Investigation of intrapartum clearence of the upper airway in the presence of meconium contaminated amniotic fluid using an animal model**

E. Pfenninger, W. Dick, D. Brecht-Krauss*, F. Bitter*, H. Hofmann, I. Bowdler

Center of Anesthesiology (Heads: Prof. Dr. F. W. Ahnefeld, Prof. Dr. W. Dick, Prof. Dr. Dr. A. Grünert) and
* Radiology Dept. III (Nuclearmedicine) (Head: Prof. Dr. Adam),
Ulm University, FRG

1 Introduction

Meconium aspiration syndrome (MAS) as an important contributory factor to neonatal morbidity and mortality has been well established [1, 2, 3, 7, 9, 15, 20, 29, 42]. Meconium contamination of amniotic fluid is found in 8 to 12% of all pregnancies [22, 32, 42]. More than half of these infants have meconium in their trachea at birth [7, 22]. Not all of these neonates become clinically ill, but some 10 to 30% develop respiratory disturbances ranging from a mild to a very severe degree [7, 22, 42]. The incidence of clinically manifested meconium aspiration syndrome is 1 to 3% [6]. Depending upon the degree of aggressive post-partum intensive care, the mortality rate of these MAS infants is reported to be between 0 and 34% [3, 30, 42, 43, 45].

Accordingly, the attention of obstetricians, pediatricians and anesthesiologists is directed towards finding methods of preventing meconium aspiration. As soon as the infant's thorax emerges from the vagina it expands due to its inherent elasticity and a first passive inspiration, and hence aspiration, occurs at this stage [27, 28]. Because this is so, CARSON et al., [9] were able to show that suction and clearence of the upper airways as soon as the head is delivered while the thorax remains

Curriculum vitae

ERNST PFENNINGER *was born in 1948 in Eichenberg, West Germany. He studied medicine at the University of Erlangen and graduated from there in 1975. Between 1977 and 1981, he specialized in anesthesia, and since 1980 he has been in the Anaesthetics Department of Ulm University. Main interests: Emergency medicine, intracranial pressure, neonatal resuscitation.*
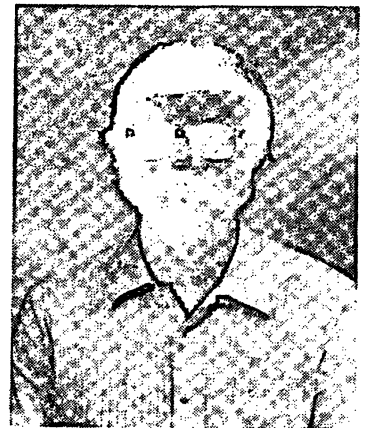
compressed, led to a marked reduction in MAS morbidity.

GAGE [16] reported that suction with a conventional catheter is significantly more efficient than use of a "bulb syringe", but recommendations on the method to be used and in which sequence the airways should be cleared, are either absent in the literature or are contradictory [39]. Oropharyngeal suction alone is suggested by some [13, 15, 16, 23, 34], transnasal suction alone by others [3, 4, 5, 25, 37], while the combined transoral and transnasal suction of the neonate is recommended by others [2, 9, 10, 11, 12, 21, 24, 29, 31, 35, 38, 41].

The pilot study described here, using an animal model already described in the literature [16, 18, 26], was designed to investigate which of the previously mentioned suction clearence techniques

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can be expected to give the best results in the care of infants born with meconium contaminated amniotic fluid. Particular value was given to simulation of pressure changes which occur as the neonate passes through the birth canal.

2 Material and methods

Three different procedures (nasal, oral and combined nasal and oral suction) were carried out on each of five of kittens (2100 gm average weight) aged between 17 and 19 weeks of age. There was an interval of at least one week between each investigation.

The animals were anesthetized with 75 to 175 mg/kg body weight of ketamine given intramuscularly. No further anesthetic agents or supplimentary medication was given. At the stage of surgical anesthesia (approximately 10 minutes after injection) the cats were placed onto a Gamma camera* and oxygenated with 100% oxygen for 5 to 10 minutes. The thorax was then compressed for two minutes using a conventional blood pressure cuff inflated to 50–60 torr (6.7–8.0 kPa). This served firstly to suppress spontaneous respiration and to simulate the passage of the neonatal thorax through the birth canal [16], and secondly to partially empty the lungs following prior previous oxygenation with pure oxygen [14].

During the first minute of thoracic compression, 2 ml of Tc 99 labelled synthetic sputum** was introduced into both the oro- and nasopharynx at a standardized depth using a soft, thin catheter. The amount of radioactivity used for each investigation lay between 0.980 and 2.302 mCi.

During the second minute, the instilled fluid was aspirated using a mucous extractor with a 25 ml trap as is conventionally used on the labor wards.*** On each of the animals oral suction clearence was carried out once and once using nasal suction of both of the anterior nares respec-

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* LEM-γ-CAMERA, Firma Siemens, Federal Republic of Germany (F.R.G.)
** GLANDOSANE®, Fresenius, F.R.G.
*** MUCOUS EXT 25 cc/ml Container with detachable lid, 14 CH, Pharma-Plast, DK

tively (passage of the suction catheter into the nasal cavity was, as is the case with neonates, aboided) — and combined oral and nasal suction was used once. It must be pointed out that when either the oral or nasal routes were used alone, suction was carried out for 60 seconds; whereas, when the combined technique was applied the oral and nasal cavities were cleared for only 30 seconds each. The animals lay in the dorsosuperior position during suction in the manner of most neonates at birth. Suction was carried out blindly without laryngoscopic control, and complete clearance of the oro- and nasopharynx was always attempted although extreme efforts were avoided [41]. At the end of the two minutes, thoracic cmpression was rapidly released and a "first" part-active and part-passive inspiration induced by CO_2 accumulation and the natural elasticity of the thoracic wall. After a further five minutes the radioactivity remaining after suction was documented using a data-system attached to the γ-camera. The radioactivity of the instilled and of the extracted fluid was measured curimetrically and the difference taken as a measure of the amount which could not be recovered.

Statistical analysis was carried out by comparison of median values using the WILCOXON-test for unpaired groups. A probability of < 5% was regarded as significant.

