



State-of-the-Art Treatments for Sarcoidosis

REVIEW

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ABSTRACT

Sarcoidosis is a heterogeneous disease with various treatment indications. Although it affects mainly the lungs, sarcoidosis can affect every organ, especially when the disease course is chronic and protracted. Regular patient follow-up is recommended for early recognition of active, ongoing organ-specific granulomatous inflammation to avoid progression to irreversible fibrosis. In this review, we elaborate on treatment indications and various anti-sarcoidosis regimens proven useful in clinical trials. We also review specialized treatment of specific disease manifestations, with a focus on cardiac sarcoidosis. We also report on treatment for special conditions such as fatigue and small fiber neuropathy. Treatment for sarcoidosis is an emerging landscape, with new data complementing the existing knowledge.

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INTRODUCTION

Sarcoidosis is a multisystem granulomatous disease of yet unknown etiology. It has great predilection for the lungs, but multiorgan involvement is common, especially when the disease course is chronic and protracted. Timely recognition and treatment is important as inflammation may progress to fibrosis, leading to irreversible organ damage. Older as well as recent guidelines for follow-up include identification of symptoms, history and physical examination, pulmonary function testing, and blood tests (complete blood counts, serum creatinine, serum alkaline phosphatase, serum calcium).^{1,2} Depending on symptoms, additional tests may include an eye examination, cardiac investigations, vitamin D assessment, and computed tomography (CT) of the lungs. Cardiac sarcoidosis (CS) occurs in 5% of all sarcoidosis cases, but autopsy and imaging studies reveal clinically silent CS in 25% of cases in the United States.³ CS manifests with atrioventricular blocks, arrhythmias, heart failure, and sudden cardiac death, accounting for up to 25% of total sarcoidosis deaths; therefore, prompt recognition and treatment is crucial.⁴ CS affects all races, has a mean age presentation of 50 years, and may be isolated without evidence of extracardiac sarcoidosis in 25% of those who have it.⁴ In this review, we address the principles and indications of sarcoidosis treatment, regimens and disease-modifying drugs, and treatment of special conditions.

INDICATIONS FOR TREATMENT

Not all sarcoidosis patients need systemic immunomodulatory treatment. This variation occurs because in roughly 30% of cases, the disease may subside by itself without ever being treated.⁵ Also, certain disease manifestations (ie, anterior uveitis, skin disease other than lupus pernio) may be treated only locally. Conversely, a recent British Thoracic Society report states that a significant proportion, up to 30%, of patients develop severe and worsening chronic disease requiring ongoing systemic treatment. Mortality is significant among this subgroup of patients, ranging up to 25%.⁶

The decision to treat with disease-modifying agents requires symptomatic, ongoing, and gradually worsening organ involvement (pulmonary or extrapulmonary) as well as certain asymptomatic but significant extrapulmonary manifestations, namely CS, neurosarcoidosis, posterior uveitis, and hypercalcemia.^{1,2} In other words, treatment is warranted when there is danger of permanent debilitating organ damage or dysfunction with associated morbidity and/or a significantly compromised health-related quality of life

on patient-reported outcomes.⁶ Thus, the goal of treatment is to prevent irreversible evolution of active granulomatous inflammation to fibrosis.⁷ Disease activity has to be demonstrated before initiation of treatment because already established organ dysfunction should not be treated; disease activity is not sufficient by itself for treatment initiation when organ dysfunction is absent or mild.

Diagnosis of CS with high probability requires abnormal findings in electrocardiogram and/or Holter monitoring and/or echocardiography with abnormal advanced imaging features at cardiac magnetic resonance (CMR) and/or cardiac fluorodeoxyglucose positron emission tomography (FDG-PET).^{8,9} Isolated CS may be diagnosed clinically in the absence of cardiac and extracardiac histology when positive PET scan combines with clinical features with or without positive CMR.^{8,10}

Recent studies have identified key risk factors for increased mortality in pulmonary sarcoidosis, including decreased diffusion capacity of carbon monoxide (DLCO), presence of pulmonary fibrosis in high-resolution CT, and pulmonary hypertension.^{11,12} The ideal regimen and medication doses in sarcoidosis are not always straightforward, because randomized double-blind placebo-controlled trials are generally lacking in sarcoidosis due to disease complexity, heterogeneity, and ethical considerations to withhold established treatments (with corticosteroids). **Table 1** summarizes a treatment algorithm of CS.^{13,14} FDG-PET seems to be useful to monitor active myocardial inflammation.¹⁵ Treatment has not shown to alter the natural course of the disease longitudinally, as granulomas often recur or progress. The most efficient drug against sarcoidosis is undisputedly corticosteroids. The other two categories of drugs with anti-inflammatory effect are antimetabolites and biologic agents.

TREATMENTS CORTICOSTEROIDS

Corticosteroids remain the mainstay first-line treatment of sarcoidosis. They have been proven to improve overall disease control, symptoms, quality of life, and pulmonary radiology and/or delay disease deterioration in patients with symptomatic pulmonary sarcoidosis. These effects are short-term, lasting for a period of 1 to 2 years, and fade after treatment withdrawal.¹⁶⁻²⁰ Note that oral corticosteroids may not have an effect on pulmonary physiology as expressed by forced vital capacity (FVC) and diffusing capacity for carbon monoxide. Furthermore, inhaled corticosteroids, commonly used, have proven ineffective in clinical trials.²¹

Studies show that an initiating dose of prednisone at 20 mg daily is not inferior to higher doses in clinical

Monitoring	At least yearly or sooner depending on symptoms, disease severity, laboratory parameters (echocardiography, troponin, BNP)
Addressing concomitant cardiovascular risk factors	Coronary artery disease, hypertension
Standard medical treatments of heart failure, diastolic dysfunction	
Managing conduction abnormalities (AV blocks)	Consider pacemaker
Managing ventricular arrhythmias, risk for sudden cardiac death	Consider implantable cardioverter defibrillator
Immunosuppressive treatment*	Administer in functional cardiac abnormalities (arrhythmias, myocardial pathology, blocks)® In asymptomatic cases with normal ejection fraction: individualized assessment as per treatment initiation
First-line treatment: corticosteroids	Second-line treatment: methotrexate, leflunomide, azathioprine, mycophenolate mofetil Third-line treatment: infliximab, adalimumab, cyclophosphamide

Table 1 Management of cardiac sarcoidosis.

