

Sarcoidosis: Beyond First Line Therapy

ECHO Didactic Series

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The Challenge

- The challenge is to differentiate those patients who need treatment from those who do not
- We do not cure, only put it at bay
- Main goal of treatment should be to improve quality of life or symptoms
- Prevent harm



Treatment Indications: Pulmonary Sarcoid

- Worsening symptoms
- Deterioration in pulmonary function on serial testing
 - decline in TLC $\geq 10\%$
 - FVC $\geq 15\%$
 - DLCO $\geq 20\%$, worsening gas exchange
- Progression in radiograph, evidence of fibrosis
- Signs of pulmonary hypertension



Treatment Indications: Extrapulmonary Sarcoid

- Cardiac disease
- Neurologic disease
- Ocular disease refractory to topical therapy
- Severe constitutional symptoms
- Disfiguring skin disease
- Hypercalcemia
- Renal sarcoid



Treatment Since 1960s

- No agent has been approved for treatment of sarcoidosis
- Prednisone 0.5-1.0 mg/kg IBW (20-40 mg) for 1-3 months, reassess, taper over several months and plan on 6-12 months of treatment
- Relapse rate is high
- Among those who are treated, >50% will need treatment in the future



Summary Steroids

Main conclusions:

- Steroid treatment may relieve dyspnea, but only in the minority
- Prolonged treatment with corticosteroids appears to modify the course of progressive pulmonary sarcoidosis
- Steroid treatment does not increase the chance of complete remission



Steroid Sparing Agents/Alternative Agents

- Methotrexate (refractory sarcoid, ocular)
- Imuran (refractory disease)
- Plaquenil (skin disease, hypercalcemia)
- Cytoxan (refractory dz, neurologic dz)
- NSAIDS (E. nodosum)
- Ketoconazole (hypercalcemia)
- Minocycline (skin disease)
- Thalidomide (STEPS)
- Leflunomide (prevents de novo synthesis of pyrimidines and inhibits T cell proliferation)
- TNF- α inhibitors



Infliximab

- TNF- α antagonist – human murine chimeric Ab to TNF- α
- TNF- α plays a critical role in the granulomatous inflammation
- Elevated in patients with sarcoid

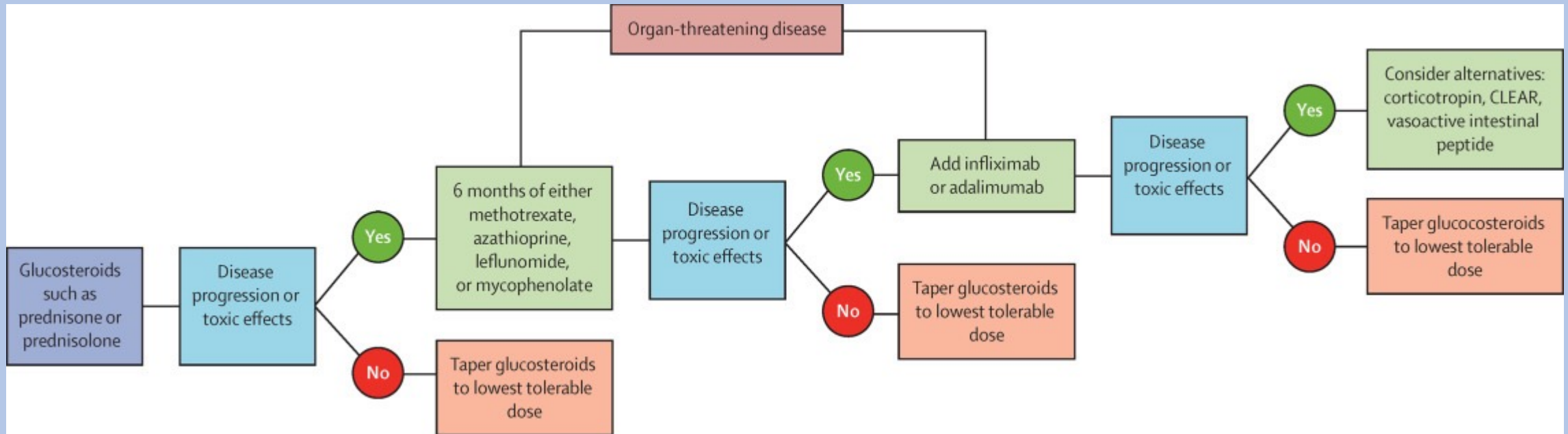


Infliximab Therapy in Patients with Chronic Sarcoidosis and Pulmonary Involvement

