

# Use of CT Imaging in Acute Diverticulitis

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## Abstract

**Background:** Acute colonic diverticulitis is generally considered to be a clinical diagnosis, however the use of CT (computed tomography) imaging in diverticulitis is becoming more common to exclude complicated diverticulitis.

**Objectives:** To assess the use of CT imaging in the acute presentation of suspected colonic diverticulitis and whether clinical management was altered depending on imaging findings.

**Methods:** Retrospective audit of all patients admitted to Flinders Medical Centre with a clinical diagnosis of acute colonic diverticulitis in ED or following investigation with CT between July 2011 and February 2012.

**Results:** A total of 79 patients were suspected of having diverticulitis. 57 (72.2%) patients were confirmed to have diverticulitis following imaging of which 46 (80.7%) patients had simple diverticulitis and 11 (19.3%) patients had complicated diverticulitis (perforation n = 7 [12.3%]; abscess n = 4 [7.0%]). Overall only 6.3% of patients required radiological or surgical management for their presentation.

**Conclusions:** There is an overuse of CT in the investigation of acute diverticulitis with limited change in clinical management as only 6.3% of patients required surgical or radiological intervention. We suggest medical management with intravenous antibiotics and bowel rest with imaging indicated after 72 hours if no clinical improvement (or earlier if warranted by the clinical status).

**Keywords:** Colonic, Computed Tomography, Diverticulitis, Imaging, Laparotomy

## 1. Background

Acute colonic diverticulitis is a commonly encountered condition that is estimated to affect 10% - 20% of patients with diverticulosis at some stage (1). The prevalence of diverticulosis is around 10% in patients younger than 40 years and is believed to be up to 60% in patients who are 80 years of age or older (2). Although acute colonic diverticulitis is considered a clinical diagnosis, some sources suggest that the sensitivity of diagnosing acute diverticulitis on clinical examination alone is only 64% (3). Despite this, imaging is generally only encouraged when there is concern that the presentation may be one of complicated diverticulitis (i.e. diverticular abscess or perforation). Several studies have suggested clinical scoring systems to aid clinicians when deciding on whether imaging will change patient management (4, 5). Imaging in colonic diverticulitis remains a controversial issue as some observers suggest that computed tomography (CT) should be initiated within 48 hours from the onset of symptoms - regardless of the clinical picture or whether treatment had been commenced - in order to rule out perforation or abscess early in the presentation and improve clinical outcomes (6).

There has been concern about the widespread use of

CT and the radiation risks associated with this. Some studies estimate that one CT scan of the abdomen and the radiation exposure from that (in a 25 year old) may induce cancer in 1/900 patients and fatal cancer in 1/1800 patients (7). With this in mind, Flinders Medical Centre (FMC) developed a protocol aiming to minimise unnecessary CT imaging for diverticulitis by introducing a time delay for clinical response. This protocol suggests imaging (CT of the abdomen and pelvis) after 72 hours if there has been no clinical improvement despite intravenous antibiotics and a thorough medical review. However there is provision for the use of plain radiographs of the abdomen or chest early in the presentation if the clinician has a differential diagnosis of perforation or bowel obstruction and if the patient is older than 50 years of age.

Another important aspect is the consistent reporting of CT imaging requested for acute diverticulitis. Consistent reporting allows treating teams the opportunity to make well-informed and appropriate clinical decisions. Ambrosetti et al. (8) published guidelines for radiologists who are reporting on CT scans for diverticulitis. The authors felt that certain findings on CT could be used to reasonably predict failure of medical therapy and any early or late complications. It was suggested that bowel wall thick-

ening greater than 5 mm and inflammation of pericolic fat was indicative of moderate diverticulitis whereas evidence of pericolic abscess, any extraluminal air or contrast leakage was suggestive of severe diverticulitis.

## 2. Objectives

With this study we wanted to assess the yield of CT for the investigation of acute colonic diverticulitis and whether the use of imaging changed clinical management.

## 3. Methods

A retrospective review was performed and study cohort selected by identifying all admissions to Flinders medical centre, Adelaide (between July 2011 and February 2012) that had a diagnosis (clinical or radiological) of diverticulitis after presenting to the emergency department (ED). A review of patient management during their hospital admission including clinical management, CT imaging and whether management was altered on the basis of CT findings, were undertaken and recorded. Exclusion criteria were any patient who was found to have a diagnosis other than diverticulitis during inpatient investigation or repeated admission with diverticulitis within the study period.

