Award Number:  W81XWH-11-1-0639

TITLE:  Development of Pain Endpoint Models for Use in Prostate Cancer Clinical Trials and Drug Approval

PRINCIPAL INVESTIGATOR:  Dr. Ethan Basch

CONTRACTING ORGANIZATION:  University of North Carolina at Chapel Hill
Chapel Hill, NC, 27599

REPORT DATE: October 2017

TYPE OF REPORT: Annual

PREPARED FOR:  U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland  21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
Distribution Unlimited

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.
OBJECTIVE: The objective of this work is to establish standard methods for measuring pain palliation and pain progression in prostate cancer clinical trials that are feasible, methodologically rigorous, and meet regulatory requirements for drug approval and labeling. The primary aim of this award is to conduct an observational longitudinal study in men with castrate-resistant metastatic prostate cancer receiving docetaxel-based chemotherapy, in order to establish key design elements of a pain endpoint model which can be used in pivotal trials.

SUMMARY: We report the following progress: (1) the study designed to address Aim 1 is accruing patients at all four sites; (2) a manuscript resulting from the work described in Aim 2 has been published in the journal European Urology, titled: “Effects of Cabozantinib on Pain and Narcotic Use in Patients with Castration-resistant Prostate Cancer: Results from a Phase 2 Nonrandomized Expansion Cohort” and (3) the manuscript resulting from work described in Aim 3 has been published by the journal Cancer, titled: “Pain Palliation Measurement in Cancer Clinical Trials: The US Food and Drug Administration Perspective.” Both manuscripts have been attached to annual report submitted to Department of Defenses in November 2015.
<table>
<thead>
<tr>
<th>TABLE OF CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION .................................................................</td>
</tr>
<tr>
<td>KEYWORDS .................................................................................</td>
</tr>
<tr>
<td>OVERALL PROJECT SUMMARY ...................................................</td>
</tr>
<tr>
<td>KEY RESEARCH ACCOMPLISHMENTS ..........................................</td>
</tr>
<tr>
<td>CONCLUSIONS ...........................................................................</td>
</tr>
<tr>
<td>PUBLICATIONS, ABSTRACTS, AND PRESENTATIONS ..........................</td>
</tr>
<tr>
<td>INVENTIONS, PATENTS AND LICENSES ........................................</td>
</tr>
<tr>
<td>REPORTABLE OUTCOMES ........................................................</td>
</tr>
<tr>
<td>OTHER ACHIEVEMENTS ............................................................</td>
</tr>
<tr>
<td>REFERENCES ..............................................................................</td>
</tr>
<tr>
<td>APPENDICES ............................................................................</td>
</tr>
</tbody>
</table>
INTRODUCTION

Pain is common in men with metastatic prostate cancer and can substantially impair functioning and quality of life. Regulatory standards for the design of symptom endpoints have evolved substantially over the past decade (culminating in an FDA Guidance document issued on this topic in December 2009), and approaches used previously to assess cancer-related pain and analgesic use are no longer considered sufficiently methodologically rigorous. The objective of this work is to establish standard methods for measuring pain palliation and pain progression in prostate cancer clinical trials that are feasible, methodologically rigorous, and meet regulatory requirements for drug approval and labeling. The primary aim of this award is to conduct an observational longitudinal study in men with castrate-resistant metastatic prostate cancer receiving docetaxel-based chemotherapy, in order to establish key design elements of a pain endpoint model which can be used in pivotal trials. The second aim is to analyze data from a feasibility study of pain assessment nested within an industry-sponsored phase II treatment trial conducted in the Prostate Cancer Clinical Trials Consortium. The third aim is to conduct literature reviews and moderate a consensus meeting, with input from investigators in the Prostate Cancer Clinical Trials Consortium, FDA Office of Oncology Drug Products, FDA Study Endpoint and Label Development Team, and FDA Division of Anesthesia, Analgesia and Rheumatology Products, in order to establish discrete guidelines and produce a publication delineating key methodological components of pain studies in prostate cancer.

KEYWORDS

Pain, metastatic castrate resistant prostate cancer, clinical trials, FDA, study endpoints

OVERALL PROJECT SUMMARY

In this section, we report the progress made towards the completion of each Aim.

Aim 1 To conduct an observational longitudinal study in men with castrate-resistant metastatic prostate cancer receiving docetaxel-based chemotherapy, in order to establish key design elements of a pain endpoint model which can be used in pivotal trials.

