MRI grading of perianal fistula (evaluation of imaging sequences)

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Purpose

The purpose of this study was to evaluate the accuracy of different MR imaging sequence in the detection of anal fistulas and to assess MR grading of perianal fistula and its implication for patient management.
Methods and Materials

Patients and methods:

From August 2006 to October 2007, 32 patients (27 males and 5 females ranging in age from 20 to 60 years with the mean age 39 years) were referred from specialist colorectal surgeons. All were attending for clinically suspected anorectal sepsis. 25 of these patients had clear evidence of active fistula disease on clinical examination. 3 patients had no evidence of fistula on clinical examination but complaining of anal pain, of these 2 had previous history of fistula in anus. 4 patients with inflammatory bowel disease complaining of ano-rectal discharge. All the patients were subjected to MR imaging after obtaining consent in Radiology Department. No other pre-operative imaging was done.

Imaging techniques

- No bowel preparation and no catheters were introduced into the anal canal.
- I.V. cannula was inserted for I.V. contrast Gd-DTPA administration.
- MR imaging was performed with the use of 1.5 T MRI machine. A quadrature phased array coil was used.
- Sagittal localizer was taken to visualize the longitudinal axis of the anal canal.
- Accurate coronal and axial planes were achieved by angulation of these planes to be exactly parallel and perpendicular to the long axis of the anal canal respectively.

Pulse sequences used were:

1- coronal and axial T1WI 2D turbo spin echo ( TR/TE 500-600/10-12 msec ), slice thickness 3-5 mm; gap 0.3-0.5 mm; NEX 4; FOV 20-25 cm. and matrix 256 x 256.

2- coronal or axial T2WI 2D turbo spine echo ( TR/TE 3500 / 150 msec ), slice thickness 3-5 mm; gap 0.3-0.5 mm; NEX 8; FOV 20-25 cm. and matrix 256 x 256.

3- coronal and axial short tau inversion recovery ( STIR ) ( TR/TE/TI 5000/65/230-270),slice thickness 3-5 mm;gap 0.3-0.5 mm; FOV 20-25 cm. and matrix 256x256.

4- Coronal and axial T2WIs with fat suppression using a frequency specific spectral presaturation (TR/TE,2588/70: six excitation) slice thickness 3-5 mm; gap 0.3-0.5 mm; NEX 8; FOV 20-25 cm. and matrix 256 x 256.
5-post I.V. Gd-DTPA (0.1 nmol/kg) T1WIs 2d turbo S.E. in coronal and axial planes with the same parameters of pre-contrast T1WI sequence. 6-post I.V. Gd-DTPA (0.1 nmol/kg) T1WIs 2d turbo S.E. fat suppression in coronal and axial planes

**Imaging analysis**

- The presence and site of active inflammation and scarring to indicate the course of primary track, the site of any internal or external opening and the presence of any secondary tracks, abscess or horse shoe extension. Fistula were classified according to Parks et al classification (8):

In Grade I, the primary track is seen in the intersphincteric plane, entirely confined by the external sphincter, Grade II perianal fistula, the primary track is associated with an abscess cavity or secondary ramification but still in the intersphincteric plane, in grade III the perianal fistula, the primary track is transphincteric piercing the external sphincter and coursing into the ischiorectal or ischeoanal fossa again, no abscess or secondary ramification, grade IV perianal fistula, however, the transphincteric primary track is complicated by secondary ramifications or abscess in the ischeorectal or ischeoanala fossa, in Grade V the perianal fistula extends above the insertion of the levator ani muscle.

Since the relationship of any track to the anal sphincter complex and levator plate is pivotal to this classification, the visibility of these structures was noted on all sequences.

**Data analysis**

- Surgery was performed for all patients.

- The extent of the disease was established by cannulating the fistula with probes and by laying open all primary tracks, extensions and abscesses are classified according to Park classification.

- The initial surgical results were compared with the MR imaging findings which were blinded to the surgeon.

- The final surgical findings after correction with MR imaging were accepted as a reference standard and against which MR imaging were compared.

The sensitivity and specificity of different MR imaging sequence were calculated in predicting the presence and exact location of primary tracks, secondary extension and abscess formation and internal opening.
## Results

<table>
<thead>
<tr>
<th>No.</th>
<th>T2 fat suppression</th>
<th>STIR</th>
<th>Contrast enhanced T1 FSE</th>
<th>Contrast enhanced T1 fat suppression</th>
<th>Primary surgical findings</th>
<th>Final surgical findings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TP</td>
<td>FN</td>
<td>FP</td>
<td>TN</td>
<td>TP</td>
<td>FN</td>
</tr>
<tr>
<td>Grade 1</td>
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<td>2</td>
<td>1</td>
<td>22</td>
<td>9</td>
<td>-</td>
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<tr>
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<td>6</td>
<td>1</td>
<td>-</td>
<td>25</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
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<td>1</td>
<td>-</td>
<td>27</td>
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<td>-</td>
</tr>
<tr>
<td>Grade 5</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>28</td>
<td>4</td>
<td>-</td>
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</table>

Table (1): Correlation between findings of different MR imaging sequences with surgical findings for the detection and classification of perianal fistulas in 32 patients included in the study.

