63rd ERA CONGRESS
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Challenge Your Thinking

GUT-LUNG-KIDNEY AXIS: Gut Microbiome as Predictor of Renal Dysfunction in COPD

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INTRODUCTION

The gut-lung-kidney axis is an emerging concept linking intestinal dysbiosis to systemic inflammation and multi-organ dysfunction. In COPD patients, gut microbiome alterations may promote renal impairment through chronic low-grade endotoxemia, systemic inflammation amplification, and immune dysregulation. Despite growing evidence for gut-lung interactions, the role of intestinal microbiota in predicting renal dysfunction in COPD remains unexplored.

AIM

To investigate intestinal microbiome alterations as an independent predictor of renal dysfunction in COPD patients within the gut-lung-kidney axis framework.

METHOD

Study population and microbiological assessment

- 270 COPD patients (GOLD I–IV); renal function assessed by eGFR (CKD-EPI) and UACR
- Intestinal microbiota quantified by bacteriological culture and MALDI-TOF: lactobacilli, bifidobacteria, Klebsiella pneumoniae
- Dysbiosis defined as lactobacilli <5×10^5 and/or bifidobacteria <5×10^7 CFU/g with Klebsiella >=10^6 CFU/g; multivariable logistic regression adjusted for age, smoking, COPD severity
- Statistical analysis: Pearson correlation, t-test, logistic regression; AUC-ROC; significance at p<0.05

RESULTS

Microbiota depletion & dysbiosis

Lactobacilli 48% lower in renal dysfunction: 2.8±1.2 vs 5.4±1.8 ×10^5 CFU/g (p<0.001)

Bifidobacteria 55% reduced: 3.2±1.5 vs 7.1±2.0 ×10^7 CFU/g (p<0.001)

Klebsiella colonization: 85% vs 32% (p<0.001) — 2.7-fold higher prevalence

Complete dysbiosis pattern (depleted beneficial + Klebsiella overgrowth): 78% vs 25% (p<0.001)

Dysbiotic patients: CAT 76% higher (26.8±7.2 vs 15.2±4.8), FEV$_1$ more impaired (48±13% vs 64±12%, p<0.001)

Systemic inflammation 2-fold elevated: CRP 14.2±4.5 vs 6.5±2.0 mg/L; IL-6 32.5±10.5 vs 16.8±5.5 pg/mL; TNF-α 23.8±8.2 vs 12.5±4.5 pg/mL (all p<0.001)

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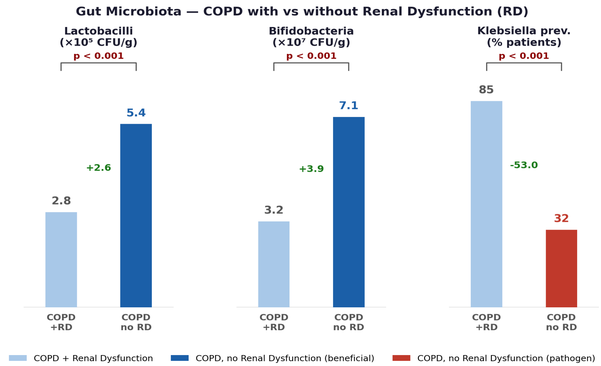
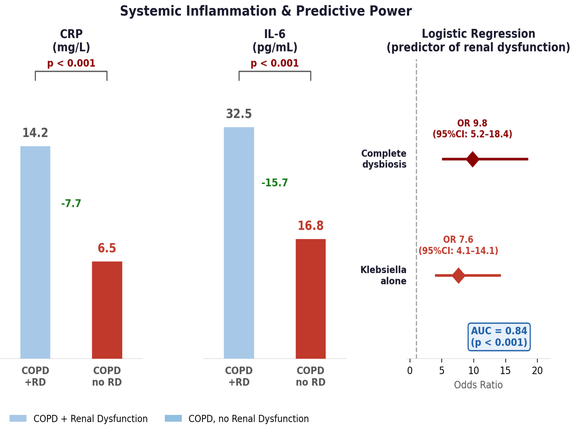


Correlations: lactobacilli–eGFR r=0.65; bifidobacteria–eGFR r=0.68; Klebsiella–eGFR r=−0.73 (all p<0.001)

Logistic regression: complete dysbiosis OR 9.8 (95%CI: 5.2–18.4, p<0.001); Klebsiella alone OR 7.6 (95%CI: 4.1–14.1, p<0.001); AUC 0.84 (p<0.001)



CONCLUSIONS

Intestinal dysbiosis — characterized by beneficial bacteria depletion and Klebsiella overgrowth — is a powerful independent predictor of renal dysfunction in COPD (OR 9.8, AUC 0.84). Present in 78% of patients with renal impairment, gut-lung-kidney axis dysregulation establishes microbiome profiling as a novel risk stratification tool. Targeted probiotic interventions (Lactobacillus, Bifidobacterium) may prevent or delay renal complications in high-risk COPD patients.

CONTACT INFORMATION

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