Autoimmune Diseases

Goals and Objectives

Course Description
"Autoimmune Diseases" is an online recorded video of a previously presented live CE webinar for physical therapists and physical therapist assistants. This course presents contemporary information about four of the most common autoimmune diseases: type 1 diabetes, multiple sclerosis, rheumatoid arthritis, and systemic lupus erythematosus. This course includes discussion of pathophysiology, etiology, clinical presentation, and medical management strategies.

Course Rationale
The purpose of this course is to provide participants with contemporary information about four of the most common autoimmune diseases. Occupational therapy professionals can use this information to develop and implement effective treatment programs that address the specific needs of individuals effected by these disorders.

Course Goals and Objectives
Upon completion of this course, participants will be able to:
1. Compare normal and dysfunctional immune system functioning.
2. Distinguish the primary mechanisms of tissue damage in autoimmune disease.
3. Identify etiological factors contributing to the development of autoimmune disease.
4. Differentiate organ and system specific autoimmune diseases.
5. Identify the immunologic mechanisms contributing to multiple sclerosis, type 1 diabetes, rheumatoid arthritis, and systemic lupus erythematosus.
6. Define the clinical presentation of common autoimmune conditions.
7. Identify therapeutic considerations for common autoimmune conditions.
8. Identify pharmacological trends for common autoimmune conditions.
9. Identify other common autoimmune diseases and comorbidities.
10. Identify emerging trends in the management of autoimmune diseases.

Course Provider – Innovative Educational Services

Provider Contact Information – information@cheapceus.com

Course Instructor – Jodi Gootkin, PT, Med, CEAS

Financial/Non-financial Disclosure - Neither the Provider nor the instructor have any financial or non-financial conflict of interest related to the presentation of this CE program.

Target Audience – Physical Therapists, Physical Therapist Assistants

Course Educational Level – This course is applicable for introductory learners.

Course Prerequisites – None

Instructional Method – Distance Learning – Independent; Asynchronous online video-based home study

Location - Cheapceus.com

Date – Continuously available on-demand

PD Activity Completion Requirements / Criteria for Issuance of CE Credits – Completion of viewing of 1 hour recorded video, and a score of 70% correct or greater on the course post-test.

Continuing Education Credits – Three (3) contact hours

Course Fee - $34.95

Registration Information – No pre-registration required; available on-demand at Cheapceus.com

Special Needs Requests – Email: information@cheapceus.com or phone: 954-663-4101

Cancellation by the Learner – Learners may cancel their participation at any time and receive a full refund of all paid fees.

Cancellation by the Provider – Registrants for the cancelled activity will be contacted by an IES staff member via phone call or email within 12 hours of the cancellation decision. If the decision to cancel is made less than 14 hours prior to the event, each participant will be contacted no later than 2 hours prior to the scheduled start time of the activity. Registrants will receive a full refund if an activity is cancelled by the Provider. The refund will be processed back to the Registrant within 12 hours of the cancellation.

Complaint Resolution – Please call 954-663-4101 (24 hours/day, 7 days/week) to speak with a live customer service agent. Our goal is to work with our customers to resolve all issues to the customer's satisfaction with just one phone call whenever possible.

Refund Policy - Unrestricted 100% refund upon request. The request for a refund by the learner shall be honored in full without penalty or other consideration of any kind. The request for a refund may be made by the learner at any time without limitations before, during, or after course participation.

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Autoimmune Diseases

Presented By:
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Course Overview

- "Autoimmune Diseases" presents contemporary information about four of the most common autoimmune diseases: type 1 diabetes, multiple sclerosis, rheumatoid arthritis, and systemic lupus erythematosus. This course includes discussion of pathophysiology, etiology, clinical presentation, pharmacological management and therapeutic considerations for patients with these diagnoses.

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Course Rationale

The purpose of this course is to provide participants with contemporary information about four of the most common autoimmune diseases. Rehabilitation professionals can use this information when implementing their treatment programs to address the specific needs of individuals effected by these disorders.

3

4

Goals and Objectives

1. Compare normal and dysfunctional immune system functioning.
2. Distinguish the primary mechanisms of tissue damage in autoimmune disease.
3. Identify etiological factors contributing to the development of autoimmune disease.
4. Differentiate organ and system specific autoimmune diseases.
5. Identify the immunologic mechanisms contributing to multiple sclerosis, type 1 diabetes, rheumatoid arthritis, and systemic lupus erythematosus.
6. Describe the clinical presentation of common autoimmune conditions.
7. Identify therapeutic considerations for common autoimmune conditions.
8. Identify pharmacological trends for common autoimmune conditions.
9. Identify emerging trends in the management of autoimmune diseases.
10. Identify contemporary dietary considerations in the management of autoimmune diseases.

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Disclaimer

Application of concepts presented in this webinar is at the discretion of the individual participant in accordance with federal, state, and professional regulations.

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Course Outline and Schedule

Topic	Time
The Healthy Immune System	0:00-0:10
Immune System Dysfunction	0:11-0:15
Etiology of Autoimmune Disease	0:16-0:20
Genetic Susceptibility	0:21-0:30
Environmental Factors	0:31-0:35
Rheumatoid Arthritis	0:36-0:40
Pathophysiology/Clinical Presentation	0:41-0:45
Medical Management	0:46-0:50
Interactive Discussion of Clinical Applications	**0:51-0:60**
Rheumatoid Arthritis	1:00-1:05
Rehabilitation Considerations	1:06-1:15
Pharmacological Management	1:16-1:25
Systemic Lupus Erythematosus	1:26-1:30
Pathophysiology/Clinical Presentation	1:31-1:35
Medical Management	1:36-1:40
Rehabilitation Considerations	1:41-1:45
Type I Diabetes Mellitus Pathophysiology	1:46-1:50
Interactive Discussion of Clinical Applications	**1:51-2:00**
Type I Diabetes Mellitus	2:01-2:05
Clinical Presentation	2:06 -2:10
Medical Management	2:11-2:15
Research Advances	2:16-2:20
Multiple Sclerosis	2:21-2:25
Pathophysiology/Clinical Presentation	2:26-2:30
Medical Management/Rehab Considerations	2:31-2:35
Research Advances	2:36-2:45
Autoimmune Disease Dietary Considerations	2:46-2:50
Interactive Discussion of Clinical Applications	**2:51-3:00**

Consider This

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How To Obtain CEUs For This Course

7

- After watching the video go to www.cheapceus.com
- Complete the post test with score of at least 70%
  - May be retaken multiple times
- Submit online payment for course
- Print certificate
- Course review and summary for post test at the end of the webinar.

Consider This

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Healthy Immune System

8

- Humeral Immunity: B-cells recognize antigens attacking them and retaining memory with antibodies engaging for protection with subsequent exposure.
- Cellular Immunity: T-cells promote long term immunity through
  - Cytotoxic T-cells disrupt cell membrane, target cell's DNA, and to destroy invading cells
  - Regulator T-cells (Tregs) inhibit T and B cells to prevent self injury and maintain tolerance

8

Immune System

9

- Collectively, autoimmune diseases are among the most prevalent diseases in the US, affecting more than 23.5 million Americans.

9

Self-tolerance

10

- A complex network protects against foreign agents (antigens) and removes apoptotic cells.
- The sophisticated process itself does not induce an immune response as the body recognizes its own tissues which is referred to as self-tolerance.

10

Immune System Dysfunction

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Hypersensitivity
- Allergic reaction

Immunodeficiency
- Immune system unable to suppress foreign antigens

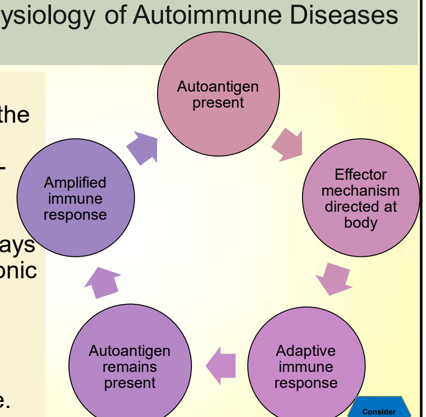
Autoimmune Disease
- Loss of self-tolerance causes an amplified autoimmune response
- Autoantigens – normal tissue that is targeted by humeral or cell-mediated immune response

Consider This

Pathophysiology of Autoimmune Diseases

12

- Without elimination of the stimulating antigen, a self-perpetuating response of effector pathways leads to a chronic inflammatory immune-mediated response and tissue damage.