3 Results

The amount of extracted radioactively labelled material was taken as the basis for assessing the effectivity of the various methods. Fig. 1 shows these amounts for each of the animals, grouped according to the technique used. It can be seen that when nasal suction alone was used the amount extracted was much less than with either of the other two techniques; using this route, an average of 13 % (one-eighth of the amount instilled) could be recovered. The individual and the average values obtained with oral method alone and combined oronasal suction were much higher. Oral suction led to the recovery of an average of 52% of the material instilled, and the combined technique recovered as much as 56%. Statistical analysis revealed significant difference at the 5%
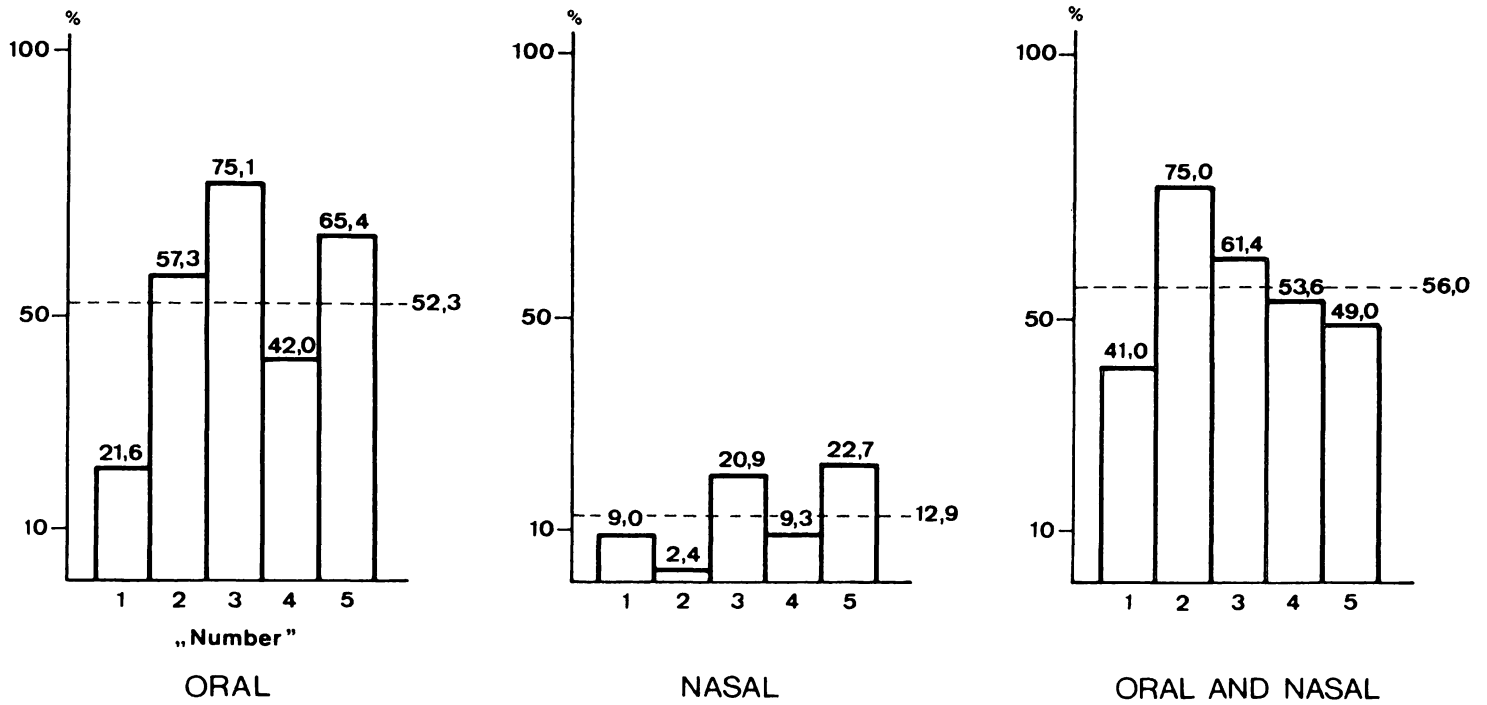
Fig. 1. Diagram of amount of radioactive material removed per animal.

level between oral and nasal and oronasal and nasal suction.

Independent of which technique was used, individual values showed a wide range. With the oral route the range was 22 to 75 % of the fluid instilled, with the nasal route it was 2 to 23 % and with the combined procedure, 41 to 75 %. These wide differences must be seen as the result of the element of chance present during "blind" suction without laryngoscopic control.
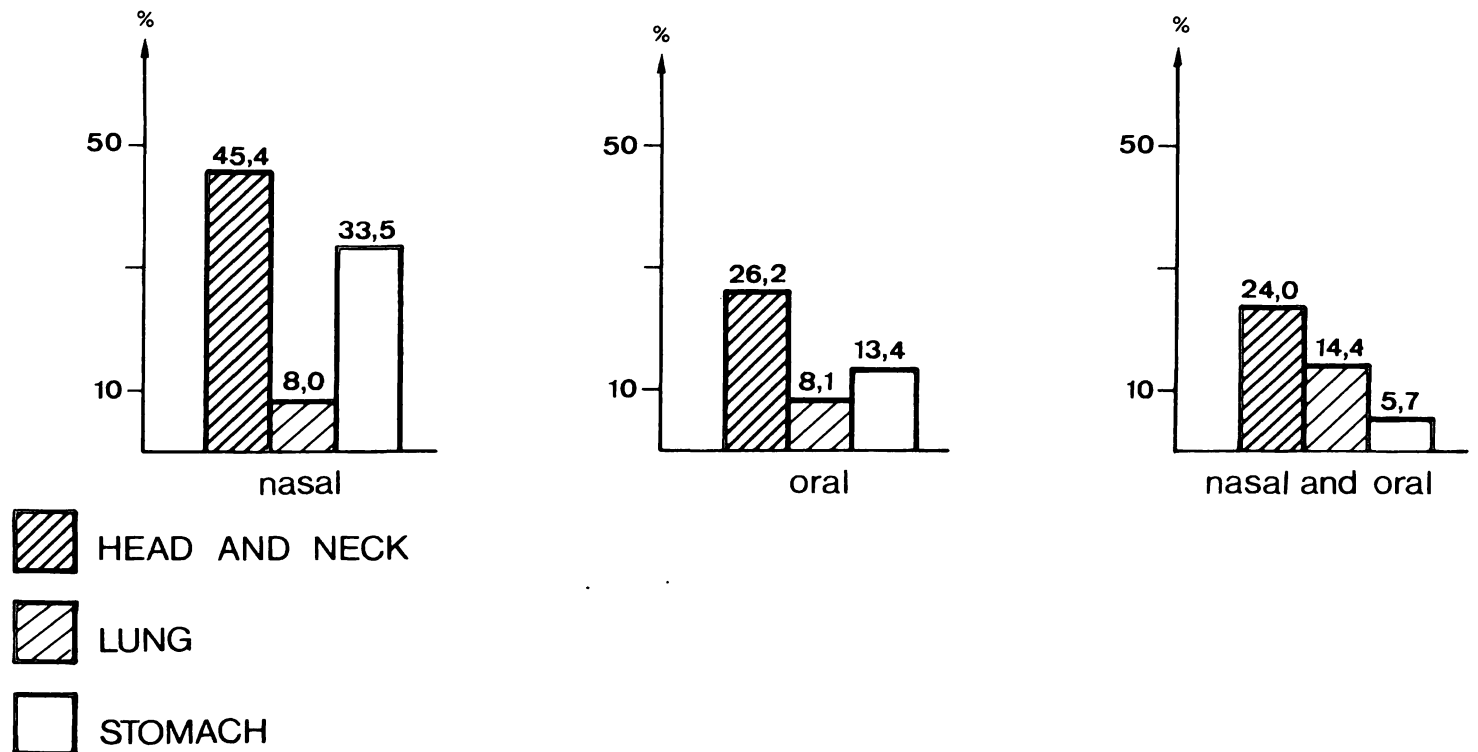

