Contrast-enhanced MRI as gold standard method to evaluate recto-vaginal fistulae

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Purpose

Primary objectives.

To show that the use of contrast-enhanced MRI (CEMRI) is a reliable tool to study the localization, the tract, the abscessualization and for the follow-up in patients after therapy with recto-vaginal fistulae (RVF).

Secondary objectives.

To define a RVF.

To recognize a RVF from his signs and symptoms.

To understand the role of imaging in the management of RVF.

To compare non-enhanced MRI with contrast-enhanced MRI.

Background

Recto-vaginal fistulas (RVF) are a disabling disease with a dramatic impact on women's life. In addition, these conditions may occur in the background of other chronic diseases.

Fistula is defined as an abnormal communication between two epithelized surfaces. Recto-vaginal fistulae, in particular, are perianal lesions that arise from a penetrating ulceration of the anal canal or rectum into the vagina. The main predisposing factors are obstetric and vaginal trauma, inflammatory bowel diseases, radiation proctitis, anorectal and pelvic cancer, postoperative iatrogenic complications, pelvic infection. Obstetric and vaginal trauma is the most frequent cause of RVF occurring in 0.1% of vaginal delivery. Inflammatory bowel disorders (IBD) have been reported as second cause of RFV. For example, the cumulative incidence of all perianal fistulas in Crohn’s disease is 50% after age 20 years, and up to 9% of these are RVFs. It is estimated that up to 10% of women with Crohn's disease will develop an RVF. Other disorders have been associated with RVFs, as well as infections (for example diverticulitis and abscesses arising from crypts of Morgagni or from Bartholin’s gland) and postoperative iatrogenic complications (Table 1).

1. Obstetric and vaginal trauma
2. Inflammatory bowel diseases
3. Radiation
Post operative complications

Cancer

Infections

Table 1: Main causes of RVF

There are several classification for RVFs. They can be classified by location: RVFs with rectal origins proximal to the anorectal sphincter complex are defined as high fistulas, those originating distally from the anal sphinter complex are defined as low. The Parks classification\(^{(1,2)}\) (figure 1) divides fistulas into four groups: inter-sphincteric, trans-sphinteric, supra-sphincteric and extra-sphincteric.

In addition RVF can be classified as simple or complex and according to the etiology. The distinction between low and high RVFs is of paramount importance because the operative strategy for each entity varies.

Concerning clinical evaluation, main signs of RVF can be the discharge of stool, gas, or mucopurulent feces from vagina, as well as recurrent vaginal infections, dyspareunia, perineal pain and signs of perineal inflammation. Before examination, a careful history must be collected regarding medical, surgical, and obstetric history. Special concern should be addressed to the extraintestinal signs of Crohn's disease. Patients should be inquired about constitutional symptoms, such as recent weight loss and fatigue. Assessment of the patient's continence should also be performed focusing on the frequency and severity of any previous incontinence episodes\(^{(3)}\).

Imaging plays a critical role for the detection of RVF. Firstly RVFs can be investigated with fluoroscopic contrast medium-enhanced studies, such as fistulography. Standard endoanal ultrasound is used to locate internal openings and to define sphincter anatomy of anorectal fistula and RVF with 7% to 73% correctness\(^{(4,5,6)}\). The addition of contrast injected into the tract increases diagnostic accuracy to about 48% to 73%. Cross sectional studies, such as Computed Tomography (CT) and MRI, can demonstrate extraintestinal disease adjacent to the fistula\(^{(7)}\). MRI in particular, due to the intrinsic soft-tissue resolution and multiplanar imaging capability, has a high sensitivity in demonstrating soft-tissue abnormalities and is recommended for the diagnosis of infection and fluid collection in the perianal area\(^{(8)}\). T2w images can depict lesions (fistulas and fluid collection) with high signal intensity, whereas it has been proved that the use of contrast enhancement guarantees an higher sensibility in showing RVF and surrouniding tissue lesions. While previous studies have stressed the role of MRI (endo or body coil) in recognizing RVF, there has not yet been any study that propose CEMRI as the most effective tool to show RVF and surrounding tissue lesions\(^{(9,10,11)}\).
Images for this section:

**Fig. 0:** Parks classification: trans-sphincteric (1), extra-sphincteric (2), supra-sphincteric (3) and inter-sphincteric (4)