Consider This

Etiology of Autoimmune Diseases

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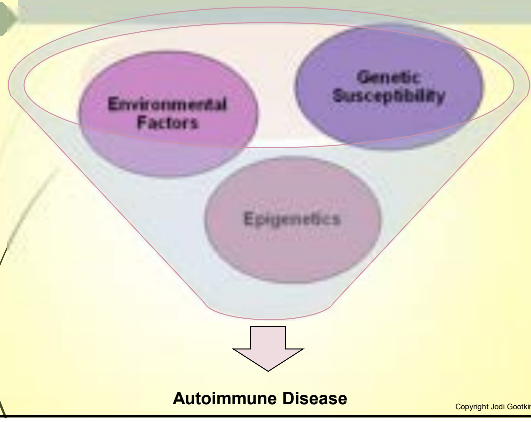

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Genetic Susceptibility

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- Major Histocompatibility Complex (MHC) specifically the Human Leukocyte Antigen (HLA) genes supply the instructions for synthesis of critical immune system proteins.
- Alterations appear to create T-cell dysfunction allowing them to becoming more autoimmune reactive.
- Genetic mapping has noted specific genetic variants that predispose individuals to multiple autoimmune diseases suggesting common pathogenesis.

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Female Predisposition

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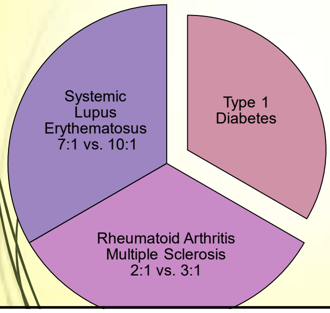
- A significant gender bias exists in the prevalence of autoimmune disease with 65% - 80% of those effected being female.



Liu, K., Kurien, B. T., Zimmerman, S. L., Kaufman, K. M., Taft, D. H., Kottyan, L. C., ... & Chodosh, J. (2016). X chromosome dose and sex bias in autoimmune diseases: Increased prevalence of 47, XXX in systemic lupus erythematosus and sjögren's syndrome. *Arthritis & Rheumatology*, *68*(5), 1290-1300.
Ortona, E., Pierdominici, M., Maselli, A., Veroni, C., Aloisi, F., & Shoenfeld, Y. (2016). Sex-based differences in autoimmune diseases. *Annali dell'Istituto Superiore di Sanità*, *52*(2), 205-212.

15

Female Predisposition Continued

16

- Immune cells contain receptors for estrogens, progesterone, androgens and prolactin that influence their functioning.

Estrogens	Testosterone and Progesterone
Enhance immunity	Immunosuppressive
Exacerbate autoimmunity	Protect against self-attack

- During early female embryogenesis, one of the two X chromosomes is silenced but some immune related genes may escape inactivation allowing overexpression of autoantigens.

Ortona, E., Pierdominici, M., Maselli, A., Veroni, C., Aloisi, F., & Shoenfeld, Y. (2016). Sex-based differences in autoimmune diseases. *Annali dell'Istituto Superiore di Sanità*, *52*(2), 205-212.
Chitnis, S., Monteiro, J., Glass, D., Apatoff, B., Salmon, J., Concannon, P., & Gregersen, P. K. (2000). The role of X-chromosome inactivation in female predisposition to autoimmunity. *Arthritis Research*, *2*(5), 399–406.

16

Epigenetics

17

- Emerging research is identifying the processes that help direct when individual genes are turned on or off.
- These influence cellular function without altering the DNA and may be triggered by environmental influences.

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Environmental Factors

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- Specific triggers may activate genes with the development autoantibodies initiating the pathologic process.
  - Food additives
  - UV exposure
  - Infectious agents
  - Chemical toxins
  - Tobacco smoke
  - Stress

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Food Additives

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- The gut contains a significant proportion of the body's immune cells with the intestinal microbiota playing a role in immune homeostasis.
- The tight mucosal intercellular junctions balance regulatory and effector T-cell action in response to antigens.
- Diet can substantially effect this equilibrium and structure which in turn increases proinflammatory cytokines, reduced Tregs responsiveness, and susceptibility to autoimmune inflammation.

Campbell, A. W. (2014). Autoimmunity and the Gut. *Autoimmune Diseases*, *2014*, 152428. http://doi.org/10.1155/2014/152428

19

Food Additives Continued

20

- Certain food additives increase the intestinal mucosal permeability allowing exposure to foreign immunogenic antigens that trigger the autoimmune cascade.
  - Glucose
  - Salt
  - Emulsifiers
  - Gluten
  - Transglutaminase
  - Nanoparticles

Lerner, A., & Matthias, T. (2015). Changes in intestinal tight junction permeability associated with industrial food additives explain the rising incidence of autoimmune disease. *Autoimmunity Reviews*, *14*(6), 479-489.

20

Vitamin D Deficiency

21

- Vitamin D receptors (VDR) on target organs allow mineral metabolism which contributes an immune modulating effect to the body.
- Mutations on the VDR gene that encode the receptors is associated autoimmune disease.
- It is proposed that the resultant low levels of Vitamin D are a causative factor in the development of autoimmune disease.

National Center for Biotechnology Information. (2017) VDR Vitamin D receptor [Homo sapiens (human)] Gene ID: 7421 Updated Sept 17, 2017. https://www.ncbi.nlm.nih.gov/gene/7421#summary
Hayes, C. E., Hubler, S. L., Moore, J. R., Barta, L. E., Praska, C. E., & Nashold, F. E. (2015). Vitamin D actions on CD4+ T cells in autoimmune disease. *Frontiers in Immunology*, *6*, 100.

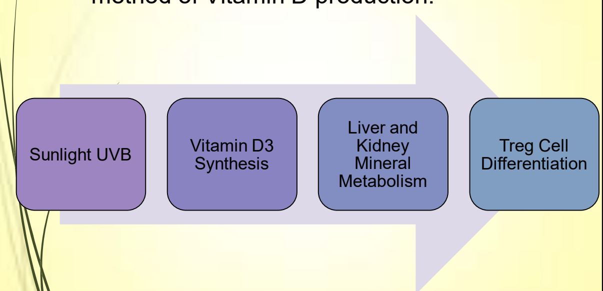
Consider This

21

Vitamin D Deficiency Continued

22

- Ultraviolet light exposure is the primary method of Vitamin D production.



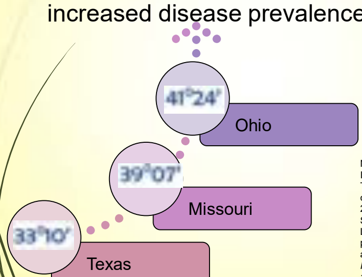
Hart, P. H., Gorman, S., & Finlay-Jones, J. J. (2011). Modulation of the immune system by UV radiation: more than just the effects of vitamin D? *Nature Reviews Immunology*, *11*(9), 584-596.

22

Vitamin D Deficiency Continued

23

- A strong latitudinal gradient exists for Multiple Sclerosis and Type 1 Diabetes where higher geographic latitude is associated with increased disease prevalence.



Noonan CW, Williamson DM, Henry JP, Indian R, Lynch SG, Neuberger JS, et al. The prevalence of multiple sclerosis in 3 US communities. Prev Chronic Dis 2010;7(1):A12.
Simpson S, Blizzard L, Otahal P*, et al* Latitude is significantly associated with the prevalence of multiple sclerosis: a meta-analysis *Journal of Neurology, Neurosurgery & Psychiatry* 2011;**82:**1132-1141.

Autoimmune Diseases

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Developmental Origins of Health and Disease (DOHAD)

24

- Previously referred to as Fetal Origins Of Adult Disease (FOAD) or Baker Hypothesis
- Theory proposes that maternal environmental exposures are alter the intrauterine environment influencing fetal tissue structure which can predispose to the development of disease later in life.
- An inverse relationship has been found between UVB exposure during gestation and development of adult autoimmune disease.