*Risk factors: Age greater than 50, left ventricular ejection fraction of less than 40%, New York Heart Association functional class 3 or 4, increased left ventricular end-diastolic diameter, late gadolinium enhancement on cardiac MRI, ventricular tachycardia, cardiac inflammation identified by fluorodeoxyglucose positron emission tomography (FDG-PET) scan, echocardiographic evidence of abnormal global longitudinal strain, interventricular septal thinning, elevated troponin or BNP. BNP: brain natriuretic peptide; AV: atrioventricular

®: Monitor myocardial inflammation with FDG-PET

efficacy, control of the disease, physiology, or quality of life parameters.²²⁻²⁴ In recent studies, these relatively moderate doses are shown to manage sarcoidosis manifested as acute disease or as flares of chronic disease, and they are currently recommended by major societies (British Thoracic Society, European Respiratory Society) as an initiation dose with specific exceptions.^{6,14} These guidelines consider the significant toxicity of treatment with corticosteroids associated with both cumulative dose and duration of treatment. Common side effects including weight gain, diabetes, glaucoma, osteoporosis, and depression have been frequently observed in sarcoidosis patients.²⁵

When initiating corticosteroids in a patient with sarcoidosis, close follow-up every 3 months is mandatory. The initial dose is tapered after 3 to 6 weeks, usually by 5 mg, targeting a maintenance dose of 5 to 10 mg of prednisone by approximately 6 months after initiation of treatment. The maintenance dose is required by the majority of patients for a period of 6 to 24 months.

Based on existing literature, several principles apply when considering treating pulmonary sarcoidosis with corticosteroids: (1) acute disease and flares of chronic disease require the same prednisone doses, (2) the chronic maintenance dose should be the lowest possible, and (3) treatment with corticosteroids should be fairly prolonged to allow clearance of the etiologic antigen and adequate suppression of granulomatous reaction.⁷

Decision to discontinue corticosteroids is based on disease activity and end organ damage. When adequate control of the disease is accomplished, they should be

tapered off. Optimal duration of treatment is not known. Factors that may facilitate decisions in clinical practice are the appropriate selection of high-risk cases, PET-CT scan, and quality of life parameters. Up to 70% of patients experience sarcoidosis relapse during corticosteroids tapering or after treatment withdrawal. Relapses are treated with the same corticosteroid dose as in acute disease.

Addition of a second anti-inflammatory agent is deemed necessary when disease is severe and continued, when serial relapses occur, when corticosteroids are unable to be tapered below 10 to 15 mg of prednisone, when toxicity is significant, and when disease does not respond to corticosteroids.²⁶

METHOTREXATE

The most commonly studied second-line agent in sarcoidosis is antimetabolite methotrexate (MTX). MTX has exhibited a higher efficacy rate among second-line options managing disease control and steroids tapering in about 65% to 85% of patients with persistent pulmonary sarcoidosis.²⁶⁻²⁹ MTX has also shown improvement in radiology and in FVC but only in observational or retrospective studies.²⁶⁻²⁹ Additionally, MTX has proven effective in neurosarcoidosis, cardiac disease, skin, eye, and disrupted calcium metabolism.¹ It is given at a total dose of 15 mg weekly, divided in one or two doses. The most common side effects are blood (cytopenias) and liver toxicities, so these parameters should be monitored closely. To prevent bone marrow toxicity, concomitant treatment

with folic acid is imperative. Less than 10% of patients have to stop MTX because of toxicity, and relapses after MTX withdrawal may occur.²⁸ When initiating MTX, males and females of child-bearing age should be warned to prevent fertility due to fetal toxicity during pregnancy. Based on the existing evidence and acceptable toxicity profile, MTX is the recommended first option for a steroid-sparing second-line agent when treating sarcoidosis.^{14,26}

AZATHIOPRINE

Azathioprine (AZA) is a second antimetabolite that has long been used for rheumatic and hematologic diseases and historically has been used in sarcoidosis. Its efficacy is considered less than that of MTX, ranging between 20% to 80%.^{29,30} However, these data come from retrospective or observational studies only. Additionally, AZA has significant side effects, mainly gastrointestinal issues, myelodysplasia, malignancies, and secondary infections, with treatment cessation more frequent than MTX. Recent European Respiratory Society (ERS) guidelines made no recommendation for its use as a steroid-sparing agent in sarcoidosis.¹⁴

LEFLUNOMIDE

Leflunomide is a cytotoxic drug used in rheumatoid arthritis. Small series have shown efficacy of leflunomide at a dose of 10 to 20 mg daily in pulmonary and extrapulmonary sarcoidosis to improve pulmonary physiology, quality of life, extrapulmonary organ response, and as a steroid-sparing agent.^{31,32} Leflunomide is typically used when a need arises for a second agent with a better safety toxicity profile than MTX. However, leflunomide has adverse effects, most significantly interstitial pneumonia and peripheral neuropathy.^{33,34}

HYDROXYCHLOROQUINE

Chloroquine and hydroxychloroquine (HCQ) are antimalaria drugs used to treat sarcoidosis. Recently, HCQ is used more often due to its lower toxicity profile, although retinopathy remains a significant concern, prompting ophthalmology evaluation upon symptoms.³⁵ HCQ has shown efficacy in cutaneous sarcoidosis and hypercalcemia.^{36,37} In these conditions, it is usually given as an adjunct to low-dose corticosteroids or monotherapy. One randomized trial showed some efficacy in pulmonary sarcoidosis and physiology.³⁸ Considered less potent than MTX or other second-line agents, HCQ may be considered in refractory cases when drug toxicity is significant and in combination with one or two other drugs.

MYCOPHENOLATE MOFETIL

Mycophenolate mofetil (MMF) is a powerful inhibitor of lymphocyte proliferation, used to prevent allograft rejection after transplant. Used in various rheumatic diseases, its

role in sarcoidosis remains unclear. Retrospective studies showed that MMF has a steroid-sparing effect in chronic sarcoidosis and neurosarcoidosis but is probably less effective than other second-line agents (mainly MTX), with higher relapse rates and a more favorable toxicity profile.³⁹⁻⁴¹ Its specific position in the treatment pyramid, likely as a second-line agent, must be further elucidated.

