

# Effect of an acute care surgical service on the timeliness of care

Andrea M. Faryniuk, MD  
David J. Hochman, MD

From the Department of Surgery,  
University of Manitoba, Winnipeg, Man.

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**Correspondence to:**  
A.M. Faryniuk  
383 Cordova St.  
Winnipeg MB R3N 1A5  
faryniuk.andrea@gmail.com

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**Background:** In the spring of 2008, St. Boniface General Hospital in Winnipeg, Man., created an acute care surgical service (ACSS) designed to improve care for emergent, nontrauma surgical patients. We sought to assess the effect of the ACSS on patient care timeliness.

**Methods:** We retrospectively examined the time intervals in care for patients admitted with acute appendicitis, acute cholecystitis and small bowel obstruction in 3 study periods: pre-ACSS, newly formed ACSS and established ACSS.

**Results:** There was a 2-fold increase in patient volume after the ACSS was created. Patient characteristics were similar in all 3 groups. Time from triage to surgical consultation was also similar. The ACSS significantly reduced the duration of the surgical consultation (1 h 43 min in period 1 v. 62 min in period 2 and 49 min in period 3,  $p = 0.029$ ). Time from admission to operation was similar despite a significant increase in patient load after the ACSS was created. Total length of hospital stay was similar except in the subgroup analysis (appendicitis + cholecystitis only), where the length of stay was reduced after creation of the ACSS (2 d 15 h pre- v. 1 d 19 h post-ACSS,  $p = 0.009$ ). Most operations occurred between 4 pm and midnight.

**Conclusion:** With the implementation of an ACSS, the number of surgical patients assessed and treated doubled. Despite the increased volume, consultations were completed significantly faster, there was no significant difference in time to operation, and on subgroup analysis length of hospital stay was significantly faster.

**Contexte :** Au printemps 2008, l'Hôpital général de Saint-Boniface, à Winnipeg, au Manitoba, s'est doté d'un service de chirurgie de courte durée (SCCD) dans le but d'améliorer les soins aux patients qui doivent subir une chirurgie urgente non d'origine traumatique. Nous avons voulu mesurer l'impact du SCCD sur la rapidité avec laquelle les patients ont eu accès aux soins requis.

**Méthodes :** Nous avons examiné de manière rétrospective combien de temps les patients admis pour appendicite aiguë, cholécystite aiguë et obstruction du grêle ont attendu avant de recevoir leur traitement au cours de 3 périodes distinctes : avant la création du SCCD, au moment de son déploiement et depuis son établissement.

**Résultats :** On a noté que le volume de patients traités a doublé après la création du SCCD. Les caractéristiques des patients des 3 groupes étaient similaires. Les délais entre le triage et la consultation en chirurgie étaient également similaires. Le SCCD a significativement abrégé la durée de la consultation en chirurgie (soit de 1 h 43 min à la période 1 c. 62 min à la période 2 et 49 min à la période 3,  $p = 0,029$ ). Le délai entre l'admission et l'intervention est resté similaire malgré l'augmentation significative du nombre de patients après la création du SCCD. La durée totale du séjour hospitalier est restée inchangée, sauf dans l'analyse des sous-groupes (appendicite + cholécystite seulement), selon laquelle la durée du séjour a diminué après la création du SCCD (2 j 15 h pré-SCCD c. 1 j 19 h après SCCD,  $p = 0,009$ ). La plupart des interventions ont été effectuées entre 16 heures et minuit.

**Conclusion :** Avec la mise en place d'un SCCD, le nombre de patients de chirurgie évalués et traités a doublé. Et malgré cet accroissement de volume, les consultations ont eu lieu significativement plus rapidement. On n'a noté aucune différence significative quant au délai précédant l'intervention et à l'analyse des sous-groupes, la durée des hospitalisations a été significativement plus brève.

Acute care surgical services (ACSS), designed to care for emergent nontrauma surgical patients, have recently come into existence in both the United States and Canada, but owing to independent forces. In the United States, the number of operations performed by trauma surgeons has declined, and thus the interest of surgical trainees in trauma has also declined.<sup>1-4</sup> The American acute care surgery model, integrating trauma and emergency surgery, has been implemented to provide an increased operative workload for trauma surgeons and more efficient care for the increasing emergent surgical patient population.

In Canada, the traditional model has relied on an elective subspecialized service to take on the emergent surgical patient load. Tight scheduling of operative, clinic, research and academic time has made care for emergency surgical patients in this setting exceedingly difficult and often ill-timed. As a result, emergency procedures have often been done at the end of busy elective slates or through the night, with a negative impact on the surgeon's daytime schedule.

