Update on Infections in Pediatric Dermatology
Streptococcal Intertrigo

- Three case reports, all mistaken for candida intertrigo
- All with bright red, moist, glistening, foul smelling plaques in intertriginous areas
  - Creases of the neck and inguinal region
  - Nuchal region
  - Neck, antecubital, popliteal, axillary and inguinal regions

Streptococcal Intertrigo

- All grew group A β-hemolytic streptococci
- One case with *Staph aureus* as well
- Treated successfully with oral antibiotics and topical mupirocin and 1% hydrocortisone
Positive *Staph Aureus* Culture May Not Help in the Diagnosis of SSSS

- Fifty-four *S. aureus* isolates from children suspected of having SSSS
- Seventeen (31%) produced exfoliative toxins A or B by PCR or Western blot
- Sixty-nine percent were not toxin-producing strains of *S. aureus*
- Not a specific test for SSSS

Methicillin-Resistant *Staphylococcus aureus* Disease in Three Communities

- Centers for Disease Control and Prevention surveillance project 2001-2
  - Atlanta, Georgia (18 months)
  - Baltimore, Maryland (12 months)
  - Minnesota (24 months)
- MRSA surveillance from hospital and community based laboratories
- Community-acquired based on medical record and phone interview

Methicillin-Resistant *Staphylococcus Aureus* Disease in Three Communities

- 12,553 patients with MRSA
- 2107 (17%) with confirmed or probable community-acquired MRSA
- 1647 cases associated with clinical illness
  - 25.7 cases per 100,000 in Atlanta
  - 18.0 cases per 100,000 in Baltimore
- More common in those less than 2 years of age
- More common in blacks than whites in Atlanta
Methicillin-Resistant *Staphylococcus Aureus* Disease in Three Communities

- 77% skin and soft tissue infections
  - 59% abscesses
  - 42% cellulitis
  - 7% folliculitis
  - 3% impetigo
- 6% invasive - bacteremia, septic arthritis, osteomyelitis
- 10% wound infections
- 2% pneumonia
Methicillin-Resistant *Staphylococcus Aureus* Disease in Three Communities

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Atlanta</th>
<th>Baltimore</th>
<th>Minnesota</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cipro</td>
<td>63%</td>
<td>19%</td>
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<td>Clinda</td>
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<td>Erythromycin</td>
<td>11%</td>
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<tr>
<td>Rifampin</td>
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<td>97%</td>
</tr>
<tr>
<td>TCN</td>
<td>89%</td>
<td>61%</td>
<td>91%</td>
</tr>
<tr>
<td>Linezolid</td>
<td>100%</td>
<td>92%</td>
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</tr>
<tr>
<td>Bactrim</td>
<td>97%</td>
<td>83%</td>
<td>99%</td>
</tr>
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</table>
Methicillin-Resistant *Staphylococcus Aureus* Disease in Three Communities

- 58% received β-lactam antibiotics alone
- 15% received β-lactam antibiotics and non-β-lactam antibiotics
- 26% received only non-β-lactam antibiotics
- There were no significant differences in outcomes based on antibiotic coverage
- 23% hospitalized for CA-MRSA infection
- One death
Methicillin-Resistant Staphylococcus Aureus Disease in Three Communities

- MRSA is common around the country
- Sensitivities vary by region
- The outcome may not be dependant on antibiotic coverage
- The infections may be serious and death may result
Methicillin-Resistant *Staphylococcus Aureus* Epidemic in Southern Texas

- January 2001 to December 2002 compared with the previous decade
- Percentage of S. aureus that was MRSA
  - 2.9% in 1990
  - 10.6% in 1999
  - 19% in 2000
  - 62.4% in 2003, 92.6% of which are community-acquired

Methicillin-Resistant *Staphylococcus Aureus* Epidemic in Southern Texas

- CA-MRSA requiring hospitalization
  - 1990-1999 = 3.8 cases per 100,000 admissions
  - 2000-2001 = 57.8 cases per 100,000 admissions
  - 2002-2003 = 277.1 cases per 100,000 admissions
- “Categorizing children with CA-MRSA infections into those without risk factors is losing any clinical relevance...The antibiotic susceptibility patterns and the spectrums of disease are becoming increasingly similar.”
Staph Sepsis and Community-Acquired MRSA

