STANDARD OPERATING PROCEDURE (SOP) FOR REJECTING IMAGES AND REJECT DATA ANALYSIS

DIRECTORATE: RADIOLOGY

AIM AND SCOPE OF PROCEDURE

The purpose of this SOP is to provide clear guidance for radiographers in regards to rejecting plain film images and subsequent analyses of rejection data.

This SOP is a mandatory, working document that describes the responsibilities of the staff and the means of subsequent analysis of data.

This SOP ensures that the rejection rate is analysed routinely, consistently and standardised across the trust as part of quality assurances. This SOP is based on the recommendations of published literature to ensure best practice.

APPROVAL PROCESS

<table>
<thead>
<tr>
<th>APPROVED BY</th>
<th>DATE</th>
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<tbody>
<tr>
<td>RADIOLOGY DIRECTORATE / GOVERNANCE MEETING</td>
<td>17th February 2021</td>
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<table>
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<tr>
<th>REVIEW DATE:</th>
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<td>16th March 2023</td>
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KEY STAFF RESPONSABILITIES

<table>
<thead>
<tr>
<th>POST</th>
<th>RESPONSIBILITY</th>
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<tbody>
<tr>
<td>CHIEF RADIOGRAPHER</td>
<td>To ensure policy is followed by radiographers</td>
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<tr>
<td>REJECT ANALYSIS RADIOGRAPHER AT EACH SITE</td>
<td>An appointed radiographer with the role of assisting the lead modality radiographer with the analysis and compliance of this policy.</td>
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<tr>
<td>REPORTING RADIOGRAPHER</td>
<td>To evaluate rejected images to provide feedback to the lead modality radiographer.</td>
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<tr>
<td>RADIOGRAPHERS</td>
<td>To ensure that rejection rates are as low as reasonably practicable without impacting on image quality or patient diagnosis.</td>
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<tr>
<td>SITE LEAD SUPERINTENDENT</td>
<td>To ensure policy is disseminated to relevant staff,</td>
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<tr>
<td>MODALITY LEAD RADIOGRAPHER</td>
<td>Investigate potential issues regarding rejected images and provide teaching and training where appropriate</td>
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REFERENCES:


Radiology Directorate – Procedure for rejecting images and data analysis

Justification

As part of normal working practice a radiographer/assistant practitioner should usually only acquire 1-2 images per body part (AP and Lateral/Axial) in line with the respective radiological protocol. However occasional repeat or supplementary images may also be required for the following example reasons; the patient moves during the examination, the quality of the image is insufficient due to the technique, the field is more collimated than it should be and leaves out part of the region of interest. Repeat or supplementary imaging is available as an option to the radiographer if they feel, within their professional judgment, that an addition image would aid diagnosis. Further advice can be sort from a senior radiographer, reporting radiographer or radiologist.

These rejected images provide an important component of quality assurance within a radiology department, allowing accurate determination of the causes of rejected images resulting in reduced patients’ dose, tailor guided education and training of staff (Atkinson et al., 2020). Unfortunately not all x-ray equipment has the ability to provide local reject analysis and therefore this relies on manual data entry introducing human error and significant use of human resources. This SOP details the use of automatic data analysis to improve standardised means of analysis across the trust, reduce human resources and improve accuracy of the acquired data.
Supporting Literature

A literature review was conducted in order to obtain a standard recommended rejection rate or nation guidance that can be used to within WAHT radiology department (See appendix 1). With limited guidance from evidence based practice it is suggested that a rejection rate of 4-10% for WAHT would be in line with international findings. It is recommended that rejection rate alone would lack specificity and instead the rejection rate should be directly compared to previous months of the same department.

Based on the data analysis provided by the rejection rate software, continual review by both the lead radiographer of an area and the reporting radiographers provides best practice with continual loop audit to review trend analysis. This would allow tailored practical teaching to be provided per body part with specific mention to when to reject and when not to reject an image (See feedback).

Procedure for rejecting images

All images that have resulted in a patient dose must be sent to PACS, with no patient images to be left unsent or rejected from the x-ray machine. All patient images must be visible to the clinician/reporter unless the result in QA’ing the images would potentially result in a false diagnosis. Example reasons would include double film exposure or an image with the incorrect patient details. Images that have been sent to PACS that fall into the category of potentially resulting in false diagnosis can be rejected by the operator at the time of QA-ing the image.

Change in practice:

As this is a change in practice to the way images were being rejected, a simple flow diagram is attached below to be displayed in working area (See appendix 2 and 3).

