Low-dose Radiation Therapy and Severe COVID-19-Related Pneumonia

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Disclosures

• I have no conflicts of interest to disclose
Biologic Rationale: COVID-19 pneumonia

- Accumulation of macrophages in the alveolus, lymphocytes in the interstitium, and a diffuse alveolar damage¹
- Cytokine storm is the result of activated immune cells producing large amounts of cytokines that in turn leads to hyperinflammation
  - Macrophage activation implicated as a key component of cytokine storm²
  - Immune suppression (dexamethasone) has proven useful in severe COVID-19

Why might this work?

• Cells of different types have varying sensitivity to radiation
  • Immune cells – relatively sensitive
  • Other lung cells - relatively resistant
• Low dose radiation (< 1 Gy)
  • can reduce the oxidative burst and NO• production from macrophages1,2
  • can cause fibrocytes to differentiate, reducing proliferation and eventual fibrosis3
  • may reduce leukocyte adhesion to endothelial cells


Cell Death & Differentiation. 27: 1451–1454(2020)
Cytokines/Correlatives

- Inflammation
  - IL-6
  - CRP
  - LDH
  - Ferritin
  - ESR
- Kidney injury
  - Creatinine
- Liver injury
  - AST
  - ALT

**Bold:** p<0.05; **italics:** trend

What are some concerns?

- Risk of long-term toxicity
  - Risk of cancer or cardiac damage is well documented from similar radiation doses in long term atomic bomb survivors
- Reducing long term toxicity
  - Determining whether there is a benefit that outweighs risks
  - Treating patients at lower risk of cancers (shorter overall life expectancy)
  - The lowest dose that achieves successful outcomes will reduce long term risks
  - Fractionated versus single dose (safety of patients and caregivers)
- Low dose is variably defined
- Lymphocytes more sensitive than macrophages – can this impact immunity or clearance?