery. Is it worth while to apply the principles of the new surgery to the management of the child's navel?

Perhaps the majority of physicians would answer that the old methods of caring for the cord are good enough. By the old methods I do not mean now the primitive methods of animals and savages, that is, tearing or biting off the cord and letting the stump hang until it is separated by rapid suppuration in one or two days. The old methods to which I refer are semi-surgical methods of the ordinary nurses and midwives, namely, cutting the cord with a stump one to two inches long and keeping it wrapped in a piece of old linen and covered with oil or lard or perhaps dusted with powder till it falls away. Treated in this way the stump sloughs off in from two to six days and the ulcer, retracted below the surface of the skin, heals in a few days more. There is really very little difference between this method and what might be called the primitive method. The suppuration is nearly as rapid and the inflammation quite as intense.

The dangers of this method of treatment are not appreciated, because in general the importance of disturbance of navel healing in the causation of infantile disease in the first days of life is not properly studied. The management of the navel is generally left to the nurse, even when she is totally ignorant. If the temperature of the infant is regularly taken, which is rarely the case, fever is often or generally found, but this is ascribed to colic or some such cause. There is good reason for the statement that this fever is due in at least 90 per cent. of the cases to navel infection. Postmortem examinations of infants dying within two or three weeks of birth generally show, besides localized inflammation around the navel, also an arteritis, phlebitis or lymphangitis of the umbilical vessels, or all of these pathological conditions together.

It is not my purpose to give a complete résumé of the investigations in the pathology of the separation of the cord nor of the studies concerning the anatomy and histology of the cord. There is already a considerable modern literature which has recently been summarized in English by Dickinson[1] of Brooklyn, whose monograph is accessible to all. I will only call attention to the papers of Eroess of Budapest published in 1891, which was one of the first of the more recent papers to draw attention to the importance of this subject. He found in a careful study of cases in the Budapest clinic that the process of separation was pathologic in 68 per cent., that fever was due to navel infection in 45 per cent. of the cases, and that very serious illness and in some cases death were due to these diseased conditions. All who have given the subject any attention are agreed that navel cord separation is one of the most serious dangers that menace the newborn child and that the subject of its management is of the greatest importance.

While inflammatory changes due to bacterial presence are no doubt a constant accompaniment and factor in the separation of the cord and healing of the navel wound in a state of nature, it is possible that these events may occur without inflammation, that is, in a state of asepsis. There are three distinct physiological processes: 1, drying the cord; 2, separation of the cord from the body of the child; 3, epidermization of the navel wound. The drying or mummification of the cord is due to retrogressive changes in the Wharton jelly, resulting from lack of nutrition, combined with the desiccating action of air. The mummification makes the cord impossible as soil for bacterial growth. An impervious dressing would prevent its desiccation. Should bacteria then gain access to it there would result moist gangrene. This is often found in the stump, particularly that portion next the navel which is much less apt to mummify than the outer end. The lesson from the study of the retrogressive changes in the cord teaches that if any of the cord is left attached to the child it should be freely exposed to desiccation.

It is in the second process, that of separation of the cord, that the influence of the bacteria is in Nature's plan most efficient. There is no doubt that bacterial growth favors the early separation of the cord. Yet a sterile dried cord would in time be thrown off, when its vital connection is severed, just as a sterile blood scab is separated from an aseptic wound. The best way to remove the cord aseptically is by cutting the jelly

* Read before the Chicago Medical Society, Feb. 19, 1902.

1. Robt. L. Dickinson: Is the Sloughing Process at the Child's Navel Constituent with Asepsis in Childbed? Am. Jour. Obst., December, 1898; June, 1899.

with scissors and ligating the vessels, as will be described. By using a silk ligature drawn pretty tightly around the cord at its base a considerable part of the jelly is cut through, but by this manipulation we are unfortunately often in danger of cutting through the vessels at the same time.

The epidermization of the denuded surface left by the cast-off cord will go on much better when the parts are sterile than when they are infiltrated with bacteria and their poisons. Hence, this important process is favored by surgical treatment.

