

Emergency general surgical admissions

Prospective institutional experience in non-traumatic acute abdomen: Implications for education, training and service

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ABSTRACT

Objectives: To assess the pattern of non-traumatic acute abdomen (NTAA) in emergency general surgical admissions in Saudi Arabia (SA) and highlight the implications for education, training and patient care.

Methods: A prospective study including all emergency general surgical admissions with NTAA at King Fahd Hospital of the University, Al-Khobar, SA over a 2-year period from October 2001 to September 2003.

Results: There were 3,706 general surgical admissions; 1,661 (45%) electives and 2,045 (55%) emergencies. A total of 1,096 admissions (mean age 27.6 years, 73% males) with NTAA were analyzed. Acute appendicitis was the most common diagnosis (47%), followed by non-specific abdominal pain (19%), gallstone disease (11%) and intestinal obstruction (8%). Surgical intervention

was indicated in 65% of the admissions; 77% of these had appendectomy. There were 35 patients (3%) with malignancy, and 12 hospital deaths (1%). The mean length of hospital stay (LOS) was 6.6 days. The LOS increased significantly with age.

Conclusions: In our setting, NTAA was the most common cause for general surgical admissions, accounting for 30% and 54% of the total surgical and emergency surgical admissions respectively. Most of the patients were young and acute appendicitis was the most common diagnosis. Further National/regional multicenter studies are needed to assess the trend of emergency surgical admissions and their impact on surgical practice, overall health care costs, medical education and training in SA.

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Over the past few years, we have observed in various departmental academic and clinical activities, such as morning reports and grand rounds that the number of emergency admissions to the department have increased. Recent literature also indicates a continuing rise in the overall numbers of emergency admissions¹ including surgical emergencies² requiring re-thinking in health management. Although non-

traumatic acute abdomen (NTAA) is a common cause for emergency surgical admissions, there is relatively scant literature on its general pattern worldwide. Most studies on NTAA are limited to specific age groups particularly elderly patients presenting with malignancy.³ In addition to the geographical differences, the pattern of NTAA may change over time in the same country. For example, non-specific

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abdominal pain (NSAP) remains the most common diagnosis among emergency surgical admissions with NTAA in the United Kingdom (UK),^{2,4,5} and acute appendicitis has replaced intestinal obstruction as the leading cause of NTAA in Nigeria.⁶

Several authors from Saudi Arabia (SA) have reported their experience with abdominal trauma,^{7,8} but to the author's knowledge, no previous study has reported the frequency nor the pattern of emergency surgical admissions in SA. The aims of this prospective study were to assess the pattern of NTAA in all emergency general surgical admissions at a University hospital, the outcome of management and the length of stay (LOS), and to highlight the impact its findings may have on education, training and service.

Methods. This prospective study included all general surgical patients with NTAA who were admitted from the emergency room at King Fahd Hospital of the University (KFHU), Al-Khobar, SA, from October 2001 to September 2003. The department of general surgery at KFHU has 50 beds and provides a 24-hour coverage 7-days a week for all adult and pediatric surgical emergencies except emergencies admitted under orthopedic, urological and neurosurgical services that are independent. The KFHU is the only academic institution in the region that offers clinical undergraduate courses and internship training and is accredited for postgraduate training in all surgical and non-surgical specialities. It is also affiliated to faculty of Nursing and the College of Applied Medical Sciences in King Faisal University, Dammam, SA. It is not a purpose-built facility but has been adapted over the years to meet the secondary and tertiary needs of patients and training.

For the purpose of this study, acute abdomen was defined as "abdominal pain of acute onset and of less than one week duration at the time of admission".⁹ A diagnosis of NSAP was made when no cause for the abdominal pain was found during the current admission.¹⁰ The data were collected by on-duty surgical residents using a standard data-collection form. The data included patients' demographics, method of treatment, histology report, clinical outcome and final diagnosis. Data sources were patients' charts, the hospital data base as well as the wards admission and operation room logbooks. The total number of elective and emergency general surgical admissions were recorded for comparative

uses. The form entries were checked and validated by the author before computer input and analysis of the data.

Statistical analysis was performed with SPSS version 10.0 for Windows. Descriptive statistics were used. Mean and standard deviation were used for quantitative variables. Independent t-test was used for comparison between two groups. Levene test was used to determine if the variances were equal. If this assumption did not hold, Mann-Whitney U-test was used to compare between two groups. One-way analysis of variance (ANOVA) or Kruskal-Wallis test was used for comparing means of more than two groups. A *p* value <0.05 was considered statistically significant.

Results. There were 3,706 general surgical admissions; 1,661 (45%) electives and 2,045 (55%) emergencies. Of these, 1,067 were admitted with NTAA. Twenty-seven patients were admitted more than once with a maximum of three re-admissions, making a total of 1,096 emergency surgical admissions with NTAA. There were 803 males and 293 females with a mean age of 27.6 years (range: 1 day to 93 years). Most of the patients were in the second, third and fourth decades; 82.6% were below the age of 40 years (**Figure 1**).

