

# The prevalence of pathological findings identified by next day abdominal ultrasound in patients discharged from the emergency department

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## CLINICIAN'S CAPSULE

### What is known about the topic?

A common strategy for managing emergency department patients with low-risk abdominal pain is to arrange for next day outpatient ultrasound.

### What did this study ask?

What proportion of outpatient ultrasounds with pathological findings require further evaluation or intervention within 14 days of imaging?

### What did this study find?

While the majority of patients did not have ultrasound findings requiring urgent intervention, a significant number (7.7%) did have serious pathology.

### Why does this study matter to clinicians?

Clinicians using this deferred management strategy should be aware that a significant proportion of patients may have actionable pathological findings.

five (21.7%) had cholecystitis, four (17.4%) had urological pathology, three (13.0%) had gynecological pathology, and three (13.0%) had gastrointestinal diagnoses. Of note, 14 (60.9%) patients requiring follow-up or intervention within 14 days had symptoms that improved or resolved at the time of the outpatient ultrasound. For the 277 (92.6%) patients not requiring intervention, 117 (42.2%) had improved, 89 (32.1%) were unchanged, 50 (18.1%) had resolved, and 5 (1.8%) had worsened symptoms at the time of the follow-up ultrasound. Of the non-intervention patients, 13 (4.7%) went on to have alternative imaging, including magnetic resonance imaging, computed tomography, and a sonohysterogram.

**Conclusions:** Next-day ultrasound imaging remains a good way of identifying patients with serious pathology not appreciated at the time of their ED visit.

## RÉSUMÉ

**Objectif:** L'une des conduites souvent tenues devant les douleurs abdominales à faible risque au service des urgences (SU) est de retourner les patients à domicile et de fixer un rendez-vous à la clinique externe pour une échographie d'évaluation à effectuer le lendemain. L'étude visait donc à déterminer la proportion de patients soumis à une échographie en consultation externe, qui ont dû subir une intervention dans les 14 jours suivants.

**Méthode:** Il s'agit d'un examen rétrospectif de dossiers de patients et de patientes non enceintes, âgés de 18 à 40 ans, ayant consulté dans un SU d'hôpital d'enseignement (65 000 selon le recensement annuel) pour des douleurs abdominales qui ont motivé l'urgentologue à fixer un rendez-vous à la clinique externe (le lendemain) pour une échographie abdominale.

**Résultats:** Au total, 299 patients ont été retenus, dont 252 femmes (84,3%), et l'âge moyen (écart type) était de 28,4 ans (6,0). Parmi ceux qui ont été soumis à une échographie, 23 patients (7,7%) ont dû subir une intervention au cours des 14 jours suivant l'examen par imagerie. Sur ce nombre, 8 (34,8%)

## ABSTRACT

**Objective:** A common strategy for managing emergency department (ED) patients with low-risk abdominal pain is to discharge them home and arrange for next day outpatient ultrasound for further assessment. The objective was to determine the proportion of outpatient ultrasounds with findings requiring intervention within 14 days.

**Methods:** This was a retrospective chart review of non-pregnant patients ages 18 to 40 years, presenting to an academic ED (annual census 65,000) with an abdominal complaint for whom the emergency physician arranged an outpatient (next day) abdominal ultrasound.

**Results:** Of the 299 included patients, 252 (84.3%) were female and mean (SD) age was 28.4 (6.0) years. Twenty-three (7.7%) patients had ultrasounds requiring intervention within 14 days of imaging. Of these, eight (34.8%) had appendicitis,

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souffraient d'appendicite, 5 (21,7%), de cholécystite; 4 (17,4%), de troubles urinaires; 3 (13,0%), de troubles gynécologiques; et 3 (13,0%) de troubles gastro-intestinaux. Point à souligner, chez 14 patients (60,9%) qui ont eu besoin d'un suivi ou d'une intervention dans les 14 jours suivants, les symptômes s'étaient atténués ou avaient disparu complètement au moment de l'échographie en consultation externe. Chez les 277 autres patients (92,6%) qui n'ont pas eu à subir d'intervention, 117 (42,2%) ont vu leurs symptômes diminuer; 89 (32,1%), rester inchangés; 50 (18,1%), disparaître; et 5 (1,8%) s'intensifier au

moment de l'échographie de suivi. Parmi ceux qui n'ont pas subi d'intervention, 13 (4,7%) ont été soumis à d'autres examens par imagerie, notamment à un examen par résonance magnétique, à une tomодensitométrie ou à une échographie utérine.

