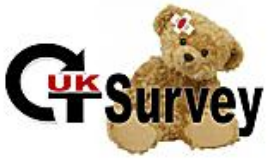
CT dose survey data acquisition form



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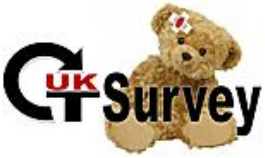
CT Protocol			page 2 ☐
☐ Head A (query bleed)		☐ Head B (hydrocephalus/blocked shunts)	
☐ 3D Head (abnormal head shape)		☐ C-spine (fracture)	
☐ Chest (query lymphadenopathy/infection)		☐ Chest angiography (blood flow)	
☐ Chest then abdomen (query malignancy)		☐ Abdomen and pelvis (abscess)	

Body Mass (m) in kg			
☐ m ≤7	☐ 7< m ≤15	☐ 15< m ≤35	☐ 35< m ≤50

Exam Accession Number		**Sample Number**	/20
Health Care Facility		Scanner ID	
Age at time of scan	Years	Months	Gender ☐ M ☐ F
Scanner Make	☐ GE ☐ Philips ☐ Siemens ☐ Toshiba ☐ Other		
Number of Detector Rows	☐ 16 ☐ 64 ☐ 128 ☐ Other		

Parameters	**Sequence 1**	**Sequence 2**	**Sequence 3**
Tube Voltage (kV)			
Fixed mA or Auto mA's available range			
Tube Current Modulation brand used			
Auto mA quality factor			
IV contrast used	☐	☐	☐
Gating used	☐	☐	☐
Beam collimation (mm)			
Scan field of View (mm)			
Patient transverse width (mm)			
Patient anteroposterior (AP) width (mm)			
Axial (A) or Helical (H) scan	☐ A ☐ H	☐ A ☐ H	☐ A ☐ H
No. of slices or pitch			
Scan length (mm)			
$CTDI_{vol}$ (mGy)			
DLP (mGy.cm)			
DLP for total examination (mGy.cm)			
☐ mean mAs/slice or mean mA (if given) ☐ total mAs (if given)			

CT dose survey data acquisition form



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Health Protection Agency

CT Protocol ☞A☜			page 2 ☞B☜
☐ Head A (query bleed)		☐ Head B (hydrocephalus/blocked shunts)	
☐ 3D Head (abnormal head shape)		☐ C-spine (fracture)	
☐ Chest (query lymphadenopathy/infection)		☐ Chest angiography (blood flow)	
☐ Chest then abdomen (query malignancy)		☐ Abdomen and pelvis (abscess)	
Body Mass (m) in kg ☞C☜			
☐ m ≤7	☐ 7< m ≤15	☐ 15< m ≤35	☐ 35< m ≤50

Exam Accession Number ☞D☜		Sample Number ☞D☜	
Health Care Facility		Scanner ID	
Age at time of scan ☞E☜	Years	Months	Gender ☐ M ☐ F
Scanner Make	☐ GE ☐ Philips ☐ Siemens ☐ Toshiba ☐ Other		
Number of Detector Rows	☐ 16 ☐ 64 ☐ 128 ☐ Other		

Parameters	Sequence 1	Sequence 2	Sequence 3
Tube Voltage (kV)			
Fixed mA or Auto mA's available range	☞F☜		
Tube Current Modulation brand used			
Auto mA quality factor			
IV contrast used	☐	☐	☐
Gating used	☐	☐	☐
Beam collimation (mm)	☞G☜		
Scan field of View (mm)			
Transverse width (mm)	☞H☜		
Anteroposterior (AP) width (mm)			
Axial (A) or Helical (H) scan	☐ A ☐ H	☐ A ☐ H	☐ A ☐ H
No. of slices or pitch			
Scan length (mm)			
$CTDI_{vol}$ (mGy)			
DLP (mGy.cm)			
DLP for total examination (mGy.cm)			
☐ mean mAs/slice or mean mA (if given) ☐ total mAs (if given)			

Bulleted instructions:

Form Note	Description
☞A☜	CT protocols are listed along with their key clinical indications in parenthesis. Further details are included below, including keywords and generic search strings for RIS searches. Examples of typical CT protocols are also included below, including referral notes, anatomical markers and showing regions under investigation. Details of typical contrast use and number of sequences/phases are also given. <u>However, please provide data on your equivalent protocols that are in use at your centre.</u>
☞B☜	Indicate here if this is the second sheet for the same patient and scanner attendance, required if more than three image sequences were employed.
☞C☜	For later analysis, data will be grouped by how much patients weigh (kg). Please indicate which of the four bands is appropriate for the patient.
☞D☜	Accession number is used as an anonymous scan ID reference, held locally only, that can be used to find examinations on RIS and PACS. Accession number is linked to sample number on this form, to facilitate help with any further queries after data have been submitted. The target for data collection is 20 different patients per CT protocol and body mass band (tick sheet included at the end of the document), on a single scanner. Sample number out of 20 must be recorded here. Only sample number will be added to the spreadsheet later. *NB. Whilst 20 patients per body mass band is the target, this may not always be achievable for some types of examination.*
☞E☜	Please supply age at the time of scan in years and months. Maximum child age of 12-years old. Age < 1 month, please quote number of weeks (1-3) as quarters of one month (0.25-0.75).
☞F☜	Many scanners are now in use with automatic tube current modulation. To help to assess how these systems are being used please record the range of mA that the automatic system can select between. (This is the range for the protocol not for each patient.) Please also record the auto mA brand (e.g. “Smart mA”, “CareDose”) and the actual quality factor (e.g. “noise index” of x, “quality reference mAs”, “mAs/slice") used.
☞G☜	Please supply the collimation product for multi-slice systems, e.g. 64x0.5mm.
☞H☜	To get a measure of patient size, other than body mass and that can be calculated retrospectively, cross-sectional area is being used. To estimate this, using the middle image in the main scan sequence, measure the major (transverse) and minor (anteroposterior (AP)) patient widths using your PACS viewer (shown graphically below). These will be used to estimate the cross-sectional area, approximating the patient to be an ellipse. These measurements are only needed from one image sequence per patient.

Data acquisition:

1. Field work will be a collaboration between radiographers and medical physicists
2. We need a straightforward system that can be operated at all centre across the UK
3. We envisage the survey will be performed prospectively at many centres, if patient body mass is not recorded routinely
4. For prospective data acquisition the accession number and body mass will need to be linked with CT protocol and sample number, for later collection of remaining data
5. Radiographers will be asked to perform RIS searches, identify relevant patients and to perform some of the data acquisition
6. Clinical professionals (radiographers and/or physicists) with access to PACS will complete data acquisition
7. Data managers (physicists or radiographer as appropriate) will verify data before transferring it to the survey spreadsheet
8. Final results should be returned to HPA by e-mail

NB.

- Existing recent survey results can be used and added to as appropriate
- Where existing local electronic data searches are in operation these can be used to query and simplify data acquisition

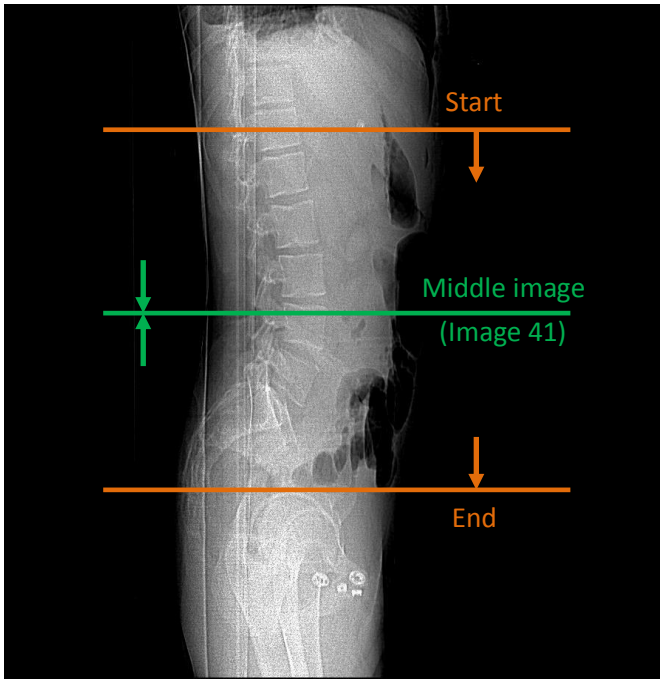
Any queries please contact me using: stuart.meeson @ hpa.org.uk

Continuing Professional Development:

The College of Radiographers has endorsed the survey via CPD Now. Participation will enable practitioners to develop their knowledge and expertise in a range of data collection and dose optimisation techniques.

IPEM members participating can include any activities in their personal CPD record.

