

Respiratory Failure Caused by Neutropenia and Meningitis

Fairview Southdale Hospital Edina, Minnesota

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Intensive Care Unit

Patient

30-year-old Caucasian female admitted to emergency department with 2-day history of flu-like symptoms including fever, nausea and abdominal pain. No other prior medical history.

Diagnosis

Initial lab tests revealed neutropenia. A lumbar puncture revealed bacterial meningitis. Coagulation studies were performed and showed signs of disseminated intravascular coagulation. Patient presented with early signs of sepsis and progressed to severe septic shock. Antibiotic therapy was initiated.

Hospital Day 1:

- 00:10 Patient admitted to medical floor. The initial chest x-ray revealed infiltrates in both lung fields. Patient's temperature elevated to 102°F. Patient received 5-pack of platelets, 3 units cryoprecipitate and 4 liters of saline. Lactate level was 6.
- 01:30 Patient transferred to ICU.
- 02:00 Repeat chest x-rays revealed pulmonary effusion. Intensivist and Hematologist consulted.
- 06:30 Chest x-rays revealed right side infiltrate.
- 07:30 Systolic blood pressure remained in 80s. Normal saline, hetastarch and fresh frozen plasma (FFP) administered to help maintain blood pressure. Dopamine drip initiated.
- 14:00 Chest x-rays revealed right basilar atelectasis and right side infiltrate. Increasing respiratory effort noted.
- 14:30 Patient intubated and placed on pressure control ventilation. Systemic anesthetic administered for sedation. Sodium bicarbonate 100mg administered.
- 16:00 Norepinephrine drip administered. Continued to receive fluid volume in form of hetastarch and FFP.
- 22:45 Started on drotrecogin alfa.

Hospital Day 2 (Picture A):

- 00:45 Arterial blood gases revealed: pH 7.27, PaO₂ 48mmHg, PaCO₂ 37mmHg with bicarbonate content 16mEq/L, despite 100% FiO₂ and positive end-expiratory pressure 10cmH₂O.
- 06:00 Reverse inspiratory/expiratory ratio and peak pressure ventilation was attempted with no improvement.
- 08:00 Prone position ordered with RotoProne™ Therapy System.

RotoProne™ Therapy Initiation (Table 1)

Patient was placed on the RotoProne™ Therapy System at 08:00 on day 2 of hospitalization. The goal of proning therapy for this patient was to improve arterial oxygenation to help stabilize the patient.^{1,2} Initial settings rotated 62° (Kinetic Therapy) in the prone position with pause times of 10 minutes on each side. Planned supine respite for 1-2 hours after 12 hours. At one hour, blood gases showed pH 7.33, PaO₂ 97mmHg, PaCO₂ 33mmHg with bicarbonate 17mEq/L. At the first supine rotation, the patient tolerated less than 20 minutes before respiratory rate increased and oxygen saturation dropped below 80. Patient was again placed in prone position.

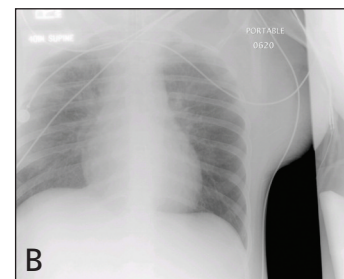
On **Day 2** of RotoProne™ Therapy, the chest x-ray showed dense infiltrate on the right upper lobe with a marked decrease in the infiltrate previously noted at the right lung base. Patient remained prone for the majority of the day, except for increasing periods of supine positioning up to 30 minutes. Blood gases were pH 7.27, PaO₂ 336mmHg, PaCO₂ 43mmHg with bicarbonate 19mEq/L. Femoral dialysis catheters were placed and dialysis started at 14:00.

On **Day 3** of RotoProne™ Therapy, the chest x-ray showed the lungs were clear (Picture B). During the next 24 hours, efforts were made to increase supine time to two hours, while maintaining Kinetic Therapy in both the prone and supine positions. Blood gases and x-rays remained essentially unchanged.

On **Day 4** of RotoProne™ Therapy, the patient was tolerating the majority of time in supine position while maintaining Kinetic Therapy of 45° rotation on each side. Blood gases revealed pH 7.33, PaO₂ 179mmHg, PaCO₂ 46mmHg with bicarbonate 24mEq/L. X-rays showed bilateral lungs to be clear.