**Conclusion:** Une échographie effectuée le lendemain demeure une bonne conduite à tenir devant des manifestations pathologiques sérieuses mais non reconnues au moment de la consultation au SU.

**Keywords:** Imaging, pain, ultrasound

## INTRODUCTION

Abdominal pain is the most common chief complaint encountered in the emergency department (ED), accounting for approximately 8% of all visits.<sup>1,2</sup> Of these, 25% of patients are discharged from the ED with a diagnosis of undifferentiated abdominal pain.<sup>3,4</sup> Studies have shown that most patients discharged with this diagnosis will experience an improvement or resolution of their symptoms without any specific intervention.<sup>4-6</sup> Despite this, it is common for patients with undifferentiated abdominal pain to have an outpatient ultrasound ordered from the ED to rule out significant pathology. For patients presenting to the ED with abdominal pain on weekends or after hours on weekdays, outpatient ultrasounds with immediate ED reassessment are often arranged. However, a significant proportion of these ultrasounds fail to identify any definitive diagnosis or alter clinical management.<sup>7,8</sup>

The objective of this study was to examine the utility of outpatient ultrasounds to assess undifferentiated abdominal pain in patients who are stable enough to be discharged home from the ED and to determine the proportion of those outpatient ultrasounds with pathological findings requiring further evaluation or intervention within 14 days of imaging.

## METHODS

This was a retrospective chart review of non-pregnant patients ages 18 to 40 years, presenting to an academic ED (annual census 65,000) with an abdominal complaint for whom the emergency physician arranged an outpatient (next day) abdominal ultrasound. The age range was selected to represent a large proportion of low-risk patients presenting to the ED with abdominal pain who

can be safely discharged home with appropriate outpatient follow-up. Pregnant or recently pregnant females and patients admitted to a hospital at the time of the initial ED assessment were excluded. This study protocol was reviewed and approved by the Research Ethics Board at Mount Sinai Hospital in Toronto, Ontario.

Using a computerized, structured data abstraction form, trained research personnel reviewed the medical records from Mount Sinai Hospital and extracted patient data, including patient demographics, ED investigations, follow-up ultrasound interpretation and follow-up interventions. Data were entered directly into a study-specific Microsoft Excel database (Microsoft Corporation, Redmond, WA). Descriptive statistics were summarized using means with standard deviations (SD), medians with interquartile ranges, or frequencies with 95% confidence intervals, where appropriate. Data extraction was done independently and in duplicate for 25% of charts. Interrater agreement was estimated using Cohen's kappa ( $\kappa$ ) statistic. Data analysis was performed using SPSS 25.0 (IBM Corporation, Armonk, NY).

## RESULTS

Of the 299 included patients, 252 (84.3%) were female and mean (SD) age was 28.4 (6.0) years. Twenty-three (7.7%) patients had ultrasounds requiring intervention within 14 days of imaging. Of these, eight (34.8%) had appendicitis, five (21.7%) had cholecystitis, four (17.4%) had urological pathology, three (13.0%) had gynecological pathology, and three (13.0%) had gastrointestinal diagnoses. The full list of diagnoses is presented in [Table 1](#).