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Methods and Materials

The protocol used to visualize the fistulas had scheduled the use of MRI (Siemens Magnetom Symphony 1,5 T). The basal protocol is performed by the sequences in table 2.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>TR</th>
<th>TE</th>
<th>FA</th>
<th>Thickness</th>
<th>TF</th>
<th>Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>T2-tra</td>
<td>4410</td>
<td>95</td>
<td>180</td>
<td>4 mm</td>
<td>15</td>
<td>384x256</td>
</tr>
<tr>
<td>T2-tra-FS</td>
<td>5050</td>
<td>95</td>
<td>180</td>
<td>4 mm</td>
<td>15</td>
<td>384x256</td>
</tr>
<tr>
<td>T2-sag</td>
<td>4740</td>
<td>91</td>
<td>180</td>
<td>4 mm</td>
<td>15</td>
<td>256x106</td>
</tr>
<tr>
<td>T2-cor</td>
<td>6320</td>
<td>181</td>
<td>180</td>
<td>4 mm</td>
<td>25</td>
<td>384x222</td>
</tr>
<tr>
<td>T1-tra</td>
<td>578</td>
<td>8.1</td>
<td>150</td>
<td>3 mm</td>
<td>7</td>
<td>320x154</td>
</tr>
<tr>
<td>T1-tra-FS</td>
<td>584</td>
<td>8.1</td>
<td>150</td>
<td>3 mm</td>
<td>7</td>
<td>320x154</td>
</tr>
</tbody>
</table>

Table 2: TR (repetition time), TE (echo time), FA (flip angle), TI (inversion time), TF (turbo factor). T2 sequences are all HASTE (Half-Fourier Acquisition Single-shot Turbo spin Echo), T1 sequences are all SE.

To the basal protocol were added 60 sec. after the administering of MDC (0,2 ml/kg) the sequences in table 3. Contrast medium was administrated e.v. to all the patients, the contrast (MDC) we used is Omniscan 0,5 mmol/ml GE Healthcare injectable solution for venous usage V08CA03 Gadodiamide.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>TR</th>
<th>TE</th>
<th>FA</th>
<th>Thickness</th>
<th>TF</th>
<th>Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1-tra-FS</td>
<td>584</td>
<td>8.1</td>
<td>150</td>
<td>3 mm</td>
<td>7</td>
<td>320x154</td>
</tr>
<tr>
<td>T1-cor</td>
<td>380</td>
<td>8.1</td>
<td>150</td>
<td>3 mm</td>
<td>7</td>
<td>320x178</td>
</tr>
</tbody>
</table>

Table 3: TR (repetition time), TE (echo time), FA (flip angle), TI (inversion time), TF (turbo factor). T1 sequences are all SE.

We have evaluated 26 patients:

8 with Crohn's disease, 10 with not specified inflammatory bowel disease, 2 with post surgery pelvic floor abscesses, 2 with post operative fistula for a drained tubo-ovarian abscesses, 2 with post operative fistula after prolascsectomy, 2 with No Evidence of Disease (NED) (table 4).
Table 4: Causes of RVF in our population.

<table>
<thead>
<tr>
<th>Cause</th>
<th>N of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBD</td>
<td>10</td>
</tr>
<tr>
<td>Crohn's disease</td>
<td>8</td>
</tr>
<tr>
<td>Surgery pelvic floor</td>
<td>2</td>
</tr>
<tr>
<td>Prolassectomy</td>
<td>2</td>
</tr>
<tr>
<td>Tubo-ovarian abscesses</td>
<td>2</td>
</tr>
<tr>
<td>NED</td>
<td>2</td>
</tr>
</tbody>
</table>

For all patients are been inspected the sequences pre and post administration of contrast medium. There are evaluated: the presence of a RVF, abscesses, secondary tracts or other fistulas and the rectal and-or vaginal opening of the fistulas.

The results have been controlled by three different radiologists with the same experience in abdominal MRI.

Moreover same patients (8 patients) underwent further check-up tests after the surgical (4 patients), pharmacological (2 patients) or stem cell (2 patients) therapy.
Results

We obtained the same findings of surgical or clinical examination for 24/26 patients. In 2 patients no fistulas were diagnosed so we can't evaluate the accuracy or the negative predictive value as surgery (the gold standard we have referred to) is based on our radiological report.