- More than 70% of CA-Staph aureus at Texas Children’s caused by MRSA
- Prior to Sept. 2002, severe, life-threatening infections with CA-MRSA were rare
- Sept. 2002 to Jan. 2004
  - Report of 14 adolescents at TCH with CA-Staph aureus sepsis, 12 of which were CA-MRSA
  - 13/14 with bone/joint and pulmonary infections
  - 3/14 died, 2 of which where MRSA infections

Methicillin-Resistant *Staphylococcus Aureus* Experience in Southern New England

- 1063 children with *Staph aureus* cultures
  - Five year span of 1997-2001
  - 57 (5.4%) MRSA
  - 23 (2.2%) community-acquired MRSA
- Percentage of MRSA increased each year
  - From 2.7% (1997) to 9.3% (2001)
- Many of the children never received an antibiotic effective against MRSA and still recovered

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Management of Abscesses Caused by MRSA

- Dallas, Texas
- Sixty-nine children with culture-proven, community-acquired methicillin-resistant *Staphylococcus aureus* skin and soft tissue abscesses
- Most all children had their abscesses drained
- No difference in outcome based on whether or not they received an antibiotic effective against MRSA

Nasal Carriage of MRSA

- Routine nasal culture of 500 healthy children in Nashville, TN
- MRSA colonization in 9.2%
- Increase from 0.8% in 2001
- About 20% of the isolates had the PVL gene, which is associated with necrotizing pneumonia, furunculosis and abscesses

MRSA in Pro Football

- 2003 season, CDC investigation of 8 MRSA infections in 5 players on the St. Louis Rams
- All linemen or linebackers
- All associated with turf burns (elbows, forearms, knees)
- All large abscesses, 5-7 cm
- Total of 17 missed days due to infection
- Players have 2-3 turf burns per week, most common on artificial turf

MRSA in Pro Football

- Those with infection “had a significantly higher body-mass index” than those without infection.
- Similar infections developed in players on “Team A” (San Francisco 49ers).
- Identical strain (US300) in all players on both teams.
- All positive for Panton-Valentine leukocidin (PVL), a cytotoxin associated with abscesses and necrotizing pneumonia.
- 40% *Staph aureus* nasal colonization but no MRSA.
MRSA in Pro Football

- **Main risk factors**
  - Turf burn
  - Frequent skin-to-skin contact
  - Lack of regular access to hand hygiene

- **Infection control measures for health care providers**
  - Recognize MRSA emergence as pathogen in skin abscesses
  - Get cultures
  - Drain abscesses
  - Provided guidance regarding hand and personal hygiene
MRSA in High School Football

- MRSA in 11 high school football players from western PA with 20 infections
- Most were linemen
- Abscesses were very common and drainage was needed for most
- 33 times more likely to develop a recurrent infection if antibiotic coverage did not include an antibiotic guided by bacterial sensitivities
- Compliance with Bactroban to nares only 38.9%

Emergence of Predominant Clone of CA-MRSA

- Isolates obtained from Texas Children’s Hospital
- 62% increase in MRSA 2000 to 2003
- One clone has emerged over the past 3 years
  - TCH A
  - Same clone has been described around the United States and is referred to as US300 (remember the Rams and 49ers)
  - Accounts for about 94% of all MRSA

Increasing Clindamycin Resistance in MRSA

- S. aureus cultures from pediatric patients at 57 military hospitals and clinics from 2001-2 and 2003-4 were compared
- Clindamycin resistance increased from 0.48% to 4.0%
- Sensitivity to TMP-SMX was unchanged at >96% both years
- D-test positivity was low

Third Reported Case of Vancomycin-Resistant *Staph Aureus*

- Nursing home patient in NY
- Recovered in the urine
- Sensitive to chloramphenicol, linezolid, minocycline, quinupristin, rifampin, trimethoprim-sulfamethoxazole
- Two previous cases in PA and MI with no epidemiologic connection to this case

*MMWR* 2004;53:322-3
Linezolid (Zyvox) Versus Vancomycin

- Children 12-years-old and younger with nosocomial gram positive infections
- Randomized to receive either linezolid or vancomycin
- Cure rates were virtually identical for methicillin susceptible *Staph aureus*, methicillin resistant *Staph aureus*, and coagulase negative staphylococci
- Linezolid treated patients required significantly fewer days of intravenous therapy and had fewer drug related adverse events

Transient Psychosis in a Teen-age Girl Treated with Bactrim

- 19-year-old girl with spina bifida given Bactrim for UTI
- After third dose she became confused and agitated
- Visual, then auditory hallucinations
- Resolved completely within 6 days of stopping the Bactrim and no recurrence since that time
- No other suspect medications at the time

