ORIGINAL ARTICLE

Management of Birth Asphyxia at Home and Health Center

Anna Alisjahbana, Sjarif Hidayat, Mintardaningsih, Aris Primadi, Enny Harliany, Yulia Sofiatin, Atte Triyanti

(WHO Collaborating Center for Perinatal Care and Department of Child Health, Medical School, Padjadjaran University, Bandung, Indonesia)

ABSTRACT Birth asphyxia is the main cause of death in newborns and is an emergency situation that need immediate action. In Indonesia more than 60% of deliveries are attended by traditional birth attendants. Although infant mortality has decline significantly in the last decade, the neonatal component of IMR however remain the same. The definition of birth asphyxia recommended by World Health Organization is: A newborn infant who does not cry and who does not breath or has poor breathing efforts soon after birth. The paper present the result of a field study conducted in Tanjungsari (West-Java). The study is part of a multicountry study conducted in four countries organized by World Health Organization. TBAs were trained in the basic steps of resuscitation starting from drying, stimulation, suction and providing. Positive Pressure Ventilation using a tube and mask device on infants with birth asphyxia. Community midwives were trained in the same procedure and additional training for cardiac massage. Team work between TBA and CM was stressed. More infants with birth asphyxia survive, one fresh still born infant survive after vigorous resuscitation. Although the result looks promising, close supervision and regular refreshing courses are necessary to have a significant impact on neonatal mortality.
[Paediatr Indones 1999; 39:88-101]

Introduction

Studies have shown that neonatal asphyxia constitutes more than 50% of all early neonatal deaths. Appropriate management of asphyxia especially in rural areas will decrease the number of deaths in the neonatal period and reduce further handicap in infancy. In Indonesia. with 200 million population and 2.5% birth rate, the annual number of births is 5,000,000. If the incidence of birth asphyxia is 3-5% of total

Author's address: Prof. Anna Alisjahbana, MD, Department of Child Health, Medical School, Padjadjaran University, Jalan Pasteur No. 38, bandung, Indonesia, Tel (62) (22) 234426; Fax. 232216.

births[1] then 250,000 babies will be born with birth asphyxia, about 34,000 babies will die (13%) annually, and the same number of infants will have long-term consequences of asphyxia. These figures may be higher in rural areas where most deliveries are conducted by untrained birth attendants and newborn care is not immediately available. Many community studies[2,3] reveals that birth asphyxia is the main cause of neonatal death during the first week of life.

Although the government of Indonesia since the VI five year developmental plan has committed to the Safe Motherhood Initiatives (SMI), with the result 54,000 community midwives (CM) has been trained and placed in villages, in many rural areas more than 60% deliveries are still attended by traditional birth attendants (TBA).[4] This fact has to be considered in any efforts to improve perinatal and neonatal care; study in India has shown that TBA can recognize birth asphyxia but mostly they can not deal with it.[6] Reports from Indonesia also shows that TBA or CM are less informed with the appropriate knowledge and technical skills to resuscitate asphyxiated babies though they do make some traditional but usually ineffective efforts to revive asphyxia babies using mouth to mouth resuscitation. Resuscitation of newborns is also considered as technically complex and involved complicated equipment. However procedures such as endotracheal intubation, oxygen and drugs are rarely needed.[6,7] Consequently little attention has been paid improving the management of birth asphyxia by birth attendants (BA) who deliver babies at peripheral level of the health care system or at home. BA and TBA are not using mouth resuscitation for many reasons, one of those reasons is that they are concerned for their own health because of transmission of infections such as AIDS. Resuscitation at home is believed to be associated with greater risk of death or handicapped baby and is therefore considered not advisable. However a study in Bombay and Dar es Salaam have shown that bag to mouth resuscitation is not different to mouth to mouth or tube to mask ventilation. A study in India also shows that illiterate TBA can practice mouth to mask ventilation according to the guidelines developed by SWACH.[8] The purpose of this paper is the report on the field testing of a tube and mask device for resuscitation by TBA and community midwives at home and birthing homes. The study was part of a multicenter study organized by World Health Organization Geneva and conducted in four countries e.g. India, Bangladesh, Indonesia, and Iran.