INFLIXIMAB AND OTHER BIOLOGIC AGENTS

Anti-tumor necrosis factor- α (anti-TNF- α) agents are considered effective third-line drugs in sarcoidosis (especially with refractory pulmonary disease and neurosarcoidosis) by blocking TNF- α , a significant cytokine in granulomatous inflammation. In particular, infliximab (and biosimilars) have shown improvement in FVC in two double-blind randomized studies and was granted a conditional recommendation for use in refractory pulmonary sarcoidosis under CS with or without a second-line agent.^{42,43} Infliximab is further proven effective in lupus pernio (efficacy 77%), cutaneous sarcoidosis, and neurosarcoidosis (clinical improvement 77%, imaging improvement 82%).^{44,45} Clinicians must be aware of side effects, ie, infections and tuberculosis.^{46,47} Adalimumab may be an alternative in case of infliximab intolerance, as shown (at least partly) in small open-label studies.⁴⁸ Conversely, neither golimumab nor ustekinumab (anti-IL12/23) showed efficacy in refractory pulmonary sarcoidosis in one randomized trial.⁴⁹

OTHER TREATMENTS

Various other drugs have been tested in sarcoidosis. Phosphodiesterase inhibitors, pentoxifylline, roflumilast, and apremilast have shown to reduce disease flares, improve quality of life, and improve cutaneous disease, respectively, in small studies.⁵⁰⁻⁵² Rituximab is an anti-CD20 B-lymphocytes antibody that has shown partial efficacy in small case series of advanced pulmonary, eye, and neurosarcoidosis, with a favorable tolerance profile, and may be considered a third-line option.⁵³ Antimycobacterial treatment (CLEAR regimen) for 4 months failed to demonstrate clinical or physiological improvement in chronic pulmonary sarcoidosis.⁵⁴ Repository corticotropin injection (RCI) was approved in the 1950s for sarcoidosis. Originally considered a steroid analog, RCI may have additional immunological properties and a steroid-sparing effect, although its action is currently limited.⁵⁵ Janus kinase inhibitors are a drug family recently introduced in sarcoidosis treatment. Among them, tofacitinib showed 60% steroid-sparing efficacy in chronic sarcoidosis in a small proof-of-concept study.⁵⁶ An overview of drugs used, dosages, and respective monitoring events, with a focus on CS, is presented in [Table 2](#).

DRUG	DOSE	SIDE EFFECTS	CARDIAC SARCOIDOSIS
Prednisone	20 mg qd Follow-up 5-10 mg qd	Diabetes Weight gain Osteoporosis Glaucoma Cataract Depression/psychosis	Initiating dose 30 mg qd
Methotrexate	10-15 mg once a week	Nausea, bone marrow suppression, liver toxicity, pulmonary toxicity	Effective in combination with corticosteroids
Leflunomide	10-20 mg qd	Nausea, peripheral neuropathy, interstitial pneumonia	
Azathioprine	50-250 mg qd	Nausea, bone marrow suppression, liver toxicity, malignancies	Less effective than methotrexate
Mycophenolate mofetil	500-1500 mg bid	Diarrhea, monitor blood cell counts	Reasonably effective
Infliximab	3-5 mg/kg initially, 2nd dose after 2 weeks, then every 4-6 weeks	Tuberculosis activation, infections, contraindicated in severe heart failure, demyelinating neurological diseases, active tuberculosis, prior malignancy	Effective, caution for infections, cardiac symptoms ⁴⁷
Adalimumab	40 mg every 1-2 weeks	Tuberculosis activation, infections Contraindicated in severe heart failure, demyelinating neurological diseases, active tuberculosis, prior malignancy	Less effective than infliximab, caution for infections, cardiac symptoms ⁴⁷
Rituximab	500-1000 mg every 1-6 months	Screen for hepatitis, tuberculosis activation, humoral deficiency	
Hydroxychloroquine	200-400 mg qd	Retinopathy	

Table 2 Drugs used to treat sarcoidosis. qd: every day; bid: twice a day

SPECIFIC CONSIDERATIONS

EXTRAPULMONARY SARCOIDOSIS

Depending on organ involvement, extrapulmonary sarcoidosis may warrant local treatment, systemic treatment escalation, or multimodality interventions.

Cutaneous Sarcoidosis

Cutaneous sarcoidosis should initially be treated with local or intralesional corticosteroid injection. Cosmetically important disfiguring lesions (such as lupus pernio) should be treated with oral corticosteroids to achieve control in two-thirds of cases.⁵⁷ Continued disease should be treated with an additional agent. Hydroxychloroquine and methotrexate are currently used and have shown efficacy in small studies.⁵⁸ Randomized studies provide support for the use of infliximab in severe skin disease.^{44,59} Thalidomide, on the other hand, is proven ineffective compared with a placebo in skin sarcoidosis.⁶⁰

Ocular Sarcoidosis

Anterior uveitis should be treated locally with steroidal eye drops. Posterior uveitis, however, carries risk for blindness and requires systemic treatment, which includes corticosteroids and/or methotrexate in the majority of

cases.⁶¹ Mycophenolate mofetil and infliximab may be used as well, depending on course and individual toxicities.

Calcium Metabolism

Hypercalciuria is treated initially with dietary dairy and restricted sun exposure while hypercalcemia requires systemic treatment. Corticosteroids and/or HCQ are effective in treating hypercalcemia, the latter as sole treatment particularly in cases of unacceptable corticosteroids toxicity.³⁶ Osteoporosis should be treated carefully in sarcoidosis, as exogenous vitamin D supplementation may lead to hypercalcemia and is only indicated when 1,25(OH)₂ vitamin D levels are normal or reduced. When 1,25(OH)₂ vitamin D is elevated, osteoporosis is treated with bisphosphonates or denosumab.⁶²

Cardiac Sarcoidosis

Treatment of CS is two-fold. First, based on current guidelines and cardiology consultation, patients at increased risk for sudden cardiac death should be recognized and given an implantable cardioverter defibrillator (ICD), as in all arrhythmogenic cardiomyopathies. Such patients include those with episode of arrest, left ventricle ejection fraction (LVEF) ≤ 35%, and sustained ventricular tachycardia but

COMPETING INTERESTS

The authors have no competing interests to declare.