Fig. 2. Distribution of the remaining amount of radioactive material expressed as a percentage of the amount instilled, and grouped according to the suction procedure used.
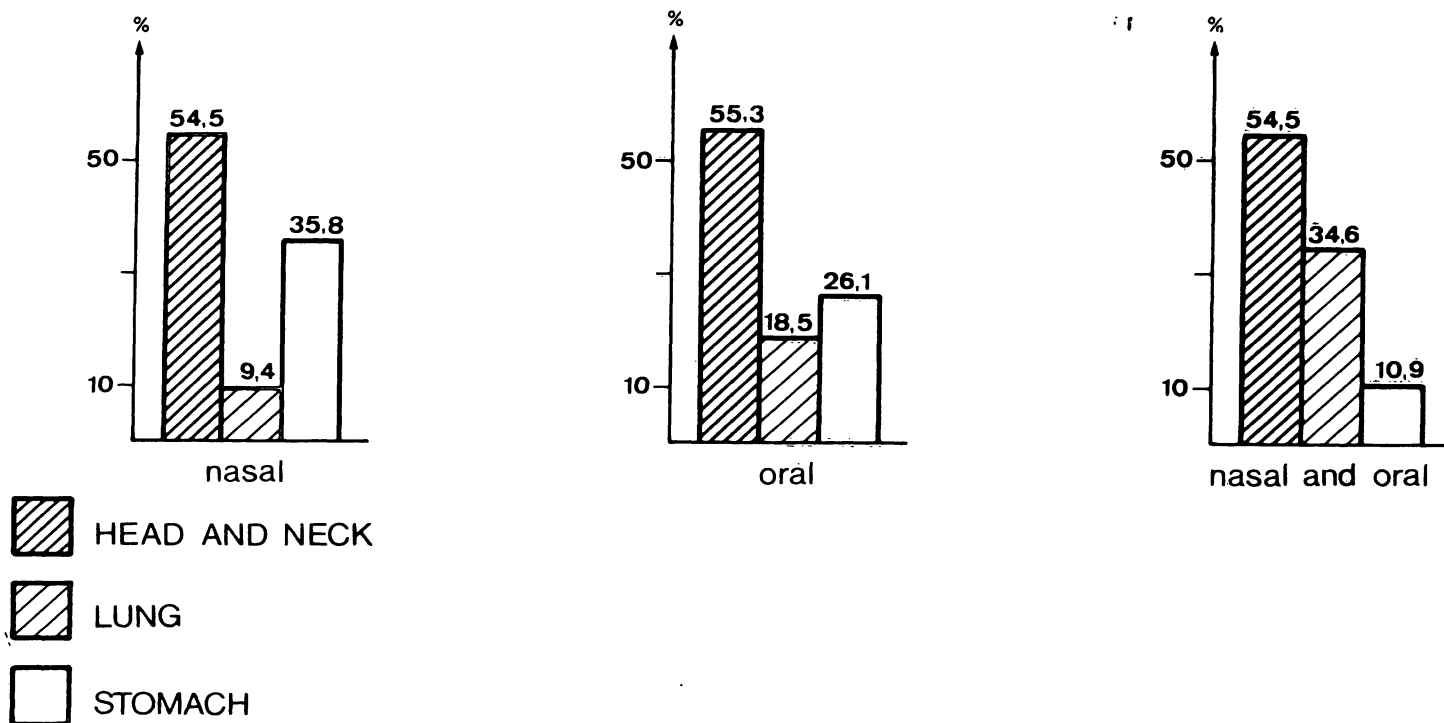
Fig. 3. Relative distribution of the remaining amount of radioactive material, grouped according to the procedure used.

The second part of the investigation was to determine the distribution of radioactivity remaining after suction had been carried out and spontaneous respiration resumed. The head/neck area were arbitrarily defined as the cranial, the stomach and the lower respiratory tract as the two caudal components of the system. Fig. 2 shows the average amount of activity incorporated, expressed as a percentage of the instilled amount and grouped according to the method used. Fig. 3 on the other hand shows the relative distribution. It can be clearly seen that independent of the efficacy of the technique used, the majority of the remaining radioactivity (55 relative percent) is localized in the head and neck area.

Absolute values are 45% for nasal suction, 26% for oral, and 24% for the combined oro-nasal route. Hence these values lie between approximately one quarter and one half of the amount instilled.

It is of note that following nasal suction a relatively large proportion of retained material is found in the stomach. This may be an indication that secretions left in the oropharynx tend to get swallowed rather than aspirated. When the combined technique was used, relatively little radio-

activity (less than 6%) was found in the gastrointestinal tract.

Five minutes after spontaneous respiration had resumed, the lungs revealed only a centrally distributed radioactivity. This corresponds anatomically to the trachea and major bronchi [17]. The peripheral area of the lungs was free of aspirate at this point in time.

