

# Missed appendicitis diagnosis: A case report

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*Objective: The purpose of this case report is to highlight and emphasize the need for an appropriate and thorough list of differential diagnoses when managing patients, as it is insufficient to assume cases are mechanical, until proven non-mechanical. There are over 250,000 cases of appendicitis annually in the United States. Of these cases, <50% present with classic signs and symptoms of pain in the right lower quadrant, mild fever and nausea. It is standard for patients who present with appendicitis to be managed operatively with a laparoscopic appendectomy within 24 hours, otherwise the risk of complications such as rupture, infection, and even death increases dramatically.*

*Clinical Features: This is a retrospective case report following a 27-year-old male with missed appendicitis, who presented to a chiropractor two-weeks after self-diagnosed food poisoning. On assessment, he was tender with resisted lumbar rotation. Psoas Sign, McBurney's Point, vascular exam, hip exam, were negative. A diagnosis of an abdominal strain was provided. Two weeks later, he returned to the chiropractor without an improvement of symptoms.*

*Objectif : Cette étude de cas vise à souligner la nécessité d'une liste appropriée et détaillée de diagnostics différentiels lors de la gestion des patients, car il n'est pas suffisant de supposer que les cas sont d'ordre mécanique, jusqu'à la preuve du contraire. Il y a plus de 250 000 cas d'appendicite par an aux États-Unis. Parmi ces cas, < 50 % présentent des signes et des symptômes classiques de douleur dans le quadrant inférieur droit, de fièvre légère et de nausées. Il est normal qu'un patient qui se présente avec une appendicite soit géré par une intervention chirurgicale (appendicectomie par laparoscopie) dans les 24 heures, sinon le risque de complications, telles que rupture, infection et décès, augmente considérablement.*

*Caractéristiques cliniques : Ceci est une étude de cas rétrospective qui suit un homme de 27 ans dont le diagnostic d'appendicite a été manqué lorsqu'il s'est présenté à un chiropraticien deux semaines après un autodiagnostic d'intoxication alimentaire. Son examen avait révélé une sensibilité au toucher avec une résistance à la rotation lombaire. Le signe du psoas, le point de McBurney, l'examen vasculaire et l'examen de la hanche se sont révélés négatifs. Un diagnostic de claquage abdominal a été établi. Deux semaines plus tard, il est retourné au chiropraticien sans aucune amélioration des symptômes.*

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**Intervention & Outcome:** *The patient was sent to the hospital, where he was provided a diagnosis of missed appendicitis. He required a hemicolectomy due to the associated phlegmonous mass.*

**Summary:** *When a patient presents to a chiropractic clinic with symptoms of abdominal pain, having a comprehensive list of non-mechanical differential diagnoses as well as mechanical differentials is crucial. Appropriate assessment and management of abdominal cases decreases the risk to patients, as missed diagnoses often require more invasive interventions.*

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**KEY WORDS:** chiropractic, appendicitis, diagnosis

## Introduction

The appendix (vermiform appendix, see Figure 1) is a vestigial structure of the gastrointestinal tract found in the right lower quadrant of the abdomen. Located intraperitoneally, it is found on the posteromedial side of the caecum. While it may assume one of several orientations in relation to the caecum, it is most commonly found behind the caecum or ascending colon (75%), or descending along the pelvic brim (20%).<sup>1</sup> It can vary in size from 2-20cm, typically found longer in children and atrophied in adults. The three taenia coli converge at the opening lumen of the appendix to create a triangular orifice.<sup>2</sup>

Appendicitis is defined as an acute inflammation of the appendix, typically resulting in abdominal pain, anorexia, and abdominal tenderness<sup>1</sup>. In the United States, >250,000 cases of appendicitis occur each year.<sup>3</sup> The lifetime prevalence is approximately 5-7% in the general population, with onset usually during the third decade.<sup>4</sup> It occurs more commonly in males than females at a rate of 3:2 until the fourth decade, at which point it equalizes.<sup>4</sup> Prior to the development of surgical interventions, >50% of patients who developed this condition died. The introduction of the appendectomy reduced mortality to 15%.<sup>5</sup> Mortality now occurs in between 1-3% of cases.<sup>3</sup> The pathophysiology is commonly caused by an obstruction of the opening of the appendix.<sup>5</sup> Once obstructed, distension, bacterial overgrowth, ischemia and inflam-

**Intervention et résultats :** *Le patient a été envoyé à l'hôpital, où une appendicite manquée a été diagnostiquée. Il a fallu lui faire une hémicolectomie en raison de la masse phlegmoneuse associée.*

