

Supplemental Table. Laboratory Testing Results in COVID-19–Associated Pernio^a

Source article	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		Severity of COVID-19 symptoms, n/N
	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	
Kolivras et al,¹ 2020	1/1	23	1/1 M	1/1 positive	Not done	1/1 feet, toes	1/1 consistent with pernio	0/1	1/1 CBC, ESR, PT, aPTT, thrombin time, D-dimer, ANA, EBV serology	1/1 mild
Alramthan et al,² 2020	2/2	27, 35	2/2 F	2/2 positive	Not done	2/2 hands, fingers	Not done	0/2	2/2 CBC, CMP	2/2 asymptomatic

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Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Estébanez et al,³ 2020	1/1	28	1/1 F	1/1 positive (test not specified)	Not done	1/1 feet, heels	Not done	Not done	Not done	1/1 mild
Romani et al,⁴ 2020	12/12	43, 46, 12, 14, 7, 15, 12, 14, 14, 17, 11, 17	4/12 M 8/12 F	0/12 positive	0/5 positive	1/12 hands, 1/12 fingers, 4/12 hands and feet, 2/12 ankles, 4/12 feet	2/2 consistent with pernio	1/10 elevated ferritin	10/10 CBC, D-dimer, LDH 9/10 ferritin	12/12 asymptomatic
Landa et al,⁵ 2020	6/6	15, 15, 23, 44, 91, 24	3/6 M 3/6 F	2/3 positive	0/1 positive	4/6 toes, 1/6 toes and heel, 1/6 fingers and heel	Not done	Not done	Not done	2/6 asymptomatic 3/6 mild 1/6 moderate-severe (hospitalized prior)

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Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Piccolo et al, ⁶ 2020	63/63	Median 14	30/63 M 33/63 F	2/11 positive	2/6 positive	54/63 feet, 5/63 feet and hands, 4/63 hands	Not done	1/10 Mycoplasma 1/6 ANA	Serology for other infections	7/63 GI symptoms 5/63 respiratory symptoms 3/63 fever
Recalcati et al, ⁷ 2020	14/14	11 children (mean 14.4) 3 adults (mean 29)	6/14 M 8/14 F	0/3 positive 0/2 rectal positive	Not done	8/14 feet, 4/14 hands, 2/14 feet and hands	2/2 acral biopsies consistent with pernio 2/2 elbow biopsies of targetoid lesions showed perivascular dermatitis	0/14	14/14 CBC, CRP, LDH, D-dimer, other viral serologies	11/14 asymptomatic 3/14 mild (3 weeks prior)

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	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	
Fernandez-Nieto et al,⁸ 2020	132/346	Mean 19.9	71/132 M 61/132 F	2/11 positive	Not done	41/132 hands, 108/132 feet, 120/132 on digits, 22/132 on heels or wrists	Not done	Not reported	Not reported	113/132 asymptomatic 19/132 mild
Docampo-Simón et al,⁹ 2020	42 chilblains-like/58 with acral skin lesions	Median 14	29/58 M 29/58 F	1/39 positive	0/2 positive	9/58 hands, 36/58 feet, 13 hands and feet	Not done	Not reported	Not reported	41/58 asymptomatic 10/58 mild 1/58 severe, with vascular ulcer on toe 6/58 unknown

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Galván Casas et al,¹⁰ 2020	71/375	Mean 21.8	23/71 M 48/71 F	29/71 positive (test not specified)	Not done	Not specified	Not done	Not reported	Not reported	37/71 cough 18/71 dyspnea 44/71 fever 27/71 headache 17/71 GI 10/71 pneumonia 9/71 hospitalized 2/71 ventilated 0/71 deaths
Andina et al,¹¹ 2020	22/22	Median 12	13/22 M 9/22 F	1/19 positive	Not done	19/22 feet, heels, toes 3/22 feet, toes, fingers	6/6 consistent with pernio	1/16 elevated D-dimer	18/18 PT, fibrinogen, aPTT 15/16 D-dimer 10/10 CBC 4/4 LDH 1/1 lupus anticoagulant	12/22 asymptomatic 10/22 mild (respiratory and/or GI)

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Cordoro et al,¹² 2020	6/6 Additional 24 patients	Ages 12-17 Ages 10-19	5/6 M 1/6 F	0/6 positive 0/13 positive (additional cases in area)	0/6 positive	6/6 feet, toes 3/6 livedo reticularis	6/6 consistent with pernio	1/6 ASO positive 3/6 mildly reduced fibrinogen	6/6 CBC, CMP autoimmune serology, coagulopathy panel, inflammatory markers	4/6 asymptomatic 2/6 mild
Freeman et al,¹³ 2020	318/505	Median 25	163/318 M 155/318 F	14/60 positive	6/20 positive 4 positive by unknown assay	298/318 feet 48/318 hands Feet only 84%, Hands only 5.1%, Both 10%	7/7 consistent with pernio	Not reported	Not reported	174/318 asymptomatic 138/318 mild 6/318 severe (hospitalized) with 2/318 deaths

