

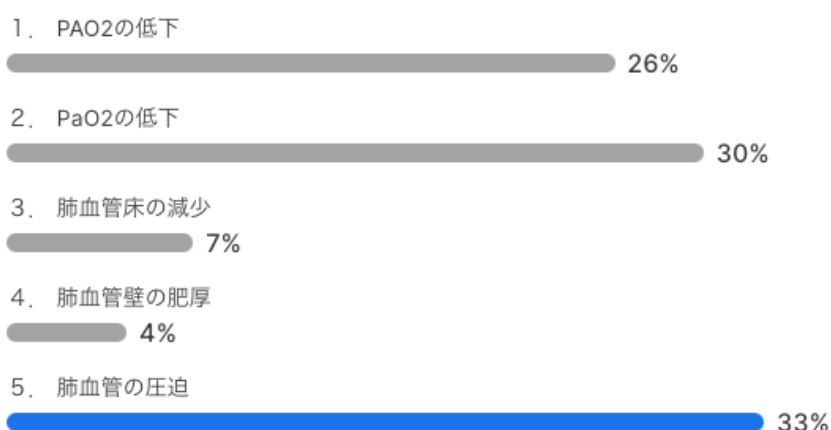
肺高血圧症UpDate

Ⅲ群（肺疾患および／または低酸素による）

中村 健介
DVM, PhD, DAiCVIM
北海道大学 獣医内科学教室

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Q1.肺疾患により肺高血圧症を生じる機序として最も寄与の低いメカニズムはどれでしょう 27 人



2

Right ventricular adaptation to pulmonary hypertension: an interspecies comparison

Pierre Wauthy, Alberto Pagnamenta, Fabio Vassalli, Robert Naeije, and Serge Brimiouille
Laboratory of Physiology, Free University of Brussels, and Department of Intensive Care, Erasme University Hospital, Brussels B-1070, Belgium

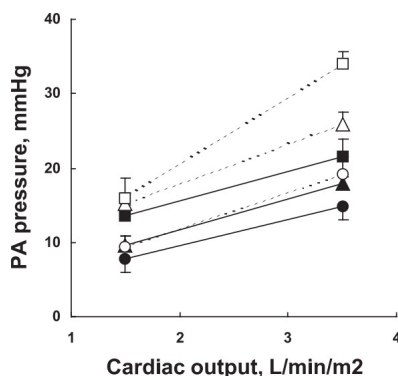


Fig. 3. PA flow-pressure relationships in dogs (circles), goats (triangles), and pigs (squares) at baseline (filled symbols) and in hypoxia (open symbols). Values are means $\pm$ SE ($n = 10$ dogs, 8 goats, and 8 pigs). Basal tone and hypoxic response are lower in dogs, intermediate in goats, and higher in pigs.

pressure curve determination (4). Data sets were first obtained at baseline and after 10-min hypoxia (inspired oxygen reduction for PaO_2 of ~ 40 mmHg). After return to hyperoxia and 30-min stabilization, in

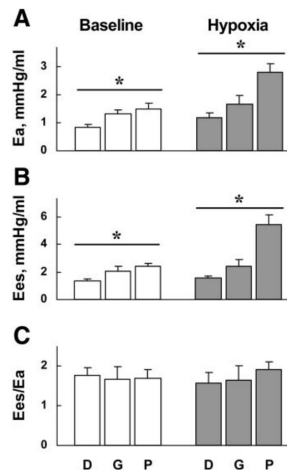


Fig. 4. RV afterload (E_a ; A), RV contractility (E_{es} ; B), and RV-arterial coupling efficiency (E_{es}/E_a ratio; C) in dogs (D), goats (G), and pigs (P) at baseline and during hypoxia. At baseline, afterload increases from dogs to pigs, contractility increases proportionally, and coupling is optimal in all species. In hypoxia, afterload is higher but contractility is also higher, and coupling remains optimal in all species. $*P < 0.05$, pigs vs. goats vs. dogs (factor analysis).

3

Pulmonary hypertension secondary to respiratory disease and/or hypoxia in dogs: Clinical features, diagnostic testing and survival

J.A. Jaffey^{a,1}, K. Wigen^a, S.B. Leach^a, I. Masseau^b, R.E. Girens^a, C.R. Reinero^{a,*}

^a Department of Veterinary Medicine and Surgery, Veterinary Health Center, University of Missouri, 900 East Campus Drive, Columbia, MO, 65211, USA

^b Department of Science Cliniques, Faculté de Médecine Vétérinaire, Université de Montréal, St-Hyacinthe, Canada

Obstructive airway/lung disease

	Definitive (%)	Suspected n (%)
Tracheal collapse	27 (57)	0 (0)
MSB collapse	24 (51)	0 (0)
Bronchomalacia	18 (38)	0 (0)
Bronchiectasis	9 (19)	0 (0)
Bronchiolar disease	4 (10)	0 (0)
Emphysema	1 (2)	0 (0)
BOAS	1 (2)	0 (0)

Restrictive lung disease

	Definitive (%)	Suspected (%)
Pulmonary fibrosis	4 (8)	10 (21)
Pulmonary neoplasia	2 (4)	0 (0)
ARRS	0 (0)	4 (8)
Uncharacterized parenchymal disease	0 (0)	5 (10)
<i>Pneumocystis</i> pneumonia	1 (2)	0 (0)

MBD, Mixed-breed dog; SCWT, Soft coated wheaten terrier; WI cocker spaniel; MSB, mainstem bronchial collapse; BOAS, brachycephalic airway syndrome

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Ninety-one percent (43/47) of dogs had at least one respiratory clinical sign described by owners at the time of PH identification. These included: cough 72.0% (31/43); increased respiratory effort 30.0% (13/44); tachypnea 21.0% (9/44), syncope 16.2% (7/43); acute respiratory distress 7.0% (3/43); wheezing 7.0% (3/43); **cyanosis** 7.0% (3/43); hemoptysis 2.3% (1/43); and exercise intolerance 2.3% (1/43). Many dogs exhibited more than one respiratory sign.

これで血管攣縮して
肺高血圧に
なると思います??

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ACVIM consensus statement guidelines for the diagnosis, classification, treatment, and monitoring of pulmonary hypertension in dogs

Carol Reiner¹ | Lance C. Visser² | Heidi B. Kellihan³ | Isabelle Masseau⁴ | Elizabeth Rozanski⁵ | Cécile Clercx⁶ | Kurt Williams⁷ | Jonathan Abbott⁸ | Michele Borgarelli⁹ | Brian A. Scansen¹⁰

3. Pulmonary hypertension secondary to respiratory disease, hypoxia or both^f

3a. Chronic obstructive airway disorders^g

3a1. Tracheal or mainstem bronchial collapse^{18,85,91}

3a2. Bronchomalacia⁹¹⁻⁹³

3b. Primary pulmonary parenchymal disease

Chronic Obstructive Airway Disorders
Chronic bronchitis^{14,95}
Organizing pneumonia⁹⁷
Pulmonary fibrosis^{99,100}
Pulmonary vasculopathy^{66,92,101}
Pneumocystis^{91,102,103}; Ehrlichia^{104,105}
Foreign body^{5,66,85,91,92,106}

3c. Miscellaneous: bronchiolar disorders⁹¹; bronchiectasis⁹¹; emphysema^{91,113}; pneumonectomy¹¹⁴

2016-2017 年度活動

肺高血圧症治療ガイドライン (2017 年改訂版)

Guidelines for Treatment of Pulmonary Hypertension (JCS 2017/JCPCPS 2017)

第 3 群 肺疾患および / または低酸素血症に伴う肺高血圧症

- 3.1 慢性閉塞性肺疾患
- 3.2 間質性肺疾患
- 3.3 拘束性と閉塞性の混合障害を伴う他の肺疾患
- 3.4 睡眠呼吸障害
- 3.5
- 3.6
- 3.7

Chronic Obstructive Pulmonary Disease

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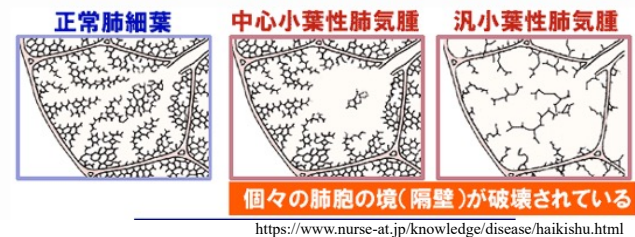
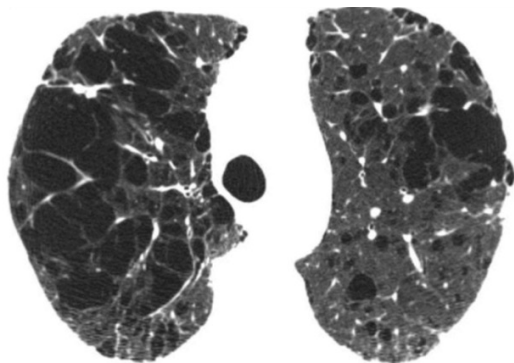
CT-Definable Subtypes of Chronic Obstructive Pulmonary Disease: A Statement of the Fleischner Society

