Gallium-68 citrate PET/CT findings in an experimental model of acute appendicitis in rabbits

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Abstract
Objective Acute appendicitis (AA) is the most common abdominal surgical emergency worldwide. Several infection and inflammation imaging methods have been used in a limited number of cases. Gallium-68 (68 Ga) has recently been investigated as an infection and inflammation imaging agent. The aim of our study was to produce 68 Ga-citrate in an automated synthesis unit and perform 68 Ga-citrate PET/CT imaging in rabbits with experimentally induced AA. Furthermore, this study aimed to investigate and correlate PET/CT findings with those of histopathological and biochemical examinations. Methods 68 Ga-citrate was synthesized using the cationic method in an automatic synthesis unit. Twelve rabbits of the New Zealand strain (Oryctolagus cuniculus) were divided into two groups. In the AA group (n = 6), the appendices of the rabbits were surgically ligated. In the sham group (n = 6), the abdomen was surgically opened and closed. All rabbits were imaged using 68 Ga-citrate PET/CT at 12, 24 and 36 h following the establishment of the experimental models, and at 36 h, all rabbits were appendectomised. Appendices were examined histopathologically and blood samples were drawn from all rabbits at the beginning and end of the experimental process. Interleukin-6 (IL-6) and procalcitonin (Pct) levels were measured. PET/CT results were compared statistically with histopathological and biochemical references. Results The labelling efficiency of 68 Ga-citrate was more than 98%. The sensitivity, specificity and accuracy of 68 Ga-citrate PET/CT in AA were 100%, 83.3% and 81.7%, respectively. IL-6 and Pct levels at 36 h in the AA group were significantly higher than those in the sham group and at baseline (p < 0.05). Conclusions 68 Ga-citrate was synthesized in an automatic synthesis unit for the first time, and 68 Ga-citrate uptake was shown using PET/CT in a histopathologically and biochemically confirmed experimental AA rabbit model.

Full Text
Due to technical limitations, full-text HTML conversion of this manuscript could not be completed. However, the manuscript can be downloaded and accessed as a PDF.

Figures
Figure 1

Establishment of the sham (a) and experimental models of AA (b). The red arrow indicates the region where the appendix was ligated.

Figure 2

In 36-h 68Ga-citrate PET/CT images of a rabbit (AA6) with experimental acute appendicitis, acute appendicitis is observed in the abdomen adjacent to the left kidney and spleen. MIP (a); transaxial PET/CT fusion image (b); transaxial CT image (c) (red arrows).
In 36-h 68Ga-citrate PET/CT images of a rabbit (AA4) with experimental acute appendicitis, acute appendicitis is observed in the abdomen in the right lower quadrant. MIP (a); PET/CT coronal fusion image (b); coronal CT image (c) (blue arrows).

68Ga-citrate PET/CT images, time graph of SUVmax averages obtained from AA region for the AA and sham group.
Figure 5

Histopathological view of the appendix of a rabbit in the sham group (a) neutrophil infiltration of the mucosa and appendix wall (b) Histopathological examination of another rabbit in the AA group showed full-layer necrosis (c) in the appendix wall (HEX 40).