The ACSS model described in this study has a dedicated surgeon committed for a full week, Monday to Sunday, 8 am to 4 pm, focused on the efficient care of the emergent nontrauma surgical patient. Surgeons are thereby allowed to focus completely on their elective practices when not on the ACSS. As proven in previous studies from the United States, ACSS models are more efficient in terms of more surgery being performed during regular work hours, decreased delay to surgery, reduced length of hospital stay and decreased procedure times.<sup>5-8</sup> In a recent Canadian study on appendicitis, the creation of an ACSS resulted in faster time to surgery and decreased emergency department crowding.<sup>9</sup> Regardless of the different pressures that have led to the creation of both the American and Canadian ACSS models, there is a common goal of more efficient and effective care of the emergent surgical patient.

The ACSS at the St. Boniface General Hospital in Winnipeg, Manitoba, has been designed to care for nontrauma emergent surgical patients and consists of a dedicated, on-site weekly staff surgeon, with a fresh surgeon on home-call at night, exclusively for the ACSS. This study was designed to evaluate the timeliness of patient care within the ACSS since its implementation.

## METHODS

We performed a retrospective chart review for 3 separate time periods.

- Period 1 (June 1–Aug. 31, 2007): a pre-ACSS period in which the elective services accommodate emergent surgical patients.
- Period 2 (June 1–Aug. 31, 2008): the newly formed ACSS period, after a 2-month introduction and adjustment period.
- Period 3 (June 1–Aug. 31, 2009): the established ACSS period, 1 year after creation of the ACSS.

All patients who presented to the St. Boniface General Hospital with acute appendicitis, acute cholecystitis and small bowel obstruction were identified by health records and included in the study. Patients' demographic data were collected in addition to the times of presentation to the emergency room (triage time), the emergency department consultation, the surgical team response, admission, operation and discharge. Critical to this study was the acquisition of accurate time points for analysis and comparison. Time data were collected by emergency physicians; emergency, operative and ward nurses; and surgical residents and entered in the permanent medical record. We retrospectively retrieved data on these time points from standard locations within the medical charts. We calculated 5 separate time intervals:

1. time from triage to emergency consultation (how long it took the emergency physician to decide whether the patient required a surgical consult),
2. time from emergency consultation to surgical team response (how long it took the surgical team to arrive at the bedside once the surgical consultation was initiated),
3. time from surgical team response to admission (how long it took the surgical team to assess the patient and determine whether the patient required admission),
4. time from admission to operation, and
5. total length of hospital admission.

We compared these time intervals for all 3 time periods studied. The University of Manitoba Research Ethics Board and the St. Boniface Research Review Committee approved our study protocol.

## Statistical analysis

We used SPSS software version 15.0 for Windows for data analysis. Comparison of categorical variables was performed using Fisher exact tests, and comparison of continuous variables was performed using Student *t* tests or analysis of variance (ANOVA). Mean times were reported in minutes, hours or days, as appropriate.

## RESULTS

We identified 67 patients from the pre-ACSS period for this study. However, 142 patients from period 2 and 137 from period 3 were identified, representing a doubling in patient volume. In all 3 time periods studied, about 50% of patients presented with acute appendicitis. In 2008 compared with the other 2 study periods, in the newly formed ACSS, significantly more patients presented with cholecystitis, and fewer patients presented with bowel obstruction, although this difference was not significant (Table 1).

Patient demographic characteristics were similar for all 3 time periods (Table 1). In each time period, more than 90% of patients presenting with acute appendicitis and more than 60% presenting with acute cholecystitis proceeded to

operative management. There was variable progression to operation with the presentation of small bowel obstruction.

The time from triage to emergency department consultation was not significantly different among the 3 groups. Emergency assessment time (presurgical consult) ranged from 3 to 4 hours on average for all 3 time periods.

The creation of the ACSS resulted in significantly faster intervals from emergency consultation to surgical team response. During period 1, the average time to respond to a surgical consultation was 1 hour 43 minutes; the average decreased to 62 minutes in period 2 and 49 minutes in period 3. Time from surgical team response to admission was unchanged between the pre-ACSS and both ACSS groups, with the average surgical assessment requiring 2 hours and 30 minutes. Overall, the time in the emergency department once the ACSS was involved in patient care was faster than with the previous standard. In period 1, the average length of hospital stay was 4 hours 4 minutes; the average decreased to 3 hours 46 minutes in period 2 and to 3 hours 9 minutes in period 3.