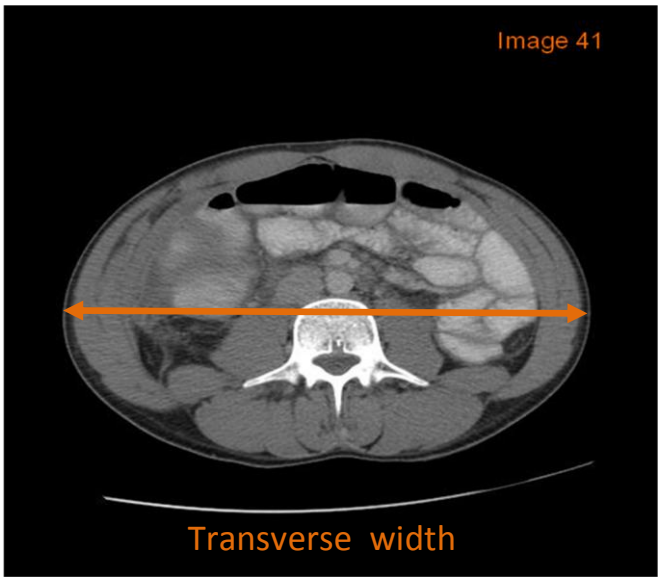
Transverse and Anteroposterior (AP) patient width measurements:



Schematic showing a scout scan used to identify the middle image in the sequence.

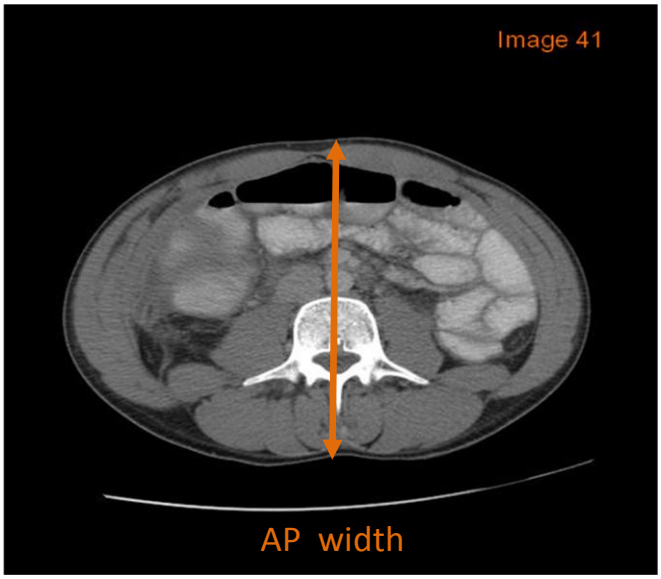
NB. For C-spine examinations, select an image close to the middle of the sequence that avoids the shoulders.

For 3D Head (abnormal head shape), select an image with approximately the largest head size.



Transverse width (mm) measured using the axial image from the middle of the sequence.

NB. If axial images do not show the full extent of the patient, try other image views.



Anteroposterior (AP) width (mm) measured using the image from the middle of the sequence.

One set of width measurements per patient.

Clinical indications and keywords:

CT Protocol	Clinical indications	Keywords for electronic searches
Head A	Bleed/collection	Bleed, haemorrhage, trauma, NAI, fluid, increased pressure (ICP)
Head B	Hydrocephalus/ blocked shunts	CSF/fluid on the brain, hydrocephalus
3D Head	Abnormal head shape	Craniosynostosis, abnormal head shape
C-spine	Fracture	Trauma, fracture/dislocation
Chest	Lymphadenopathy	Lymphadenopathy, malignancy, recurrent infection
Chest angiography	Blood flow	PE, pulmonary veins
Chest then abdomen	Malignancy	Cancer/metastases/malignancy/tumour/neoplasm
Abdomen and pelvis	Abscess	Abscess, infection, infected fluid