**Résumé :** *Quand un patient se présente à une clinique de chiropratique avec des symptômes de douleurs abdominales, il est crucial d'avoir une liste complète de diagnostics différentiels non-mécaniques ainsi que de différentiels mécaniques. L'évaluation et la gestion appropriées des douleurs abdominales diminuent le risque pour les patients, car les diagnostics manqués nécessitent souvent des interventions plus invasives.*

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**MOTS CLÉS :** chiropratique, appendicite, diagnostic

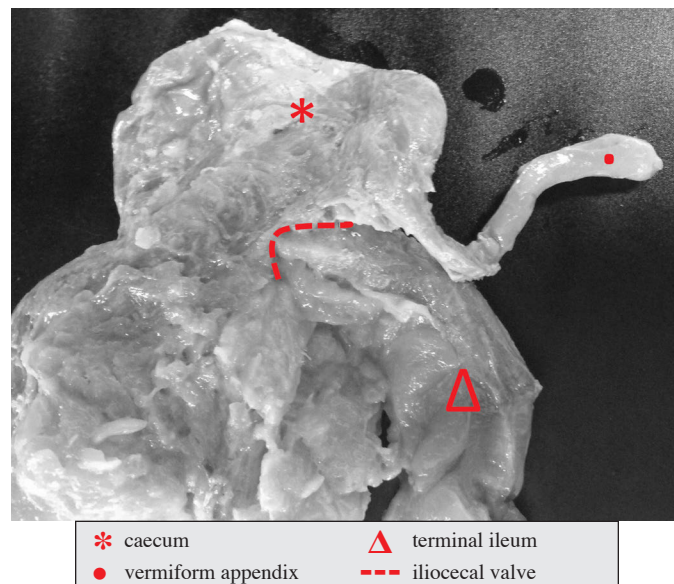


Figure 1.

*Vermiform appendix in 61-year-old male cadaveric model*

mation follow. If this remains untreated, perforation, and necrosis may occur.<sup>1</sup>

Current guidelines recommend correlating the clinical findings to direct further investigations, such as blood work (white blood cell count (WBC), c-reactive proteins

(CRP), and polymorphonuclear cells (PMN))<sup>6</sup>, or diagnostic imaging<sup>7</sup>; however, 55% of patients do not have a “classic presentation.” In a classic presentation, the patient will present with pain around the umbilicus that exacerbates when coughing, or straining. In the early stages, there may be referred pain diffusely across the lower abdomen that progresses to periumbilical pain indicating early appendicitis. The pain will gradually localize to the right lower quadrant as the appendix and adjacent peritoneal tissue becomes inflamed.<sup>8</sup> The patient may have a low fever (~38°C), have voluntary muscular guarding that progresses to involuntary as the pain increases, and may experience nausea and/or vomiting.<sup>1</sup> This process occurs usually within 4-6 hours.<sup>8</sup> If during this time the symptoms decrease, perforation of the appendix should be suspected. When a patient does not seek care within 24h after developing appendicitis-like symptoms, a diagnosis of ‘missed appendicitis’ is provided. The frequency of missed appendicitis ranges from 20-40%, with children having a higher incidence.<sup>1,10</sup> Appendicitis is the number one cause of emergency abdominal surgery in both children and adults.<sup>1,11</sup>

Orthopaedic testing may contribute to the clinical picture of appendicitis.<sup>8</sup> The pain will present in McBurney’s Point: the most distal third of an imaginary line from the right anterior superior iliac spine to the umbilicus. Palpation of this site with direct pressure causes severely painful tenderness. Some other tests include:

1. Psoas Sign: a test of resisted right hip flexion while the patient is supine, and passive extension while the patient is side-lying. Increased abdominal pain with either manoeuvre suggests irritation of the psoas created by the inflamed appendix.
2. Obturator Sign: passive internal rotation of the right hip while the patient lies supine. Pain in the right hypogastric region suggests irritation of the obturator muscle by the inflamed appendix.
3. Rovsing’s Sign: a test for rebound tenderness, where the practitioner inserts their fingers deeply and evenly in the left lower quadrant, then quickly withdraws their fingers. This creates a ripple effect that will disturb the inflamed appendix, creating an exacerbation of pain.

When the physical exam supports the diagnosis, confirmatory imaging is done. While ultrasonography (US) may be easily accessed and have decreased radiation to the patient, computed tomography (CT) is the modality of choice for imaging for its greater diagnostic accuracy<sup>1</sup>. An exception applies to paediatric patients, as US is preferred, to reduce exposure to ionizing radiation. CT for appendicitis in practice has been reported having a sensitivity of 80-96%<sup>12-13</sup>, exceeding that of ultrasound. However, there is a greater risk of false negatives with CT that leads to patients with appendicitis being discharged prematurely, risking the development of missed appendicitis. When the patient returns and diagnosis of appendicitis has been confirmed, surgical intervention is the next step.

