Non-Inpatient Parenteral Antibiotic Therapy: clinical and cost effective option

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TAYSIDE OHPAT EXPERIENCE
Case Study

Seen in A&E or AMU

- 66 year old woman, independent, lives with husband
- Mild asthma, thyroxine replacement and obese
- 3 days of fever, with pain and increase swelling and spreading erythema over right leg. Athlete’s foot.
- Nauseated after oral antibiotic therapy
- Started on oral flucloxacillin by GP 36 hours earlier
- T 38.2c. No evidence of sepsis
- Diagnosis, Cellulitis - need for IV therapy
Why Parenteral Antibiotics?

- Rapid levels
- More rapid resolution of symptoms
- High levels to penetrate infected areas
- Assure absorption & compliance
- If no oral agent available or oral agent not tolerated or has failed
- Proven effectiveness: endocarditis, meningitis, osteomyelitis, bactereramia, severe infections where rapid cidal therapy is required
What would you do where you work?

1. Admit to hospital and start inpatient IV therapy (flucloxacillin)
2. Try higher dose of oral therapy and ask to return for review
3. Seek OHPAT team review & discharge on IV therapy (once daily ceftriaxone)
4. Admit for 24 hour observation and change to oral therapy or continuing IV therapy with OPAT team review
5. Other
What is it?

- OPAT : (Outpatient Parenteral [iv, im] Antibiotic or Antimicrobial Therapy)
  - Health care professional delivered H-OPAT
  - Self administered S-OPAT

- CO-PAT (Community parenteral antibiotic therapy)

- OHPAT (Outpatient and Home Parenteral Antibiotic or Antimicrobial Therapy)

- Ambulatory or non-inpatient parenteral antimicrobial therapy

- Non-inpatient parenteral antimicrobial therapy (NIPAT)
Fog Bar Theatre presents an original, unexpected production of "The Martinis Brothers' Instant Cabaret."

Often in peril, but never in a hurry.

A frenetic spectacle of circus acts with a dash of 60s cool!

Directed by Tim Wolliscroft & Lindsay Hart, starring an international all-star cast.

Featuring Andy Dextors & Tim Foolery.

Special guest appearances by members of the public.

Producers: Mark Simmons & Andre Pattenden.

Written & conceived by Andrew P. morals.
OPAT in the United States

- First described in 1974 in children with cystic fibrosis
- Now over 250,000 patients are treated with OPAT each year (1/1000 Americans)
- Over $1.5 billion/year
- Growing still
Growth in home, outpatient and ambulatory care

- Home care from $2 billion in 1998 to $34 million in 2000
- Massive increase in private sector in UK
- OPC’s 62.5 million in 1993 to 67.1 million in 1996
- Big investment in ambulatory care
- Physician office visits 717 million in 1993 to 734 million in 1996
- Big investment in community care
- Commissioning of care by primary care groups
Reasons for OPAT

- Ambulatory care is at the heart of healthcare reform
- Hospital beds are at a premium
- Quality of life: Patient & carer benefits
  - Family and friends
  - Sleep, clothing, and food
  - Return to work or school
- Cost savings or cost-neutral
- Risks of hospitalization
  - Nosocomial infections (5%, $2500+ each)
  - Antibiotic-resistant organisms, *C. difficile*
  - Non-infection risks
Advantages of OPAT

- Prevents social / psychological problems
- Allows choices of therapy to suit individual needs
- Preferred by patients
- Allows for earlier discharge (reduce LOS) or prevent hospitalisation
- Eases pressure on beds
- Improved efficiency of resource use
  - Waiting times impact e.g orthopaedics
- Reduces hospital medical / nursing staff workloads but primary care impact must be resourced
- Avoids hospital-acquired infections
- Cost effective
CHATTERING CLASSES

‘At least the waiting lists are improving – I only had to wait two months to get MRSA’
## Respondents’ speciality, experience of OHPAT and views regarding parenteral antibiotic therapy in the UK