- 138 patients randomized to 3 or 5 mg/kg Infliximab or placebo given on weeks 0, 2, 6, 12, 18, and 24, followed through 52 wks
- Primary endpoint was change from baseline to 24 wks in % predicted FVC
- Infliximab - FVC increased by 2.5% v. no increase in placebo (p=0.038)
- Benefited those with more symptoms, worse baseline FVC, and longer disease duration most



Proposed Algorithm



ACTHAR GEL

- Purified preparation of ACTH
- FDA approved in 1952, in 1954 for sarcoid
- Stimulates the adrenal cortex to release glucocorticoids
- Directly stimulates melanocortin receptors on T lymphocytes and macrophages
- May have suppressive effects beyond cortisol stimulation



Repository Corticotropin

- Chronic sarcoid patients (n=18) on prednisone with decline of 5% in FVC
- 80 units daily for 10 days SC
- 40 v. 80 units SC twice weekly 24 wks
- At 24 weeks, 8 pts in each arm



Repository Corticotropin

- Primary: Both doses resulted in **significant fall in prednisone dose**
- Secondary:
 - No change in FEV1 or FVC
 - **Significant rise in DLCO % pred at 24 weeks** for both doses
 - No change in 6 MWD
- Imaging: 1 worse, 9 same, 5 better
- PET: Significant fall in SUV of highest lung lesion but no clinical correlation



Infection and Sarcoid

- Mycobacterial nucleic acid found in 26% of sarcoid tissues
- MTB DNA found in 38% tissue biopsies
- Propionibacterium acnes has been cultured from up to 78% of sarcoid samples



CLEAR

- Antimicrobial therapy has immunomodulatory effects
- Concomitant levofloxacin, ethambutol, azithromycin, and rifampin
- Reduction in size of lesions and granuloma burden in cutaneous disease



CLEAR: Pulmonary Sarcoid

- Phase II, double blind, placebo-controlled trial
- CLEAR v. placebo x 16 weeks + current care
- **No change in FVC compared with placebo**
- **No change in 6 MWD**
- SGRQ score favored placebo
- Significant decline in ESAT-6 immune responses (Ag secreted by mycobacteria)



Efzofitimod

- A fusion protein comprised of the immunomodulatory domain of **histidyl-tRNA synthetase** fused to the Fc region of a human antibody
- A selective modulator of **neuropilin-2 (NRP2)** that downregulates innate and adaptive immune response in inflammatory disease states
- NRP2 is expressed in neutrophils, dendritic cells, macrophages, including alveolar macrophages, T cells, and B cells



Efzofitimod

- Neuropilin-2 (NRP2) is a cell surface receptor that plays a key role in **lymphatic development** and in regulating inflammatory responses
- NRP2 can bind to multiple ligands and co-receptors to influence various cellular functions such as:
 - type 3 semaphorins and plexins to impact **inflammation and neural development**
 - forms of vascular endothelial growth factor (VEGF) and their receptors, especially VEGF-C and VEGFR3, which are centrally involved in **lymphangiogenesis**



Efzofitimod

- NRP2 expression is upregulated on target immune cells during inflammation (sarcoid granulomas)
- Prevented inflammation and fibrosis in multiple animal models of ILD
- Mediates T cell responses and prevents granuloma formation *in vitro*
- It may play important roles in migration, phagocytosis and efferocytosis, and cell-to-cell interactions



Phase 1b/2a study

- Multiple-ascending dose, double-blind, placebo-controlled study in 37 patients with pulmonary sarcoidosis
- Designed to evaluate the safety, tolerability, immunogenicity and pharmacokinetic profile of multiple doses of ATYR1923 compared to placebo
- Preliminary efficacy measures including **steroid sparing effect, measures of lung function and potential disease biomarkers**



Efzofitimod

- Outcome data showed the highest dose (5 mg/kg) led to significant improvements in **lung function**, as well as **reduced shortness of breath, cough, and fatigue**, compared to a placebo
- At all three doses tested, efzofitimod was well tolerated and safe
- Efzofitimod lowered the use of corticosteroids by 58%
- 33% of patients at the highest efzofitimod arm were able to taper off steroids completely



EFZO-FIT-Phase 3

- One-year **EFZO-FIT** multi-center, international study intends to enroll 264 patients with pulmonary sarcoidosis
- Participants will be assigned randomly to receive either 3.0 mg/kg or 5.0 mg/kg doses of efzofitimod, or placebo, administered IV monthly for a total of 12 doses
- Primary outcomes will be the effect on **corticosteroid use**
- Secondary objectives include changes in lung function (**FVC**) and other sarcoid symptoms
- FDA – Orphan Drug Status
- August 2022 – Fast Track Designation Status