It must be pointed out that the aspirate need not be distributed in both of the caudal parts of the system. Both the stomach and the lungs can be involved alone. Examples of this are shown in Figs. 4 and 5. Fig. 6 shows the absolute distribution expressed as a percentage of the amount instilled. Again, the larger amounts present in the head/neck area are clearly seen.

4 Discussion

A number of authors [2, 3, 9, 18, 21, 24] recommend an aggressive approach for the clearence of the upper airways of infants born with meconium stained amniotic fluid. There is as yet no definite answer to the question as to which procedure is most effective in the suctioning of the oro- and
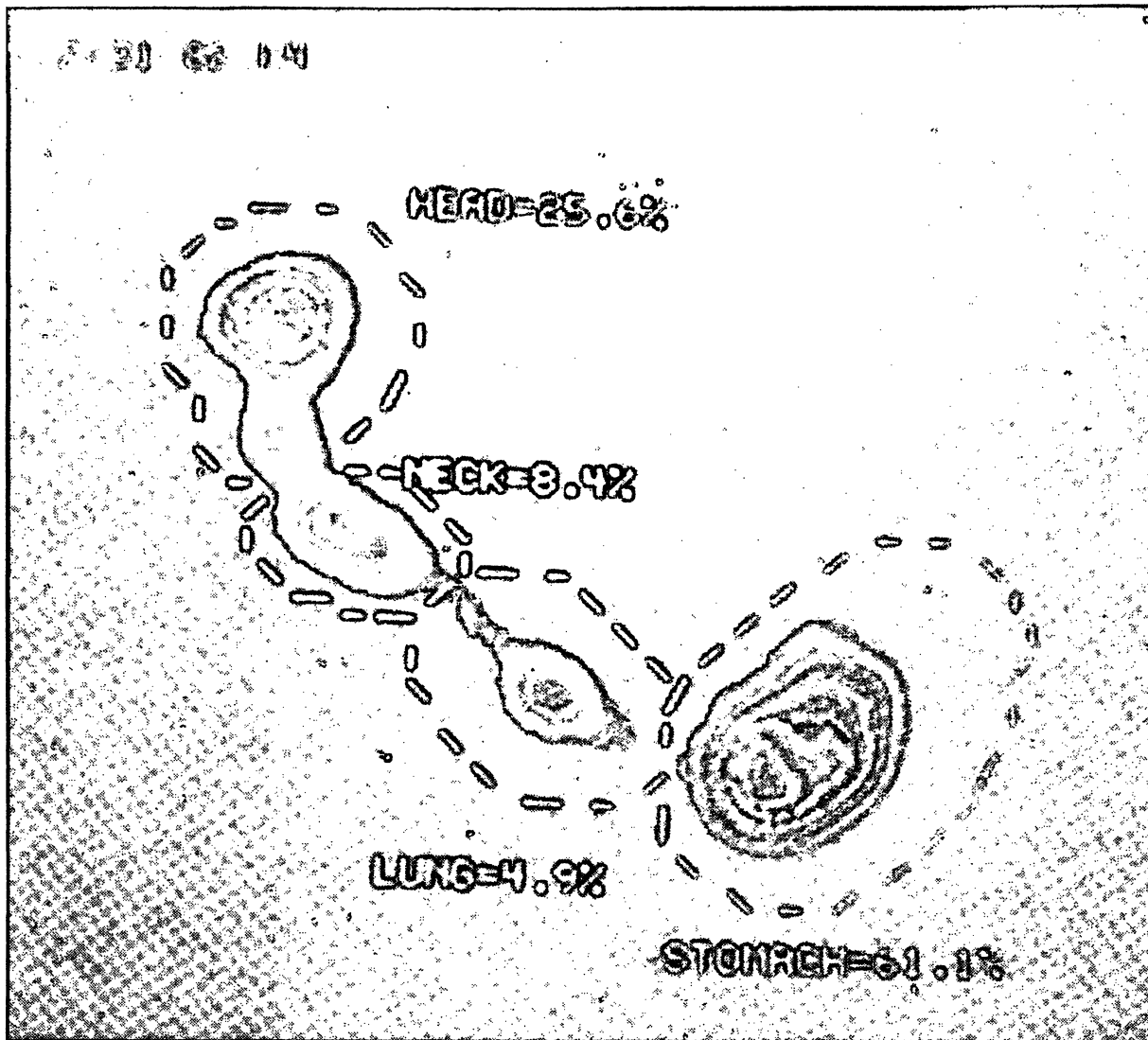
Fig. 4. Lateral view scintigram of the distribution of aspirated material — here in both caudal compartments (lungs and stomach).

nasopharynx immediately after delivery of the head. In this study we have, using an animal model, attempted to find a solution to the problem of which method and in which sequence suction should be carried out on neonates with meconium contaminated amniotic fluid.

With respect to the method used, firstly it must be discussed whether the radioactively labelled synthetic sputum used is comparable to aspirated meconium, and secondly, whether kittens in ketamine narcosis lying in a dorsosuperior position with a mechanically compressed thorax are an adequate model for the process occurring at birth. Synthetic sputum was used as radioactive carrier rather than meconium, because of its bland nature. Hence chemical-toxic damage to the respiratory