Methods

The study design was a community based prospective study with pre- and post- intervention evaluation. For the purpose of meta-analysis, among the participating countries it was agreed that each participating center should at least resuscitate 50 infants with birth asphyxia by TBA.

Subdistrict Tanjungsari was selected as the study area. The selection was based on

the following criteria: it was reasonably close to the research institute for easy supervision monitoring, availability of transportation and communication, 70-80% of the deliveries were carried out by TBA, and the availability of basic statistics for comparison.

Subdistrict Tanjungsari total population was almost 100,000 based on a birth rate of 2%, a total number of 2,000 births/year was expected. Trained birth attendants who had at least 2-3 deliveries per month or 24-36 deliveries per year (including medium and high case load TBA) were the subjects of the study. Based on previous studies this constitute a total of 49 TBA who were trained in resuscitation procedures. The occasional TBA and low case TBA were excluded from the study.

Forty nine TBA and 6 senior midwives were trained in the step by step of resuscitation. They were provided with a suction tube, a mask and tube and forms to register the proses of resuscitation. Training of trainers (TOT) was provided to senior midwives living at the same area, some were not health center midwives and all of them had their own private clinic. The operational definition of birth asphyxia was: a newborn who does not cry and who does not breath or has poor breathing effort soon after birth. A standard treatment guideline was developed to provide the needed care for asphyxiated newborns. The guideline described all the step by step procedures for recognition and managing birth asphyxia, including assessment of the baby, management decisions and action. The sequence of resuscitation are as follows: 1. asses the case, 2. decide about the condition/problem, and 3. initiate treatment. In this guideline all steps and actions were organized on the basis of the response of the baby within the recommended procedure, e.g. newborn cry, breathing effort or heart beat were assessed after each procedure. The guidelines of the training package includes exercises at the end of each session such as multiple choice questions, true and false statements and identifying correct and incorrect procedures by observation. Birth asphyxia management card contains the sequence for assessments, decision and procedures of birth asphyxia. Symbols were used to provide visual guidance to the users (see Figure 1 in the Appendix).

Especially for TBA, case management card was pictorial; however it did not include external cardiac compression since this procedure was not recommended for home deliveries unless conducted by higher educated health professionals such as community midwives. In this study, procedures related to the identification of risk conditions were not included in the package since in the study area, birth attendants were already familiar with this or had some training in MCH or Safe Motherhood programs.

TBA were trained in the basic steps procedures of resuscitation. They were provided with a De Lee mucous trap and a tube and mask resuscitator, a timer, recording forms and pictorial guidelines. The senior midwife was provided with a tube to bag resuscitator, recording forms and written guidelines. Training of trainers was provided by the research team who were trained by Dr. Raina from India using the training modules developed by SWACH, PATH, WHO and UNSAID.[8] It was consistently stressed that the most important factor in resuscitation of the newborn is to following

each basic step of resuscitation procedures accurately and timely according to the algorithm (see Figure 1 in the Appendices). For the purpose of evaluation six field interviewers were trained to independently monitor, interviewed and observed each delivery by TBA especially in situation where the baby does not cry immediately. Training of TBA lasted 18 hours or one hour/day. Before training TBA were aware that crying is the important sign of the newborn well-being. Physical stimulation was considered the most important intervention that can initiate breathing in depressed newborns. After training 80% of TBA answered that they would initiate breathing in a newborn who is not breathing at birth. At the end of the study, knowledge and skills were reassessed.

Results

Community midwives were included at a later stage of the pilot study due to several reasons: they were first excluded because they were not eligible due to the inclusion criteria of the required number of births/month. Their average number of deliveries is 0-1 month and therefore should be included in low load birth attendants. However due to governmental policies to prepare community midwives as the most outreach health provider for mother and child, they were included at a later stage of the study.

Table 1. Mortality after training of resuscitation for birth asphyxia (12 months study period in Tanjungsari)

Characteristics of births	TBAs	TBAs and Community Midwives	Senior Midwives
N births	1094	75	293
Mean birthweight (SD), grams	2920 (532.2)	2916.1 (543.7)	3049.5 (478.8)
Macerated stillbirths	15 (1.4%)	3 (2.2%)	2 (0.7%)
Fresh still births	2 (0.2%)	1 (0.7%)	3 (1.0%)
Delayed cry	179 (16.4%)	16 (11.9%)	13 (4.4%)
Resuscitation died	3 (1.7%)	0	2 (15.4%)
Resuscitation survived	176 (98.3%)	16 (11.9%)	11 (84.6%)
Immediate cry	898 (82.1%)	55 (73.3%)	275 (93.4%)

Following the inclusion criteria the CM probably will not have enough cases of birth asphyxia, so the research team decided to couple them with high load TBA as a

team. The team also decided to train the CM for external cardiac massage additional to ventilation. An additional finding was: TBA and CM team reported that they feel more confident working with the TBA as a team when facing an asphyxiated infant.