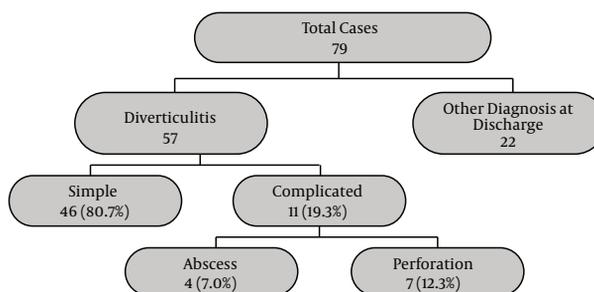
FMC has a diverticulitis treatment protocol whereby patients diagnosed and admitted with colonic diverticulitis are given metronidazole 500 mg Q12H IV, ampicillin 1 gm Q6H IV and gentamicin 4 - 6 mg/kg daily IV. Diverticulitis patients with a penicillin allergy are reviewed by the FMC Infectious Disease team and their antibiotic treatment changed appropriately. Furthermore, this protocol states that all patients should undergo a CT scan of the abdomen if there is no improvement in their clinical status following 72 hours of IV antibiotics and bowel rest. All patients that had a CT scan of the abdomen had the imaging reviewed and findings documented, including whether or not the Ambrosetti diverticulitis grading system had been used when reporting CT scans and whether imaging results affected clinical management (i.e. operative or non-operative management) and ultimately, overall patient outcome.

Univariate and multivariate analysis of patient data was undertaken using SPSS v.23.0 with Chi-square and t-tests to assess for statistical differences in the patient groups.

Ethics approval for this project was granted by the Southern Adelaide clinical human research ethics committee.

## 4. Results

For the specified time period, a total of 79 patients with an ED diagnosis of acute colonic diverticulitis were identified (Figure 1). There were 22 patients (27.8%) excluded from the final cohort. These patients had an initial clinical diagnosis of diverticulitis but following further investigation as inpatients, were found to have other diagnoses. These included abdominal pain unspecified (n = 3), ureteric calculus (n = 3), small bowel obstruction (n = 3), gastroenteritis (n = 2) and large bowel obstruction (n = 1).



**Figure 1.** Total Cases of Suspected Diverticulitis on Clinical Diagnosis and Confirmed Cases Following Imaging

Therefore our final cohort had 57 patients with a diagnosis of diverticulitis (clinical or radiological), 46 (80.7%) of which were simple and 11 (19.3%) complicated (abscess n = 4 [7.0%], perforation n = 7 [12.3%]). In our cohort, the average age was 63.8 years (range 35 - 87 years), 66.7% of the cohort was male and 36.8% were diabetic patients. Univariate analysis could not find any statistically significant differences between the simple and complicated diverticulitis groups.

There were 46 computed tomography (CT) scans of the abdomen and pelvis at Flinders medical centre. Four patients had more than two CT scans during their admission whilst one of those patients had three CT scans during his admission.

Overall 78.3% of CT scans for diverticulitis were ordered outside of the suggested FMC protocol for acute diverticulitis. This was broken down as 22 CT (47.8%) scans being requested within 24 hours of review by a medical officer, 29 (63.0%) scans within 48 hours and 36 scans (78.3%) within 72 hours. Emergency medical teams only accounted for a small proportion (8.7%) of requests. Surgical teams requested the greatest proportion of CT scans of the abdomen/pelvis (91.3%) with surgical registrars ordering 65.2%. In addition, most CT scans requested outside of the suggested protocol were requested by surgical registrars (78.9%) and all surgical RMO requested CT scans were outside of the suggested protocol. Interestingly surgical con-

sultants requested 6 out of 8 scans outside of the suggested diverticulitis protocol. However those 6 cases revealed two cases of complicated diverticulitis whilst the other 2 cases resulted in alternate diagnoses (suggesting strong clinical suspicion of either complicated diverticulitis or an alternate diagnosis). Merely 35.5% of CT imaging performed to exclude complicated diverticulitis, confirmed the diagnosis ( $P=0.18$ ). Only 10 CT (21.7%) scans were requested according to protocol and of those, 5 (50%) revealed complicated diverticulitis.

Overall only 5 (6.3%) of the 79 patients with an initial diagnosis of acute colonic diverticulitis required surgical or radiological intervention ( $P=0.07$ , 95% CI 0.32 - 1.81). All other patients improved with conservative management (i.e. IV antibiotics, bowel rest and supportive care) and were discharged home with appropriate follow up. In terms of surgical management, two of the four patients had a Hartmann's procedure performed for perforated diverticulitis, one had a laparotomy for abscess drainage and one had an anterior resection for recurrent diverticulitis. Furthermore there was only one interventional procedure (drainage of presacral collection for complicated diverticulitis) performed.