Disanto, G., Chaplin, G., Morahan, J. M., Giovannoni, G., Hyppönen, E., Ebers, G. C., & Ramagopalan, S. V. (2012). Month of birth, vitamin D and risk of immune-mediated disease: a case control study. *BMC medicine*, *10*(1), 69

24

Chemical Exposure

25

- Silica dust exposure primarily leads to silicosis lung disease with increased production of autoantibodies and immune complexes also noted.
- Associations with other autoimmune diseases is emerging.
  - Systemic Lupus Erythematosus
  - Rheumatoid Arthritis

Shtraichman, O., Blanc, P. D., Ollech, J. E., Fridel, L., Fuks, L., Fireman, E., & Kramer, M. R. (2015). Outbreak of autoimmune disease in silicosis linked to artificial stone. *Occupational Medicine*, kqv073.

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Classification of Autoimmune Diseases

26

- As the etiology is not specifically understood, classification is based on patterns of presentation and the specific cells involved in the immune responses.
- Type III Immune Complex Response
  - Systemic
    - Systemic Lupus Erythematosus
    - Rheumatoid Arthritis
  - Type IV T-cell Response
    - Organ-specific
      - Type I Diabetes
      - Multiple Sclerosis

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Type III Immune Complex Disease

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- In a normal response, antibodies bind to the foreign substance creating large immune complexes when there are enough antibodies that are subsequently cleared by the reticuloendothelial system.
- When more ubiquitous autoantigens are present than IgG antibodies, small immune complexes form which are deposited in issues and small blood vessels.
- Rheumatoid Arthritis
  - Rheumatoid Factor, Tumor Necrosis Factor (TNF) cytokine
- Systemic Lupus Erythematosus
  - DNA, histones, ribosomes, snRNP, scRNP

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Type IV T-cell Mediated Disease

28

- Organ-specific damage results directly from T-cell actions against the tissues or failure of regulatory T-cells (Tregs) to limit the inappropriate inflammatory response.
- Multiple Sclerosis
  - Myelin basic protein, proteolipid protein, myelin oligodendrocyte glycoprotein
- Type I Diabetes Mellitus
  - Pancreatic beta cell destruction

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Rheumatoid Arthritis (RA)

29

- Altered T-cell activation and production of Rheumatoid Factor (RF) autoantibodies target a portion of the naturally occurring IgG antibody.
- The immune complexes produced provoke activation of synovial leukocytes stimulating an intense inflammatory process.
- Chronic inflammation leads to progressive synovial deterioration, hyperplasia, joint erosion and systemic symptoms of the cardiovascular and pulmonary systems.

RA Pathophysiology

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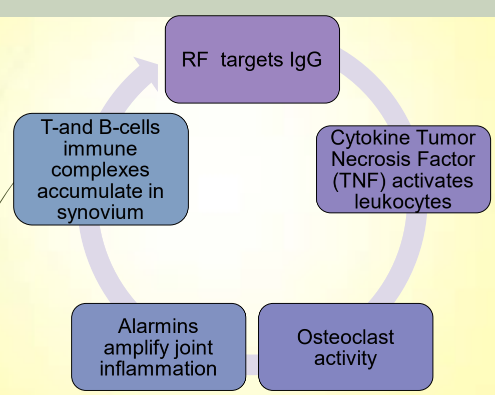

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RA Diagnosis

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- Laboratory tests measure inflammation and biomarkers.

Inflammation	Antibodies
Erythrocyte Sedimentation Rate (ESR)	Rheumatoid Factor (RF)
C-Reactive Protein (CRP)	Anti-Cyclic Citrullinated Peptide (anti-CCP)
	Antinuclear Antibody (ANA)

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RA Clinical Presentation

32

- Characterized by polyarticular pain, morning stiffness, fatigue, restricted range of motion, joint deformity, and joint inflammation.
  - Bilaterally primarily small joints affected
  - Exacerbations and remissions

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RA Joint Deformities

33

Deformity	Features
Boutonniere	**MCP Hyperextension, PIP Flexion, DIP Hyperextension**
Swan Neck	**PIP Hyperextension, DIP Flexion**
Hitchhiker's Thumb	**MCP Flexion, IP Hyperextension**
Ulnar Drift	**MCP joints sublux with fingers shifting toward ulna**
Claw Toe	**MTP Hyperextension, PIP and DIP Flexion**

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RA Complications

34

- Some patients experience systemic extra-articular complications from RA.
  - Anemia
  - Rheumatoid nodules in skin
  - Lung Fibrosis
  - Renal Amyloidosis
  - Atherosclerosis
  - Low Vision
  - Peripheral Neuropathy
  - Osteoporosis

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RA Medical Management

35

- Comprehensive management of RA includes:
  - Monitoring for long term system compromise
  - Dietary modification
  - Rehabilitation
  - Pharmacologic agents
  - Joint replacement surgery

35

RA Dietary Modification

36

- EPA and DHA are Omega-3 fatty acids that decrease pro-inflammatory cytokine production, contribute to deactivation of B-cells and synoviocytes.
  - Improved morning stiffness, pain levels, and joint inflammation have been noted.
  - Marine based Omega-3 show best results

Tedeschi, S.K. & Costenbader, K.H. Is there a role for diet in the therapy of rheumatoid arthritis? *Current Rheumatology Report* (2016) 18: 23.
Lemerle, J., Arleevskaya, M. I., Brooks, W. H., & Renaudineau, Y. (2016). Effects of enviro environmental factors and omega-3 fatty acids on rheumatoid arthritis. *Annals of Joint*, *1*(4).

36

RA Rehabilitation Considerations

37

- Strengthening provides stability to affected joints – isometric exercise for inflamed joints.
- ROM and contracture management – avoid stretching acutely inflamed joints.
- Education on energy conservation and joint protection.
- Centers for Disease Control and Prevention Arthritis Programs
  - Physical Activity
  - Self-Management

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RA Assessment Tools

38

- American College of Rheumatology endorses specific tools to assess disease activity and define remission.
- Disease Activity Score (DAS28)
- Patient Activity Scale (PAS)
- Routine Assessment of Patient Index Data 3 (RAPID3)
- Clinical Disease Activity Index (CDAI)
- Simplified Disease Activity Index (SDAI)

Anderson, J., Caplan, L., Yazdany, J., Robbins, M. L., Neogi, T., Michaud, K., ... & Kazi, S. (2012). Rheumatoid arthritis disease activity measures: American College of Rheumatology recommendations for use in clinical practice. *Arthritis care & research*, *64*(5), 640-647.

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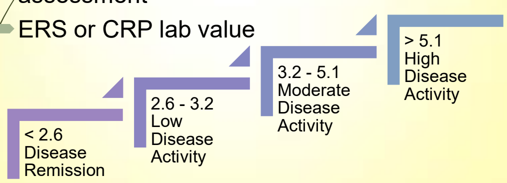
RA Assessment Tools
Disease Activity Score (DAS28)

39

- Considers several factors to determine if symptoms are effectively managed.
- Number of joints in hands, wrists, elbows, shoulders, and knees that are swollen and/or tender.
- Visual Analog Score (VAS) global assessment
- ERS or CRP lab value



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RA Definition of Remission

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- ACR/EULAR task force defines remission as a score of ≤1 on each of the following:
  - Tender Joint Count
  - Swollen Joint Count
  - C-reactive Protein Level (mg/dl)
  - Patient Global Assessment

OR

- Simplified DAS of ≤3.3

Singh, J. A., Saag, K. G., Bridges, S. L., Akl, E. A., Bannuru, R. R., Sullivan, M. C., ... & Curtis, J. R. (2016). 2015 American College of Rheumatology guideline for the treatment of rheumatoid arthritis. *Arthritis & rheumatology, 68*(1), 1-26.

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RA Assessment Tools
Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH)

41

- Assesses severity of functional limitation from impairment of the upper extremity in performing self-care activities of daily living, mobility, home maintenance, and recreation.
  - Responses scored 1-no difficulty to 5-unable
  - Optional work and music/sport sections
  - Higher score out of 100 reflective of greater level of disability

RA Assessment Tools
Five Times Sit to Stand Test (FTSS)

42

- Performance of repetitive sit to stand to assess lower extremity functional strength.
- Straight back chair with 16” seat height.
- Perform 5 sit to stand repetitions as quickly as possible keeping arms folded across chest.