**Table 1. Demographic characteristics and distribution of patients by diagnosis in the pre-ACSS, the newly formed ACSS and the established ACSS study periods**

Variable	Period 1, pre-ACSS, 2007	Period 2, newly formed ACSS, 2008	Period 3, established ACSS, 2009	<i>p</i> value
Diagnosis, no. (%)				
Appendicitis	35 (52)	77 (54)	75 (54)	
Cholecystitis	5 (8)	39 (28)	9 (7)	
Obstruction	27 (40)	26 (18)	53 (39)	
Total	67 (100)	142 (212)	137 (204)	
Mean age, yr	50.8	45.5	49.7	0.10
Sex, no. (%)				0.75
Female	29 (43)	69 (49)	66 (48)	
Male	38 (57)	73 (51)	71 (52)	

ACSS = acute care surgical service.

There was no significant difference among the 3 periods in time from admission to operation, but we observed a trend toward faster time to surgery after the ACSS was created. The average time to surgery in period 1 was 14 hours; the average decreased to 11 hours in period 2 and 7 hours in period 3 (Table 2).

As a whole, for the individual diagnoses, we observed a decrease in time from emergency triage to operative intervention (Table 3).

There was no significant difference in total length of hospital stay among the 3 time periods, with the average duration of admission ranging from 3 to 4 days (Table 2). On subgroup analysis, including patients who presented with acute appendicitis and cholecystitis but eliminating patients who presented with bowel obstruction, there was a significant improvement in total length of hospital stay. During period 1, the average length of hospital stay for those presenting with appendicitis and cholecystitis was 2 days 21 hours compared with 1 day 23 hours in period 3 ( $p = 0.009$ ).

For period 3, we assessed the time of day of surgery. We found that out of a total of 109 procedures, 34 (31%) occurred between 8 am and 4 pm, 54 (50%) occurred between 4 pm and midnight and 21 (19%) occurred between midnight and 8 am. Overall, 69% of operations occurred outside of regular work hours. These results are similar to the timing of operations both in the pre-ACSS (period 1) and within the newly formed ACSS (period 2; Table 4).

## DISCUSSION

As part of the introduction of the ACSS, there was consolidation of emergency surgery care in the city of Winnipeg. Several smaller hospitals no longer provided emergency surgical care, thus patients were referred to St. Boniface for surgical consultation, which explains the doubling of patient volume seen after the ACSS was created.

**Table 2. Comparison of time intervals among the 3 study periods**

Period	Time ( <i>p</i> value*)		
	Emergency consult to surgical team response	Admission to operation	Total length of hospital stay
Period 1, pre-ACSS, 2007	103.1 min	850.5 min/14 h 10 min	5803.8 min/4 d 0 h 44 min
Period 2, newly formed ACSS, 2008	61.6 min (0.029)	667.3 min/11 h 7 min (0.50)	4534.6 min/3 d 3 h 34 min (0.049)
Period 3, established ACSS, 2009	48.9 min (0.002)	453.4 min/7 h 33 min (0.10)	5677.6 min/3 d 22 h 38 min (0.91)

ACSS = acute care surgical service.  
\*Compared with period 1 (pre-ACSS, 2007).

**Table 3. Time from emergency department presentation to operative intervention**

Presentation	Period 1, pre-ACSS	Period 2, newly formed ACSS	Period 3, established ACSS
Appendicitis	12 h 35 min	11 h 12 min	11 h 19 min
Cholecystitis	20 h 58 min	1 d 10 h 6 min	10 h 1 min
Obstruction	2 d 0 h 6 min	1 d 18 h 17 min	16 h 32 min

ACSS = acute care surgical service.

Time from triage to surgical consultation was unchanged throughout this study, representing consistent emergency practices throughout all 3 time periods.

Despite a doubling in patient volume, the time to response by the ACSS team was significantly faster, illustrating that with a dedicated service, requests for surgical consultations were answered more efficiently. Time from consultation to admission was unchanged, as assessment of a surgical patient necessitates time for a history and physical examination, but also for laboratory testing and imaging, which in our study required an average of 2 hours 30 minutes to complete (data not shown), partly owing to delays inherent in ancillary services. Although the time to assess patients was unchanged, the overall time the patient spent in the emergency department once the ACSS was involved decreased. Thus the ACSS immediately improved patient flow through the emergency department. It is important to note that at St. Boniface, surgical beds are separate from medical beds, and surgical beds are rarely an issue for direct admission. Data on whether other surgical services or elective operations were affected by the creation of the ACSS were not collected.

