Figure S1: Morphology of lymph nodes at 2 h and 24 h after ferumoxytol infusion.
Axial T2 PROPELLER images show morphology of lymph nodes at (A) 2h after ferumoxytol infusion (B) shows benign node with hypointense hilum and hyperintense cortex. The same pattern is visible at (C) 24h after ferumoxytol infusion in (D) benign lymph nodes. In (E) malignant lymph nodes at 2h (F) a homogenous hyperintense pattern is displayed. This also applies for (G) 24h after ferumoxytol infusion (H) no hilum is discernible.
**Figure S2: Morphologies of different sizes of benign and malignant lymph nodes after ferumoxytol infusion:** Axial ferumoxytol-enhanced T2-FSE and PROPELLER images of benign lymph nodes with a short axis of (A) <5 mm often show no T2-hypointense hilum, it is easily visible in lymph nodes (C) with a size between 5-10 mm and (E) ≥10 mm. In malignant lymph nodes with a short axis of (B) <5 mm, (D) ≥5 - <10 mm and (F) ≥10 mm a homogenously T2-hyperintense pattern without a recognizable ferumoxytol-enhancement is present. The specific enhancement-pattern especially helps depict benign and malignant lymph nodes in the range between ≥5 - <10 mm where size has a bad prediction of malignancy.

T2-FSE: T2-weighted fast spin echo.
Table S1: Patient demographics

| Patient ID | Age (years) | Sex | Diagnosis                                      | Hours post ferumoxytol infusion |
|------------|-------------|-----|-----------------------------------------------|---------------------------------|
| 1          | 16          | F   | Nasopharyngeal carcinoma                      | 24                              |
| 2          | 16          | F   | Ovarian steroid cell tumor                    | 24                              |
| 3          | 11          | M   | Wilms Tumor                                   | 24                              |
| 4          | 15          | F   | Ewing sarcoma                                 | 24                              |
| 5          | 13          | M   | Ewing sarcoma                                 | 24                              |
| 6          | 15          | M   | Hepatocellular carcinoma                      | 24                              |
| 7          | 18          | M   | Osteosarcoma                                  | 24                              |
| 8          | 13          | F   | Osteosarcoma                                  | 24                              |
| 9          | 16          | M   | Lipoma                                         | 2                               |
| 10         | 17          | M   | Gastrointestinal stromal tumor                | 24                              |
| 11         | 14          | M   | Osteosarcoma                                  | 2                               |
| 12         | 10          | M   | Synovial sarcoma                              | 2                               |
| 13         | 14          | M   | Desmoplastic small round cell tumor           | 2                               |
| 14         | 10          | M   | Undifferentiated sarcoma                      | 2                               |
| 15         | 8           | M   | Malignant peripheral nerve sheath tumor       | 2                               |
| 16         | 8           | M   | Synovial sarcoma                              | 2                               |
| 17         | 14          | M   | Osteosarcoma                                  | 2                               |
| 18         | 11          | M   | Rhabdomyosarcoma                              | 24                              |
| 19         | 16          | M   | Ewing sarcoma                                 | 24                              |
| 20         | 11          | M   | Langerhans cell histiocytosis                 | 24                              |
| 21         | 8           | F   | Rhabdomyosarcoma                              | 24                              |
| 22         | 16          | M   | Rhabdomyosarcoma                              | 24                              |
| 23         | 15          | M   | Ewing sarcoma                                 | 24                              |
| 24         | 18          | M   | Osteosarcoma                                  | 24                              |
| 25         | 17          | F   | Osteosarcoma                                  | 24                              |
| 26         | 14          | M   | Osteosarcoma                                  | 24                              |
| 27         | 7           | F   | Synovial sarcoma                              | 2                               |
| 28         | 9           | M   | Osteosarcoma                                  | 2                               |
| 29         | 11          | F   | Langerhans cell histiocytosis                 | 24                              |
| 30         | 14          | M   | Undifferentiated sarcoma                      | 24                              |
| 31         | 11          | F   | Osteosarcoma                                  | 2                               |
| 32         | 14          | F   | Germ cell tumor                               | 24                              |
| 33         | 18          | F   | Wilms Tumor                                   | 2                               |
| 34         | 11          | M   | Langerhans cell histiocytosis                 | 2                               |
| 35         | 15          | F   | Langerhans cell histiocytosis                 | 2                               |
| 36         | 14          | M   | Langerhans cell histiocytosis                 | 2                               |
| 37         | 15          | M   | Langerhans cell histiocytosis                 | 2                               |
| 38         | 11          | M   | Osteosarcoma                                  | 2                               |
| 39         | 13          | F   | Osteosarcoma                                  | 2                               |
| 40         | 16          | M   | Desmoplastic small round cell tumor           | 2                               |
| 41         | 18          | M   | Desmoplastic small round cell tumor           | 2                               |
| 42         | 18          | M   | Neuroblastoma                                 | 24                              |