<table>
<thead>
<tr>
<th>Replies to Questionnaire</th>
<th>No</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microbiologist</td>
<td>145</td>
<td>(82)</td>
</tr>
<tr>
<td>Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>North England</td>
<td>61</td>
<td>(39)</td>
</tr>
<tr>
<td>South England</td>
<td>51</td>
<td>(31)</td>
</tr>
<tr>
<td>Scotland</td>
<td>15</td>
<td>(10)</td>
</tr>
<tr>
<td>Wales</td>
<td>12</td>
<td>(8)</td>
</tr>
<tr>
<td>Ireland</td>
<td>4</td>
<td>(3)</td>
</tr>
<tr>
<td>Not known</td>
<td>14</td>
<td>(9)</td>
</tr>
<tr>
<td>Experience of OHPAT in Community acquired infection in current post</td>
<td>81</td>
<td>(52)</td>
</tr>
<tr>
<td>Experience of OHPAT in Hospital acquired infection in current post</td>
<td>96</td>
<td>(61)</td>
</tr>
<tr>
<td>OHPAT service already in place</td>
<td>33</td>
<td>(21)</td>
</tr>
<tr>
<td>Perceive need for OHPAT service (excludes those with service)</td>
<td>76</td>
<td>(61)</td>
</tr>
<tr>
<td>Parenteral antibiotics should always be administered in hospital</td>
<td>3</td>
<td>(2)</td>
</tr>
</tbody>
</table>
Most important factors which have prevented the development of an OHPAT service

<table>
<thead>
<tr>
<th>Factor</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small no. pts. / fragmented distribution</td>
<td>34</td>
<td>27%</td>
</tr>
<tr>
<td>Funding issues</td>
<td>43</td>
<td>35%</td>
</tr>
<tr>
<td>Lack of leadership</td>
<td>42</td>
<td>34%</td>
</tr>
<tr>
<td>Difficulties in co-ordinating hospital &amp; community care</td>
<td>37</td>
<td>30%</td>
</tr>
<tr>
<td>Staffing / training issues</td>
<td>21</td>
<td>17%</td>
</tr>
<tr>
<td>No time to organise</td>
<td>14</td>
<td>11%</td>
</tr>
<tr>
<td>Not safe (line care or drug administration)</td>
<td>12</td>
<td>10%</td>
</tr>
<tr>
<td>Lack of guidelines</td>
<td>8</td>
<td>6%</td>
</tr>
<tr>
<td>Lack of experience in OHPAT</td>
<td>9</td>
<td>7%</td>
</tr>
<tr>
<td>More suitable options (eg oral agents, OHPAT as required)</td>
<td>8</td>
<td>6%</td>
</tr>
<tr>
<td>Geographical constraints</td>
<td>6</td>
<td>5%</td>
</tr>
<tr>
<td>Not yet organised</td>
<td>5</td>
<td>4%</td>
</tr>
<tr>
<td>Not cost-effective</td>
<td>5</td>
<td>4%</td>
</tr>
<tr>
<td>Patient expectations</td>
<td>4</td>
<td>3%</td>
</tr>
<tr>
<td>Don’t know</td>
<td>3</td>
<td>2%</td>
</tr>
<tr>
<td>Total number of respondents</td>
<td>124</td>
<td>100%</td>
</tr>
</tbody>
</table>

Seaton & Nathwani 1999
OHPAT delivery: Many locations

- Outpatient clinic in hospital
- Day area in hospital
- Community hospitals
- Infusion centres
- Ambulatory diagnostic and treatment centres
- GP surgery
- Patients home
Infections appropriate for OHPAT

Treatment >2 weeks
- Endocarditis
- Osteomyelitis & PJI’s
- Septic arthritis
- Diabetic foot ulcer infections
- Fungal infections
- AIDS-related infections

Treatment <2 weeks
- Cellulitis/ssti’s
- MRSA wound & line infections
- Pyelonephritis
- UTI’s
- Meningitis
- Others
Diabetic Foot Infection
Which bacteria are treated with OPAT?

- *Staphylococcus aureus* – methicillin susceptible
- *S. aureus* – methicillin resistant
- Coagulase-negative staphylococci
- Gram-negative bacteria (ESBL’s)
- *Pseudomonas aeruginosa*
- Enterococci
Antibiotic selection for OPAT

- Proven efficacy
  - culture important
- Proven safe
- Well tolerated, few side effects
- Long half-life
- Infrequent administration
- Stable when mixed

Patient selection criteria

- Deemed to be suitable by medical staff - use of assessment criteria
- Clear treatment plan defined
- Clinically stable
- Physically and mentally able
- Appropriate home / social circumstances
- Willing and motivated
- Family support
Case Study

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- Nauseated
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<table>
<thead>
<tr>
<th>Class Approach</th>
<th>Clinical Presentation</th>
<th>Therapeutic</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Generally healthy and afebrile AND Cellulitis &lt; 5–15 cm diameter</td>
<td>Oral antibiotics</td>
</tr>
<tr>
<td>II</td>
<td>Febrile (&gt; 38°C) and healthy or afebrile with comorbidities (PVD, DM, morbid obesity) AND Cellulitis &gt; 5 cm on face &gt; 15 cm on limbs OR Bacteria resistant to oral antibiotics</td>
<td>OPAT</td>
</tr>
</tbody>
</table>

