

Original Research Article

Initial outcomes of a surgical ambulatory pathway for right upper quadrant pain

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ABSTRACT

Background: Right upper quadrant (RUQ) abdominal pain is a common emergency presentation. Ambulatory care pathways (ACP) are described as management strategies to reduce hospital bed pressure. ACP allows well patients presenting out of hours to be discharged from the emergency department, with a plan for re-presentation for further management. The aim of this study is to demonstrate that select patients with RUQ pain can be managed via ACP to achieve shorter inpatient length of stay (LOS) without higher morbidity or mortality.

Methods: Prospective data on eligible patients treated via ACP for RUQ pain between June 2021 and 2022 were compared with a retrospectively collected matched cohort of inpatient care pathway (ICP) patients from June 2019 to June 2020. Data collected included patient demographics, diagnosis, LOS, complications, and readmissions within 30 days.

Results: Patients on the ACP had significantly shorter LOS ($p < 0.001$) with a median LOS of 1.0 (IQR 0.0-1.30) compared to patients on the ICP with a median of 2.0 (IQR 1.25-2.75). There were no significant differences in patient demographics, theatre access, surgical complications, or readmissions within 30 days.

Conclusions: Patients who presented out of hours with RUQ pain treated through the ACP had a shorter LOS without increased morbidity or mortality. ACP management of RUQ pain appears safe for patients who meet strict criteria.

Keywords: Right upper quadrant pain, Ambulatory Care Pathway, Inpatient care pathway, Emergency surgery, General surgery

INTRODUCTION

Emergency department presentations with RUQ abdominal pain are common. It is generally agreed that biliary disease is the most common aetiology requiring surgical management and accounted for 86.7 per cent of surgical admissions between 2004 and 2019.¹

Within the last two decades, increasing healthcare costs and bed pressures have driven research into the feasibility and safety of ACP models. ACPs were primarily developed to reduce LOS and prevent unnecessary

hospital costs whilst trying to maintain or even improve the quality of patient care.^{2,3}

International and national data have demonstrated that surgical ACP can be safely utilised to reduce hospital LOS and improve patient satisfaction.⁴⁻⁸ However, these studies generally explore the LOS and patient satisfaction across different surgical presentations (such as appendicitis and hernia), thus often making it difficult to explore outcomes for a specific surgical pathology. A previous meta-analysis, involving seven trials and 1187 patients, looked at the effects of ACP on patients who

presented with RUQ pain. The results showed that ACP reduced hospital LOS and reported improved patient satisfaction but did not have sufficient evidence to comment on post-operative complications.⁹

The aim of this study was to assess the feasibility and safety of an ACP for RUQ abdominal pain in carefully selected patients who present out of hours to the emergency department.

The ACP aims to safely minimise unnecessary admissions and alleviate the burden on the healthcare system while patients are awaiting further management. Patients who are appropriate for the ACP are discharged from ED and asked to re-present the following morning. Post-operatively, patients are usually admitted overnight using a 23-hour model of care to complete the inpatient admission within 24 hours.¹⁰

Exclusion criteria (Table 1) were developed based on patient factors, sepsis criteria, and social factors to help filter patient presentations and identify patients who could be safely put onto the ACP. Patients with these

factors who presented with RUQ pain out of hours were not treated via the ACP and hence excluded from the study.⁹

The ACP was implemented in a single-site outer metropolitan hospital in Victoria, Australia. The pathway was implemented for patients who presented out of hours (after 1700) between Monday to Friday from 20th June 2021. Patients who presented to emergency department (ED) would be assessed and given a presumed diagnosis by a general surgery registrar in ED. If theatre access or investigations were not available then ACP eligible patients would be discharged home with instructions to present to the day surgery unit the next day for planned investigations or management (Figure 1). This included patients who presented with all manner of pathologies that might otherwise present with RUQ pain including cholecystitis, biliary colic/those patients who were more undifferentiated and required further investigations to determine their management trajectory. Patients who were diagnosed with cholecystitis and were appropriate for the ACP were also given a stat dose of intravenous antibiotics prior to discharge from ED as per protocol.