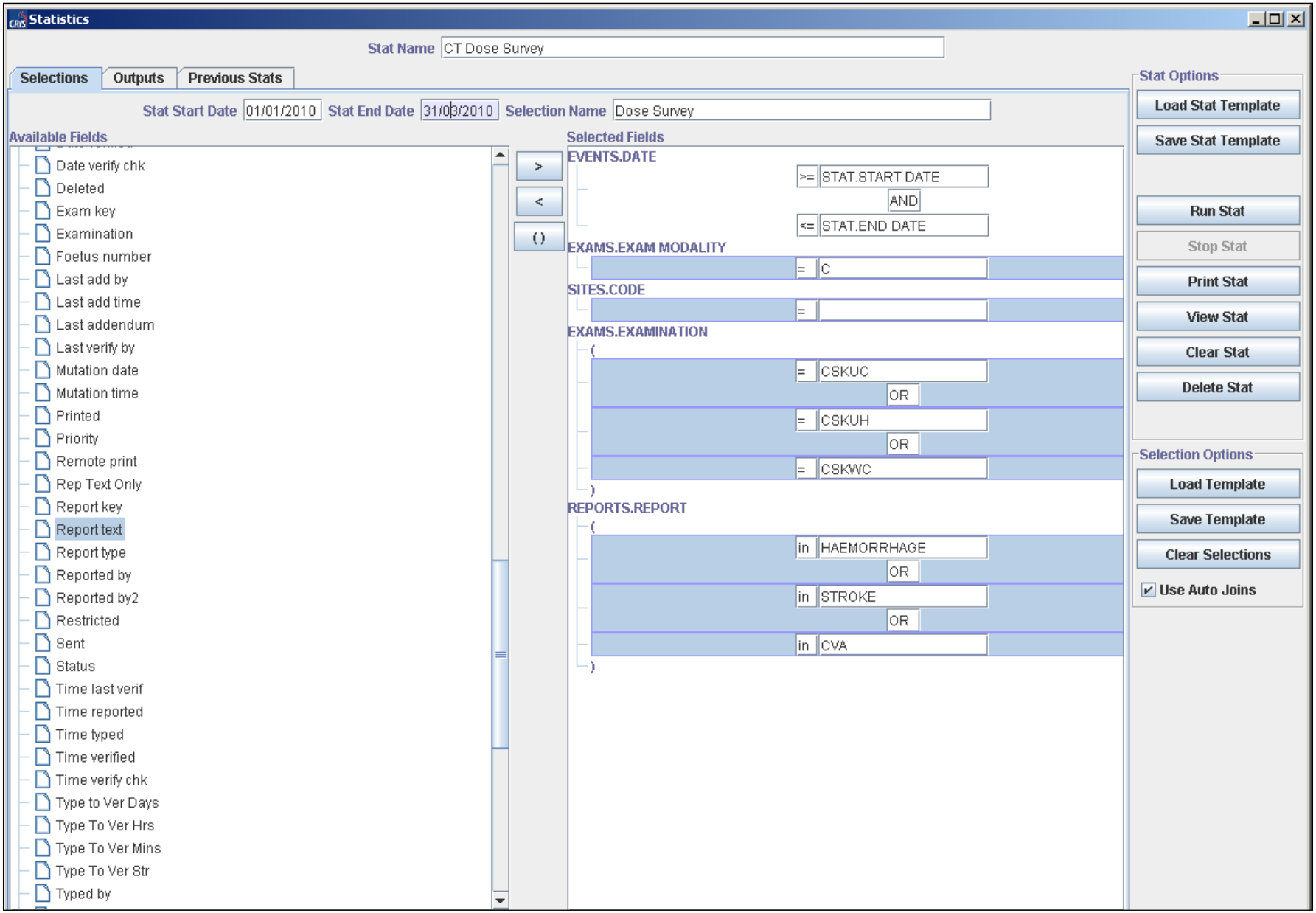
Generic RIS search examples for retrospective data collection:

The screenshots included below provide examples of searches that may be undertaken on RIS to locate suitable CT examinations as required for HPA CT dose survey.

In Screenshot 1 the Selections screen includes fields that may be used to refine a search of the RIS. These include:

- date range – typically a 3 month window, but longer for low frequency examinations and up to 1-year retrospectively
- modality
- site
- examinations – multiple exam code may be used to include examinations of a body part with and without contrast
- text found in a report – multiple key words may be used in a single search