David A. Lynch , John H. M. Austin, James C. Hogg, Philippe A. Grenier, Hans-Ulrich Kauczor, Alexander A. Bankier, R. Graham Barr, Thomas V. Colby, Jeffrey R. Galvin, Pierre Alain Gevenois, Harvey O. Coxson, Eric A. Hoffman, John D. Newell, Jr, Massimo Pistolesi, Edwin K. Silverman, James D. Crapo

✓ Author Affiliations

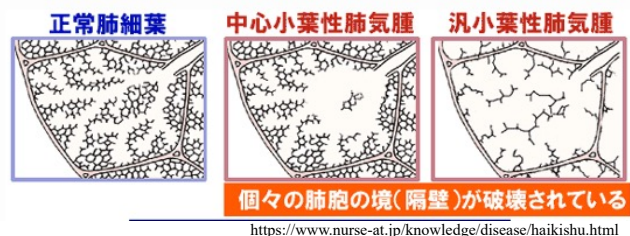
medRxiv content

Published Online: May 11 2015 | <https://doi.org/10.1148/radiol.2015141579>



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要因 2 : 肺血管の消失



間質に存在する
肺毛細血管が
消失するために
PVRが上昇する

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⁸Although “chronic bronchitis” has been listed as a diagnosis in some canine reports,^{18,85} this syndrome alone in the dog is unlikely to cause PH. The term chronic obstructive pulmonary disease (COPD) used in humans encompasses underlying and overlapping conditions such as chronic bronchitis and emphysema. Both cause airflow limitation and dyspnea in people. Canine chronic bronchitis by itself (ie, without concurrent bronchomalacia) does not cause airflow limitation leading to increased expiratory respiratory effort and emphysema is very rare in dogs, thus the term COPD is inappropriate to use in this species. Tracheal and mainstem bronchial collapse and bronchomalacia are common causes of obstructive airway disorders; however, referenced studies proving they cause PH are somewhat limited by many reported dogs having comorbid conditions also known to cause PH.

いくつかの論文では慢性気管支炎や気管気管支虚脱を
PHの原因と言っちゃってるけど、
そもそも人のCOPDのように肺気腫を起こすような病態は
犬にはほとんどないから、
COPDという言葉は犬に使うのは不適切だし、
PHの原因じゃ無いと思うよ

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3a. Chronic obstructive airway disorders⁸

3a1. Tracheal or mainstem bronchial collapse^{18,85,91}

3a2. Bronchomalacia⁹¹⁻⁹³

3b. Primary pulmonary parenchymal disease

3b1. Interstitial lung disease (reviewed in^{94,95})

3b1a. Fibrotic lung disease^{18,28,40,91,92,96}

3b1b. Cryptogenic organizing pneumonia/secondary organizing pneumonia⁹⁷

3b1c. Pulmonary alveolar proteinosis⁹⁸

3b1d. Unclassified interstitial lung disease (ILD)^{41,66,85,91,99,100}

3b1e. Eosinophilic pneumonia/eosinophilic bronchopneumopathy^{66,92,101}

3b2. Infectious pneumonia^h: Pneumocystis^{91,102,103}; Ehrlichia^{7,104,105}

3b3. Diffuse pulmonary neoplasia^{35,66,85,91,92,106}

3c. Obstructive sleep apnea/sleep disordered breathing^{107,108,d; 91,92,109,j}

3d. Chronic exposure to high altitudes¹¹⁰⁻¹¹²

3e. Developmental lung disease⁹¹

3f. Miscellaneous: bronchiolar disorders⁹¹; bronchiectasis⁹¹; emphysema^{91,113}; pneumonectomy¹¹⁴

2016-2017 年度活動

肺高血圧症治療ガイドライン (2017 年改訂版)

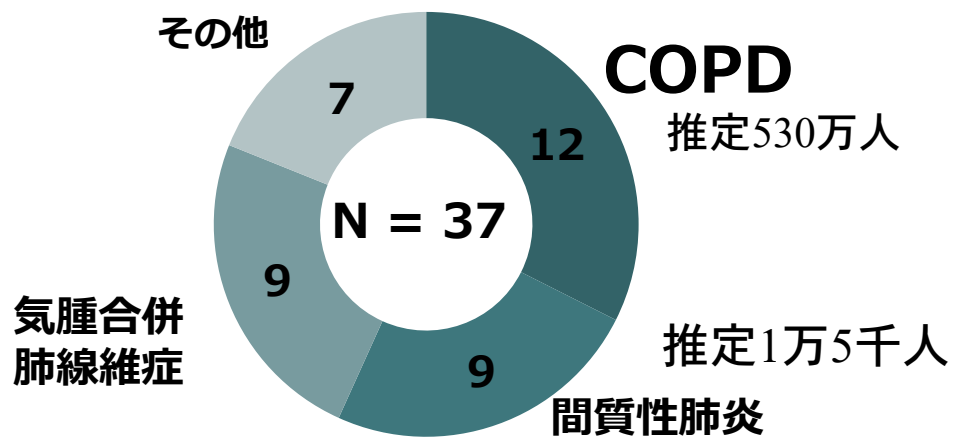
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- 3.4 睡眠呼吸障害
- 3.5 肺胞低換気障害
- 3.6 高所における慢性曝露
- 3.7 発育障害

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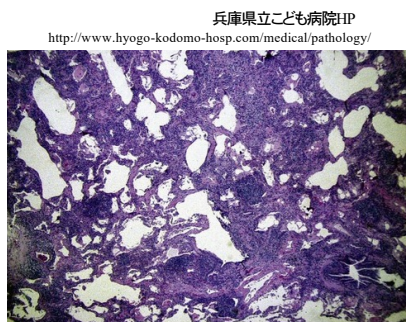
患者数および内訳-3 (3群PH)



北大医学部呼吸器内科 辻野一三教授より

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要因2：肺血管の消失・圧迫



特発性肺線維症
IPF

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Idiopathic Pulmonary Fibrosis in West Highland White Terriers

Henna P. Heikkilä-Laurila, DVM^{*}, Minna M. Rajamäki, DVM, PhD

KEYWORDS

• Dog • Interstitial lung disease • Bronchoalveolar lavage • Arterial blood gases
• HRCT • Biomarker

Vet Clin Small Anim 44 (2014) 129–142
<http://dx.doi.org/10.1016/j.cvs.2013.08.003>

0195-5616/14/\$ – see front matter © 2014 Elsevier Inc. All rights reserved.

vetsmall.theclinics.com

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J Vet Intern Med 2006;20:912–920

Doppler Echocardiographic Prediction of Pulmonary Hypertension in West Highland White Terriers with Chronic Pulmonary Disease

Karsten E. Schober and Hanno Baade

Table 1. Patient characteristics.