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	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	
De Masson et al,¹⁴ 2020	142 acral/277 106 chilblain-like, 20 dyshidrosis-like, 16 other	Median 27	67/132 M 65/132 F	25/34 positive the of 277 7/25 positive had acral lesions	Not done	23/34 hands 18/34 feet	3/3 consistent with pernio	Not reported	Not reported	174/277 asymptomatic 103/277 with mild symptoms 59/106 asymptomatic (isolated chilblains)
Kanitakis et al,¹⁵ 2020	17/17	mean 32	M 11 F 7 # error	0/17 positive	0/17 positive	9/17 toes 6/17 feet 2/17 fingers	17/17 consistent with pernio 0/3 PCR positive for SARS-CoV-2	0/17	17/17 Routine blood tests, inflammatory markers, D-dimer, ANA, complement, cryoglobulins, antiphospholipid antibodies	12/17 asymptomatic 5/17 mild

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Kerber et al,¹⁶ 2020	1/1	7	1/1 M	0/1 positive	1/1 positive	1/1 toes, feet	Not done	0/1	1/1 CBC, ESR, CMP, EBV serology	1/1 asymptomatic
Locatelli et al,¹⁷ 2020	1/1	16	1/1 M	1/1 positive	Not done	1/1 fingers, toes	Consistent with pernio	0/1	1/1 Routine blood tests, coagulation, autoimmune, cryoglobulins, other viral serologies	1/1 mild

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Suarez-Valle et al,¹⁸ 2020	3/3 acro-ischemia	Not reported	Not reported	3/3 positive	Not done	3/3 toes 1/3 soles	Ischemic necrosis of epidermis and dermis with signs of re-epithelialization. Vasculitis or microthrombi not observed	D-dimer elevated 3/3 fibrinogen elevated 2/3	3/3 other coagulation studies normal	3/3 hospitalized with bilateral pneumonia, and recovered
Garcia-Lara et al,¹⁹ 2020	27/27	Mean 14.4	18/27 M 9/27 F	0/2 positive	0/9 positive	20/27 feet 6/27 hands 1/27 both	Not done	Not reported	Not reported	26/27 asymptomatic 1/27 mild, with diarrhea

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Colonna, Monzani et al,²⁰ 2020	4/4	11, 11, 6, 5	1/4 M 3/4 F	0/4 positive	Not done	4/4 feet, toes 1/4 hands	1/1 consistent with pernio	1/4 mild thrombocytosis and monocyto- sis 1/4 elevated D-Dimer	3/4 blood count, 4/4 CRP, coagulation profile, fibrinogen, antiphospholipid antibodies, other viral serologies	4/4 mild
Ruggiero et al,²¹ 2020	100/100	Mean 12.5	64/100 M 36/100 F	1/11 positive	Not done	75/100 feet 25/100 hands	Not done	Not reported	Not reported	84/100 asymptomatic 16/100 symptomatic

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Mahieu et al,²² 2020	10/10	Median 27	Not reported	0/10 positive	0/10 positive	9/10 feet, toes 2/10 fingers 1/10 sole	3/3 consistent with pernio 0/4 PCR positive for SARS-CoV-2	0/10	10/10 CBC, CRP, immunoglobulin levels, cryoglobulins, complement, antiphospholipid antibodies	8/10 asymptomatic 2/10 mild
Guarneri et al,²³ 2020	23/23	Mean 14.3	9/23 M 14/23 F	6/23 positive	Not done	Not reported	Not done	Not reported	Not reported	Not reported

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
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EI Hachem et al,²⁴ 2020	19/19	Mean 14	14/19 M 5/19 F	0/19 positive	0/19 positive for IgG to nucleocapsid protein 1/19 positive IgG to S1 domain of spike protein 6/19 positive IgA to S1 domain of spike protein	19/19 toes 10/19 heels 8/19 soles	18/18 consistent with pernio 0/3 PCR positive for SARS-CoV-2	0/19	19/19 CBC, ESR, cryoglobulins, autoantibodies (ANCA, ANA, anti-dsDNA, ENA, antiphospholipid antibodies) C3, C4, immunoglobulins (IgG, IgM, IgA), and coagulation screening (D-Dimer, PT, aPTT, fibrinogen)	13/19 asymptomatic 6/19 mild symptoms (5 respiratory prior, 1 GI post)

