Clinical
Radiology

The Royal College of Radiologists

Implementing Ordercomms (electronic requesting) in radiology

Contents

Summary

The use of electronic requesting for diagnostic imaging tests continues to increase across the healthcare landscape. In order to maintain the core benefits of paperless requesting, build additional value for staff and patients, and avoid new risks, it is vital that radiologists and other radiology staff work closely with clinical and IT colleagues in the procurement, implementation and ongoing deployment of these systems and their interfaces with other hospital systems. Ease of use and fast, effective two-way communication between the referring clinician and the radiology department remain the core features for a successful implementation.

Introduction

Electronic requesting systems are designed to enable clinicians to electronically request radiology procedures and receive electronic updates on the progress of their requests, replacing the need for conventional paper-based systems.

The terms 'order communications' (Ordercomms, OC) are the terms commonly used for electronic requesting.

Ordercomms software should be designed in such a way as to support appropriate referral of patients for radiology tests and timely scheduling and reporting of the test.

The use of Ordercomms systems has become widespread with the roll-out of picture archiving and communication systems (PACS) and radiology information systems (RIS) across the NHS. There has also been increasing use of these systems in general practice to improve access to diagnostic imaging.

It is the responsibility of the requesting doctor and their clinical team to read and act upon the report findings as efficiently and quickly as possible.

The Ionising Radiation (Medical Exposure) Regulations (IR(ME)R) aim is to protect patients from the risk of harm when being exposed to ionising radiation. Responsibilities for the referrer include:

- Be a registered healthcare professional
- Follow referral guidelines provided to them
- Provide sufficient medical data to enable justification by the practitioner

Acknowledgements

1
Designing electronic 'request forms'

The first step in designing an electronic request pro forma is to ensure all the essential information is captured (as was possible on paper request forms). Engagement with referring clinicians (primary and secondary care) is an essential part of this design process.

Essential features include:

- Accurate patient identifier information and patient location
- Collecting relevant clinical information
- Include clinical priority of request
- Making some fields compulsory.

Desirable features include:

- Providing clinicians with decision support tools. For example, integration to The Royal College of Radiologists' *iRefer: Making the best use of clinical radiology* (www.irefer.org.uk)
- Access to the patient's electronic record and radiology examination history to avoid requesting duplicate or unnecessary examinations (maybe via a context link)
- Pre-population of request fields based on information stored in the electronic patient record (such as patient location, principal diagnoses, allergies, recent blood results; for example, eGFR)
- Targeted information based on the user selection (for example, links to the relevant information leaflets)
- Necessary information required for particular tests (for example, safety information)
- Alerts based on custom rules designed into the system (for example, if a duplicate examination request is made within a predefined interval).

2
Integration of Ordercomms, RIS and PAS

The RIS is central to the vetting and scheduling of radiology requests. The Ordercomms should send the information seamlessly to the RIS system using a standard messaging format such as health level 7 (HL7) messaging standards, with little or no requirement for manual data entry within the RIS. The RIS in turn should be able to send HL7 message updates relaying the status of the request – for example, accepted, approved, scheduled, exam performed or reported.

Unique identifiers (ID): A prerequisite of any Ordercomms system integration is that a common unique patient identifier is used in both the requesting and the receiving system. With increasing networking and expectations that records can be shared between organisations, it is important that the NHS number is also an identifier along with an organisation-specific unique identifier (PAS ID in the NHS) in both systems.

Patient data synchronisation: In secondary and tertiary care, the patient administration system (PAS) usually provides the patient master index of **patient demographics** (name, date of birth, sex, address, PAS number, NHS number). It also holds the information regarding the **patient's location**, and their **responsible consultant** at a particular point of a clinical episode. It is mandatory that patient demographics and current location information are kept synchronised realtime between PAS, Ordercomms and RIS.

Hence for patient registrations, demographic updates and merges must be kept in sync using global standards such as health level 7 (HL7) ADT.

Look-up table synchronisation (MFN-master file notification): List of **referrers, reporters** and **patient locations** *(names of wards, outpatient departments, emergency departments and hospital sites)* are listed in look-up tables (or reference files) within healthcare IT systems, and that there is adequate administrative time to keep these lists up to date in the PAS. For safe patient care, it is vital that these lists are kept synchronised using global standards such as HL7 MFN (master file notification). Manual data entry carries risk of misaligned information and risk to patients. See Appendix 4.