The result shows that out of 179 infants delivered by TBA had delayed cry, 3 died after resuscitation (1.7%) and 176 survive (98.3%). In the group of combined providers (TBA and CM) there were 16 with delayed cry and all survive, while out of 292 infants delivered by senior midwives, 13 infants had delayed cry and 2 (15.4%) died (see Table 1). One fresh stillbirth baby survive after vigorous resuscitation by a TBA.

Delayed cry is a rough indicator for birth asphyxia and it may varied from mild asphyxia that can be treated by immediate drying, stimulating and suction of the infants, to severe asphyxia where PPV, is required. Among babies delivered by TBA there were 53 infants who needed PPV using the tube and mask, 3 died (5.6%) compared to 2 infant delivered by senior midwives and both infants died.

Discussion

In a retrospective study in 7 hospitals in Sweden, Palmer-Kilandar[9] found that 1.7% of live born babies had low Apgar scores and that before delivery 19% were not expected to have low Apgar scores that requires ventilation, showing the fact that even in developed countries birth asphyxia is not always predictable before birth. The author also concluded that among infants who need ventilation, 80% of apneic infants could be ventilated satisfactory by face and mask, only the remainder were intubated. Routine intubation or administration of buffer in cases of postnatal asphyxia had no influence on the time to onset of regular spontaneous breathing. Table 2 shows the differences in management of asphyxia in severely asphyxiated newborns in hospital settings and in rural areas. Probably the main differences is that no oxygen for PPV is required (WHO/MCH/90.6)[10] and secondly correction of metabolic disturbance using bicarbonate and glucose infusion was change by oral feeding if the baby can suck or given express breast milk when babies are too weak to suck.

The most important factor in positive pressure ventilation is the ability to provide 30-40 cm H_2O pressure through the tube and mask device. To be able to do so Massawe et al[11] in Sweden and Dar es Salam, studied mouth to mask ventilation in resuscitation of asphyxia newborn babies. They conclude that if adequate training is provided and the respiratory frequency is kept within normal range, mouth to mask ventilation is an alternative to assisted ventilation when no bag and mask is available, however since this method is tiring and uncomfortable further studies are necessary. Therefore this simple device was developed consisted of a tube, valve and mask by Leardal with technical advice of WHO.[6]

For this pilot study the inclusion criteria were all birth attendants who lived in the study area and have at least 3 deliveries per months, categorized as high load birth

attendants. Birth asphyxia is relatively rare and the incidence is expected to be 3-5%, this means that low load birth attendants will not likely experience any birth asphyxia during a study period of one year.

Table 2. Resuscitation procedures in moderately or severely asphyxiated newborns

No	Procedures	Current practices in hospitals	Recommended Procedures for use at home/maternity facility
1.	Clearing of airways	▪ Oropharyngeal suction ▪ Endotracheal suction	▪ Physical stimulation ▪ Oropharyngeal suction
2.	Ventilation	▪ Via bag-and mask/ ▪ endotracheal tube	▪ Via face mask tube and mask
3.	Provision of oxygen	▪ Increasing oxygen concentration	▪ Atmospheric air
4.	Correction of metabolic disturbance	▪ Correction, acidosis ▪ IV glucose	▪ Oral feeding if the baby can swallow

Source: WHO/FRH/MSM/96.13[12]

The study was conducted in Tanjungsari a rural area in West-Java. During previous studies conducted at the same area all TBA were registered and the number of births for each TBA were known. Almost all TBA were trained and regularly supervise by CM however in the training curriculum, management of asphyxia was not specifically addressed for TBA as well as for CM. Other reasons is the low incidence of asphyxia result that only birth attendants who have a high number of deliveries will experience babies that did not cry immediately. The third assumptions is that not only has the CM a low number of deliveries but their patients are also coming from middle and upper socioeconomic level and can be considered as low risk group. As is previously mentioned, only 50% of asphyxia is related to mother conditions, the other 50% of asphyxia cases can happened any time and is often unpredictable. Several studies have shown that asphyxia in the newborn is the most important cause of death in the perinatal period.[1-3] For this reason it is important that all birth attendants (formal and informal) especially those with a high birth load have experience in the basic steps of resuscitation of the newborn.

