The Care and Nutrition of a Patient in Prolonged Coma

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ALTHOUGH about three per cent of all hospital admissions are due to coma, it is unusual for the coma or stupor to last for a long period of time. We have been caring for a patient who has been unresponsive for more than 17 months. To maintain such a patient in adequate nutrition and health presents many problems. Some of the broader concepts of this management and the case history, which illustrates these concepts, are presented.

GENERAL MANAGEMENT

Regardless of the cause of the coma, comatose patients frequently die from anoxia. Occasionally, the patient may be able to maintain adequate aeration but usually, because of tongue retraction, poor positioning of the head, and increasing pharyngeal and tracheal secretions, anoxia occurs. Frequently, an oral airway and nasopharyngeal suction are inadequate as secretions collect beyond the reach of the catheter. Intratracheal intubation requires the technical skill of trained anesthetists and the tube must be changed and cleaned every 24 hours, thereby increasing laryngeal and tracheal edema. Tracheotomy is superior to any other method of maintaining efficient aeration of the lungs and keeping a tracheobronchial tree free of secretions. If the patient shows any signs of respiratory distress or if coma persists more than 48 hours, a tracheotomy should be done.[1,2]

The head of the bed should be elevated 30–45° and lowered for 15 minutes every one to two hours to facilitate removal of secretions. This position favors cerebral venous return, allows a fuller excursion of the diaphragm, and permits more adequate ventilation of the lungs.

Adequate suction, administration of oxygen, preferably humidified to prevent drying of tracheobronchial tree, and avoidance of respiratory depressant drugs are important adjuncts. Since convulsions increase bronchial secretions, they should be controlled with barbiturates, administered intravenously if necessary, or with chloral hydrate. If nasal oxygen is given, the tube should be checked frequently for even partial plugging.

The abnormal static position of the comatose patient and the inability to cough and breathe deeply are factors conducive to atelectasis and pulmonary infection. In addition, this immobility favors the formation of decubitus ulcers, contractures, and degenerative joint changes, as well as venous thrombosis of the extremities.

Positioning of the patient as described, turning from side to side every two hours, tracheobronchial suction, skin massage, and passive exercises, in which all joints are moved through a complete range of motion many times daily, will prevent almost all of these debilitating sequelae. The bed must be kept dry and the sheets removed properly to prevent sheet burn. "Doughnuts" around pressure areas are to be condemned as they retard circulation, but bridging on each side of the pressure area may be used.

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Fecal impaction with distention and diarrhea is the principal bowel problem. A rectal examination should be performed at least every three days, and enemas and mild cathartics administered as needed.

Urinary retention, infection, and stone formation are frequent complications in patients who are bedfast. A Foley catheter should be inserted and attached to an intermittent bladder irrigator with Suby-Albright solution or a mild antiseptic irrigating solution. The catheter should be changed every 10 to 30 days and antibiotics used as indicated. An adequate urinary output must be maintained to prevent stone formation due to the mobilization of calcium and phosphorus from the bones. Marshall and Green[3] report that a diet low in phosphorus and aluminum gel by mouth will decrease the urinary output of phosphorus. Since two-thirds of all urinary calculi in the bedfast patient are of the phosphate variety, a low urinary excretion of phosphorus is desirable. Dietary calcium need not be restricted.[4]

Corneal drying, ulceration, and perforation should be prevented by using the following measures: (1) some form of modified tarsorrhaphy so that the eye can be examined easily, such as Scotch tape to close the lids or silk suture through the upper lid and taped to the cheek; (2) the use of methylcellulose drops $^1/_2$ per cent, during the day and mineral oil drops at night to prevent drying; (3) antibiotics as indicated; (4) staining of the cornea twice a week to detect ulceration

HYDRATION AND NUTRITION

There are two major practical routes by which nutrients may be administered to the comatose patient: intravenous and nasogastric tube feeding. The basic minimum daily requirement of the average adult at bed rest consists of a diet containing approximately 70 g protein and 2400 calories, 30 per cent as fat, in addition to vitamins and minerals.[5]

In order to maintain this requirement by the intravenous route, at least 3000 ml of a 5 per cent protein hydrolysate in 10 to 15 per cent glucose solution must be given daily.[6] Whole blood, plasma, and alcohol have been recommended as supplements, but 500 ml of whole blood will supply only 17.5 g of proteins and 70 calories.[6,7] Alcohol, which supplies calories only, should not be given to the unconscious patient.[8] Although it is possible to maintain a patient in positive nitrogen balance for a short period of time by intravenous feeding, more than twice as much nitrogen is required with the same caloric intake.[9,10] Of course, the intravenous route is limited by the veins available and by the skill of the house staff and nursing care.[9]

In the first 24 to 72 hours, the intravenous route is preferred to supply adequate fluid, blood, and plasma, but after that time tube feeding should be instituted. Different commercially available formulas have been advocated for tube feeding.[11,12] These formulas contain milk or milk powder, sugar and protein; vitamins are added as necessary.

Barron and Fallis[13] believe that no commercially prepared formula can replace natural food and recently reported their experience in the tube feeding of 200 patients. By the use of a blendor or liquefying machine, whole food was converted to a liquid and injected into the stomach with a feeding pump through a small 2.5-mm plastic tube. This diet was well tolerated and 1300 calories could easily be included in one liter of fluid. Barker[14] agrees that it is an ideal feeding mixture.[14]

Distention and diarrhea have been a minor but constant side-effect from tube feeding of a formula. Elman and co-workers[11] reported an overall incidence of 5 per cent, with discontinuance of tube feeding necessary in 2 per cent of 316 patients. Others report an incidence of up to 39 per cent.[5] That diarrhea is a rather constant feature is illustrated by the frequent suggestions for the use of Banthine (brand of methantheline bromide), paregoric, pectin, etc., for its temporary control.[15,16] Diarrhea did not occur, however, with liquefied whole food.