RA Smartphone Apps

43

- Quality apps that include comprehensive tracking are lacking.
- Arthritis Power
  - Symptom tracking Function
  - Composite Measure of RA disease Activity
  - Lacking joint count function (swollen and tender)

Grainger, R., Townsley, H., White, B., Langlotz, T., & Taylor, W. J. (2017). Apps for People With Rheumatoid Arthritis to Monitor Their Disease Activity: A Review of Apps for Best Practice and Quality. *JMIR mHealth and uHealth, 5*(2), e7. http://doi.org/10.2196/mhealth.6956

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RA Joint Protection and Energy Conservation

44

- Application of proper ergonomics and biomechanics when performing ADLs protects joint from abnormal forces that may aggravate deformities, increase pain, and induce fatigue.

Joint Protection

- **Distribute load on more than one joint**
- **Avoid positions favoring deformity**
- **Limit force when holding objects**
- **Use the stronger and larger joint to perform work**

Energy Conservation

- **Balance time with activity and rest**
- **Prioritize tasks, delegate**
- **Modify your environment**

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RA Adaptive Equipment

45

- Adaptive equipment for performance of activities of daily living (ADLs) promotes functional independence, energy conservation, and minimizes motions that foster joint subluxation.
  - Large door knobs or add handle levers
  - Flat press light switches
  - Ergonomic kitchen products
  - Use mugs instead of glasses

45

RA Pharmacological Management

46

- Non-opioid medications can provide relief of mild to moderate pain with opioids indicated for severe pain.
  - Non-opioid - Acetaminophen, Tramadol
  - Opioids – Fentanyl, Oxycodone, Hydromophone
- Nonsteroidal Anti-inflammatory agents can inhibit the inflammatory process.
  - NSAIDs – Celebrex, Naproxen, Ibuprofen
- Corticosteroids slow radiographic progression and improve function through anti-inflammatory action.
  - Low-dose Prednisone

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RA Pharmacological Management Continued

47

- Disease-Modifying Antirheumatic Drugs (DMARDs) disrupt the proinflammatory pathway through several mechanisms.
  - Methotrexate: Targets synovial adenosine receptors to inhibit the production of pro-inflammatory cytokines.
  - Adalimumab: Binds to TNF cytokine receptors inhibiting leukocyte migration.
- Biologics: Rituximab
  - Mediates B-cell apoptosis by targeting an antigen on the surface of lymphocytes.

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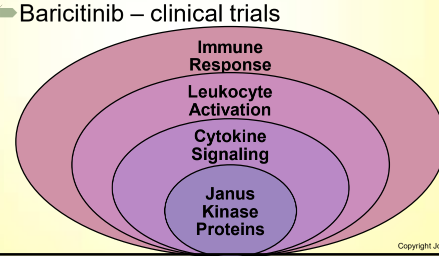
RA Pharmacologic Management Continued

48

- Janus Kinase (JAK) Inhibitors target the protein inside the cells allowing influence on a wider range of hyperactive immune cells.
  - Tofacitinib – FDA approved
  - Baricitinib – clinical trials



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RA Antirheumatic Medication Monitoring

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- Patients must be monitored for specific adverse reactions, toxicity, and side effects.
  - Opioid overuse – lethargy, mental confusion, respiratory depression, constricted pupils, pruritus, constipation
  - Opportunistic bacterial, viral, fungal infections
  - Hepatitis B reactivation
  - Tuberculosis
  - Shingles
  - Liver toxicity

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RA Research Advances

50

- Current treatments are aimed at slowing down the tissue damage with new research to identify biologic targets for drug development.

Genetics
- Gut microbiota
- Gene specific treatments

Disease Process
- TNF medication weaning
- Tests for earlier diagnosis

New Therapies
- Additional JAK Trials
- Stem cell research
- Smartphone and social media patient support tools

https://www.niams.nih.gov/Health_Info/Rheumatic_Disease/default.asp#ra_13

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Autologous Adipose Tissue Stromal Vascular Fraction (SVF) Cells

51

- SVF cells contain stem cells that possess regenerative and immunomodulary properties.
- Harvesting SVF from an individuals fat and reintroducing the specific cells is theorized to
  - Target and attenuate joint inflammation
  - Enhance Treg production

https://rheumatoidarthritisnews.com/2015/12/15/stemgenix-ra-clinical-study-stem-cell-therapy/

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Systemic Lupus Erythematosus (SLE)

52

- Multisystem inflammatory condition with immune complexes are damaging musculoskeletal, renal, hematopoietic, and central nervous systems.
- The condition is common of women of child bearing age with at significant female predisposition.
- Course of the disease is characterized by flares and remissions.

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SLE Pathophysiology

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- The body recognizes specific intracellular nucleoproteins as antigens.
- During the immune reaction, these components are exposed on the dead and dying cells.
- Small immune complexes form that phagocytosis cannot clear so they are deposited on the endothelial lining of small blood vessels.
- The cycle of inflammation perpetuates creating a continuous supply of exposed nucleoproteins that initially triggered the response.

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SLE Pathophysiology Continued

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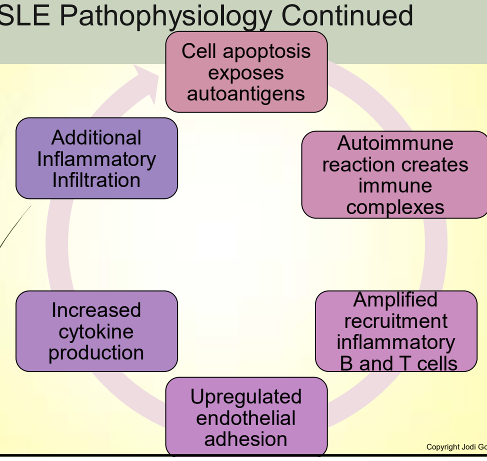

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SLE Pathophysiology Continued

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- The magnitude of the dysregulation of immunity in SLE suggests additional mechanisms that mimic a sustained antiviral response.
- A potential mediator may be Interferon Type 1 (INF1) which is a protein that binds to surface receptors on IFN-α that are produced by leukocytes.

Crow, M. K. (2014). Type I interferon in the pathogenesis of lupus. *The Journal of Immunology*, *192*(12), 5459-5468.

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SLE Clinical Presentation

56

- Polyarthralgia, polyarthritis, myalgia
- Oral ulcers
- Malar rash and discoid rash
- Photosensitivity
- Alopecia
- Peripheral and cranial neuropathy
- Renal pathology
- Pleurisy, pericardial effusion, pericarditis, peritonitis
- Fatigue, weight loss, fever
- Anemia

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SLE Diagnosis

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Clinical Criteria	Immunological Criteria
Acute Cutaneous Lupus	ANA
Chronic Cutaneous Lupus	Anti-dsDNA
Oral Ulcers	Anti-Sm
Non-scaring alopecia	Anti-Phispholipid
Synovitis ≥ 2 joints	Low Complement C3, C4, CH50
Serositis - pleurisy	
Renal Manifestations	
Neurological Manifestations	
Hemolytic anemia	
Leucopenia/Lymphopenia	
Thrombocytopenia	

- At least 4 criteria (1 each category)

Or

- Biopsy proven nephritis and ANA or anti-dsDNA antibodies

Systemic Lupus International Collaborating Clinics (SLICC) guidelines 2012
https://resources.lupus.org/entry/revision-of-classification-criteria-for-systemic-lupus

57

SLE Vascular Complications

58

- Lupus nephritis
- Antiphospholipid antibodies alter the body's anticoagulation ability resulting in clot formation.
  - Venothromboembolism
  - Transient Ischemic Attack (TIA)
  - Cerebrovascular Accident (CVA)
  - Myocardial Infarction (MI)
  - Pulmonary Embolism
  - Libman-Sacks Endcarditis
- Vascular spasm leads to livedo and Raynauds disease

58

SLE Medical Management

59

- "Treat to Target" strategy employed with goals of
  - Remission of organ manifestations
  - Prevention of early and late organ damage
  - Prevention of flares
- Exercise, diet, lifestyle modification to minimize multisystem complications
- Pharmacological Management

59

SLE Rehabilitation Considerations

60

- Monitor patient for systemic complications.
  - Thrombophlebitis
  - Nephritis
  - TIAs, angina
  - Seizures
- Patient education on limiting sun exposure.
- Close physician monitoring with pregnancy.

