insight surgery

Digital Planning & Personalized Solutions

3D SOLUTIONS FOR ONCOLOGY SURGERY BROCHURE

3D PRINTED ANATOMICAL MODELS,
VIRTUAL SURGICAL PLANNING,
PATIENT-SPECIFIC SURGICAL GUIDES

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Designing the cage

Virtual planning of the surgery also allowed for the subsequent design of a set of custom patient-specific implants, consisting of a carbon fibre spinal cage, bespoke rods, and screws which would fixate onto the remaining boney anatomy post-osteotomy.

The Insight Surgery engineer, under direction from the surgical team, designed these patient-specific implants to fit the patient's anatomy while taking into account the anatomical situation once the vertebrae and tumour were surgically removed.

Resection challenge

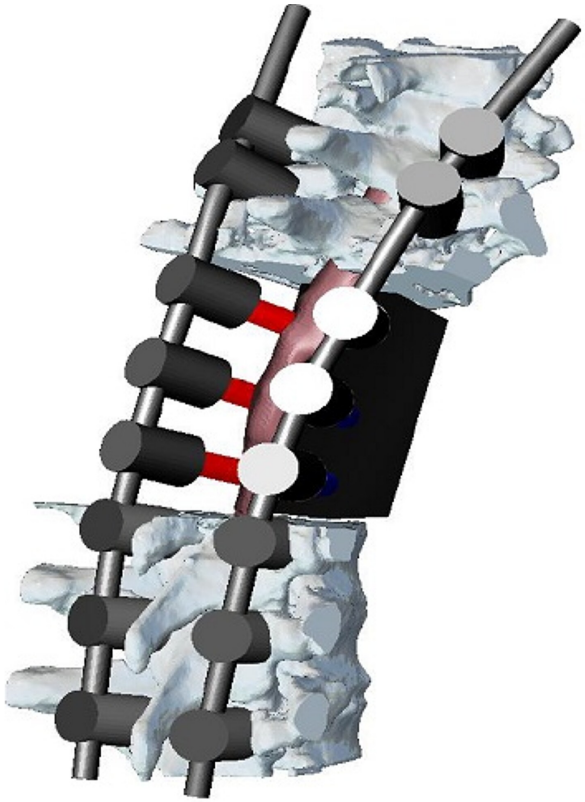
In surgery, the aggressive nature of the tumour became clear, having grown an additional 1.5cm in the interim month between virtual surgery and live theatre.

It was impossible to remove a safe margin of tissue around the tumour site without resulting in quadriplegia for the patient as the growth was sitting on the spinal cord. Inevitably, cancer cells would be left behind. However, the Carbo-Fix rod, screws and cage made targeted proton therapy possible.

INSIGHT SURGERY
CASE STUDY

ONCOLOGICAL PRE-SURGICAL PLANNING AND VIRTUAL SURGICAL SIMULATION

SPECIALITY ONCOLOGY
PROCEDURE CHORDOMA RESECTION AND SPINAL CAGE INSERTION
DEVICE 3D VIRTUAL AND PRINTED PATIENT-SPECIFIC ANATOMICAL MODEL



CUSTOM ROD IMPLANTATION

Carbo-Fix carbon fiber rods were chosen to fix the cage in place owing to their level of fatigue strength and suitability for follow-up radiation therapy; producing no backscattering, no attenuation, and allowing precise radiation planning. The rods fit "absolutely perfectly" as a result of Insight Surgery's tailoring and the surgical team was able to finish the surgery in the second session, without the need to operate for a third straight day. The predicted screw lengths from the virtual plan proved to be correct intraoperatively. The only deviation from the virtual plan was a decision to shorten the carbon cage in theatre.

OUTCOME / BENEFITS

After a total operation time of 31 hours, spread over two days with more than 5 surgeons, the surgery was considered a complete success and the patient has begun recovery. The Virtual Surgical Planning service provided proved to be extremely beneficial in allowing them to complete an efficient and accurate set of procedures.

Case Summary

A patient diagnosed with a chordoma (a rare type of sarcoma growing in the thoracic region (T2-T4) of their spine) required timely surgery to remove the tumour due to its proximity to the spinal cord and subsequent effect on the structural integrity of the spinal column.

The surgical team were presented with the difficulty of resecting the tumour and affected tissue in an extremely challenging location in the body. Additionally, artificial support would need to be implanted to maintain the patient's structural mobility and strength. A request was made for an anatomical model to be used for pre-surgical planning and virtual surgical simulation ahead of the live procedure.