There has been investigation as to which surgical intervention is most appropriate for the general population. One systematic review suggests that while laparoscopic interventions take longer to complete, they reduce wound infection, postoperative pain, duration in hospital recovery, and time to returning to work. There is also a significant decrease post-operative complication, such as abscess or paralytic ileum.<sup>14</sup> However, if missed appendicitis occurs, the intervention may need to be more invasive, requiring an open operation.<sup>14</sup>

## Case Report

A 27-year-old man presented to the chiropractic clinic with a complaint of an abdominal strain of two-week duration. The pain onset a few days after having an 8-hour bout of self-diagnosed food poisoning, that he felt had passed with no persistent symptoms. He described it as a dull ache in the general right side that did not exceed 2/10 on the numerical pain rating scale. He could not determine which activities were aggravating, and found it was always short lived. The purpose of the visit was to determine why there had been no improvement after two weeks. There were no radicular symptoms or red flags in the history, such as inability to pass gas, or any changes to his bowel or bladder function. He did not have constitutional symptoms, or persistent gastrointestinal concerns, and noted that his appetite was normal.

On physical examination, there were no clinical findings on observation. His lumbar ranges of motion were full and pain-free in all directions except for left rotation, which he reported recreated his pain of chief complaint, both actively and with resisted ranges of motion. Super-



Figure 2.

*Transverse Abdominal CT at L5 identifying markedly dilated appendix*



Figure 3.

*Coronal Section of Abdomen. Calcified appendicolith at base of appendix with significant periappendiceal phlegmonous appearing fat stranding and fluid.*

Physical palpation of the abdominals recreated pain, worse when palpated with resisted ranges of motion. Hip range of motion was full and pain free bilaterally. His neurological assessment (motor, sensory, deep tendon reflexes of the lower limb) was intact. Lumbar spine and hip orthopaedic tests were non-contributory. An abdominal exam was performed and was normal. Vascular screen (abdominal, femoral, and pedal pulses) was normal. There were no constitutional signs. Rovsing's sign and McBurney's point were both negative.

The patient was given a working diagnosis of abdominal wall strain. He was treated with soft tissue therapy and advised to avoid aggravating behaviours until the symptoms resolved. He was also given advice to go to the hospital if he developed a fever or if his symptoms progressed rapidly, with the concern of an overlooked visceral source of pain.

Two weeks later, he returned to the clinic to report that though he had stopped aggravating behaviours, the pain in his abdomen had not resolved. He noted that specifically on that day only, whenever his heel struck when stepping off of a step, the pain in his abdomen was worsened to a level of 6-7/10. His oral temperature was 38°C. He

was sent to the emergency room to rule out appendicitis or infection, due to the progression of pain symptoms and lack of response to conservative care.

At the hospital, the patient's CT results found phlegmonous appendicitis (see Figures 2 and 3). After a failed trial of conservative care (antibiotics and fluids), he required an emergency hemicolectomy due to the massive inflammation that encased and adhered the ruptured appendix and ileum, to the abdominal wall.

The patient returned to the chiropractic clinic six weeks later, after clearance from his surgeon for post-surgical core rehabilitation. He was re-assessed and found to have full ranges of motion in the lumbar spine and bilateral hips. The patient was started on a course of progressive rehabilitative exercises to re-train his abdominal muscles.

### Discussion

The classical presentation of appendicitis is right lower quadrant pain that is exacerbated by coughing, sneezing and straining. It comes on insidiously and progresses to severe pain within hours. Lack of appetite, low-grade fever and abdominal rigidity is typical, with inflammatory markers present in the blood. However, this presentation



is only present in <50% of adults presenting to the emergency department.<sup>9</sup> There are many reasons for this, as previously discussed. Blood markers may not be elevated on assessment until the appendix is compromised<sup>1</sup>.

As chiropractors, there is a battery of tests that are taught to aid in the diagnosis of appendicitis. They include Psoas sign, Obturator sign, Rovsing's sign, rebound tenderness and palpation of McBurney's Point. According to a 2006 study of the presentation of acute appendicitis at an emergency surgical ward in Iran, the sensitivity and specificity of the Psoas sign is 23% & 50%, respectively.<sup>15</sup> However, another Spanish study indicated the psoas sign to have a sensitivity of 16% and specificity of 95% in an emergency surgical unit.<sup>16</sup> The obturator sign works under a similar concept as the psoas sign. The same paper from Iran mentioned previously reported a sensitivity of 15% and a specificity of 75% for patients in the operating room with appendicitis, however, the diagnostic accuracy of the Obturator test is poorly tested.<sup>15</sup> Interestingly, the authors were unable to find any evidence supporting the use of the Rovsing's test in a clinical or research context. It appears to be unreliably executed and has not been adequately tested to assess validity or accuracy.