Summary of CA-MRSA

- Infection and carriage are getting more common with each passing year and a single clone may be emerging
- Not just in “hot spots” around the United States
- Treatment with “ineffective” antibiotics may not give a worse outcome (?more recurrences)
- MRSA can be associated with serious disease and sepsis
- Drain abscesses
- Clindamycin resistance is increasing and Vancomycin resistance has become a reality
- Linezolid may match Vancomycin’s efficacy
"Pseudomonas aeruginosa" in Cartilage Ear Piercing

- Seven confirmed cases of *Pseudomonas aeruginosa* infection from a single kiosk
- All performed on upper ear cartilage
- Another 18 cases suspected but unproven
- Two workers, “disinfectant” spray bottle and sink also culture positive for genetically identical strain
- Many with resultant deformity

Keene WE, Markum AC, Samadpour M. Outbreak of *Pseudomonas aeruginosa* infections caused by commercial piercing of upper ear cartilage. *JAMA*. 2004;291:981-5
Pityrosporum Folliculitis

- Case reports of six adolescent females on acne therapy with recent worsening
- Uniform 1-to-2 mm monomorphic, erythematous papules and pustules
- Pruritic during hot weather or increased activity
- KOH with spores and budding yeast
- Treated with various regimens of oral ketoconazole or fluconazole plus topical cream or shampoo

Pityrosporum Folliculitis

- Suspect when:
  - Pimples look all the same
  - Acne itches
  - Gets worse with exercise or heat
  - Associated with seborrheic dermatitis
  - Extends into the scalp

- Treatment
  - Ketoconazole 200 mg for 14 days, follow-up phone call with results
  - Topical ketoconazole shampoo or ZNP soap bar
  - Prophylaxis with fluconazole
Griseofulvin Takes on the Challengers

- Multicenter, prospective, randomized, non-industry sponsored study
- Compared the efficacy & safety of griseofulvin, terbinafine, itraconazole, & fluconazole in the treatment of *Trichophyton* tinea capitis
- 200 patients, 4 treatment groups

Griseofulvin Takes on the Challengers

- Griseofulvin 20 mg/kg micro x 6 wks
- Terbinafine >40 kg = 250mg, 20-40 kg = 125 mg, <20 = 62.5 mg x 2-3 weeks
- Itraconazole 5 mg/kg/d x 2-3 weeks
- Fluconazole 6 mg/kg/d x 2-3 weeks
- Patients evaluated at weeks 4, 8, 12
- Effective rx = mycological cure +/- a few residual symptoms
Griseofulvin Takes on the Challengers

- ITT population = 50 for each agent
- Conclusion: Newer oral agents, used for 2-3 weeks, are as effective as 6 weeks of griseofulvin

![Graph showing the success rates of different oral agents compared to griseofulvin over 2-3 weeks and 6 weeks. The graph indicates that Terbinafine has a success rate of 94%, Itraconazole has a success rate of 86%, Fluconazole has a success rate of 84%, and Griseofulvin has a success rate of 92% over 6 weeks. The 2-3 weeks as needed treatment option is also shown.]
Adverse Effects

- 6 patients in Griseo group – GI
- 1 patient in Griseo group – d/c – nausea
- No adverse effects in other treatment groups
- No laboratory studies checked
Terbinafine vs. Griseofulvin in Tinea Capitis: A Comparative Trial

- Double-blind, randomized prospective evaluation in 50 Peruvian children
- 74% *T. tonsurans*, 26% *M. canis*
- Griseofulvin 15 mg/kg/day for 8 weeks (*n* = 25)
- Terbinafine dosed by weight for 4 weeks, then placebo (*n* = 25)
- Clinical evaluation at weeks 2, 4, 6, 8, 12
- Culture at weeks 8 and 12

Terbinafine vs. Griseofulvin in Tinea Capitis: A Comparative Trial

- **Cure at 8 weeks**
  - Griseofulvin = 76%
  - Terbinafine = 72%
- **Cure at 12 weeks**
  - Griseofulvin = 44%
  - Terbinafine = 76%
  - If *M. canis* eliminated, 15/16 in terbinafine group cured at week 12 (94% cure rate)
- **Dosage of griseofulvin was too low**
Terbinafine for Tinea Capitis

- 159 patients with culture proven *Trichophyton* tinea capitis randomized to 1, 2 or 4 weeks of treatment with terbinafine, 3-6 mg/kg/d
  - Less than 20 kg- 62.5 mg
  - 20-40 kg- 125 mg
  - > 40 kg- 250 mg
- A 20 kg patient received 6.25 mg/kg
- A 40 kg patient received 3.13 mg/kg
- 41 patients discontinued randomized treatment