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	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	
Colmenero et al,²⁵ 2020	7/7	11, 13, 14, 15, 15, 15, 17	4/7 M 3/7 F	0/6 positive	None	6/7 feet only 1/7 feet and hands	7/7 consistent with pernio 7/7 positive for SARS-CoV-2 spike protein by IHC	1/6 D-dimer minimally elevated	6/6 CBC, coagulation studies	2/7 asymptomatic 5/7 mild
Iria et al,²⁶ 2020	8/8	Mean 12.8	3/8 M 5/8 F	0/8 positive (excluded anyone that tested positive for SARS-CoV-2)	0/8 positive	8/8 toes 3/8 soles and heels 3/8 fingers	2/2 consistent with pernio 0/1 PCR positive for SARS-CoV-2	3/8 slight lymphocytosis	5/8 CBC 8/8 LDH, ferritin, CRP, ANA anti-phospholipid antibodies, PT/INR, aPTT, fibrinogen, D-dimer, other viral	8/8 asymptomatic

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									serologies	
Colonna, Spinelli et al,²⁷ 2020	45/45	Pediatric, ages not reported	Not reported	0/45 positive	1/8 positive (IgG)	Feet most common	Not reported	2/8 elevated D-dimer and fibrinogen degradation products	Not reported	A personal or family history of mild symptoms frequently reported

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Roca-Ginés et al,²⁸ 2020	20/20	Mean 12.3	13/20 M 7/20 F	0/20 positive	0/20 positive (IgG, IgM, IgA)	14/20 feet only 2/20 hand only 4 hand & feet	6/6 consistent with pernio	2/20 positive ANA	18/20 ANA 20/20 CBC, CMP, ESR, ferritin, LDH, CRP, D-dimer, cryoglobulins, protein C & S, ANCA, antiphospholipid antibodies, C3, C4, other viral serologies	20/20 asymptomatic

Source article	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		Severity of COVID-19 symptoms, n/N
	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	
Herman et al,²⁹ 2020	31/31	Median 22	12/31 M 19/31 F	0/31 positive	0/31 positive (IgM, IgG)	27/31 feet only, 3/31 hands and feet, 1/31 hand only	22/22 consistent with pernio 0/22 PCR positive for SARS-CoV-2	8/31 ANA	23/31 ANA 31/31 RF, CH50, C3, C4, ANCA, ASO, cold agglutinins, PT, aPTT, D-Dimer, antiphospholipid antibodies, cryoglobulins, CRP, SPEP	10/31 asymptomatic 20/31 mild symptoms 1/31 unspecified severity

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Hubiche et al,^{30, 31} 2020	40/40	Median 22	19/40 M 21/40 F	0/26 positive	12/40 positive (7 IgA, 3 IgG, 1 IgM & IgG, 1 IgA & IgG)	Toes, rarely heels and fingers	19/19 consistent with pernio Direct immunofluorescence with granular C3 of papillary dermal vessels	24/40 elevated D-Dimer 9/40 positive ANA 4/40 positive antiphospholipid antibodies IFN- α increased after stimulation	25/25 negative cryoglobulins	25/40 asymptomatic 15/40 mild symptoms

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García-Legaz Martínez et al,³² 2020	19 acral /26	Mean 28	14/26 M 12/26 F	2/19 positive prior to onset of rash 0/19 positive at onset of rash	3/19 positive (2 with IgG 1 with IgG & IgA)	Not specified	1/1 consistent with pernio	1/19 HHV-6 nasopharyngeal, 1/19 Parvovirus B19 serum Both of unknown significance	Parvovirus B19, measles, rubella, HHV-6	17/19 asymptomatic 2/19 mild (prior fever)
Santonja et al,³³ 2020	1/1	35	1/1 F	0/1 positive	0/1 positive (IgG, IgM)	1/1 feet, toes	1/1 consistent with pernio 1/1 positive for SARS-CoV-2 spike protein by IHC	Not reported	Not reported	1/1 mild (2 days fever and cough)

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	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	
Rouanet et al,³⁴ 2020	10/10	Median 33	5/10 M 5/10 F	0/7 positive	0/9 positive (IgG)	3 fingers 1 both fingers and toes 6 toes	9/9 consistent with pernio 0/9 PCR positive for SARS-CoV-2	3/10 positive ANA	7/10 ANA 10/10 CBC, CRP, complement, ANCA, cryoglobulins, D-dimer, antiphospholipid antibodies	5/10 asymptomatic 5/10 mild
Colonna, Genovese et al,³⁵ 2020	30/30	Median 11	17/30 M 13/30 F	0/6 positive	Not done	27/30 feet only 2/30 hands only 1/30 hands and feet	2/2 consistent with pernio	Not reported	Not reported	17/30 asymptomatic 13/30 mild

