HAP / VAP Clinical Trials: Can we reduce complexity to reduce cost while improving the quality of the data and inferences we make?

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Knirsch Disclosure

Employee of Pfizer and compensated with equity

This presentation does not reflect an official position of Pfizer

Does reflect the views of a physician/investigator deeply concerned about the current state of antibacterial discovery and development
Overview

Problem Statement from a Drug Developers POV

Anti-bacterial discovery and development are *in extremis* so a good place to start; generalisable to the clinical trial ecosystem that is at risk

Academia (IDSA) alone will not solve this; Public Private Partnership eg CTTI is more likely to succeed

The Industry has committed in 3rd party convened fora, time and effort to the thought experiment and discussed, presented and published our work

Last Gasp
Eroom’s Law:
New FDA Approvals / Billion $: halved every 9 years

Anti-bacterial discovery failures

Confirm Development Inefficient

Nature Reviews | Drug Discovery  Scannell et al 2012
Simple Substantive Steps Now
Knirsch CTTI 2012 Workshop Summary

• Increased Funding for basic bacterial laboratory work

• Infrastructure and network for clinical trial excellence particularly learn phase development at leading academic medical centers

• Enhance GAIN or other mechanisms (Foundations, NGO’s) for discovery and early development incentives

• Continue and commit to the progressive Regulatory stance we have heard at this meeting and comments in other fora eg PCAST

• Not relaxed standards but efficient development to bring much needed medicines to the clinic faster with robust pharmaco-vigilance and stewardship
  • Use of existing expedited Regulatory Pathways (Sub-part H and PV Guidance)

• Progressive value models eg LSE report from the Swedish Presidency
The paradigm gap

- For registration, we traditionally expect
  - Two substantial trials per indication (e.g., two UTI trials)
  - Typical size/trial: ~1,000 patients
- This presumes ready availability of substantial numbers of patients with the target disease
- But, what if the target disease includes a less common, but important, pathogen or type of resistance?
  - Less common pathogen: *Pseudomonas*
  - Emerging form of resistance: KPC or Metallo-ß-lactamase
- When only limited clinical data for these important subsets are possible, current paradigms give no easy way forward
  - Waiting for widespread resistance means we can’t anticipate the epidemic
A tiered approach: Aligning feasibility and the quantity of clinical data with the unmet medical need

- The need for a tiered approach is real – there are real products at each tier that need a path forward.
- Determination of the appropriate tier should be based on context:
  - Feasibility
  - Unmet medical need
  - Strength of the preclinical data
  - By utilizing the totality of data, existing regulatory requirements can be met at each tier.

Increased degree of and decreased ability to test unmet medical need

Eisenstein - Tier B-C overview, EMA workshop 25-26 Oct 2012

Rex et al Lancet ID 2012
**A & D are familiar, B & C are new**

- **A**: Large clinical datasets (high quantity of data)
  - P3 x 2

- **B**: Small clinical datasets
  - P3 x 1 plus small studies
  - Reliance on human PK data combined with preclinical data*

- **C**: Animal studies
  - Pathogen-focused for unmet need

- **D**: Acceptance of smaller clinical datasets (often merged across body sites)
  - Response to unmet medical need

*Animal rule

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**Quantity of Clinical Efficacy Data**

**Acceptance of smaller clinical datasets (often merged across body sites) in response to unmet medical need**

Goldberger - MDR Overview, EMA workshop 25-26 Oct 2012

Rex et al Lancet ID 2012
It’s all about Benefit-Risk

• High unmet need for new MDR therapies justifies accepting more uncertainty regarding efficacy and safety in product development.
  – Without this, we’ll see a continuing increase in unmet need
  – These greater levels of uncertainty can be managed & described

• Efficacy
  – Increased utilization of pre-clinical and early clinical data
  – At least some controlled data in the clinical trials

• Safety
  – Usual preclinical assessments
  – Safety data from all trials to identify AEs in the 0.5-1.0% range

• SmPC to focus on situations where both potential benefit and tolerance of unexpected safety events are greater
Summary

• MDR development focuses on an unmet need
• A totality of evidence approach expedites development while enhancing the strength of evidence supporting the new drug
• Development approaches must anticipate the problem of Drug #2: To meet the challenge of evolving resistance patterns there must be feasible pathways for both the initial and subsequent drugs that do not require a demonstration of superiority on a hard endpoint
• To provide these new therapies it will be necessary to accept greater uncertainty regarding efficacy and safety but some of the associated risk can be mitigated
• Harmonization of regulatory requirements is an essential component of this paradigm
Staged approval