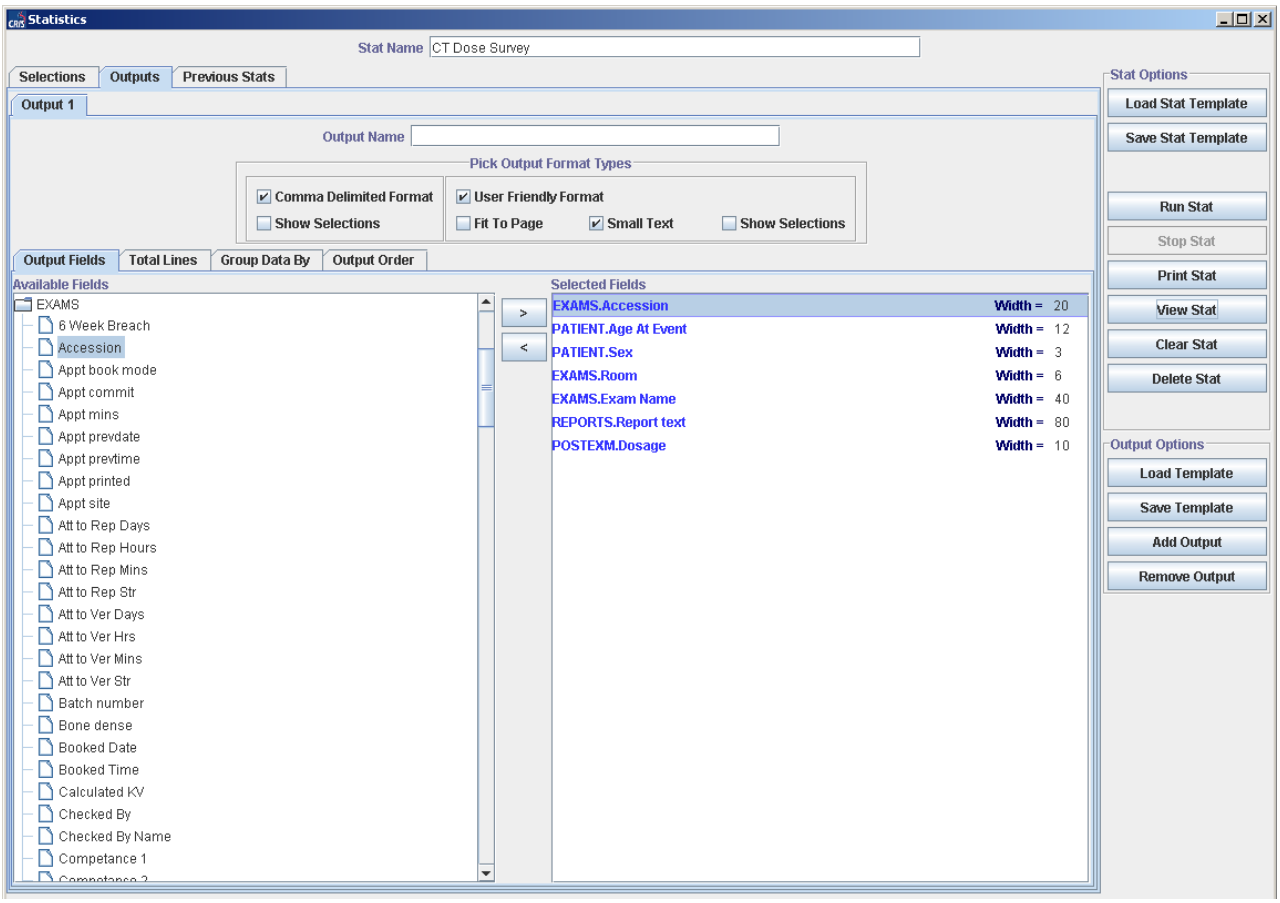
Screenshot 1: example of a RIS Selections screen



From this search Screenshot 2 shows some of the outputs that may be displayed:

- exam accession number
- age at the time of scan
- patient sex
- room – this will identify which scanner was used if more than one at a site
- exam name
- report – by being able to view the report the reason for the scan may be determined
- dose

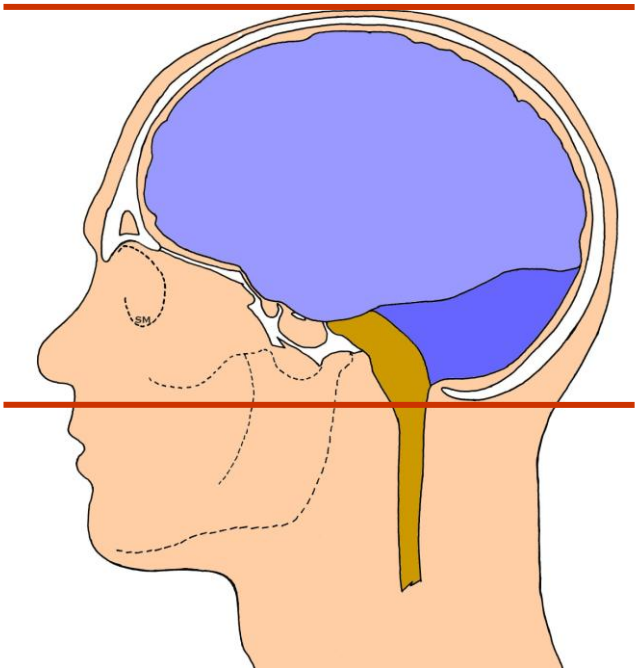
This list is not exhaustive and it may be that more fields will be used as appropriate.



Screenshot 2: example of a RIS Outputs screen

Once examinations that meet the criteria have been identified, the accession number may be used to locate the images on PACS. From these images other required information as laid out on the data acquisition form can be recorded.

Head A – typical protocol



Clinical indication: query bleed/ICP

Typical scan justification: query bleed/fluid/increased pressure (ICP)

Could include: *trauma, fractured skull, head injury, infarct, haemorrhage, NAI. Post operative surveillance. Recurrent seizures, headache, vomiting, slurred speech, limb weakness, infection.*

NB. Exclude image guided surgery as requires protocol variation.