tract was never observed following aspiration. The mixture of synthetic sputum and eluted Te 99 has a consistancy which is more similar to finely rather than roughly dispersed meconium. Finely dispersed meconium tends to be largely aspirated into the periphery of the lungs compared to roughly dispersed meconium, because of the difference in particle size [16]. It can therefore be assumed that the distribution of "peasoup" meconium will tend to be even more in the cranial — the head/neck and trachea — area, than the experimental mixture. This is of advantage when carrying out suction clearence either intra- or postpartally. It follows from this that especially the postpartal clearence [3, 12, 15, 16, 21] of oro- and nasopharynx is indeed of importance. In the presence of roughly
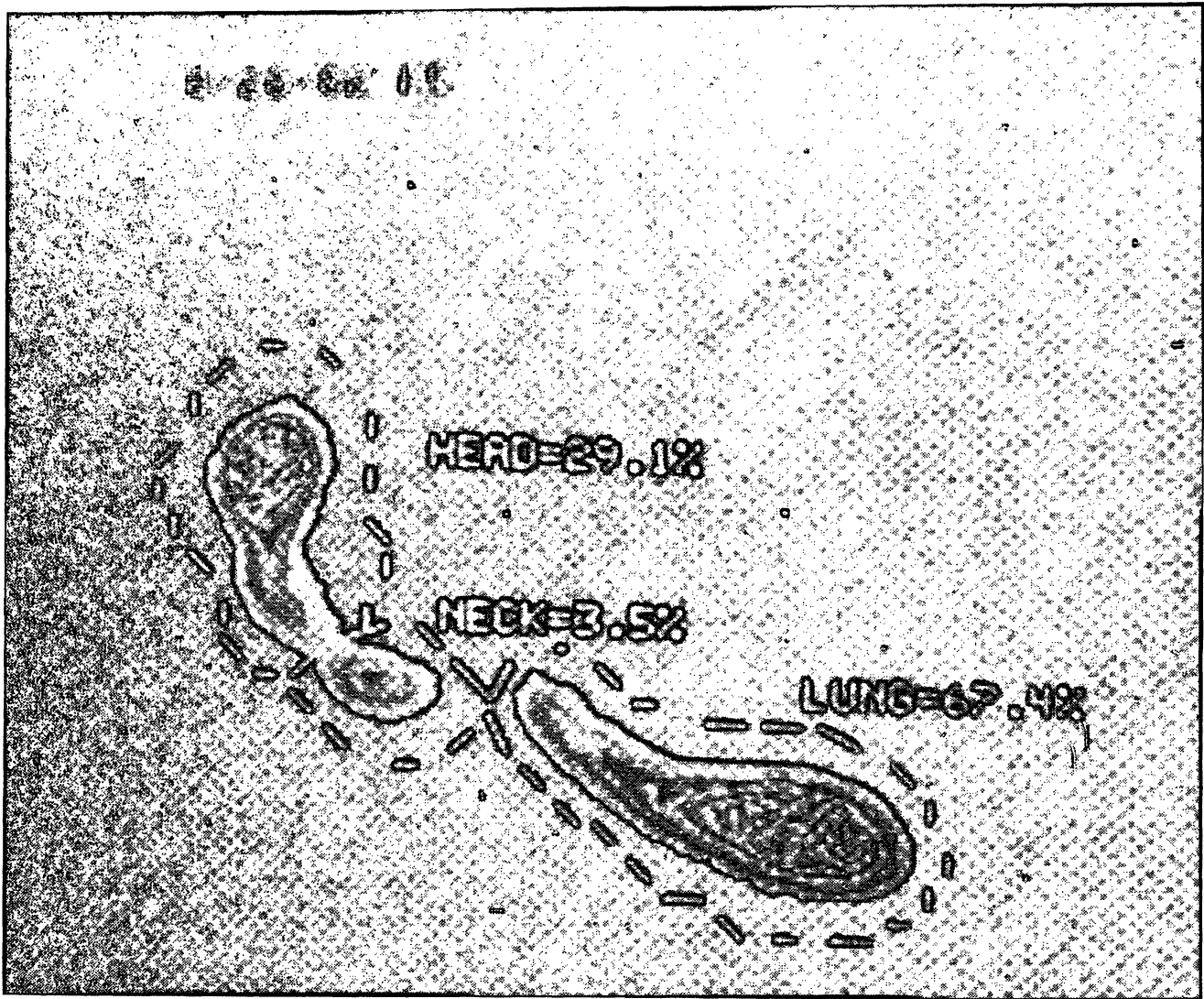
Fig. 5. Lateral scintigram of the distribution of aspirated material — present in the lungs only.

N   = NASAL SUCTION

O   = ORAL SUCTION
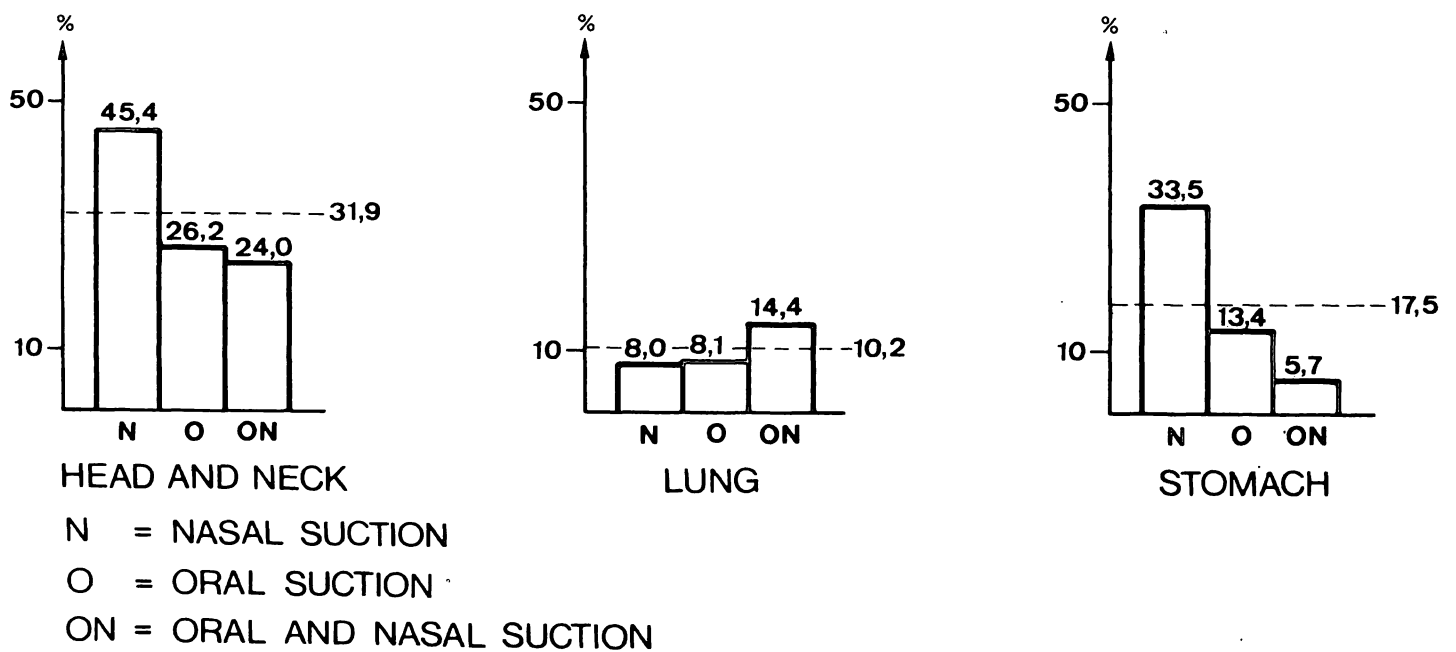
ON = ORAL AND NASAL SUCTION

