insight surgery

Digital Planning & Personalized Solutions

PELVIC ONCOLOGY

ANATOMICAL MODELS AND
SURGICAL GUIDES

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Case Summary

This paediatric patient required a partial pelvic resection, including the distal part of the iliac bone and superior part of the periacetabular bone, to remove metastatic thyroid carcinoma.

Description

Insight Surgery first created a virtual model of the patient's pelvis, including the tumour. The model was then printed in bone-like material.

Three surgical cutting guides were then designed following the completion of virtual surgery by the surgeon, in which the optimum cutting planes were determined.

The first guide provided the cutting plane to resect the inferior ilium, with the aim of retaining continuity between the ischium and ilium and the greater sciatic notch. The second guide provided trans-acetabular cutting planes to connect the ilium resection to pubic resection. The third provided resection through the superior pubic ramus.

The surgical guides were printed in sterilisable material and delivered for surgery.

Blade – 1mm (20mm) (Misonix Bonescalpel)

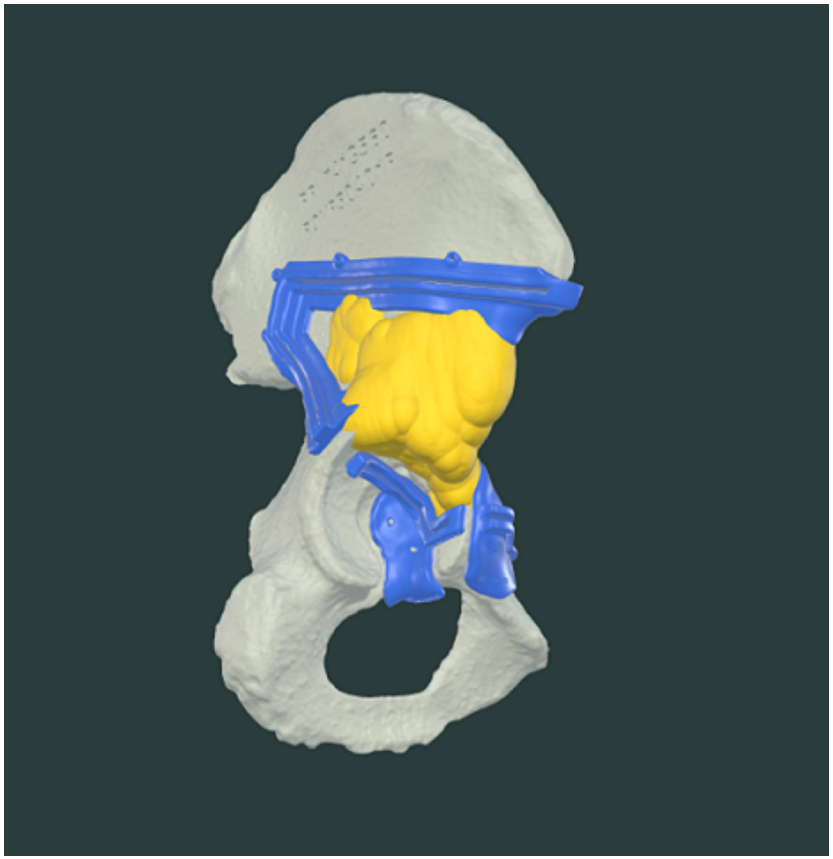
Fixation – 1.6mm K Wire

INSIGHT SURGERY

CASE STUDY

ONCOLOGICAL PRE-SURGICAL PLANNING, VIRTUAL SIMULATION, SURGICAL GUIDES

HOSPITAL ROYAL NATIONAL ORTHOPAEDIC
PROCEDURE PI & PII HEMIPELVECTOMY
DEVICE 3D PRINTED PATIENT-SPECIFIC ANATOMICAL MODEL AND SURGICAL GUIDES (POLYAMIDE)



OUTCOME / BENEFITS

Insight Surgery were able to combine the CT and MRI scans provided to create a detailed model and patient-specific guides that translated careful pre-operative planning into navigated osteotomies with accurate and clear margins. The anatomical model allowed for preoperative assessment of the surgical guides, facilitated discussions between disciplines, and was referred to throughout the complex resection.