- Conditional approval with POC data, with limited use and promotion
- Requirement for additional data in a post-approval commitment depending on epidemiology could lead to enhanced label

Advantage

- Brings much needed medicine to patients in a timely manner
- Incentive to Discovery, Early Development
- Benefit-Risk Evolves

Alemayehu et al CID 2012
Objective: streamlined clinical trial MRSA only (innovative prior to CID supplement)

8 Inclusion Criteria (multi-component); 26 Exclusion Criteria

1225 Patients enrolled over 5.5 yrs; 3 protocol amendments; DMC changes

448 culture-positive for MRSA (mITT) ; 348 evaluable at End-of-Study (PP)

280 (63%) ventilated at baseline (mITT)

156 Centers
- 90 US (58%)
- 28 EU (18%)
- 16 Latin America (10%)
- 13 Asia (8%)
- 9 Other (6%)
Study Design

Vancomycin IV
30 mg/kg/day in 2 divided doses q12h

Linezolid IV
600 mg q12h

1:1 Randomization

Within 5 days of EOT

EOT Visit

EOS Visit

7-3-30 days after EOT

- Vancomycin dose adjusted by unblinded pharmacist based on renal function and trough concentration
- Initial Cefepime or other Gram-negative coverage (not MRSA active) required
Key Inclusion Criteria

- Criteria must be present within 24 h of enrollment (not pre-treated)
- If pre-treated, S/S present 24 h prior to that treatment or within 72 h prior to enrollment (whichever is closer to enrollment)

Two of the following:

- Fever
- Hypotension
- Altered Mental Status
- Total WBCs >10,000, L shift or leukopenia
  + positive sputum meeting criteria

OR

New onset or worsening of purulent sputum production

+ 1 of the following:

- Fever
- Total WBCs > 10,000
Key Inclusion Criteria

Hospitalized adults (≥18 yo) with clinically documented nosocomial pneumonia, defined as:

- Pneumonia with clinical onset ≥48 hours after hospitalization in an acute inpatient healthcare facility
- Pneumonia acquired in a long-term care or sub-acute/intermediate healthcare facility or in a subject who is admitted with pneumonia within 90 days of a recent hospitalization of ≥48 hours (HCAP)

To continue in study required to culture positive for MRSA
Key Exclusion Criteria

Treatment with MRSA active antibiotic for more than 48 hours prior to study
- Exception: documented treatment failure (other than linezolid or vancomycin), defined as lack of response despite at least 72 hours of treatment

Severe neutropenia (<500 cells/mm3)

MRSA resistant to either study drug

Other Conditions:
- Rapidly fatal underlying disease with estimated survival less than study duration or high likelihood of death within 72 hr
- Sustained shock > 2 hr despite fluid/ sympathomimetics
- Empyema, lung abscess
- Lung transplant or BMT
The Integrated Quality Management Plan (IQMP) is:

- A document which prospectively describes the factors that are most important to quality and the actions that will be taken to address the risks that matter most.

- A process of quality oversight whereby quality planning drives quality control which drives quality improvement.
Plan-Do-Check-Act Quality Cycle

Plan
- Determine quality objectives and metrics
- Identify, prioritize, and mitigate risks to quality

Do
- Conduct the study

Check
- Measure and monitor quality performance

Act
- Respond to quality issues as identified

http://www.iso.org/iso/catalogue/management_standards/understand_the_basics.html
## Control Plan with Select CTQs and Metrics

<table>
<thead>
<tr>
<th>CTQ</th>
<th>Measure</th>
<th>Target Value*</th>
<th>Upper Spec Limit*</th>
<th>Lower Spec Limit*</th>
<th>Minimum Measure Frequency</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>All subjects randomized meet inclusion/exclusion criteria</td>
<td>Percent of subjects randomized that do not meet inclusion/exclusion criteria at the time of randomization</td>
<td>0%</td>
<td>5%</td>
<td>0%</td>
<td>Monthly</td>
<td>Clinical</td>
</tr>
<tr>
<td>All study procedures are completed as per the protocol</td>
<td>Percent of subject visits at which protocol deviations related to improper study procedures are identified</td>
<td>0%</td>
<td>5%</td>
<td>0%</td>
<td>Monthly</td>
<td>Clinical</td>
</tr>
<tr>
<td>Data are entered by the site into the database in a timely manner and the database is accurate and complete</td>
<td>Percent of subject visits meeting data entry target timelines within 4 calendar days</td>
<td>80%</td>
<td>100%</td>
<td>75%</td>
<td>Monthly</td>
<td>Study Mgmt</td>
</tr>
</tbody>
</table>