Rejection reasons:

When the operator rejects an image they will be required to pick from the following county wide pre-set list of rejection reasons:

- Artefacts other than grid
- Collimation
- CR
- Detector artefacts
- Double exposure
- Equipment
- Grid artefacts
- Inappropriate image processing
- Incorrect detector
- Motion blur
- No image
- Other
- Overexposed
- Underexposed
- Patient movement
- Poor inspiration
- Positioning
- QA
- Software failure
- Test image
- Unknown failure
- Wrong patient

RITA web software

All rejected image data in PACS is automatically harvested by a web software program call RITA (Rejected Images Trends & Analysis) at the beginning of each month for data analysis. RITA is accessed via the Trust intranet page - clinical systems - PACS Gateway link then clicking on the top right image. This launches the Radiology Portal. RITA is accessed by clicking on lowest rightmost selector. Alternatively enter: http://pacs.worcestershirehealth.nhs.uk/radstart.php into the web URL address bar to launch the Radiology Portal.
The reject data is analysed electronically to provide standardised means of analysis across the trust as well as to avoid human error and reduce the requirement of staff resources. In addition, not all x-ray equipment has the ability to provided reject analysis and thus relied on manual data analysis.

The home page gives a cursory overview of all rejected images within the trust looking at total number of images acquired, rejected images and overall reject rate over a year. You can see other month’s total data using the month select tabs underneath the graph.

RITA allows a specific site location to be selected within Worcestershire Acute Hospitals Trust, for example at Worcester the department is split further into level 1 and level 2 due to its size. The data on the site selector tabs provide an overall total images taken, total rejects, rejection percentage rate & month-on-month reject trend that is specific to that department site for that month. This data is also broken down further into a list of studies with rejected images, the number of rejected images and the rejection reason. In addition, the site provides other tables with the data further broken down and grouped into body part and Reject reason. All maximum values are highlighted in red to aid quick data reading. The data displayed has been sorted in ascending chronological order.

The sites yearly reject rate is also displayed graphically. Two further tables are provided from the data. The first shows all exams with the number of images taken and if it exceeds the number of images that would normally be expected to be taken for that exam. The second table shows the number of image expected per body part and then the current percentage value this has been exceeded by.

**Scheme of work for the analysis of rejected images:**

- **Feedback:**

  Feedback is an integral part of reject analyses as a way disseminating the information and educating the radiographic staff. In addition providing continual timely feedback ensures a robust audit loop is in place as part of quality assurances. In order to achieve this, R.I.T.A will automatically notify the plain film modality leads/appointed reject analysis radiographer at the end of each month via email that the current month’s analysis data is available for review. The plain film modality leads/appointed reject analysis radiographer is also provided with an action plan table on the RITA website (to be completed within two weeks) where they are required to manually enter: Areas for improvement and Description of action required where necessary as shown in the example below.
**Example Action plan:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Area for improvement</th>
<th>Description of Action</th>
<th>Initials of the person responsible for the action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High rejection rate for Knees</td>
<td>Presentation given by DBL on knees and when to reject and when not to reject.</td>
<td>DBL</td>
</tr>
</tbody>
</table>

-Suggested action plan if rejection rate is high: Where the rejection rate is higher than guidance from literature and with consideration to the department site then the radiographic modality lead or appointed reject analysis radiographer must analyse the data to look for trends, quality control and areas of improvement. Example action plans to improve the rejection rate percentage would include; teaching material made available on the team share drive, one to one sessions with a reporting radiographer, practical tutorials led by a senior member of staff, radiographer led reflection and CPD talks focused on the criteria of when to repeat an image. Where teaching and learning is deemed necessary it is important that a robust feedback loop is put in place and this will require re-evaluation on a monthly bases to measure improvements and establish further areas of development.

-Suggested action plan if the rejection rate is low: Where the rejection rate is lower than guidance from literature and with consideration to the department site then the radiographic modality lead or appointed reject analysis radiographer must contact the reporting team to determine if optimal imaging is being acquired or if further repeat imaging would have improved the diagnosis of the patients. This information can be used to compile any necessary action plans.

These action plans are submitted on the R.I.TA website and after two weeks R.I.T.A software automatically compiles the data into a document to be emailed to all radiographic staff and to the clinical governance team. This feedback document includes the overall trust rejection rate, individual site rejection rate, reason for any high rejection rate in addition the action plans submitted by the plain film modality leads. The feedback document provides recorded evidence of rejection analysis audit as well as the action plans of how these areas have been addressed for quality assurance purposes.

-Ensuring compliance

  - **Rejected images on the x-ray machine**

  The reject analysis software is required to still be running on the x-ray machine where possible; this is so that if the radiographer accidently rejects the image on the machine it is still archived. At the end of the month the modality lead of the department or appointed reject analysis radiographer will review any rejected images on the machine and discuss with the radiographers reminding them all that images that resulted in a patient dose must be sent to PACS to be rejected.