It will therefore be seen that it is possible to manage the cord according to surgical principles. Suppuration, although natural and almost constant, is not necessary. These statements, probably true from our knowledge of surgical pathology, have been verified by clinical experience.

If surgical treatment of the cord is possible the prevention of infection is certainly desirable. The fact that most babies get on pretty well or at least do not die when the cord is left to Nature, which is practically what we do no matter how much we fuss with it in any of the old ways, should not satisfy us. Most women will live even if the obstetrician is not clean, but there is generally some disturbance in child-bed and at times serious trouble. Just as we have learned that the strictest possible asepsis in labor pays, so we shall find in the course of the next few years that surgical treatment of the cord will pay. I do not believe that the ideal method of managing is yet perfected. The methods that I shall shortly describe are only those that are best at present to advise for general use.

LIGATION.

We first ask where to ligate and cut the cord. It has sometimes been claimed that ligation is unnecessary; but the experience of all of us with hemorrhage in cases of poorly ligated cords would prevent the introduction of any practice which did not secure us against the possibility of bleeding. The mass ligature is in almost universal use and is no doubt to be advised for the use of nurses and those physicians who have no surgical experience. The objection pertains to it that in a cord of moderate size the rapid shrinking of the Wharton jelly leaves the knot loose and makes secondary hemorrhage possible. For mass ligation a narrow tape perfectly sterilized is best, as it will not be as apt to cut through the gelatinoid cord when tied very tightly as would a silk ligature. The elastic ligature has had some adherents, and ingenious devices for fastening it have been devised. Its use is somewhat complicated and the after-management is not so simple. As said above, there is no question that separate ligation of the vessels at the base of the cord is the best procedure not only because it is a sure protection from hemorrhage but also because it best favors the separation of the cord. The crushing of the cord and vessels with forceps and the use of the cautery as hemostatic have been tried but have no advantages to justify their adoption.

The cord has been tied at the junction of the skin and cord, and at all distances from the body. Unless the ligation is made close to the body of the child the best plan is to tie about 1 inch, or 2 cm., away and cut the cord 3 to 5 mm. beyond the ligature. This length of cord allows it to be laid over on the abdomen for dressing and access to the separating zone is easy. The increased length of the cord has no influence on the rapidity of its dying. If the stump is too short it will not lie well on the child for dressing and is more likely to be pulled by the clothes and when the child nurses or is handled.

The best place for tying is, however, close to the body of the child, at the junction of the skin of the body and the amniotic sheath of the cord. When tied here and cut as closely as possible the after-dressing is exceedingly simple. The only objection is the fear of secondary hemorrhage. This is overcome almost completely by adopting the technic to be recommended. Such a hemorrhage, if it did occur, could be controlled by the nurse with pressure until surgical help could be secured. August Martin, formerly of Berlin, proposed to provide against the danger of secondary hemorrhage by severing the cord with the actual cautery, using for this that article of some ladies' toilet, the curling iron. This cauterization would also serve to remove the cord jelly or hasten its mummification and prevent infection. The danger of burning the squirming child, as well as the demonstration of the uselessness of the cauterization by the good results of the Paris clinics, where the cord is severed with the scissors after short ligation, has led Martin and his followers to abolish the cautery.

DRESSING.

In studying the best dressing of the cord, we must keep in mind the three physiologic changes that must take place, namely, the dying of the cord, its separation from the body and the epidermization of the surface left by the stump of the cord. Some, among others Goodell, have advised against any dressing, in order to favor the drying of the cord. That this is an important process all must admit who have seen the condition of moist gangrene and trembled over its possible dangers. Yet desiccation is interfered with only slightly by a dressing of gauze or absorbent cotton, which may perhaps help in protecting the cord from infection. Under any circumstances the impervious dressing should be proscribed.