60

SLE Rehabilitation Considerations Continued

61

- Distinguish headaches caused by lupus flare from those of other origin.
- Neuropsychiatric symptoms from altered CNS microvasculature leads to hemiparesis, spasticity, and other stroke-like symptoms.
  - Corticosteroids
  - Neurorehabilitation techniques

61

SLE Assessment Tools SLE Disease Activity Index (SLEDAI-2k)

62

- Global score index to assess active disease considering manifestations in 9 organ systems with different point values awarded for each symptom:

Neurologic	Musculoskeletal	Renal
Vascular	Musculocutaneous	General
Respiratory	Hematopoietic	Cardiac

0 None → 1-5 Mild → 6-10 Moderate → 11-19 High → ≥20 Very High

Consider This

62

SLE Assessment Tools SLE Responder Index (SRI-50)

63

- Utilizes symptoms identified on SLEDAI-2K with rating of change on next visit entered as a prorated value in recalculation.

0	Full Points	Half Points
Complete remission on next visit	<50% Improvement	≥ 50% Improvement but not full remission

63

SLE and Exercise

64

- Goal is to manage fatigue and pain, increase cardiovascular fitness, and improve functional status.
  - Aerobic exercise
  - Muscle strengthening
  - Aquatic Therapy
  - Relaxation
  - Joint protection and energy conservation techniques

64

SLE Patient Education

65

- Increase patient awareness of disease progression symptoms and self monitoring.
- Psychoeducational strategies have been shown to lower fatigue scores, improve physical function, and enhance mental health.
  - Patient and familial education
  - Social support
  - Self-efficacy and problem solving strategies

Karlson EW, Liang MH, Eaton H, Huang J, Fitzgerald L, Rogers MP, et al. A randomized clinical trial of a psychoeducational intervention to improve outcomes in systemic lupus erythematosus. Arthritis Rheum 2004;50:1832–41.

65

SLE Pharmacological Management

66

- NSAIDs and Corticosteroids to manage inflammation of cardiac, pleural, and synovial linings.
- Antimalarials are synthetic forms of quinine originally derived from tree bark.
  - Hydroxychloroquine
- Biologics block B-cell survival factors inducing apoptosis.
  - Rituximab
  - Belimumab
- Immunosuppressive agents
  - Azathioprine
  - Methotrexate
- Anti-thrombolytic therapy

66

SLE Research Advances

67

- Intel Array Silicon Chip
  - Short pieces of the SLE associate protein are place on silicon microchips which measure the multiple autoantibodies simultaneously.
- Treatment of Uncontrolled Lupus via Interferon Pathway (TULIP)
  - Phase III clinical trials are underway to block the Type 1 Interferon inflammatory pathway.
    - Anifrolumab

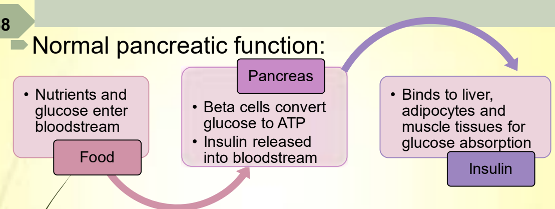
http://med.stanford.edu/news/all-news/2012/08/stanfordintel-study-details-power-of-new-chip-to-diagnose-disease-analyze-protein-interactions.html

67

Type 1 Diabetes Mellitus (T1D)

68

- Normal pancreatic function:



- Typically diagnosed in childhood, the metabolic disorder is characterized by destruction of beta cells in the Islets of Langerhans of the pancreas leading to loss of insulin production and dysregulation of glucose.

68

T1D Pathophysiology

69

- Genetic mutation of certain variants of the HLA gene produces dysfunctional Tregs circulating in the body that fail to terminate the body's attack against its own beta cells.
- By failing to control the immune reaction, a chronic inflammatory response develops destroying the insulin producing cells of the pancreas.
- Without a sufficient level of functioning beta cells insulin production is not possible.

Consider This

69

T1D Controlling Glucose Levels

70

- Insulin replacement is required for T1D with regular blood glucose monitoring through a home meter.
- The Target level varies for each individual with over 160 mg/dl considered high.

Time of Day	Person without DM	Person with DM
Before breakfast (fasting)	<100	70-130
Before lunch, dinner, snack	<110	70-130
Two hours after a meal	<140	<180
Bedtime	<120	90-150

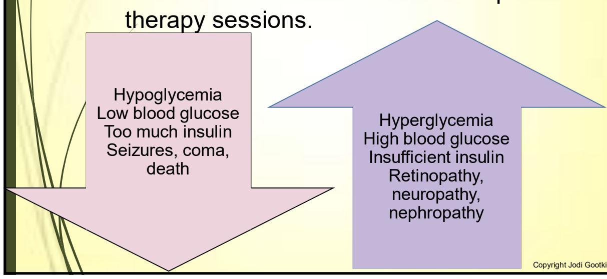
Nathan, D. M., & for the DCCT/EDIC Research Group. (2014). The Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications Study at 30 Years: Overview. *Diabetes Care, 37*(1), 9–16.
https://www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/InVitroDiagnostics/GlucoseTestingDevices/default.htm

70

T1D Altered Insulin Levels

71

- Hypoglycemic or hyperglycemic episodes can occur if insulin is not appropriately monitored.
- Glucose level should be assessed prior to therapy sessions.

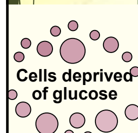


71

T1D Hyperglycemia

72

- Insufficient insulin present for glucose to move into cells as energy with accumulation in bloodstream.
  - Too much food
  - Too little exercise
  - Skipped, insufficient, ineffective insulin
  - Stress, illness, infection, injury or surgery



72

T1D Hyperglycemia Continued

73

- Symptoms
  - Fruity odor on breath
  - Nausea or vomiting
  - Xerostomia
  - Tachypnea and dyspnea
  - Polydipsia and polyuria
- Treatment
  - Exercise
  - If blood glucose 240 or higher, check urine for ketones and contact physician.
  - Determine if there is a pattern to the increased levels

73

T1D Hypoglycemia

74

- Circulating glucose has been depleted by cells.
  - Ineffective delivery of insulin
  - Increased physical activity
  - Decreased food intake
  - Altered insulin sensitivity
  - Organic absorption problems
- Symptoms
  - Diaphoresis, lightheadedness, headache, fatigue, nervousness, unsteadiness, seizure
- Treatment
  - Consume glucose or simple carbs

74

T1D Complications

75

- Over time, circulating glucose damages the endothelial lining resulting in vascular complications.

Diabetic Retinopathy	• Vision assessment
Diabetic Nephropathy	• Glomerular Filtration Rate and Blood Urea Nitrogen monitoring
Diabetic Neuropathy	• Sensation and skin integrity assessment
Heart Disease and Stroke	• Blood pressure and cholesterol monitoring

75

Thyroid Associations with T1D

76

- Autoimmune thyroid disease demonstrates greater incidence in individuals with T1D.
- Concurrent Celiac disease appears to increase this risk.

Hashimoto's Disease Hypothyroidism	Grave's Disease Hyperthyroidism
Weight gain Feeling cold Lethargy Dry skin Constipation Alopecia	Diaphoresis Weight loss Restlessness Goiter Heat intolerance

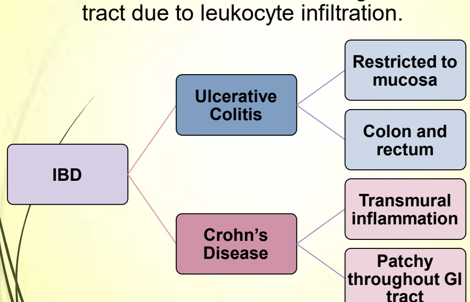
Hughes, J. W., Riddlesworth, T. D., DiMeglio, L. A., Miller, K. M., Rickels, M. R., & McGill, J. B. (2016). Autoimmune diseases in children and adults with type 1 diabetes from the t1d exchange clinic registry. *The Journal of Clinical Endocrinology & Metabolism*, jc-2016Kurien, M., Mollazadegan, K., Sanders, D. S., & Ludvigsson, J. F. (2016). Celiac disease increases risk of thyroid disease in patients with type 1 diabetes: a nationwide cohort study. *Diabetes care*, *39*(3), 371-375

76

Inflammatory Bowel Disease (IBD) Associations with T1D

77

- General term for disorders involving chronic inflammation of the gastrointestinal tract due to leukocyte infiltration.