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Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Torres-Navaro et al,³⁶ 2020	2/2	16, 16	1/2 M 1/2 F	0/2 positive	Not done	2/2 hands, fingers	Not done	0/2	2/2 CBC, ESR, CMP, ANA, C3, C4, antiphospholipid antibodies, cold agglutinins, other viral serologies, levels of IgG, IgM, IgA	2/2 asymptomatic
Lesort et. al,³⁷ 2020	45/45	Mean 30.1	26/45 M 19/45 F	0/17 positive	0/17 positive	37/45 toes 2/45 fingers 6/45 both	17/17 consistent with pernio 0/11 PCR positive for SARS-CoV-2	6/15 increased interferon score	17/17 CBC, inflammatory markers autoimmune markers, D-dimer	33/45 asymptomatic 12/45 mild

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Rizzoli et. al,³⁸ 2020	16/16	9,11,1 2,12,1 2,12,1 4,15,1 5,15, 16, 19	4/12 M 8/12 F	0/16 positive	1/12 positive (IgG)	9/12 feet only 2/12 hands only 1/12 both hands and feet	Not done	0/4	4/4 other viral serologies	Not reported
Das et al,³⁹ 2020	5/5	27, 29, 32, 45, 52	Not reported	5/5 positive	Not done	4/5 toes 1/5 fingers	Not done	Not reported	Not reported	5/5 in COVID isolation ward, with mild symptoms

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Valtueña et al,⁴⁰ 2020	8/8 acral edema	Not reported	Not reported	Not reported	Not reported	8/8 feet or hands	Consistent with pernio	0/8	8/8 complement, markers of bacterial infection	Mild
García-Gil et al,⁴¹ 2020	1/1 acral purpura	18	1/1 M	0/1 positive	0/1 positive	1/1 feet	1/1 consistent with pernio	1/1 elevated ESR, CRP, INR, D-dimer, PT time, fibrinogen, and monocytes	1/1 cryoglobulin, cold agglutinins, rheumatoid factor, ANA, complements, other viral serology	1/1 Mild

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Wargo et al,⁴² 2020	1/1	49	1/1 F	Not done	0/1 positive	1/1 feet, toes	1/1 consistent with pernio	0/1	1/1 CBC, CMP, PT, aPTT, D-Dimer, fibrinogen, ANA	1/1 mild
Quintana-Castanedo et al,⁴³ 2020	1/1	11	1/1 M	0/1 positive	1/1 positive (IgG)	1/1 toes	Not done	0/1	1/1 complement, autoimmune panel, CRP, coagulation studies, cryoglobulins, D-dimer, other viral serology	1/1 asymptomatic (ophthalmology found retinal vasculitis in left eye)

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Battesti et al,⁴⁴ 2020	7/7	42 mean	3/7 M 4/7 F	0/7 positive	1/7 positive (IgA)	7/7 feet	7/7 consistent with pernio 0/7 PCR positive for SARS-CoV-2 7/7 positive for myxovirus resistance protein-A	2 ANCA 1 lupus anticoagulant	7/7 hematologic, immunologic, antiphospholipid antibodies, cryoproteins, cold agglutinins, other viral serology	2/7 asymptomatic 5/7 mild
Le Cleach et al,⁴⁵ 2020	311 acral/481 202 classical chilblains	median 25.7	129/31 1 M 182/31 1 F	7/121 positive	5/75 positive (IgG)	236/311 feet 36/311 hands 37/311 both hands and feet	26/29 consistent with pernio	12 with immunologic abnormalities	57/66 CBC, 20/20 CRP, 61/61 aPTT, 14/14 complement, 34/34 cold agglutinins, 30/30 cryofibrinogens, 57/57 other viral serology	151/311 asymptomatic 157/311 mild 3/311 pneumonia 0/311 ICU or deaths

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Freeman et al,⁴⁶ 2020	31 pernio with laboratory confirmed COVID-19/422 pernio	median 35	15/31 M 16/31 F	16/31 positive	11/31 positive 4 positive on unspecified assay	26/31 feet 10/31 hands	1 consistent with pernio	Not reported	Not reported	6/31 asymptomatic 21/31 mild 5/31 hospitalized with 2 deaths
Ladha et al,⁴⁷ 2020	1/1	16	1/1 F	0/1 positive	1/1 positive	1/1 toes and finger	1/1 consistent with pernio	0/1	1/1 CBC, ANA, ENA, dsDNA, antiphospholipid antibodies, complement, coagulation, D-dimer, cryoglobulins, cryofibrinogens, cold agglutinins,	1/1 asymptomatic

