

# Automated 3D overlay for X-ray guided surgery

<b>Submission date</b> 08/01/2015	<b>Recruitment status</b> No longer recruiting	<input type="checkbox"/> Prospectively registered <input type="checkbox"/> Protocol
<b>Registration date</b> 16/01/2015	<b>Overall study status</b> Completed	<input type="checkbox"/> Statistical analysis plan <input type="checkbox"/> Results
<b>Last Edited</b> 24/07/2020	<b>Condition category</b> Surgery	<input type="checkbox"/> Individual participant data <input type="checkbox"/> Record updated in last year

## Plain English summary of protocol

### Background and study aims

For some types of keyhole surgery and procedures, it is not possible to use camera technology and X-rays are used for guidance instead. While X-rays are good at showing the position of bones and surgical instruments, they do not show soft tissues well and they produce flat (2D) pictures. On the other hand, CT scans show soft tissues and can produce solid (3D) images but they are not very good for guiding procedures because of the amount of radiation. This study is testing a new technology that uses high-powered computing to match the X-ray pictures (that doctor will use to guide an operation) to an earlier CT scan. Accurate matching of the X-rays to the CT scan means that the doctor can see 3D images of parts of the body that can't otherwise be seen with just X-rays. This study tests a new technology that will help doctors see more clearly during X-ray guided surgery. It is hoped that this will reduce the amount of X-rays needed during surgery and lead to better outcomes for patients in future.

### Who can participate?

Patients aged 18 or over who are booked for an X-ray guided intervention in an anatomic zone covered by the technology

### What does the study involve?

The doctors performing the procedures use the new 3D guidance technique in addition to the standard X-ray technique. The accuracy and reliability of the new technology is analysed to check if it is safe and performs as expected. The amount of X-ray (radiation) exposure, the length of operation and the dose of iodinated contrast (a potentially harmful substance widely used to help these procedures) are recorded.

### What are the possible benefits and risks of participating?

The doctor may be able to see the anatomy inside the body a bit more clearly, and participants may have a quicker operation or procedure and be exposed to fewer potentially harmful X-rays. It is possible that the 3D overlay system may disagree with the standard X-ray technique and a double-check of position is needed, in which case participants may be exposed to more X-rays than normal.

### Where is the study run from?

St Thomas's Hospital (UK)

When is the study starting and how long is it expected to run for?  
November 2014 to March 2015

Who is funding the study?  
Cydar Limited and Technology Strategy Board (UK)

Who is the main contact?  
Mr Tom Carrell

## Contact information

**Type(s)**  
Scientific

**Contact name**  
Mr Tom Carrell

**Contact details**  
St Thomas's Hospital  
249 Westminster Bridge Road  
London  
United Kingdom  
SE1 7EH

## Additional identifiers

**Protocol serial number**  
17937

## Study information

**Scientific Title**  
Cloud high-performance computing for 3D overlay in X-ray guided surgery: an observational case-controlled study

**Study objectives**  
CT scans are a common diagnostic test that contain 3D information and show soft tissues, but they are not useful for live guidance due to high radiation dose. Instead, low-dose X-ray videofluoroscopy guidance is used to guide many types of keyhole surgery. But while X-rays are good at showing bones and the position of surgical instruments, they do not show soft tissues well and they produce flat (2D) images that superimpose all the 3D anatomical features. One way to improve clinicians' perception of 3D anatomy and soft tissue is to accurately overlay selected information from a preoperative CT scan onto the live X-ray image, creating a '3D roadmap'. The research team from King's College London and Guy's and St Thomas' NHS Trust have developed an automated 3D roadmap software technology for use in X-ray guided keyhole surgical procedures. This has been tested and validated in more than 130 operations over the last 5 years (IRAS 09/H/0707/64). The technology uses software algorithms to detect anatomical information present in live X-ray images and match ('register') them to the preoperative CT scan in order to determine the patient's exact position. This match then allows 3D information from the preoperative CT scan to be overlaid on the live X-ray. The system requires high computing

power to work quickly. Cydar Ltd is a spinout company from King's College London and Guy's and St Thomas' NHS Trust, taking this technology and building a prototype system, Cydar RTRS1.0, that uses the power of cloud high-performance computing to deliver a fast, clinically useful system. The next step in the development of this technology is to test the RTRS1.0 cloud high-performance computing prototype to test the safety, performance, usability and clinical benefit with a view to finalising system design and regulatory approval.

### **Ethics approval required**

Old ethics approval format

### **Ethics approval(s)**

14/EE/1143; First MREC approval date 10/10/2014

### **Study design**

Non-randomised; Observational; Design type: Case-controlled study

### **Primary study design**

Observational

### **Study type(s)**

Treatment

### **Health condition(s) or problem(s) studied**

Topic: Surgery; Subtopic: Surgery; Disease: All Surgery

### **Interventions**

Automated 3D overlay. Software will generate overlays of 3D anatomy from a pre-operative CT scan, registered to intraoperative XR fluoroscopy images with the intent of enhancing the interventional clinicians' perception of 3D anatomy.

### **Intervention Type**

Device

### **Primary outcome(s)**

Accuracy and robustness; Timepoint(s): Real-time acquisition of image registration data during X-ray guided procedure for analysis

### **Key secondary outcome(s)**

Measured once during the X-ray guided intervention:

1. Procedure time
2. Radiation dose
3. Iodinated contrast dose

### **Completion date**

31/03/2015

## **Eligibility**

### **Key inclusion criteria**

1. Willing and able to give informed consent
2. Aged 18 or over
3. Booked for an X-ray guided intervention in an anatomic zone covered by the technology (currently paravertebral: e.g. aortoiliac, spinal, retroperitoneal, pelvic)
4. Have had a preoperative CT scan
5. Able (in the investigator's opinion) and willing to comply with the study requirements

**Participant type(s)**

Patient

**Healthy volunteers allowed**

No

**Age group**

Adult

**Lower age limit**

18 years

**Sex**

All

**Key exclusion criteria**

1. Female participants who are pregnant or planning pregnancy during the course of the study
2. Any other significant disease or disorder which, in the opinion of the Investigator, may either put the participants at risk because of participation in the study, or may influence the result of the study, or the participant's ability to participate in the study
3. Participants who have participated in another research study involving an investigational product in the past 12 weeks

**Date of first enrolment**

02/12/2014

**Date of final enrolment**

31/03/2015

**Locations****Countries of recruitment**

United Kingdom

England

**Study participating centre**

St Thomas's Hospital

249 Westminster Bridge Road

London  
United Kingdom  
SE1 7EH

## Sponsor information

### Organisation

Guy's and St Thomas' NHS Foundation Trust

### ROR

<https://ror.org/00j161312>

## Funder(s)

### Funder type

Industry

### Funder Name

Cydar Limited (UK)

### Funder Name

Technology Strategy Board

### Alternative Name(s)

TSB

### Funding Body Type

Private sector organisation

### Funding Body Subtype

For-profit companies (industry)

### Location

United Kingdom

## Results and Publications

### Individual participant data (IPD) sharing plan

Electronic imaging data from CT scans and X-ray fluoroscopy are stored in the Cydar Vault, an ISO27001 certified data repository, as pseudonymised files. Patient identifier keys for the

pseudonyms are stored in a separate Cydar Vault container. Consent from all 109 participants was obtained. Personal Health Information is not processed by Cydar.

## IPD sharing plan summary

Stored in repository

### Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
<a href="#">HRA research summary</a>			28/06/2023	No	No
<a href="#">Study website</a>	Study website	11/11/2025	11/11/2025	No	Yes