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REFERENCES

- Hunninghake GW, Costabel U, Ando M**, et al. ATS/ERS/WASOG statement on sarcoidosis. American Thoracic Society/European Respiratory Society/World Association of Sarcoidosis and other Granulomatous Disorders. *Sarcoidosis Vasc Diffuse Lung Dis.* 1999 Sep;16(2):149-73.
- Crouser ED, Maier LA, Wilson KC**, et al. Diagnosis and Detection of Sarcoidosis. An Official American Thoracic Society Clinical Practice Guideline. *Am J Respir Crit Care Med.* 2020 Apr 15;201(8):e26-e51. doi: [10.1164/rccm.202002-0251ST](https://doi.org/10.1164/rccm.202002-0251ST)
- Birnie D, Ha AC, Gula LJ, Chakrabarti S, Beanlands RS, Nery P**. Cardiac Sarcoidosis. *Clin Chest Med.* 2015 Dec;36(4):657-68. doi: [10.1016/j.ccm.2015.08.008](https://doi.org/10.1016/j.ccm.2015.08.008)
- Kandolin R, Lehtonen J, Airaksinen J**, et al. Cardiac sarcoidosis: epidemiology, characteristics, and outcome over 25 years in a nationwide study. *Circulation.* 2015 Feb 17;131(7):624-32. doi: [10.1161/CIRCULATIONAHA.114.011522](https://doi.org/10.1161/CIRCULATIONAHA.114.011522)
- Baughman RP, Nagai S, Balter M**, et al. Defining the clinical outcome status (COS) in sarcoidosis: results of WASOG Task Force. *Sarcoidosis Vasc Diffuse Lung Dis.* 2011 Jul;28(1):56-64.
- Thillai M, Atkins CP, Crawshaw A**, et al. BTS Clinical Statement on pulmonary sarcoidosis. *Thorax.* 2021 Jan;76(1):4-20. doi: [10.1136/thoraxjnl-2019-214348](https://doi.org/10.1136/thoraxjnl-2019-214348)
- Judson MA**. The treatment of pulmonary sarcoidosis. *Respir Med.* 2012 Oct;106(10):1351-61. doi: [10.1016/j.rmed.2012.01.013](https://doi.org/10.1016/j.rmed.2012.01.013)
- Terasaki F, Azuma A, Anzai T**, et al; Japanese Circulation Society Joint Working Group. JCS 2016 Guideline on Diagnosis and Treatment of Cardiac Sarcoidosis- Digest Version. *Circ J.* 2019 Oct 25;83(11):2329-2388. doi: [10.1253/circj.CJ-19-0508](https://doi.org/10.1253/circj.CJ-19-0508)
- Vita T, Okada DR, Veillet-Chowdhury M**, et al. Complementary Value of Cardiac Magnetic Resonance Imaging and Positron Emission Tomography/Computed Tomography in the Assessment of Cardiac Sarcoidosis. *Circ Cardiovasc Imaging.* 2018 Jan;11(1):e007030. doi: [10.1161/CIRCIMAGING.117.007030](https://doi.org/10.1161/CIRCIMAGING.117.007030)
- Kawai H, Sarai M, Kato Y**, et al. Diagnosis of isolated cardiac sarcoidosis based on new guidelines. *ESC Heart Fail.* 2020 Oct;7(5):2662-2671. doi: [10.1002/ehf2.12853](https://doi.org/10.1002/ehf2.12853)
- Kirkil G, Lower EE, Baughman RP**. Predictors of Mortality in Pulmonary Sarcoidosis. *Chest.* 2018 Jan;153(1):105-113. doi: [10.1016/j.chest.2017.07.008](https://doi.org/10.1016/j.chest.2017.07.008)
- Kouranos V, Ward S, Kokosi MA**, et al. Mixed Ventilatory Defects in Pulmonary Sarcoidosis: Prevalence and Clinical Features. *Chest.* 2020 Nov;158(5):2007-2014. doi: [10.1016/j.chest.2020.04.074](https://doi.org/10.1016/j.chest.2020.04.074)
- Birnie DH, Sauer WH, Bogun F**, et al. HRS expert consensus statement on the diagnosis and management of arrhythmias associated with cardiac sarcoidosis. *Heart Rhythm.* 2014 Jul;11(7):1305-23. doi: [10.1016/j.hrthm.2014.03.043](https://doi.org/10.1016/j.hrthm.2014.03.043)
- Baughman RP, Valeyre D, Korsten P**, et al. ERS clinical practice guidelines on treatment of sarcoidosis. *Eur Respir J.* 2021 Dec 16;58(6):2004079. doi: [10.1183/13993003.04079-2020](https://doi.org/10.1183/13993003.04079-2020)
- Coulden RA, Sonnex EP, Abele JT, Crean AM**. Utility of FDG PET and Cardiac MRI in Diagnosis and Monitoring of Immunosuppressive Treatment in Cardiac Sarcoidosis. *Radiol Cardiothorac Imaging.* 2020 Aug 27;2(4):e190140. doi: [10.1148/ryct.2020190140](https://doi.org/10.1148/ryct.2020190140)
- Paramothayan NS, Lasserson TJ, Jones PW**. Corticosteroids for pulmonary sarcoidosis. *Cochrane Database Syst Rev.* 2005 Apr 18;2005(2):CD001114. doi: [10.1002/14651858.CD001114.pub2](https://doi.org/10.1002/14651858.CD001114.pub2)
- James DG, Carstairs LS, Trowell J, Sharma OP**. Treatment of sarcoidosis. Report of a controlled therapeutic trial. *Lancet.* 1967 Sep 9;2(7515):526-8. doi: [10.1016/s0140-6736\(67\)90493-x](https://doi.org/10.1016/s0140-6736(67)90493-x)
- Zaki MH, Lyons HA, Leilop L, Huang CT**. Corticosteroid therapy in sarcoidosis. A five-year, controlled follow-up study. *N Y State J Med.* 1987 Sep;87(9):496-9.
- Pietinalho A, Tukiainen P, Hahtela T, Persson T, Selroos O**; Finnish Pulmonary Sarcoidosis Study Group. Early treatment of stage II sarcoidosis improves 5-year pulmonary function. *Chest.* 2002 Jan;121(1):24-31. doi: [10.1378/chest.121.1.24](https://doi.org/10.1378/chest.121.1.24)
- Gottlieb JE, Israel HL, Steiner RM, Triolo J, Patrick H**. Outcome in sarcoidosis. The relationship of relapse to corticosteroid therapy. *Chest.* 1997 Mar;111(3):623-31. doi: [10.1378/chest.111.3.623](https://doi.org/10.1378/chest.111.3.623)
- Broos CE, Poell LHC, Looman CWN**, et al. No evidence found for an association between prednisone dose and FVC change in newly-treated pulmonary sarcoidosis. *Respir Med.* 2018 May;138S:S31-S37. doi: [10.1016/j.rmed.2017.10.022](https://doi.org/10.1016/j.rmed.2017.10.022)
- Baughman RP, Iannuzzi MC, Lower EE**, et al. Use of fluticasone in acute symptomatic pulmonary sarcoidosis. *Sarcoidosis Vasc Diffuse Lung Dis.* 2002 Oct;19(3):198-204.