The study shows that it is possible to decrease neonatal mortality by providing training and supervision of TBA in the basic steps of resuscitation using simple equipment and appropriate methods. The tube and mask device fulfill the requirements of the basic principles of appropriate technology that is simple, cost effective and can be produce locally. The tube and mask device is now readily available in Indonesia.

During follow-up in the first week of live, one case of convulsion and one case of floppy infant were identified. Although the result was promising, it has to be reminded that in scattered rural populations most of the TBA and also CM conduct only a few deliveries with birth asphyxia per year. Therefore maintenance of the skills learnt by TBA and CM is important. Periodic retraining on a mannequin or using the ball and one liter coca cola bottle is necessary for learning and retention of resuscitation skills.

Subdistrict Tanjungsari is frequently used for community intervention studies by Medical School Padjadjaran University. To monitor the impact of each intervention affect mortality rates, frequent and regular rapid assessment (using sweeping methods) by an independent research group was conducted. The study had focused the intervention on TBA with a high number of deliveries/month, it is expected that more than 75% of deliveries will be attended by these TBA and an impact on the mortality rates can be expected. The results can be seen in Table 3, it shows a continue decrease in PMR however the highest fall was after the fifth rapid survey.

A previous study conducted in 1991-1993, "the Regionalization of Perinatal Care", showed a PMR of 35-40 per 1000 births and birth asphyxia was the main cause of early neonatal death. One year and two years post-intervention of the intervention study, the PMR remain low (22.7 and 26.5 per thousand births, period III and IV). After two years of the study two more intervention studies were carried out at the same study area: e.g. (1) improving communication skills of community midwives and (2) management of asphyxia by birth attendants. The result of the rapid assessment showed a PMR of 15.5°/$_{oo}$ births almost a 40% decrease the difference is significant (PMR: Period IV (26.5/1000) >< Period V (15.5/1000, z=2.349, p=0.019) neonatal mortality was 12.0°/$_{oo}$ live births, a decrease of more than 50%. Introducing the management of birth asphyxia for birth attendants may not the only intervention responsible for a decrease in neonatal mortality however it is more likely because improving communication skills of CM did not increase the number of deliveries by CM significantly. In the study area Tanjungsari, programs for Safe Motherhood Initiatives continued after the intervention study Regionalization of Perinatal Care and the management of birth asphyxia was superimposed on the already existing health programs.

The result raises the question whether TBA can retain her skills and knowledge to resuscitate newborn infants after the study is finalized, especially when the incidence of asphyxia is low. The study found that only 10% of all cases with birth asphyxia need resuscitation. Since the tube and mask device would only make a difference if used on the right cases timely and accurately, skilled based training to conduct the basic steps of asphyxia management procedure is the most important component whereas the tube and mask is only used if other measures does not work.[7] Considering also the high number of low birth weight infants among newborn infants who did not cry immediately.

Table 3. Monitoring PMR, NMR, IMR and Maternal mortality in the study area Tanjungsari

	Rapid Assessment of Mortality Rate				
	I	II	III	IV	V
Total births	1958	1119	1987	2337	1678
Total live births	1905	1096	1961	2309	1669
Perinatal Mortality Rate	43.4	35.8	22.7	26.5	15.5
Neonatal Mortality Rate	20.5	22.8	17.3	24.2	12.0
Infant Mortality Rate	*	*	48.4	47.6	31.2
N maternal deaths	10	4	6	1	1

Retrospective period covered through rapid survey

I. January 1, 1992 - December 1992
II. January 1, 1993 - June 30, 1993
III. January 1, 1994 - December 31, 1994
IV. January 1, 1995 - December 31, 1995
V. August 1, 1996 - July 30, 1997

Although the numbers were small, TBA and CM working in pairs showed better result, this was also reported from focus group discussions, as a team CM as well as TBA feels more secure and comfortable in the management of birth asphyxia.