Rarely have cases of tracheo-esophageal fistula been reported when an orogastric tube and tracheal cannula were used together.[17] Fallis and Barron,[18] using small polyethylene

TABLE I

Laboratory Studies on a Patient in Prolonged Coma

Determination	1954			1955	
	8/23	9/3	12/23	5/9	11/5
Hemoglobin (g/100 ml)	6.4	12.5	12.1	16.2	15.1
Nonprotein nitrogen (mg/100 ml)	69.5	61.0	26.9	29.5	29.0
CO_2 (vol/100 ml)	76	69	68	73	—
Chlorides (meq/liter)	104	108	—	104	99
Potassium (meq/liter)	4.9	5.5	5.5	—	5.3
Sodium (meq/liter)	145	146	137	143	132
Total proteins (g/100 ml)	—	—	7.13	7.6	7.43
A/G Ratio	—	—	0.84/1	1.03/1	1.2/1

tubes, found no irritation from the tubes after many months' use. McNeer thought that more frequent pulmonary complications occurred, but Pack and others do not agree.[14]

It is important that the feedings be given as a constant slow drip or at spaced intervals to prevent vomiting and aspiration due to gastric distention. It also should be noted that azotemia, hypernatremia, and hyperchloremia may occur if an insufficient amount of fluid is given with a high protein diet.[19]

We are reporting our experience with a patient who was admitted to this hospital in August 1954 because of a fall and multiple fractures. He became comatose on the same day after occurrence of fat embolism. Maintenance of nutrition has been accomplished with homogenized whole food, and physiotherapy has prevented all of the complications inherent in the prolonged bed rest. His nutritional status has improved and his condition remains excellent after *more than 17 months of coma*.

CASE REPORT

R.S., a 37-year-old colored man fell two stories on August 20, 1954, and landed on his left leg and side. He was brought immediately to the emergency room of the hospital, and at that time was completely conscious and co-operative. There were obvious closed fractures of the left leg and hip, as well as tenderness in left flank and costovertebral angle. In the absence of head injury, 15 mg of morphine was given for pain. Roentgenograms revealed comminuted fractures of the left tibia, fibula, and subtrochanteric area of left femur.

The patient was placed in balanced traction with a Kirschner wire through the lower tibia. He became progressively stuporous and 11 hours after admission could not be aroused. At that time, the blood pressure was 170/120 mm Hg, pulse, 110 per minute, and respirations, 36 per minute. His hemoglobin, which had been 12.8 g on admission had dropped to 11.4 g per 100 ml. He was seen by a general surgeon for possible intra-abdominal injury and by a neurosurgeon for the cause of coma. Fat embolism was suggested and urinalysis revealed large amounts of fat. A Foley catheter was inserted and attached to an intermittent bladder irrigator. Antibiotic therapy was started.

An oral airway was introduced and humidified oxygen was given through a nasal catheter. Because of accumulating secretion and increasing respiratory difficulty, a tracheotomy was done the following morning with respiratory improvement. Although he remained critically ill for the next two weeks, his vital signs gradually returned to within normal limits. During this time, he received nine pints of blood and intravenous fluids totaling 3000 ml daily in order to maintain an adequate urinary output and normal electrolyte balance. He received an average of 650 calories a day.

Two weeks after admission, a nasogastric polyethylene tube was inserted and formula feeding was started. He received 126 grams of protein, 142 grams of fat, 336 grams of carbohydrate, and 3000 calories in 2400 ml. Oxygen could be discontinued on the 27th day. The patient's arms and right leg were moved through a complete range of motion every hour and the patient was turned every two hours. Four months after admission, balanced traction was discontinued and skin traction applied for an additional month.

Four and one-half months after admission, a liquefied general diet was started. A regular diet was liquefied with a Waring blendor, after removal of bones and seeds, and liquids were added as necessary. From 100 to 200 ml of the liquefied diet is given every hour through the tube. The diet he is now receiving furnishes 2400 calories, 20 to 25 per cent as fat, with 70 grams of protein, and 3000 ml of fluid daily.

Although the patient manifests decerebrate rigidity, he is lifted into a chair daily and has no contractures. He has not had pneumonia at any time and has no evidence of urinary tract stones. The urinary output is adequate. He has been on a homogenized regular diet for more than a year and has had no diarrhea.

Although Zintel[20] states that patients do not often improve on formula feeding, we find that in this case the patient's total protein and hemoglobin concentration have improved (Table I). We believe that for long-term feeding by the nasogastric route, a homogenized general diet will provide the ideal feeding mixture.

SUMMARY AND CONCLUSION

We have briefly outlined the care and nutrition of the patient in prolonged coma, a subject about which little can be found in the literature. We believe the following points should be emphasized:

(1) Tracheotomy should be performed in all patients who show signs of respiratory difficulty or who remain in coma over 48 hours.

(2) Intravenous blood and fluid should be administered until the patient has passed the initial critical phase of his illness, at which time nasogastric tube feeding should be begun if that route is available.

(3) Tube feeding with liquefied whole food is superior to other types of feeding formulas; it is easy to prepare, is well tolerated, has fewer side effects, and needs no supplementation.

An illustrative case history of a patient who has now been in coma for 17 months has been presented. We realize that his prognosis is hopeless, but he demonstrates what can be done to maintain a patient in prolonged coma in good physical condition.

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