23. **McKinzie BP, Bullington WM, Mazur JE, Judson MA.** Efficacy of short-course, low-dose corticosteroid therapy for acute pulmonary sarcoidosis exacerbations. *Am J Med Sci.* 2010 Jan;339(1):1-4. doi: [10.1097/MAJ.0b013e3181b97635](https://doi.org/10.1097/MAJ.0b013e3181b97635)
24. **Panselinas E, Judson MA.** Acute pulmonary exacerbations of sarcoidosis. *Chest.* 2012 Oct;142(4):827-836. doi: [10.1378/chest.12-1060](https://doi.org/10.1378/chest.12-1060)
25. **Khan NA, Donatelli CV, Tonelli AR, et al.** Toxicity risk from glucocorticoids in sarcoidosis patients. *Respir Med.* 2017 Nov;132:9-14. doi: [10.1016/j.rmed.2017.09.003](https://doi.org/10.1016/j.rmed.2017.09.003)
26. **Baughman RP, Scholand MB, Rahaghi FF.** Clinical phenotyping: role in treatment decisions in sarcoidosis. *Eur Respir Rev.* 2020 Mar 20;29(155):190145. doi: [10.1183/16000617.0145-2019](https://doi.org/10.1183/16000617.0145-2019)
27. **Cremers JP, Drent M, Bast A, et al.** Multinational evidence-based World Association of Sarcoidosis and Other Granulomatous Disorders recommendations for the use of methotrexate in sarcoidosis: integrating systematic literature research and expert opinion of sarcoidologists worldwide. *Curr Opin Pulm Med.* 2013 Sep 1;19(5):545-561. doi: [10.1097/MCP.0b013e3283642a7a](https://doi.org/10.1097/MCP.0b013e3283642a7a)
28. **Fang C, Zhang Q, Wang N, Jing X, Xu Z.** Effectiveness and tolerability of methotrexate in pulmonary sarcoidosis: A single center real-world study. *Sarcoidosis Vasc Diffuse Lung Dis.* 2019;36(3):217-227. doi: [10.36141/svdl.v36i3.8449](https://doi.org/10.36141/svdl.v36i3.8449)
29. **Vorselaars ADM, Wuyts WA, Vorselaars VMM, et al.** Methotrexate vs azathioprine in second-line therapy of sarcoidosis. *Chest.* 2013 Sep;144(3):805-812. doi: [10.1378/chest.12-1728](https://doi.org/10.1378/chest.12-1728)
30. **Müller-Quernheim J, Kienast K, Held M, Pfeifer S, Costabel U.** Treatment of chronic sarcoidosis with an azathioprine/prednisolone regimen. *Eur Respir J.* 1999 Nov;14(5):1117-22. doi: [10.1183/09031936.99.14511179](https://doi.org/10.1183/09031936.99.14511179)
31. **Sahoo DH, Bandyopadhyay D, Xu M, et al.** Effectiveness and safety of leflunomide for pulmonary and extrapulmonary sarcoidosis. *Eur Respir J.* 2011 Nov;38(5):1145-50. doi: [10.1183/09031936.00195010](https://doi.org/10.1183/09031936.00195010)
32. **Baughman RP, Lower EE.** Leflunomide for chronic sarcoidosis. *Sarcoidosis Vasc Diffuse Lung Dis.* 2004 Mar;21(1):43-8. doi: [10.1007/s11083-004-5178-y](https://doi.org/10.1007/s11083-004-5178-y)
33. **Bonnel RA, Graham DJ.** Peripheral neuropathy in patients treated with leflunomide. *Clin Pharmacol Ther.* 2004 Jun;75(6):580-5. doi: [10.1016/j.clpt.2004.01.016](https://doi.org/10.1016/j.clpt.2004.01.016)
34. **Raj R, Nugent K.** Leflunomide-induced interstitial lung disease (a systematic review). *Sarcoidosis Vasc Diffuse Lung Dis.* 2013 Nov 22;30(3):167-76.
35. **Melles RB, Marmor MF.** The Prevalence of Hydroxychloroquine Retinopathy and Toxic Dosing, and the Role of the Ophthalmologist in Reducing Both. *Am J Ophthalmol.* 2016 Oct;170:240. doi: [10.1016/j.ajo.2016.06.045](https://doi.org/10.1016/j.ajo.2016.06.045)
36. **Baughman RP, Lower EE.** Evidence-based therapy for cutaneous sarcoidosis. *Clin Dermatol.* May-Jun 2007;25(3):334-40. doi: [10.1016/j.clindermatol.2007.03.011](https://doi.org/10.1016/j.clindermatol.2007.03.011)