Acknowledgments

The study was supported by WHO Geneva and the World Bank through the Directorate of Family Health Population V no. LB. 02.07.001.281. The tube and mask resuscitator with some modification adjusted to local condition is now available at Techno Design, Jalan Lembah Pakar Timur no.2, Bandung. Phone: 022-250 6338. Fax.: 022-702865.

References

1. Peliowski A, Finner NN. Birth asphyxia in the term infant, In: Bracken MB, Sinclair JC, editors. Effective care of the newborn infant. Oxford University Press, 1993: 249-72.

2. Perera T, Lwin KM. Perinatal mortality and morbidity including Low birth weight, A South-East Asia Regional Profile, Searo Regional papers no.3, 1984.
3. Alisjahbana A. The risk approach by traditional birth attendants in Tanjungsari. Thesis. Rotterdam Erasmus University 1993.
4. Kumar R. Training traditional birth attendants for resuscitation of newborns. Tropical doctor. January 1995 page 29-30.
5. Raina N and Kumar V. Management of birth asphyxia by traditional birth attendants. World Health Forum vol.10, 1989 page 243-8.
6. Milner AD, Syokes GM, Tunell R, Mc. Keugh M and Martin h. laboratory assessment of leardal mouth to tube mask prototype resuscitation device. Medical & Biological Engineering & computing. January 1992.
7. Zupan J. Techniques for resuscitation in developing countries. NRP. Instructor Update. vol. 6 no.1 June 1997.
8. WHO, SWACH Foundation and UNSAID, 1995, Birth asphyxia A guide for maternity facility staff. Path.
9. Palme - Kilandar C. Methods of resuscitation in low Apgar-score newborn infants a national survey. Acta Pediatr 81: 739-44, 1992.
10. Massawe A, Kilew C, Irani S, et al. Assessment of mouth to mask ventilation in resuscitation of asphyctic newborn babies, A pilot study. Tropical Medicine and International Health vol 1 no.6 page 865-73, 1996.
11. Banu ACK, Azad Chowdhury MAK and Raham M. Birth Asphyxia. A prospective Study in Dhaka Shishu Hospital DS (Child) HJ Vol 12 (1996) 1:21.
12. WHO. Consultation of birth asphyxia and thermal control of the newborn. Paris 29031 July 1989. WHO/MCH/90.6.
13. Milner AD, Resuscitation of the newborn. Archives Dis Child 1991;66: 66-69.
14. WHO. Basic newborn resuscitation: a practical guide. WHO/RHT/MSM/98.1.

APPENDICES

Management of birth asphyxia

Maternal and fetal conditions are risk factors that sometimes can be anticipated. However risk factors are not always good indicators for birth asphyxia. For up to half of newborns who require resuscitation, no risk factors could be identified before birth. Therefore it is not enough to be prepared only in cases where one of risk factors are present. Resuscitation must be anticipated in every birth and every birth attendant should be prepared and able to resuscitate since resuscitation should only initiated by the closest available person.

The most important indicator that resuscitation is required is the failure to breath after birth if the newborn does not cry or breath or is gasping within 30 seconds of births, after infant is being dried, the essential steps of resuscitation should be taken