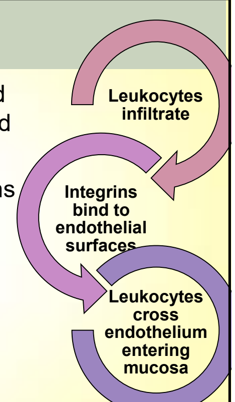


Autoimmune Diseases

IBD Management

78

- Traditionally, systemic immunosuppressives and corticosteroids are utilized
- New medications specifically target integrins located on the surface of leukocytes to block their adhesion to endothelial cells.
  - Side effects – headache, nausea, nasopharyngitis



Singh, H., Grewal, N., Arora, E., Kumar, H., & Kakkar, A. K. (2016). Vedolizumab: A novel anti-integrin drug for treatment of inflammatory bowel disease. *Journal of Natural Science, Biology, and Medicine*, *7*(1), 4–9.
Khanna, R., Mosli, M. H., & Feagan, B. G. (2016). Anti-Integrins in Ulcerative Colitis and Crohn's Disease: What Is Their Place?. *Digestive Diseases*, *34*(1-2), 153-159.

78

T1D Medical Management

79

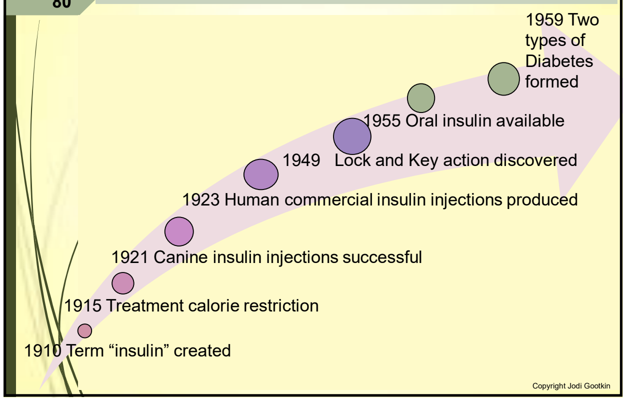
- Management is multimodal with insulin replacement, laboratory monitoring, and lifestyle strategies.
- Insulin
- Glycosylated Hemoglobin A1C Monitoring
- Urine Monitoring For Ketones And Microalbuminuria
- Carbohydrate Controlled Diet
- Exercise
- Patient Education

https://www.niddk.nih.gov/health-information/diabetes

79

T1D History of Insulin

80



80

T1D Insulin

81

- Insulin must mimic the normal way the pancreas would produce and distribute insulin.
  - Subcutaneous Delivery – syringe, pen, injector
  - Insulin Infusion Pump
- Calculation of the appropriate amount of insulin based on meal consumption of carbohydrates can be aided by technology.

81

T1D Continuous Subcutaneous Insulin Infusion (CSII)

82

- A pump worn outside the body delivers continuous infusion of rapid acting insulin through a thin catheter in the skin.
- The continuous glucose monitoring (CGM) device component takes frequent subcutaneous glucose measurements.
- The patient preprograms the insulin amount and timing to account for carbohydrate intake with meals.

82

T1D A1C Monitoring

83

- Glycosylated Hemoglobin A1C is a blood test measuring the amount of glucose that is attached to hemoglobin molecules in red blood cells providing information about the average blood glucose level over the past 2-3 months.
  - Target is below 7%
- A higher A1C level indicates elevated glucose levels that contribute to increased complications in other body systems.

83

Food and Drug Administration Food Labeling

84

- Regulations for labeling of conventional foods and dietary supplements must provide updated nutrition information to assist consumers in maintaining healthy dietary practices.
- Compliance deadline varies based on annual sales of manufacturer.
  - Over $10 million: July 2018
  - Under 10 million: July 2019
- Changes include removal of calories from fat, addition of "added sugars", Vitamin D and Potassium, and updated serving sizes.

https://www.regulations.gov/document?D=FDA-2012-N-1210-0875

84

85

https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm385663.htm#dates

85

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https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm385663.htm#dates

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87

https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm385663.htm#dates

87

T1D Healthy Diet

88

- The 'plate method' helps limit the consumption of carbohydrates.

Whole grains
Fruits
Non-starchy Vegetables
Healthy fat
Nonfat or low fat dairy
Proteins

Added sugars
Starch vegetables
Butter, cream, shortening

88

T1D and Exercise

89

- Regular exercise provides several benefits in the management of T1D in the pediatric and adult population.
  - Reduced and better maintained A1C levels
  - Decreased miroalbuminuria
  - Improved cardiovascular disease risk profile
  - Decreased total daily insulin needs

Riddell, M. C., Gallen, I. W., Smart, C. E., Taplin, C. E., Adolfsson, P., Lumb, A. N., ... & Annan, F. (2017). Exercise management in type 1 diabetes: a consensus statement. *The Lancet Diabetes & Endocrinology*.http://www.smep.org.mx/wp-content/uploads/2017/04/Exercise-management-in-type-1-diabetes.pdf

T1D and Exercise Continued

90

- Adult exercise recommendation
  - 150 minutes accumulated physical activity per week
  - No more than 2 consecutive days without exercise
  - Resistance training 2-3 days a week
- Pediatric exercise recommendation is 60 minutes per day
- Exercise contraindications
  - Urine ketones ≥4.0mml/L
  - Recent hypoglycemia ≤50 mg/dL in 24 hours

http://www.smep.org.mx/wp-content/uploads/2017/04/Exercise-management-in-type-1-diabetes.pdf

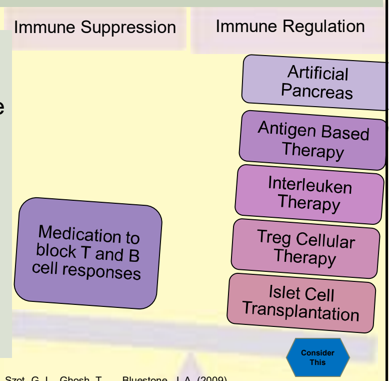
89

90

T1D Research Advances

91

- Research is shifting away from immunosuppressive strategies toward understanding Treg function to develop interventions that protect or replace functional beta cell mass.



Putnam, A. L., Brusko, T. M., Lee, M. R., Liu, W., Szot, G. L., Ghosh, T., ... Bluestone, J. A. (2009). Expansion of Human Regulatory T-Cells From Patients With Type 1 Diabetes. *Diabetes, 58*(3), 652–662.

91

T1D Artificial Pancreas

92

- The amount of insulin required throughout the day varies based on meals intake, physical activity, stress, and illness making stabilization of glucose levels challenging.
- An “artificial pancreas” is an externally worn device that can allow better stabilization of glucose levels when disturbances occur.
  - Glucose sensor
  - Control calculation system
  - Infusion pump

Boiroux, D., Duun-Henriksen, A. K., Schmidt, S., Nørgaard, K., Poulsen, N. K., Madsen, H., & Jørgensen, J. B. (2017). Adaptive control in an artificial pancreas for people with type 1 diabetes. *Control Engineering Practice*, *58*, 332-342.

92

T1D Antigen Based Therapy

93

- Exploration has begun into preventing seroconversion to beta autoantibodies in babies.
- It is theorized that exposing neonatal oral mucosa to the antigen (insulin) will stimulate the immune response in a controlled manner guiding it toward self-tolerance.

Lamb MM, Simpson MD, Seifert J, Scott FW, Rewers M, Norris JM (2013) The association between IgG4 antibodies to dietary factors, islet autoimmunity and type 1 diabetes: The diabetes autoimmunity study in the young. PLoS ONE 8(2): e57936.
Ziegler, A. G., Danne, T., Dunger, D. B., Berner, R., Puff, R., Kiess, W., ... & Bonifacio, E. (2016). Primary prevention of beta-cell autoimmunity and type 1 diabetes–The global platform for the prevention of autoimmune diabetes (GPPAD) perspectives. *Molecular Metabolism*, *5*(4), 255-262.

