IVIG or Plasmapheresis for Neuromuscular Disease: Pros and Cons

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Gertrude and Dewey Ziegler Professor of Neurology
University Distinguished Professor
University of Kansas Medical Center

KUMC Neurology/Neurosurgery Grand Rounds
April 18, 2014
Immunotherapeutic Options in Neuromuscular Disease

- Corticosteroids
- Azathioprine
- Cyclophosphamide
- Methotrexate
- Mycophenylate
- Cyclosporine
- IVIG
- Plasmapheresis
- Mycophenolate
- Rituximab
- Thymectomy
What is IVIG?

- Intravenous immunoglobulin – IVIG
- A polymeric, highly purified preparation of IgG that is derived from large pools of plasma donors
Donors are screened
Plasma is screened for units of HIV, HBV, HCV, and CJD
Nucleic acid testing is performed on plasma pools for viral genomes
No incidence of HIV, CJD or HBV
IVIG

Possible Mechanisms of Action

IVIG has multiple immunomodulatory mechanisms of action relevant to the development of different disorders:

- Inhibits complement activation and MAC formation (Dermatomyositis, MG, CIDP, GBS)
- Down-regulates antibody production (MG, LEMS, anti-MAG and anti-GM1 Ab syndromes)
- Neutralizes pathogenic cytokines (Dermatomyositis, GBS, CIDP, PM)
- Modulates macrophage-mediated phagocytosis through blockade of Fc receptors (Demyelinating dz, DM, PM)
- Modulates T-cell function and antigen recognition (GBS, CIDP, DM, PM)
Neuromuscular Disorders Treated with IVIG

- Acute Inflammatory Demyelinating Polyneuropathies (GBS, Miller Fisher Syndrome)
- Multifocal Motor Neuropathy
- Chronic Demyelinating Polyneuropathies
- Multifocal Acquired Sensory and Motor Neuropathy
- Myasthenia Gravis
- Lambert-Eaton Syndrome
- Dermatomyositis
- Polymyositis
- Stiff-person Syndrome
IVIG Treatment in Neuromuscular Disease Indications

- First Line Rx In:
  - GBS (off label)
  - CIDP (FDA approved)
  - MMN (FDA approved)
- Second Line Rx In:
  - DM (off label)
  - MG (off label)
PLASMAPHERESIS

• Directly removes humoral factors such as autoantibodies, immune complexes, complement and other nonspecific inflammatory mediators.

• Remove 3-6 liters of plasma over several hours. Replace with albumin or purified protein fraction (PPF).

• Indications:
  - MG: crises; pre-thymectomy; severe MG (not in crises) when initiating or increasing oral immunosuppressive drugs.
  - GBS/CIDP
  - LEMS
Evidence-based guideline update: Plasmapheresis in neurologic disorders
Report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology

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Abbreviation: PANDAS = pediatric autoimmune neuropsychiatric disorders associated with streptococcal infection.
Acute Inflammatory Demyelinating Polyneuropathies

(Guillain–Barre Syndrome)
GBS
Plasmapheresis
North American Study
(Neurology 1985; 35:1096)

• 228 pts/21 centers
• Randomized/Not Blinded
• Time to Walk Unaided
  • Pheresis pts dec. time by: 32 days (all)
  • respiratory 72 days (respirator)
• Average Time on Vent. Dec. by 12 Days
# Dutch IVIG vs. Plasmapheresis Studies Compared to the North American Plasmapheresis Study

<table>
<thead>
<tr>
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<th>Dutch PE</th>
<th>North American PE</th>
<th>North American Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total patients</td>
<td>74</td>
<td>73</td>
<td>108</td>
<td>120</td>
</tr>
<tr>
<td>Improved 1 grade (4 wk)</td>
<td>53%</td>
<td>34%</td>
<td>59%</td>
<td>39%</td>
</tr>
<tr>
<td>Median days to 1 grade ^</td>
<td>27</td>
<td>41</td>
<td>19</td>
<td>40</td>
</tr>
<tr>
<td>Days grade 2 # multiple complications</td>
<td>55</td>
<td>69</td>
<td>19</td>
<td>40</td>
</tr>
<tr>
<td>Ventilator by week 2</td>
<td>27%</td>
<td>42%</td>
<td>--</td>
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PE, IVIG, and PE + IVIG for GBS