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Rodríguez-Villa Lario et al,⁴⁸ 2020	1/1	17	1/1 M	0/1 positive	1/1 positive (+IgG, -IgM)	1/1 toes	1/1 consistent with pernio	1/1 elevated IgA	1/1 CBC, ANA, cryoglobulins, D-dimer	Not reported
Hébert et al,⁴⁹ 2020	33/33	Mean 23.4	19/33 M 14/33 F	0/3 positive	1/33 positive (IgM) 0/33 positive (IgG)	33/33 toes 12/33 fingers	5/5 consistent with pernio 0/5 IgG positive for anti-SARS-CoV-2 0/5 PCR positive for SARS-CoV-2	7/33 mild lymphopenia 2/33 ANA 3/33 type III cryoglobulins	26/33 CBC 33/33 ESR, CRP	23/33 asymptomatic 10/33 mild symptoms

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Torrelo et al,⁵⁰ 2020	4/4 with acral pernio-like and erythema multiforme-like lesions	11, 12, 15, 17	3/4 M 1/4 F	1/4 positive	Not done	4/4 feet 4/4 hands	2/2 consistent with pernio 1/1 positive for SARS-CoV-2 spike protein by IHC	0/3	2/2 hemogram 3/3 coagulation 2/2 D-dimer	1/4 asymptomatic 3/4 mild symptoms

Source article	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		Severity of COVID-19 symptoms, n/N
	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	
Aghazadeh et al,⁵¹ 2020	1/1 with pernio-like acral erythema with oral vesicles and erosion	9	1/1 F	1/1 positive	Not done	1/1 hands and feet	Not done	Not reported	Not reported	1/1 mild symptoms
Magro et al,⁵² 2020	3/9 with pernio (6/9 with acral livedoid or retiform purpura)	16, 48, 65	1/3 M 2/3 F	0/2 positive	0/1 positive	2/3 toes 1/3 fingers	3/3 consistent with pernio 3/3 positive for myxovirus resistance protein-A 3/3 rare SARS-CoV-2 positive cells	Not reported	Not reported	1/3 asymptomatic 2/3 mild symptoms

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Proietti et al,⁵³ 2020	1/1	35	1/1 F	1/1 positive	Not done	1/1 ear	Not done	0/1	1/1 CBC, LDH, CMP, coagulation panel, autoimmune panel	1/1 asymptomatic
García-Gil et al,⁵⁴ 2020	1/1 with acral purpura and blisters	12	1/1 M	0/1 positive	0/1 positive	1/1 feet/heels	1/1 consistent with pernio	0/1	1/1 CBC, CMP, coagulation studies, nasopharyngeal swab for other respiratory viruses, serology for other viruses	1/1 asymptomatic

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Nasopharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Caselli et al,⁵⁵ 2020	38/38 with acute pseudo-chilblain	Median 13.5	22/38 M 16/38 F	0/38 positive	0/38 positive	38/38 feet or hands	Not done	1/38 with positive ANA 1/38 positive for mycoplasma	38/38 nasopharyngeal swab for other viruses and bacteria	30/38 asymptomatic 8/38 mild symptoms prior
Ko et al,^{56, 57} 2020	5/5	31, 61, 62, 76, 82	1/5 M 4/5 F	Not done	0/3 positive	3/5 finger only 1/5 toe only 1/5 toe, foot, wrists, knees	5/5 consistent with pernio 0/5 positive for SARS-CoV-2 nucleocapsid protein by IHC 3/5 positive for SARS-	0/5	2/2 negative ANA 1/1 negative antiphospholipid antibodies	5/5 asymptomatic

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
							CoV-2 spike protein by IHC 0/3 positive for SARS-CoV-2 spike protein by RNA ISH			
Denina et al,⁵⁸ 2020	24/35 with pernio and serologic testing	Mean 13	9/24 M 15/24 F	1/17 positive via rectal swab 0/4 fecal PCR positive	4/24 positive by ELISA or chemiluminescence assay	22/24 toes 2/24 heels	Not done	2/24 positive lupus anticoagulant 1/24 positive anticardiolipin	24/24 ANA, cryoglobulins, C3, C4, PT, aPTT, D-Dimer, Fibrinogen, CRP, LDH, ESR, IgA, IgG, IgM	4/24 fever 10/24 cough 5/24 GI symptoms

Source article	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		Severity of COVID-19 symptoms, n/N
	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	
Pangti et al,⁵⁹ 2020	1 chilblain-like/138 hospitalized COVID-19+ patients	50	1/1 F	1/1 positive	Not done	Toes of both feet	Not done	Not reported	Not reported	1/1 Mild Lower limb ischemia on doppler ultrasound
Gianotti et al,⁶⁰ 2020	5 chilblain-like/20 patients biopsied at risk for COVID-19 2 chilblain-like/10 patients biopsied with positive PCR for COVID-19	Not reported	Not reported	2/7 positive	Not done	Not reported	7/7 consistent with pernio 3/3 positive eccrine gland staining for SARS-CoV-2 nucleocapsid protein by IHC	Not reported	Not reported	2/7 PCR positive with active infection 5/7 mild symptoms and/or COVID-19 home exposure