Of note, 14 (60.9%) patients requiring intervention within 14 days had symptoms that improved or resolved at the time of the outpatient ultrasound. For the 277 (92.3%) patients not requiring intervention, 117 (42.2%)

**Table 1. Patients requiring medical intervention within 14 days of imaging**

Age	Sex	Chief complaint	ED discharge diagnosis	Symptom evolution at follow-up visit	Diagnoses after ultrasound	Intervention within 14 days of imaging
39	Female	Abdominal pain	Abdominal pain NYD	Improved	Pyelonephritis or UP obstruction with superimposed infection	Urgent specialist referral; surgical intervention
27	Female	Abdominal pain	Abdominal pain NYD R/O appendicitis	Unchanged	Acute non-complicated appendicitis	Urgent specialist referral; antibiotics
22	Female	Abdominal pain	Abdominal pain NYD	Unchanged	Acute Crohn's – thickened and inflamed terminal ileum and cecum with fistulous tract	Urgent specialist referral; antibiotics
37	Female	Abdominal pain	Abdominal pain NYD	Worsened	Acute cholecystitis	Urgent specialist referral; hospital admission; surgical intervention
29	Female	Nausea	Abdominal pain NYD	Unchanged	Enlarged left ovary with multiple simple appearing cyst; unable to exclude ovarian torsion	Urgent specialist referral; surgical intervention
20	Female	Abdominal pain	Benign pelvic pain	Improved	Eccentrically malpositioned IUD	Urgent specialist referral; surgical intervention
28	Female	Abdominal pain	Possible ovarian cyst	Improved	Tube-ovarian abscess	Urgent specialist referral; antibiotics
28	Female	Abdominal pain	Abdominal pain NYD	Improved	Acute non-complicated appendicitis	Surgical intervention
39	Male	Abdominal pain	R/O right hydronephrosis	Unchanged	Renal colic	Hospital admission
26	Female	Abdominal pain	R/O biliary colic v. cholelithiasis	Improved	Acute cholecystitis	Urgent specialist referral
23	Male	Abdominal pain	Abdominal pain NYD	Resolved	Acute appendicitis	Urgent specialist referral; antibiotics
27	Female	Abdominal pain	Abdominal pain NYD	Unchanged	Infectious enteritis, inflammatory bowel disease cannot be excluded	Urgent specialist referral; antibiotics
38	Male	Abdominal pain	Biliary colic	Resolved	Thickened gallbladder wall with gallstones – chronic cholecystitis	Urgent specialist referral
31	Female	Flank pain	UTI R/O pyelonephritis	Resolved	Renal colic	Urgent specialist referral
29	Female	Flank pain	Flank pain	Improved	Renal colic	Urgent specialist referral
34	Male	Abdominal pain	Abdominal pain NYD	Unchanged	Acute appendicitis	Urgent specialist referral; hospital admission; surgical intervention
22	Female	Abdominal pain	Abdominal pain NYD	Improved	Acute appendicitis	Urgent specialist referral; hospital admission; surgical intervention
28	Female	Abdominal pain	Abdominal pain	Resolved	Acute cholecystitis	Urgent specialist referral
23	Female	Abdominal pain	R/O cholelithiasis	Unchanged	Acute cholecystitis	Urgent specialist referral; hospital admission; surgical intervention
19	Female	Abdominal pain	Vaginal yeast infection – R/O UTI and ovarian cyst	Unchanged	Acute appendicitis	Urgent specialist referral; hospital admission; surgical intervention
34	Female	Abdominal pain	Diverticulitis	Improved	Acute diverticulitis	Urgent specialist referral; hospital admission; surgical intervention
35	Male	Abdominal pain	R/O appendicitis	Improved	Acute appendicitis	Urgent specialist referral; hospital admission; surgical intervention
24	Male	Abdominal pain	Flank pain NYD	Improved	Acute appendicitis	Urgent specialist referral; hospital admission

ED = Emergency department; IUD = intrauterine device; NYD = not yet diagnosed; R/O = rule out; UP = ureteropelvic; UTI = urinary tract infection.

had improved, 89 (32.1%) were unchanged, 50 (18.1%) had resolved, and 5 (1.8%) had worsened symptoms at the time of the follow-up ultrasound. There were 16 (5.8%) charts that did not contain any information in regard to change in patient-reported symptoms. Of the non-intervention patients, 13 (4.7%) went on to have alternative imaging, including magnetic resonance imaging, computed tomography, and sonohysterogram.