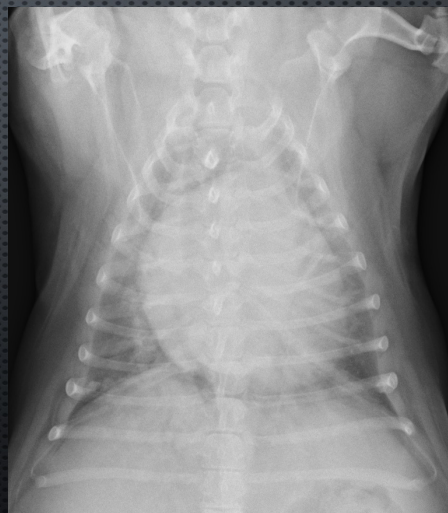
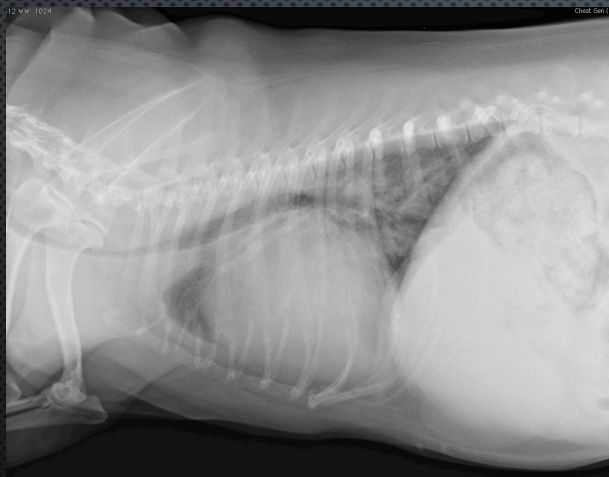
Dogs Clinical Status Group	WHWT Healthy Control (I)	Boxers Healthy Control (II)	Normal PAP (IIIA)	WHWT Interstitial Pulmonary Disease Unknown PAP (IIIB)	PH (IIIC)
N	41	32	7	18	20
Age (years)	6.0 (0.6–12.7)	2.3 ^b (0.4–8.0)	9.8 ^b (5.5–15.0)	10.2 ^b (3.0–14.0)	11.0 ^b (5.8–13.0)
Sex (female/male) ^a	12/29	18/14 ^b	3/4 ^b	9/9 ^b	9/11 ^b
BW (kg)	10.0 (6.5–11.5)	29.5 ^b (22.0–36.1)	9.9 (5.5–12.0)	10.2 (2.0–15.0)	11.0 (6.7–12.6)
PR ^a	13	12	1	2	15
PR (m/s)	0.80 (0.24–1.15)	0.55 (0.41–1.12)	1.92 (n.d.)	1.42 (0.95–1.88)	2.41 ^b (0.55–3.83)
TR ^a	14	10	6	0	20
TR (m/s)	1.84 (1.00–3.05)	2.73 (2.66–3.01)	2.97 (0.98–3.05)	n.d.	3.95 ^b (3.23–5.44)