93

T1D Interleukin Therapy

94

- The goal is to expand Tregs so that self-tolerance mechanisms are restored and some of the insulin producing beta cells are spared from damage.
- Administration of low does Interluken-2 (IL-2) appears to increase proliferation of Tregs that limit the destructive inflammatory response.
- Action of effector T-cells is preserved allowing beneficial immune responses to other pathogens to continue.

Dwyer, C. J., Ward, N. C., Pugliese, A., & Malek, T. R. (2016). Promoting immune regulation in type 1 diabetes using low-dose interleukin-2. *Current Diabetes Reports*, *16*(6), 1-10.

94

T1D T-cell Therapy

95

- Treg Cellular Therapy: Extracted Tregs from the individual’s circulatory system or cryopreserved umbilical cord blood (UCB) can be isolated and expanded then reintroduced into the body to restore immune tolerance to the pancreatic beta cells.
- Engineered Tregs: Designing Tregs with specialized receptors to recognize beta cells can protect them from the autoimmune attack and preserve overall immune system responsiveness.

http://diabetes.ufl.edu/research/

95

T1D Islet Cell Transplant

96

- Donor islet cells are removed using specialized enzymes for allo-transplantation
- A thin catheter in the upper abdomen infuses the cells into a portal vein of the liver.

https://www.niddk.nih.gov/health-information/diabetes/overview/insulin-medicines-treatments/pancreatic-islet-transplantation

96

Multiple Sclerosis (MS)

97

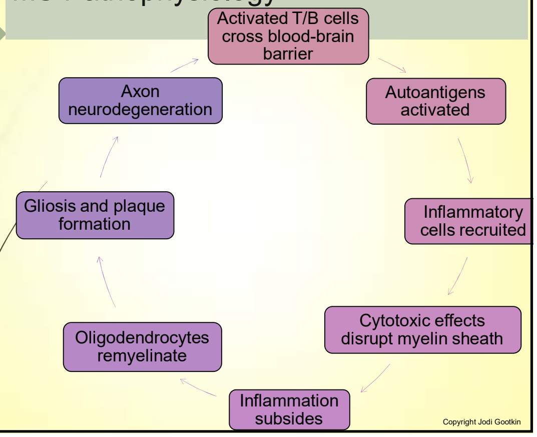
- Neurodegenerative disease where immune neurotoxic inflammatory products in the central nervous system triggering an inflammatory response and neuronal stress resulting in demyelination.

Consider This

97

MS Pathophysiology

98



98

MS Clinical Presentation

99

Clinically Isolated Syndrome (CIS)	First episode of neurologic symptoms lasting at least 24 hours single neurologic symptom or multifocal
Relapsing-remitting (RRMS)	Early active inflammation followed by remission with break through disease activity.
Secondary-progressive (SPMS)	Begins as RRMS then becomes progressive with or without minor acute episodes
Primary-progressive (PPMS)	Relentless disease progression
Progressive-relapsing (PRMS)	Clearly progressive with acute exacerbations

99

MS Clinical Presentation Continued

100

- Symptoms are extremely variable and diverse.
  - Sensory: paresthesias, dysesthesias
  - Lhermitte's sign
  - Visual: unilateral optic neuritis, diplopia
  - Motor: motor weakness, spasticity, dysphagia
  - Cerebellar: ataxia, dysmetria, dysdiadochokinesia, intention tremor, nystagmus, dysarthria, scanning speech
  - Pain, fatigue, cognitive impairment
  - Bowel, bladder, sexual dysfunction

100

MS Medical Management

101

- Multimodal treatments focus on downregulation of the inflammatory process, up-regulation of the anti-inflammatory process, and management of symptoms:
  - Dietary modification
    - Omega-3 and Vitamin D supplements
    - Low sodium diet
  - Emotional wellness
  - Rehabilitation
  - Medication to manage disease process and exacerbations

Dunn, M., Bhargava, P., & Kalb, R. (2015). Your patients with multiple sclerosis have set wellness as a high priority–and the National Multiple Sclerosis Society is responding. *US Neurology*, *11*, 80-6.

MS Rehabilitation Considerations Emotional Considerations

102

- Pseudobulbar Affect (PBA) involves episodes of uncontrolled laughing and/or crying not related to their underlying mood.
  - Antidepressant medications
  - Educate patient on management strategies
- Adaptive coping and solution focused coping can enhance emotional well-being.

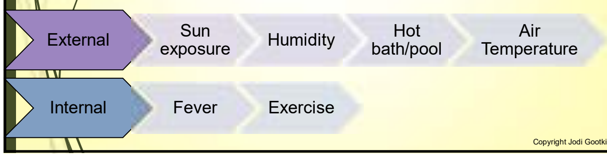
Dennison, L., Yardley, L., Devereux, A., & Moss-Morris, R. (2011). Experiences of adjusting to early stage Multiple Sclerosis. *Journal of health psychology*, *16*(3), 478-488.

101

102

103 MS Rehabilitation Considerations Exacerbation

- Patient education should include strategies to minimize exacerbations.
  - Maintain good overall health status
  - Minimize stress
    - Major and minor stresses
  - Uthoff's symptom is an adverse reaction to heat that leads to a pseudoexacerbation.



103

104 MS Rehabilitation Considerations Fatigue

- Central fatigue is due to deterioration of the myelin sheath that slows neural conduction causing them to fatigue more quickly.
- Sensitivity to heat exacerbates fatigue
  - Submaximal exercise
  - Borg scale
- Energy conservation techniques
  - Adaptive equipment
  - Environmental modifications
- Maintain respiratory function
- Avoid extreme physical exertion

104

105 MS Rehabilitation Considerations Sleep Disturbance

- Lesions to the hypothalamus, low melatonin levels, muscle cramps, and urinary urgency/frequency may contribute to difficulty staying and falling asleep.
- Promote good sleep hygiene and stimulus control
- Decrease daytime napping
- Sleep position modification and spasticity management
- Stress, anxiety, depression management

https://www.nationalmssociety.org/NationalMSSociety/media/MSNationalFiles/Documents/Sleep_Hughes_2016.pdf

105

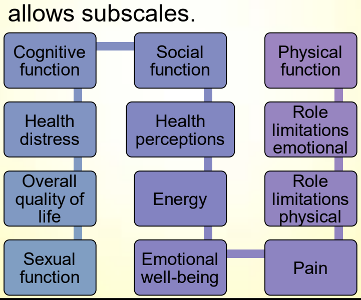
106 MS Assessment Tools Fatigue Severity Score (FSS)

- Self-report questionnaire measures fatigue severity and impact on activities and lifestyle.
- Items scored as 1 strongly disagree to 7 strongly agree
- Minimum score of 9 and maximum 63 with higher score indicating greater fatigue severity

106

107 MS Assessment Tools Multiple Sclerosis Quality of Life-54 (MSQOL-54)

- Combines the Short Form 36 (SF-36) with 18 MS specific issues to generate physical health and mental health composite summary scores and allows subscales.



107

108 MS Assessment Tools Symptom Tracker App

- The National Multiple Sclerosis Society created the "Multiple Sclerosis Diagnosis and Management" smartphone app with information for clinicians and patients.
  - Diagnosis and management suggestions
  - Interactive assessment tools
  - MS Society resources
  - Symptom tracking tools

108

MS Pharmacological Management

109

- Disease modifying medications can be biologics or immunosuppresives.
- Fingolimod: Binds to receptors that block lymphocytes from entering bloodstream from lymph nodes.
- Daclizumab: Bind to Interleuken-2 receptors mediating lymphocyte activation.
- Interferon beta-1a: Restores Tregs and enhances autoreactive T-cell apoptosis
- Corticosteroids

Costello. K and Halper,J. (2017) The use of disease-modifying therapies in multiple sclerosis: Principles and current evidence. A Consensus paper by the Multiple Sclerosis Coalition. Updated March 2017

109

MS Medication Monitoring

110

- Patients should be monitored for side effects
  - Eye toxicity
  - Infections
  - Hepatic injury
- Smoking decreases medication effectiveness and increases risk of SPMS.

