Section: Radiology

Original Research Article

BEYOND MCBURNEY'S POINT: A CT-BASED PICTORIAL ESSAY ON ATYPICAL APPENDICITIS, ITS COMPLICATIONS, AND INTERVENTIONAL RADIOLOGICAL MANAGEMENT PARADIGMS

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ABSTRACT

Background: This study aims to illustrate the spectrum of atypical clinical presentations of acute appendicitis resulting from its anatomical variability. It seeks to highlight the subsequent severe complications and underscore the indispensable role of contrast-enhanced computed tomography (CECT) in modern diagnosis and management.

Materials and Methods: This study combines a retrospective analysis of a six-patient case series, involving individuals aged 12-24 years from a tertiary care teaching hospital in Northern India, with a comprehensive literature review. All patients presented with atypical symptoms and were definitively diagnosed with complicated (ruptured) appendicitis via CECT.

Results: Clinical presentations were uniformly atypical, mimicking cholecystitis, urologic pathology, or presenting as vague abdominal pain, which led to significant diagnostic delays ranging from 3 to 21 days. CECT was the definitive diagnostic modality in all cases, revealing severe complications including extraperitoneal rupture, pyogenic liver abscess, mesenteric abscess, and extensive pneumoperitoneum.

Conclusion: Atypical presentations of appendicitis are a direct consequence of its anatomical variations, leading to diagnostic delays and an increased risk of life-threatening complications. A high index of suspicion is crucial for any patient with acute abdominal pain, regardless of location. CECT is an essential tool in the diagnostic algorithm for atypical cases, providing the anatomical and pathological detail necessary to guide timely and appropriate multidisciplinary management.

Keywords: CECT - Contrast-Enhanced Computed Tomography, CT - Computed Tomography, CRP - C-reactive Protein, IR - Interventional Radiology, LLQ - Left Lower Quadrant, PID - Pelvic Inflammatory Disease, RLQ - Right Lower Quadrant, RUQ - Right Upper Quadrant, STROBE - Strengthening the Reporting of Observational Studies in Epidemiology, US – Ultrasound, WBC - White Blood Cell.

INTRODUCTION

Acute appendicitis stands as one of the most prevalent surgical emergencies encountered globally. The classic diagnostic paradigm—characterized by periumbilical pain migrating to the right lower quadrant (RLQ), anorexia, and fever—is deeply ingrained in clinical training. However, this "typical" presentation manifests in only approximately 50% of patients, creating a formidable diagnostic challenge

that frequently leads to delays in appropriate treatment.[1-6] Historically, this uncertainty contributed to a negative appendicectomy rate as high as 10–30%, a practice where a normal appendix was removed to avoid the graver error of missing an inflamed one. In the modern era of advanced diagnostic imaging, this approach is no longer tenable given the potential for postoperative complications and the availability of more precise diagnostic tools.[7-12]

Anatomical Variability as the Root Cause

The fundamental source of this diagnostic uncertainty is the profound anatomical variability of the vermiform appendix. While its base is relatively fixed to the cecum at the convergence of the taeniae coli, its length, orientation, and terminal position are remarkably inconsistent.[4] The embryological underpinnings of this variability lie in the complex rotation of the midgut and the subsequent descent and fixation of the cecum during fetal development.[3] Any deviation from this intricate process can result in an atypically positioned cecum and, consequently, an atypically located appendix.

Adding another layer of complexity is the compelling hypothesis that the appendix is a mobile organ, capable of changing its position within the abdominal cavity over time.[1] This concept of a "wandering appendix" is powerfully supported by a case report documenting its migration from the left to the right side of the abdomen on sequential CT scans.[9] This dynamic potential suggests that an individual's appendiceal anatomy is not necessarily static, adding a temporal unpredictability to the already vast spatial variability and further complicating the clinical picture, particularly in cases of recurrent or prolonged symptoms.

The Indian Anatomical Paradox

The literature describes a wide spectrum of appendiceal positions, but their reported prevalence demonstrates significant heterogeneity across different global populations. A critical analysis of data from the Indian subcontinent reveals a significant contradiction, as summarized in [Table 1].