Fig. 6. Distribution of the amount of material incorporated (expressed as a percentage of the amount instilled) according to the suction procedure used.

dispersed and hence viscous meconium it can be assumed that an even larger amount of the secretion remaining after intra-partum suction clearence than that found in this investigation will remain in the head and neck area whence it can be removed in part by a thorough second clearence. The result of aspirating slightly meconium contaminated amniotic fluid is variously reported in the literature. MILLER [32] found that finely as opposed to roughly dispersed meconium could be correlated with higher Apgar values, and GOODLIN [20] observed that in animal experiments a 2% meconium solution had the same effect on survival rate as aspiration of saline. GREGORY [22] on the other hand failed to find a statistical correlation between the consistency of meconium in the trachea and the incidence of MAS.

There is agreement however, that the severity of MAS correlates with the amount aspirated. Meconium causes a partial obstruction of the lower airways which results in air trapping and a disturbance of the ventilation-perfusion quotient. A chemical pneumonitis affects the alveolar epithelium [2, 3, 44, 45].

In addition to assessing distribution according to the characteristics of the fluid instilled, the question arises as to whether the degree of absorption of the instilled substance through the particularly well perfused mucous membranes of the oro- and nasopharynx is of importance in interpreting these results. The 99 can easily diffuse through mucous membranes [33], so that the relatively short time interval of 5 minutes was chosen between completion of suction and documenting distribution. No measurable resorption took place within this space of time (Figs. 4 and 5), and 5 minutes was regarded as a realistic measure of the time within which the newborn can be adequately cared for. The period of observation was not extended because the resorption which would then occur.

The anatomical and physiological similarity of the upper respiratory tract of the animal model used to that of the neonate, has already been discussed by several authors [8, 16, 26, 36]. Of the non-primates, kittens have the greatest similarity to human neonates with respect to both the anatomy of the face and the oro- nasopharynx [8, 16, 26],

and the physiology of the swallowing and respiratory reflexes [36, 40]. The laryngeal and swallowing reflexes of ketamine anesthetized kittens are more active though, than those of an asphyxiated neonate aspirating meconium [16]. One could therefore expect the human neonate to have even more aspirate in the head and neck area than that found under experimental conditions. There is therefore the danger that when suction clearence is inadequate, large amounts of meconium can be introduced into the trachea and bronchi during subsequent assisted or controlled ventilation.

The model of a kitten's thorax compressed by a blood pressure cuff inflated to 50 to 60 torr, with an apnea time of 2 minutes following previous oxygenation; is equivalent to the situation when the infant's head has been delivered, but the airless thoracic cage is still compressed by the cervix [16]. According to some authors [13, 35], this is exactly that point in time when the upper airways should be cleared.

The nasopharynx was cleared soley by placing a catheter tip at the anterior nares and causing a suction pressure gradient. This procedure is routine in many delivery rooms [10, 11, 29, 35]. We avoided introducing the relatively thick (14 Ch) catheter up to the choanae because of the risk of damage to the nasal mucosa and possibly causing bleeding or edema. Because of the relatively cranial position of the larynx, neonates have to breath through their noses. If the nasal airway becomes obstructed, the infant closes his mouth and tries to blow air through its nose. Only when crying does mouth breathing occur [31]. One must therefore take pains to avoid any measure which might damage the nasal mucosa and hence cause obstruction of the nasal cavity. This procedure has the disadvantage that it is difficult to build up an adequate negative pressure in the nasopharynx due to air entering through the other nostril. The use of thinner catheters would enable the nasal cavity to be reached but there would then be danger that the thinner lumen may become blocked with sticky meconium or even with large particles. The repeated change of catheters which would then be necessary could lead to a large time loss, and could markedly decrease the efficacy of oral suction clearence.

The amount of secretion removed is a direct indicator of how effective the method is. Suction at the anterior nares alone must be regarded as relatively inadequate. Comparison between oral and oronasal suction reveals no particular advantage of either method, but only oral as composed to only nasal suction reveals that the oral component — although when combined onf only 30 seconds duration — is more effective. This is important in that neonates who are in poor condition — asphyxic, acidotic, and bradycardic — resuscitation should begin as soon as possible, and not be delayed by prolonged suction procedures [35]. Therefore, in all cases oral suction should be carried out first, as soon as the head is delivered. If the infant is obviously in poor condition, the time required for relatively ineffective nasal suction can be spared, this is particularly so, because intubation and artificial ventilation are usually necessary. In these instances the endotracheal tube should be introduced through the mouth and not through the uncleared nasal cavity. If procedure do not have to be rushed on the other hand, nasal suction can be carried out after clearing the oral cavity. When this is the case, it may be more appropriate to clear the nasal pharynx with a soft thin catheter.

The finding that over 50% of the radioactive material not cleared by suction is found in the head and neck area 5 minutes after resumption of spontaneous breathing emphasizes that a second clearence must be carried out in the post-partum interval, ideally, on a pre-warmed neonatal reanimation table [3, 12, 15, 16, 21]. For a certain period of time, aspirated material remains largely in the upper airways. GAGE [16] for example, found no contamination at the periphery of the lungs at 20 minutes, but marked contamination 2 1/2 hours after meconium aspiration. GOODING [19] found that Tantal-labelled meconium passed from the trachea and major bronchi into the periphery within one hour. This observation is in agreement to the work of TRAN et al. [44] on the inspiratory and exspiratory resistance of intubated rabbits following meconium aspiration. After a maximum of 15 minutes following the introduction of meconium resistance values fell markedly over the next 2 to 3 hours, indicating that

meconium was passed from the major airways into the bronchi and bronchioles. Because aspirated material remains in the upper airways for a relatively long period of time, endotracheal and endobronchial suction should be carried out a number of times especially when laryngoscopy reveals that the vocal cords are stained green [7, 22, 23]. Lavage with physiological saline once, in some cases even more often [7], may be considered.

Should regurgitation occur, there is a danger that the large quantities of previously swallowed fluid be aspirated. A stomach tube should therefore be passed post-partum and gastric contents emptied. This procedure will additionally exclude the presence of an esophageal atresia [12].