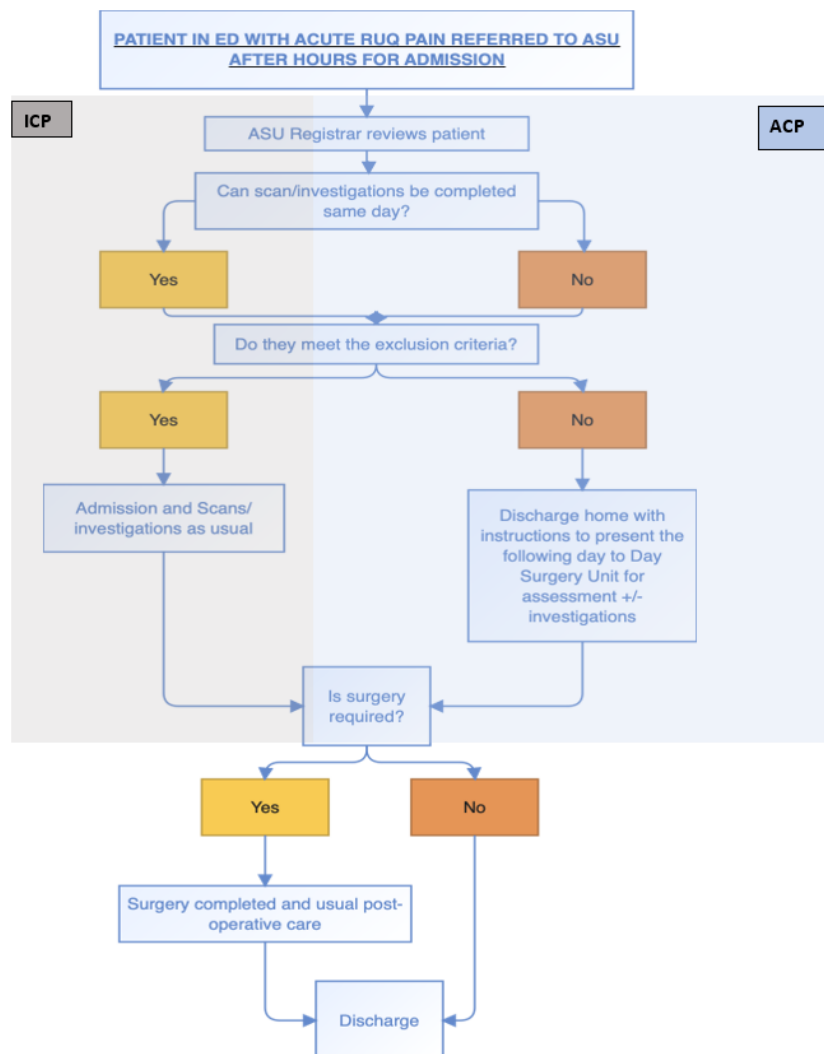


Figure 1: Simplified flow chart comparing the traditional ICP (Left) and ACP (Right).

Table 1: List of exclusion criteria used to help identify patients who would be safe to be discharged home on ACP.

Comorbidities	Stability	Logistics
Age >75	Fever >38°	No transport to go home
T1DM or T2DM or immunosuppression	Tachycardia (HR >100 bpm)	Patients without adequate support at home
Medications requiring active perioperative management	Hypotension (sBP <100 mmHg)	Patients who live >1 hr away from the hospital
Significant comorbidities	Deranged LFT's, specifically bilirubin (>20 micromol/L)	Patients in residential care
	Dilated CBD on imaging (>6 mm)	People with physical/intellectual disability
	Raised lipase (>180U/L) or imaging suggestive of pancreatitis	
	Pain not controlled with opioid analgesia	

METHODS

Study type

This was a comparative cohort study comprising a prospective ACP cohort and a retrospective matched ICP control cohort. The ACP cohort was prospectively collected from 20 June 2021 to June 2022, while the matched ICP cohort was retrospectively identified from presentations between 1 July 2019 and June 2020.

Study place and period

The study was conducted at Casey Hospital, Monash Health, Australia. Patients managed through the ACP were prospectively identified between 20 June 2021 and June 2022. Patients managed through the ICP were retrospectively identified from 1 July 2019 to June 2020 and served as the matched control cohort.

Patient selection criteria

All patient encounters involving presentation to the Emergency Department with RUQ abdominal pain and referral to the General Surgery Department were identified.

Patients who met the predefined criteria for management through the ACP were included in the prospective cohort. For the ICP cohort, matched patients were identified through a retrospective search of the electronic medical record (EMR) for presentations with RUQ pain during the specified study period. These encounters were subsequently screened according to the predefined exclusion criteria (Table 1).