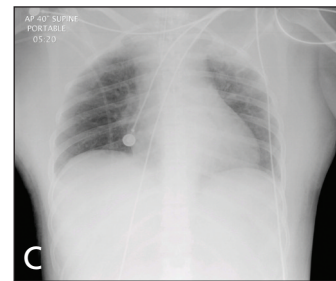
Eight hours prior to initiation of RotoProne™ Therapy



Day 3 of RotoProne™ Therapy

RotoProne™ Therapy Discontinued

On Day 6 of RotoProne™ Therapy, the patient was removed from the RotoProne™ Therapy System and placed on a TriADyne™ Therapy System to maintain Kinetic Therapy. (Picture C) Blood gases revealed pH 7.30, PaO₂ 179mmHg, PaCO₂ 41mmHg, bicarbonate 20mEq/L. Three hours after patient was placed on the TriADyne™ System, blood gases were checked to evaluate patient's tolerance of therapy: pH 7.38, PaO₂ 114mmHg, PaCO₂ 38mmHg, bicarbonate 22mEq/L. The patient was extubated on hospital Day 18 and TriADyne™ therapy was discontinued. The patient was transferred from the ICU to a regular medical bed on hospital Day 20.



Day 6 of RotoProne™ Therapy; RotoProne™ discontinued

Patient Summary Data

Not only did this patient survive a critical, life-threatening condition, she was able to progress to rehabilitation status without any further respiratory complications. Within the first 24 hours of hospital admission, this patient's condition was in rapid decline and at high risk of mortality. After three days of RotoProne™ Therapy, the patient's lungs were clear and blood gases were much improved. The patient was transferred to a TriADyne™ Therapy System after 6 days of RotoProne™ Therapy and discharged from the ICU on hospital Day 20.

Table 1. Arterial Blood Gas Progression^{3*}

RotoProne™ Therapy Days	pH	PaO ₂ (mmHg)	PaCO ₂ (mmHg)	Bicarbonate content (mEq/L)	Degree of Rotation, Pause	Position
Approximately 7 hours prior to RotoProne™ Therapy initiation	7.27	48	37	16	none	Supine
1 (9:00—1 hour post RotoProne™ Therapy initiation)	7.33	97	33	17	62°, 10 min pause each side	12 hours prone followed by 20 min supine
2 (01:00)	7.31	83	32	16	62°, 10 min pause each side	12 hours prone followed by 30 min supine
2 (06:00)	7.27	336	43	19	62°, 10 min pause each side	12 hours prone followed by 30 min supine
3	7.27	336	43	19	62°, 10 min pause, progressed to 45°, 10 min pause	4 hours prone followed by 1 hour supine for 12 hours; progressed to 4 hours prone then 2 hours supine
4	7.33	179	46	24	45°, 5 min pause	Majority supine
6 (10:30—discontinue RotoProne™ Therapy)	7.30	179	41	20	45°, 5 min pause	Majority supine
6 (13:35—3 hours post TriADyne™ System initiation)	7.38	114	38	22	45°, 5 min pause	Supine

* Clinical data in table referenced from Fairview Southdale Hospital (Edina, MN, USA) facility medical records, 2005.

References

- Balas, M.C. Prone Positioning of Patients with Acute Respiratory Distress Syndrome: Applying Research to Practice. *Critical Care Nurse* 2000; 20(1): 24-36.
- Stocker, R., Neff, T., Stein, S., et al. Prone Positioning and Low-Volume Pressure-Limited Ventilation Improve Survival in Patients with Severe ARDS. *CHEST* 1997; 111: 1008-1017.
- Data based on Fairview Southdale Hospital (Edina, Minnesota, USA) records, 2005.

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NOTE: As with any case study, the results and outcomes should not be interpreted as a guarantee or warranty of similar results. Individual results may vary depending on the patient's circumstances and condition. Unless otherwise specified, any economic value or savings reported is based on data provided by the facility/clinician and the observations/experience of the clinician involved in the case. Savings are estimates only and specific to the individual case. Savings may not be typical and may vary.

Caution: Federal law restricts this device to sale/rental by or on the order of a physician.

Note: RotoProne™ Therapy System units have specific indications, contraindications, safety information and instructions for use. Please consult product labeling and instructions for use prior to use.

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