Terbinafine for Tinea Capitis

- Mycological cure = 60%, 76%, & 72%
- Effective treatment = 56%, 69%, 65%
- No significant difference between 2 & 4 week therapy
- Mean treatment dose = 4.5 mg/kg/day
- Those with dose > 4.5mg/kg/day had higher cure rates
Relationship Between Dose of Terbinafine Received and Efficacy Parameters in *Trichophyton* Study

- Median daily dose received:
  - < 4.5 mg/kg/day (n=88)
  - > 4.5 mg/kg/day (n =71)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Dose &lt; 4.5 mg/kg/day</th>
<th>Dose &gt; 4.5 mg/kg/day</th>
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<tr>
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<tr>
<td>Clinical cure</td>
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<td>67.6</td>
</tr>
<tr>
<td>Mycological cure</td>
<td>53.5</td>
<td>70.4</td>
</tr>
</tbody>
</table>
Is Terbinafine economical?

- Probably yes!
- Assume a 21 kg child who will be treated for:
  - 3 weeks with terbinafine at 125 mg (half a 250 mg pill) daily = $150
  - 6 weeks with liquid suspension 20 mg/kg = $265
  - 6 weeks with ultra microsized 250 mg pill, one and a half pills daily = $130
Itraconazole for Tinea Capitis Caused by *Microsporum Canis*

- Prospective study of 163 Austrian children
- Open-label, nonrandomized
- 5 mg/kg/day until clear or max of 12 weeks
- Clinical and mycologic cure in all children
- Mean treatment period 39  12 days

Chickenpox After Vaccination

- Outbreak of chickenpox in an Oregon elementary school, total of 21 cases
  - 18/152 (12%) vaccinated students
  - 3/7 (43%) unvaccinated students
  - Vaccine efficacy of 72%, similar to other reports
- Students vaccinated > 5 years prior to the outbreak were 6.2 times more likely to develop disease
- Fever less common in vaccinated group
- Lesion counts about the same
- Will revaccination be needed in the future?

Chickenpox After Vaccination

- Outbreak of chickenpox in two Utah elementary schools, total of 83 cases, October 2002-Feb. 2003
  - 26 vaccinated students
  - 57 unvaccinated students
  - Vaccine efficacy of 87%
  - Risk factors for breakthrough varicella included vaccinated > 5 years prior to the outbreak or vaccinated at < 18 months of age
- Milder disease in vaccinated group

Chickenpox After Vaccination

- Retrospective, population-based study
- Four million covered lives per year from over 100 health insurance plans
- Primary diagnosis of varicella (not zoster)
  - Decline from 2.3 to 0.3 hospitalizations per 100,000
  - 88% decrease (P<0.001)
  - Decline from 215 to 89 ambulatory visits per 100,000
  - 59% decrease (P<0.001)
- Similar results for any diagnosis of varicella

Chickenpox Mortality After Vaccination

- Death records 1988-2000 reviewed in the state of California
- Varicella as either an underlying or contributing cause of death
- Vaccine licensure in 1995
- Mortality high of 0.97 per million in 1990
- Mortality low of 0.22 per million in 1999

Chickenpox Mortality After Vaccination

- Information from National Center for Health Statistics Multiple Cause-of-Death Mortality Data, 1990-2001
- Total deaths decreased from 145 per year to 66 per year
- 1990-1994 = 0.41 deaths per million
- 1999-2001 = 0.14 deaths per million

First Reports of Stroke After Varicella Vaccination

- Lacunar infarction recognized as complication of varicella infection since 1983
- 14 and 18-month-old girls with confirmed strokes 7 and 5 days after immunization
- No coagulopathy or vasculitis
- No rash in either
- Pathogenesis unknown- ? direct viral infection of the vessel or post-viral immune-mediated reaction

Acyclovir Is Minimally Helpful In Treating Varicella

- Meta analysis of three placebo-controlled studies
  - 988 patients, 2-18 years of age
- Conclusion
  - Shortens time to fever reduction and time to new lesions by one day
  - No effect on complication rates
  - Only works if treatment initiated within 24 hours of rash
  - “Use of acyclovir should not currently be recommended in immunocompetent children with chickenpox”

Bullous Herpes Zoster

- Four-year-old in consolidation phase of treatment for leukemia
- Known previous chicken pox infection
- Vesicles in C6, C7, T1 distribution
- Vesicles enlarged forming large bulla
- PCR confirmation of varicella DNA
- Improved with opening the bulla and IV acyclovir

Facial Paralysis From Varicella-Zoster

- Study from Sapporo, Japan
- 30 children with “idiopathic” facial nerve palsy (Bell’s palsy)
- 2 children with cutaneous lesions of zoster (Ramsey-Hunt syndrome)
- 10/28 with significant rise in IgM and IgG titers
  - Only three with varicella-zoster DNA by PCR
- Reactivation of varicella-zoster (zoster sine herpete) may play a role in a percentage of children with Bell’s palsy

Monkeypox in the U.S.