少なくとも半分以上がPH

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■ ウェスティ、去勢雄、7歳

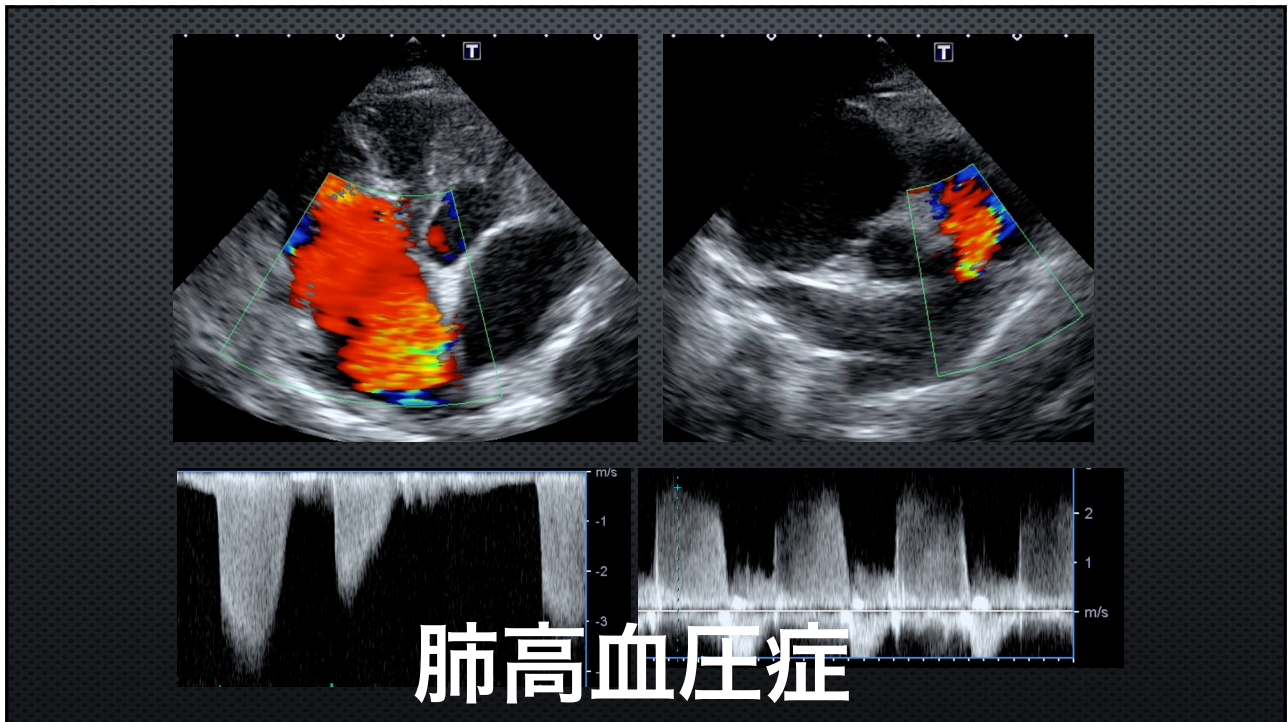
■ 最近疲れやすく咳をする



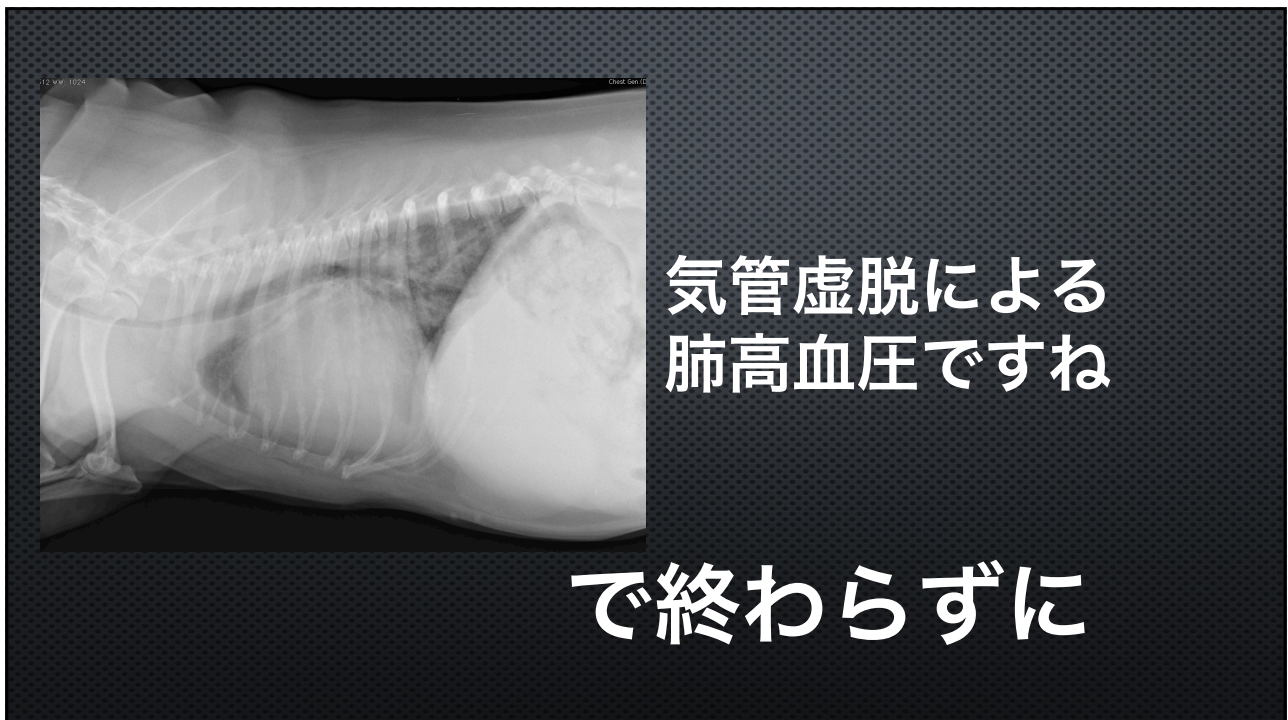
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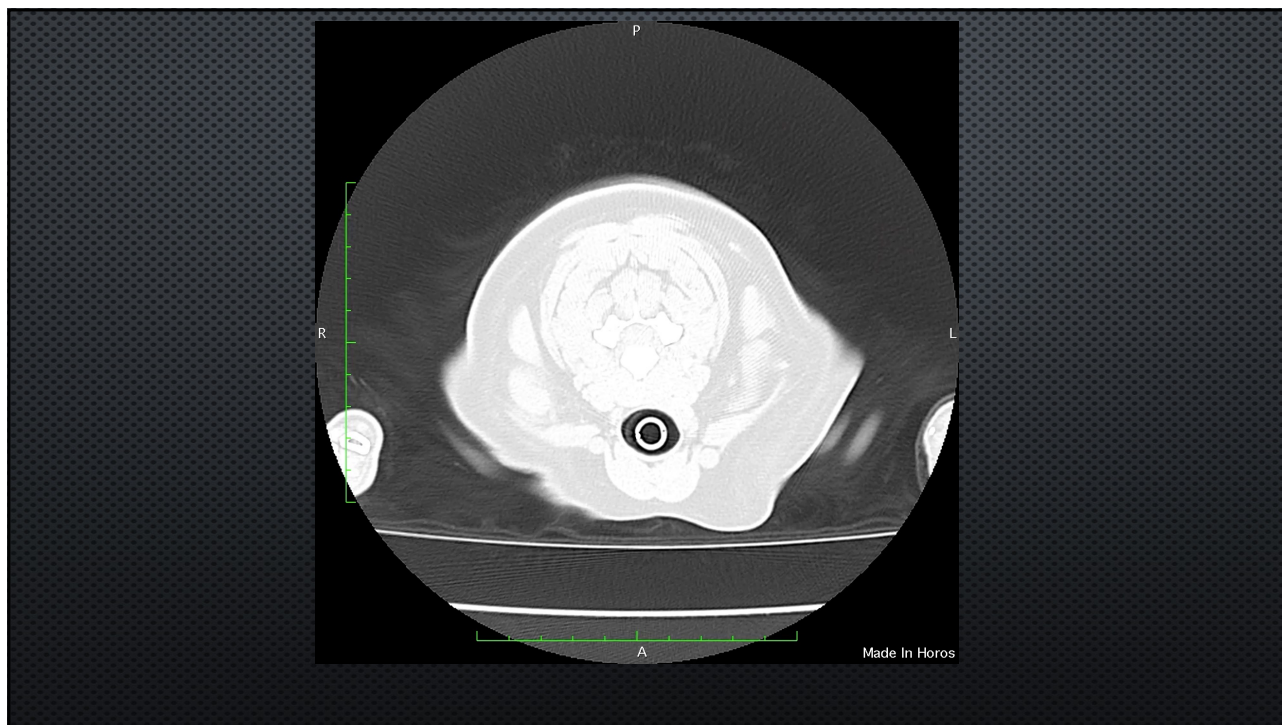
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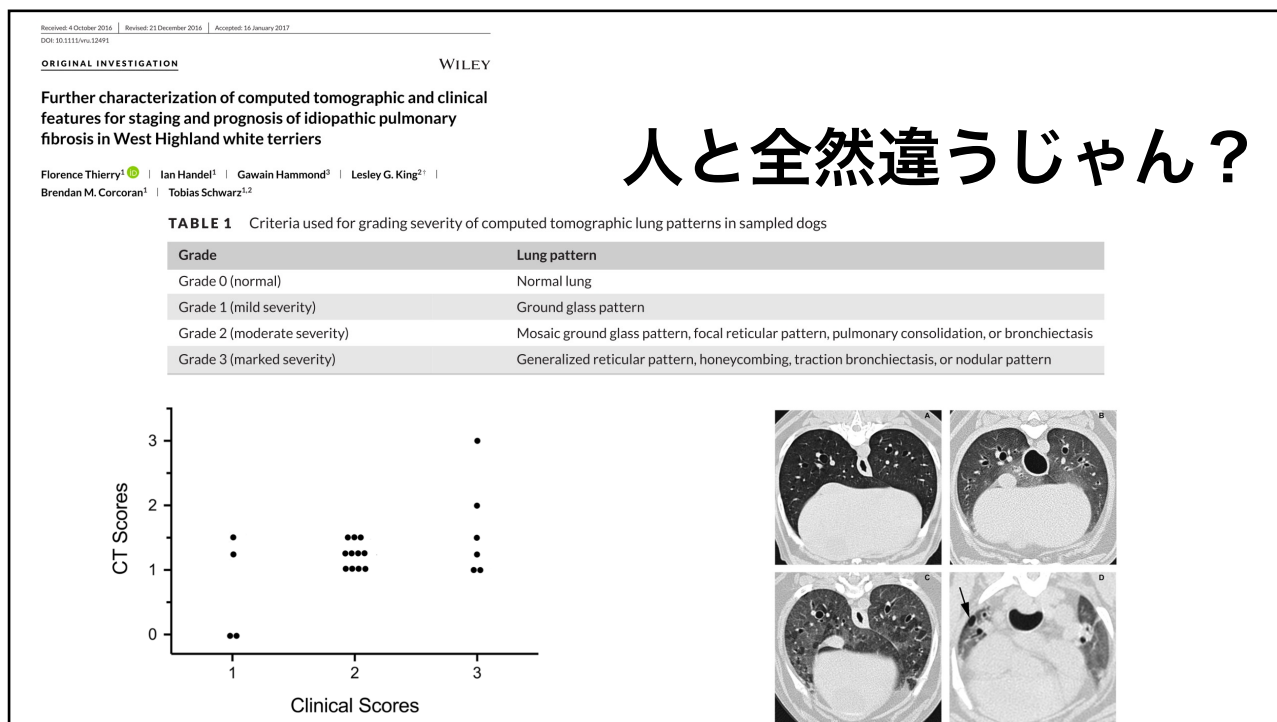
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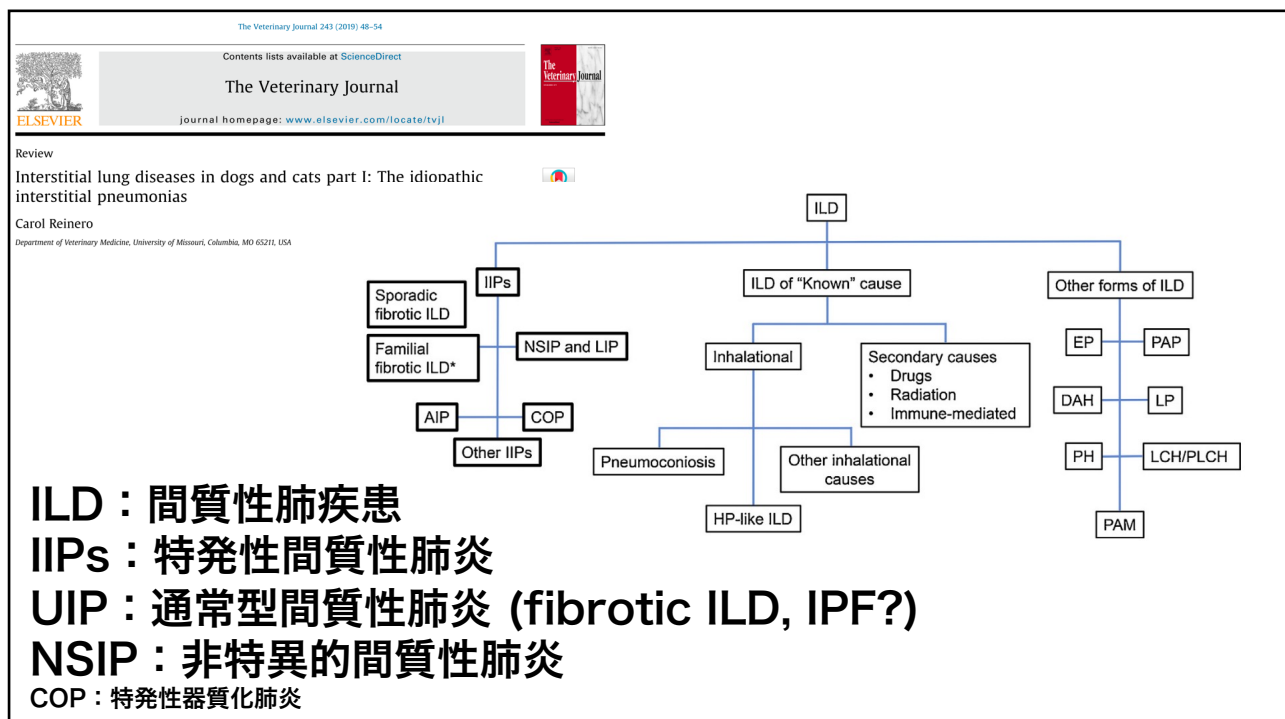
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SPONTANEOUSLY ARISING DISEASE

The Histopathology of Idiopathic Pulmonary Fibrosis in West Highland White Terriers Shares Features of Both Non-specific Interstitial Pneumonia and Usual Interstitial Pneumonia in Man