Status update synchronisation: A feedback loop (status updates) is necessary to update the referrer as to the progress of the request using global standards such as HL7 ORM (order message) updates. See Appendix 2.

Context links: It is also desirable for the referrer and radiology staff to be able to access supplementary clinical information from the electronic patient record (EPR), relevant pathology results and clinical communications (clinic letters, discharge summaries and so on). This requires 'context links' from Ordercomms and RIS / PACS to other systems including EPR.

Patient banner information display should meet NHS standards in Ordercomms, RIS and PACS for patient safety.

3 Electronic requesting and IR(ME)R

The *Ionising Radiation (Medical Exposure) Regulations 2017 (IR(ME)R)*[1] requires that employers have written procedures to enable identification of the referrer, operator and practitioner for any procedure using ionising radiation. Procedures for an electronic remote requesting system are similar to paper-based systems, but rely on a user's login credentials to identify the referrer, instead of a handwritten signature. The trust's procedures should ensure it is a disciplinary offence to request a procedure using someone else's login, just as it is to request a procedure on a pre-signed request card. The risk of this occurring can be minimised by optimising trust computer systems to reduce the number of passwords used and time taken to log out and in as a different user.

Electronic remote requesting systems can assist an employer in complying with the legislation by:

- Restricting referrals to users with appropriate access privileges
- Name, contact information, and job role of the referrer clearly defined with each referral *(consultant, GP, doctor-SAS/trainee or non-medical referrer)*
- Providing the referrer with recommendations concerning referral criteria for medical exposures, including radiation doses
- Ensuring the referrer provides the radiology department with required information to enable the practitioner to justify the procedure
- Maintaining a log of all requested procedures for audit purposes.

4
Planning and implementing Ordercomms

Ordercomms systems may be standalone or integrated with an EPR. The change from a paper-based system to remote electronic requesting enables the redesign of radiology services. Trusts implementing these systems should take the opportunity to process map their existing workflow and consider how the use of the technology can improve patient and staff experiences of the service. Options to consider include:

- Ensuring clinicians (both primary and secondary care) have training and access to information and decision support tools (for example, iRefer) to help them request the most appropriate investigations.

- Providing radiology staff with decision support tools (for example, iRefer) integrated to RIS to facilitate vetting and justification.

- Facilitating ease of access to EPR for radiology staff to check further clinical information, if needed.

- Producing clear communication pathways (phone, electronic or meetings) for re-discussion of complex imaging requests.

- The radiology electronic requesting software can sometimes be integrated with other disciplines (for example, pathology, phlebotomy, microbiology). In these situations, it is important that all stakeholders are involved from the start of the process and any major differences in information handling between the specialties be identified.

- Closing the loop: Ensure that the organisation has an IT system compatible with accepted standards that facilitates reading and tracking of radiology reports. The IT systems should also be capable of accepting failsafe alert notifications.[2] Any cancellations or rejected requests must be communicated to the referrer, with the reason for cancellation included.[3]

The involvement of radiologists in the deployment of these IT systems is of the utmost importance as the central role of diagnostic imaging in the delivery of healthcare increases.

References

1. Department of Health. *The Ionising Radiation (Medical Exposure) Regulations 2017 (together with notes on good practice)*. www.legislation.gov.uk/uksi/2017/1322/contents/made

2. The Royal College of Radiologists. *Standards for the communication of radiological reports and fail-safe alert notification*. London: The Royal College of Radiologists, 2016. Ref No. BFCR(16)4. www.rcr.ac.uk/publication/standards-communication-radiological-reports-and-fail-safe-alert-notification

3. The Royal College of Radiologists. *Vetting (triaging) and cancellation of inappropriate radiology requests*. London: The Royal College of Radiologists, 2021 www.rcr.ac.uk/system/files/publication/field_publication_files/bfcr214-vetting-triaging-cancellation-inappropriate-radiology-requests.pdf

Appendix 1
Additional information and dialogue to optimise electronic requesting of radiology exams

A Q&A must be configurable in any Ordercomms to enable a relevant questionnaire for the type of exam requested. Below is a sample set of questions to help initial implementation. *This list is by no means exhaustive, and local implementations should edit these and add other questions, as per local needs. It must be easy for radiologists to request additional questions to be added by system administrators, where needed, but questionnaires must be kept as short as possible and be used to collect clinically relevant information only. The temptation to collect management / tracking and audit information should be resisted.*

I.   'Read by referrer' exams

For example, plain X-ray requests for limbs post-fracture manipulation, fluoroscopy images in theatre, orthopantogram (OPT) and so on will have the following question.