37. **Adams JS, Diz MM, Sharma OP.** Effective reduction in the serum 1,25-dihydroxyvitamin D and calcium concentration in sarcoidosis-associated hypercalcemia with short-course chloroquine therapy. *Ann Intern Med.* 1989 Sep 1;111(5):437-8. doi: [10.7326/0003-4819-111-5-437](https://doi.org/10.7326/0003-4819-111-5-437)
38. **Baltzan M, Mehta S, Kirkham TH, Cosio MG.** Randomized trial of prolonged chloroquine therapy in advanced pulmonary sarcoidosis. *Am J Respir Crit Care Med.* 1999 Jul;160(1):192-7. doi: [10.1164/ajrccm.160.1.9809024](https://doi.org/10.1164/ajrccm.160.1.9809024)
39. **Hamzeh N, Voelker A, Forssén A, et al.** Efficacy of mycophenolate mofetil in sarcoidosis. *Respir Med.* 2014 Nov;108(11):1663-9. doi: [10.1016/j.rmed.2014.09.013](https://doi.org/10.1016/j.rmed.2014.09.013)
40. **Moravan M, Segal BM.** Treatment of CNS sarcoidosis with infliximab and mycophenolate mofetil. *Neurology.* 2009 Jan 27;72(4):337-40. doi: [10.1212/01.wnl.0000341278.26993.22](https://doi.org/10.1212/01.wnl.0000341278.26993.22)
41. **Bitoun S, Bouvry D, Borie R, et al.** Treatment of neurosarcoidosis: A comparative study of methotrexate and mycophenolate mofetil. *Neurology.* 2016 Dec 13;87(24):2517-2521. doi: [10.1212/WNL.0000000000003431](https://doi.org/10.1212/WNL.0000000000003431)
42. **Baughman RP, Drent M, Kavuru M, et al.;** Sarcoidosis Investigators. Infliximab therapy in patients with chronic sarcoidosis and pulmonary involvement. *Am J Respir Crit Care Med.* 2006 Oct 1;174(7):795-802. doi: [10.1164/rccm.200603-402OC](https://doi.org/10.1164/rccm.200603-402OC)
43. **Rossmann MD, Newman LS, Baughman RP, et al.** A double-blinded, randomized, placebo-controlled trial of infliximab in subjects with active pulmonary sarcoidosis. *Sarcoidosis Vasc Diffuse Lung Dis.* 2006 Oct;23(3):201-8.
44. **Baughman RP, Judson MA, Lower EE, et al.;** Sarcoidosis Investigators. Infliximab for chronic cutaneous sarcoidosis: a subset analysis from a double-blind randomized clinical trial. *Sarcoidosis Vasc Diffuse Lung Dis.* 2016 Jan 15;32(4):289-95.
45. **Gelfand JM, Bradshaw MJ, Stern BJ, et al.** Infliximab for the treatment of CNS sarcoidosis: A multi-institutional series. *Neurology.* 2017 Nov 14;89(20):2092-2100. doi: [10.1212/WNL.0000000000004644](https://doi.org/10.1212/WNL.0000000000004644)
46. **Keane J, Gershon S, Wise RP, et al.** Tuberculosis associated with infliximab, a tumor necrosis factor alpha-neutralizing agent. *N Engl J Med.* 2001 Oct 11;345(15):1098-104. doi: [10.1056/NEJMoa011110](https://doi.org/10.1056/NEJMoa011110)
47. **Gilotra NA, Wand AL, Pillarisetty A, et al.** Clinical and Imaging Response to Tumor Necrosis Factor Alpha Inhibitors in Treatment of Cardiac Sarcoidosis: A Multicenter Experience. *J Card Fail.* 2021 Jan;27(1):83-91. doi: [10.1016/j.cardfail.2020.08.013](https://doi.org/10.1016/j.cardfail.2020.08.013)
48. **Minnis PA, Poland M, Keane MP, Donnelly SC.** Adalimumab for refractory pulmonary sarcoidosis. *Ir J Med Sci.* 2016 Nov;185(4):969-971. doi: [10.1007/s11845-015-1363-9](https://doi.org/10.1007/s11845-015-1363-9)
49. **Judson MA, Baughman RP, Costabel U, et al.** Safety and efficacy of ustekinumab or golimumab in patients with chronic sarcoidosis. *Eur Respir J.* 2014 Nov;44(5):1296-307. doi: [10.1183/09031936.00000914](https://doi.org/10.1183/09031936.00000914)

