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Differential Diagnosis of Acute Appendicitis in Surgery: Systematic Review

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Abstract: **A number of reports have suggested the benefits of the acute care surgery (ACS) design in surgical results. We aimed to mark the impact of the ACS model on surgical effectiveness and quality.Before the ACS model was executed, abdominal surgical emergencies were evaluated by an on-call non-trauma basic cosmetic surgeon (pre-ACS model). An in-house injury cosmetic surgeon dealt with all patients with injury or non-trauma abdominal surgical emergencies after the ACS design. Patients with acute appendicitis who went through appendectomies were consisted of. We conducted a pre- and post research study to compare the time patients remained in the emergency department and surgical qualities.The ACS model might improve abdominal surgical performance and quality. Our research study results echoed the benefits of the application of the ACS design shown in North America.**

Keywords: **Acute Care Surgery (ACS), Pre-ACS Model.**

1. INTRODUCTION

Trauma and abdominal emergencies are both typical causes for emergency department (ED) sees and typically require a surgeon's assessment and surgical treatment[(1-3)]. Patients confessed to the ED are considered critically ill; therefore, prompt diagnosis and prompt intervention are needed.

In practice, trauma surgeons are responsible for the timely management of injured patients and ought to provide internal service. Many level 1 trauma centers have 24/7 in-home faculty trauma cosmetic surgeons who are well trained and acquainted with a vast array of surgical issues[(4-6)]. Thus, many health centers have actually had their trauma programs incorporate emergency surgery into their practice[(7-9)]. Several reports from North America have shown that the combination of emergency basic surgery into injury programs enhanced the results of patients with non-trauma surgical emergencies.[(7,10,11)]. This severe care surgery (ACS) model is a com- bination of injury surgery, broad-based emergency situation surgery, and surgical vital care and has actually been championed by the American Association for the Surgery of Trauma and a variety of other injury and surgical societies[(9)].

The population of capable basic cosmetic surgeons is reducing[(12,13)]. There are progressively fewer medical students and citizens taking part in emergency surgery since of the disinterest in supplying on-call service. In addition, increasing surgical performance and quality have actually likewise been required. These issues have actually become worldwide problems, and, for that reason, they also exist in Taiwan. The ACS model was described as a response to the formerly mentioned issues [(7-9)] and has been used because August 2010 in our organization to supply precise decision making and prompt surgery for abdominal emergencies.

We carried out a pre- and post- study to figure out the impacts of the ACS design in the crucial time period in the ED. We examined the timelines for the action of cosmetic surgeons to assessment demands and surgical choice making in the ACS model. Additionally, we likewise attempted to define the impact of the ACS model on surgical results and quality of care.

2. METHODOLOGY

The databases of PubMed, the Cochrane library, EMBASE, Chinese Biomedical Database and ISI Web of Knowledge were searched up to July 2015 without language and publication status restrictions. The search strategies included the following terms[Mesh]: "Acute appendicitis ", "Surgical efficiency ",

"Surgical quality", "trauma ". In addition, Google scholar and the lists of references were also searched for other relevant RCTs.

3. RESULTS AND DISCUSSION

During the 24-month research study period, 146 patients and 159 patients with acute appendicitis who went through appendectomies were registered in the pre-ACS model (August 2009 to July 2010) and ACS design (August 2010 to July 2011), respectively, for an overall of 305 patients. Their mean age was 42.6 6 32.5 years. Of these 305 patients, 161 were male (52.8%) and 144 were female (41.2%). Patient age, sex, preoperative condition (eg, systolic blood pressure, white blood cell count, and body temperature), and timing of operation exist in (Table 1). There were no significant differences in general demographics, application rates of CT scans, or preoperative conditions between these groups of patients. The rate of nighttime surgery among patients in the ACS model was 73% (116/159), which was substantially higher than the rate in the pre-ACS design (39%, 57/146) (P,.001).

Table 2 lists the contrasts of the key time periods in the ED in between the pre-ACS model and the ACS design. There was no significant distinction in the time required for ED registration to the surgical assessment request in between these 2 groups of patients (98.3 6 44.2 vs 104.6 6 58.7 minutes, P 5.254). The periods in between the surgical consultation request to the decision to operate and the choice to operate to the OR in ACS model patients were substantially much shorter than those in the pre-ACS design patients. Therefore, surgical decision time and total ED LOS were likewise shorter in the ACS design than the pre-ACS design.