PVD = peripheral vascular disease, DM = diabetes mellitus, OPAT = outpatient parenteral antibiotic therapy.
## Classification Scheme (CONT’D)

<table>
<thead>
<tr>
<th>Class Approach</th>
<th>Clinical Presentation</th>
<th>Therapeutic</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Septic appearance*</td>
<td>Admit to ward</td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rapidly spreading, limb-threatening infection, especially with gangrene, crepitus, or bullae</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Deep involvement of fascia, tendon, joint, or bone</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cellulitis with PVD requiring revascularization</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class II patient lacking home support or noncompliant in off-loading extremity</td>
<td></td>
</tr>
</tbody>
</table>

*Fever plus change in mental status.
<table>
<thead>
<tr>
<th>Class</th>
<th>Clinical Presentation</th>
<th>Therapeutic</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Necrotizing fasciitis or other severe cellulitis</td>
<td>Admit to ICU</td>
</tr>
<tr>
<td></td>
<td>+ sepsis syndrome*</td>
<td></td>
</tr>
</tbody>
</table>

*Hypotension, acute renal insufficiency, thrombocytopenia, acute respiratory distress syndrome, metabolic acidosis.
Written patient information / education

- To enhance and not replace verbal information
- Developed in partnership with patients / carers
- Ensures informed choice of treatment
- Specifies advantages / disadvantages
- Line management / care of vascular access device
- Storage / reconstitution / administration of drugs
- Drug reactions / interactions
- Problem solving
- 24-hour helpline
OHPAT AGENTS

- Ceftriaxone
- Teicoplanin
- Gentamicin
- Amphotericin B
- Ertapenem
- Daptomycin
- Dalbavancin (once weekly)
- Oritavancin
- Caspofungin
- Infusion pumps
OPAT treatment options: people resource

- Treatment delivered by a health-care professional H-OPAT
- Treatment self-administered S-OPAT
Comparison between H-OPAT (n=1621) and S-OPAT (n=513)

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>H-OPAT (% of diagnosis)</th>
<th>S-OPAT (% of diagnosis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infected prosthesis</td>
<td>30.2</td>
<td>19.1</td>
</tr>
<tr>
<td>Osteomyelitis &amp; septic arthritis</td>
<td>42.2</td>
<td>50.2</td>
</tr>
<tr>
<td>SSTI</td>
<td>5.8</td>
<td>4.9</td>
</tr>
<tr>
<td>Endovascular infection</td>
<td>4.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Bacteraemia</td>
<td>7</td>
<td>1.6</td>
</tr>
<tr>
<td>Viral/fungal/mycobacterial</td>
<td>0.5</td>
<td>1.9</td>
</tr>
<tr>
<td>Other</td>
<td>9</td>
<td>11.3</td>
</tr>
</tbody>
</table>

WHAT MODEL OF CARE?

1. Effective
2. Cost-effective
3. Safe
4. Improves patients' quality of life
Flow-chart for the organization of a home-care team

1. Final protocol (written, agreed document approved by local ethics committee)
2. Establish hospital-based home-care team led by doctor. Nurse to co-ordinate day-to-day activities
3. Liaison with other physicians and specialist nurses
4. Selection of suitable patients
5. Training of hospital- and community based members of team
6. Audit process - regular, written reports
7. Make modifications to protocol, if necessary
8. GP, community nurses, social workers
9. 24-hour direct advice available - clear written guidelines for patients/doctors on how to obtain service

Nathwani et al CMI 2000; 6: 1-15
OPAT Map to identify risks associated with an OPAT service

- Assessment of risk to staff and patients of introducing an OPAT service using the Healthcare Failure Mode Effect Analysis (HFMEA)
- Map OPAT process and identify system failures so as to design an OPAT model where the risk is minimized
- Use of a consensus panel to which the HFMEA model was applied
- 6 processes, 67 sub-processes and 217 possible failures identified

Final OPAT Map that the HFMEA team agreed upon

- **Step 1**: Patient considered for OPAT
- **Step 2**: Discussion with patient regarding OPAT
- **Step 3**: Patient assessment by OPAT team
- **Step 4**: Patient accepted onto OPAT & treatment initiated
- **Step 5**: Ongoing treatment and monitoring
- **Step 6**: IV therapy under OPAT concluded

