

# 睡眠時無呼吸と動脈硬化の関係に関する研究

## 睡眠と低換気に関する研究

### 睡眠時無呼吸における間欠的低酸素

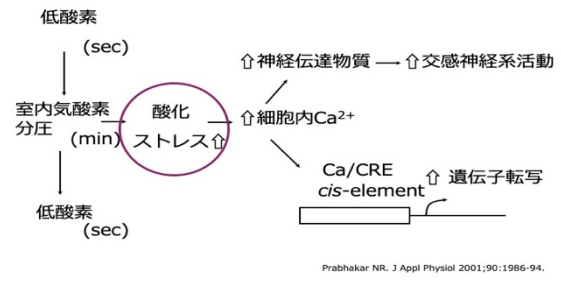
ヒトは有酸素状態の地球上で生活しているが、地球誕生時には無酸素状態であったと言われている。ヒトは酸素を利用することにより現在の活動を維持している。生体への低酸素暴露パターンとしては持続性低酸素素がとりあげられてきた。健康人でもエベレスト登山、潜水時などでは持続性低酸素状態になる。

睡眠時無呼吸の本態は間欠的低酸素素が生体に及ぼす悪影響である。無呼吸により低酸素に陥る時ではなく、室内気酸素分圧に戻る時に発生する酸化ストレスが心血管系合併症の発症を助長すると考えられる。心血管系合併症は動脈硬化の進展の結果であり、睡眠時無呼吸は動脈硬化に繋がる。無呼吸は単独で生体に悪影響を及ぼしうるが、主役は内臓脂肪蓄積であり、その結果生じるインスリン抵抗性、レプチン抵抗性が問題となることを示した (Chest 2005;127:543-549. Chest 2005;127:716-721. Chest 2007;131:1387-92. Circ J 2007;71:1293-1298)。

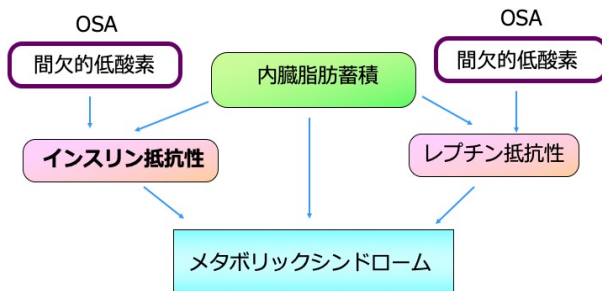
### 生体への低酸素曝露パターン



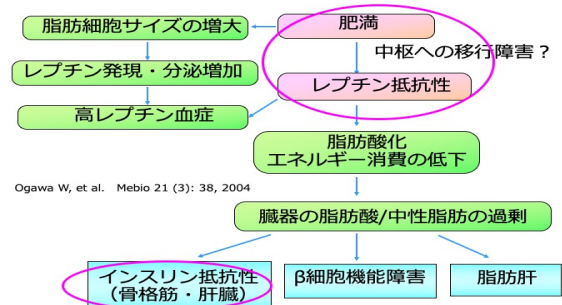
### 低酸素と酸化ストレス



### 睡眠時無呼吸とメタボリックシンドローム

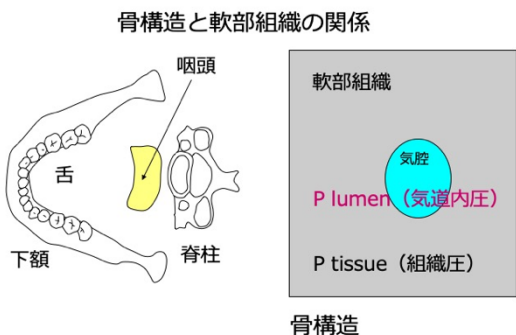


### 肥満とレプチン抵抗性

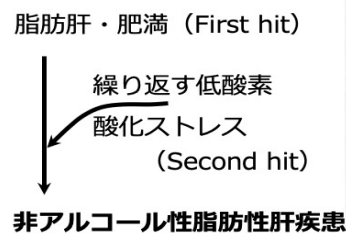


閉塞型睡眠時無呼吸は上気道における骨構造と軟部組織の解剖学的バランスが崩れ、上気道周囲の組織圧が高まり気道内圧の維持が困難になる時に生じる。覚醒時の上気道は開存性が維持されるが、睡眠時には上気道開大筋に対する神経出力が低下するため無呼吸が生じる (Anesthesiology 2008;108:1009-1015)。

### 閉塞型睡眠時無呼吸は上気道の解剖学的バランスの崩れ



### 睡眠時無呼吸はNASHの誘因になりうる



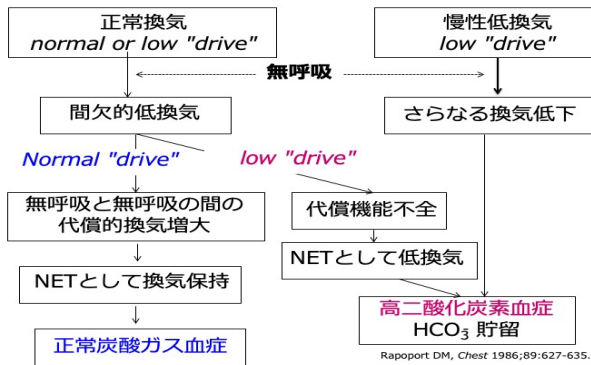
Tatsumi K, et al. Hepatology Research 2005;33:100



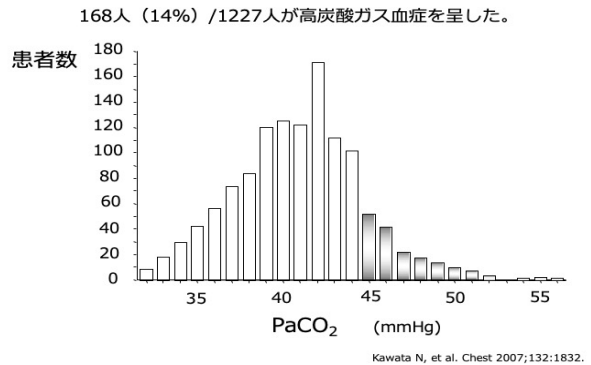
睡眠時無呼吸は動脈硬化の悪化因子となりうるが、非アルコール性脂肪性肝疾患（NASH）の second hit にもなりうる（Hepatology Res 2005;33:100-104）。

睡眠時無呼吸の存在は覚醒時の低換気（二酸化炭素貯留）病態と関係しうる。閉塞型無呼吸と肥満の合併が肥満低換気症候群の病態であり、CPAP 療法でも覚醒時低換気が改善しない一群があり、生命予後不良である可能性が高い（Chest 2007;132:1832-1838）。

### 呼吸ドライブから考える肺泡低換気症候群



### OSAS患者における高炭酸ガス血症の頻度



2020年の時点において、睡眠呼吸障害の診断・治療を phenotype で考え、睡眠と呼吸の関係を科学することが重要になっている。例えば、オレキシンニューロンは睡眠・覚醒に関与しうるということが知られており、今後の展開が期待される。

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