Report required (radiology)

Is a report required? Yes/No

If 'no', a statement that the requesting doctor will record the result must be agreed.

II.   Female and of childbearing age (For relevant exams only, all CT, MR, fluoroscopy, some plain X-rays, NM and so on)

Pregnancy (radiology)

Is the patient pregnant? Yes/No

If 'yes', expected due date (EDD) DD/MM/YY. For MR exams, the following message will appear. 'Please discuss the need for an MR with a radiologist.'

III.   Inpatient/A&E examinations

Infection (radiology)

Does the patient suffer from any infections which require barrier nursing? No/C difficile/ MRSA/Hepatitis A, B, C/HIV/COVID 19

Mobility (radiology)

Mobility? Chair/bed/trolley/portable imaging required (if possible)

IV.   Outpatient examinations

Transport (radiology)

Transport required by patient: Own transport/medicar/ambulance

V.   Questions for exams requiring iodinated IV contrast (CT with contrast, angiogram, intravenous urogram and so on)

Contrast-induced nephropathy risk assessment (Iodinated contrast exams only – not MR)

What is the risk of contrast-induced nephropathy: Low/High/On Dialysis – so not relevant/ Up-to-date eGFR requested – RCR endorsed guidelines on use of iodinated contrast are: www.ranzcr.com/search/ranzcr-iodinated-contrast-guidelines

Suggest these are written in consultation with local renal service.

Diabetes (Iodinated contrast exams only – not MR)

Is the patient diabetic? Yes/No

If 'yes', is the patient on: diet control, insulin, metformin or medication other than metformin?

If on metformin, please read the RCR endorsed guidance on this:
www.ranzcr.com/search/ranzcr-iodinated-contrast-guidelines

VI. Questions for MR exams

Contraindications to MR

Does the patient have any electro-magnetic implants (which are MR hazards) such as?

- Cochlear implants
- Brain/nerve/bladder stimulator

Yes/No

If 'yes', patient cannot have an MR scan. Please discuss with radiologist regarding alternative test.

Cardiac device information

Does the patient have a cardiac pacemaker or defibrillator? Yes/No

If they choose 'no', let them proceed with the next question

If they choose 'yes', is the pacemaker/defibrillator

- MR conditional
- MR unlabelled (*previously referred to as non-MR conditional*)

If they choose 'MR conditional'

Please provide details of the manufacturer and model of the generator and lead(s) and the device clinic where the patient is usually followed up (in the free text box below). Requests will not be accepted without this information. They can proceed with the next question if this field is completed.

If they choose 'MR unlabelled' (previously referred to as non-MR conditional)

Please discuss with consultant radiologist regarding potential available options for imaging this patient.

Possible contraindication to MR – safety assessment required

Does the patient have any possible contraindications to MR such as?

- Intracranial aneurysmal clips
- Retained shrapnel
- Metallic prosthesis
- Spinal rods
- Heart surgery
- Spinal surgery
- Brain surgery

- Recent surgery
- Shunts/vascular stents/vascular clips
- Others.

Yes/No

If 'yes', please provide details with date and type of procedure/implant. MR staff will do a safety assessment prior to MR.

Metallic intra-orbital foreign body (MR hazard)

Does the patient have any history of a metallic intraorbital foreign body? (Please take relevant occupational history such as welder and so on).

Yes/No

If 'yes', MR department will pursue with patient to ensure safety as per intraorbital foreign body policy for MR.

Claustrophobia

Is the patient claustrophobic? Yes/No

If 'yes', do you think the patient will require oral sedation or general anaesthetic (GA)? (They will need to choose one of the options).

- *If they choose oral sedation, the following message will appear:* Please discuss with the MR department regarding prescribing the sedation for the patient, prior to the scan.
- *If they choose GA, the following message will appear:* Please take relevant medical history and refer to Anaesthetic department for assessment.