Acute appendicitis was the most common diagnosis, followed by NSAP, gallstone disease and intestinal obstruction; these diagnoses were significantly more common among patients below 40 years of age (**Table 1**). Of the 86 patients with intestinal obstruction, 25 had adhesions, 20 had complicated hernias, 11 had malignant disease and the rest had less common

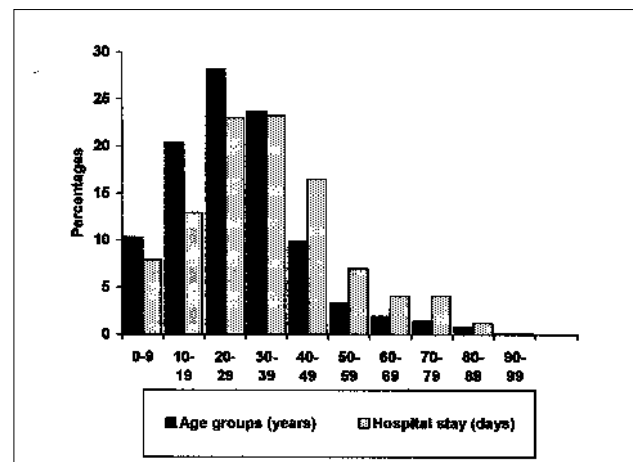


Figure 1 - Hospital stay according to age distribution in 1096 emergency general surgical admissions with non-traumatic acute abdomen.

Table 1 - Final diagnoses in 1,096 admissions with non-traumatic acute abdomen, and in patients aged < 40 years and ≥ 40 years.

Diagnosis	No. of admissions			
	Total (n=1096)	Age <40 years (n=905)	Age ≥ 40 years (n=191)	p-value
Acute appendicitis	520 (47.4)	484 (53.5)	36 (18.8)	<0.001
Non-specific abdominal pain	203 (18.5)	187 (20.7)	16 (8.4)	0.007
Gallstone disease	125 (11.4)	70 (7.7)	55 (28.8)	<0.001
Intestinal obstruction	86 (7.8)	55 (6.1)	31 (16.2)	0.002
Perforated duodenal ulcer	25 (2.3)	16 (1.8)	9 (4.7)	0.027
Urological diseases	25 (2.3)	21 (2.3)	4 (2.1)	NS
Pancreatic diseases	21 (1.9)	9 (1.0)	12 (6.3)	0.001
Gynecological diseases	21 (1.9)	17 (1.9)	4 (2.1)	NS
Gastroduodenal diseases ^a	17 (1.6)	10 (1.1)	7 (3.7)	0.023
Colonic diseases	15 (1.4)	6 (0.7)	9 (4.7)	0.005
Liver diseases	7 (0.6)	7 (0.8)	0	NS
Sickle cell crisis	7 (0.6)	7 (0.8)	0	NS
Medical diseases	6 (0.5)	5 (0.6)	1 (0.5)	NS
Miscellaneous	18 (1.6)	11 (1.2)	7 (3.7)	0.035
Values in parentheses are percentages, NS - not significant, ^a Other than perforated duodenal ulcer				

Table 2 - Types of malignancy in 35 admissions with non-traumatic acute abdomen.

Type	No. of patients
Colorectal carcinoma	11
Colonic carcinoma	10
Rectal carcinoma	1
Gastric carcinoma	4
Pancreatic carcinoma	4
Ovarian carcinoma	3
Cholangiocarcinoma	2
Abdominal lymphoma	2
Ampullary carcinoma	2
Neuroblastoma	2
Miscellaneous ^a	5
^a One case each of carcinoma of the appendix, duodenum, small intestine, gallbladder and testis	

Table 3 - Management of 1,096 emergency general surgical admissions with non-traumatic acute abdomen.

Management	No. of patients (%)
Not-operated	382 (35)
Operated	714 (65)
Appendectomy	551
LC	55
Diagnostic laparoscopy	30
Simple closure of perforated DU	25
Bowel resection	19
Hernia surgery	18
Miscellaneous	16
LC - laparoscopic cholecystectomy, DU - duodenal ulcer	

Table 4 - Final diagnoses in 66 patients with negative appendectomy.

Diagnosis	Males	Females	Total
NSAP	36	19	55
Ovarian cyst	0	4	4
Mesenteric adenitis	1	1	2
Perforated colonic diverticulosis	1	1	2
Perforated Meckle's diverticulum	1	0	1
Perforated duodenal ulcer	1	0	1
Crohn's disease	1	0	1
Total	41	25	66
NSAP - non-specific abdominal pain			

causes. Thirty five (3.2%) patients had malignancy; 10 were below the age of 40 years and 25 were aged 40 years or above (**Table 2**).

Surgical intervention was indicated in 714 (65%) patients. Appendectomy was the most frequent operation performed in 551 patients (**Table 3**). A total of 66 patients (12%) had histologically normal appendices; in these patients NSAP was the most common final diagnosis (**Table 4**). Diagnostic laparoscopy, and closure of perforated duodenal ulcer were carried out in 30 and 25 patients respectively and intestinal resection and hernia surgery were other but less frequent procedures. Laparoscopic cholecystectomy was performed in just under half (44%) of those admitted with the diagnosis of gallstone disease.