It is essential for us to determine whether we shall strive to secure an aseptic or an antiseptic dressing. It may be admitted at once that an aseptic management of a long stump is a practical impossibility. If the duration of the management lasted only a few hours the attempt would not be so hopeless, but the most particular nurse would fail to secure asepsis in a dressing on an infant's belly for a period of three or four days. Hence, if we allow a stump at all we must be content with antisepsis and indeed with partial success. The avoidance of contamination as far as possible is of course our aim. We should be able to exclude the more dangerous contaminations such as tetanus and erysipelas germs. The saprophytes, the staphylococci and probably the colon bacilli will surely appear. Hence, the choice and method of using an antiseptic becomes an important question.

The objection to a routine and efficient use of the poisonous antiseptics like sublimate and carbolic acid are apparent. The much used boric acid is too inefficient to merit consideration. For several years I have used and advocated in my classes the use of alcohol. In 1900, Ahlfeld of Marburg, who is well known as an advocate of the practical value of alcohol as an antiseptic, published his method of treating the cord with this agent, a method which he had used for three or four years and which is essentially like my own. The method consists in thoroughly washing the region of separation of cord from the body once or twice a day with alcohol and protecting this region in the interval

with sterile or antiseptic gauze or cotton. My results agree with those of Ahlfeld in being on the whole quite satisfactory if not ideal.

Theoretically an antiseptic powder would be desirable, but practically the use of powder has not fulfilled our expectations. Iodoform is not to be thought of, on account of its odor if for no other reason. Bismuth, boric acid, dermatol, etc., are inefficient or form crusts under which the process of suppuration goes on undisturbed. Some of these powders may be of value after the cord has separated before the denuded surface is covered. For the slight eczematous condition sometimes found at this time I have often used nosophen with advantage.

Closely connected with the subject of the dressing of the cord is that of the bath of the infant. Much has been written on this subject, particularly since Doktor in Pest, following up the studies of Eroess, showed the improvement in the morbidity of infants by omitting the daily bath. It may be admitted that the tub bath is a source of contamination and in aseptic management such as we should strive for in short ligation of the vessels of the cord it should be avoided. In the antiseptic management which alone is possible with a stump it is doubtful if the bath has any deleterious effect. We must assume that bacteria begin to appear in the region of the navel in a few hours after thorough disinfection. A careful enclosure of the cord with sterile cotton will hinder the access of the germs somewhat, but in twelve hours and at least in twenty-four hours they will be found in contact with the separating cord. Now, the washing off of the cotton or gauze with alcohol and the renewed disinfection is necessary. It is not probable that the momentary contact of the bacteria in the bath water will lead to much extra contamination. The germs thus brought to the cord are at once washed away by the alcohol that is used immediately after the bath.

It is quite possible that the wetting of the cord will hinder its mummification and therefore be a further objection to the tub bath. The immediate drying of the cord after the bath and the use of the hygroscopic alcohol will, however, reduce the objectional influence of the bath to the minimum.

For these reasons I have generally allowed the bath in cases treated with a stump and have not become convinced of any deleterious effects. I always direct that the child be cleaned from all feces before it is bathed and if it has boils or pustules I interdict the tub in order that other parts of the body as well as the navel should not be contaminated.

Our observations on the antiseptic management of the navel apply to those cases where a stump of greater or less length is left. When the ligature is placed at the base of the cord and particularly when the gelatinoid envelope of the vessels is removed and the vessels ligated directly, I believe that we may strive to secure asepsis. The first method of ligation, which is that of Pinard and the one now followed by Martin and many others, may require some antiseptic treatment, for some jelly remains to mummify. The little button of jelly 2 or 3 mm. thick above the ligation is generally pulled into the navel funnel and prevents the infection of the separating junction. There can be no harm in pouring into the funnel alcohol at change of the dressing until the button separates. The aseptic dressing should protect the navel, which is no larger than after the falling off of the ligature.

When the gelatinoid envelope is removed and the vessels tied directly with silk or catgut the cut vessels retract within the navel depression and aseptic management is perfectly simple. Only a dry aseptic pad over the navel is necessary. This method of management first described by Flagg, and since elaborated by Dickinson, is, I believe, very valuable and probably susceptible of general adoption.