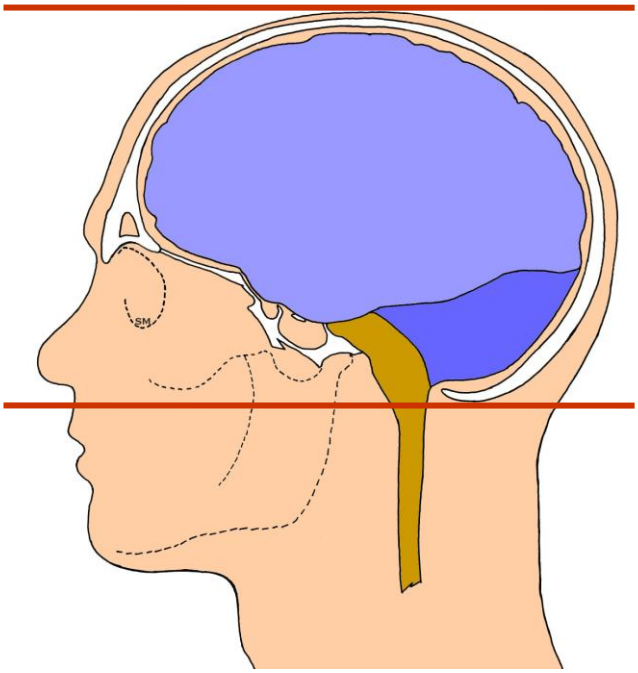
Scan from: base of skull

Ending at: top of skull

Sequences/Phases for examination: 1

Contrast used: Y or N

Head B – typical protocol



Clinical indication: hydrocephalus /blocked shunts

Typical scan justification: query CSF/fluid on the brain

Could include: *increased ICP, enlargement of the head, seizure, eye positioning, sleepiness, vomiting, changes in personality or mental agility, incontinence.*

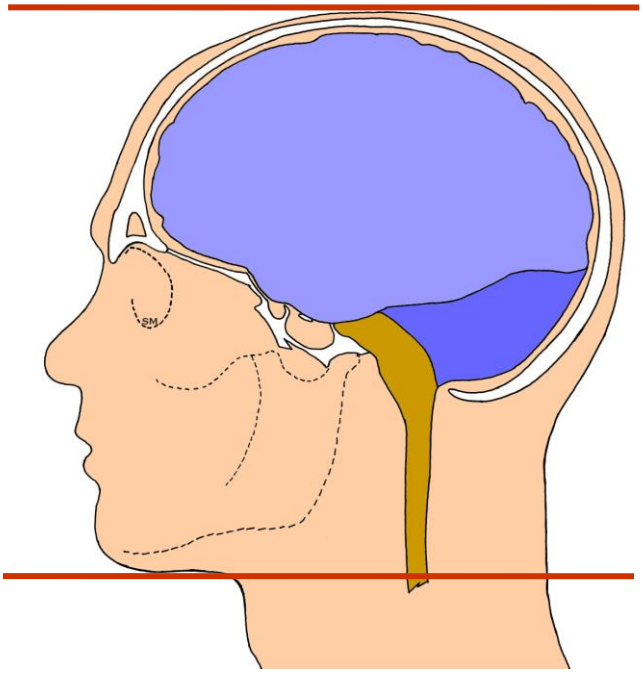
Scan from: base of skull

Ending at: top of skull

Sequences/Phases for examination: 1

Contrast used: Y or N

3D Head – typical protocol



Clinical indication: abnormal head shape

Typical scan justification: craniosynostosis, abnormal head shape

Could include: *pre-operative Crouzon assessment, coronal synostosis/craniosynostosis, cleidocranial dysostosis/dysplasia, Apert syndrome, misshapen head, congenital disorders, bone fusing.*

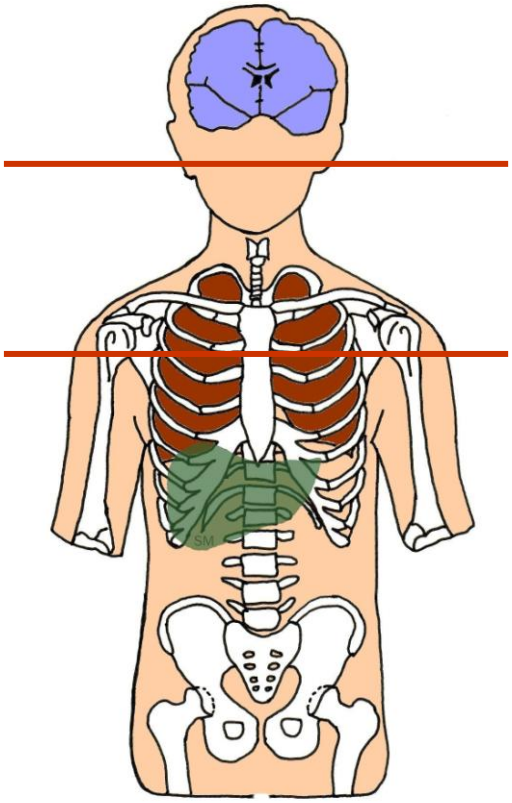
Scan from: below mandible

Ending at: top of skull

Sequences/Phases for examination: 2

Contrast used: Y or N

C-spine – typical protocol



Clinical indication: fracture

Typical scan justification: trauma, query fracture/dislocation

Could include: *head and neck injury. Fall/trauma/polytrauma. Previous vertebral tension. Neck pain or tenderness.*

RTC.