The most frequent cause of RVF in our study is a IBD with active or not disease. In fact in patients whit IBD the probability to joint out other tracts, absesses and associated report is very hight. We have found 25 RVF, 12 abscesses, 14 subordinate tracts or other fistulas non in communication with the vagina.

In 12 patients the RVF has been identified since in the T2w sequences pre mdc; in 12 patients the mdc injection has shown more secondary tracts. In 10 patients we have found parts with only tissue inflammation where there wasn't cavitation at the moment.

In 16 patients the sequence with mdc has allowed to better evaluate the orifice, tract and ramification of the fistula. In 12 patients the fistula has been identified only in the sequences with mdc. The T2w sequences have been of use to evaluate the presence of possible abscesses, the morphology and the intestinal mucosal inspissation in cased of IBD.

In this group of patients the RVF had a diameter <= 5 mm, impossible to distinguish in sequences without mdc.

<table>
<thead>
<tr>
<th></th>
<th>T2W</th>
<th>T1W-pre mdc</th>
<th>T1W-post mdc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fistula</td>
<td>12/24(50%)</td>
<td>12/24(50%)</td>
<td>24/24(100%)</td>
</tr>
<tr>
<td>Secondary tracts</td>
<td>6/24(25%)</td>
<td>6/24(25%)</td>
<td>14/24(58%)</td>
</tr>
<tr>
<td>Abscess</td>
<td>12/24(50%)</td>
<td>12/24(50%)</td>
<td>12/24(50%)</td>
</tr>
<tr>
<td>Rectal opening</td>
<td>8/24(30%)</td>
<td>8/24(30%)</td>
<td>24/24(100%)</td>
</tr>
<tr>
<td>Vaginal opening</td>
<td>8/24(30%)</td>
<td>8/24(30%)</td>
<td>24/24(100%)</td>
</tr>
</tbody>
</table>

Table 5. Results
Images for this section:

**Fig. 0:** T1w Fat Sat with mdc, same position of Fig 2. Here we can identify the walls inflammed, not discriminable in Fig 2

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**Fig. 0:** T2w image, same position of Fig 1. Here we can see only the abscess, not the walls as we can in Fig 1.

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**Fig. 0:** T1w Fat Sat with mdc, same position of Fig 4. For a subcentimetric abscess the informations given are the same we can see in T2w (Fig 4)

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Fig. 0: T2w image, same position of Fig 3.

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**Fig. 0:** T1w fat sat with mdc, same position of Fig 6. Here we can see an alteration at hour 1, not identifiable in Fig 6.

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Fig. 0: T2w image, same position of Fig 5. Here we can see only a thin tract in the recto-vaginal septum, not the alteration seen in Fig 5.

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**Fig. 0:** T1w fat sat with mdc, same position of Fig 8. Here we can see an abscess from hour 9 to 11 and a thin tract at hour 7.

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**Fig. 0:** T2w image, same position of Fig 7. Here the tract seen in Fig 7 is not identifiable.

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**Fig. 0:** T2w image, same position of Fig 10. we can see the mucosal inspissation in a patient with IBD.

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**Fig. 0:** T1w Fat Sat post mdc, same position of Fig 9. Here we can see the mucosal inspissation, no better information respect a T2w image.

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Conclusion

Our study demonstrated that CEMRI is a reliable tool to identify the localization, the tract, the openings, the intestinal mucosal inspissation or associated report (Table 5).

In the identification of abscesses the use of CEMRI provides the same informations of the basal sequencies.

We don't have enough data to be statistically significance for the follow-up after clinical or surgical therapy because we have only 8 patients in follow-up.

For the clinics and the surgeons, a valuable information is distinguish between inflammation or fibrosis and this is possible with CEMRI.

In our patients whose RVFs are thin (<= 5mm) the wall is often collapsed because of the free communication with the vagina then in the T2w sequences we only have indirect signs like the presence of air in the vaginal septum for suspect the presence of a tract.

In these thin fistulas, by means of CEMRI we found a direct sign like the enhancement caused by the inflammation of the fistula’s walls that permit to directly identify the fistula.
Fig. 0: T1w Fat Sat with mdc, same position of Fig 2. Patient treated with stem cells. The first tract of this fistula is in remission, but near the skin there is a high enhancement, sign of inflammation.

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**Fig. 0:** T2w image, same position of Fig 1. Here we can not discriminate where ends the inflammation like in Fig 1.

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References

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