* Target values and spec limits are illustrative.
Protocol Quality Evaluations and Integrated Quality Management Plans

Integrating scientific integrity and parsimony for the benefit of investigators, patients and clear reporting of data

Complexity Drivers

- AE reporting is one of most burdensome tasks for investigators in Phase 3 clinical trials
- On-site monitoring
- Unnecessary eligibility criteria
- Unnecessary visit scheduling, but ICU population
- Excessive procedures: eg. labs, EKG’s, but again (ICU population)
Additional Mitigating Measures

Reporting needs to drive data collection rather than collect everything in case of “what if questions”

- Streamlined prognostic factor/background data collection
  - Driven by science and relevance to the research hypothesis under study
- Minimal exclusion/inclusion criteria
  - restrict criteria to those absolutely essential for scientific objectives of trial, safety of patients, and to satisfy regulatory requirements.
- Effective use of technology: EDC tools, ePROs
- Use of legacy data to fill evidentiary gap

Use of large, simple trials, when appropriate

- A large sample size, limited collection of data, little or no local site monitoring, and broad eligibility criteria.
- Hard safety endpoints vs current state of “Big Data” retrospective claims data and outcomes

Regulatory guidance and commitment critical

- Agreement on minimum data requirement for review
- Progressive development of safety database
- Balance between confirmatory RCTs and large, simple trials

2012 Guidance on Collection of Safety Data in Late Stage
QbD Approach to write the Tier B Phase 3 protocol and get agreement that the primary endpoint, key secondary endpoints and safety as designed are the “playing field for debate”

Agree on FDA AC Conduct Rules with Professional Moderators

Agree on Transformative QbD Safety Collection: to benefit patients, investigators and sponsors

Consider seriously the Tier C program and agree that sub-part H applies
Thank you
### Some Factors Driving Operational Costs: Opportunities for Efficiency?

<table>
<thead>
<tr>
<th>First day CRO involvement</th>
<th>% screen failure rate</th>
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<tbody>
<tr>
<td>Treatment period for each subject</td>
<td>% discontinuation</td>
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<tr>
<td></td>
<td>Monitoring frequency pre-and post LSFV</td>
</tr>
<tr>
<td></td>
<td>Total # SAEs</td>
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<tr>
<td></td>
<td># Sites</td>
</tr>
<tr>
<td></td>
<td>% Sites in each region</td>
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<tr>
<td></td>
<td># Sites</td>
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</tbody>
</table>

- # Total CRF pages per completed patient
- # Unique tables, figures, and listings
Growing protocol design complexity stresses investigators, volunteers

 Protocol design changes challenge study conduct cycle time and performance

- The annual growth rate of unique procedures per protocol grew 6.5% between 1999 and 2005. During that same period, the total number of times unique procedures were conducted per protocol grew at a faster rate.

- To participate in clinical studies today, volunteers on average must meet a total of 49 eligibility criteria, up 58% since 2002.

- The burden to administer clinical study protocols is rising faster than the rate of growth of unique procedures or their frequency.

- Clinical trials are taking longer: between 1999-02 and 2003-06, total time from protocol design readiness to data lock rose from 460 to 780 days, or 69.6%.

- Protocol design also impacts the ability of sites to recruit and retain volunteers: enrollment rates dropped from 75% in 1999-02 to 59% in 2003-06, while retention rates declined from 69% to 48%.
Study monitor workload high & varied with wide disparity by global region

Assessment sets global benchmark for CRA workload and utilization

- Clinical research associates (CRAs) worldwide devote 41% of their time at clinical trial sites, with those based in Europe spending 30% fewer hours on-site than CRAs in North America.

- Sponsor CRAs spend more time than their counterparts at contract research organizations (CROs) conducting on-site monitoring visits, monitoring trials off-site, and handling administrative tasks.

- Half (53%) of CRAs overall rate their work life as good or excellent; those based in Latin America gave the lowest ratings.

- For Phase I studies, CRAs on average conduct 3.8 investigative site visits each month.

- For Phase II-III studies, CRAs on average conduct 7.9 investigative site visits each month.

- CRAs overall have an average of 6.3 years on the job and expect to remain in their position for another 3 years, with both metrics varying widely by region.