  - **Not using the pre-set rejection reasons or leaving it blank**

  When the modality lead radiographers are reviewing the monthly data please ensure that radiographers are not typing in their own rejection reason or leaving the reason as blank. At the end of the month any rejected reasons that are blank or not part of the pre-set list should be discussed with the radiographer involved. This data can be accessed using the accession number of these patients found on the reject analysis website.
-Important considerations

The rejection rate as a percentage for each specific radiology site provides useful sensitivity data however lacks the specificity without further analysis. For example if the rejection rate is higher or lower than the published literature recommended rate of 4-10% then this warrants further investigation to determine the cause. However as stated in published literature (Foos et al 2009, Atkinson et al 2020) the rejection percentage per department will vary significantly dependant on the type, mobility of patients being seen and the frequency of patient that require a specific type of imaging that is well known for having a high rejection rate such as knees and HBL hips. It is therefore recommended that rejection percentages should be compared to previous months from the same radiology department site to look for trends. If a direct comparison between the different radiology departments within the trust is required, strong consideration should be taken that the data can be skewed for each department and it would likely require a coefficient for direct comparison.
Appendix 1

Literature review

Introduction:

Reject analysis is an important component of quality assurance used within radiology departments to improve patient diagnosis. This allows accurate determination of the causes of rejected images resulting in reduced patients’ dose and tailor guide the education and training of staff (Atkinson et al., 2020).

To assist in the formulation of local standardised targets for reject analysis a comprehensive literature review was conducted. This literature review found limited UK studies that primarily focused on reject rates and the literature search required widening to include global studies.

The literature provided within the global search was evaluated using the Critical Appraisal Skills Programme CASP for a diagnostic tests (CASP, 2018) for empirical research. Using the CASP tool facilitates a consistent and systematic approach when evaluating each piece of research in regards to its validity and reliability (Aveyard, 2018). For each piece of the research the respective CASP tool was used by the author to complete a small summary including strengths, weakness and credibility.

Literature review:

Foos et al (2009) provides a prospective imperial study utilising a large sample size of n=288,000 conducted over 435 days within a large UK hospital. The authors suggest that the results of reject analysis differ widely dependent on the types of procedures being performed with an overall rate of 4.4% although this rose to 8% dependent on the types of examinations being performed.

This stance on a difference in reject rate dependent on department and examination is supported by Atkinson et al (2020), with the authors providing a prospective, recent imperial study with a sample size of n=90,298 demonstrating rejection rate of between 8-9% however acknowledging large variations between the types of examinations and departments such as an Accident and Emergency radiology department performing HBL hips at a rejection rate of 38% a general department performing a PA chests with a rejection rate of 5%. This lack of uniformity within rejection rates is mirrored in additional empirical studies conducted by Rastegar et al (2019), Hofmann et al (2015), Anderson et al (2012) suggesting rejection rates of 8%, 11% and 12% for their respective hospitals.

With such sporadic average rejection rates ranging from 4.4% - 12%, Atkinson et al concluded that a single overall reject rate was an inaccurate representation of a departments’ performance and that a deeper assessment of individual projections and radiographer reject rates was both necessary and an effective means to reduce reject rates and patient dose (Atkinson et al., 2020).

Rastegar et al provides supportive evidence and further suggests that causes of rejection may differ, with positioning errors and improper preparation being some of the main reasons. However they also found that radiographers varied in image rejection decision making, and the authors suggests that a regular reject analysis should be part of QA program (Rastegar et al., 2019).

Another aspect recommended by Atkinson et al is having a good relationship with radiologists, reporting radiographers and radiographers, a good feedback system in place could reduce the high percentage of positioning errors and help standardizing technical factors (Atkinson et al., 2020).
Discussion

With limited guidance from evidence based practice it is suggested that a rejection rate of 4-10% for WAHT would be in line with international findings. It is recommended that rejection rate alone would lack any specificity and instead the rejection rate should be directly compared to previous months of the same department.

Based on the data analysis provided by the rejection rate software, continual review by both the lead radiographer of an area and the reporting radiographers would be suggested as best practice with continual loop audit to review trend analysis. This would allow tailored practical teaching to be provided per body part with specific mention to when to reject and when not to reject an image.

Conclusion

This literature review has demonstrated that there currently isn’t a standard recommended rejection rate or nation guidance that can be used to within WAHT radiology department. The literature suggests that a lower reject rate would be more achievable within a community setting with only minor trauma comparative to a trauma heavy department, and thus the importance should lie with trend analysis and decreasing rejection rate in comparison to previous rates of the same department.

The literature review indicates that reject analysis is still a necessary tool in quality assurance but there needs to be a continuous review of the reasons for rejection. It is therefore the recommendation of the author that reject analysis should be used as both a feedback and educational tool to achieve best practice.

References


Appendix 2

Sending and rejecting acquired images

Please be aware that from the (22/02/2021) there is a change in practice for sending and rejecting images.

All images that resulted in a patient dose including those that require rejection are to be sent to PACS

Images that require rejection are to be rejected using one of the drop down options on PACS. If you do not find an appropriate reason please notify the lead of your area.

No patient images are to be left unsent or rejected on the X-ray machine.

Images you wish the clinician to view are to be QA’d as normal
Appendix 3: Flow diagram

Images rejected on PACS

R.I.T.A collects and analyses' rejection data

Lead radiographer of area reviews the data from R.I.T.A

Lead radiographer of area provides feedback via an action plan

Action plan and rejection data emailed to all staff.