- Monkeypox first recognized in 1958 in captive primates, first human cases in 1970 in Congo
- Not reported outside of Africa
- Outbreak of monkeypox in 11 patients in the Midwest
- Index case was a 3-year-old girl from Wisconsin who was bitten by her pet prairie dog
- All of the cases were linked to an infected Gambian giant rat which infected pet prairie dogs and subsequent contacts

Ill Gambian giant rat imported from Ghana by distributor 1 in northern Illinois
Distributor 1 asked distributor 2 to transport the rat to an exotic-animal veterinarian, eventually died
Transported with 15 prairie dogs purchased elsewhere, reportedly in a separate cage with no direct contact
Sold to 2 pet stores who later reported that the animals were ill with watery eyes, congestion and skin lesions.
Monkeypox in the U.S.

- Two patients scratched or bitten by prairie dog
- Three patients through open wounds
- Parents of the 3-year-old girl may have been inoculated while caring for their daughter

Signs and symptoms
- Fever (above 38°C), drenching sweats and chills
- Skin lesions
- Persistent cough
- Lymphadenopathy
- Sore throat
1-50 lesions starting as papules evolving to vesicopustules, some with erythematous flares
Serous or hemorrhagic crusts
Different stages of evolution
Larger lesions left central scars
Monkeypox in the U.S.

- Pathology
  - Ballooning degeneration of keratinocytes
  - Epidermal necrosis and spongiotic edema
  - Multinucleation
  - Occasional eosinophilic cytoplasmic inclusions
- Orthopoxviral antigen on immunohistochemistry
- Electron microscopy typical of orthopoxvirus
- PCR suggested a monkeypox-like Old World orthopoxvirus
Monkeypox in the U.S.

- All 11 cases self-resolved
- Only 5/11 had previously received smallpox vaccination
- Very limited person-to-person spread so not self-sustaining in human populations
- Outbreaks in Illinois, Indiana, Kansas, Missouri, Ohio in addition to Wisconsin
Monkeypox in the U.S.
The Saga Continues

- The 6-year-old girl and infected parents part of index cases reported from Indiana
- Older sibling who did not live in the home but helped purchase and transport the prairie dogs
- Prairie dogs brought to a veterinarian, one prairie dog died in the office
- The house of the 3-year-old girl was a child care facility for 26 other children
- The pet prairie dogs were taken to school and shown to 2 classes, 40 total kindergarten students

Monkeypox in the U.S.
The Saga Continues

- Older sibling who did not live in the home but helped purchase and transport the prairie dogs
  - Vesicular rash, probable case
- Prairie dog brought to a veterinarian
  - Confirmed case
- The house of the 3-year-old girl was a child care facility for 26 other children
  - 4 suspect cases, a 1-year-old had negative PCR and negative serologies
- The pet prairie dogs were taken to school and shown to 2 classes, 40 total kindergarten students
  - No cases
In Vitro Comparison of Pediculicidal Agents

- Live lice collected from 25 children and adults at a lice and nit removal service (Lice Source Services, Inc)
- Lice exposed to pediculicidal agent on cotton disk
  - Malathion
  - Permethrin, diluted and undiluted
  - Pyrethrin, Rid and A-200
  - Lindane

In Vitro Comparison of Pediculicidal Agents

<table>
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<th>Agent</th>
<th>Dead 20 min</th>
<th>Dead 1 hr</th>
<th>Dead 3 hr</th>
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<tbody>
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<td>Malathion</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>A-200</td>
<td>60%</td>
<td>82%</td>
<td>100%</td>
</tr>
<tr>
<td>Undilute Nix</td>
<td>10%</td>
<td>49%</td>
<td>74%</td>
</tr>
<tr>
<td>Dilute Nix</td>
<td>8%</td>
<td>18%</td>
<td>46%</td>
</tr>
<tr>
<td>RID</td>
<td>8%</td>
<td>21%</td>
<td>34%</td>
</tr>
<tr>
<td>Lindane</td>
<td>2%</td>
<td>8%</td>
<td>17%</td>
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</tbody>
</table>