Anatomical Model

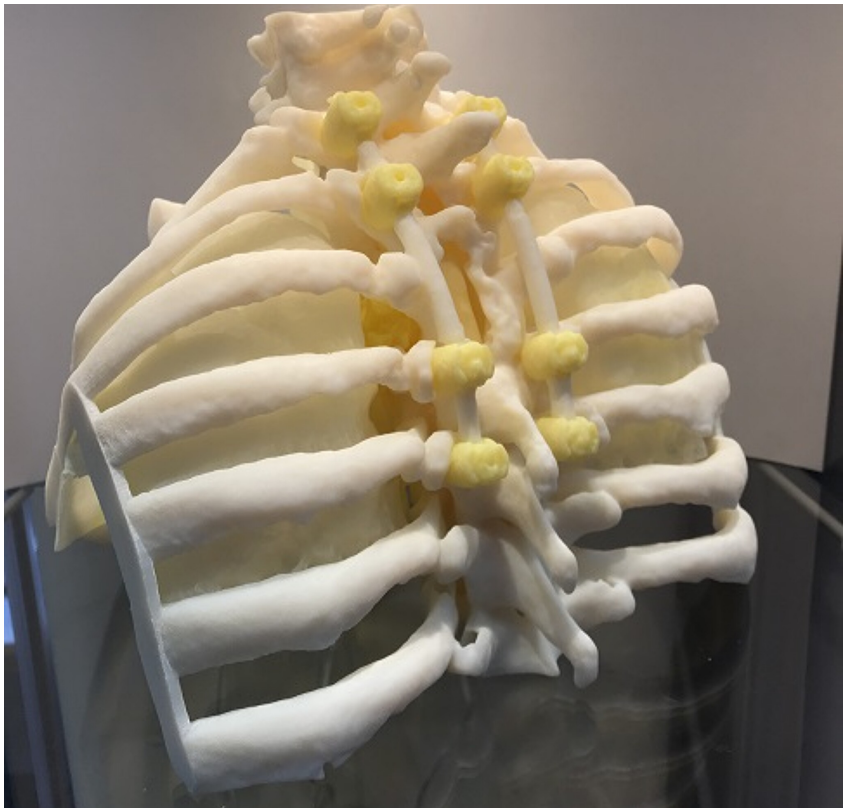
Insight Surgery used segmentation software to develop a virtual model of the patient's spine, spinal cord, oesophagus, airway, blood volume and tumour.

As the accurate boundaries of the tumour were only visible on the MRI, the imagery was overlaid onto the CT data to define its location and severity.

INSIGHT SURGERY
CASE STUDY

ONCOLOGICAL PRE-SURGICAL PLANNING AND VIRTUAL SURGICAL SIMULATION

SPECIALITY ONCOLOGY
PROCEDURE CHORDOMA RESECTION AND SPINAL CAGE INSERTION
DEVICE 3D VIRTUAL AND PRINTED PATIENT-SPECIFIC ANATOMICAL MODEL



CHANGING THE POINT OF ENTRY

Using the model in pre-surgical planning brought immediate benefit to the team as assessment made it clear how close the tumour was to the patient's oesophagus.

An oesophageal surgeon was brought in and the location of the surgical entry site altered to address this concern. This dramatically increased the accuracy of the team's plan and the patient's chances of survival, with less time in theatre anticipated.

Case Summary

A patient diagnosed with a Ewing's sarcoma in their left ilium required surgery to remove it from the pelvis. The surgical team were presented with the challenge of resecting the tumour with a safe margin in order to preserve as much of the sacroiliac joint as possible.

A request was made for virtual simulation of the surgery, together with an anatomical model to be used for pre-surgical planning ahead of the live procedure. A patient-specific surgical cutting guide was also required to ensure accuracy of resection.