Table 1: Global and Indian Prevalence of Appendiceal Positions

Position	Global Prevalence Range (%)	Indian Surgical Series Prevalence (%)	Indian Cadaveric Series Prevalence (%)
Retrocecal	25.4 - 71	36.0 - 82.0	7.0 - 71.4
Pelvic	16.5 - 31.0	11.0 - 41.0	21.0 - 55.8
Subcecal	2.3 - 20.3	7.4 - 11.4	6.5 - 19.0
Post-ileal	0.4 - 12.5	10.0 - 23.1	10.0 - 12.5
Pre-ileal	1.0 - 18.7	4.2 - 15.0	1.5 - 6.5
Subhepatic	~2.4	0.6 - 3.0	Not specified
Paracolic	Not specified	6.0 - 13.5	13.5 - Not specified

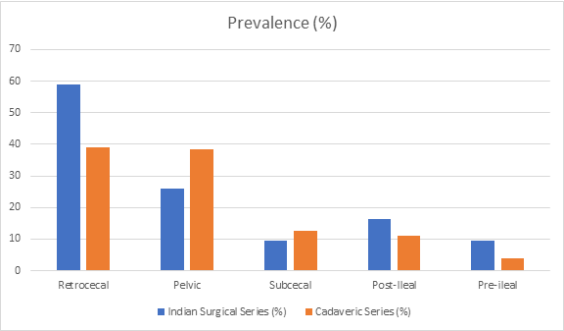

Figure 1: Horizontal bar chart comparing the reported prevalence of various appendiceal positions in Indian surgical series versus Indian cadaveric series, illustrating the "Indian Anatomical Paradox."

This "Indian Paradox" highlights a crucial discrepancy: many Indian surgical series report the retrocecal position as the most common, whereas several Indian cadaveric studies report the pelvic position as dominant.[5] This is not merely a statistical anomaly but a potential cognitive trap for clinicians. The discrepancy may arise from methodological bias; surgical series inherently study inflamed appendices, and it has been hypothesized that the relatively fixed retrocecal position may be more susceptible to inflammation, thus over-representing it in clinical cohorts.[2] Conversely, cadaveric studies may more accurately reflect the true anatomical distribution in the general population. A clinician's mental model of disease is shaped by published clinical literature. If this literature over-represents one anatomical variant, it can create an anchoring bias, lowering the index of suspicion when a patient presents with symptoms corresponding to a less frequently reported (but anatomically common) variant, such as a pelvic appendix causing suprapubic pain. This lowered suspicion is a direct potential cause of the diagnostic delays that lead to severe complications.

Aims and Objectives

This publication presents a series of six complex cases of ruptured appendicitis, each characterized by atypical presentations and severe sequelae. By integrating these illustrative cases with a comprehensive review of the contemporary literature, this report aims to:

- Illustrate the spectrum of atypical clinical presentations that result from anatomical variations and the subsequent diagnostic challenges they pose.
- Highlight the severe, life-threatening complications that can arise from the diagnostic delays common in these atypical cases.
- Underscore the indispensable role of contrast-enhanced computed tomography (CECT) in providing a definitive diagnosis and guiding management.

- Review contemporary, multidisciplinary management strategies for complicated appendicitis.

MATERIALS AND METHODS

Study Design: This study employed a dual methodology, combining a retrospective, descriptive analysis of an institutional case series with a comprehensive review of contemporary and seminal literature pertaining to the diagnosis and management of acute appendicitis. The case series was conducted at a tertiary care teaching hospital in Northern India, and the reporting of this observational study adheres to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines

Equipment, Study Design, and Patient Selection: The case series includes six consecutive patients who presented to the emergency department with signs and symptoms of an acute abdomen. The cohort comprised four females and two males, with an age range of 12 to 24 years. All patients underwent a thorough clinical evaluation by a general surgeon, standard laboratory investigations, and definitive imaging with CECT. All CECT imaging was conducted on a 128-slice GE Optima machine at Mahatma Gandhi Medical College and Hospital in Jaipur. In all cases, a diagnosis of complicated (ruptured) appendicitis was confirmed either during subsequent surgical intervention or via findings from imaging-guided drainage procedures.

Procedure: Clinical and laboratory data were meticulously extracted from the institution's electronic health records. This included patient demographics, a detailed history of the presenting illness (location, duration, and character of pain), key physical examination findings, and results from laboratory investigations, such as leukocyte count, C-reactive protein (CRP) levels, and serum bilirubin concentrations. The standardized CECT imaging protocol included the administration of intravenous contrast material, with image acquisition performed using thin axial slices (5 mm) to maximize spatial resolution and allow for high-quality multiplanar reformations.