P. Syrjä^{*}, H. P. Heikkilä[†], L. Lilja-Maula[†], E. Krafft[¶], C. Clercx[¶],
M. J. Day^{||}, M. Rönty[§], M. Myllärniemi[‡] and M. M. Rajamäki[†]



Contrasting Clinical Features of Idiopathic Interstitial Pneumonias

Features	UIP	DIP	RB-ILD	AIP	NSIP	COP
Mean age at onset (yr)	60s	40s	40s	50s	50s	50s
Onset	Insidious	Insidious	Insidious	Acute	Subacute, insidious	Acute or subacute
History of cigarette smoking	About two thirds	Most	Most	Not known	Uncommon	About half
Mortality rate (mean survival)	68% (5-6 yr)	27% (12 yr)	0%	62% (1-2 mo)	≈25% in 10 yr	10% in 5 yr
Response to steroids	Poor	Good	Good	Poor	Good	Excellent
Complete recovery possible	No	Yes	Yes	Yes, rarely	Yes	Yes (≤70% of patients)

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Pathologically Proved Nonspecific Interstitial

Pneumonia: CT Pattern Analysis as Compared with Usual Interstitial Pneumonia CT Pattern¹

Radiology: Volume 272: Number 2—August 2014 • radiology.rsna.org

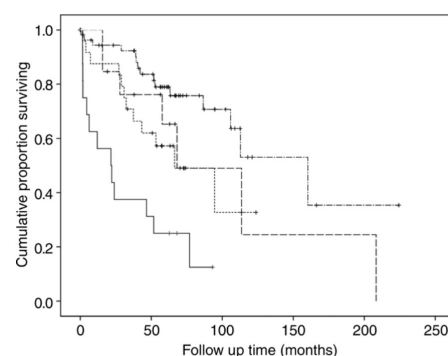
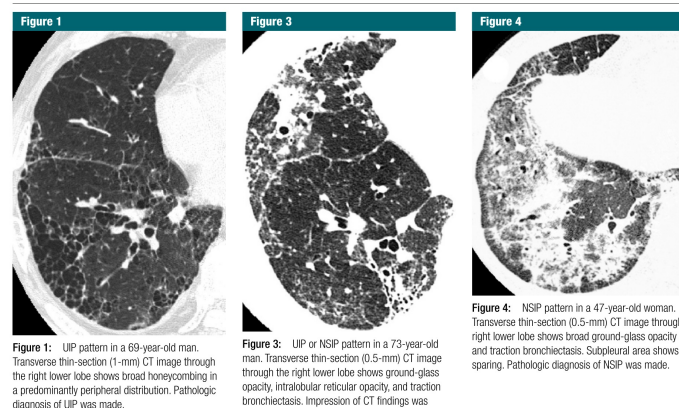
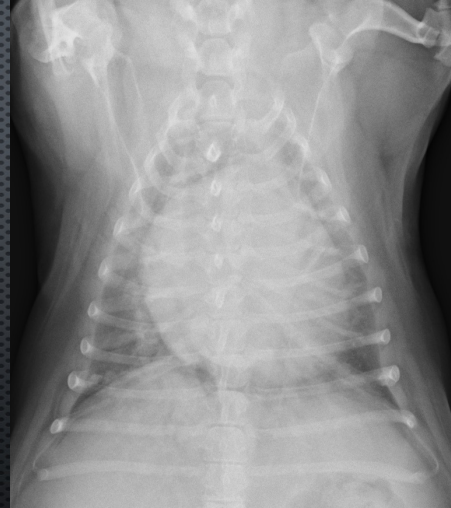
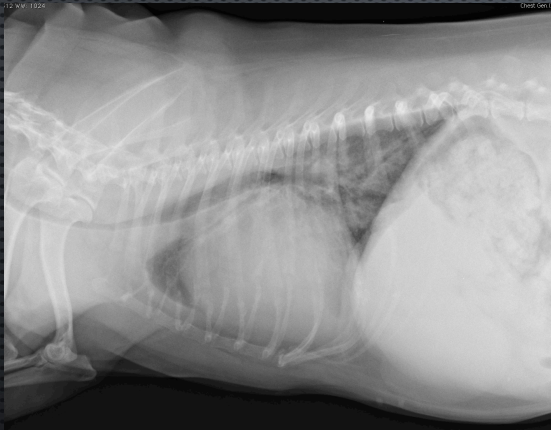


Figure 5: Kaplan-Meier survival curves for patients with UIP pattern ($n = 17$, solid line), possible UIP pattern ($n = 24$, dotted line), UIP or NSIP pattern ($n = 13$, dashed line), and NSIP pattern ($n = 56$, dashed and dotted line).

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■ ウェスティ、去勢雄、7歳

■ 最近疲れやすく咳をする



3年半後リンパ腫により死亡

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J Vet Intern Med 2014;28:379–385

Long-Term Outcome and Use of 6-Minute Walk Test in West Highland White Terriers with Idiopathic Pulmonary Fibrosis

L.I.O. Lilja-Maula, H.P. Laurila, P. Syrjä, A.K. Lappalainen, E. Krafft, C. Clercx, and M.M. Rajamäki

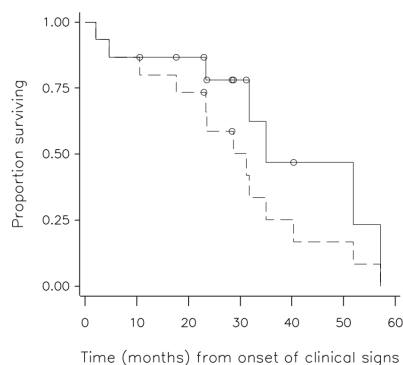


Fig 1. Kaplan-Meier survival curves for all-cause survival (dotted line) and idiopathic pulmonary fibrosis (IPF)-specific survival (solid line) of West Highland White Terriers (WHWTs) with IPF from onset of clinical signs. Censored animals (for all-cause survival WHWTs alive at study endpoint and for IPF-specific survival WHWTs alive and those who died of non-IPF-related causes) are presented as circles.

Veterinary Medicine: Research and Reports

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ORIGINAL RESEARCH

A syndrome of severe idiopathic pulmonary parenchymal disease with pulmonary hypertension in Pekingese

This article was published in the following Dove Press journal:
Veterinary Medicine: Research and Reports
23 February 2016
Number of times this article has been viewed

fering from a respiratory crisis at the time of death. An additional two dogs were euthanized due to the grave prognosis (mortality rate 77%). The recorded clinical signs in the medical record at the time of the death were either syncope or dyspnea. At the time of sampling completion, the median survival during the 3-year period was 60 days (IQR 9–210 days).

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北海道大学 動物医療センター
Hokkaido University Veterinary Teaching Hospital

第123回 日本獣医循環器学会定例会 犬の肺高血圧症における 無麻酔CT所見と予後の関連性

○塩原希¹, 中村健介¹, 新坊弦也², 山根由久², 川上侑記¹, 川元誠², 滝口満喜¹

1)北海道大学獣医内科学教室
2)北海道大学附属動物医療センター

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方法



🔍 研究デザイン

・医療記録, 画像データを用いた回顧的研究 (2018年4月～2025年10月)

・対照群:

- ① 他疾患 (整形疾患など) の精査のために無麻酔CT検査を実施
- ② 明らかな腫瘍性疾患や全身性疾患を有さない症例

・PH群:

- ① 心エコー検査にてPHの可能性が高いと診断
- ② 原因精査のために無麻酔CT検査を実施

(Reinero C et al. J Vet Intern Med. 2020)

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CT検査



①すりガラス影

- ・肺血管が見える程度の肺野の不透過性亢進

“初期の炎症や線維化”

対照群 (n=10) の肺のCT値

- ・平均 : -683.7 HU
- ・95%CI : -771.1 ~ -595.7 HU
- > -595.7 HUを“すりガラス影”



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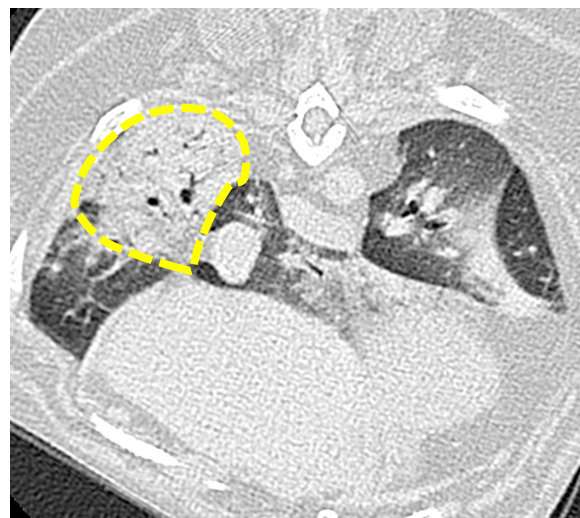
CT検査