## **DISCUSSION**

The objective of this study was to examine a strategy of deferred (scheduled next day) ultrasound investigations and ED follow-up for patients with low-risk abdominal pain, and to determine the proportion of those patients with important findings requiring treatment or intervention within 14 days. While the majority of patients who managed using this strategy did not have ultrasound findings requiring urgent intervention or treatment, a significant number (7.7%) did have serious pathology. This study suggests that this strategy may be a reasonable one, especially after hours when access to ultrasound is limited for this particular patient population. However, our findings suggest that clinicians opting to use this deferred management strategy need to be aware that a significant proportion of patients may in fact have actionable pathological findings.

A second finding from our study that could impact patient management is that 60.9% patients requiring intervention within 14 days had symptoms that improved or resolved at the time of the outpatient ultrasound. The significance of this finding is not clear; it is possible that the natural history of some cases of appendicitis and cholecystitis is to simply resolve on their own, but it seems unlikely this would account for the majority of patients with resolved abdominal pain in our study. Future studies should attempt to elucidate which, if any, clinical features from the initial ED presentation are predictive of significant pathology on outpatient ultrasound. Additionally, as emergency provider point-of-care ultrasound skills continue to advance, it is possible that fewer patients with significant abnormalities will be sent home for next day imaging. At the time of this study, over 95% of the physicians working in this ED were Canadian Emergency Ultrasound Independent Practitioner certified for point-of-care ultrasound.

Unnecessary diagnostic imaging contributes to rising healthcare costs and carries the potential for harm and

inconvenience to patients with incidental findings, leading to further investigation and, occasionally, unwarranted procedures. These additional investigations are costly at both the system and patient levels. At the system level, such testing uses scarce and expensive healthcare resources to chase what often turns out to be completely incidental findings. Additionally, the implications of a next-day compared with same-day ultrasound strategy on patient flow and ED wait times are unknown. At the patient level, in addition to the anxiety associated with abnormal results, follow-up investigations are frequently invasive, have direct time and transportation associated costs, and expose patients to additional radiation, contrast dye, and infection risks that may contribute to patient morbidity.

## ***Limitations***

This study is not without limitations. Due to the retrospective nature of this study, we can only report what was documented in the patient record. This was a single-centre study, and while clinical management strategies may be similar at other institutions, our findings may not be generalizable to other settings. It is possible that a patient may have re-presented to another hospital in the same city and received treatment or had an intervention not captured in this study. It is possible that some of the observed variation in the collected data were influenced by error or bias from the data abstractor, who was not blinded to the objective of this descriptive study. Additionally, our study could not capture the thought process and patient-physician exchanges that were involved in the imaging decision. It is possible that ED management was dictated by patient preference, point-of-care ultrasound findings, or other information not documented in the chart.

## **CONCLUSIONS**

The large majority of patients with abdominal pain discharged from the ED with planned next-day ultrasound had findings that were normal or did not require any additional management. However, 7.7% of these patients had pathological findings that required intervention within 14 days. Interestingly, many of those patients had pain that had resolved or improved by the next day. Next-day ultrasound imaging remains a good way of identifying patients with serious pathology not

appreciated at the time of their ED visit, and may be better at identifying patients with significant problems who may have had delayed presentation if simply instructed to return to the ED if their symptoms had not improved in 24 to 48 hours.

**Author contributions:** The authors all stand behind the conclusions of this manuscript, agree to be accountable for all aspects of the work, and support its publication. All authors contributed to the study conception and designed the protocol. All authors contributed to the manuscript preparation and have given approval for its submission.

**Competing interests:** None declared.

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