*A-200 contains benzyl alcohol and RID does not.
Reduced Application Time of Ovide

- Application time of 20 minutes rather than overnight
- Repeat treatment at one week if not cured
- Cure rate 98% with Ovide compared to 55% with Nix
- Reinfestation 0% with Ovide and 33% with Nix

Meinking TL, et al. Efficacy of a reduced application time of Ovide lotion (0.5% malathion) compared to Nix creme rinse (1% permethrin) for the treatment of head lice. *Pediatr Dermatol.* 2004;21:670-674
A New Suffocation-Based Pediculicide

- Nuvo lotion- applied wet and then blown dry with hair drier
- “Shrink wrap” seal suffocates the louse
- Leave on overnight and wash in the morning
- Repeat up to three times on weekly intervals
- Ingredients- stearyl alcohol, propylene glycol, sodium lauryl sulfate, cetyl alcohol, water, methyl 4-hydroxybenzoate, propyl p-hydroxybenzoate, butyl p-hydroxybenzoate
- All recognized as safe by the FDA

A New Suffocation-Based Pediculicide

- 133 subjects (subjects paid $200 refundable deposit to participate)
  - Trial 1- 93 patients comb with LiceMeister
  - Trial 2- 40 patients regular comb
- Cure 97% trial 1 and 95% trial 2
- Parents reported that treatment took about half the time of previous treatments
- Able to go to school without looking funny while the solution was in the scalp
A New Suffocation-Based Pediculicide

News Break

- Nuvo lotion is Cetaphil cleanser
- Transfer to squirter bottle like a condiment container
- More information www.nuvoforheadlice.com

Suffocation of Head Lice with 4% Dimeticone Lotion

- Clear, odorless fluid that dries by evaporation
- Two overnight applications, 7 days apart
- Cure rate of 70%

“Bug Busting” to Treat Head Lice

- Bug busting compared to OTC head lice treatments (0.5% malathion or 1% permethrin) in Great Britain
- Bug busting = use of fine toothed comb on wet hair, four combings, three day intervals between each
- Cure rates 57% for bug busting and 13% for chemical methods

Nicotine for the Treatment of Head Lice

- Nicotine used in the control of poultry lice
- In vitro study on human head lice
- Did not work well as an insecticide
- Did cause muscle twitches that may cause loss of grip on the hair shaft facilitating removal of adult lice

Tea Tree Shampoo is a wonderfully luxurious shampoo proven to help solve tough scalp problems. It can even be used to combat head lice! Tea Tree Oil is a natural oil derived from the Tea Tree Bush found only in certain areas of Australia. Because the Tea Tree bush grows so rapidly it is a natural, renewable resource. Swiss Tea Tree Shampoo has been specially formulated with natural source Tea Tree Oil.
Tea Tree Oil for the Treatment of Head Lice

- Many pediculicidal agents work by inhibition of acetylcholinesterase
- Tea Tree oil found to have inhibitory effect on acetylcholinesterase

Ingestion of Tea Tree Oil

- Tea tree oil (*Melaleuca* oil) used as a topical antiseptic and antifungal agent
- Four-year-old Amish boy accidentally given 2 tsp orally
- Ataxic then unconscious requiring intubation
- Recovered

Ivermectin-resistant Scabies

- Two case reports out of separate Aboriginal communities in Australia
- 36 yo woman and 47 yo man with 30 and 58 doses of ivermectin respectively for crusted scabies
- Neither was immunosuppressed
- Lack of in vivo efficacy and in vitro resistance demonstrated to ivermectin
- Multiple agents used to eventually clear the infestation, including Tea Tree oil

Lindane Ingestions

- Case reports from Sentinel Event Notification System for Occupational Risks-Pesticides (SENSOR-Pesticides) program and the Toxic Exposure Surveillance System (TESS)
- 870 cases of lindane ingestion from 1998 to 2003
- Rx should be filled in no more than 2 oz bottles

DEET is the best and duration of action is dependent upon concentration
- OFF Deep Woods (23.8%) 300 minutes
- OFF Skintastic (6.65%) 112 minutes
- OFF Skintastic for kids (4.75%) 88 minutes
- Bite Blocker for kids (2% soybean oil) 95 minutes
- Citronella and Skin So Soft products did not do well
- All wrist band products were worthless