②コンソリデーション (浸潤影)

- ・肺血管が不明瞭になる程の肺野の不透過性亢進

“肺胞腔に炎症や液体が浸潤した状態”



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③ Parenchymal band

- ・ 胸膜まで達する肺実質内の線状の高吸収域

“癒痕や線維化を反映”



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④ 牽引性気管支拡張

- ・ 気管支が不整に拡張・蛇行
- ・ 末梢の細気管支まで拡張

“肺の線維化に伴い気管支が拡張した状態”



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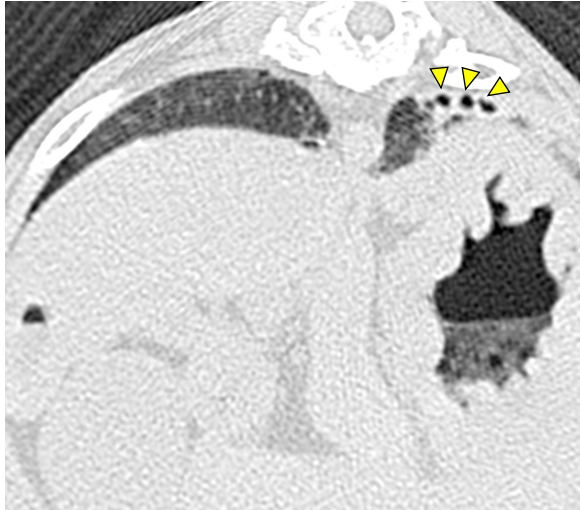
CT検査



⑤ 蜂巣肺

- ・ 主に胸膜直下を中心
- ・ 囊胞状気腔の密集・集簇

“進行した肺の線維化”



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結果



・対照群:

- ・10頭
- ・年齢:13.1 歳 (範囲 8-18.8)
- ・体重:4.9 kg (範囲 1.8-13.7)
- ・基礎疾患:椎間板ヘルニア, 環軸不安定症など
- ・犬種:Tプードル (3), チワワ (2), ヨークシャーテリア(2) など

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結果



・PH群:

- ・31頭 → 27頭 (PTE2頭, 画像不良2頭を除外)
- ・年齢: 13.9 歳 (範囲 9.2-17.6)
- ・体重: 6.8 kg (範囲 2.4-34.3)
- ・犬種: ペキニーズ (6), WHWT (3), チワワ (3) など
- ・臨床徴候
 - 失神 10/27 (37%)
 - 右心不全 8/27 (30%)

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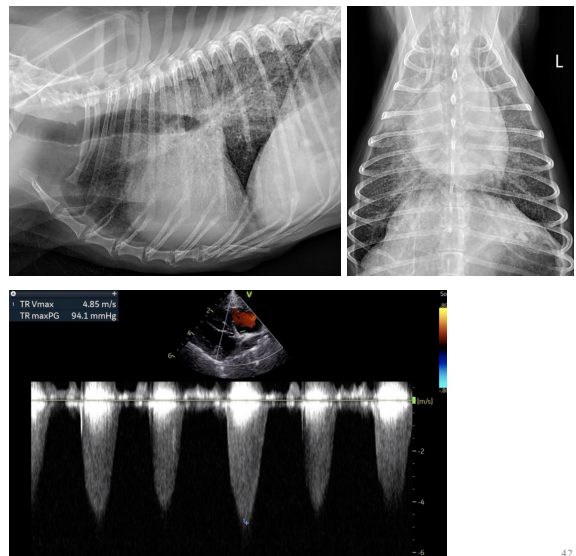
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結果



・PH群:

- ・低酸素血症: 21/27 (78%)
- ・胸部X線検査
 - 肺野の異常所見 13/27 (48%)
(気管支/間質/肺泡パターン)
- ・心エコー検査
 - TRV (m/s) 4.2 (3.78-4.9)
 - MPA/Ao 1.2 (1.1-1.42)
 - RPADi (%) 16.7 (12.4-19.2)
 - AT/ET 0.25 (0.19-0.29)



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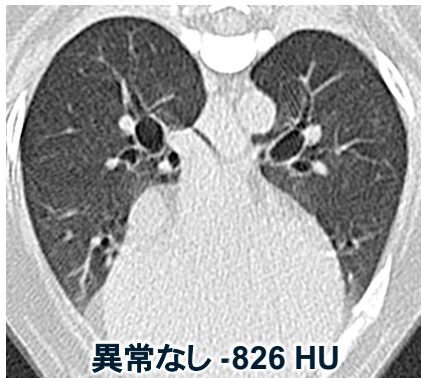
42

CT検査



・対照群:

- ・すりガラス影: 2/10 (20%)
- ・コンソリデーション, Parenchymal band, 牽引性気管支拡張, 蜂巣肺: 0/10 (0%)



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CT検査



・PH群:

- ・すりガラス影 23/27 (85%)
- ・コンソリデーション 8/27 (30%)
- ・Parenchymal band 19/27 (70%)
- ・牽引性気管支拡張 11/27 (41%)
- ・蜂巣肺 6/27 (22%)
- ・いずれの所見もなし 1/27 (3.7%)



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治療, 経過



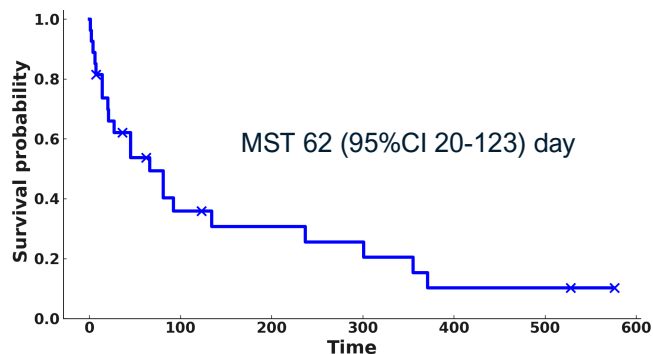
・PH群:

・治療

- PDE5阻害薬 17/27 (63%)
- ステロイド 11/27 (41%)
- ループ利尿薬 6/27 (22%)
- 無治療 3/27 (11%)

・観察期間中に21/27頭が死亡

- MST: 62 (20-123) 日



45

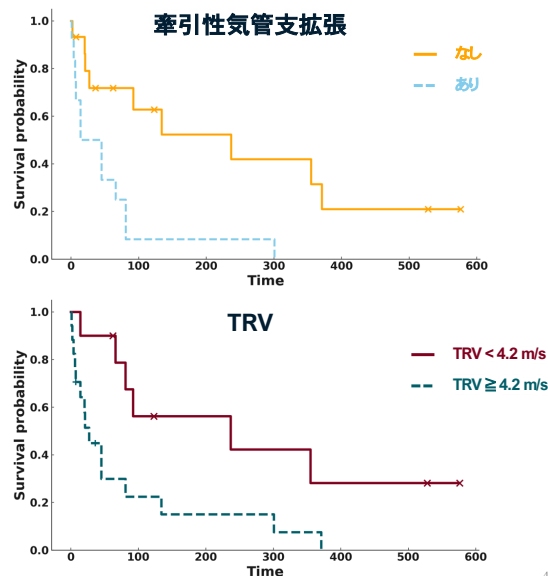
45

予後因子



・単変量解析

	変数	p値
【シグナルメント】	犬種	0.548
【臨床徴候】	失神	0.689
	右心不全徴候	0.024
【検査所見】	低酸素血症	0.613
- 胸部X線	胸部X線での異常	0.601
- 心エコー	TRV ≥ 4.2	0.025
	MPA/Ao ≥ 1.2	0.767
	PRADi ≤ 16.7	0.865
	AT/ET ≤ 0.25	0.447
- CT	すりガラス影	0.871
	コンソリデーション	0.473
	Parenchymal band	0.086
	牽引性気管支拡張	0.013
	蜂巣肺	0.239
【治療】	PDE5阻害薬の使用	0.841
	ステロイドの使用	0.488



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予後因子



・多変量解析

変数	p値	HR	95%CI
牽引性気管支拡張	0.017	3.54	1.21-10.38
TRV $\geq$ 4.2	0.029	2.91	1.06-7.96
右心不全徴候	0.085	2.92	0.92-9.26
Parenchymal band	0.965	1.02	0.32-3.12

・牽引性気管支拡張
 ・TRV $\geq$ 4.2 m/s
 
 MSTの短縮に関連

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Respiratory Investigation
Volume 56, Issue 4, July 2018, Pages 268-291



Review

Japanese guideline for the treatment of idiopathic pulmonary fibrosis

5. Clinical Questions Q1-Q17

5.1. Clinical Question 1: Should patients with IPF be treated with corticosteroid monotherapy?

We recommend strongly that patients with IPF in the chronic phase should not be treated with **corticosteroid monotherapy**.