Another method of procedure more radical than the last has been advocated by Dickinson. It consists in suturing together the skin margins of the navel after removing the cord. The vessels may first be ligated with catgut or they may be included in the grasp of the suture. Although I have not tried it, yet I mean to do so, for the suggestion is reasonable and we may find in this operation the coming method of the rational treatment of the cord.

MANAGEMENT OF THE CORD.

I will now briefly describe in detail the plan of managing the cord from the moment of the birth of the child. Just as the head is being expelled, a clean towel is got in readiness to wrap the child's body in the region of the cord. This towel is applied as soon as the body is born, then the child is wrapped in a large sterile blanket and laid between the mother's legs till the cord ceases to beat. It is then tied 4 or 5 cm. from the body with a sterile tape; the vessels are emptied out toward the placenta by the pressure of the thumb and forefinger of the left hand, and then the cord is held by the thumb and finger about 3 cm. away from the ligature. The cord is then cut with a sterile scissors and the placental end dropped. It is probably better not to tie the placental end unless a twin remains in the uterus. I generally cut the cord off again close to the vulva in order that an antiseptic pad may be applied while waiting for the third stage of labor. After the child is separated from the mother the body is wrapped well in the sterile towel so that the cord can not become contaminated. Then it is laid away until the mother is cared for. We then attend to the child. The nurse having prepared the room for the baby's bath, generally the bath room, by securing a temperature of about 90 F., having in readiness the bath, clothes, alcohol, cotton or gauze, scissors, artery forceps and ligature, takes the baby on her lap and holds down the arms and legs with clean towels. With sterile hands I unwrap the towel from around the cord and with a medium-size silk ligature retie the cord at its base or the junction of the skin and amniotic sheath. Without cutting the ligature I then carefully cut off the cord 2 or 3 mm. beyond the ligature. If the cord was quite thick, or if there is any sign of bleeding from the vessels, or if I have any doubt of the security of the ligature, after careful inspection, I enclose the cord once more with the ligature. The ends are then cut off rather short, and a large sponge of cotton saturated with alcohol is placed on the navel. This is kept in place by the nurse while she oils the child to remove the sebum, and then it is placed on its back in the tub that is only partly filled with water or the child is washed with a sponge. After the bath fresh alcohol is placed on the navel while the child is being dried and measured. Then a dry sterile pad of gauze or cotton is placed over the navel and the usual bandage applied. This pad stays in place without trouble till the next dressing of the child. As a rule, the child is bathed and the navel attended to every twenty-four hours. At the subsequent dressings a cotton sponge saturated with alcohol is applied before the bathing and also afterwards. Then a dry dressing is used. The ligature dis-

appears with the thin dry remnants of cord above in the former of the navel and is never seen until it comes off on the third to the sixth day.

The method of ligation of the vessels I have used too little to justify an opinion concerning it. My impression is that it will supersede the other method. I have performed it according to the directions of Dickinson as described in his paper before alluded to. The child is prepared for the little operation as described, and then holding the stump of the cord in the left hand we cut around the skin margin with blunt-pointed scissors. One can generally see the vein near the surface at one point. Here we must be careful not to cut the vein. The jelly is then stripped back like a cuff leaving the vessels exposed. They are then tied with a fine silk or catgut ligature and cut beyond the ligature. They at once retract and give us no further trouble. A pad is then placed on the navel and held with a bandage. The child is bathed with a sponge and not placed in a tub for a week.

These methods can not be recommended to nurses. For them I advise the procedure I myself followed until about ten months ago. The cord is cut primarily as before described, leaving a stump about 2 cm. long After the bath the cord is wrapped in cotton saturated with alcohol, which is allowed to remain three minutes. This is then removed and the cord wrapped in sterile absorbent cotton and laid to one side and bandaged. At the subsequent dressings the cord is wrapped in alcohol-saturated cotton both before and after the bath. Care is taken to apply the wet cotton to the base of the cord at the line of the separation, for it is always at this point that suppuration occurs. In applying the dry dressing it is also carefully wrapped around the cord at the line of demarcation.