Data Analysis: Radiologists evaluated the scans for specific findings indicative of acute appendicitis, including an appendiceal diameter greater than 6 mm, luminal distention, appendiceal wall thickening, and hyperenhancement (the "ring sign"). This was invariably accompanied by inflammatory stranding of the surrounding peri-appendiceal fat.[15] Furthermore, scans were scrutinized for definitive signs of perforation, such as a focal defect or lack of enhancement in the appendiceal wall, the presence of extraluminal air or an appendicolith, and the formation of a contained fluid collection or a frank abscess. The "double ring" sign, a specific marker for necrotizing appendicitis, was also considered.[11]

Ethical Considerations: The study was conducted in strict accordance with the ethical principles outlined in the Declaration of Helsinki. All patient data were fully anonymized to protect confidentiality and ensure patient privacy. Written informed consent was obtained from the patients or their legal guardians for the publication of de-identified case details and associated medical images, a critical requirement for publication in recognized medical journals.[1]

RESULTS

Case Series Findings: The cohort of six patients included four females and two males, with a mean age of 19 years (range 12-24 years). A defining feature of the series was the significantly prolonged duration of symptoms prior to definitive diagnosis, with a mean of 9.3 days and a range of 3 to 21 days. All patients presented with atypical pain locations and exhibited a significant systemic inflammatory response, as evidenced by elevated white blood cell (WBC) counts and/or C-reactive protein (CRP) levels. A summary of the cohort's baseline characteristics is provided in [Table 2].

Table 2: Demographics, Clinical Presentation, and Key Laboratory Findings of the Patient Cohort

Case	Age (years) / Gender	Primary Pain Location	Duration of Symptoms (days)	Key Physical Findings	Peak WBC (109/L) / CRP (mg/L)
1	22 / Female	Right Upper Quadrant (RUQ)	3	Dehydration, Tachycardia (110 bpm)	Leukocytosis / 200
2	14 / Female	Diffuse RUQ	4	Icterus, Tachycardia (106 bpm)	Leukocytosis / Not specified
3	12 / Female	RUQ & Epigastric	8	Fever, Chills, Night Sweats	17 / Not specified
4	23 / Male	Right Flank & Iliac Fossa	15	Fullness in Right Iliac Fossa	18 / 240
5	18 / Male	Vague Right-Sided Abdomen	21 (acute worsening over 3 days)	Fever (38.5 °C), Diffuse Right-Sided Tenderness	13.8 / Not specified
6	24 / Male	Generalized Abdomen	5	Tachycardia (158 bpm), Distention, Guarding	14.2 / Not specified

The significant diagnostic delays and distribution of atypical pain locations are visually summarized in [Figure 2-3], respectively. These figures would graphically demonstrate the prolonged symptom duration across the cohort and highlight that classic RLQ pain was absent in all six cases of complicated appendicitis.

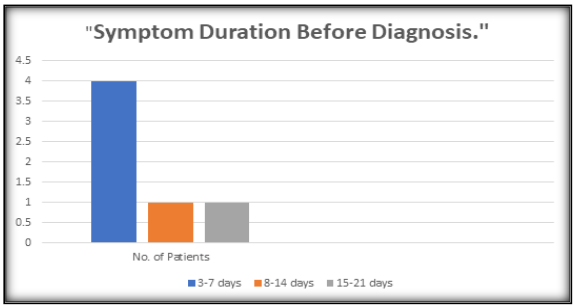

Figure 2: Bar chart illustrating the prolonged duration of symptoms (in days) for each of the six patients prior to definitive diagnosis, highlighting the significant diagnostic delays.

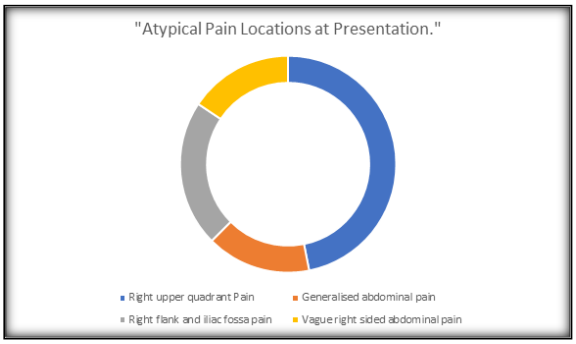

Figure 3: Doughnut chart showing the distribution of atypical primary pain locations across the six-patient cohort, demonstrating the absence of classic right lower quadrant pain.