Description

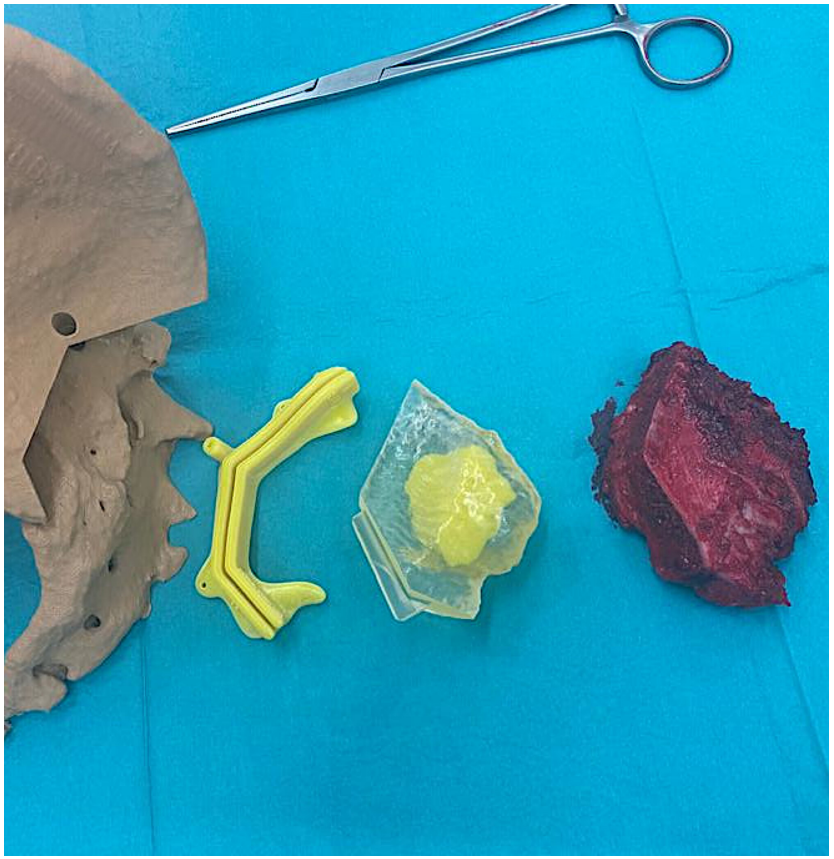
Insight Surgery used Simpleware Medical ScanIP segmentation software to develop a virtual model of the patient's left ilium and the tumour. As the accurate boundaries of the tumour were only visible on the MRI, the imagery was overlaid onto the CT data to define its location and severity.

The tumour was then digitally grown by a 1cm margin as requested by the surgeon. This grown margin was then digitally engraved on the model, providing a guide to show the ideal cutting locations on the bone. This allowed for the creation of a 3D printed surgical cutting guide to show the ideal cutting planes on the left ilium. It was printed in sterilizable polyamide on a Formlabs 3B printer.

INSIGHT SURGERY
CASE STUDY

ONCOLOGICAL PRE-SURGICAL PLANNING, VIRTUAL SIMULATION, SURGICAL GUIDE

HOSPITAL NUFFIELD ORTHOPAEDIC CENTRE (UK)
PROCEDURE RESECTION OF EWING'S SARCOMA AT THE ILIUM
DEVICE 3D PRINTED PATIENT-SPECIFIC ANATOMICAL MODEL AND SURGICAL GUIDE (POLYAMIDE)



OUTCOME / BENEFITS

Using the surgical cutting guide in theatre ensured a safe resection of the growth and secured a higher portion of healthy bone being left untouched. For the patient, this meant less time under anaesthetic, lower risk while in surgery, and a better outcome post-surgery derived from the personalized treatment.

The model will be used by the department to catalogue the patient's conditions in 3D detail, for a fuller understanding of sarcomas and refinement of future treatments. It will also act as an advanced teaching aid for other oncology surgeons and clinicians at the centre.

Case Summary

A patient diagnosed with a sarcoma of the distal radius required surgery to remove it from the forearm. The surgical team were presented with the challenge of resecting the tumour with a safe margin in order to preserve as much of the distal radius and the radiocarpal joint as possible.

A request was made for an anatomical model to be used for pre-operative planning and virtual surgical simulation. A patient-specific surgical cutting guide was also requested to facilitate highly accurate osteotomies when removing the cancerous bone.