- The award was originally grant to Memorial Sloan Kettering Cancer Center
- Initial award period 30 SEPT 2011-29 SEPT 2014
- In 2011, Dr. Ethan Basch moved from Memorial Sloan Kettering Cancer Center to University of North Carolina at Chapel Hill
- The award was relinquished by MSKCC to UNC in 2011, but administrative delays prevented Pain Registry study from opening until 2013 (aim 1)
- The second award period was 30 SEPT 2011-29 SEPT 2015
- In AUG 2015 we requested a 30 months no cost extension, as we were currently in progress of obtaining HRPO approval to re-open the study at MSKCC. This was approved on 29 SEPT 2015.
- The current award period is 30 SEPT 2011-31 MARCH 2018
The table below lists Tasks of Aim 1 as outlined in the Statement of Work (PC100563 Basch 7-20-2011, revised 10-7-2016)

Summary of events:

<table>
<thead>
<tr>
<th>SITE</th>
<th>Date of Initial IRB Approval</th>
<th>Date of Initial HRPO Approval</th>
<th>Date of First Enrollment</th>
<th>Date of Closure to Accrual</th>
<th>Date of Closure to Participant Follow-up</th>
<th>Data Analysis End Date</th>
<th>Projected Study End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>OHSU</td>
<td>10 MAY 2013</td>
<td>27 AUG 2013</td>
<td>22 APR 2014</td>
<td>29 FEB 2016</td>
<td>28 FEB 2017</td>
<td>NA</td>
<td>28 FEB 2017</td>
</tr>
</tbody>
</table>
Table 1. Current Status of Tasks Outline in Scope of Work

<table>
<thead>
<tr>
<th>Task 1. Develop study protocol and obtain IRB approval (Months 1 – 6)</th>
<th>IN PROGRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. Submit Letter of Intent to Prostate Cancer Clinical Trials Consortium (Month 23)</td>
<td>Completed – AUG 2013</td>
</tr>
<tr>
<td>1b. Elicit input on study design from collaborators (Months 1 – 2)</td>
<td>Completed</td>
</tr>
<tr>
<td>1c. Draft study protocol, including all case report forms (CRFs) (Months 1 – 3)</td>
<td>Completed</td>
</tr>
<tr>
<td>1d. Submit protocol to departmental review committees at UNC (Month 14)</td>
<td>Completed – NOV 2012</td>
</tr>
<tr>
<td>1e. Obtain IRB approval at UNC (Months 19) Note: Revise protocol to indicate UNC is now coordinating center. Submit for IRB approval at UNC (Month 20). Administrative delays prevented the opening of the study at UNC Chapel Hill until JAN 2013</td>
<td>Completed – JAN 29 2013</td>
</tr>
<tr>
<td>1f. Submit for IRB review at participating sites:</td>
<td></td>
</tr>
<tr>
<td>SITE</td>
<td>Date of Initial IRB Approval</td>
</tr>
<tr>
<td>OHSU</td>
<td>10 MAY 2013</td>
</tr>
<tr>
<td>JHU</td>
<td>9 MAY 2013</td>
</tr>
<tr>
<td>UW</td>
<td>6 NOV 2013</td>
</tr>
<tr>
<td>MSKCC</td>
<td>15 JUL 2015</td>
</tr>
<tr>
<td>Completed – JUL 15 2015</td>
<td></td>
</tr>
<tr>
<td>1g: Complete the transition of the award from MSKCC (original lead site) to UNC (SEPT 2013, Month 24)</td>
<td>Completed – SEPT 30 2013</td>
</tr>
<tr>
<td>1h. Submit each site for HRPO review:</td>
<td></td>
</tr>
<tr>
<td>SITE</td>
<td>Initial HRPO Approval Date</td>
</tr>
<tr>
<td>UNC</td>
<td>15 AUG 2013</td>
</tr>
<tr>
<td>OHSU</td>
<td>27 AUG 2013</td>
</tr>
<tr>
<td>JHU</td>
<td>29 AUG 2013</td>
</tr>
<tr>
<td>UW</td>
<td>14 MAR 2014</td>
</tr>
<tr>
<td>MSKCC</td>
<td>11 NOV 2015</td>
</tr>
<tr>
<td>Completed – NOV 11 2015</td>
<td></td>
</tr>
</tbody>
</table>
Task 2. Prepare for data collection and analysis (Months 1 – 6)
IN PROGRESS

2a. Develop IVRS platform (Months 1 – 3)
Completed

2b. Develop study databases on secure, password-protected server (Months 3 – 6)
Completed

2c. Draft statistical analysis plan and elicit feedback from collaborators (Months 1 – 6)
In Progress

Task 3. Implement study protocol (Months 23-60)
COMPLETED

3a. Conduct site orientations (Month 25-48)
Completed

3b. Recruit and enroll patients (Months 23-61)
Completed

3c. Track accrual/follow-up, conduct weekly telephone meetings with site data managers, and conduct monthly telephone meetings with site PIs (Months 23-75)
Completed