5 Conclusions

Based on this study we would make the following recommendations:

— Oropharyngeal suction clearence immediately upon delivery of the infant's head is markedly superior to nasal clearence and should therefore be carried out first.

— When sufficient time is available, nasal suction can be carried out on completion of oropharyngeal clearence, because in some instances, the amount of material aspirated can thus be further reduced.

— Because a large amount of the meconium present in the oro- and nasopharynx stays there initially even when spontaneous respiration has begun, a second careful clearence of the oral and nasal cavities must be carried out post-partum.

— It takes a relatively long time before aspirated meconium leaves the trachea and the major bronchi for the peripheral airways, repeated endotracheal suction and saline lavage can largely prevent this happening.

— Once spontaneous respiration has begun, a not inconsiderable amount of meconium can be swallowed and on regurgitation later aspirated; therefore the stomach must always be emptied.

Summary

In order to define as effective a procedure as possible for the intra- and post-partum clearance of the upper airways of meconium contaminated infants, three methods of suction clearance, nasal, oral and combined nasal and oral, were carried out on each of five kittens aged between 17 to 19 weeks. There was an interval of at least one week between each investigation. The animals were anaesthetized with ketamine intramusculary. The pressure changes during delivery were simulated using a compressed blood pressure cuff around the kittens thorax.

During the first minute of thoracic compression Tc 99 labeled synthetic sputum was introduced into both the oro- and nasopharynx, then during the 2nd minute the instilled fluid was removed using a conventional extractor with mucus trap.

Soley oral or soley nasal routes were used, suction was carried out for 60 secs, whereas when the combined technique was applied the oral and nasal cavities were cleared for only 30 secs each. At the end at the 2nd minute thoracic compression was released and a deep inspiration occured. After five minutes the radioactivity remaining after suction was documented using a gamma-camera.

We attempted to answer the following questions: How much mucus could be extracted with each different method, and where the remaining amount was later distributed?

Nasal suction alone was found to be inefficient; using this route an average of 13 % (only an eight of the amount instilled) could be removed. Oral suction led to the recovery of an average of 52 % of the material instilled, the combined technique much as 56 %. After re-establishment of spontaneous respiration, it could be clearly seen that, independent of the efficacy of the technique used, the majority of the remaining radioactivity (55 relative percent) is localized in the head and neck area. Absolute values are 45 % for nasal suction, 26 % for oral, and 24 % for the combined oro-nasal route. The other part of the remaining radioactivity was found in the lung or in the stomach. It must be pointed out that the aspirate need not be disturbed in both of the parts, both the stomach and the lungs can be soley involved.

Five minutes after spontaneous respiration had been resumed the lungs revealed only a centrally distributed radioactivity. This corresponds anatomically to the trachea and major bronchi. The peripheral area of the lungs was free of aspirate at this point in time.

Based on this study we would recommend the following proceeding:

Oral suction immediately after delivery of the infant's head is much more effective and should be carried out first. When sufficient time is available, nasal suction should be done after completion of pharyngeal clearance. In some instances the amount of meconium can be further reduced. Because a large amount of meconium present in oro- and nasopharynx stays there initially even when spontaneous respiration has begun, a second very careful clearance of the oral and nasal cavities must be carried out post-partum. After the beginning of spontaneous respiration a relatively large proportion of meconium can be found in the stomach. The stomach must always be emptied in order to prevent later regurgitation and aspiration. Because it takes a relatively long time before aspirated material leaves the trachea and the major bronchi into the peripheral airways, repeated endotracheal suction and/or saline lavage can be necessary.

Keywords: Ketamine – sedated kittens, meconium aspiration, neonatal breathing, respiratory distress, resuscitation/ newborn, upper airway suctioning.

Zusammenfassung

Tierexperimentelle Studie zur intrapartalen Reinigung der oberen Luftwege des Neugeborenen bei mekoniumhaltigem Fruchtwasser

Um die intra- und postpartale Reinigung der oberen Luftwege bei Mekoniumkontamination so effektiv wie möglich zu gestalten, haben wir drei verschiedene Absaugmethoden (nasal, oral und eine Kombination aus beiden) nacheinander bei fünf jungen Katzen im Alter von 17 bis 19 Wochen durchgeführt und miteinander verglichen. Zwischen den Versuchen lag ein Intervall von mindestens einer Woche. Die Tiere wurden mit Ketamin i.m. anästhesiert. Um die Druckänderungen während einer Geburt zu simulieren, wurde eine Blutdruckmanschette um den Thorax angebracht und der Thorax so komprimiert.

Während der ersten Minute nach Thoraxkompression wurde ein mit 99 Tc markiertes, synthetisches Sputum in den Oro- und Nasopharynx eingebracht. Anschließend wurde während der zweiten Minute die instillierte Flüssigkeit über ein konventionelles Absaugegerät mit Sekretfalle wieder entfernt.

Wenn nur die transnasale bzw. nur die transorale Reinigung erfolgte, wurde 60 Sekunden abgesaugt. Bei der kombinierten Technik wurde der nasale Raum und der orale Raum jeweils 30 Sekunden abgesaugt. Nach zwei Minuten wurde die Thoraxkompression aufgehoben und es erfolgte eine tiefe Inspiration. Nach weiteren fünf Minuten haben wir die nach Absaugung verbliebene, inkorporierte Radioaktivität mit einer Gamma-Kamera dokumentiert.

Folgende Fragen waren zu beantworten: Welche Sputummenge konnte mit den verschiedenen Methoden abgesaugt werden und wie verteilte sich der nicht abgesaugte Rest? Die alleinige transnasale Absaugung erwies sich als ineffektiv; es konnten im Durchschnitt lediglich 13 % (d. h. 1/8 der instillierten Menge) abgesaugt werden. Bei der transoralen Absaugung wurden durchschnittlich 52 % der verabreichten Menge wiedergefunden, bei der kombinierten Methode mehr als 56 %. Nach Einsetzen der Spontanatmung konnten wir beobachten, daß sich unabhängig von der Effektivität der Technik der Hauptanteil, nämlich 55 Relativprozent, der nicht abgesaugten Radioaktivität im Kopf- und Halsbereich lokalisieren läßt. Die Absolut-

werte in Prozent ausgedrückt, betrugen für die nasale Absaugung 45%, für die orale 26% und für die kombinierte Methode 24%. Der andere Teil der nicht abgesaugten Radioaktivität ließ sich in der Lunge und im Magen nachweisen. Es sei darauf hingewiesen, daß nicht beide Kompartimente unbedingt gleichzeitig betroffen waren; Lunge und Magen konnten auch isoliert inkorporierte Radioaktivität aufweisen.

