

Continuous Lateral Rotation Therapy: Good for the Lungs, Safe for the Skin?

Research Question

Are there differences in skin interface pressure readings, skin integrity, or perceived discomfort among three positioning scenarios:

- Continuous lateral rotation therapy (CLRT)
- CLRT with static manual wedge
- Static manual wedge

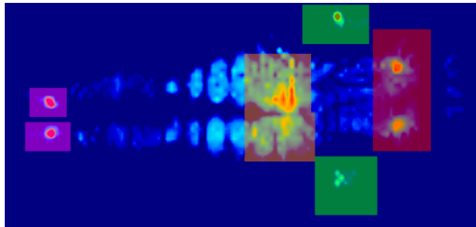


Figure 1: Supine pressure map with anatomical area demarcations

Background

What is Continuous Lateral Rotation Therapy (CLRT)?

- Therapy used to mechanically rotate patients continuously in bed (left-center-right)
- Promotes early mobilization
- Decreases hemodynamic effects of immobility
- Mobilizes pulmonary secretions to improve alveolar gas-exchange
- Decreases risk for ventilator-associated events
- Improves PaO₂/FiO₂ in hypoxemic acute lung injury or Acute Respiratory Distress Syndrome (ARDS)

How does pressure affect skin integrity?

- Hypoperfusion, hyperemia, reperfusion cytokine response
- Capillary occlusion pressure:
 - External pressure required to stop blood flow through capillary bed leading to hypoperfusion/necrosis
 - No standardized capillary occlusion pressure (12-32mmHg)
 - Indirectly measured through external interface pressure

How are CLRT and skin integrity related?

- High-degree CLRT does not reduce capillary occlusion pressure enough to maintain perfusion to skin (postulated historically)
- CLRT is frequently paused for manual repositioning
 - May improve perfusion to skin
 - Hinders treatment to damaged lungs

Hypothesis

There will be **no** difference in interface pressure readings, skin integrity, or perceived discomfort among the three positioning scenarios.

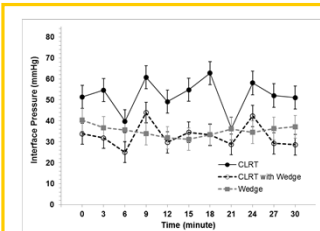


Figure 2: Heel – Max Pressure

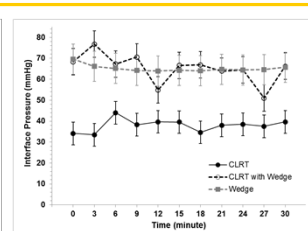


Figure 3: Hip – Max Pressure

Sample/Methods

- Human subjects' protection approval obtained from IRB
- Exclusion Criteria: Diabetes Mellitus; Chronic skin/tissue breakdown or current healing/developing pressure ulcer; Peripheral vascular disease; Advanced age (> 65); Current continuous use of NSAIDs, chemotherapeutic agents, antibiotics.
- 10 healthy subjects provided informed consented
- Demographic data, height, weight, and Body Mass Index collected
- XSENSOR® Pressure Mat (30"x74") placed under standard linens on Hill-Rom TotalCare SpOrt® bed
- Pressures recorded every 3 minutes for 30 minutes for each of the three positioning scenarios
 - Pain and visual skin assessments performed at baseline and after each 30 minute session
 - Following each scenario, the subject was allowed to ambulate for 15 minutes

Data Analysis

- All pressures < 13mmHg were excluded from calculations to avoid underestimation of average pressures
- Anatomical areas isolated for analysis based on visual estimation:
 - Bilateral scapulae, ischial tuberosities, elbows, and heels
- Data screened for outliers and all pressures = 0 were eliminated
- Linear mixed model analysis for repeated measures used for average and maximum pressures at each anatomical area to show time/interaction effect

Results

	Ischial Tuberosity	Elbow
CLRT vs CLRT with Wedge	-13.46+7.15 to -43.31+7.15 27.23+5.83 lower (p = 0.001)	7.58+6.63 to 29.46+6.63 19.08+3.91 higher (p = 0.001)
CLRT vs Wedge	-21.15+7.94 to -32.63+7.94 27.22+7.58 lower (p=0.009)	0.18+6.97 to 29.46+6.97 16.71+5.16 higher (p = 0.018)
CLRT with Wedge vs Wedge	No difference (p > 0.99)	No difference (p = 0.886)

Table 1: CLRT vs Other Scenarios (mmHg)

Conclusions

- No significant differences were found between scenarios except lower pressures were noted on the ischial tuberosity and higher pressures on the heel with CLRT positioning
- Heel pressure is minimized in the clinical setting using heel elevation as standard of care
- Decreased ischial tuberosity pressure may be clinically significant in critically ill patients
 - May allow patients to remain on CLRT for longer, uninterrupted periods of time
- Pain noted in Wedge scenario by 7/10 subjects; CLRT with Wedge scenario by 6/10 subjects
- No posterior skin erythema noted

Limitations

- Subjectivity of anatomical area isolation
- Small sample size

Implications for Practice

- Providing CLRT continuously rather than pausing for manual repositioning may improve lung treatment/function without a negative impact on posterior skin/tissue integrity
- Pressure relieving heel protectors used as standard of care in inpatient setting
- Clinical outcomes/significance may not be generalizable to critically ill patients since healthy subjects participated in this feasibility study
- Continuous surveillance of posterior skin integrity is recommended CLRT research is needed with critically ill patients taking perfusion status, vasopressor therapy, nutrition status, and overall clinical condition into account.

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