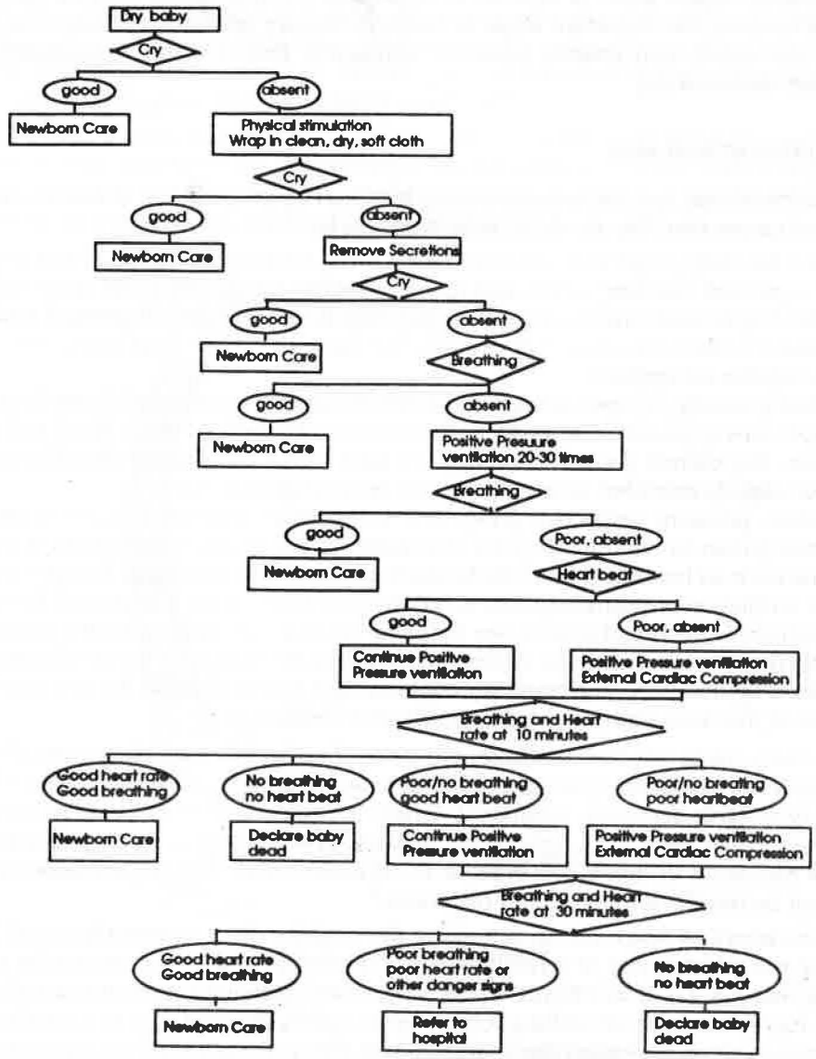

Figure 1. Algorithm of the management of birth asphyxia for home deliveries in rural area (Source: WHO, 1995)

immediately. Apgar score is difficult to implement in rural areas. Besides quick and correct suction, the important steps in resuscitation are prevention of heat loss, opening of the airway and positive pressure ventilation. Neonatal care immediately after birth are the following:

Prevention of heat loss

Prevention of heat loss include preventing heat loss by evaporation, radiation, conduction and convection. The newborn should always be

1. dried the baby, cover with clean and dry towels. Additional warmth is best provided by a radiant warmer, when this is not possible simply warp the baby with dry cloth. Vigorous drying provides sufficient stimulation in mildly depressed newborns and no further stimulation is needed. The baby should be kept covered whatever procedures are applied.
2. opening airway, to open airway, the newborn must be positioned correctly and the upper airway (mouth and nose) suction to remove amniotic fluid, blood and meconium. The correct position is on his/her back with a towel under shoulder and the neck slightly extended. Suctioning much be through but quick.
3. positive pressure ventilation (PPV). PPV is the most important aspect of newborn resuscitation to ensure adequate ventilation of the lungs, oxygenation of vital organs such as heart and brain and initiate spontaneous breathing. To open the lung the ventilation pressure required is 30-40 cm of water, later it is around 20 cm. Approximately 40 breaths/min. are required. Only a soft mask provides a good seal with the newborns face to achieve such pressure. Adequacy of ventilation is assessed by observing the chest movements. The best indication for adequate pressure is the chest rising and falling easily with ventilation.

The three steps are the most essential steps of any resuscitation and will according to experience establish spontaneous breathing in more than three quarter of newborns with birth asphyxia. Additional oxygen is not necessary for basic resuscitation although it has been considered by all pediatricians. Oxygen is rarely available at all places especially in home deliveries, it is expensive, and high oxygen concentration may not be beneficial in most circumstances.[6]

Assessment of heart rate to determine the need for chest compression and for assessing the effectiveness of ventilation is not needed in basic resuscitation for the following reasons: (1). It is difficult to asses heart rate reliable, a non experience person has a high probability of making a mistake in assessing heart rate in a newborn. (2). the time spent on assessing the heart rate without necessary skill and equipment can be wasted. In basic newborn resuscitation, advanced resuscitation (such as, endotracheal intubation, tracheal suction, oxygen and chest compression) are needed only in a small proportion of infants that failed to responds to ventilation with tube and mask.