Task 4. Analyze study data (Months 23 – 72)
IN PROGRESS

4a. Import data from IVRS to secure study database (Months 23 – 78)
Completed

4b. Collect CRFs completed by clinic staff on monthly basis (Months 23 – 73)
Completed

4c. Enter CRF data into secure study database (Months 23 – 78)
Completed

4d. Perform data quality audits on monthly basis (Months 23 – 78)
Completed

4e. Analyze data, per SAP, and prepare tables and figures (Months 47 – 78)
In progress

4f. Prepare manuscripts and abstracts with input from collaborators (Months 47 – 78)
In progress

The current accrual for each site is as follows:

<table>
<thead>
<tr>
<th>SITE</th>
<th>Number of Patients Screened and Approached</th>
<th>Number of Patients Enrolled</th>
<th>Consent Rate %</th>
<th>Target Accrual</th>
<th>% Target Accrual Reached</th>
<th>Accrual Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNC</td>
<td>52</td>
<td>51</td>
<td>98%</td>
<td>48</td>
<td>106%</td>
<td>CLOSED</td>
</tr>
<tr>
<td>MSKCC</td>
<td>38</td>
<td>32</td>
<td>84%</td>
<td>27</td>
<td>119%</td>
<td>CLOSED</td>
</tr>
<tr>
<td>OHSU*</td>
<td>65</td>
<td>52</td>
<td>80%</td>
<td>50</td>
<td>104%</td>
<td>CLOSED</td>
</tr>
<tr>
<td>JHU*</td>
<td>73</td>
<td>57</td>
<td>78%</td>
<td>65</td>
<td>88%</td>
<td>CLOSED</td>
</tr>
<tr>
<td>UW*</td>
<td>40</td>
<td>28</td>
<td>70%</td>
<td>30</td>
<td>93%</td>
<td>CLOSED</td>
</tr>
<tr>
<td>TOTAL</td>
<td><strong>268</strong></td>
<td><strong>220</strong></td>
<td><strong>82%</strong></td>
<td><strong>220</strong></td>
<td><strong>100%</strong></td>
<td></td>
</tr>
</tbody>
</table>
All study sites are closed to accrual after reaching the target accrual (N=220). The study has closed follow-up on patients enrolled at JHU, UW, and OHSU as of 28-FEB-2017. Additionally, the study has closed follow-up enrolled patients at UNC and MSKCC, as of 30-SEPT-2017. As stated in the previous annual review, although accrual was slower than originally hoped, follow-up and compliance have been higher than anticipated resulting in richer follow-up data and better overview of outcome.

Through the careful work of the project coordinators (Sarah Drier, Philip Carr, and Ryan Brooks) we have strong relationships with the research staff at each of the studies sites. The activities of the study progressed well throughout accrual and follow-up. There were open lines of communication with the sites for the duration to ensure data quality. The renewal of subcontracts and the renewal of IRB approvals (continuing review) is proceeding well at each site. Now that the follow-up period has closed, we have asked sites to remain engaged with the study so that we may obtain additional data or make inquiries during analysis.

Preliminary results of the primary objective were presented at the International Society for Quality of Life Research annual research meeting on October 20, 2017. The citation is below:


**Aim 2** To analyze data from a feasibility study of pain assessment nested within an industry-sponsored phase II treatment trial conducted in the Prostate Cancer Clinical Trials Consortium.

Data analysis from pain assessment nested in a phase II clinical trial of cabozantinib has been analyzed. The manuscript, published by the journal *European Urology*, has been attached to the annual report submitted to Department of Defenses in November 2015.


**Aim 3** To conduct literature reviews and moderate a consensus meeting, with input from investigators in the Prostate Cancer Clinical Trials Consortium, FDA Office of Oncology Drug Products, FDA Study Endpoint and Label Development Team, and FDA Division of Anesthesia, Analgesia and Rheumatology Products, in order to establish discrete guidelines and produce a publication delineating key methodological components of pain studies in prostate cancer.

A meeting with the relevant stakeholders was held. A manuscript was written with FDA collaboration. This manuscript, published by the journal *Cancer*, has been attached to the annual report submitted to Department of Defenses in November 2015.


**KEY RESEARCH ACCOMPLISHMENTS**

**Aim 1.** The study is closed to accrual and follow-up at all sites. Accrual at JHU, OHSU, and UW all ended in February 2016 and their follow-up ended in February 2017. Accrual at MSK and UNC closed in December 2016 and follow-up closed in September 2017. Data analysis is underway, and preliminary results of the primary objective have been presented at an annual research meeting.