The blood markers evaluated (WBC, CRP, PMN) are specific for acute infection.<sup>6</sup> WBC has been extensively studied and is routinely elevated in appendicitis. Recent research suggests that a WBC count of >10,000 increases diagnostic sensitivity, but not specificity.<sup>6</sup> It is insufficient to use WBC alone as a diagnostic modality due to the poor specificity and variety of other conditions that create elevated WBC counts.<sup>6</sup> CRP is an acute phase reactant that begins to rise 8-12 hours after the onset of an inflammation process, and peaks in 24-48 hours. CRP is suggested to be a strong indicator of perforated appendicitis, though a poor marker for simple (not perforated) appendicitis.<sup>6</sup> PMN cell counts that are >11x10<sup>9</sup>/L are reported to have a specificity of 92% with the largest likelihood ratio over any other laboratory test.<sup>6</sup> The greater the PMN value, the greater the likelihood ratio.<sup>6</sup>

Pain may not be felt due to the multiple possible orientations of the appendix when the inflammation occurs.<sup>9</sup> If the appendix is oriented posteriorly, the inflammation may be walled off before freely perforating into the abdomen. Early intervention is imperative for appendicitis successful management of appendicitis. When the appendix becomes perforated, the mortality rate increases from

Table 1.  
Selected Differential Diagnoses of Abdominal Pain<sup>17</sup>

Region	Differential
Right Upper Quadrant	Biliary: cholecystitis, cholelithiasis, cholangitis Colonic: colitis, diverticulitis Hepatic: abscess, hepatitis, mass Pulmonary: pneumonia, embolus Renal: nephrolithiasis, pyelonephritis
Epigastric	Biliary: see above Cardiac: myocardial infarction, pericarditis Gastric: esophagitis, gastritis, peptic ulcer Pancreatic: pancreatitis, mass Vascular: aortic dissection, mesenteric ischemia
Left Upper Quadrant	Cardiac: angina, myocardial infarction, pericarditis Gastric: esophagitis, gastritis, peptic ulcer Pancreatic: mass, pancreatitis Renal: nephrolithiasis, pyelonephritis Vascular: aortic dissection, mesenteric ischaemia
Periumbilical	Colonic: early appendicitis Gastric: esophagitis, gastritis, peptic ulcer, small bowel mass, obstruction Vascular: aortic dissection, mesenteric ischemia
Right Lower Quadrant	Colonic: appendicitis, colitis, diverticulitis, IBD, IBS Gynecological: ectopic pregnancy, fibroids, ovarian mass, torsion, PID Renal: nephrolithiasis, pyelonephritis
Suprapubic	Colonic: appendicitis, colitis, diverticulitis, IBD, IBS Gynecological: ectopic pregnancy, fibroids, ovarian mass, torsion, PID Renal: cystitis, nephrolithiasis, pyelonephritis
Left Lower Quadrant	Colonic: colitis, diverticulitis, IBD, IBS Gynecologic: ectopic pregnancy, fibroids, ovarian mass, torsion, PID Renal: nephrolithiasis, pyelonephritis
Any	Abdominal wall: herpes zoster, muscle strain, hernia Other: bowel obstruction, mesenteric ischaemia, peritonitis, narcotic withdrawal, sick cell crisis, porphyria, IBD, heavy metal poisoning

RUQ = right upper quadrant; LUQ = left upper quadrant; LLQ = left lower quadrant; RLQ = right lower quadrant; IBD = inflammatory bowel disease; IBS = irritable bowel syndrome; PID = pelvic inflammatory disease  
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0.8 per 1000 to 5.1 per 1000. The increased mortality is more common in very young or elderly patients.<sup>1</sup> The average rate of perforation when a patient presents to the emergency department is 16-30%.<sup>14</sup>

As primary contact healthcare providers, it is extremely important for chiropractors to be well versed in possible differential diagnoses (See Table 1).<sup>17</sup> It is pertinent that we use our clinical tools to investigate an unusual history,

an unusual or progressive symptom presentation, or when the physical exam does not seem to correlate as expected with the given history. There are many different visceral complaints that can replicate mechanical symptoms. It has been reported that complementary and alternative practitioners, while trained in appropriate medical evaluation of patients, lack confidence in appropriate and timely referrals of patient presentations with possible non-mechanical diagnoses.<sup>18</sup>

### Summary

This report aims to highlight the importance of discerning non-mechanical differentials from mechanical differentials when assessing patients, especially when they do not respond to your care. Clinical index of suspicion in place of 'classic' signs and symptoms will help the clinician appropriately manage their patient in urgent cases such as the one reported. Further, the physical tests taught in the chiropractic curriculum may be antiquated. As such, it is pertinent that chiropractors co-manage patients who present with complaints that may be visceral in origin.

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