Narrative Case Presentations (Cases 1-6)

Case 1: Perforated Retrocecal Appendix Mimicking Acute Cholecystitis

A 22-year-old female presented with a three-day history of acute RUQ pain, high-grade fever, and diarrhea. Given the location of pain and systemic inflammatory signs (leukocytosis, CRP 200 mg/L), acute cholecystitis was a primary differential. CECT revealed a retrocecally positioned appendix with its inflamed tip extending superiorly. Critically, the scan identified extraluminal air pockets, significant periappendiceal fat stranding, and localized free fluid, diagnostic of a perforated retrocecal appendicitis [Figure 4].

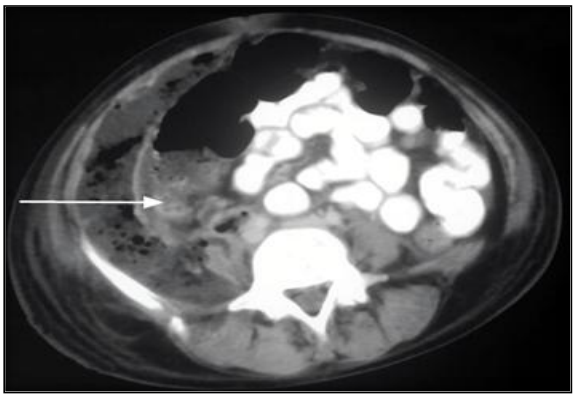

Figure 4: Arrow showing extraluminal air pockets around the apex of the appendix posterior to the cecum, along with significant peri-appendiceal fat strands and peri-appendiceal free fluid.

Case 2: Extraperitoneal Rupture with Pneumoperitoneum in a Pediatric Patient

A 14-year-old female presented with a four-day history of diffuse RUQ pain, fever, and icterus. Liver function tests showed elevated bilirubin (Total Bilirubin: 4.3 mg/dL), further confounding the diagnosis. An abdominal ultrasound was inconclusive. Subsequent CECT demonstrated pneumoperitoneum and a significant fluid collection in the periappendiceal area, consistent with an extraperitoneal rupture of the appendix [Figure 5].

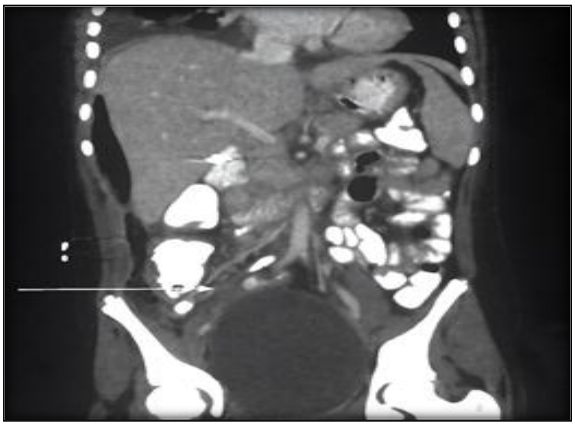

Figure 5: Arrow showing pneumoperitoneum with fluid around appendiceal area suggestive of extraperitoneal rupture.

Case 3: Pyogenic Liver Abscess as the Presenting Sign of Occult Appendicitis

A 12-year-old female was admitted with an eight-day history of worsening RUQ and epigastric pain, fevers, and chills. CECT was pivotal, revealing a well-defined, rim-enhancing hypodense mass measuring 4 cm in the right lobe of the liver, diagnostic of a pyogenic liver abscess [Figure 6]. Although the appendix was not the most prominent feature, it was identified as the most likely occult primary source, representing a severe complication of neglected, likely subhepatic, appendicitis.

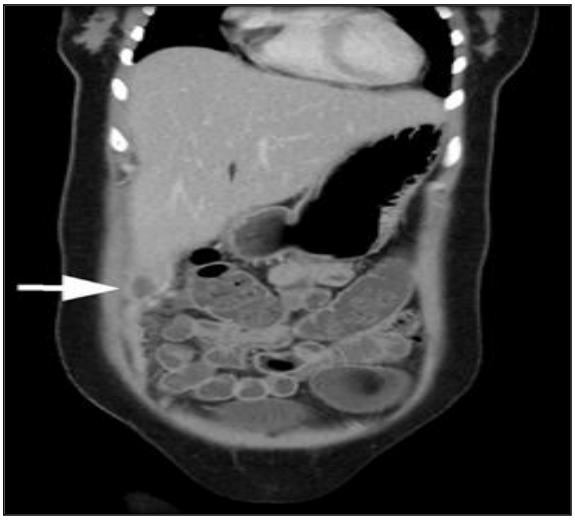

Figure 6: Arrow showing a hypodense mass measuring 4 cm in the liver, suggestive of an abscess.