The completed resection was noted to be accurate and as expected. The surgeon stated "the advantage of using guides was that I could achieve clear but close margins that conserved bone and enabled ice cream cone reconstruction. It wouldn't have been possible if I'd free-handed the cuts".

Case Summary

A patient diagnosed with a complex chondrosarcoma arising from an osteochondroma required surgery to partially remove areas of the right part of their pelvis. The large tumour involved numerous soft tissue structures and surgery would require a multi-disciplinary team.

The orthopaedic surgeon requested surgical guides to help facilitate the safe and effective removal of the tumour and compromised anatomy, in the form of a hemipelvectomy from the right ilium (between the sciatic notch and the superior/inferior iliac spine) to the contralateral pubis.

Description

Following the segmentation of the patient's CT scan data and the development of an accurate virtual 3D model of both the pelvis and osteochondroma, two surgical guides were devised by the biomedical engineer once the optimum cutting planes were determined by the surgeon.

The first guide transected from the sciatic notch, while the second transected through the contralateral pubis.

A 3D print of the anatomy, plus demo guides for reference, were also printed to assist the surgeon's planning and for intra-surgical reference.

Blade – 1mm (20mm) (Misonix Bonescalpel)

Fixation – 1.6mm K Wire

INSIGHT SURGERY

CASE STUDY

ONCOLOGICAL PRE-SURGICAL PLANNING, VIRTUAL SIMULATION, SURGICAL GUIDES

HOSPITAL ROYAL NATIONAL ORTHOPAEDIC
PROCEDURE PI & P3 HEMIPELVECTOMY
DEVICE 3D PRINTED PATIENT-SPECIFIC ANATOMICAL MODEL AND SURGICAL GUIDES (POLYAMIDE)

OUTCOME / BENEFITS

In this case, all cuts were successfully carried out as planned, with the surgeon complimentary about both the guides and the engineer's work in designing the devices, describing it as an "excellent job".

The surgical team noted how valuable the model was as a visual reference throughout the surgery.

Case Summary

A 36 year old male with a complex spindle cell sarcoma required a partial resection of the pelvis (right side) to remove the tumorous tissues.

The surgeon requested the design and manufacture of sterilisable surgical guides to aid in the hemipelvectomy from the right ilium (between the sciatic notch and the superior/inferior iliac spine) to the contralateral pubis.

Description

Insight Surgery segmented the patient's data, merging CT and MRI scans to capture both bony and soft tissue, to develop a virtual model of the pelvis and tumour. The model was printed in bone-like material and resin (Tumour) and used by the surgical team for intra-operative reference.

Four surgical cutting guides were created from the surgeon's virtual plan. The first guided a bilateral cut through the ilium from the lateral aspect. The second ensured the sacral cut travelled parallel to, and intersected, the anterior aspect of the sacroiliac joint. The third navigated a cut through the contralateral pubis, parallel to the pubic symphysis; this was provided in two iterations that could be decided in surgery depending on soft tissue.

All four guides were printed in sterilisable material in Insight Surgery's controlled environment.

Blade – 1mm (20mm) (Misonix Bonescalpel)