Time to operation was no different among the pre- and post-ACSS periods, but this must be taken in the context of a doubling of patient volume after the establishment of the ACSS. This is in contrast to the findings of some ACSS services, indicating that in the context of acute appendicitis, the presence of an in-house acute care surgeon significantly decreased the time to operation.<sup>6,9</sup> When considering patients with acute cholecystitis, Lehane and colleagues<sup>8</sup> reported that an ACSS model decreased the median time to surgery; however, Ekeh and colleagues<sup>7</sup> found no improvement in time to surgery with the presentation of appendicitis in their ACSS model.

In the present study, 63%–69% of emergency surgical operations occurred outside of regular work hours (4 pm to 8 am), illustrating a restricted access to the operating room during regular daytime hours. Dedicated operating time during the day would have a direct impact on patient throughput and timeliness of care. Given resource restrictions, this was not possible for the ACSS at the time of our study. This is in direct contrast to findings of a study of an American ACSS model, which reported that in the year before implementation of an ACSS model, 55.4% of emergent procedures were performed during a regular workday between the hours of 7:30 am and 5:30 pm, and improved to

70% after implementation of their ACSS model.<sup>5</sup> This is in stark contrast to our findings, suggesting that direct access to operating room resources would improve timeliness of care for surgical patients within the context of the ACSS.

There was no difference in total length of hospital stay when all diagnoses were considered, but our subgroup analysis including appendicitis and cholecystitis but excluding bowel obstruction demonstrated that the ACSS decreased the length of stay (1 d 23 h in period 3 v. 2 d 21 h in period 1). This result highlights the efficiency of a dedicated surgical team in the management of patient flow. Our findings of shorter hospital stay were echoed by Earley and colleagues<sup>6</sup> and Lehane and colleagues<sup>8</sup> when considering acute appendicitis and acute cholecystitis, respectively.

This was a retrospective study, thus a decrease in time intervals for the study patients did not come at the expense of other patients with alternate surgical diagnoses also seen by the ACSS during the study. In fact, the very acute surgical emergencies (e.g., perforated viscus, ischemic bowel, necrotizing fasciitis) that take priority during triaging were not included in our study. We felt that because these patients take priority, with the creation of ACSS, the timeliness of care for these individuals would have also been significantly improved.

### Limitations

Limitations of our study include a relatively small number of patients evaluated in each group (most certainly a reflection of the 3-month periods studied), perhaps leading to an inability to establish significance in many of the care time periods examined. Our study was limited to 3 diagnoses (appendicitis, cholecystitis and bowel obstruction) and did not consider the many other diagnoses managed by the ACSS, including perforated viscus, diverticulitis, ischemic colitis and acute general surgical diagnoses. Whether the efficiency observed after the introduction of the ACSS exists within the context of these other disease processes is unknown, and we can only extrapolate based on the disease processes studied.

It was also impossible to evaluate whether other emergent surgical cases, such as perforated viscus, superseded or “bumped” surgery for patients with appendicitis, cholecystitis or bowel obstruction, thereby delaying the time to surgical intervention in our study.

The inclusion of bowel obstruction has affected our

Table 4. Timing of operations

Period	Total procedures	Time of surgery; no. (%)			
		8 am to 4 pm	4 pm to midnight	Midnight to 8 am	4 pm to 8 pm
Period 1, pre-ACSS	51	19 (37)	26 (51)	6 (12)	32 (63)
Period 2, newly formed ACSS	107	38 (36)	54 (50)	15 (14)	69 (64)
Period 3, established ACSS	109	34 (31)	54 (50)	21 (19)	75 (69)

ACSS = acute care surgical service.

ability to truly evaluate both the time to operation and total length of hospital stay, as the treatment of obstruction usually commences with a trial of conservative management, thus naturally lengthening these time intervals. In retrospect, perhaps this diagnosis should not have been included. Future studies include staff and resident satisfaction and perceived efficiency of the ACSS.

## CONCLUSION

In Canada there has been a trend toward the creation of ACSS models.<sup>9,10</sup> In our institution, the creation of a dedicated ACSS allowed for surgeons and the resident team to focus on the care of nontrauma emergency surgical patients, with an overall improvement of patient flow and improved efficiency.

**Competing interests:** None declared.

**Contributors:** Both authors contributed to study design, data analysis and article review, and both approved publication. A.M. Faryniuk acquired the data and wrote the article.

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