Source article	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		Severity of COVID-19 symptoms, n/N
	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	
Stavert et al,⁶¹ 2020	24 antibody tested/26 consecutive chilblains	27,30, 27,64, 26,33, 11,12, 41,55, 24,31, 25,31, 19,28, 59,28, 33,31, 32,25, 41,37	12/24 M 12/24 F	1/21 positive	4/24 positive	21/24 toes only 2/24 fingers only 1/24 toes and fingers	Not done	Not reported	Not reported	10/24 asymptomatic 14/24 mild symptoms
Mohan et al,⁶² 2020	1/1	10	1/1 M	0/1 positive	0/1 positive	1/1 toes of both feet	Not done	Not reported	Not reported	1/1 mild flu-like symptoms

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Daneshjou et al,⁶³ 2020	7/7	33,39, 31,44, 31,25	4/7 M 3/7 F	0/5 positive	1/6 positive	7/7 toes 1/7 toes and fingers	Not done	0/6	6/6 with no coagulation or rheumatologic abnormalities	3/6 mild symptoms 3/6 asymptomatic
Baeck et al,⁶⁴ 2020	54/54 (23 additional pernio, 31 reported previously)	Not reported	Not reported	1/47 positive	2/54 positive 0/39 positive on repeat testing	Toes and/or fingers	Not reported	Not reported	Other systemic causes of chilblains excluded in the 23 additional patients	More than 50% with mild symptoms (flu-like) prior the skin lesions

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Recalcati et al,⁶⁵ 2020	32/32 (18 additional pernio, 14 pernio previously reported)	Average 16.3	17/32 M 15/32 F	2/11 positive	0/22 positive with chemiluminescent immunoassay for IgG 3/22 positive IgM	10/32 feet and hands 15/32 feet only 7/32 hands only	Not done	Not reported	Not reported	12/32 with mild symptoms
Rosés-Gibert et al,⁶⁶ 2020	36/36	Mean 11.1	23/36 M 13/36 F	0/7 positive	0/1 positive	34/36 feet only 1/36 hands and feet 1/36 hands only	Not done	Not done	Not done	11/36 with mild viral symptoms

Source article	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		Severity of COVID-19 symptoms, n/N
	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	
Ludzik et al,⁶⁷ 2020	1/1	48	1/1 F	0/1 positive	0/1 positive	1/1 toes	Consistent with pernio	Not reported	Not reported	1/1 with mild respiratory and GI symptoms
Freeman, McMahon et al,⁶⁸ 2020	534 pernio /906 dermatologic manifestations	Not reported	Not reported	23/157 positive	12/75 positive	Not reported	Not reported	Not reported	Not reported	Not reported

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Diociaiuti et al,⁶⁹ 2020	30/30 (13 additional pernio, 17 pernio previously reported)	Range 12-17	21/30 M 9/30 F	1/30 positive	5/30 IgG positive (4/30 initial test positive, 1/17 second test positive) 16/30 IgA positive (11/30 initial test positive 8/17 second test positive)	30/30 toes	Not reported in new group	Not reported in new group	Not reported in new group	7/30 mild viral symptoms

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Docampo-Simón,⁷⁰ 2020	59/59 17 previously reported	Median 14	34/59 M 25/59 F	0/37 positive	0/25 positive	6/59 hands only 43/59 feet only 10/59 hands and feet	Not done	Not reported	19/19 parvovirus B19 negative	45/54 asymptomatic 9/54 with viral symptoms
Gallizzi et al,⁷¹ 2020	9/9	5, 8, 11, 11, 12, 13, 14, 14, 15	4/9 M 5/9 F	0/9 positive	0/9 1 borderline IgM	3/9 hands 6/9 feet	Not done	3/9 mildly increased D-Dimer 4/9 positive ANA 3/9 IgM antiphospholipid antibody	9/9 normal immunoglobulin, complement levels, ESR	3/9 asymptomatic 6/9 mild respiratory symptoms

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Maestro et al,⁷² 2020	6 pseudo-chilblain/75 hospitalized patients with laboratory confirmed COVID-19	Mean 67.5	48/75 M 27/75 F	Not specified	Not specified	Feet	Not reported	Not reported	Not reported	All patients admitted to hospital, but not ICU
Gambichler et al,⁷³ 2020	1/1	80	1/1 F	1/1 positive	1/1 positive (IgG and IgA)	1/1 thumb	Consistent with pernio 1/1 positive eccrine and endothelial staining for SARS-CoV-2 spike protein by IHC	Increased leukocyte count, CRP, and ferritin Decreased sodium	Not reported	1/1 admitted with pneumonia, discharged with full recovery