Procedure

Eligible patient data were collected using the EMR. Patients presenting out of hours with RUQ abdominal pain were assessed in the Emergency Department and referred to the General Surgery Department for further evaluation. Patients meeting the predefined ACP criteria were managed through the ambulatory pathway, allowing suitable patients to be discharged from the Emergency Department with a planned re-presentation for ongoing surgical assessment and management. Patients who did not meet the criteria for ACP management were managed through the conventional ICP.

For each patient, demographic data including age and sex were collected. Clinical and outcome data included diagnosis, hospital LOS, delays to theatre, readmission within 30 days, and postoperative complications.

Complications were classified according to the Clavien-Dindo classification. Outcomes were compared between patients managed through the ACP and those managed through the ICP.

Ethical approval

All patient data were de-identified and stored in a secure online database with restricted user access and two-factor authentication. The study was considered a quality assurance activity and was therefore exempt from formal research ethics committee approval.

Statistical analysis

Statistical analysis was performed using RStudio with R version 4.0.3. Patient demographics between the ACP and ICP cohorts were compared using an independent two-tailed test for continuous variables and the chi-squared test for categorical variables. LOS, delays to theatre, complication rates, and 30-day readmission rates were compared using the Wilcoxon rank-sum test. A two-tailed $p < 0.05$ was considered statistically significant.

RESULTS

The 92 patients were included in the final analysis (Table 2). The 43 patients in the ICP cohort (70.8% female) and 49 patients in the ACP cohort (79.6% female). There was no significant difference in patient gender between the two cohorts. ($p = 0.40$).

There was no significant difference between the mean age of the ICP cohort and ACP cohort (42.6 ± 12.1 years old, 37.8 ± 13.0 years old; $p > 0.05$).

Within the ICP cohort, 51.2% of the patients were diagnosed with cholecystitis, and 44.2% ($n = 19$) proceeded to surgery during the same admission. Meanwhile, 63.3% of patients were diagnosed with cholecystitis within the ACP cohort and 61.2% ($n = 30$) proceeded to acute surgery. Although proceeding to acute surgery was less common in the ICP cohort, this was not significantly different ($p = 0.15$).

Here was a cumulative total LOS of 86.2 days in the ICP cohort compared to 51.5 days in the ACP cohort. There was a significant difference in the median LOS between the ICP and ACP cohorts (2.00 days, IQR 1.25-2.75 days; 1.00 days, IQR 0.00-1.30 days; $p < 0.001$, respectively), with a reduced LOS seen in the ACP cohort (Table 3). Within the ACP group, there was a single outlier with a LOS of 10.2 days awaiting transfer for inpatient care that was not available at the study hospital (Figure 2).

Two of the 19 patients (10.5%) who proceeded to surgery in the ICP cohort had their surgery rescheduled to the following day. In comparison, 7 of the 30 patients (23%) in the ACP cohort had their laparoscopic cholecystectomy two days after presenting to the ED. This was not a statistically significant difference in delays to theatre between the groups ($p = 0.17$). Both cohorts had no post-operative complications based on the Clavien-Dindo classification and no re-admissions within 30 days (Table 4).

Table 2: Comparison of patient demographics between ICP and ACP cohorts.

Variables	ICP	ACP	P value
Total patients	43 (46.7%)	49 (53.2%)	
Age (in years)	Mean ($\pm$ SD)	42.6 ($\pm$ 12.1)	37.8 ($\pm$ 13.0)
	P value (normality test)	0.47 ¹	0.60 ¹
Gender	Male	13 (30.2%)	10 (20.4%)
	Female	30 (70.8%)	39 (79.6%)
Theatre	19 (44.2%)	30 (61.2%)	0.40 ³
			0.15 ³

*¹Kolmogorov-Smirnov test, ²Student's t-test (independent, two-tailed), ³Chi Squared test

Table 3: Comparison of LOS in days between ICP and ACP and cost in Australian Dollars.

Variables	ICP	ACP	P value
Number of patients	43	49	
Cumulative total LOS (days)	86.2	51.5	
Average LOS (days)	2.00	1.05	
Median LOS (days) (IQR)	2.00 (1.25-2.75)	1.00 (0.00-1.30)	<0.001
Kolmogorov-Smirnov test for normality	0.50	<0.01	
Cost of admission (AUD) per patient per average LOS	\$5, 219.60	\$2, 740.29	
Total cost of admission (AUD)	\$224, 442.80	\$134, 274.21	

Table 4: Comparison of surgical outcomes between ICP and ACP cohorts.