The most important steps in resuscitation of birth asphyxia are implementing the

basic step and replacing harmful practices with unproven benefit by simple method of newborn resuscitation. Traditional methods such as slapping the newborn, soaking it in cold water, sprinkling it with water, stimulating the anus, using onion juice, are a few examples of practices still used. However not all "modern practices" are beneficial either and some originate from traditional practices.[8]

Basic resuscitation whether it is conducted in a hospital or at home in rural areas requires a tube and mask for ventilation, a mucus extractor for suction, a source of warmth for thermal protection and a clock. It is important that the equipment should be in working condition and that it should not fail when most needed.

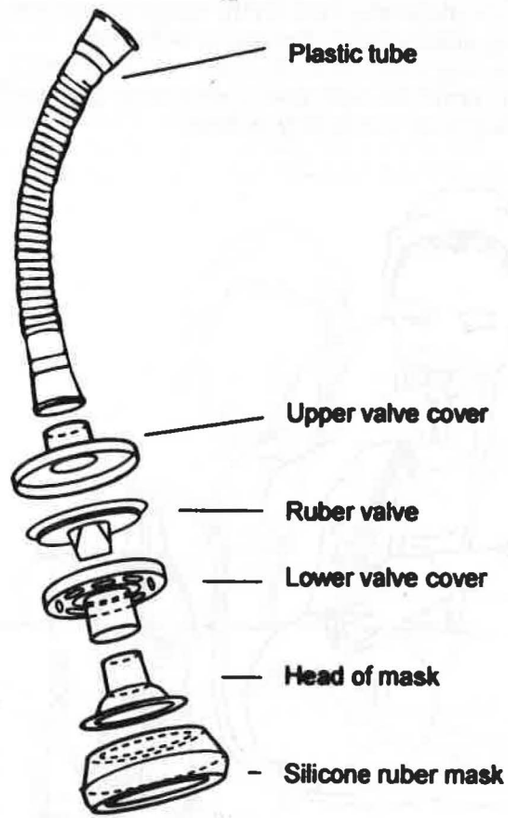

Figure 2. The tube and mask rususcitator

Specifications for tube to mask should have:

- the mouth piece to mask connector that is flexible and provide comfortable distance between mouthpiece and mask
- the mouth piece should fit snugly into the resuscitator's mouth
- the various parts of the equipment should be easy to dismantle for cleaning. The face mask should be circular to fit the baby's nose and mouth well. A circular mask leaks less than masks of other shapes
- the two piece mask should come apart during resuscitation
- the appropriate size for a new born is approximately 6 cm in diameter so that it does not overhang the chin and does not cover the eyes of the baby
- soft but able to retain its shape when put on the baby's mouth and nose
- easy to clean by boiling, silicone mask can also be autoclave
- contain a reusable one way valve made of rubber which allows air to be blown into the baby but does not permit the back flow of exhaled air from the baby. It offers no resistance when blowing in air and is easy to clean.

Figure 3. Model for practicing ventilation

Practicing ventilation on a model is necessary so that the skills required for providing ventilation at the correct pressure and at an appropriate breathing rate can be learnt. A suitable and simple model consist of a rigid plastic ball of about 10-15 cm in diameter. A hole is made in the ball so that a rubber tube (which is not too thin or flexible) can be inserted into it. The other end of this tube is inserted into the top of a plastic bottle which is just over 30 cm in height. Water is filled in this bottle up to a level of 30 cm. The rubber tubing must touch the bottom of the bottle (see Figure 3 in the Appendix). Another hole is made in the ball. The face mask is placed firmly on the ball so as to fully cover the hole. The operator should blow air into the mask. If the pressure of air being flown in is correct, bubbles of air should be seen in the water every time air is blown into the mouthpiece. At the same time, water should not overflow from the top of the bottle while the air being blown in. The rate of ventilation should at least 30 times per minute. This model can also be used for mouth to mouth ventilation. To do this, the operator should cover the hole on the ball with her mouth and follow the recommended ventilation procedure. In real life the TBA will apply the tube and mask on the babies face covering the mouth and nose with the mask. The sequence of events and correctness were recorded (See Figure 4).

Figure 4. A traditional birth attendant applying tube to mask resuscitation