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso- pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
							1/1 positive PCR for SARS- CoV-2			
Fertitta et al,⁷⁴ 2020	17/30	Mean 11.2	10/17 M 7/17 F	0/3 positive	1/16 positive	14/17 feet only 2/17 hands only 1/17 hands and feet	Not done	1/16 leukocyto- sis 1/16 elevated CRP 3/16 elevated aPTT 11/14 positive ANA	16/16 fibrinogen, D-Dimer, lymphocyte count, hemoglobin	7/7 asymptomatic 10/17 mild viral symptoms

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
								1/12 positive antiphospholipid antibodies		
								2/15 positive C-ANCA		
								1/9 low CH50		
								10/10 IFN γ assay		

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Fabbrocini et al,⁷⁵ 2020	15/15	Mean 13	9/15 male 6/15 female	0/15 positive	Not done	15/15 toes 4/15 heels	Not done	1/15 positive anti-EBV IgM	No other alterations reported	9/15 asymptomatic 6/15 mild symptoms
Feito-Rodríguez et al,⁷⁶ 2020	37/37	Mean 22	17/37 M 10/37 F	3/37 positive	3/37 positive serology 3/3 positive antigen recall assay	15/37 toes only 10/37 fingers only 9/37 toes and feet 3/37 fingers and toes/feet	11/37 consistent with pernio 6/11 with C3d and C4d vessel deposition 0/3 positive PCR or electron microscop	5/37 positive anticardiolipin 1/24 elevated interferon	Other cytokines normal	20/37 asymptomatic 17/37 mild symptoms

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso- pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
							y for SARS- CoV-2			
Gómez-Fernández et al,⁷⁷ 2020	54/54 with chilblains	Mean 14	31/54 M 23/54 F	0/34 positive	0/53 positive (IgG, IgM, IgA)	31/54 dorsal toes 8/54 heels, soles, lateral feet 15/54 both distributi ons on feet	10/10 consistent with pernio 7/7 + C3d and C4d vessel walls	4/54 slightly elevated D-dimer 4/54 positive ANA 4/54 anticardio lipin 4/54 anti- b2	CBC, PT, aPTT, SPEP, C3, C4, IgM, IgG, IgA	32/54 asymptomatic 22/54 mild COVID-19 symptoms before or after evaluated for chilblains

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
						8/54 on hands		glycoprotein 1/42 lupus anticoagulant 1/54 positive ANCA 34/51 cryofibrinogens 2/47 cryoglobulin		

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Giavedoni et al,⁷⁸ 2020	17 chilblain-like/58 COVID-19-associated skin lesions	Median 29	10/17 M 7/17 F	3/13 positive	4/15 positive	Not specified	11/12 chilblain-like 10/11 anti-C9 deposits in dermal vessels 7/11 direct immunofluorescence with IgM or IgG, C3, and Fibrinogen in dermal vessels	3/15 positive ANA 1/15 positive anti-b2 glycoprotein 2/15 positive for anti-cardiolipin	Median CRP, ferritin, ESR statistically significantly lower in chilblain-like than other COVID-19 skin lesions	8/17 asymptomatic 9/17 COVID-19 symptoms 2/5 with lung infiltrates on chest x-ray 2/17 hospitalized 1/17 ICU 0/17 mortality

Source article	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		Severity of COVID-19 symptoms, n/N
	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	
Sohier et al,⁷⁹ 2020	10 chilblain-like/13 acral cutaneous lesions	Median 32	7/13 M 6/13 F	0/13 positive	Not done	Not specified	10/13 chilblain-like 8/13 with plasmacytoid dendritic cells 3/13 thrombotic vasculopathy	None	White blood cell count, CRP, LDH, ANA, D-dimer, lupus anticoagulant	4/13 asymptomatic 9/13 mild symptoms
Rubin et al,⁸⁰ 2020	1/1 chilblain-like lesions with bullae	27	1/1 F	1/1 positive	Not done	1/1 bilateral dorsal toes	Not done	Not done	Not done	1/1 mild (6 weeks prior toe lesions, patient with ageusia and anosmia, and no other symptoms)

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Pavone et al,⁸¹ 2020	2/2 chilblains-like lesions	7, 11	2/2 F	2/2 positive	Not done	2/2 toes 1/2 fingers	Not done	Not reported	Not reported	2/2 mild respiratory symptoms
Alonso et al,⁸² 2020	5 pseudo-pernio/24 acro-ischemia	Mean 44	3/5 M 2/5 F	3/5 positive	0/1 positive	Not specified	Not done	Not specified for subgroup	Not specified for subgroup	5/5 with mild viral symptoms