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Table 33 Recommendations for pulmonary hypertension due to lung diseases

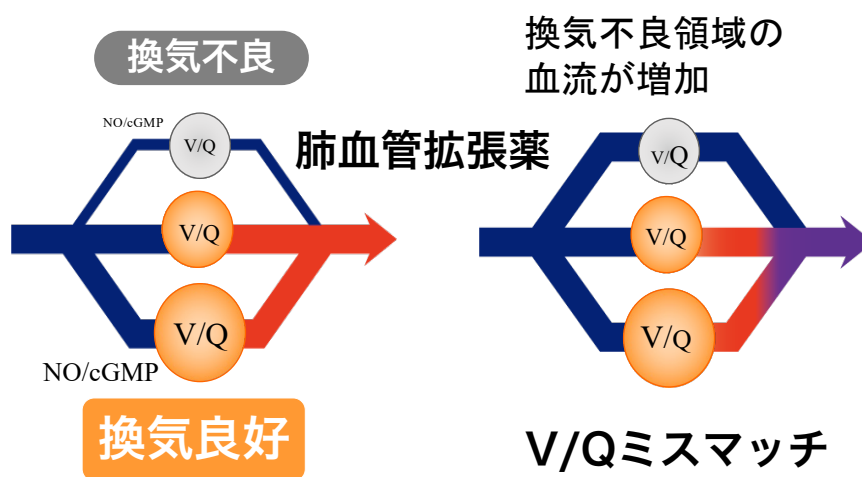
Recommendations	Class ^a	Level ^b	Ref. ^c
Echocardiography is recommended for the non-invasive diagnostic assessment of suspected PH in patients with lung disease	I	C	403, 405
Referral to an expert centre is recommended ^d in patients with echocardiographic signs of severe PH and/or severe right ventricular dysfunction	I	C	
The optimal treatment of the underlying lung disease, including long-term O ₂ therapy in patients with chronic hypoxaemia, is recommended in patients with PH due to lung diseases	I	C	169
Referral to PH expert center should be considered for patients with signs of severe PH/severe RV failure for individual-based treatment	IIa	C	
RHC is not recommended for suspected PH in patients with lung disease, unless therapeutic consequences are to be expected (e.g. lung transplantation, alternative diagnoses such as PAH or CTEPH, potential enrolment in a clinical trial)	III	C	169
The use of drugs approved for PAH is not recommended in patients with PH due to lung diseases	III	C	411–416

2015 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension

3群PHには
PAHに準ずる治療は
推奨されない

49

換気V／血流Q不均衡

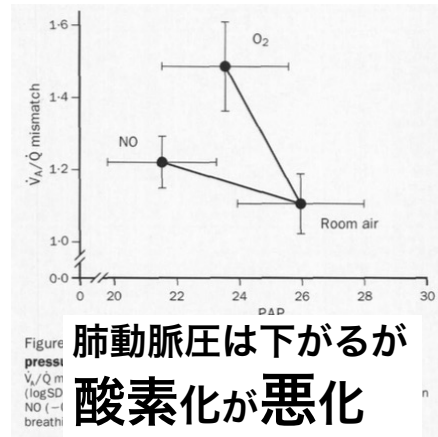


Ghofrani, H. A. et al.: Nat Rev Drug Discov 5(8):689, 2006
[L20060907077]より改変

酸素化効率の悪化

50

Joan A Barberà, Núria Roger, Josep Roca, Irene Rovira, Timothy W Higenbottam, Robert Rodriguez-Roisin



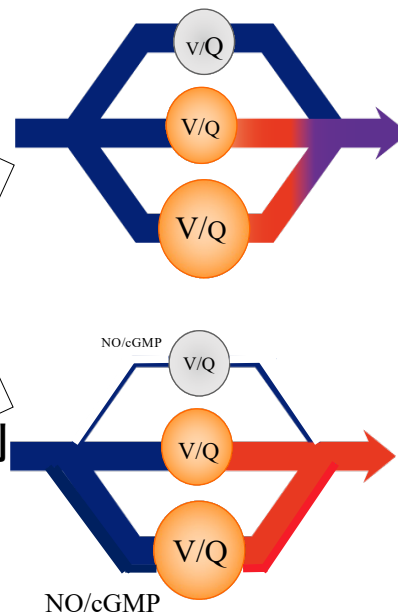
肺動脈圧は下がるが
酸素化が悪化

選択制のない
肺血管拡張剤

肺血流の
■ 選択と集中

 **PDE5阻害剤**

NO/cGMP



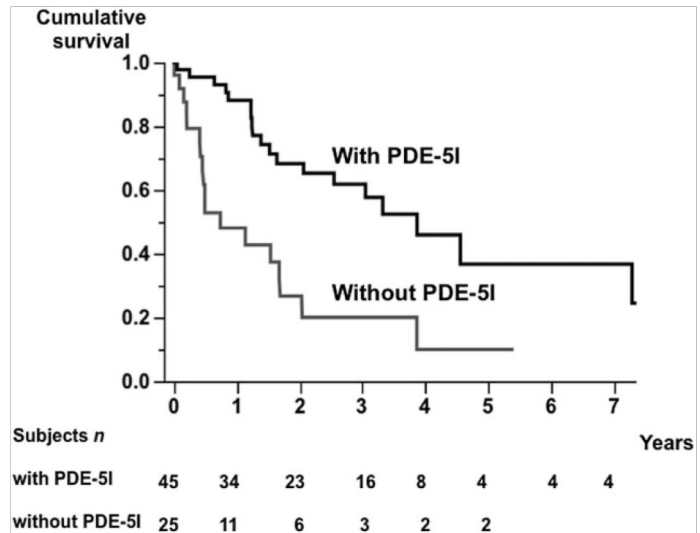
Ghofrani, H. A. et al.: Nat Rev Drug Discov 5(8) :689, 2006
[L20060907077]より改変

ORIGINAL ARTICLE

Multi-institutional retrospective cohort study of patients with severe pulmonary hypertension associated with respiratory diseases

NORUHIRO TANABE,^{1,2} HIROYUKI TANIGUCHI,² ICHIRO TSUJINO,¹ FUMIO SAKAMAKI,¹ NORIHIRO EMOTO,³ HIROSHI KIMURA,⁴ KEI TAKAMURA,⁵ MASAYUKI HANAOKA,⁶ MASAHARU NISHIMURA,⁶ AND KOICHIRO TATSUMI¹ FOR THE JRS Lung Disease PH Study Group*

Severe PH (mPAP >35 mmHg)
Retrospective



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2022 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension

Developed by the task force for the diagnosis and treatment of pulmonary hypertension of the European Society of Cardiology (ESC) and the European Respiratory Society (ERS).

Recommendation Table 23B

Recommendations	GRADE		Class ^a	Level ^b
	Quality of evidence	Strength of recommendation		
PDE5is may be considered in patients with severe PH associated with ILD (individual decision-making in PH centres)	Very low	Conditional	IIb	C
The use of PDE5is in patients with ILD and non-severe PH is not recommended	Very low	Conditional	III	C

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ACVIM consensus statement guidelines for the diagnosis, classification, treatment, and monitoring of pulmonary hypertension in dogs

Carol Reiner¹ | Lance C. Visser² | Heidi B. Kellihan³ | Isabelle Masseau⁴ | Elizabeth Rozanski⁵ | Cécile Clercx⁶ | Kurt Williams⁷ | Jonathan Abbott⁸ | Michele Borgarelli⁹ | Brian A. Scansen¹⁰

7.3.3 | Group 3 PH secondary to respiratory disease, hypoxia, or both

In people, for the same reasons noted for group 2 PH, the use of PH-specific treatments for group 3 PH are not routinely recommended.²¹⁴ In contrast, in dogs with group 3 PH, there may be benefit to additional PH-specific treatment during or after treatment for underlying pulmonary disease. In a recent study of dogs with diverse causes of group 3 PH, administration of PDE5i was the only independent predictor of survival in a multivariable analysis.⁹¹

T20. A PDE5i is recommended in group 3 dogs.^{40,42,52,84,205,210}

- Consensus in 7/7 members of the panel and 5/5 advisory reviewers

may be benefit?