Case 4: Ruptured Appendicitis with Extensive Extraperitoneal Abscess

A 23-year-old male presented with a 15-day history of right flank and iliac fossa pain, initially treated as a urinary tract infection with minimal improvement. CECT demonstrated a large, complex, multiloculated fluid collection originating from the cecal pole and extending superiorly into the right pre-peritoneal and retroperitoneal spaces. The appendix itself was not identified within the extensive inflammatory mass, a common finding in advanced perforation. The diagnosis was complicated ruptured appendicitis with an extensive extraperitoneal abscess [Figure 7].

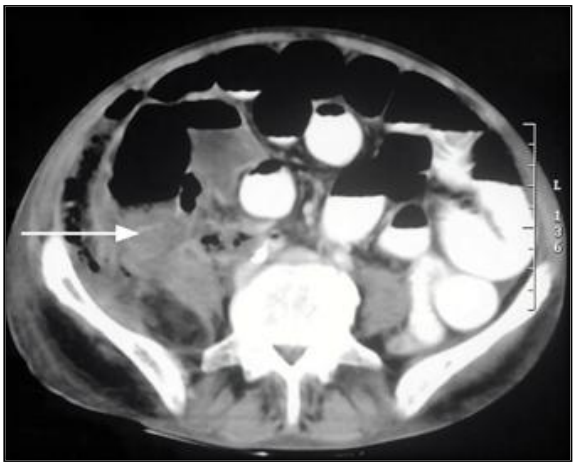

Figure 7: Arrow showing large multi-loculated collection arising from the caecal pole, extending to the right pre-peritoneal space.

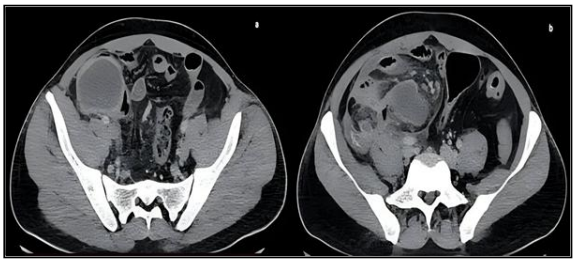

Figure 8: Arrow showing an ill-defined hypodense collection was seen in the right iliac fossa, extending up to the mesentery.

Case 5: Perforated Appendix with Mesenteric Abscess Formation

An 18-year-old male presented with a prolonged three-week history of vague right-sided abdominal pain that had acutely worsened over the preceding three days. CECT identified an ill-defined, rim-enhancing hypodense collection in the right iliac fossa that extended superiorly into the leaves of the small bowel mesentery. The visualized portion of the appendix was directed towards the collection, confirming it as the origin of the abscess [Figure 8.

Case 6: Generalized Peritonitis from Ruptured Appendix with Perihepatic Abscess

A 24-year-old male was referred with a five-day history of undiagnosed abdominal pain and signs of peritonitis, including tachycardia (158 bpm) and guarding. An upright abdominal radiograph showed subdiaphragmatic free air. CECT provided a comprehensive picture, confirming a perforated appendix as the source and demonstrating extensive pneumoperitoneum with a notable air-fluid level in the right perihepatic space (Morison's pouch) [Figure 9].

Figure 9: Arrow showing extraperitoneal rupture with pneumoperitoneum with air-fluid level in right perihepatic space.

General Findings Across Clinical Applications

CECT was the definitive diagnostic modality in every case, establishing the diagnosis and delineating the nature and extent of severe complications. The key CECT findings across the cohort are summarized in [Table 3]. A crucial radiological observation was that in three of the six cases of proven complicated appendicitis, the appendix itself was not clearly visualized, having been obliterated by the severe inflammatory process. This underscores the importance of recognizing secondary signs, such as an abscess contiguous with the cecal pole, to make an accurate diagnosis.