Contact sports neck related injury.

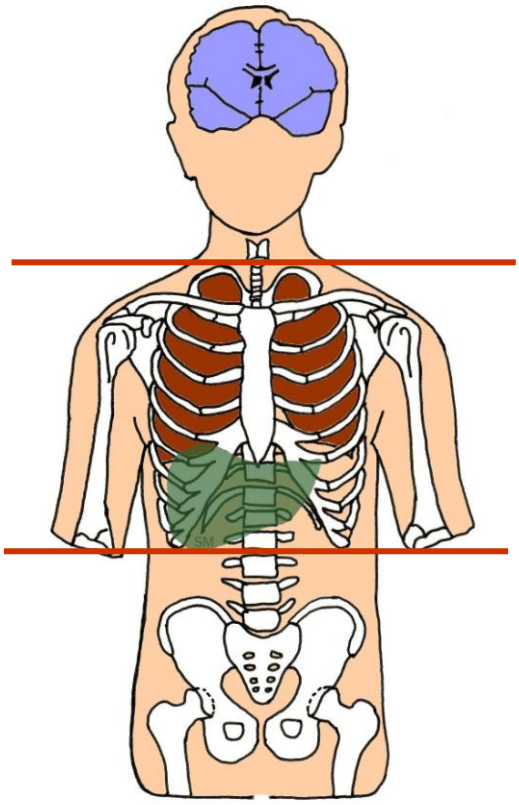
Scan from: base of skull

Ending at: T2

Sequences/Phases for examination: 1

Contrast used: Y or N

Chest – typical protocol



Clinical indication: lymphadenopathy /recurrent infection

Typical scan justification: query lymphadenopathy, malignancy

Could include: *previous lymph node enlargement. Bulky hilum (that persists on plain X-ray). Hodgkin's lymphoma, Burkitt's lymphoma, non-Hodgkin's lymphoma. Query fungal infections and lymphohistiocytosis, neuroblastoma, CGD, AML,HLH.*

Recurrent chest infection, bronchiolitis, abscess, empyema, SOB. Post BMT assessment.

Scan from: top of the lungs

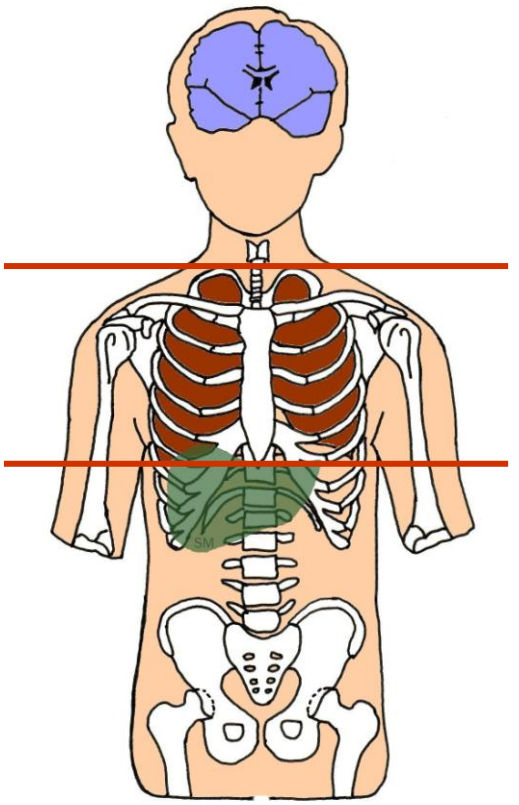
Ending at: below liver

Sequences/Phases for examination: 1

Contrast used: Y or N

Breath held: Y or N

Chest angiography – typical protocol



Clinical indication: blood flow

Typical scan justification: query PE, pulmonary veins

Could include: *pulmonary hypertension, Scimitar syndrome, oxygen dependence, vein stenosis, vascular ring, aortic coarctation, double aortic arch, major aortopulmonary collaterals (MAPCAs).*
NB. Exclude CCAM as requires protocol variation.

