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## The evolving management of the appendix mass in the era of laparoscopy and interventional radiology

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### ABSTRACT

**Aim:** An appendix mass is the result of a walled-off perforation of the appendix which localises, resulting in a mass and it is encountered in up to 7% of patients presenting with acute appendicitis. However, its management is controversial due to the lack of high level evidence. This review article sets out a rationale diagnostic and therapeutic strategy for the appendix mass based upon up-to-date available evidence.

**Methods:** A literature review of the investigation and management of appendix mass/complicated appendicitis was undertaken using PubMed, EMBASE and Google Scholar.

**Results/conclusion:** No prospective studies were identified. The great majority of recent evidence supports a conservative management approach avoiding urgent appendicectomy because of the high risk of major complications and bowel resection. Appendix abscesses over 5 cm in diameter and persistent abscesses should be drained percutaneously along with antibiotics. Appendix phlegmon should be treated with antibiotics alone. Surgery is reserved for patients who fail conservative treatment. Routine interval appendicectomy is not recommended, but should be considered in the context of persistent faecolith, ongoing right iliac fossa pain, recurrent appendicitis and appendix mass persistent beyond 2 weeks. Clinicians should be particularly wary of patients with appendix mass aged over 40 and those with features suggesting malignancy.

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### Introduction

An appendix mass is the result of a walled-off perforation of the appendix which localises, resulting in a mass. This walled-off perforation varies in nature from a simple inflammatory mass to a pus-containing collection (an appendix abscess).<sup>1</sup> An inflammatory appendix mass (phlegmon) includes complicated appendicitis and the joining of adjacent bowel loops and at times other viscera/greater

omentum.<sup>2</sup> It is being encountered in only 2%–7% of patients presenting with acute appendicitis<sup>3</sup> but its incidence may increase due to recent trends in the management of acute appendicitis with antibiotics alone. Even though antibiotics have been shown to be effective and safe as a primary treatment for patients with uncomplicated appendicitis with success rates up to 73%,<sup>4</sup> they are associated with treatment failures and crossover to surgery at 48 h in up to 50% of patients, and there is also a 23% risk of recurrent appendicitis

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within one year, which one can argue poses an increased risk for complicated appendicitis and appendix mass.<sup>5,6</sup> Neither the diagnosis nor the management of the appendix mass is standardised so far due to lack of relevant evidence from the literature. In general there are three treatment approaches: a. the “classical” management approach comprises initial conservative management (antibiotics ± percutaneous drainage of associated collections) followed by interval appendicectomy, b. immediate appendicectomy and c. an entirely conservative approach that aims to completely avoid appendicectomy. Two studies from the UK and Ireland explored surgeon preferences with regard to management of appendix mass, and they both found significant heterogeneity in management amongst surgical consultants and registrars,<sup>7,8</sup> with both studies concluding that there is a significant need for clear guidelines and protocols to be devised to streamline and improve practice. This paper represents an update of a previous review<sup>9</sup> underlining more the role of non-operative primary treatment of the appendix mass. The proposed algorithm includes details on the management of related abscess, imaging in various patients’ groups and the role of laparoscopic lavage as a damage limitation measure in this setting.

## Methods

A literature review of the investigation and management of appendix mass/complicated appendicitis was undertaken using PubMed, EMBASE and Google Scholar. We included retrospective studies, randomised controlled trials, comparative studies, systematic reviews, meta-analyses, review articles and case series/reports. A search of the English literature was conducted for “appendix mass”, “appendix abscess”, “appendix phlegmon”, “interval appendicectomy”, “laparoscopic appendicectomy” and complicated appendicitis. Further articles were obtained from cross-referencing of the literature we reviewed.

## Diagnosis of the appendix mass

A detailed history and examination is vital to differentiate between the broad diagnoses that may be responsible for a right iliac fossa (RIF) mass (Table 1). Patients with symptoms suggestive of appendicitis lasting over 72 h are more likely to have an appendix mass.<sup>2</sup> Inflammatory markers will be invariably increased. Proper radiological investigations are essential for the diagnosis and differential of an appendix mass, and if used appropriately should lead to a reduced incidence of first diagnosis of the appendix mass at surgery/under anaesthesia. Relevant imaging modalities are ultrasonography, computed tomography (CT) and magnetic resonance imaging (MRI). Ultrasound is quick and safe and often serves as the baseline investigation for patients with RIF pain. It is also useful in women of childbearing age in order to exclude gynaecological pathology, in pregnant women and in children as it avoids radiation exposure. The sensitivity of combined trans-abdominal and trans-vaginal ultrasound for the diagnosis of acute appendicitis is 97%

with specificity of 91% but they are highly operator dependent.<sup>10</sup> CT has sensitivity and specificity for acute appendicitis that approaches 100%<sup>11</sup> and it is excellent in differentiating between simple perforation of the appendix, appendiceal abscess and appendix phlegmon, and in the setting of complicated appendicitis, CT may prevent surgical complications and conversion to open surgery.<sup>12</sup> CT is also very useful for excluding other pathology in the RIF, particularly in patients over 40 (Table 1). MRI is indicated in patients with special radiation protection requirements, in particular women of child bearing age, women in whom a pregnancy cannot be ruled out in the emergency situation, and pregnant women. The sensitivity and specificity of conventional MRI for the diagnosis of acute appendicitis is between 90% and 100%.<sup>13</sup> Due to the longer examination times, higher costs, and the limited availability, MRI of the abdomen is not the first choice method in the case of clinical suspicion of an appendix mass. However, it should be considered in these groups of patients particularly if the ultrasound has not been contributory to the diagnosis of appendix mass (Fig. 1) (see Table 2).

## Non-operative management of appendix mass

### Percutaneous drainage

Image-guided percutaneous drainage in combination with broad-spectrum antibiotics has been shown to be an effective, minimally invasive treatment of patients with appendix abscess. Jamieson et al.<sup>14</sup> reported a successful treatment rate of 91% for appendix abscesses treated with drainage and IV antibiotics. Similar results have been reported for paediatric patients.<sup>15</sup> On the other hand, in certain situations percutaneous drainage is less likely to be successful. A large, poorly defined peri-appendiceal abscess and an appendicolith on pre-procedure CT images were independent predictors of clinical failure of percutaneous drainage in both adult and paediatric patients.<sup>16</sup> In these instances, CT-guided percutaneous drainage might be successful initially with resolution of the abscess cavity, but the abscess will reform almost invariably following removal of the catheter necessitating formal surgical drainage with removal of the appendicolith in order to achieve a successful outcome.<sup>16</sup> Thus if percutaneous drainage is considered as a primary management strategy, it is of particular importance to inform the patient and the family regarding the possibility of treatment failure and the need for further surgical therapy.

The main complications of percutaneous drainage include infection (superficial and intra-abdominal), bleeding and non-target puncture.<sup>17</sup> In the case of appendix mass, the abscess may be deep in the pelvis, it can be technically challenging to gain access and it may require careful planning. The sacrum, innominate bones, iliac crests, urinary bladder and multiple bowel loops may be in the direct path of the abscess, and dense pelvis vasculature further limits the choice of route of access. In some patients access may need to be via the trans-rectal/trans-vaginal route. In the paediatric group percutaneous drainage may carry up to an 11%

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