110

MS Research Advances

111

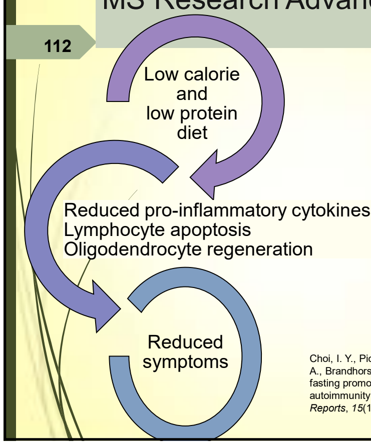
- High Dose Immunosuppressive Therapy and Autologous Hematopoietic Cell Transplant (HDIT/HCT)
- Immunosuppressive therapy followed by transplantation of a person's own blood-forming stem cells can induce sustained remission of relapsing-remitting MS.
  - Halted symptom progression
  - Relapse-free survival
  - Some improved mobility

Nash, R. A., Hutton, G. J., Racke, M. K., Popat, U., Devine, S. M., Steinmiller, K. C., ... & Stuve, O. (2017). High-dose immunosuppressive therapy and autologous HCT for relapsing-remitting MS. *Neurology*, *88*(9), 842-852.

111

MS Research Advances Continued

112



- A short diet mimicking fasting may induce immune responses to ameliorate demyelination.

Choi, I. Y., Piccio, L., Childress, P., Bollman, B., Ghosh, A., Brandhorst, S., ... & Wei, M. (2016). A Diet mimicking fasting promotes regeneration and reduces autoimmunity and multiple sclerosis symptoms. *Cell Reports*, *15*(10), 2136-2146.

112

MS Research Advances Continued

113

- Chronic Cerebrospinal Venous Insufficiency (CCSVI) proposes that insufficient blood drainage contributes to altered brain circulatory patterns and neuron degeneration.
- Restoring vascular flow through stent insertion may provide relief.

Hassoun, H. K., Al Essawi, R. W., Al Tiraihi, T., Al-Jussani, N., & Allebban, Z. (2017). Assessment of chronic cerebrospinal venous insufficiency among Iraqi multiple sclerosis patients by Echo color Doppler sonography.

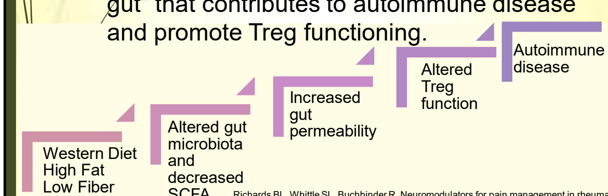
Autoimmune Diseases

113

Autoimmune Disease Dietary Considerations

114

- Short-chain fatty acids (SCFA) that form when the body ferments soluble fiber promote strong bonds in the intestinal mucosa.
- These metabolites help prevent the "leaky gut" that contributes to autoimmune disease and promote Treg functioning.



Richards BL, Whittle SL, Buchbinder R. Neuromodulators for pain management in rheumatoi arthritis. Cochrane Database of Systematic Reviews 2012, Issue 1. Art. No.: CD008921

114

SCFA Food Sources

115

Resistant Starches	Barley, brown rice, beans, lentils, cooked and cooled potatoes, green bananas
Inulin	Artichokes, onions, asparagus, leeks
Arabinoxylan	Cereal grains wheat bran, corn, rice, rye, oat, barley
Pectin	Apples, apricots, carrots, oranges
Butyrate	Parmesan cheese, goat milk, butter

Damen, B., Cloetens, L., Broekaert, W. F., François, I., Lescroart, O., Trogh, I., ... & Verbeke, K. (2012). Consumption of breads containing in situ–produced arabinoxylan oligosaccharides alters gastrointestinal effects in healthy volunteers. *The Journal of nutrition*, *142*(3), 470-477.

115

Mediterranean Diet

116

- The Mediterranean diet is associated with increased production of beneficial SCFAs.
- High intake of whole grains, vegetables, fruits, legumes
- Olive oil and fish instead of saturated fats
- Low intake of red meat, poultry, dairy
- Regular moderate ethanol

116

Paleolithic Diet

117

- The Paleo diet mirrors dietary intake from the hunter-gatherer lifestyle.
- 30-35% game meats and plant foods
- Multiple daily servings of green, sulfur rich and intensely colored fruits and vegetables
- High intake polyunsaturated fats
- Limited processed foods, domesticated meats, dairy

117

Anti-inflammatory Foods

118

- Avoiding foods that can trigger inflammation and increasing anti-inflammatory foods may aid in the management of autoimmune disease symptoms.

Omega-3 Fatty Acid – decreases inflammatory cytokines	Fruit, Vegetable, Whole Grain Fiber – decreases CRP levels	Extra virgin olive oil – bocks inflammatory enzymes

118

Spices

119

Thyme → Basil → Ginger → Black pepper → Chili pepper → Oregano → Cumin → Sage → Bay leaves → Licorice → Tumeric → Thyme

- Certain spices suppress inflammatory pathways by elevating interleukin or inhibiting pro-inflammatory cytokine production.

Consider This

Prasad, S., & Aggarwal, B. B. (2014). Chronic diseases caused by chronic inflammation require chronic treatment: anti-inflammatory role of dietary spices. *Journal of Clinical & Cellular Immunology*, *2014*.
Mueller, M., Hobiger, S., & Jungbauer, A. (2010). Anti-inflammatory activity of extracts from fruits, herbs and spices. *Food Chemistry*, *122*(4), 987-996.

119

Nanotechnology

120

- Exploration has begun to develop a drug-delivery system that will introduce biodegradable nanoparticle-coupled Tregs into the body.
- The "vaccine" will modulate the immune response by activating Tregs that will suppress the body's attack of self-antigens.
- The goal is to prevent the tissue destruction that leads to pathology development.

http://technologylicensing.research.ufl.edu/technologies/13837_nanoparticle-coupled-regulatory-t-cells-for-the-treatment-of-type-1-diabetes

120

Conclusion

- Management of patients with autoimmune disease is multimodal including monitoring of to limit complications, provision of comprehensive care to enhance function, and ongoing research to develop treatments that accommodate for and prevent the self directed immune response.

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1. How is the fundamental problem in autoimmune disease best described?
   A. Enhanced tolerance for self-antigens
   B. Amplified autoimmune response
   C. Diminished target organ sensitivity
   D. Deactivation of self-reactive lymphocytes

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2. Immune mediated diseases are generally described as ____________ because the initiating trigger cannot be eliminated.
   A. Self-limiting
   B. Acutely reactive
   C. Self-perpetuating
   D. Exposure specific

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3. Deficiency of _____________ is associated with increased prevalence of autoimmune disease.
   A. Vitamin C
   B. Cortisol
   C. Vitamin D
   D. Zinc

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4. Joint stiffness and pain from Rheumatoid Arthritis may be improved through dietary intake of __________.
   A. Fructose
   B. Monosodium Glutamate
   C. Omega 6 Fatty Acid
   D. Omega 3 Fatty Acid

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5. Which of the following is NOT a condition at increased risk of developing in patients taking antirheumatic medications?
   A. Vertigo
   B. Hepatitis B
   C. Shingles
   D. Tuberculosis

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6. Which assessment tool assesses multiple organ systems to determine the level of active disease in patients with Systemic Lupus Erythematosus?

A. DASH
B. SLEDAI-2k
C. CSII
D. FTSS

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7. Alterations to the ___________ gene is the prevailing contributor to the development of Type 1 Diabetes and most autoimmune diseases.

A. ABC
B. MMT
C. RC26
D. HLA

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8. What is the focus of current research trends to manage Type 1 Diabetes?

A. Protection of beta cell mass
B. Improved oral medications
C. Immunosuppressive strategies
D. Beta cell abolishment

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9. The immunopathology of ____________ involves neurotoxic products triggering an inflammatory response and neuronal stress resulting in demyelination.

A. Systemic Lupus Erythematosus
B. Multiple Sclerosis
C. Rheumatoid Arthritis
D. Diabetic Neuropathy

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10. Which of the following spices is part of an anti-inflammatory diet?

A. Mustard Seed
B. Turmeric
C. Cilantro
D. Rosemary

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Autoimmune Diseases

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