MR safety questionnaire reminder

Please ensure that the patient fills in and signs the MR safety questionnaire. If the patient is unable to fill in/sign off a safety questionnaire, it is the responsibility of the referring doctor to sign it on behalf of the patient.

Patient girth and MR

Please ensure that the patient's maximum body circumference does not exceed (typically) 170 cm otherwise the patient will not fit in the MR scanner.

Exam-specific girth and MR
(this will appear for certain exams like cervical spine/neck)

Please ensure that the [body part requested] circumference does not exceed [measurement in cm] otherwise the patient will not fit in the MR [coil type] coil.

- Maximum neck circumference = typically 45 cm
- Maximum knee circumference = typically 60 cm
- Maximum circumference for chest, pelvis, liver, MRCP, abdomen = typically 150 cm

MR contrast (gadolinium)
(this will appear for all examinations that require gadolinium)

The last eGFR was [x] on DD/MM/YY.

Please read *'BFCR(19)4 - Guidance on gadolinium-based contrast agent administration to adult patients'* in patients who:

- Have impaired renal functions
- Are peri-operative liver transplant
- Are pregnant
- Are breastfeeding.

VII. Alert for exams requiring bowel preparation (for example, CT colonography)

Bowel preparation alert

Please ensure that the patient can tolerate bowel preparation.

VIII. Reminder for exams needing consent form

Consent form reminder

Please complete a consent form for this exam. Particular care with paediatric examination to ensure that consent is obtained from the right responsible adult.

IX. Additional specific questions for interventional radiology procedures

- Blood results: Hb, Plt, clotting, eGFR.
- Is patient on antiplatelet and/or anticoagulant therapy? Yes/No. If 'yes' please give details.
- For angio (not biopsies) add diabetic question re iv contrast medium.
- Suitable for a daycase procedure?
- For some procedures consider asking clinical questions needed for mandatory registry data entry, for example, NVR.

X. Communicable disease question

For example, COVID 19 suspicion or confirmed.

Appendix 2
Synchronisation of workflow status and cancellation reasons

Workflow status is a very important field transmitted in HL7 messages between Ordercomms, RIS and PACS. This table must be included in Ordercomms, RIS and PACS. They will be transmitted in ORC 5 field.

- Requested (N)
- In-vetting *(request sent for vetting in RIS)* – IV
- Vetted (justified) – V
- Held *(request held in RIS awaiting additional information and so on)* – HD
- Scheduled (or appointment given) – SC
- Cancelled (with reason) – CA
- Arrived (in department) – AR
- Exam in progress (exam started) – IP
- Exam completed (CM)
- Report dictated (RD)
- Unauthorised report (UR)
- Authorised/verified report (F)
- Partial report available (A)

Reasons for cancellations of a radiology request will include:

1. Patient did not attend
2. Declined at vetting or justification process
3. Exam not performed by radiographer
4. Duplicate request
5. Other

Free text narrative for reason for cancellation must be allowed in RIS for proper communication with the referrer regarding why an exam was cancelled. It is transmitted in ORC 16 field of HL7 v2 message.

Appendix 3
Patient data flows between IT systems

There are essentially three types of HL7 v2 messages radiology departments need to be aware of:

HL7 ADT messages: These messages provide demographic updates between healthcare IT systems. PAS systems will normally send out ADT messages to update any change in patient demographics or current hospital admission information (current location and current consultant) to recipient systems like RIS, Ordercomms and PACS.

HL7 ORM messages: These are order messages (electronic request) sent by Ordercomms to other systems – RIS, PACS, GP systems or EPR. Scheduling systems like RIS provide status update messages to all above systems via an ORM message update.

HL7 ORU messages: These are result messages containing the radiology report sent by the RIS to other systems like EPR, PACS and GP systems.

HL7 ADT messages from PAS will update the following information on Ordercomms, RIS and PACS. The below information is normally displayed on the patient banner of IT systems.