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<tr>
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<th>PE (N=121)</th>
<th>IVIG (N=130)</th>
<th>PE + IVIG (N=128)</th>
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<tr>
<td>Mean change in disability</td>
<td>.9</td>
<td>.8</td>
<td>1.1</td>
</tr>
<tr>
<td>Number of patients ventilated</td>
<td>28</td>
<td>29</td>
<td>21</td>
</tr>
<tr>
<td>Days to stopping ventilation</td>
<td>29</td>
<td>26</td>
<td>18</td>
</tr>
<tr>
<td>Days to unaided walking</td>
<td>49</td>
<td>51</td>
<td>40</td>
</tr>
<tr>
<td>Days to hospital discharge</td>
<td>63</td>
<td>53</td>
<td>51</td>
</tr>
<tr>
<td>Days to returning to work</td>
<td>290</td>
<td>371</td>
<td>281</td>
</tr>
<tr>
<td>Unable to walk after 48 days</td>
<td>19</td>
<td>21</td>
<td>17</td>
</tr>
<tr>
<td>Deaths</td>
<td>5</td>
<td>6</td>
<td>8</td>
</tr>
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AAN Practice Parameters: Immunotherapy for GBS (Quality Standards Subcommittee AAN)

- Treatment with plasma exchange (PE) or IVIG hastens recovery from GBS
- PE is recommended in non-ambulant adult pts within 4 weeks of onset symps
- IVIG is recommended for non-ambulant adult pts within 2 or possibly 4 weeks of onset of symps
- PE and IVIG are treatment options for children with severe GBS
- Corticosteroids are not recommended for the management of GBS

GBS in Adults: Conclusions
AAN Therapeutics & Tech Subcommittee. Neurology. 78;1009; 2012.

• Based on 2 Class I studies, IVIG is as efficacious as plasmapheresis for treating GBS in adults. Because plasmapheresis is established as effective GBS treatment, we conclude that IVIG also has established effectiveness.

• Based on one adequately powered Class I study, the combination of plasmapheresis and IVIG is probably not better than either treatment alone.
## PE and IVIG for GBS

<table>
<thead>
<tr>
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<th>Plasma Exchange</th>
<th>IVIG</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regimen</strong></td>
<td>200-250 ml/kg plasma x 4 sessions over 7-14 days</td>
<td>0.4 g/Kg IV x 5 days</td>
</tr>
<tr>
<td><strong>Rationale</strong></td>
<td>Removal of autoantibodies and other humoral factors</td>
<td>Reduces inflammatory cytokine production and inhibits C’</td>
</tr>
<tr>
<td><strong>Disadvantages</strong></td>
<td>Limited availability; requires an experienced team</td>
<td>Allergy, headache, transient LFT, meningitis</td>
</tr>
<tr>
<td><strong>Contraindications</strong></td>
<td>Coagulopathy, thrombocytopenia, hemodynamic instability, poor venous access</td>
<td>Prior allergy, antibodies to IgA, poor renal function</td>
</tr>
</tbody>
</table>

van der Meche et al. *Current Treatment Options in Neurology*. 2000;2:507-516
GBS
Treatment Caveats

• After PE or IVIG, Be Patient,
  Don’t Expect Dramatic Results

• No Reason to Use Both PLEX and IVIG

• No Reason to Use Steroids
CIDP: Clinical Features

- Symmetric proximal and distal weakness
- Generalized areflexia
- Progressive or relapsing course over 8 weeks
- CSF protein typically $> 60 \text{ mg/dl}$
- 15% have a monoclonal (IgM or IgG)
- Electrodiagnostic Criteria:
  - NCV <75% LLN in 2 or more nerves
  - DL>130% ULN in 2 or more nerves
  - Unequivocal TD or CB in 1 or more nerves
  - F wave latency >130% ULN in 1 or more nerves
CIDP: Plasmapheresis