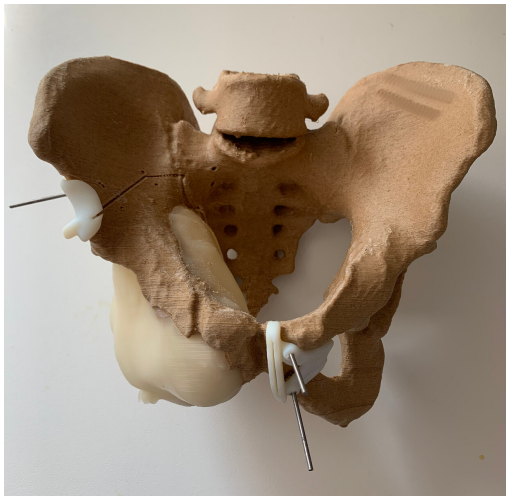
Fixation – 1.6mm K Wire

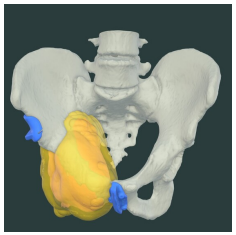
INSIGHT SURGERY

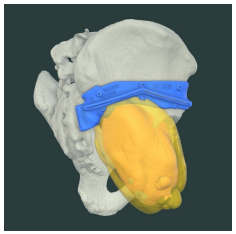
CASE STUDY

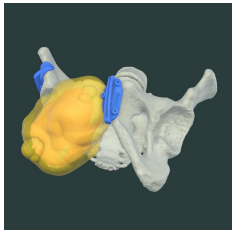
ONCOLOGICAL PRE-SURGICAL PLANNING, VIRTUAL SIMULATION, SURGICAL GUIDES

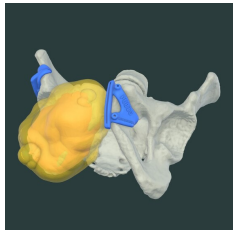
HOSPITAL ROYAL NATIONAL ORTHOPAEDIC
PROCEDURE PI & P3 HEMIPELVECTOMY
DEVICE 3D PRINTED PATIENT-SPECIFIC ANATOMICAL MODEL AND SURGICAL GUIDES (CLEAR POLYAMIDE)

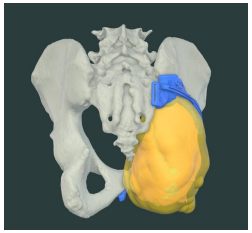












OUTCOME / BENEFITS

The guides enabled the surgical team to carry out the pre-determined cuts as planned with clear margins, and reliance on the digital scans was reduced due to the provision of the anatomical model.

The surgeon also positively noted Insight Surgery's decision to manufacture the guides in an ISO-certified, 3D print biocompatible, transparent material, stating it was an improvement on previous opaque materials as it allowed visibility of the blades in relation to the bone when being used. The inclusion of the silhouettes (Guides) and the cutting planes on the model was also noted as valuable.

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

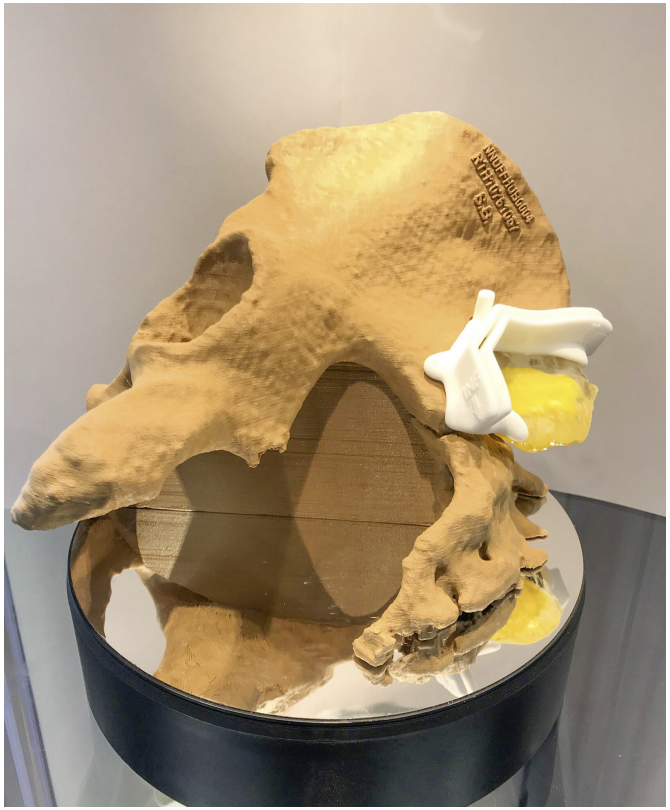
Insight Surgery first created a virtual model of the patient's left ilium including the tumour. In order to obtain a complete picture, a merging of imaging modalities was required. The boundaries of the tumour were only visible on MRI and so this imagery was overlain onto the CT data, which best shows the bone, to define the tumour's location and dimensions.