Table 3: Comprehensive Summary of CECT Findings and Final Diagnoses

Case	Appendix Visualized	Appendix Position (Inferred)	Key CECT Signs of Perforation	Abscess Formation	Free Fluid / Air	Final Diagnosis
1	Yes	Retrocecal	Extraluminal air pockets	No	Localized free fluid	Perforated Retrocecal Appendicitis
2	No	Not specified	Extraperitoneal fluid collection	No	Pneumoperitoneum	Extraperitoneal Appendiceal Rupture
3	No (Occult)	Subhepatic/ Retrocolic	None directly at appendix	Yes (4 cm liver abscess)	No	Pyogenic Liver Abscess secondary to Appendicitis
4	No	Retrocecal	Large collection from cecal pole	Yes (Large, multiloculated extraperitoneal)	No	Complicated Ruptured Appendicitis with Extraperitoneal Abscess

5	Yes (Portion)	Pelvic/Iliac	Collection contiguous with appendix	Yes (Mesenteric abscess)	No	Perforated Appendix with Mesenteric Abscess
6	Yes	Not specified	Air-fluid level in perihepatic space	Yes (Perihepatic)	Extensive pneumoperitoneum	Perforated Appendix with Generalized Peritonitis

DISCUSSION

Interpretation and Comparison with existing literature

This case series powerfully illustrates that acute appendicitis can be a "diagnostic chameleon," with its clinical presentation dictated largely by its underlying anatomical position. The atypical symptomology observed in our cohort is a direct consequence of the vermiform appendix's inherent anatomical variability, a factor that must be at the forefront of a clinician's mind when evaluating a patient with acute abdominal pain.[13]

The anatomical basis of Atypical Presentations: A Clinical-Radiological Correlation (Anatomy Dictates Symptomatology)

The connection between an atypically located appendix and a misleading clinical picture is a well-established phenomenon, and these cases provide compelling real-world examples of this principle.1 The patients in Cases 1, 2, 3, and 6, who presented with prominent RUQ pain, are classic examples of a high-riding retrocecal or subhepatic appendix mimicking acute cholecystitis or liver pathology.[7] The development of a pyogenic liver abscess, as seen in Case 3, represents a rare but devastating sequela that occurs when a subhepatic or retrocolic appendix incites septic thrombophlebitis of the portal venous system, allowing bacteria to seed the liver directly. Similarly, the patient in Case 4, with right flank pain, demonstrates how a perforated retrocecal appendix can mimic a primary psoas abscess or pyelonephritis. The medially-directed appendix in Case 5 led to a mesenteric abscess and vague central pain, mimicking mesenteric adenitis.[13]

This link between anatomy and complication is not a matter of coincidence but rather a direct pathophysiological cascade. An atypical anatomical position leads to atypical symptoms. These unfamiliar symptoms cause diagnostic uncertainty and delay. This delay provides a critical window for the inflammatory process to progress unchecked from simple, contained inflammation to transmural necrosis, gangrene, and ultimately, perforation. The final location of the complication—be it a subhepatic fluid collection, a mesenteric abscess, or an extraperitoneal phlegmon—is directly determined by the initial position of the appendiceal tip.[6]

Imaging in the Diagnostic Quagmire: The Supremacy of CT in Equivocal Cases (The Diagnostic Gauntlet)

All six of our cases presented atypically, falling squarely into the "equivocal" clinical category where scoring systems like the Alvarado score have limited utility and first-line imaging with ultrasound is often inconclusive.[1] In Case 2, the initial ultrasound was non-diagnostic, a common outcome when the appendix is in a retrocecal position or obscured by overlying bowel gas.[10] In this challenging clinical landscape, CECT proved to be the definitive diagnostic tool. A visual comparison of diagnostic modalities [Figure 10] would clearly show the superior accuracy of CECT (92.3-98%) over ultrasound (72.2%) and clinical scores (Alvarado 82.6%) in equivocal cases.[1]

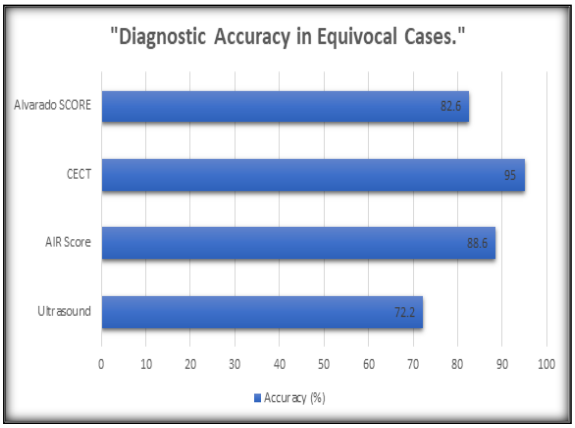

Figure 10. Bar chart comparing the diagnostic accuracy of CECT, the Alvarado Score, and Ultrasound in equivocal cases of appendicitis, demonstrating the superior performance of CECT.