- Each PLEX reduces IgG by 45%; 3-5 PLEX removes 90%
- 2 RCTs demonstrated transient NDS & NCS improvement:
  - Sham-controlled, 33% response at 3 weeks
  - Cross-over with 5-week washout, 80% response at 4 weeks
- Efficacy equivalent to that of IVIG
- Risks of central venous catheter placement
  - Hypotension, cardiac arrhythmia, vasovagal
  - Allergy to albumin
  - Hypocalcemia, anemia, thrombocytopenia
  - Citrate toxicity (use heparin)

Hahn AF et al Brain. 1996:1055-6
# Randomized Controlled Trials of IGIV in CIDP Before 2008

<table>
<thead>
<tr>
<th>Reference</th>
<th>Year</th>
<th>Therapy</th>
<th>No. of Pts</th>
<th>Design/Duration</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>van Doorn et al¹</td>
<td>1990</td>
<td>IGIV</td>
<td>7</td>
<td>Double-blind, placebo-controlled, crossover; single-dose comparison</td>
<td>Improvement in all patients</td>
</tr>
<tr>
<td>Vermeulen et al²</td>
<td>1993</td>
<td>IGIV</td>
<td>28</td>
<td>Double-blind, placebo-controlled, parallel-group comparison of 5 consecutive daily doses</td>
<td>No significant difference between groups</td>
</tr>
<tr>
<td>Hahn et al³</td>
<td>1996</td>
<td>IGIV</td>
<td>30</td>
<td>Double-blind, placebo-controlled, crossover; 4 weeks</td>
<td>Improvement in 63% of patients</td>
</tr>
<tr>
<td>Thompson et al⁴</td>
<td>1996</td>
<td>IGIV</td>
<td>7</td>
<td>Double-blind, placebo-controlled, crossover; 24 weeks (stopped early)</td>
<td>Improvement in 3 of 7 patients</td>
</tr>
<tr>
<td>Mendell et al⁵</td>
<td>2001</td>
<td>IGIV</td>
<td>53</td>
<td>Double-blind, placebo-controlled; 6 weeks</td>
<td>Improvement in 75% of patients</td>
</tr>
<tr>
<td>Hughes et al⁶</td>
<td>2001</td>
<td>IGIV vs prednisolone</td>
<td>32</td>
<td>Double-blind, placebo-controlled, crossover; 6 weeks</td>
<td>Improvement but no significant difference between groups</td>
</tr>
<tr>
<td>Dyck et al⁷</td>
<td>1994</td>
<td>IGIV vs plasma exchange</td>
<td>15</td>
<td>Randomized, observer-blinded, crossover; 6 weeks</td>
<td>Improvement but no significant difference between groups</td>
</tr>
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Intravenous immune globulin (10% caprylate-chromatography purified) for the treatment of chronic inflammatory demyelinating polyradiculoneuropathy (ICE study): a randomised placebo-controlled trial

Richard A C Hughes, Peter Donofrio, Vera Bril, Marinos C Dalakas, Chunlin Deng, Kim Hanna, Hans-Peter Hartung, Norman Latov, Ingemar SJ Merkies, Pieter A van Doorn, on behalf of the ICE Study Group*
Inflammatory Neuropathy Care and Treatment Score (INCAT)

INCAT – Upper Extremity
• Arm Disability Score
  • 0 No upper limb problems
  • 1 Minor symptoms in one or both arms, but not affecting any of the functions (zips and buttons, washing or brushing).
  • 2 Disability in one or both arms affecting any of the above mentioned functions.
  • 3 Disability in one or both arms preventing one or two of the above mentioned functions.
  • 4 Disability in both arms preventing three or all functions.
  • 5 Inability to use either arm for any purposeful movement.

INCAT – Lower Extremity
• 0 Walking not affected
• 1 Walking affected but walks independently outdoors
• 2 Usually uses unilateral support to walk outdoors (stick, single crutch, one arm)
• 3 Usually uses bilateral support to walk outdoors (stick, crutches, frame, two arms)
• 4 Usually uses wheelchair to travel outdoors, but able to stand and walk a few steps
• 5 Restricted to wheelchair, unable to stand and walk a few steps with help

INCAT Disability scores and total below:
• Upper Extremity Disability Score = _______ (0-5)
• Lower Extremity Disability Score = _______ (0-5)
• Overall Extremity Disability Score = _______ (Sum of Upper and Lower Disability Scores)