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Received: 22 June 2019 | Accepted: 25 November 2019
DOI: 10.1111/jvim.15679

STANDARD ARTICLE

Journal of Veterinary Internal Medicine ACVIM
Official Journal of the American College of Veterinary Internal Medicine

Clinical features and outcome in 25 dogs with respiratory-associated pulmonary hypertension treated with sildenafil

Lynelle R. Johnson | Joshua A. Stern

TABLE 2 Distribution and combinations of suspected respiratory causes of pulmonary hypertension in 22 dogs of this study

	Number of affected dogs
Interstitial lung disease	8 ^a
Interstitial lung disease + BOAS	1
Interstitial lung disease + tracheobronchomalacia	1
Tracheobronchomalacia	4
Tracheobronchomalacia + BOAS + inflammation	1
Tracheobronchomalacia + BOAS	1
Tracheobronchomalacia + inflammation	1
Tracheobronchomalacia + infection	1
Infection	1
BOAS + infection	1
BOAS	1
Inflammation (eosinophilic)	1

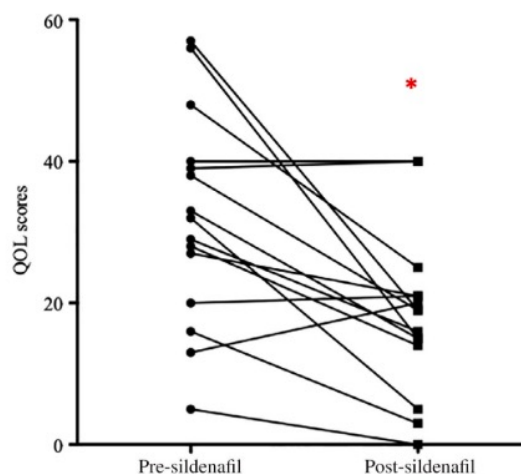


FIGURE 1 Quality of life (QOL) scores out of a maximum of 85 points before and after 1 month of treatment with sildenafil (n = 15). Although 4 dogs demonstrated a worsening in QOL as indicated by an increased score, overall values were significantly lower posttreatment, *P = .002

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2022 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension

Developed by the task force for the diagnosis and treatment of pulmonary hypertension of the European Society of Cardiology (ESC) and the European Respiratory Society (ERS).

Recommendations	GRADE		Class ^a	Level ^b
	Quality of evidence	Strength of recommendation		
PDE5is may be considered in patients with severe PH associated with ILD (individual decision-making in PH centres)	Very low	Conditional	IIb	C
The use of PDE5is in patients with ILD and non-severe PH is not recommended	Very low	Conditional	III	C
Inhaled treprostinil may be considered in patients with PH associated with ILD ⁷³⁴			IIb	B
The use of ambrisentan is not recommended in patients with PH associated with IPF ⁷⁴⁰			III	B
The use of riociguat is not recommended in patients with PH associated with IIP ¹⁸¹			III	B
The use of PAH medication is not recommended in patients with lung disease and non-severe PH ^e			III	C

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ORIGINAL ARTICLE

Inhaled Treprostinil in Pulmonary Hypertension Due to Interstitial Lung Disease

Aaron Waxman, M.D., Ph.D., Ricardo Restrepo-Jaramillo, M.D.,
Thenappan Thenappan, M.D., Ashwin Ravichandran, M.D., Peter Engel, M.D.,
Abubakr Bajwa, M.D., Roblee Allen, M.D., Jeremy Feldman, M.D.,
Rahul Argula, M.D., Peter Smith, Pharm.D., Kristan Rollins, Pharm.D.,
Chunqin Deng, M.D., Ph.D., Leigh Peterson, Ph.D., Heidi Bell, M.D.,
Victor Tapson, M.D., and Steven D. Nathan, M.D.

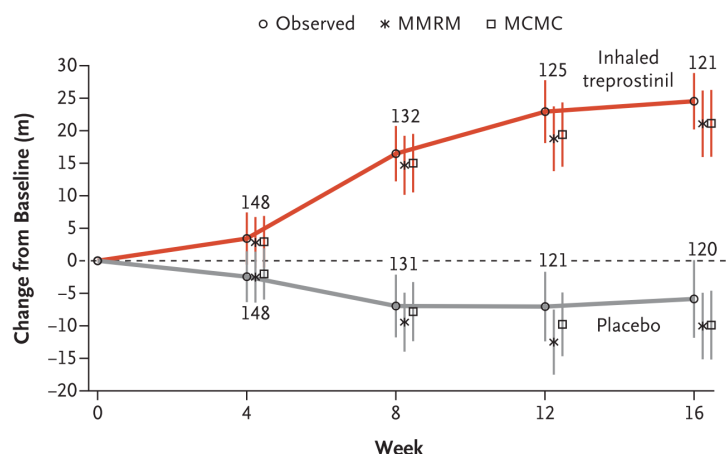


Figure 2. Mean Change from Baseline in Peak 6-Minute Walk Distance through Week 16.

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Respiratory Investigation 62 (2024) 980–986						
Contents lists available at ScienceDirect						
Respiratory Investigation						
journal homepage: www.elsevier.com/locate/rsinv						
Efficacy, safety, and pharmacokinetics of inhaled treprostinil in Japanese patients with pulmonary hypertension associated with interstitial lung disease						
Seiichiro Sakao ^{a,*} , Yasuhiro Kondoh ^b , Hideyuki Kinoshita ^c , Osamu Nishiyama ^d , Takeshi Ogo ^e , Nobuhiro Tanabe ^f , Shun Minatsuki ^g , Kazuhiko Nakayama ^h , Yu Taniguchi ⁱ , Kenta Takahashi ^j , Masahiro Takatsu ^k , Takashi Oeura ^l						
Table 2 Hemodynamic parameters (n = 20).						
	Baseline	Week 16			Change from baseline to Week 16	
	Mean ± SD	Pre-inhalation Mean ± SD	Post-inhalation			Post-inhalation Best Mean ± SD (95% CI)
			15 min Mean ± SD	30 min Mean ± SD	Best Mean ± SD	
PVRI (Wood units·m ²)	9.7 ± 5.0	9.3 ± 5.9	6.0 ± 3.3	6.0 ± 2.9	5.6 ± 3.2	−4.1 ± 3.7 (−5.8 to −2.4)
PVR (Wood units)	5.9 ± 3.1	5.6 ± 3.6	3.7 ± 2.2	3.7 ± 2.0	3.5 ± 2.1	−2.4 ± 2.3 (−3.5 to −1.3)
mPAP (mmHg)	33.3 ± 7.1	33.7 ± 9.9	26.7 ± 6.7	26.3 ± 7.2	25.7 ± 6.7	−7.6 ± 7.2 (−11.0 to −4.2)
CO ^h (L/min)	4.4 ± 0.8	4.3 ± 0.9	4.8 ± 1.0	4.8 ± 1.0	4.9 ± 1.0	0.6 ± 0.8 (0.2 to 0.9)
Cardiac index (L/min/m ²)	2.6 ± 0.5	2.6 ± 0.5	2.9 ± 0.6	2.9 ± 0.6	3.0 ± 0.6	0.3 ± 0.5 (0.1 to 0.5)
SVR (Wood units)	23.1 ± 6.8	23.5 ± 7.1	20.1 ± 6.2	20.4 ± 6.2	19.7 ± 6.3	−3.4 ± 4.0 (−5.3 to −1.6)
SVRI (Wood units·m ²)	38.3 ± 10.8	38.9 ± 11.1	33.2 ± 8.6	33.5 ± 8.5	32.4 ± 8.6	−5.9 ± 6.5 (−9.0 to −2.9)
PAWP (mmHg)	9.1 ± 3.3	10.6 ± 3.6	10.2 ± 4.5	9.7 ± 4.0	9.4 ± 4.0	0.4 ± 3.2 (−1.1 to 1.9)
mRAP (mmHg)	4.4 ± 3.4	4.6 ± 3.3	3.3 ± 2.9	3.4 ± 3.5	2.7 ± 2.5	−1.7 ± 2.6 (−2.9 to −0.5)
SvO ₂ (%)	68.4 ± 6.2	68.1 ± 7.8	67.7 ± 6.6	66.9 ± 5.8	68.0 ± 6.5	−0.4 ± 4.4 (−2.5 to 1.7)

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まとめ

■左心の大きくないPHを見たら

✓間質性肺疾患も疑いましょう

✓レントゲンではわかりません

■治療は？

✓ステロイド？

✓シルデナフィル？

●低酸素を悪化させるかもしれない

●ということに注意して使ってみましょう

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