The primary value of CECT in these atypical cases extends beyond mere accuracy; it lies in its ability to overcome the clinician's cognitive bias. An atypical presentation, such as RUQ pain, creates a strong initial diagnostic hypothesis like cholecystitis, a form of anchoring bias. This can lead to a targeted but potentially incorrect imaging request (e.g., "RUQ Ultrasound"). An inconclusive or negative targeted study, as occurred in Case 2, reinforces the diagnostic uncertainty and prolongs the delay. CECT, with its global view of the abdomen and pelvis, is less susceptible to this initial anchoring bias. It can reveal the true pathology regardless of the pre-test clinical suspicion. Therefore, CECT's role is not just diagnostic; it is a tool to break the vicious cycle of misdirection initiated by the atypical anatomy itself. This is supported by studies showing that a missed CT diagnosis of appendicitis is strongly correlated with a non-specific clinical request (e.g., "abdominal pain") versus a specific one ("rule out appendicitis").[15] This underscores the need for strong communication between clinicians and radiologists, especially in atypical cases.

Modality	Key Metric	Reported Value(s)	Key Limitation(s)
Clinical Scores (Alvarado/AIR)	Diagnostic Utility	Useful for stratifying risk in typical cases.	Non-diagnostic in equivocal or atypical cases; not a standalone tool.
Ultrasound (US)	Specificity	Excellent specificity when appendix is visualized.	Lower sensitivity than CT; operator-dependent; high rate of non-visualization.
Computed Tomography (CT)	Accuracy	98%	Radiation exposure; requires contrast for optimal evaluation.
	Sensitivity	100%	
	Specificity	95%	
	Negative Predictive Value	100%	

A Clinical Chameleon: Mapping atypical locations to their mimics the diagnostic challenge of atypical appendicitis stems from its ability to impersonate a wide range of other acute conditions. Creating a mental map that links specific anatomical locations to their clinical mimics is an essential tool for any clinician evaluating acute abdominal pain. Table 4 provides a systematic framework for this differential diagnosis [8].

Table 4: Differential Diagnosis of Atypical Appendicitis Based on Anatomical Location

Atypical Appendix Location	Corresponding Clinical Presentation	Common Clinical Mimics	Relevant Case Example(s) from this Series
Subhepatic / High Retrocecal	Right Upper Quadrant (RUQ) pain, pleuritic chest pain	Acute cholecystitis, pyelonephritis, perforated duodenal ulcer, liver abscess, basal pneumonia	Cases 1, 2, 3, 6
Retro-ileal / Periduodenal	Epigastric or central abdominal pain, back pain, vomiting	Duodenal ulcer, pancreatitis, gastroenteritis, mesenteric adenitis	Case 5 (Mesenteric extension)
Pelvic	Suprapubic pain, dysuria, tenesmus, diarrhea	Ovarian torsion, pelvic inflammatory disease (PID), ectopic pregnancy, cystitis, sigmoid diverticulitis, ureteric colic	N/A
Left-sided (Malrotation/Situs Inversus)	Left Lower Quadrant (LLQ) pain	Sigmoid diverticulitis	N/A
Inguinal / Scrotal (Amyand's Hernia)	Groin or scrotal pain, swelling, tenderness	Incarcerated inguinal hernia, testicular torsion, epididymo-orchitis	N/A

This framework demonstrates that a subhepatic appendix can produce RUQ pain and even jaundice (as in Case 2), directly mimicking biliary pathology.[7] A pelvic appendix can irritate the bladder or rectum, causing urinary symptoms or diarrhea, and in females, it can be indistinguishable from gynecologic emergencies.[13] Awareness of this spectrum of mimicry is the first step toward avoiding misdiagnosis.

Study / Review	Country / Region	Study Type	Sample Size (n)	Retrocaecal (%)	Pelvic (%)	Post-ileal (%)	Subcaecal (%)	Pre-ileal (%)	Other (%)
Khatun S, et al. (2019).[11]	Nepal	Appendectomy Patients	264	36.0	25.4	23.1	11.4	4.2	0.0
Ghorbani A, et al. (2014).[16]	Iran	Cadaveric	200	7.0	55.8	12.5 (Retroileal)	19.0	1.5	4.2 (Ectopic)
Kumar B, et al. (2023).[17]	India (Delhi)	Cadaveric	200	27.5	21.0	10.0	6.5	6.5	18.5 (Promonteric/Paracolic)
Salwe NA, et al. (2019).[14]	India	Cadaveric	50	62.0	32.0	4.0	2.0	0.0	0.0
Sakellariadis A, et al. (2024).[12]	Global	Systematic Review	N/A	25.4 - 71.0	N/A	N/A	3.5 - 20.3	~4.0 (Prececa l)	3.1 - 7.5 (Paracecal)