Glichrist M et al. JAC 2008; 62: 177-183
Is it safe?
## Comparison between H-OPAT (n=1536) and S-OPAT (n=473)

### Complications

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>H-OPAT (% of diagnosis)</th>
<th>S-OPAT (% of diagnosis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total complications</td>
<td>23.2</td>
<td>23.6</td>
</tr>
<tr>
<td>Drug related complications</td>
<td>12.2</td>
<td>12.5</td>
</tr>
<tr>
<td><em>C. difficile</em></td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Line related complications</td>
<td>-0.6</td>
<td>1.0</td>
</tr>
<tr>
<td>Other complications related to therapy</td>
<td>2.9</td>
<td>3.8</td>
</tr>
<tr>
<td>Other complications not related to therapy</td>
<td>6.3</td>
<td>7.3</td>
</tr>
</tbody>
</table>

Economics of OPAT provision

- Oxford programme
- 2005
- 286 patients for OPAT
- >6200 bed days saved

- Singapore programme (S-OPAT)
- 2004
- 53 patients
- 7022 bed days saved

Ingram PR et al. JAC2007
Cellulitis and erysipelas

Burden

- 1985 29820 SSTIs and mean occupancy of 664 hospital bed days each day\(^1\)
- Average length of stay in NI in 2003 was 11d (2081 admissions)\(^2\), Scotland mean LOS 5.5d
- 69576 (Cellulitis) and 516 (erysipelas) episodes admitted to UK hospitals in 2004-2005 \(^3\) ~ 390,000 bed days assuming mean of 5.5 bed days
- If ~ £200/day in hospital ~ £77m/year

2. CREST [www.crestni.org.uk](http://www.crestni.org.uk)
3. Hospital episode statistics:
   http://www/hesonline.nhs.uk/Ease/servlet/ContentServer?siteID=1937&categoryID=203
<table>
<thead>
<tr>
<th>Patients treated</th>
<th>Bed days saved</th>
<th>Monthly average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>101</td>
<td>1461</td>
</tr>
<tr>
<td>Year 2</td>
<td>113</td>
<td>1419</td>
</tr>
<tr>
<td>Year 3</td>
<td>120</td>
<td>1793</td>
</tr>
<tr>
<td>Year 4</td>
<td>126</td>
<td>1914</td>
</tr>
<tr>
<td>Year 5</td>
<td>132</td>
<td>1918</td>
</tr>
<tr>
<td>Year 8</td>
<td>129</td>
<td>3007</td>
</tr>
</tbody>
</table>

Medical 95 patients/1338 beds/Orthopaedics 29 patients/1525 beds
Optimising OHPAT

- Patient group directive for iv to oral switch for cellulitis patients
- Nurse-led management of uncomplicated cellulitis
- Cellulitis (CREST) protocol
Nurse-Led Management of Cellulitis

- N = 114  V 230 CONTROLS managed traditionally through OHPAT
- Protocol management: Admission criteria and need for medical review
- Outcomes:
  - No difference in clinical outcome, complications, readmission
  - IV THERAPY decreased from 4 to 3 days
  - Physician review decrease from 100% to 19%

Seaton RA et al JAC 2005; 55: 764-767
QUALITY ASSURANCE
Clinical outcome:
- Cure/improving: 96%
- No change: 2%
- Worse: 2%

Unscheduled re-admission: 3%
PIC line complications: 0-0.5%
Adverse drug reactions: 2%
Microbiology: positive cultures: 20%
Economic outcome:
- Additional daily cost of drug: <£6

- No severe allergic reactions (anaphylaxis)
- Very few cases of *C. difficile* reported
- No suggestions of emerging resistance in organisms

50% GP referrals, 40% hospital (60% AMU), 5% LTCF, 5% A&E
Patient Satisfaction Audit

98.5%  Said this form of treatment met or exceeded their expectations
96.5%  Preferred this service to in-patient treatment
96.5%  Would prefer this form again of treatment if the need arose
96.5%  Of family / carers were satisfied with all aspects of the service
98.0%  Said the service improved the quality of their life
89.5%  Of patients felt they were happy with all aspects of the service
OHPAT Conclusions

- We have come a long way in the UK
- More than 50 centres now
- Variety of models and diseases treated; link to other disease areas/models of ambulatory care
- Adapt models to local infrastructure and resource
- AMU’s can play an important role here
- Variable level of primary care involvement: needs to be shared care
- NHS and private home care involved
- Safety and quality key to success
- Cost-effectiveness
- Patient satisfaction & involvement high