Responder = change (decrease) or ≥ 1 point
Relapse = increase in score
GAMUNEX-C Significantly Improved CIDP in 24 weeks (Disability Scores, INCAT)

\[ P = 0.006 \]

- Gamunex-C: 47.5% (n=59)
- Placebo: 22.4% (n=58)
CIDP Rx Recommendations

• 1st Line:
  • IVIG 2 gm/kg, then 0.4 to 1 gm/kg/q 3-4 weeks
  • Pred 100 mg/d x 2 wks, then 100 mg qod

• 2nd Line (Relapse or Non-Responder):
  • IVIG or Pred if not 1st line
  • PE 5-10x over 1-6 wks
  • AZA 2-3 mg/kg/d

• 3rd Line:
  • Mycophenylate 2-3 gm/d
  • Cyclosporine 3-6 mg/kg/d
  • Cyclophosphamide 1.5-2 mg/kg/d
  • Methotrexate 20 mg/week
Multifocal Motor Neuropathy

• Clinical:
  • Adults, Male > female, initially in nerve distribution
  • Slowly progressive distal weakness of hands > feet
  • No sensory symps/signs & No UMN signs

• Lab:
  • Serum-elevated GM-1 AB in 50-80%
  • EDX-CB or other demyel features
  • CSF – usually normal
  • Sensory nerve Bx – normal or minimally abnl

• Treatment options limited:
  • No response to pred; +/- pheresis
  • IVIG is Rx of choice based on RCT phase III
  • Cyclophosphamide is 2nd line of Rx
  • ? Rituximab monoclonal Ab to CD20 cells
### IVIG for MMN: Double-Blind, Placebo-Controlled Trials

<table>
<thead>
<tr>
<th></th>
<th>Dosing</th>
<th>Duration</th>
<th>Patients</th>
<th>Improved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azulay, et al, 1994</td>
<td>0.4 gm/kg/5 days</td>
<td>56 days</td>
<td>12</td>
<td>100%</td>
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<tr>
<td>Van den Berg, et al, 1995</td>
<td>0.4 gm/kg/5 days</td>
<td>14 days</td>
<td>16</td>
<td>83%</td>
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<tr>
<td>Federico, et al, 2000</td>
<td>0.4 gm/kg/5 days</td>
<td>28 days</td>
<td>16</td>
<td>67%</td>
</tr>
<tr>
<td>Léger, et al, 2001</td>
<td>0.5 gm/kg/5 days/3 months</td>
<td>120 days</td>
<td>18</td>
<td>78%</td>
</tr>
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</table>
10% IVIG in treated MMN


- Pts stabilized on IVIG then randomized to IVIG or placebo
- 41 subjects: 5 phases / subject, each phase for 3 months
- Primary endpoint measures:
  - Grip strength* (DynEX)
  - Upper arm section of Guy’s Neurological Disability Scale
- Secondary endpoint measures:
  - % of subjects with ≥ 30% grip strength decline*
  - # & % of subjects with decline in less affected hand
  - # of subjects with accelerated switch
  - Patient disability assessment
  - Overall Disability Sum Score
  - Timed Peg Board Test
  - Patient VAS assessment

*In the more affected hand*
10% IVIG in treated MMN

- Forty-four cases, 17 sites & 41 completed the study
- Accelerated switch to open-label IVIG if grip strength decreased ≥ 50% in the more affected hand or intolerable functional deterioration was objectified
- Substantially greater decline from baseline (34%) in the mean grip strength in the more affected hand following placebo administration, as compared to IGIV (p=0.005)
- A greater proportion of subjects had a ≥ 30% decline in grip strength of the more affected hand (43% vs. 5%; p<0.001), as well as the less affected hand (31% vs. 0%; p<0.001), PBO vs. IVIG
- 69% of PLAC required accelerated switch compared to only 1 (2.4%) on blinded IVIG
- IVIG was demonstrated to be safe, well-tolerated and an effective treatment for MMN in this phase III study
- FDA-approval and labeling indication
Myasthenia Gravis
Plasmapheresis vs. IVIG for MG