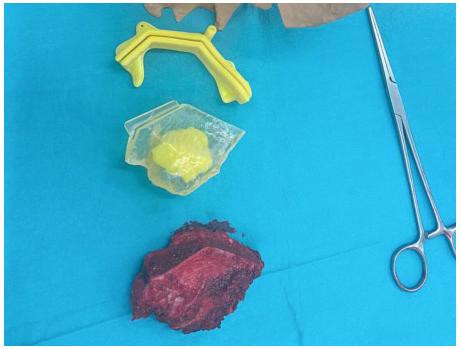
The tumour was then digitally grown by a 1cm margin, on request by the surgeon. This growth margin was then digitally applied, to show the ideal cutting locations on the bone. This allowed for the creation of a 3D printed surgical cutting guide for the left ilium, which was printed in sterilisable polyamide (above the yellow tumour model). The resected bone is beneath the model.

INSIGHT SURGERY
CASE STUDY

ONCOLOGICAL PRE-SURGICAL PLANNING, VIRTUAL SIMULATION, SURGICAL GUIDE

SPECIALITY ONCOLOGY
PROCEDURE RESECTION OF EWING'S SARCOMA AT THE ILIUM
DEVICE 3D PRINTED PATIENT-SPECIFIC ANATOMICAL MODEL AND SURGICAL GUIDE





OUTCOME / BENEFITS

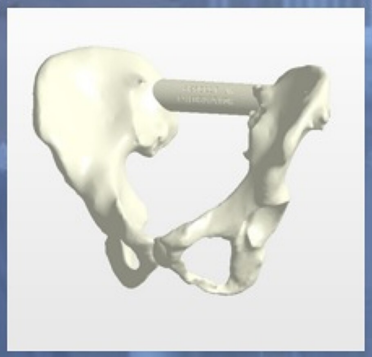
The surgical cutting guide ensured a safe and accurate resection of the tumour and allowed a larger portion of healthy bone to be left untouched. The surgeon commented "[The use of the 3D Model] removed the need for further surgical dissection and bone cuts". For the patient, this meant less time under anaesthetic, lower risk while in surgery, and an opportunity for a better outcome post-surgery derived from the personalised treatment.

In-House Workflow

Surgical Guide In-House Workflow

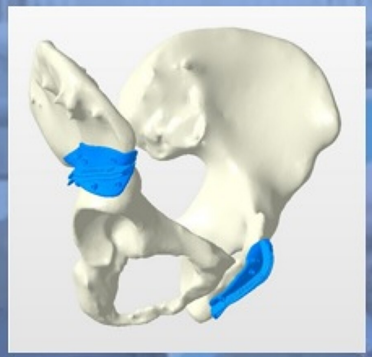
Planning

In-house engineer engages with the surgeon and clinical team prior to surgery to understand deadlines and objectives. Perhaps by attending MDT meetings.



Segmentation

Multiple scan modalities segmented to reconstruct patient's anatomy in 3D. Patient DICOM data remains on-site and secure



3D Design

Engineer designs patient-specific devices to accurately translate the surgeon's virtual plan. Devices reviewed side by side and authorised by surgeon

Manufacture

Approved designs are manufactured in an on-site 'controlled environment', in sterilisable material, alongside an anatomical model and demo guides for testing and reference

Hand Delivery

Devices are hand-delivered for sterilisation before use in theatre. Engineer on-site to assist in device use in surgery if necessary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