Variables	ICP		ACP		RR	95 %CI	Fisher p value
	N	%	N	%			
Delays to theatre	2	4.6%	7	14.35	3.07	0.67-14.0	0.17
Readmission within 30 days	0	-	0	0.0%	∞	-	1.00
Return to Theatre within 30 days	0	-	0	0.0%	∞	-	1.00

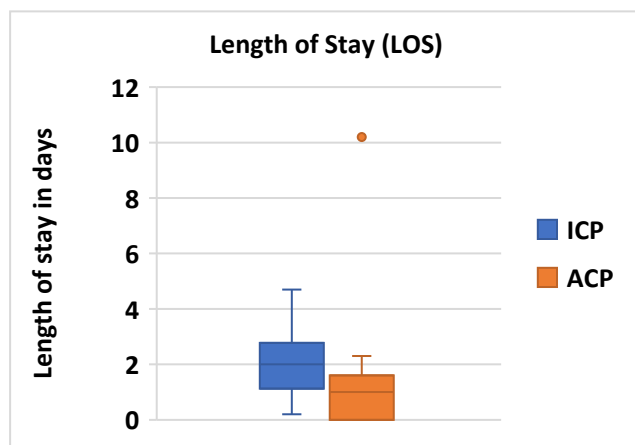


Figure 2: Comparison of LOS in days between ICP (left) and ACP (right).

DISCUSSION

This study showed a reduction in inpatient hospital LOS for patients presenting to emergency with RUQ pain who were managed using an ACP without any difference in perioperative surgical complications based on the Clavien-Dindo classification of perioperative morbidity.

ACPs were primarily developed to reduce LOS and prevent unnecessary hospital costs whilst trying to maintain or even improve the quality of patient care.^{2,3} As the demand for in-hospital healthcare services rises and places significant pressure on the availability of inpatient beds, finding safe methods to reduce the length of hospital stays is increasingly important.¹¹ Recent studies have examined the safety and feasibility of managing a wider variety of surgical cases using the ACP including a

similar study in the management of abscesses.¹² However, there is limited research regarding the reduction of bed occupancy through the use of ACP for cases necessitating emergency surgery, balancing bed pressures and clinical need in a public health system.

Patients on the ACP in this study experienced a significantly shorter inpatient bed days LOS nearly one day less than those on the ICP, resulting in a cumulative total difference of 34.7 days. There is a greater reduction seen in 24-hour LOS and this aligns with reductions observed in other ACP implementations in the United Kingdom, such as Leighton Hospital, which reported an average decrease of 18.6 hours in 2019 for patients with various conditions, including RUQ pain, right iliac fossa pain, abscesses, and stable per rectal bleeding.⁶ Additional national and international studies have shown similar outcomes, with surgical ACPs consistently leading to reduced hospital LOS and enhanced patient satisfaction.⁴⁻⁶ However, these comparative results were more heterogeneous as they included various types of surgical presentations rather than focusing on specific conditions or presenting complaints, therefore making the data less generalisable and precluding direct comparisons. A 2014 meta-analysis also examined the effectiveness of ACPs for a variety of presentations, revealing reductions in hospital LOS and costs along with improved patient satisfaction. However, this meta-analysis' failure to address post-operative complications, a key safety concern in surgical patients, limits its impact on driving change in clinical practice.⁹

The outlier for LOS in this cohort was a clinical deviation due to the service provision limitations of the hospital featured in the study. At intraoperative cholangiogram, choledocholithiasis was diagnosed which required endoscopic retrograde cholangiopancreatography (ERCP) decompression at a different facility as this procedure is not offered at the index institution. The extended LOS reflects the significant impact of bed pressure on patient management and highlights the need for pathways that can streamline patient management without compromising quality care for the majority of patients that have an uneventful postoperative recovery.

