Development of an in-house AI auto-contouring model for target delineation in craniospinal irradiation

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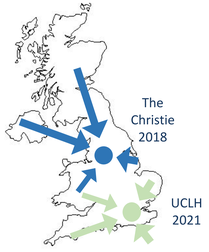
The Christie NHS Foundation Trust

Background

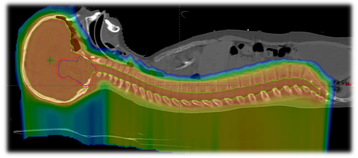
Proton Beam Therapy (PBT) is a national service provisioned by two NHS Trusts in England.

50+ Referring Centres

Up to 1,500 patients/year



Craniospinal Irradiation (CSI) includes the entire brain and spinal canal, including nerve exit foramina



At The Christie PBT Centre:



Treatments are CSI



CSI Cases are under 24 y.o.

Model Details

Trained using the nnU-Net on 145 CT and contour datasets from Christie treated patients

Models Created



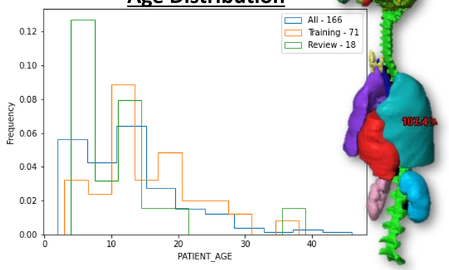
★ Target

Intra-brain

Gross anatomy

★ *Current focus*

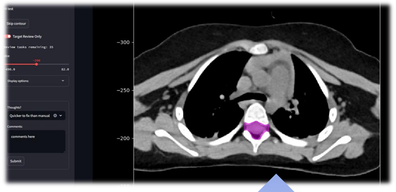
Age Distribution



Model Evaluation

Blinded Clinical Review

- 2 consultants reviewed the CSI target contours independently
- Clinicians were blinded to if the contour was AI generated or not
- Qualitative scores gathered using 18 validation cases.



Considerations

Staff training

Post-deployment surveillance

Quality system documentation

Study length

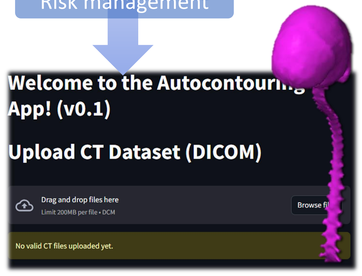
Workflow changes

Risk management

Datasets blinding

Matching clinical visual conditions

Result capture



Prospective Timing Study

- 5 consultants who treat CSI cases at The Christie are participating
- 20 CSI cases will be alternate between having the AI target contour and not
- Clinicians will record time taken to complete the target contouring
- Clinicians will record qualitative experience of using the AI contour

Results

Blinded Clinical Review – Scores from the 2 independent consultants

Score	Clinical Contour	AI Contour
Clinically Unusable	0	0
Longer to fix than manual	0	0
Quicker to fix than manual	1	36
Clinically usable	35	0

Estimated reduction in contouring time 50-90% across review cases.

Prospective Timing Study – Validation of improvements in efficacy

Commissioned for evaluation

Involves wider consultant team

Simple contour creation via app

On-going recruitment

Conclusion

AI auto contouring for craniospinal irradiation target delineation can potentially provide substantial improvements in efficiency.

There is an absence of commercial solutions suitable for paediatric auto contouring resulting in an underserved population of patients.

In-house development of AI auto contouring models can be generated on relatively small datasets using frameworks such as nnU-Net.

Implementation of in-house AI models requires a multidisciplinary approach and a suitable quality framework to bring into clinical use.