Table 1 A comparison of demographics, timing of operation, application rates of CT scans, and preoperative conditions of patients with acute appendicitis between the pre-ACS and ACS models

	Pre-ACS (n 5 146)	ACS (n 5 159)	P value
Age	41.3 6 16.9	43.8 6 29.0	.178*
Sex, n (%)			.413†
Male	73 (50)	88 (55.3)	
Female	73 (50)	71 (44.7)	
SBP (mm Hg)	138 + 39.5	146 +57.6	.091*
Body temperature (C)	37.4 + 3.1	36.9 + 4.8	.314*
WBC (/mL)	14695 +5483.7	15312 + 7344.9	0.237*
Application rate of CT scan (%)	77.4	76.7	1.000
Timing of operation			,.001†
Day, n (%)	89 (61.0)	43 (27.0)	
Night, n (%)	57 (39.0)	116 (73.0)	

ACS model patients had a substantially much shorter medical facility LOS than pre-ACS design patients (2.44 6 1.39 vs 3.83 6 2.21 days, P 5.022). The discharge rates within 24 and 48 hours for the ACS design patients were 44% and 75.5%, respectively, whereas the rates for the pre-ACS design patients were just 2.7% and 24.7%, respectively. Neither the perforation rate nor the complication rate was substantially different in between the 2 patient groups. Under the ACS design, 4 (2.5%) patients went back to the ED within 48 hours after discharge, and 4 (2.5%) patients were readmitted within 14 days after discharge. There were no substantial differences in these 2 rates between the pre- ACS and ACS models.

The increasing requirement for coverage of basic surgical emergency situations and the diminishing population of capable basic surgeons are global concerns[12,13]. In Taiwan, less medical students and citizens are showing an interest in becoming practicing trauma cosmetic surgeons because of the heavy work, relatively low salary, and high threat of legal issues. As well as the quality of service and patient fulfillment in the ED is a present concern. The ACS design developed by the American Association for the Surgery of Trauma serves as an action to these problems[9] . Previous reports have explained the ACS model training programs and benefits[16-18].

In the management of patients with abdominal emergency situations, ED physicians provide main evaluations. If the requirement for abdominal surgery is suspected, a surgical consultation is requested. The cosmetic surgeons then carry out a secondary assessment and decide concerning whether to carry out surgery. Waiting for a surgical assessment, a decision regarding surgery, then an offered OR can frequently be lengthy. These delays might increase the possibility of ED overcrowding, which is specified as a scenario where need for acute care surpasses the capability of nurses and doctors to supply prompt quality care[19-21].ED overcrowding has actually been determined as a extensive and serious problem with unfavorable consequences that threatens patient health and promotes patient dissatisfaction[20-22]. In the existing research study, there were no substantial differences in the general demographics or preoperative conditions of patients with acute appendicitis in between the pre-ACS and ACS designs (Table 1). In addition, the time required from ED registration to surgical assessment request, which was evaluated by the very same ED doctors, was not substantially different (98.3 6 44.2 vs 104.6 6 58.7 minutes, P 5.254) (Table 2). Nevertheless, the time in between the surgical consultation request to the decision to run (184.3 6 78.2 vs 61.6 6 13.9 minutes, P,.001) and the surgical choice time (282.7 6 131.3 vs 166.2 6 92.2 minutes, P,.001) were considerably decreased after the execution of the ACS design (Table 2). Before the application of the ACS model, surgical assessment was carried out mostly by on-duty homeowners and was followed by a discussion of the patient's condition and the reaching of a decision with the on-call doctor by telephone. At times, the surgical decision might not be made in a timely manner since of uncertain details provided by inexperienced locals. The going to doctor had to go to the health center for duplicated evaluations and decisions. This scenario delayed diagnosis and treatment, adding to ED over-crowding. On the other hand, in-house injury cosmetic surgeons can provide precise medical diagnosis and shorten the time needed for assessment under the ACS model. Even in difficult cases, they can deciding precisely and with confidence. As a result, unnecessary observation or further examination can be avoided. The similar application rates of CT scans (77.4% vs 76.7%, P 5 1.000) in between these 2 models exposed that the contrast of key time periods would not be impacted by diagnostic techniques.

In addition to the surgical decision time, the accessibility of cosmetic surgeons is an issue in the evaluation of the effect of the ACS model.[7] During the day (0800 to 1700 hours), attending cosmetic surgeons with regular clinical responsibilities can assess patients with abdominal emergencies in the ED directly rather than depending on the citizens' reports. The operation can then be performed in a timely way. Therefore, the function of cosmetic surgeon availability in the ACS model is not considerable in the daytime. Patients who check out the ED at night in some cases only get conservative treatment and observation even after the choice to carry out surgery has been made. An appendectomy is carried out the next early morning after the going to doctor has actually gone back to the healthcare facility. In the current study, there were considerably more patients getting appendectomies during the night (1700 to 0800 hours) after the ACS design was implemented than during the pre-ACS design period (73% vs 39%, P,.001) although patients with abdominal emergency situations come to all hours of the day and night (Table 1). This truth might describe the considerably much shorter time required for the choice to the OR in the ACS design compared to the pre-ACS design (134.1 6 78.6 vs 436.5 6 279.3 minutes, P,.001) (Table 2). With the level of internal consultation and surgery supplied by the ACS model, definitive treatment was not delayed. Patients might undergo timely surgical treatment after the diagnosis was confirmed. Furthermore, it is frequently more efficient to carry out the emergency surgical treatments in the evening if the attending physicians and OR team are offered. The ACS design prevents disruption of the routine OR schedule or center in the daytime.