TP = True positive  FN = false negative
FP = false positive  TN = True negative

<table>
<thead>
<tr>
<th>Grade</th>
<th>T2 fat supression</th>
<th>STIR</th>
<th>Contrast enhanced T1WIS</th>
<th>Contrast enhanced T1 fat supression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sensitivity</td>
<td>Specificity</td>
<td>Sensitivity</td>
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<td>95.6</td>
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</tr>
<tr>
<td>Grade 3</td>
<td>80</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

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Table (2): Sensitivity and specificity of different MR imaging sequences in grading perianal fistulas in 32 patients included in the study

-3 patients had no perianal fistula.

-MR imaging correctly depicted 29 patients with perianal disease (true positive n=29)

-One healed fibrotic track diagnosed as grade I perianal fistula by all MRI sequences (one false positive result).

-2 cases with perianal fistula grade I were missed by contrast enhanced T1 FSE and one case was missed by post contrast T1 fat suppression (false -ve).

-The anal sphincter and pelvic floor musculature were better resolved by STIR rather than T2WIs with fat suppression and contrast enhanced T1WIs sequences leading easier and more confident determination of fistula anatomy in 6 patients (two cases with grade I, one case with grade II, one case with grade III, one case with grade IV and one case with grade V).

-4 patients with false negative primary surgical findings (n=4); 2 cases of perianal fistula grade II, the third case with transphicteric collection (grade IV), and the fourth one with supralelevator abscess collection (grade V).

-The signal intensity of inflammatory tissue and fistulas track were higher in T2 fat suppression rather than STIR sequence but all cases with inflammatory tissue could be seen by both techniques.

-Examination under anesthesia failed to show the internal opening in 3 patients.

-The sensitivities and specificities of MR imaging sequences for grading of perianal fistula are given in table (2).
Fig. 0: Fig 1. Simple intersphincteric track displaying hyperintense signal on STIR MR images (a axial & b coronal) and more bright on T2 fat supression images (c axial and d coronal). It did not show contrast enhancement in post contrast images (e axial T1 FSE & f T1 with fat suppression). The internal opening into the anal canal is located at 10 O"clock. The relation of the fistula track to the external anal sphincter was better visualised by STIR sequence.

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**Fig. 0:** Fig 2. Grade 2 Left sided perianal fistulas track seen in the intersphinctric space. It extends cranially and medially in the intersphinctric space ending in small collection at 12 clock. The track appears of high signal in axial STIR(a), more bright signal in axial T2 with fat suppression (b). The relation of the fistula track to the external anal sphincter was better visualised by STIR. sequence.

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**Fig. 0:** Fig 3. Grade 3 transsphincteric fistula. Transsphincteric fistulous track is seen pericing the right side of the external sphincter, coursing into the right iachioanal fossa. It is opened internally into the right posterolateral aspect of the anal canal at 7 O,clock. (a&b) axial and coronal T2 fat suppression, (c) axial STIR. The relation of the fistula track to the external anal sphincter was better visualised by STIR sequence.
**Fig. 0:** Fig 4. Grade 4 right sided Perianal fistula associated with fluid collection seen in the ischioanal fossa with the fistula track seen coursing medially through the external anal sphincter and extending into intersphincteric space opening in the internal sphincter at 6 and 9 clock. The track is hyperintense on STIR sequence (a axial and b coronal) and more bright in T2 fat suppression (c axial &d coronal) and showed marginal enhancement on post-contrast T1WI (e coronal) and fat suppressed T1WI (f coronal) images. Note that the relationship of the fistulas track and internal opening to the sphincter complex was better assessed by STIR sequence.
Fig. 0: Fig 5. Grade 5 right sided perianal fistula. An enhancing fistula track is seen in the right ischio-rectal and ischio-anal fossa extending cranially up to right levator ani plate. It is seen opening externally in the right perianal cleft. The track is hyperintense on STIR image (coronal a) and enhancing after GD DTPA injection (b coronal T1 FSE and c coronal T1 with fat suppression).

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**Fig. 0:** Fig 6. Grade 5 perianal fistula. Irregular shaped fistulas tract is seen in the left ischiorectal fossa pointing externally into the left perianal cleft while deeply it shows multiple ramifications one of them piercing the left external anal sphincter into the intersphincteric space while the other one seen coursing upward reaching the left plate of levator ani muscle. The track is hyperintense on STIR images (axial a&b) and enhancing after contrast GD DTPA T1 FSE (coronal c) and T1 fat suppression (coronal d).
Conclusion

High spatial resolution MR imaging is accurate for detection of perianal fistula and provides important additional information on secondary extensions in patient with complex fistula. MR imaging-based grading system employs simple anatomic discriminators identifiable on axial and coronal MR images. By using this system, the radiologist can alert the referring clinician to the presence of complex disease that may require expert surgical management if the ischeoretal, ischeoanal fossae or levator plate are affected resulting in better prediction of patient outcome. There is no significant difference was found in detection of perianal fistula when comparing T2 with fat suppression and STIR sequences. Using STIR is more confident rather than T2 fat suppression and contrast enhanced T1 sequences in fistula classification. This study suggests that axial and coronal STIR sequences alone are sufficient for fistula diagnosis and classification and it is better than other MRI sequences as the relationship of the fistula to anal sphincter is better visualised by this sequence.
References


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