tribution as Editor-in-Chief of ANESTHESIOLOGY, the Editorial Board wishes to add this documentation. It is an expression of appreciation, with respect and humility, for what has been a treasured learning experience.

The Editorial Board

Mechanical Ventilation of the Newborn

THE ARTICLES "Mechanical Ventilation of the Newborn Infant: III, IV, and V," by William Daily and his associates represent the most comprehensive and informative analysis of the treatment of respiratory failure in a large series of newborns that has been published to date. To appreciate the significance of their accomplishments, an assessment of the progress made in the past ten years is necessary. To place their work in perspective, the effectiveness of intermittent positive-pressure ventilation (IPPV) in reducing mortality and the role of the anesthesiologist should be considered.

The first successful and well documented experience with prolonged ventilation of a substantial number of newborns was reported by Smythe and Bull.[1] They treated infants with neonatal tetanus by means of tracheostomy, IPPV and *d*-tubocurarine for respiratory control, with a resulting decrease in mortality from nearly 100 to less than 20 per cent.[2] Since that time most attention and effort have been directed to the more common problems of respiratory failure associated with the respiratory distress syndrome (RDS or hyaline membrane disease). It is estimated that in the United States alone, nearly 25,000 newborns die of this disorder each year, making it the leading killer of live-born, low-birth-weight infants.[3] The difficulty of establishing a tracheal airway for prolonged periods in the newborn delayed the development of IPPV as a therapeutic tool in RDS. Introduction of prolonged nasotracheal intubation of small infants with polyvinylchloride tubes by Brandstadter in 1962[4] obviated the need for immediate tracheostomy, and became the key to the use of IPPV in neonatal intensive care units around the world. Catheterization of an umbilical artery for repeated sampling of arterial blood for *p*H and blood gas analyses was considered a research procedure until 1962, when Warley and Gairdner[5] reported its use in infants with RDS for periods beyond two days without major complications. Subsequently, the use of umbilical artery catheters has become a routine part of the management of infants with RDS in most neonatal centers.

In 1965, Thomas and co-workers described their early successful experience at the Stanford University Hospital with the use of prolonged IPPV via nasotracheal tube in the treatment of 18 infants with respiratory failure.[6] In the same year, Delivoria-Papodopoulos and co-workers[7] reported 40 per cent survival in a larger series of moribund infants with RDS utilizing IPPV and tracheostomy. The latter report represents a landmark because it defined stringent criteria for the use of mechanical ventilation, virtually assuring that infants with better than a 15 per cent chance of survival would not be treated by this extraordinary means. Since 1965 a number of different centers have reported their results in the treatment of RDS and other neonatal respiratory disorders by IPPV. Although the criteria for diagnosis of respiratory failure and the use of mechanical ventilation have differed slightly, they bear a strong resemblance to those utilized by Delivoria-Papodopoulos and by Daily and co-workers.[8] Unfortunately, only one published study was designed prospectively to determine the increase or decrease in mortality that might accompany mechanical ventilation when less stringent criteria were used. This study established that early use of intermittent negative-pressure ventilation with a tank respirator neither decreased nor increased mortality from RDS.[9] In a recent review of the experiences in neonatal intensive care units throughout the Western world, Swyer[10] found an average survival rate of 39 per cent in more than 500 infants with respiratory failure from RDS who received mechanical ventilation, quite similar to the overall survival achieved by Daily and co-workers.[11] Swyer[10] also concluded that mechanical ventilation accounted for a 13 per cent reduction in mortality from RDS.

Neurologic impairment and other complications appear to occur no more frequently in infants surviving RDS than in comparable low-birth-weight infants who did not have RDS.[12] Less than 5 per cent of survivors develop recurrent pulmonary infection, wheezing, and x-ray evidence of peribronchial and alveolar fibrosis,[13] despite previous reports implying that chronic pulmonary disease may be a common sequela of mechanical ventilation in the newborn.[14] The incidence of severe retrolental fibroplasia appears to be increasing, but can be minimized by frequent determinations of Pa_{O_2} and regulation of Fi_{O_2}.[15]

Alternatives to intermittent positive-pressure ventilation and nasotracheal intubation merit consideration. Stern and co-workers[16] have employed intermittent negative-pressure ventilation with an incubator tank ventilator without nasotracheal intubation in infants with RDS and respiratory failure. They achieved survival rates comparable to those of other groups using IPPV apparently with fewer complications. IPPV by bag and mask for five to ten minutes every half hour has been advocated by Klaus and Gruber[17] as an alternative to mechanical ventilation that is more acceptable for routine use in infants with severe RDS. Recently Gregory and Tooley[18] have used continuous positive airway pressures of 5 to 10 cm H_2O throughout the respiratory cycle to raise the Pa_{O_2}'s in infants with severe RDS and impending respiratory failure. These infants were breathing unassisted through an orotracheal tube. Preliminary results indicate a survival rate better than 80 per cent and a considerable reduction in the need for subsequent mechanical ventilation.

The complex techniques involved in the treatment of respiratory failure of the newborn[19] require a neonatal intensive care unit staffed by specially trained nurses, a geographic full-time staff of physicians composed of neonatologists and anesthesiologists, and senior resident coverage at all times. A 24-hour laboratory service to provide rapid determinations of *p*H, blood gas tensions, glucose, bilirubin, electrolytes, and total protein in ultramicro-samples of blood must be provided. Few hospitals in this country are so equipped and staffed, yet there is convincing evidence that such facilities can achieve nearly a threefold reduction in the overall mortality rate for low-birth-weight infants.[20] Therefore, it seems logical to hospitalize the pregnant woman whose fetus is at risk in an institution with such a facility, or to transfer low-birth-weight infants to a neonatal intensive care center when they are born in hospitals lacking this facility. In Canada, considerable effort is being devoted to the development of transportation systems for the ill newborn,[21] and preliminary programs are under way in the United States.[22]

However, the pediatrician and the anesthesiologist frequently are faced with caring for the infant with RDS in a hospital which lacks a neonatal intensive care program; neither a regional neonatal intensive care center nor adequate transportation facilities are available. Under these circumstances the anesthesiologist should encourage the use of rational, conservative measures. Morbidity and mortality from RDS can be reduced by early diagnosis in the delivery room, the controlled administration of oxygen, intravenous sodium bicarbonate and glucose,[23] and maintenance of optimal thermal conditions.[24, 25] These measures, in addition to sampling of blood from the umbilical artery for repeated assessment of Pa_{O_2}, acid–base status, and glucose levels, and the use of heart rate and apnea monitors, should result in greater survival than the occasional use of mechanical ventilation. Finally, every physician should foster the development of regional neonatal intensive care centers and the establishment of effective transportation systems with adequately trained personnel to attend the ill infant. In this way, the greatest number of critically ill newborns can be provided with excellent care, such as that described by Daily and co-workers, at the least expense to society.

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Drugs

INTRA-ARTERIAL SECOBARBITAL Accidental self-administration of secobarbital intra-arterially produces a characteristic clinical syndrome of immediate, severe, burning pain radiating into the hand. Tense muscle edema and necrosis develop over the next 24 to 48 hours despite the presence of an intact radial pulse. Confusion with cellulitis may delay accurate diagnosis. (*Morgan, N. R., and others: Volkmann's Ischemic Contracture after Intra-arterial Injection of Secobarbital, J.A.M.A. 212: 476 (April) 1970.*)