Description

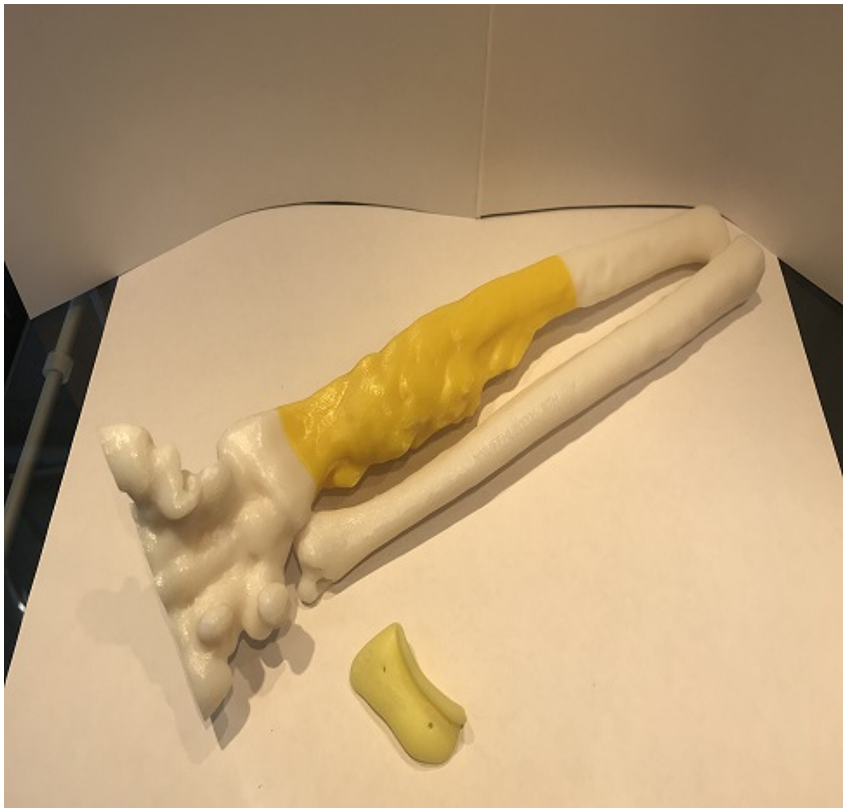
Insight Surgery used segmentation software to develop a virtual model of the patient's distal radius and the tumour. The tumour was then digitally grown by a 1cm margin as required by the surgeon. This grown margin was then sectioned on the model, which allowed the creation of a patient-specific cutting guide, showing the ideal cutting planes on the radius. The model was then 3D printed in multicolour to vividly show tumour boundaries

The surgical guide was 3D printed in sterilisable Polyamide for the surgery.

INSIGHT SURGERY
CASE STUDY

ONCOLOGICAL PRE-SURGICAL PLANNING, VIRTUAL SIMULATION, SURGICAL GUIDE

SPECIALITY ONCOLOGY
PROCEDURE PARTIAL RADIAL OSTEOTOMY
DEVICE 3D PRINTED PATIENT-SPECIFIC ANATOMICAL MODEL AND SURGICAL GUIDE



OUTCOME / BENEFITS

Using the custom surgical guide to pre-determine the safest cutting planes in theatre ensured a safe resection of the growth and secured a higher portion of healthy bone being left untouched. For the patient, this meant less time under anaesthetic, lower risk while in surgery, and a better outcome post-surgery derived from the personalised treatment.

The model will be used by the department to catalogue the patient's conditions in 3D detail, for a fuller understanding of sarcomas and refinement of future treatments. It will also act as an advanced teaching aid for other oncology surgeons and clinicians at the centre.

Case Summary

This patient presented with a non-symptomatic Grade 1 chondrosarcoma that had been picked up in a routine scan for a separate investigation. The tumour was small and localised in their left ilium, and the surgeon planned to do a targeted, bone-conserving resection that preserved the integrity of the ilium whilst maintaining safe margins.

Insight Surgery was asked to design and deliver a novel sterilizable surgical drill guide that allowed for this.

Description

Simpleware Medical ScanIP was used to segment both bony structures from the patient's CT scan (a 1 mm slice of the left ilium) and tumour structures from the MRI. These were combined in Simpleware to create a virtual model. The tumour was then grown digitally by 10mm to create a safe surgical margin and highlighted for better visualization.

The consultant determined their ideal path for resection and Insight Surgery's devised a patient-specific, circular drilling channel guide for use in theatre.
The surgical guide was printed in Biomed Clear, a biocompatible, sterilizable material on a Formlabs 3D Printer, and delivered to the surgical team alongside a 3D printed anatomical model for intra-operative reference. The guide was printed in Insight Surgery's controlled environment facilities, located within its Nuffield Orthopaedic Centre hub (UK).

INSIGHT SURGERY
CASE STUDY

ONCOLOGICAL PRE-SURGICAL PLANNING, VIRTUAL SIMULATION, SURGICAL GUIDE

HOSPITAL: NUFFIELD ORTHOPAEDIC CENTRE
PROCEDURE: TARGETED RESECTION OF ILIUM
DEVICE: 3D PRINTED PATIENT-SPECIFIC ANATOMICAL MODEL AND SURGICAL GUIDE

OUTCOME / BENEFITS

The surgery was extremely straightforward and completed within an hour. The guide fitted well and once the drill holes were made the surgeon was able to easily complete the osteotomy with a uni sawblade. The surgical team appreciated the level of precision the guides enabled and were able to salvage all of the sacroiliac joint, whilst also avoiding disturbance of any neurovascular structure. Sectioning of the tumour showed good margins.

Post-operatively, the patient experienced a quick rehabilitation period and was able to return home after 48 hours.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