- Patient demographics (name, date of birth, sex, PAS number, NHS number, address)
- Current patient location *(if patient is admitted to hospital this refers to the ward location – otherwise it is blank)*
- Current responsible clinician *(if patient is admitted to hospital this refers to the consultant responsible for the inpatient episode – otherwise it is blank)*

HL7 ORM messages are transmitted from Ordercomms to the RIS and PACS and contain the following information:

- Clinical history
- Exam code and description (NICIP code and description list)
- Clinical priority (at time of request)
- Status (ie, workflow status – as per Appendix 2)
- Requesting responsible consultant/GP/clinician
- Requesting specialty (using main speciality code in NHS Data Dictionary)
- Name of requester
- Grade of requester (job role as per NHS Data Dictionary)
- Contact number of requester
- Patient location (where the *patient will be* when the exam is scheduled)
- Patient category (NHS, private, medicolegal or other)
- Date of request made
- Any associated Q&A relevant from Appendix 1

*Patient location – where the *patient will be* when the exam is scheduled. The distinction between 'requesting' versus 'current patient' location must be understood. For outpatient, GP or daycase requests, the radiology department will send the appointment details to the patient's home. Whereas for inpatient or A&E location they will ring the ward or A&E. The radiology department will also check on the morning of the exam, to see if current location has changed (ie, whether the patient has recently been admitted to the hospital) at the day of exam.

Below is a table of the segments and fields which contain the clinical information transmitted in HL7 messages.

NHS clinical terminology	HL7 segment and field
Patient Name	PID:5
Patient Date of Birth	PID:7
Patient Gender	PID:8
Patient Address	PID:11
NHS/CHI Number (National ID)	PID:3.1 (NHS No.) PID:3.4 (NHS – assigning authority)
PAS ID (Hospital ID)	PID:3.1 (PAS No.) PID:3.4 (assigning authority – NHS ODS code)
Current patient location *(if patient is admitted to* hospital *– otherwise it is blank)*	PVI:3 (Assigned Patient Location)
Current responsible clinician *(if patient is admitted to hospital – otherwise it is blank)*	PV1:7 (Attending Physician)
Patient Location* (where the *patient will be* when the exam is scheduled for appointment details to be sent to)	ORC:13.1 (Location Code) ORC:13.9 (Location Name)
Patient Location Type (Inpatient, Daycase, Outpatient, GP, A&E and Other)	ORC:13.6 Or PV1:2 (Patient Class)
Clinical History	NTE:3
Exam code and description (NICIP Code and Description list)	OBR:4

NHS clinical terminology	HL7 segment and field
Clinical Priority (at time of request) – Urgent, Routine and 2WW	ORC:7.6 or OBR:27.6
Workflow Status (As per Appendix 2)	ORC:5 (as per Appendix 2 list)
Requesting responsible consultant/GP/ clinician (Name)	ORC:12.2 and 12.3
Requesting responsible consultant/GP/ clinician (GMC No. or other ID)	ORC:12.1
Requesting responsible consultant/GP/ clinician (Job Role)	ORC:12.5
Requesting specialty (using main speciality or treatment function code in NHS Data Dictionary)	ORC:12.7
Requester (Name)	ORC:10.2 and 10.3
Requester (national ID-eg, GMC number)	ORC:10.1
Grade of Requester (Job Role as per NHS Data Dictionary)	ORC:10.5
Contact number of requester	ORC:14
Patient Category (NHS, Private, Medicolegal or Other)	PV1:18
Request Date and Time	ORC:9
Appointment Date and Time	ORC:7.3 or OBR:27.3
Associated Q&A at the time of Request (Appendix 1)	OBX Segment

NHS clinical terminology	HL7 segment and field
Reason for Cancellation	ORC:16
Person Cancelling the Exam (Actioned By)	ORC:19.1 (ID – GMC no./other) ORC:19:2 and 19.3 (Surname and Name)
Unique Order No. (generated by Ordercomms)	ORC:2 and OBR:2
Group Order No. (generated by Ordercomms to order two or more exams together)	ORC:4
Accession No. (generated by RIS)	ORC:3 and OBR:3
Visit No. – for scheduling two or more exams together (generated by RIS)	PV1:19

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Appendix 4
Synchronisation of reference files (look-up tables)

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Master file notification (HL7 standard)

In healthcare IT systems there is often a set of common reference files used by one or more application systems. Such files are called 'master files'.