In the existing research study, the ACS design lowered both the surgical decision time and the time needed for the choice to the OR. The total ED LOS in the ACS model was substantially much shorter than in the pre-ACS model (300.3 6 61.7 vs 719.1 6 339.0 minutes, P,.001) (Table 2). Reveals that many patients (91.9%) were sent to the operating room within 6 hours after ED registration with the application of the ACS design, which considerably minimized ED overcrowding.

Table 2 A comparison of the key time intervals in the ED for patients with acute appendicitis between the pre-ACS and ACS models

Key time intervals in the ED (min)	Pre-ACS (n 5 146)	ACS (n 5 159)	P value*
ED registration to surgical consultation request (A)	98.3 +44.2	104.6 + 58.7	.254
Surgical consultation request to decision to operate (B)	184.3 + 78.2	61.6 +13.9	<.001
Decision to OR (C)	436.5 + 279.3	134.1 +78.6	<.001
Surgical decision time (A 1 B)	282.7 +131.3	166.2 +92.2	<.001
Overall ED LOS (A 1 B 1 C)	719.1 + 339.0	300.3 + 61.7	<.001

There were reports indicating a trend toward treatment of complicated appendicitis with antibiotics then considering interval appendectomy[23-25]. Similarly, the appendectomies were carried out semielectively on the next day after a duration of antibiotics in some institutions[26-27]. However, it also has been reported that the danger of perforation of appendicitis might increase because of delays in treatment.[28-29] Yardeni et al [30] reported that the risk of perforation rose 5% for each ensuing 12-hour period with untreated symptoms. Although there was no substantial distinction in the perforation rate of appendicitis in between the 2 designs in the current study, there was still a trend towards a lower perforation rate in the ACS design (17.8% vs 10.1%, P 5.072). This result might be considerable with bigger sample sizes. The perforation rate of appendicitis may be minimized by the application of the ACS model since of the much shorter time required for surgical choice making.

In addition to ED LOS, medical facility LOS was likewise significantly much shorter in the ACS model compared with the pre-ACS model (2.44 + 1.39 vs 3.83 + 2.21 days, P 5.022). More- more, 44.0% and 75.2% of ACS design patients were released within 24 and 48 hours, respectively, which were significantly higher rates than in the pre-ACS model (Table 3). Reveals that a lot of patients (19.5%) were discharged within 16 to 24 hours after admission in the ACS design, which was substantially earlier than in the pre-ACS design. Nevertheless, quality of care need to also be an issue even with a shorter healthcare facility LOS. In the present research study, there was no considerable difference in the issue rate between the 2 designs (5.5% vs. 6.3%, P 5.954). More- more, the rates of go back to the ED within 72 hours and within readmission 14 days after discharge were not considerably various in between the 2 designs. The ACS model reduced the medical facility LOS for patients with acute appendicitis however still maintained quality of care.

A limitation of the present study is the small number of cases analyzed. A possible selection bias may restrict our conclusions. In addition, the appendectomy is only an isolated treatment with restricted LOS. Our outcomes cannot compare for a more complicated operation, where continuity of care may be more important. However, the results show the advantages of the ACS model in terms of ED overcrowding and surgical outcomes. Further studies with bigger sample sizes are had to examine the expense-effectiveness and feasibility of the ACS design in other emergency abdominal surgical treatments.

Table 3 A comparison of outcomes, hospital LOS, and quality of care in patients with acute appendicitis between the pre-ACS and ACS models

	Pre-ACS (n=146)	ACS (n=159)	P value
Outcome			
Perforation, n (%)	26 (17.8)	16 (10.1)	.072*
No perforations, n (%)	120 (82.2)	143 (88.7)	.954*
Complications, n (%)	8 (5.5)	10 (6.3)	
No complications, n (%)	138 (94.5)	149 (93.7)	.022†
Hospital length of stay (d)	3.83 6 2.21	2.44 + 1.39	<.001*
Discharge within 24 hours, n (%)			<.001*
Yes	4 (2.7)	70 (44.0)	
no	144 (97.3)	89 (56.0)	
Discharge within 48 hours, n (%)			0.759*
Yes	36 (24.7)	120 (75.5)	
no	110 (75.3)	39 (24.5)	
Quality of care			.420*
Return to the ED within 48 hours after discharge,n (%)			
Yes	2 (1.4)	4 (2.5)	
No	144 (98.6)	155 (97.5)	
Readmission within 14 days after discharge, n (%)			
Yes	1 (.7)	4 (2.5)	
No	145 (99.3)	155 (97.5)	

4. CONCLUSION

The application of the ACS model might reduce both the ED LOS and hospital LOS in patients with acute appendicitis. Our present study results showing the advantages of the ACS model are in accordance with those discovered in North America in regards to the surgical treatment of acute appendicitis.

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