50. **Park MK, Fontana Jr, Babaali H**, et al. Steroid-sparing effects of pentoxifylline in pulmonary sarcoidosis. *Sarcoidosis Vasc Diffuse Lung Dis*. 2009 Jul;26(2):121-31.
51. **Baughman RP, Judson MA, Culver DA**, et al. Roflumilast (Daliresp®) to reduce acute pulmonary events in fibrotic sarcoidosis: a multi-center, double blind, placebo controlled, randomized clinical trial. *Sarcoidosis Vasc Diffuse Lung Dis*. 2021;38(3):e2021035. doi: [10.36141/svdl.v38i3.11684](https://doi.org/10.36141/svdl.v38i3.11684)
52. **Baughman RP, Judson MA, Ingledue R, Craft NL, Lower EE**. Efficacy and safety of apremilast in chronic cutaneous sarcoidosis. *Arch Dermatol*. 2012 Feb;148(2):262-4. doi: [10.1001/archdermatol.2011.301](https://doi.org/10.1001/archdermatol.2011.301)
53. **Sweiss NJ, Lower EE, Mirsaeidi M**, et al. Rituximab in the treatment of refractory pulmonary sarcoidosis. *Eur Respir J*. 2014 May;43(5):1525-8. doi: [10.1183/09031936.00224513](https://doi.org/10.1183/09031936.00224513)
54. **Drake WP, Culver DA, Baughman RP**, et al. Phase II Investigation of the Efficacy of Antimycobacterial Therapy in Chronic Pulmonary Sarcoidosis. *Chest*. 2021 May;159(5):1902-1912. doi: [10.1016/j.chest.2020.12.027](https://doi.org/10.1016/j.chest.2020.12.027)
55. **Baughman RP, Sweiss N, Keijsers R**, et al. Repository corticotropin for Chronic Pulmonary Sarcoidosis. *Lung*. 2017 Jun;195(3):313-322. doi: [10.1007/s00408-017-9994-4](https://doi.org/10.1007/s00408-017-9994-4)
56. **Friedman MA, Le B, Stevens J**, et al. Tofacitinib as a Steroid-Sparing Therapy in Pulmonary Sarcoidosis, an Open-Label Prospective Proof-of-Concept Study. *Lung*. 2021 Apr;199(2):147-153. doi: [10.1007/s00408-021-00436-8](https://doi.org/10.1007/s00408-021-00436-8)
57. **Ungrasert P, Wetter DA, Crowson CS, Matteson EL**. Epidemiology of cutaneous sarcoidosis, 1976-2013: a population-based study from Olmsted County, Minnesota. *J Eur Acad Dermatol Venereol*. 2016 Oct;30(10):1799-1804. doi: [10.1111/jdv.13760](https://doi.org/10.1111/jdv.13760)
58. **Jones E, Callen JP**. Hydroxychloroquine is effective therapy for control of cutaneous sarcoïdal granulomas. *J Am Acad Dermatol*. 1990 Sep;23(3 Pt 1):487-9. doi: [10.1016/0190-9622\(90\)70246-e](https://doi.org/10.1016/0190-9622(90)70246-e)
59. **Judson MA, Baughman RP, Costabel U**, et al.; Centocor T48 Sarcoidosis Investigators. Efficacy of infliximab in extrapulmonary sarcoidosis: results from a randomised trial. *Eur Respir J*. 2008 Jun;31(6):1189-96. doi: [10.1183/09031936.00051907](https://doi.org/10.1183/09031936.00051907)
60. **Droitcourt C, Rybojad M, Porcher R**, et al. A randomized, investigator-masked, double-blind, placebo-controlled trial on thalidomide in severe cutaneous sarcoidosis. *Chest*. 2014 Oct;146(4):1046-1054. doi: [10.1378/chest.14-0015](https://doi.org/10.1378/chest.14-0015)
61. **Baughman RP, Lower EE, Ingledue R, Kaufman AH**. Management of ocular sarcoidosis. *Sarcoidosis Vasc Diffuse Lung Dis*. 2012 Mar;29(1):26-33. PMID: 23311120.
62. **Baughman RP, Papanikolaou I**. Current concepts regarding calcium metabolism and bone health in sarcoidosis. *Curr Opin Pulm Med*. 2017 Sep;23(5):476-481. doi: [10.1097/MCP.0000000000000400](https://doi.org/10.1097/MCP.0000000000000400)
63. **Kazmirczak F, Chen KA, Adabag S**, et al. Assessment of the 2017 AHA/ACC/HRS Guideline Recommendations for Implantable Cardioverter-Defibrillator Implantation in Cardiac Sarcoidosis. *Circ Arrhythm Electrophysiol*. 2019 Sep;12(9):e007488. doi: [10.1161/CIRCEP.119.007488](https://doi.org/10.1161/CIRCEP.119.007488)
64. **Al-Khatib SM, Stevenson WG, Ackerman MJ**, et al. 2017 AHA/ACC/HRS Guideline for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. *J Am Coll Cardiol*. 2018 Oct 2;72(14):e91-e220. doi: [10.1016/j.jacc.2017.10.054](https://doi.org/10.1016/j.jacc.2017.10.054)
65. **Towbin JA, McKenna WJ**, et al. 2019 HRS expert consensus statement on evaluation, risk stratification, and management of arrhythmogenic cardiomyopathy. *Heart Rhythm*. 2019 Nov;16(11):e301-e372. doi: [10.1016/j.hrthm.2019.05.007](https://doi.org/10.1016/j.hrthm.2019.05.007)
66. **Jefic D, Joel B, Good E**, et al. Role of radiofrequency catheter ablation of ventricular tachycardia in cardiac sarcoidosis: report from a multicenter registry. *Heart Rhythm*. 2009 Feb;6(2):189-95. doi: [10.1016/j.hrthm.2008.10.039](https://doi.org/10.1016/j.hrthm.2008.10.039)
67. **Padala SK, Peaslee S, Sidhu MS, Steckman DA, Judson MA**. Impact of early initiation of corticosteroid therapy on cardiac function and rhythm in patients with cardiac sarcoidosis. *Int J Cardiol*. 2017 Jan 15;227:565-570. doi: [10.1016/j.ijcard.2016.10.101](https://doi.org/10.1016/j.ijcard.2016.10.101)
68. **Yazaki Y, Isobe M, Hiroe M**, et al; Central Japan Heart Study Group. Prognostic determinants of long-term survival in Japanese patients with cardiac sarcoidosis treated with prednisone. *Am J Cardiol*. 2001 Nov 1;88(9):1006-10. doi: [10.1016/s0002-9149\(01\)01978-6](https://doi.org/10.1016/s0002-9149(01)01978-6)
69. **Chapelon-Abric C, de Zuttere D, Duhaut P**, et al. Cardiac sarcoidosis: a retrospective study of 41 cases. *Medicine (Baltimore)*. 2004 Nov;83(6):315-334. doi: [10.1097/01.md.0000145367](https://doi.org/10.1097/01.md.0000145367)
70. **Zhou Y, Lower EE, Li HP, Costea A, Attari M, Baughman RP**. Cardiac Sarcoidosis: The Impact of Age and Implanted Devices on Survival. *Chest*. 2017 Jan;151(1):139-148. doi: [10.1016/j.chest.2016.08.1457](https://doi.org/10.1016/j.chest.2016.08.1457)
71. **Nagai S, Yokomatsu T, Tanizawa K**, et al. Treatment with methotrexate and low-dose corticosteroids in sarcoidosis patients with cardiac lesions. *Intern Med*. 2014;53(23):2761. doi: [10.2169/internalmedicine.53.3120](https://doi.org/10.2169/internalmedicine.53.3120).
72. **Rosenthal DG, Parwani P, Murray TO**, et al. Long-Term Corticosteroid-Sparing Immunosuppression for Cardiac Sarcoidosis. *J Am Heart Assoc*. 2019 Sep 17;8(18):e010952. doi: [10.1161/JAHA.118.010952](https://doi.org/10.1161/JAHA.118.010952)
73. **Griffin JM, Chasler J, Wand AL**, et al. Management of Cardiac Sarcoidosis Using Mycophenolate Mofetil as a Steroid-Sparing Agent. *J Card Fail*. 2021 Dec;27(12):1348-1358. doi: [10.1016/j.cardfail.2021.06.010](https://doi.org/10.1016/j.cardfail.2021.06.010)