Some common examples of master files used in radiology include:

1. Staff and health practitioner master file.
2. Location (ward and clinic) master file.

These common reference files need to be synchronised across the various applications at a given site. The master file notification (MFN) message provides a way of maintaining this synchronisation by specifying a standard for the transmission of this data between applications.

In many implementations, one application system will 'own' a particular master file such as the staff and practitioner master file. The changes (for example, adds, deletes or updates) to this file are made available to various other applications on a routine basis. In the context of Ordercomms implementation, the MFN message from HL7 provides a way of automatically synchronising consultants, GPs and ward/clinic locations look-up tables/reference files between PAS, RIS and Ordercomms. This reduces the need for manual processes for updating information on RIS and Ordercomms.

HL7 v2 messages use segments and fields for communication. MFN messages will contain the following segments:

- **MSH segment:** defines the intent, source, destination, and some specifics of the syntax of a message.
- **EVN segment:** is used to communicate necessary trigger event information to receiving applications. (M02 and M05 for MFN).
- **MFI (master file identification) segment:** identifies the master file being updated, as well as the initial and requested dates for 'file-level' events (such as 'replace file').
- **MFE (master file entry) segment:** carries the record-level event code (such as add, update and so on), the initial and requested dates for the event, and the record-level key identifying the entry in the master file.
- **STF (staff identification) segment and PRA (practitioner detail) segment:** contains personnel information. STF and PRA segments are present only with a M02 trigger event.
- **LOC (location identification) segment:** present only with a M05 trigger event.

EVN – Event Segment
Field 1 – M02 (used for staff/practitioner master file) or M05 (used for location master file)

MFI – Master File Identification Segment
- Field 1 – Master File Identifier
  - LOC – Location Master File
  - STF – Staff Master File
  - PRA – Practitioner Master File

- Field 3 – File Level Event Code
  - REP: Replace current version of this master file with the version contained in this message.
  - UPD: Change file records as defined in the record-level event codes for each record that follows.

MFE – Master File Entry Segment

- Field 1 – Trigger Events:
  - MAD: Add record to master file.
  - MDL: Delete record from master file.
  - MUP: Update record for master file.
  - MDC: Deactivate: discontinue using record in master file, but do not delete from database.
  - MAC: Reactivate deactivated record.

STF – Staff Identification Segment

It identifies personnel referenced by information systems. It will include hospital consultants, GPs, dentists and so on in the context of radiology departments. However, radiographer and departmental staff should also be part of the list, if PAS does hold the full staff record which is synchronised with the electronic staff record (ESR).

- Field 1 – STF
- Field 2 – Staff ID Code – GMC No, HCPC No etc
- Field 3 – Staff Name
- Field 7 – Active/Inactive
- Field 8 – Department – Main Specialty – NHS Data Dictionary www.datadictionary.nhs.uk/attributes/main_specialty_code.html
- Field 10 – Phone No
- Field 11 – Office Address – Hospital Site with Institution Name for Hospital Doctors and GP Practice for GPs
- Field 18 – Job Title – NHS Data Dictionary – Job Role Title www.datadictionary.nhs.uk/attributes/job_role_code.html
- Field 19 – Job Code Class – Job Role Title Code www.datadictionary.nhs.uk/attributes/job_role_code.html

PRA – Practitioner Detail Segment

The PRA segment adds detailed medical practitioner information to the personnel identified by the STF segment. This would only apply to medical staff (doctors). A PRA segment may optionally follow an STF segment. A PRA segment must always have been preceded by a corresponding STF segment.

- Field 1 – PRA
- Field 2 – Practitioner Group – Name and NACS Code for GP Practice or Hospital Institution
- Field 5 – Specialty – Main Specialty – NHS Data Dictionary www.datadictionary.nhs.uk/attributes/main_specialty_code.html
- Field 6 – Practitioner ID Nos – GMC number

LOC – Location Identification Segment

- Field 1 – LOC
- Field 2 – Location Description – Free Text Description of Ward, Clinic, Operating Room or Exam Room
- Field 3 – Location Type (R – Room/Ward, C – Clinic, E – Exam Room, O – Operating Room)
- Field 4 – Organisation Name (Name for Hospital Trust/GP Surgery, Organisation ID – NACS Code)
- Field 5 – Location Address
- Field 6 – Location Phone

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