Multidisciplinary Management of Complications: The Role of Interventional Radiology (Evolving Management Paradigms)

The development of a well-formed abscess, as seen in Cases 3, 4, and 5, often shifts the management paradigm from immediate surgery to a multidisciplinary, staged approach. For a stable patient with a contained appendiceal abscess, the contemporary strategy frequently involves a conservative initial phase, colloquially termed "let it chill". This approach, which aligns with the long-standing "Ochsner-Sherren conservative treatment" for appendicular mass, consists of broad-spectrum intravenous antibiotics combined with percutaneous abscess drainage performed under imaging guidance (US or CT) by an interventional radiologist.[12]

This evolution towards less invasive management is not an independent development but is directly enabled by the diagnostic precision of CECT. The traditional approach to a suspected appendiceal mass was often immediate, high-risk surgery in a hostile, inflamed field. The modern approach of percutaneous drainage requires precise knowledge of the abscess's location, size, relationship to adjacent structures, and a safe access window. While ultrasound can guide some drainages, only CECT can provide the comprehensive 3D "road map" needed for complex, deep, or atypically located collections like the retroperitoneal and liver abscesses in this series. Therefore, CECT is not just a diagnostic tool; it is the foundational enabling technology for the entire modern, multidisciplinary management paradigm. An "interval appendectomy" is then typically considered 6-8 weeks later to prevent recurrence, which can occur in 10-25% of cases. This staged approach has been shown to reduce morbidity and decrease the risk of requiring a more extensive operation, such as a hemicolectomy.[12] A proposed management algorithm [Figure 11] would outline a structured diagnostic pathway for patients with atypical abdominal pain, emphasizing the pivotal decision-making role of CECT.

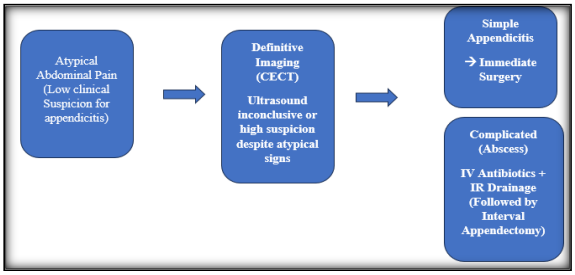

Figure 11: A proposed diagnostic and management algorithm for patients presenting with atypical abdominal pain, emphasizing the pivotal role of CECT in decision-making for both simple and complicated appendicitis.

Implications, Limitations, and Future Research

This study is subject to the inherent limitations of a retrospective case series. The sample size is small, and the cases were collected from a single tertiary care center, which may introduce selection bias. The findings, however, underscore the critical need for broader clinical awareness of the vast spectrum of appendicitis presentations. A larger, prospective multicenter study would be required to establish more definitive conclusions regarding the prevalence and outcomes of these atypical presentations and to further validate the proposed management algorithms.

CONCLUSION

Acute appendicitis, far from being a singular, predictable clinical entity, is a master of disguise. Its profound anatomical variability, which is further compounded by its potential for mobility within the peritoneal cavity, creates a vast spectrum of atypical presentations that frequently challenge clinicians and lead to diagnostic delays. This case series serves as a stark reminder of the severe consequences of these delays, which include the development of extensive, life-threatening abscesses in the liver, mesentery, and retroperitoneum.

The central clinical takeaway from this analysis is that a high index of suspicion for appendicitis must be maintained in any patient presenting with unexplained acute abdominal pain, regardless of its location or character. The classic textbook presentation should be viewed as merely one possibility among many, not as a required diagnostic criterion.

In the modern medical era, relying on clinical signs and symptoms alone to manage atypical presentations is an insufficient and potentially dangerous approach. While ultrasonography maintains a role as a valuable initial screening tool, particularly in pediatric and female patients, CECT has proven to be an indispensable and definitive modality in the diagnostic arsenal. It provides the anatomical clarity and pathological detail necessary to confidently diagnose or exclude appendicitis, accurately delineate the full extent of any complications, and guide timely, effective, and targeted multidisciplinary management. Ultimately, the judicious use of CECT is critical to mitigating the significant morbidity and mortality associated with this common, yet often elusive, disease.[15]

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