ABSTRACT

Background and Purpose: Acute appendicitis (AA) is the most common cause of acute intra-abdominal pain in adults requiring emergency surgery [1,2]. The clinical diagnosis is based upon patients` history, physical examination and elevated C-reactive protein (CRP) levels in serum analysis, and imaging including transabdominal ultrasound (US) or multidetector computed tomography (MDCT) may aid in establishing the diagnosis of AA. MDCT is the imaging modality of choice in adults [3] with a sensitivity of 90-100%, a specificity of 90-99.1%, a positive predictive value (PPV) of 83-95.7%, and a negative predictive value (NPV) of 90-100.0% [1,4]. MDCT is superior to US in the diagnosis of AA [5] and may show various established signs of AA [6,7]: wall thickness above 2mm with ring-like contrast enhancement, an increased cross-sectional diameter more than 6mm, periappendiceal edema, abscess in the right lower quadrant (RLQ) or pneumoperitoneum due to perforation, and a calcified appendicolith. Histopathological assessment serves as the reference standard, and AA may usually classified as either phlegmonous or ulcero-phlegmonous or gangrenous AA, or as AA with perforation and abscess formation.
The purpose of our study was to compare findings on MDCT with both histopathology and CRP levels in patients with AA.

Methods and Materials: The study protocol has been approved by the local Clinical Institutional Review Board and complied with the Declaration of Helsinki. All subjects had given written informed consent for the retrospective evaluation of their data.
The study group consisted of 76 consecutive patients (42 males; 34 females; age 56 ± 17.9 years; range 23-97years) with histopathologically proven AA. All patients had been referred for a preoperative MDCT scan of the abdomen due to clinically suspected appendicitis between January 2011 and January 2013. Patients were categorized into one of three groups (GR) based on histopathologic evaluation: ulcero-phlegmonous (GR1), gangrenous (GR2), and perforation (GR3). Two blinded readers with 5 (MK) and 3 (CB) years of experience in abdominal imaging reviewed the transaxial as well as the coronal MDCT images in consensus and patients were assigned into one of three GR using following criteria: Patients in GR1 showed wall thickness (2-3mm) with ring-like contrast enhancement, a cross-sectional diameter (6-10mm), and moderate periappendiceal fat attenuation, patients in GR2 showed wall thickness (>3mm) with ring-like contrast enhancement, a cross-sectional diameter (>10mm), and high grade of periappendiceal fat attenuation, and patients in GR3 showed an

abscess formation in the RLQ. CRP levels were correlated using *p*-values from Mann-Whitney's U test and receiver operating characteristic (ROC) curve analysis was performed for the identification of the optimal cutoff-point for perforation.

Results: According to histopathological evaluation of the surgical specimens, 49/76 patients (64.5%) were assigned to GR1, 5/76 patients (6.6%) to GR2, and 22/76 patients (28.9%) to GR3. Using MDCT, 42/49 patients (85.7%) were correctly identified as GR1. However, 7/49 patients (14.3%) were falsely classified as GR2. 2/5 patients (40%) were correctly identified as GR2, while the three remaining patients (60%) were falsely classified as GR1.

An abscess in the RLQ was correctly diagnosed in 19/22 patients (86.4%) in GR3. However, 3/22 patients (13.6%) were falsely classified as GR2 on MDCT. In total, 20 calcified appendicoliths were diagnosed: GR1 (n=13); GR2 (n=2); GR3 (n=5).

Mean CRP levels were 56mg/l ± 99.3 (range 0-359mg/l) in GR1, 117mg/l ± 64.6 (range 32-208mg/l) in GR2, and 139.5mg/l ± 84.3 (range 59-353mg/l) in GR3. CRP levels were significantly different between GR1 and GR3 ($p<0.03$). ROC curve analysis revealed an optimal cut-off point of >72mg/l for identification of appendiceal perforation (AUC=0.725), resulting in a sensitivity of 86.4% and a specificity of 55.1%. CRP levels were neither significantly different between GR1 and GR2 ($p=0.206$) nor between GR2 and GR3 ($p=0.786$). Patients with ulcero-phlegmonous appendicitis (GR1) could have normal CRP levels whereas appendiceal perforation (GR3) with a CRP level less than 59mg/l was very unlikely in our study cohort.

Limitations: This study had limitations. First, due to its retrospective nature, a selection bias cannot be excluded. Second, there was an unequal distribution of patients with histopathologically proven AA in the three groups. Finally, previously described cecal wall changes such as the arrowhead sign, the "cecal bar" sign, and focal cecal apical thickening could not be reliably assessed without administration of bowel contrast material in our study, and were not included as a consequence in our CT criteria for diagnosis of appendicitis [8].

Conclusion: MDCT may not only aid in establishing the diagnosis, but may correctly predict the clinically relevant differences in histopathological grading. The differentiation between patients in GR1 and GR3 on MDCT may influence the therapeutic management and could lead to a different surgical procedure (open vs. laparascopic approach).

Literature:

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