M = male; F = female
| Parameter               | axial T2w FS | axial T2w FS | axial DWI | axial IDEAL-IQ | PET |
|------------------------|--------------|--------------|-----------|----------------|-----|
| Sequence type          | FSE          | PROPELLER    | EPI       | DIXON          | N/A |
| TE [ms]                | 103          | 112          | 59        | 6 echoes (1.2-6.5) | N/A |
| TR [ms]                | 8331         | 6510         | 4457      | 6.2            | N/A |
| Matrix size [pixel]    | 384 x 320    | 384 x 384    | 128 x 72  | 160 x 160      | -   |
| FOV [cm]               | 48           | 48           | 48        | 48             | 25  |
| Slice thickness [mm]   | 4            | 4            | 6         | 6              | 2.8 |
| b-value [s/mm²]        | -            | -            | 50, 600   | -              | -   |
| FA [°]                 | 111          | 110          | 90        | 5              | -   |
| Scan duration [min]    | 3:15         | 6:20         | 01:21     | 00:24          | 3:30|

**DWI**: diffusion weighted imaging; **EPI**: echo planar imaging; **IDEAL-IQ**: iterative decomposition of water and fat with echo asymmetry and least-squares estimation; **FA**: flip angle; **FOV**: field of view; **FS**: fat saturated; **FSE**: fast spin echo; **PET**: positron emission tomography; **PROPELLER**: periodically rotated overlapping parallel lines with enhanced reconstruction; **T2w**: T2-weighted; **TE**: echo time; **TR**: repetition time.
Table S3: Morphology of all lymph nodes according to size and time point of imaging after ferumoxytol infusion

| Morphology | Benign | Malignant | All |
|------------|--------|-----------|-----|
|            | <5 mm  | ≥5 - <10 mm | ≥10 mm | ∑   | <5 mm | ≥5 - <10 mm | ≥10 mm | ∑   | ∑   |
| **post 24 h** |        |           |       |     |       |           |       |     |     |
|           | 84     | 127       | 4     | 215 | 0     | 2         | 0     | 2   | 217 |
|           | 35     | 6         | 1     | 42  | 7     | 23        | 16    | 46  | 88  |
| Total lymph nodes | 119     | 133       | 5     | 257 | 7     | 25        | 16    | 48  | 305 |
| **post 2 h** |        |           |       |     |       |           |       |     |     |
|           | 28     | 113       | 6     | 147 | 0     | 3         | 0     | 3   | 150 |
|           | 39     | 21        | 0     | 60  | 2     | 41        | 55    | 98  | 158 |
| Total lymph nodes | 67     | 134       | 6     | 207 | 2     | 44        | 55    | 101 | 308 |
| **all LN (2 + 24 h)** |        |           |       |     |       |           |       |     |     |
|           | 112    | 240       | 10    | 362 | 0     | 5         | 0     | 5   | 367 |
|           | 74     | 27        | 1     | 102 | 9     | 64        | 71    | 144 | 246 |
| Total lymph nodes | 186    | 267       | 11    | 464 | 9     | 69        | 71    | 149 | 613 |
Table S4: Quantitative data of benign and malignant lymph nodes at 2 h vs 24 h

|        | ADCmean $[10^{-6} \text{ mm}^2/\text{s}]$ | SUV-ratio | R2* $[\text{Hz}]$ |
|--------|------------------------------------------|-----------|-------------------|
|        | benign         | malignant  | benign       | malignant  | benign     | malignant  |
| 2 h    | 1616.9 ± 407.4 | 869.1 ± 179.4 | 0.49 ± 0.24 | 2.65 ± 1.08 | 131.6 ± 49.8 | 85.2 ± 25.1 |
| 24 h   | 1554.3 ± 427.3 | 754.4 ± 164.1 | 0.55 ± 0.32 | 1.48 ± 0.94 | 124.6 ± 42.9 | 82.6 ± 23.0 |
| All    | 1578.7 ± 419.8 | 851.7 ± 206.2 | 0.53 ± 0.29 | 2.77 ± 1.45 | 127.8 ± 46.3 | 84.4 ± 23.4 |

Mean +/- standard deviation. ADCmean: mean apparent diffusion coefficient; SUV: standardized uptake value; SUV-ratio: SUVmax lesion/SUVmean liver; R2*: R2*-relaxation rate.