Scan from: top of the lungs

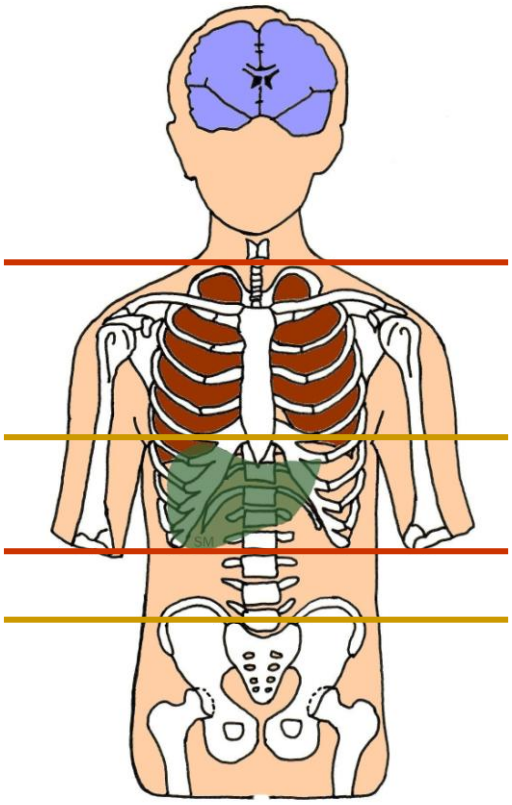
Ending at: below diaphragm

Sequences/Phases for examination: 1

Contrast used: Y or N

Breath held: Y or N

Chest then abdomen – typical protocol



Clinical indication: query malignancy

Typical scan justification: query cancer/metastases/malignancy/ tumour/neoplasm

Could include: *abdominal pain, jaundice, infection. Liver/lung/kidney investigation. Wilm's tumour, Childhood Tumour Syndrome.*

Existing/treated sites of malignancy.

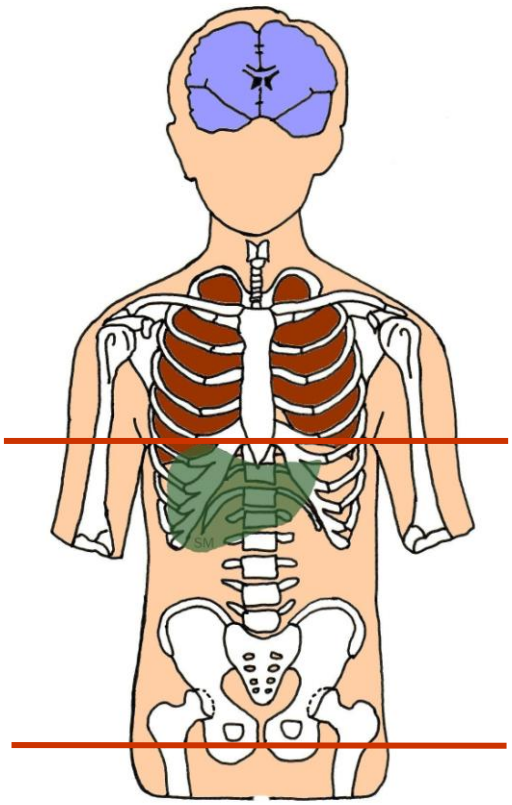
Scan: chest then abdomen

Sequences/Phases for examination: 2

Contrast used: Y or N

Breath held: Y or N

Abdomen and pelvis – typical protocol



Clinical indication: abscess

Typical scan justification: query abscess/infection/infected fluid

Could include: *abdominal distension, tenderness/pain/guarding, sepsis. Fever, leukocytosis and surgery in the last four weeks.*

Scan: abdomen and pelvis

Sequences/Phases for examination: 1

Contrast used: Y or N

Breath held: Y or N

CT Protocol	PROSPECTIVE DATA COLLECTION - Progress tick-sheet for samples of 20 patients																			
Head A, m ≤7 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Head A, 7< m ≤15 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Head A, 15< m ≤35 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Head A, 35< m ≤50 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Head B, m ≤7 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Head B, 7< m ≤15 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Head B, 15< m ≤35 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Head B, 35< m ≤50 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3D Head, m ≤7 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3D Head, 7< m ≤15 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3D Head, 15< m ≤35 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3D Head, 35< m ≤50 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
C-spine, m ≤7 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
C-spine, 7< m ≤15 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
C-spine, 15< m ≤35 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
C-spine, 35< m ≤50 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

CT Protocol	PROSPECTIVE DATA COLLECTION - Progress tick-sheet for samples of 20 patients																			
Chest, m ≤7 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Chest, 7< m ≤15 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Chest, 15< m ≤35 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Chest, 35< m ≤50 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Chest angiography, m ≤7 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Chest angiography, 7< m ≤15 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Chest angiography, 15< m ≤35 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Chest angiography, 35< m ≤50 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Chest then abdomen, m ≤7 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Chest then abdomen, 7< m ≤15 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Chest then abdomen, 15< m ≤35 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Chest then abdomen, 35< m ≤50 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Abdomen and pelvis, m ≤7 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Abdomen and pelvis, 7< m ≤15 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Abdomen and pelvis, 15< m ≤35 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Abdomen and pelvis, 35< m ≤50 kg	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20