Fünf Minuten nach Einsetzen der Spontanatmung zeigte sich nur über den zentralen Lungenabschnitten, die anatomisch der Trachea und den Hauptbronchien entsprechen, Radioaktivität. Die peripheren Lungenanteile enthielten zu diesem Zeitpunkt kein Aspirat.

Auf der Grundlage dieser Studie empfehlen wir folgendes Vorgehen:

Die orale Absaugung unmittelbar nach Durchtritt des kindlichen Kopfes ist effektiver und sollte die Erstmaß-nahme sein. Wenn genügend Zeit zur Verfügung steht, sollte nach der Reinigung des Pharynx nasal abgesaugt werden; unter Umständen läßt sich so die mekoniumkontaminierte Sekretmenge weiter reduzieren. Da selbst nach Einsetzen der Spontanatmung im Oro- und Nasopharynx befindliches Mekonium dort verbleibt, muß eine sorgfältige zweite Reinigung des Nasen- und Mundraums post partum erfolgen. Nach Einsetzen der Spontanatmung kann ein relativ großer Anteil des Mekoniums in den Magen gelangen. Der Mageninhalt muß daher in jedem Fall abgesaugt werden, um eine spätere Regurgitation und Aspiration zu verhindern. Aspiriertes Mekonium benötigt eine relativ lange Zeitspanne, um aus der Trachea und den Bronchien in die Lungenperipherie zu wandern. Ein wiederholtes endotracheales Absaugen und/oder eine Spülung mit Kochsalz können somit notwendig und sinnvoll sein.

Schlüsselwörter: Absaugung der oberen Luftwege, Mekoniumaspiration, neonatale Atmung, Respirationsstörung, Sedierung von Katzen mit Ketamin, Wiederbelebung von Neugeborenen.

Résumé

Exploration sur modèle animal de la liberté intra-partum des voies aériennes supérieures en présence de liquide amniotique méconial

Trois méthodes d'aspiration nasale, buccale et combinée, nasale et buccale, ont été utilisées chacune sur cinq chatons de 17 à 19 semaines, afin de définir une technique d'aspiration des voies aériennes supérieures la plus efficace possible chez les enfants ayant inhalé un liquide méconial. L'intervalle entre chaque examen a été d'au moins une semaine. Les animaux ont été anesthésiés par Kétamine intra-musculaire. Les variations de pression en cours d'accouchement on été simulées à l'aide d'un brassard de tensiomètre placé autour du thorax des chatons. On a introduit du mucus synthétique marqué au Tc 99, pendant la première minute de compression thoracique, à la fois dans l'oro et dans le nasopharynx, ensuite pendant la deuxième minute, le liquide instillé a été aspiré à l'aide d'un appareil d'aspiration traditionnel ayant un réservoir de mucus.

Par l'utilisation unique des voies orales ou nasales, on a aspiré pendant 60 secondes, alors que par la technique combinée on a désobstrué les cavités buccales et nasales pendant 30 secondes seulement chacune. La compression thoracique a été relachée à la fin de la deuxième minute, et une inspiration profonde s'est alors produite. Au bout de 5 minutes, la radioactivité persistante après l'aspiration a été enregistrée à l'aide d'une caméra gamma.

Nous tentons de répondre aux questions suivantes: Quelle quantité de mucus peut être extraite à l'aide de chaque méthode et où se localise ultérieurement ce qui reste?

On a trouvé que l'aspiration nasale isolée est inefficace; en utilisant cette voie, on peut aspirer une moyenne de 13% (seulement un huitième de ce qui a été instillé). L'aspiration par la bouche permet de récupérer une moyenne de 52% de ce qui a été instillé, la technique combinée plus de 56%. Après le rétablissement de la respiration spontanée, on observe clairement que, indépendemment de la technique employée, la majorité de la radioactivité persistante (55%) est localisée au niveau des aires céphaliques et cervicales. Les valeurs absolues sont de 45% pour l'aspiration nasale, de 26% pour l'aspiration orale et de 24% pour la voie combinée. L'autre partie de la radioactivité restante est localisée au niveau des poumons ou de l'estomac. On doit insister sur le fait qu'il est nécessaire d'aspirer à la fois dans ces deux directions, on peut en effet n'aspirer que l'estomac ou que les poumons.

Cinq minutes après la reprise spontanée de la respiration, la radioactivité pulmonaire se distribue uniquement au niveau de la zone centrale. Cela correspond anatomiquement à la trachée et aux bronches souches. La périphérie pulmonaire est libre de mucus à cet instant.

En se basant sur cette étude, nous voulons recommander les points suivants:

L'aspiration orale du pôle céphalique de l'enfant immédiatement après la naissance est de beaucoup la plus efficace et devrait être menée à bien dans un premier temps. Lorsque l'on a assez de temps, l'aspiration nasale ne devrait être effectuée qu'après l'entière évacuation pharyngée.

Dans certaines circonstances, la quantité de méconium peut être davantage diminuée. Du fait de la présence de grandes quantités de méconium au niveau de l'oro et du naso-pharynx dès le début même lorsque la respiration spontanée a débuté, une deuxième aspiration très soigneuse doit être effectuée après l'accouchement. Après le début de la respiration spontanée une proportion relativement importante de méconium peut être trouvée dans l'estomac. On doit toujours évacuer ce dernier afin de prévenir les régurgitations et les aspirations ultérieures.

En raison du délai relativement long avant que le matériel à aspirer quitte la trachée et les bronches souches vers les voies aériennes périphériques, des aspirations endotrachéales itératives et/ou des lavages au sérum salé peuvent être nécessaires.

Mots-clés: Chatons calmés à la Kétamine, désobstruction des voies aériennes supérieures, détresse respiratoire, inhalation méconiale, réanimation néonatale, respiration néonatale.

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Dr. med. E. Pfenninger
Zentrum für Anästhesiologie
der Universität Ulm
Prittwitzstr. 43
7900 Ulm/Donau, F.R.G.