Gajdos et al, Ann Neurol 1997

- 87 pts with MG exacerbation
- Randomized: 3 PLEX vs. 3 or 5 IVIG 0.4 gm/kg
- Endpoint – Myasthenic muscular score day 15
- Results – Equal improvements with both Rx:
  - PLEX + 18 pts
  - IVIG + 15.5 points
  - p = 0.65
- Fewer side effects with IVIG (1) vs. PLEX (8)
IV Immunoglobulin in Patients with Myasthenia Gravis
Zinman, Eduardo, Bril Neurology 2007; 68:837-881

• 51 pts IVIG vs. placebo
• QMG: Sig diff at day 14 (p=0.047)
• Persisted at day 28
• Change in
  • IVIG: -2.54
  • PLAC: -0.89
• Post intervention status at day 14
  • IVIG imp 25%
  • Plac imp 6%
• RNS/SFEMG-no sig diff
• Meriggioli editorial:
  • Getting enough “bang for the buck”
Comparison of IVIG & Plex in MG
Barth, et al Neurology 2011;76

- 84 pts to IVIG PE 1g/kg/d x 2 days
  - Or PE x 5
- QMG > 10.5 and “worsening”

Improved: 69% IVIG and 65% PE
Conclusion: IVIG & PE both effective Rx
IVIG for MG: Summation

- IVIG appears to have a role in treatment of MG, when patients are not responding to corticosteroids and other immunosuppressive drugs.

- AAN Tech and Therapeutics: 1 Class I study showed IVIG probably effective in treatment MG (Neurology 2012)

- Role in crises still unclear

- Use in MG is off-label
  - Need study for labeling indication
Indications for Plasmapheresis in MG

- Crisis
- Pre-surgery
- Worsening while adjusting meds
- Chronic Rx
### Evidence-based guideline update: Plasmapheresis in neurologic disorders

Report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology

#### Table 1: Summary of evidence

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Abbreviation: PANDAS = pediatric autoimmune neuropsychiatric disorders associated with streptococcal infection.
## Myasthenia Gravis

### My Rx Recommendations - prior to 2007

- **1st Line:** Tensilon  
  Mestinon  
  Prednisone  
  Thymectomy

- **2nd Line:** Azathioprine  
  Mycophenolate Mofetil  
  Cyclosporine

- **3rd Line:** IVIg  
  Plasmapheresis

### My Rx Recommendations – 2014

- **1st Line:** Enlon  
  Pyridostigmine  
  Prednisone  
  Thymectomy

- **2nd Line:** Azathioprine  
  Cyclosporine  
  IVIg

- **3rd Line:** Mycophenolate Mofetil  
  Plasmapheresis

- **4th Line:** Methotrexate  
  Rituximab

- **5th Line:** Cyclophosphamide  
  Tacrolimus
Additional Disorders Benefiting From IVIG Randomized Controlled Trials

• Lambert-Eaton Syndrome
  • Bain et al. *Neurology.* 1996;47:678-683

• Dermatomyositis

• Stiff-Person Syndrome
# Class of Evidence Supporting Use of IVIG

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<td>I</td>
</tr>
<tr>
<td>GBS in Children</td>
<td>II</td>
</tr>
<tr>
<td>CIDP</td>
<td>I</td>
</tr>
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Neurology 2012;78:1009
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<tr>
<td>Fisher Syndrome</td>
<td>IV</td>
</tr>
<tr>
<td>Neuropathies Associated with Monoclonal Proteins</td>
<td>IV</td>
</tr>
<tr>
<td>Neuropathies Associated with Cryoglobulinemia</td>
<td>IV</td>
</tr>
<tr>
<td>Idiopathic Neuropathies</td>
<td>IV</td>
</tr>
<tr>
<td>Polymyositis</td>
<td>IV</td>
</tr>
<tr>
<td>Inclusion Body Myositis</td>
<td>None</td>
</tr>
<tr>
<td>Idiopathic Brachial Plexopathy</td>
<td>IV</td>
</tr>
<tr>
<td>Diabetic Lumbosacral Radiculoplexopathy</td>
<td>IV</td>
</tr>
</tbody>
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*Neurology 2012;78:1009*
## Dosing