By this method of management the separation of the cord is probably delayed. It is attended, however, with no infection and that fact more than counterbalances for the delay in separation. The greatest objection to this method is the care necessary in the dressing and the inconvenience to the child, inseparable from a long stump that is apt to pull on the clothes and cause trouble.

SOME OBSERVATIONS ON RESECTION OF THE RIBS IN EMPYEMA.*

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The management of effusion into the thorax will depend much upon the character and extent of the inflammatory process which produced it. Netter has shown that in children empyema is of tubercular origin in 25 per cent. of all cases. The other 75 per cent. is due principally to the pneumococcus, with the staphylococcus, streptococcus, the Eberth and colon bacillus as occasional sources of infection. In adults Netter and Eichhorst have found 65 to 69 per cent. to be tuberculous.

It is generally recognized that empyema resulting from tubercular pleurisy has a much less favorable prognosis than when of pneumococcus origin. The latter variety of cases is attended by a less stable proliferation and the lung is left more patent and resilient than is the case in tuberculosis.

A very small percentage of cases are permanently cured by aspiration. Da Costa believes the cures to be limited chiefly to post-pneumonia cases in children and declares pointedly that "aspiration is not to be considered a method of curative treatment in empyema."

In very young tubercular subjects of progressive type Lockwood prefers aspiration and regards it as the surgical measure of election in these cases. In fact it is the experience of most operators that extensive resection in young tubercular subjects of florid type, is not attended by results sufficiently favorable to justify the hazard of such a radical measure.

In operable varieties of empyema of long standing, where the pleura is greatly thickened, nothing but extensive resection of the ribs should be undertaken. The delay so common in these cases can offer no possible hope for the patient and only endanger his life from amyloid degeneration of the liver, spleen and kidneys.

There is a principle involved in the operation for empyema which underlies the argument for radical interference and must not be lost sight of in the consideration of every chronic case. This principle consists, not in evacuation, not in drainage simply, but in the obliteration of an abscess cavity, whose non-collapsible wall is a bony arch. This obliteration may be accomplished either by releasing the thickened pleura over the bound-down lung, as De Lorme has advocated, or if this be not feasible on account of atrophy, tubercular consolidation or fibrous contraction, then collapse of the thoracic wall may be effected by some modification of Quenu's, Estlander's or Schede's method.

It is evident that the choice of operation must be governed largely by the pathologic condition in each individual case, the long-standing cases with large cavities calling for more extensive resection than those of briefer duration.

Resection of the ribs in empyema was first advocated by Warren Stone of New Orleans. Since his day a great variety of technique has been employed, but underlying each method has been the principle heretofore enunciated.

Every chronic patient presenting himself for operation should have the urine carefully examined for evidences of amyloid degeneration. As much time as the condition of the patient will permit should be devoted to preparation for the shock, which very commonly attends thoracic surgery in depleted subjects.

If a thoracotomy has previously been done, the usual preliminary withdrawal of the greater portion of the pus will, of course, not be required. I am in the habit of waiting a week or ten days after tapping before proceeding with the resection. This affords time for the heart to return to something near its normal position and for the patient to gain resistance. The heart should be supported by strychnia a week before operating. On the table 1/20 grain should be given hypodermically, to be repeated at the conclusion of the operation if necessary; and by the rectum a liter of warm salt solution, to be followed by subcutaneous transfusion of the same during the operation, should the pulse require it. These well-understood measures of preparation and support are detailed here for the purpose of their especial emphasis, and because of a belief that often they are grossly neglected in this class of surgery.

The principle of obliteration of the pus cavity is somewhat that of the contraction of a hollow sphere. Hence the widest resection should be in a plane crossing the center of the sixth rib, and should not go higher than the second, nor lower than the ninth rib. It has been

* Read before the Colorado State Medical Society, at Denver, June 18, 1901.