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Aschoff et al,⁸³ 2020	3/3 chilblain-like lesions	19,14,26	3/3 M	0/3 positive	0/3 positive	3/3 feet 2/3 toes 1/3 heels	3/3 consistent with pernio Direct immunofluorescence with IgG, IgM, C3 in small dermal vessels myxovirus resistance protein-A+ phosphorylated janus kinase 1&2+	1/3 positive ANA	Not specified	1/3 with respiratory symptoms

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Oliva Rodríguez-Pastor et al,⁸⁴ 2020	34 chilblain-type/62 rashes in pediatric emergency department	Mean 11.4	20/34 M 14/34 F	0/17 positive	4/34 positive 1/34 IgM 3/34 IgG	Feet and/or hands	Not done	Within normal limits	CBC, Fibrinogen, D-Dimer, LDH	11/34 with mild symptoms
Olsen et al,⁸⁵ 2020	4/4	Mean 32.5	1/4 M 3/4 F	0/1 positive	1/3 positive IgM/IgG	4/4 dorsal toes	Consistent with pernio (lymphocytic vasculitis, eccrine adenitis, Predominance of CD3+ T-cells Clusters of CD123+	No abnormalities	CBC, CMP, coagulation factors, ANA	4/4 with preceding mild viral symptoms

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
							plasmacytoid dendritic cells			
Rafai et al,⁸⁶ 2020	1/1	17	1/1 M	0/1 positive	Not done	1/1 Chilblain-like on toes, soles, heels targetoid on palms	Not done	Slight increase of inflammatory markers	No thrombocytopenia or hypercoagulability	1/1 mild respiratory infection

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Zaladonis et al,⁸⁷ 2020	1/1	20	1/1 M	0/1 positive	Not done	1/1 toes	Not done	Not reported	Not reported	Hospitalized for clinical manifestations of COVID-19
Rekhtman et al,⁸⁸ 2020	4 pernio-like/35 with a COVID-19-related skin eruption in 296 hospitalized adults + for COVID-19 via PCR or antibody	Median 64 (of 35 patients)	25/35 M 10/35 F	26/26 positive	4/4 positive	4/4 hands or feet 1/4 hands 3/4 fingers 1/4 feet 2/4 toes	Not done	Not specified in pernio-like patients	Not specified in pernio-like patients	35/35 hospitalized for COVID-19 27/35 use of vasopressors 11/35 dialysis 6/35 thrombosis 12/35 in-hospital mortality

	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		
Source article	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	Severity of COVID-19 symptoms, n/N
Sun et al,⁸⁹ 2020	2 chilblains/52 with skin rashes of 3128 patients with laboratory-confirmed COVID-19	Mean 43.2	38/52 M 14/52 F	Not specified	Not specified	28/52 rashes involving hand	Not specified for pernio Viral nucleocapsid protein in epidermal cytoplasm in patients with COVID-19	Not specified	Not specified	12/52 mild or moderate 40/52 severe

Source article	Patient characteristics			SARS-CoV-2 test		Skin involvement		Laboratory testing		Severity of COVID-19 symptoms, n/N
	Number with pernio, n/N	Age, years	Sex, M, F, n/N	Naso-pharynx PCR n/N	Serum Antibody n/N	Sites, n/N	Biopsy results, n/N	Positive, n/N	Negative, n/N	
Diotallevi et al, ⁹⁰ 2020	2 chilblain-like/4 rashes associated with SARS-CoV-2	12, 8	1/2 M 1/2 F	1/1 positive	Not done	2/2 distal toes	Not done	Not done	Not done	2/2 mild

^a**ANA** = antinuclear antibody; **ANCA** = antineutrophil cytoplasmic antibodies, **aPTT** = activated partial thromboplastin time; **ASO** = antistreptolysin O antibodies, **C3** = complement component 3; **C4** = complement component 4; **CBC** = complete blood count, **CH50** = total complement activity; **CMP** = complete metabolic panel; **COVID-19** = coronavirus disease 2019; **CRP** = C-reactive protein; **dsDNA** = double stranded deoxyribonucleic acid; **EBV** = Epstein-Barr virus; **ESR** = erythrocyte sedimentation rate; **F** = female; **HHV-6** = human herpesvirus 6; **IgA** = immunoglobulin A; **IgG** = immunoglobulin G; **IgM** = immunoglobulin M; **ICU** = intensive care unit; **IHC** = immunohistochemistry; **INR** = international normalized ratio; **ISH** = in situ hybridization; **ENA** = extractable nuclear antibody; **GI** = gastrointestinal; **LDH** = lactate dehydrogenase; **M** = male; **PCR** = polymerase chain reaction; **PT** = prothrombin time; **RF** = rheumatoid factor; **SARS-CoV-2** = severe acute respiratory syndrome coronavirus 2; **SPEP** = serum protein electrophoresis

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