On review of the consistency of CT reporting we found that only 20 out of 46 (43.5%) reports addressed all the criteria recommended by Ambrosetti et al. (8).

## 5. Discussion

The FMC medical imaging department developed the diverticulitis protocol in conjunction with the surgical department as there was subjective evidence of the inappropriate use of imaging for colonic diverticulitis with minimal or no change in patient management. Since the protocol had been established it was thought that there was poor adherence to this and that it had made little difference to the number of requests for CT to rule out complicated diverticulitis. This audit revealed a number of interesting findings regarding the use of CT imaging in acute diverticulitis.

Firstly, a large proportion (78.3%) of CT imaging for colonic diverticulitis was requested outside of the established Flinders medical centre protocol. Unsurprisingly, surgical registrars and surgical resident medical officers accounted for the largest proportion of requests with emergency team requests in total only accounting for 8.7%. This suggests that there were many inexperienced surgical staff likely unaware of the protocol for diverticulitis and who request imaging early on in a patient's presentation. We confirmed the difficulty in diagnosing diverticulitis on clinical suspicion alone as 27.8% of patients initially suspected of having acute diverticulitis turned out to have a

different diagnosis following imaging. Also, the clinical difficulty in diagnosing the severity of diverticulitis was illustrated by the fact that only 35.5% of CT scans requested for suspected complicated diverticulitis was positive. Our findings therefore underline the importance of clinical experience. We found that 75% of requests for CT imaging by surgical consultants was outside of the protocol, however all those requests revealed either complicated diverticulitis or an alternate diagnosis. This suggests that experienced staff minimizes unnecessary imaging.

Secondly, the vast majority of cases (simple and complicated diverticulitis) improved with non-operative management i.e. intravenous antibiotics, bowel rest and supportive care. Surgical intervention was only required in 6.3% of cases (4 patients had operative procedures, one patient had imaging guided drainage of a diverticular abscess,  $P=0.07$ ). Although this was not a statistically significant result, the trend is towards significance and a larger patient cohort would have been useful. This confirms that surgical and interventional management is only needed in a very small percentage of patients and that medical management alone is associated with a favourable outcome in the majority of patients without the need for imaging and radiation. We did find it surprising that there was only one imaging guided drainage of a diverticular abscess as anecdotal evidence would suggest this number to be higher. This was contributed to an anomaly of the data set.

Thirdly, there was inconsistency in terms of the reporting of CT imaging for the investigation of the grade of diverticulitis. Ambrosetti et al. published a paper with a suggested protocol for the reporting of CT scans of the abdomen and pelvis for diverticulitis with the aim of standardizing reporting. It was suggested that standardised reporting might improve patient management by highlighting key features for the surgical team to aid management decisions. We found that only 43.5% of CT reports commented on the four parameters suggested by Ambrosetti et al. (8). This suggests that many radiologists may not be aware of the published paper by Ambrosetti et al. (8). By raising awareness amongst radiologists and their trainees alike it should be possible to standardize reporting for acute colonic diverticulitis. Initially it may even be worthwhile to establish a diverticulitis reporting template.

Following these results, we feel that by educating junior doctors about established protocols and appropriate requesting of imaging we may minimize unnecessary radiation exposure to patients and associated financial costs. Our suggestion is that the most appropriate use of imaging in diverticulitis would be in a supplemental role where the likelihood of change in clinical management needs consideration. This audit has highlighted the overuse of CT in acute colonic diverticulitis as a significant problem

whereby only 6.3% of patients required any surgical or radiological intervention. Therefore large amounts of time and limited resources are being used inappropriately as well as exposing patients to unnecessary ionizing radiation and contrast.

There were some limitations identified within this audit. These include the accurate identification of initially clinically suspected diverticulitis patients (those presenting with left-sided pain). These patients are generally expected to enter the diverticulitis pathway; however this largely depends on their clinical presentation and the experience-level of the medical officer reviewing them. Also we did not include those patients who presented atypically (e.g. right sided pain) and have excluded those patients who had an incidental finding of diverticulitis whilst being admitted for other medical reasons.

In conclusion, we suggest that the goal in acute colonic diverticulitis is to reserve CT of the abdomen and pelvis for (1) atypical presentations requiring CT after surgical review and (2) those patients not responding to conservative treatment after 72 hours. Due to the natural history of diverticulitis, imaging is not otherwise indicated. We also need consistent reporting to guide treating teams in predicting patients at risk of complication. Further studies looking at the cost effectiveness of imaging in acute diverticulitis will also be useful.

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### Footnote

**Authors' Contribution:** Dr. Anton Mare was involved with the data collection and the preparation of the manuscript; Dr. Neil Jones provided support and valuable input to the final preparation of the manuscript.

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