**Aim 2.** A study was designed and conducted with an industry sponsor phase II trial. Results were analyzed and manuscript was published in *European Urology* (Basch, Euro Urol 2015) In addition, patient understanding and acceptance of the worst pain
NRS was established in this population (Bennett et al, ASCO and ISPOR, 2013). The manuscript and abstracts are included in the Appendix.

**Aim 3.** A meeting with the relevant stakeholders was held and a manuscript was written with FDA collaboration. This manuscript was been published by the journal Cancer. (Basch, Cancer 2014), has been attached to the annual report submitted to Department of Defenses in November 2015.

The findings of Aim 2 and Aim 3 are described below in REPORTABLE OUTCOMES

**CONCLUSIONS**

The observational longitudinal study (Aim 1) has completed accrual (N=220) and all sites are closed to accrual. Additionally, we have completed follow-up for enrolled patients as of 30-SEPT-2017. We have strong working relationships with each of the sites which will facilitate management of the study and ensure data quality as we complete analysis. As noted in the Summary of Events table, data analysis will be completed by March 31, 2018. Aims 2 and 3 of this project are now complete, with each resulting in a peer-reviewed manuscript published in high impact journals.

**PUBLICATIONS, ABSTRACTS, AND PRESENTATIONS**


Bennett AV, Atkinson TM, Heon N, O'Keefe B, Scheffold C, Schimoller F, Basch E. Qualitative assessment of the Brief Pain Inventory (BPI) "pain at its worst in the last 24 hours" item to support assessment of pain as a clinical trial endpoint in metastatic castrate resistant prostate cancer (mCRPC) per FDA labeling standards. Abstract. American Society of Clinical Oncology. Chicago IL, June 1-5, 2013.

INVENTIONS, PATENTS AND LICENSES

None

REPORTABLE OUTCOMES

Aim 1 – Research is in progress

Aim 2 – Research findings include:
  1. Collection of pain data via automated telephone system is feasible in a clinical trial including symptomatic men with advanced metastatic CRPC that is heavily pretreated.
  2. Tabulation of total analgesic dose is feasible and can be combined with pain intensity data in clinical trial response and definition.
  3. Content validity of a patient pain diary was established
  4. Patient understanding and acceptance of the worst pain NRS was established in this population (Bennett et al, ASCO and ISPOR, 2013)
  5. Related end points including sleep quality and general activity were significantly associated with pain response.
  6. Results of the phase 2 pain analysis: Cabozantinib demonstrated clinically meaningful pain palliation, reduced or eliminated patients' narcotic use, and improved patient functioning, thus meriting prospective validation in phase 3 studies. (Basch, Euro Urol, 2015)
  7. Results from this phase II pain assessment served as rationale for design of phase 3 trial with primary pain endpoints.

Aim 3 – Key findings of this paper (Basch, Cancer 2014) include articulations of current FDA thinking about the design end points in cancer trials. This includes:
  1. Methodological criteria for selective pain measurements
  2. Approaches for analgesic tabulation
  3. Approach to demonstrating durability of pain response
  4. Role of pain end points in drug approval and labeling
  5. Issues related to pain measurements in open and unblinded trials

OTHER ACHIEVEMENTS

None at this time

REFERENCES


Bennett AV, Eremenco S, Heon N, Scheffold C, Schimmoller F, Weitzman AL, Basch E. Mode equivalence of Interactive Voice Response (IVR) and paper versions of the Brief Pain Inventory (BPI) “worst pain” item in metastatic resistant prostate cancer (mCRPC) evaluated conceptually using qualitative methods. International Society for Pharmacoeconomics and Outcomes Research. 16th Annual European Congress, Dublin, Ireland, November 2-6, 2013.

APPENDICES

The following manuscripts and abstracts have been attached to the annual report submitted to Department of Defense in October 2017. Please see enclosed PDF at the bottom of this page.


Bennett AV, Atkinson TM, Heon N, O'Keefe B, Scheffold C, Schimoller F, Basch E. Qualitative assessment of the Brief Pain Inventory (BPI) "pain at its worst in the last 24 hours" item to support assessment of pain as a clinical trial endpoint in metastatic castrate resistant prostate cancer (mCRPC) per FDA labeling standards. Abstract. American Society of Clinical Oncology. Chicago IL, June 1-5, 2013.

Bennett AV, Eremenco S, Heon N, Scheffold C, Schimmoller F, Weitzman AL, Basch E. Mode equivalence of Interactive Voice Response (IVR) and paper versions of the Brief Pain Inventory (BPI) "worst pain" item in metastatic resistant prostate cancer (MCPRC) evaluated conceptually using qualitative methods. International Society for Pharmacoeconomics and Outcomes Research. 16th Annual European Congress, Dublin, Ireland, November 2-6, 2013.