- **Induction Dose:** 2 gm/kg
  - Either: 0.4 gm/kg x 5 days
  - or 0.6-0.7 gm/kg x 3 days
  - or 1gm/kg x 2 days

- **Maintenance Dose (For Chronic Diseases):**
  - 0.4 to 1.0 gm/kg every 3-4 weeks
  - But may need infusion q 2 weeks or only q 8 weeks
IVIG Rx in Chronic Neuromuscular Diseases

- For chronic disease usually determine effectiveness in 2-3 months
- Usually Rx lasts at least 6-12 months
- Reassess for continued use every 6 months
- Eventually either in time between infusions (6-8-12 wks) then discontinue or decrease number of grams per infusion
Contraindications for IVIG

- Known allergy to blood products, especially anaphylactic reaction after exposure to human immunoglobulin
- True IgA Deficiency

Relative Contraindications:
- Severe renal dysfunction
- Severe congestive heart failure
IVIG
Adverse Effects

- Most adverse effects are infusion rate-related and controlled by reducing the infusion rate or by interruption of the infusion until symptoms subside.
- Premedication with acetaminophen (1000mg) and/or diphenhydramine (50mg) may be useful for preventing infusion-related adverse effects.
- Rarely use methylprednisolone 100mg pre infusion.
IVIG: Toxicity

- Headaches infusion related (20-30%)
- Chills/fever
- Diaphoresis/flushing
- Hypotension
- Tachycardia/shortness of breath
- Nausea/vomiting
- Backaches/myalgias
- Flushing
**IVIG: Toxicity**

- Anaphylaxis - rare; most cases reported in setting of IgA deficiency
- Hepatitis
- Neurotropenia
- Hives
- Red, macular palm/sole/trunk with desquamation of skin on palms/soles
- Renal insufficiency
- Thrombosis: PE/CVA – Rare!
IVIG-induced Rash
PLASMAPHERESIS Rx

LIMITATIONS

• Trained technician
• Equipment
• IV Access - Often Requires Large Double-Lumen Catheter
• Complications: Pneumothorax, Hypotension, Sepsis, Pulmonary Embolism
• Expensive
• Benefit Lasts Several Weeks
Chronic Outpatient Plasma Exchange

Ahmed, Dimachkie, Barohn et al 2009

- 12 patients (10 MG, 1 LEMS, 1 CIDP)
- 13 double-lumen tunneled internal jugular catheters
- Mean retention time: 2 months
- Complications: infection (38%) and clotting (31%)

- 9 AV fistulas placed
- Average time to mature: 6-8 weeks
- Mean retention time: 6 months (still working in 6 patients)
- Complications: thrombosis 3 (33%), 1 while taking ASA
- Adverse effects during outpatient PLEX (n=91)
  - Transient dizziness (6%) with resumption of PLEX after fluid bolos in most
  - Nausea (1%)
Plasmapheresis:
The problem of access

- Periph IV hard to access
- Chron IJ line – 1 mo to 12 mo infection
- Ports
  - We tried Vortex Dx
  - Can’t take pressure
- AV fistulas
  - Clot
  - Cosmetic
### Plasma Exchange vs. IVIG: Pros & Cons

<table>
<thead>
<tr>
<th>Pro-PLEX:</th>
<th>Pro-IVIG:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• It makes sense</td>
<td>• Easy to give</td>
</tr>
<tr>
<td>• It works</td>
<td>• Faster to give full course</td>
</tr>
<tr>
<td>• Longer track record</td>
<td>• No sophisticated equipment needed</td>
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<tr>
<td>• ? Works faster</td>
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<table>
<thead>
<tr>
<th>Con-PLEX:</th>
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<tbody>
<tr>
<td>• Central line</td>
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<tr>
<td>• Morbidity</td>
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</tr>
<tr>
<td>• Need sophisticated</td>
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<tr>
<td>equipment and PLEX</td>
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<tr>
<td>team</td>
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<tr>
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<td>• May not work</td>
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<td>• If fails – PLEX out!</td>
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</table>
What Is Subcutaneous Ig (SCIg)?