74. **Baker MC, Sheth K, Witteles R, Genovese MC, Shoor S, Simard JF.** TNF-alpha inhibition for the treatment of cardiac sarcoidosis. *Semin Arthritis Rheum.* 2020 Jun;50(3):546-552. doi: [10.1016/j.semarthrit.2019.11.004](https://doi.org/10.1016/j.semarthrit.2019.11.004)
75. **Ballul T, Borie R, Crestani B,** et al. Treatment of cardiac sarcoidosis: A comparative study of steroids and steroids plus immunosuppressive drugs. *Int J Cardiol.* 2019 Feb 1;276:208-211. doi: [10.1016/j.ijcard.2018.11.131](https://doi.org/10.1016/j.ijcard.2018.11.131)
76. **Gupta R, Judson MA, Baughman RP.** Management of Advanced Pulmonary Sarcoidosis. *Am J Respir Crit Care Med.* 2021 Nov 23. doi: [10.1164/rccm.202106-1366CI](https://doi.org/10.1164/rccm.202106-1366CI). Online ahead of print.
77. **Shlobin OA, Kouranos V, Barnett SD,** et al. Physiological predictors of survival in patients with sarcoidosis-associated pulmonary hypertension: results from an international registry. *Eur Respir J.* 2020 May 14;55(5):1901747. doi: [10.1183/13993003.01747-2019](https://doi.org/10.1183/13993003.01747-2019)
78. **Abston E, Moll M, Hon S, Govender P, Berman J, Farber H.** Long-term outcomes of epoprostenol therapy in sarcoid associated pulmonary hypertension. *Sarcoidosis Vasc Diffuse Lung Dis.* 2020;37(2):184-191. doi: [10.36141/svld.v37i2.9150](https://doi.org/10.36141/svld.v37i2.9150)
79. **Abston E, Hon S, Lawrence R, Berman J, Govender P, Farber HW.** Treatment of newly diagnosed sarcoid-associated pulmonary hypertension with ambrisentan and tadalafil combination therapy. *Sarcoidosis Vasc Diffuse Lung Dis.* 2020;37(2):234-238. doi: [10.36141/svld.v37i2.9343](https://doi.org/10.36141/svld.v37i2.9343)
80. **Baughman RP, Culver DA, Cordova FC,** et al. Bosentan for sarcoidosis-associated pulmonary hypertension: a double-blind placebo controlled randomized trial. *Chest.* 2014 Apr;145(4):810-817. doi: [10.1378/chest.13-1766](https://doi.org/10.1378/chest.13-1766)
81. **Baughman RP, Shlobin OA, Gupta R,** et al. Riociguat for Sarcoidosis-Associated Pulmonary Hypertension: Results of a 1-Year Double-Blind, Placebo-Controlled Trial. *Chest.* 2021 Aug 4:S0012-3692(21)03613-8. doi: [10.1016/j.chest.2021.07.2162](https://doi.org/10.1016/j.chest.2021.07.2162)
82. **Le Pavec J, Valeyre D, Gazengel P,** et al. Lung transplantation for sarcoidosis: outcome and prognostic factors. *Eur Respir J.* 2021 Aug 5;58(2):2003358. doi: [10.1183/13993003.03358-2020](https://doi.org/10.1183/13993003.03358-2020)
83. **Flaherty KR, Wells AU, Cottin V,** et al.; INBUILD trial investigators. Nintedanib in progressive interstitial lung diseases: data from the whole INBUILD trial. *Eur Respir J.* 2021 Sep 2:2004538. doi: [10.1183/13993003.04538-2020](https://doi.org/10.1183/13993003.04538-2020). Online ahead of print.
84. **Fritz D, van de Beek D, Brouwer MC.** Clinical features, treatment and outcome in neurosarcoidosis: systematic review and meta-analysis. *BMC Neurol.* 2016 Nov 15;16(1):220. doi: [10.1186/s12883-016-0741-x](https://doi.org/10.1186/s12883-016-0741-x)
85. **Joubert B, Chapelon-Abrie C, Biard L,** et al. Association of Prognostic Factors and Immunosuppressive Treatment With Long-term Outcomes in Neurosarcoidosis. *JAMA Neurol.* 2017 Nov 1;74(11):1336-1344. doi: [10.1001/jamaneurol.2017.2492](https://doi.org/10.1001/jamaneurol.2017.2492)
86. **Lower EE, Broderick JP, Brott TG, Baughman RP.** Diagnosis and management of neurological sarcoidosis. *Arch Intern Med.* 1997 Sep 8;157(16):1864-8. PMID: 9290546.
87. **Cohen Aubart F, Bouvry D, Galanaud D,** et al. Long-term outcomes of refractory neurosarcoidosis treated with infliximab. *J Neurol.* 2017 May;264(5):891-897. doi: [10.1007/s00415-017-8444-9](https://doi.org/10.1007/s00415-017-8444-9)
88. **Naz I, Ozalevli S, Ozkan S, Sahin H.** Efficacy of a Structured Exercise Program for Improving Functional Capacity and Quality of Life in Patients With Stage 3 and 4 Sarcoidosis: A RANDOMIZED CONTROLLED TRIAL. *J Cardiopulm Rehabil Prev.* 2018 Mar;38(2):124-130. doi: [10.1097/HCR.0000000000000307](https://doi.org/10.1097/HCR.0000000000000307)
89. **Wallaert B, Kyheng M, Labreuche J, Stelianides S, Wemeau L, Grosbois JM.** Long-term effects of pulmonary rehabilitation on daily life physical activity of patients with stage IV sarcoidosis: A randomized controlled trial. *Respir Med Res.* 2020 Mar;77:1-7. doi: [10.1016/j.resmer.2019.10.003](https://doi.org/10.1016/j.resmer.2019.10.003)
90. **Karadalli MN, Boşnak-Güçlü M, Camcıoğlu B, Kakturk N, Türkteş H.** Effects of Inspiratory Muscle Training in Subjects With Sarcoidosis: A Randomized Controlled Clinical Trial. *Respir Care.* 2016 Apr;61(4):483-94. doi: [10.4187/respcare.04312](https://doi.org/10.4187/respcare.04312)
91. **Lower EE, Harman S, Baughman RP.** Double-blind, randomized trial of dexmethylphenidate hydrochloride for the treatment of sarcoidosis-associated fatigue. *Chest.* 2008 May;133(5):1189-95. doi: [10.1378/chest.07-2952](https://doi.org/10.1378/chest.07-2952)
92. **Lower EE, Malhotra A, Surdulescu V, Baughman RP.** Armodafinil for sarcoidosis-associated fatigue: a double-blind, placebo-controlled, crossover trial. *J Pain Symptom Manage.* 2013 Feb;45(2):159-69. doi: [10.1016/j.jpainsymman.2012.02.016](https://doi.org/10.1016/j.jpainsymman.2012.02.016)
93. **Vis R, van de Garde EMW, Meek B, Korenromp IHE, Grutters JC.** Randomised, placebo-controlled trial of dexamethasone for quality of life in pulmonary sarcoidosis. *Respir Med.* 2020 Apr-May;165:105936. doi: [10.1016/j.rmed.2020.105936](https://doi.org/10.1016/j.rmed.2020.105936)
94. **Tavee J, Culver D.** Sarcoidosis and small-fiber neuropathy. *Curr Pain Headache Rep.* 2011 Jun;15(3):201-6. doi: [10.1007/s11916-011-0180-8](https://doi.org/10.1007/s11916-011-0180-8)
95. **Tavee JO, Karwa K, Ahmed Z, Thompson N, Parambil J, Culver DA.** Sarcoidosis-associated small fiber neuropathy in a large cohort: Clinical aspects and response to IVIG and anti-TNF alpha treatment. *Respir Med.* 2017 May;126:135-138. doi: [10.1016/j.rmed.2017.03.011](https://doi.org/10.1016/j.rmed.2017.03.011)

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