While statistically insignificant, there was a slight increase in delays to surgery for patients on the ACP. Such delays can be expected in an emergency surgical setting, as high-acuity patients requiring urgent intervention can emerge unpredictably. The institutional arrangement of acute surgical operating lists at the study hospital allowed for early identification and prioritization of patients to reduce fasting times. However, these delays were likely unavoidable. Patients who were delayed whilst on the ACP pathway were re-assessed by a general surgery consultant before offering patients the option to continue on the ACP pathway or admission into hospital. Consequently, despite the ACP cohort having a marginally higher rate of surgical delays, this is more indicative of the general challenges within triage

processes for booking emergency surgery process rather than a specific issue with the ACP itself. That these delays did not contribute to or increase the perioperative complication rate lends itself to the conclusion that patient selection is key for the safe management of acute RUQ pain patients via an ACP. Notably, this is in contrast to a related study conducted in 2021 that examined the patient demographic under an ACP using the American Society of Anaesthesiologists (ASA) classification. The findings indicated that patients on the ACP experienced a higher rate of unfavourable outcomes according to the Clavien-Dindo classification. This was likely influenced by the fact that patients on the ACP had significantly higher ASA scores than patients on their ICP.¹³

The incidence of laparoscopic cholecystectomy for acute cholecystitis within the ICP cohort is expectedly lower, given that patients who were admitted into the hospital (ICP pathway) were frequently more complicated, either with their acute illness or with pre-existing comorbidities, and therefore often required further medical optimisation prior to proceeding to surgery. This could be as simple as planning for the washout period for withheld medications, or a more complex full pre-anaesthetic assessment to determine perioperative morbidity and fitness for surgery. These patients were then subsequently booked for elective surgery taking into account the medical interventions required to make their surgery as safe as possible.

Based on an average cost of \$2609.80 per day in hospital for acute patients from the National Hospital Cost Data Collection Report for 2020-2021, a reduced inpatient LOS of 0.95 days equates to a cost saving of \$2,479.31 per patient requiring laparoscopic cholecystectomy. The total cost for ICP hospital stay was \$224, 442.80, compared to \$134, 274.21 for the ACP, resulting in a total cost saving of \$90,168.59 for patients treated on the ACP. It should be acknowledged additionally that this is just the cost saving associated with the expected hospital stay and does not take into account other potential cost savings associated with an overall significantly decreased LOS.¹⁴

Our study confirms that the introduction of the ACP demonstrated meaningful benefits in the management of patients presenting with RUQ pain. Compared to traditional inpatient care, the ACP facilitated earlier discharge and more efficient use of hospital resources without compromising patient safety or surgical outcomes. Patients managed through the ACP experienced shorter hospital stays, reflecting improved patient flow and reduced bed occupancy, while maintaining comparable perioperative outcomes and readmission rates. These findings highlight the potential of ACPs to streamline surgical care delivery and enhance system efficiency within resource-constrained healthcare settings, supporting their broader implementation in the management of selected acute surgical presentations.

Limitations

This study is a focused, single unit, pilot study primarily designed to highlight the safety and efficacy of an ACP for patients with RUQ pain as their presenting complaint. This allowed consistency and adherence to the ACP protocol and management across the cohort, but inherently has its own limitations in terms of broader applicability. Larger, multicentre studies including different geographic and demographic populations would evidently strengthen these results and improve the applicability of the ACP to other institutions.

The overall demographics and clinical outcomes for patients with non-surgical diagnoses or those ineligible for the ACP were not documented, leaving the impact of the ACP on comprehensive patient flow and management unclear. Future research could incorporate the impact of individual selection factors and how they contribute to effective patient management within the ACP, aiming for optimization related to the exclusion criteria in subsequent research.

CONCLUSION

This study demonstrates that an ACP for carefully selected patients presenting out of hours with RUQ abdominal pain is a safe and effective alternative to conventional inpatient management. Patients managed through the ACP experienced a significantly shorter hospital length of stay, resulting in reduced bed utilisation and potential cost savings, without an associated increase in perioperative complications, readmissions, or adverse clinical outcomes. These findings support the use of ACPs as a strategy to improve patient flow and optimise healthcare resource allocation in the setting of acute surgical presentations. While further multicentre studies are required to validate these results and assess long-term outcomes, the ACP appears to be a feasible and sustainable model of care for appropriately selected patients with RUQ pain, offering both clinical and system-level benefits.

Future directions

As a single-site observational study, this paper cannot evaluate the efficacy or complications of the ACP across various population groups. Continuous adaptation and refinement of the ACP can be pursued through quality assurance initiatives and patient satisfaction surveys, and a review of long-term outcomes is needed to assess other implications of this care model. Nevertheless, this study suggests that the ACP for selected patients with RUQ pain is a feasible, applicable, and safe alternative to inpatient management, which can help reduce overall inpatient stay duration and alleviate bed pressure.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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