• Infusion of IgG into subcutaneous tissue, usually using an infusion pump or syringe driver
• Weekly dose usually ≈ ¼ monthly IVIG dose
• Typically self-administered at home
• Flexible schedule and regimens available
• Patient can be ambulatory during administration
• Once pt is trained and demonstrates competence, routine nursing intervention not necessary
Conversion from IVIG to SCIG

- Rec is 1: 1.5
- 1gm/kg dose of 80gm/4weeks = 120gm
- Weekly give aprox 30 gm or 15 gm per infusion twice a week
- 20% solution = 75ml
- Use 2 pumps each w/ 2 ports
- 18-20cc per port
- Can infuse aprox 20 cc/hr/per port
## SCIG in CIDP: Published/Presented Reports

<table>
<thead>
<tr>
<th>Author, year</th>
<th>Study type, duration</th>
<th>Study pop.</th>
<th>N</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koller, 2006</td>
<td>Case report</td>
<td>Previous IVIG, methylprednisolone, mycophenolate mofetil</td>
<td>1</td>
<td>Improved INCAT disability and MRC sum score with no relapses; SCIG well tolerated</td>
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<tr>
<td>Lee, 2008</td>
<td>Case report</td>
<td>IVIG responders</td>
<td>2</td>
<td>Pts remained clinically stable; SCIG well tolerated</td>
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<tr>
<td>Magy, 2009 (PNS)</td>
<td>Prospective, open label, 36 wks</td>
<td>IVIG responders</td>
<td>16</td>
<td>2 pts relapsed, 1 pt had slight sensory deterioration, 13 pts remained stable</td>
</tr>
<tr>
<td>Cocito, 2011</td>
<td>Prospective, 6 mo</td>
<td>IVIG responders, clinically stable</td>
<td>5</td>
<td>Pts remained clinically stable; SCIG well tolerated</td>
</tr>
<tr>
<td>Jakobsen, 2012 (AAN)</td>
<td>Prospective, placebo-controlled, 12 wks</td>
<td>IVIG responders, switched to SCIG or placebo</td>
<td>30</td>
<td>Muscle strength, disability, walking distance improved with SCIG vs placebo; local side effects only</td>
</tr>
<tr>
<td>Bayas, 2012</td>
<td>Case report</td>
<td>Lewis-Sumner syndrome, IVIG responders</td>
<td>2</td>
<td>Pts remained clinically stable with dosing adjustments; SCIG well tolerated</td>
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SCIG in CIDP

- Vivaglobin® 160 mg/ml & portable programmable pump
- Gradual build-up
- Case 1: IVIG dependent 0.4 gm/kg/month (60 gm)
  - Weekly SCIG dose 16 g in 100 ml infused over 10 hours divided into 5 equal doses of 3.2 g over 3 days
- Case 2 responded to IVIG induction 40 g x 5 d
  - Weekly SCIG dose 6.4 g in 40 ml divided into 2 equal doses of 3.2 g in 1 day

Lee et al MN 2008 Mar;37(3):406-9
Current Research Studies of SCIG

- CIDP
- MG
Case Report #1

• 45 y/o WM presents with progressive R>L distal arm weakness over the past 2 years
• No associated neck pain or sensory changes.
• Normal laboratory workup including CSF analysis and MRI of cervical spine.
• NCS show normal SNAPs. Right median and ulnar CMAPs show prolonged distal latencies with proximal conduction block.
Case Report #1

- TRY Steroids?
- TRY IVIG?
- TRY Plasmapheresis?
Case Report #2

- 25 y/o WF with a history of generalized antibody-positive MG presents with worsening dysphagia, proximal weakness, diplopia, and ptosis
- Medications include Mestinon 60mg TID and Cellcept 1 g BID
- Pregnancy test is positive
Case Report #2

- TRY Steroids?
- TRY IVIG?
- TRY Plasmapheresis?
Case Report #3

- 25 y/o homosexual male presents with a 3 month history of progressive, symmetric, proximal and distal weakness with diffuse areflexia
- CSF shows a protein of 150 mg/dL and 60 WBC
- CMAPs show prolonged distal latencies with slowed CVs and conduction block
- SNAPs show prolonged peak latencies with decreased amplitudes
Case Report #3

- TRY Steroids?
- TRY IVIG?
- TRY Plasmapheresis?
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