A total of 12 (1%) patients (8 males and 4 females) died in the hospital; nine were 40 years old or above.

Table 5 - Literature review of emergency surgical admissions with acute abdomen.

Author Year-Country	No. of admissions	Mean Age (years)	Most common diagnosis (%)	Malignancy (%)	Operation (%)	Mortality (%)
Irvin ⁴ 1989-UK	1190	46	NSAP (34.9)	3	47.3	4.4
Datubo-Brown ¹¹ 1990-Nigeria	279 ^a	NS	Appendicitis (51.2)	NS	NS	13.3
Hawthorn ⁵ 1992-UK	525	36	NSAP (36)	3.2	34.7	3.3
Al-Mulhim 2006-Saudi Arabia	1096	27.6	Appendicitis (47.4)	3	65	1
^a Number of patients, NSAP - non-specific abdominal pain, NS - not stated.						

The cause of acute abdomen was colonic carcinoma in four cases, and one case each of lymphoma, gallbladder carcinoma, gastric carcinoma, intestinal tuberculosis, peritonitis and megacolon. The final diagnosis was not made in 2 cases. In 9 patients emergency surgical intervention was required; seven underwent intestinal resection and 2 had biopsies.

The total hospital stay for the 1,096 admissions was 7,220 inpatient-days, with a mean of 6.6 days (range 1-93 days). There was a significant difference ($p < 0.001$) among age groups; patients younger than 40 years had a mean stay of 5.3 days while those aged ≥ 40 years stayed for a mean of 12.5 days. Overall 81% of admissions stayed for five days or less while only 7.6% stayed longer than a week before discharge or death. Although patients aged 40 years and above accounted for 17.4% of total admissions, they accounted for 33% of the total stay. This effect of age on hospital stay is shown in **Figure 1**.

Discussion. The results of this study show that more than half (54%) of all emergency general surgical admissions are due to NTAA, and that they are young with the majority in their second, third and fourth decades - an experience similar to UK⁵ and Nigeria.¹¹ However, the mean age of 27.6 years is almost 10 years⁵ and 20 years⁴ younger than those reported from UK (**Table 5**). This reflects the majority young population of SA¹² and may be relevant in the disease demography (**Table 1**) and health service planning. It also supports the result that acute appendicitis as a diagnostic group makes up almost half (47.4%) of all general surgical admissions with NTAA. Like Nigeria¹¹ it is probably a sign of changing social habits and diet in the young. This trend is contrary to reports from the UK where appendicitis as a diagnosis in one out of five NTAA admissions probably represents

an emphasis on healthy eating.^{2,4,5} Non-specific abdominal pain, labeled by some as an 'expensive mystery'¹⁰ is now dominant ($>30\%$) diagnosis in UK.^{2,4,5} Although this diagnosis was made in less than 20% of our admissions, we are mindful that 10% of patients over the age of 50 years with NSAP may harbor gastrointestinal malignancy.¹³

Gallstone disease, destined to become a day case management entity,¹⁴ ranked third in this study (11.4%). It occupies middle position between low of Africa⁶ and high of UK.^{2,4,5} However, we have in a previous study documented increased rates of cholecystectomy after the introduction of laparoscopic cholecystectomy,¹² and this tends to support the findings of Tamimi and colleagues that this rise is real.¹⁵ This finding is expected to influence health service strategies and education in the future.

Intestinal obstruction, although fourth most common diagnosis encountered in our admissions, occurs with the same frequency as in the UK^{4,5,9} but at one quarter of the frequency reported from Nigeria (7.8 versus 34.2%) where it is the second most common cause of emergency surgical admissions.^{6,11} Considering that adhesions are the main cause for obstruction in our admissions and the relatively low frequency of intestinal obstruction indicates better primary care service and early referral in SA, the level of care and integration not yet achieved in Africa.¹⁶

The small number of admissions (0.5%) with acute abdomen due to sickle cell crises in our endemic region surprised us at first, but is understandable. The majority of these patients are children or adolescents who are primarily admitted to non-surgical care, referred to surgeons only when the physicians suspect a surgical reason. We do emphasize on the students and trainees that a sickler is as likely to suffer from say acute appendicitis as the non-sickler.

Colonic diverticular disease is infrequent in our region but the perception is that it is seen and diagnosed more frequently with availability of advanced imaging. Chronic vascular disease as manifestation of diabetes is prevalent in our community but ruptured abdominal aortic aneurysm is not yet a problem here. Quite surprisingly, given the young population structure here, 3% of our admissions were due to malignancy with colonic carcinoma as the most common type and this is similar to rates from the UK.^{4,5}

Surgical intervention was needed in 65% of the admissions; appendectomy accounted for 77% of the operations, followed by laparoscopic cholecystectomy, diagnostic laparoscopy and simple closure of perforated peptic ulcer. While the reported incidence of negative appendectomy is 11-25%,^{4,5,17,18} only 12% of appendices removed were histologically normal despite the fact that our admissions with suspected acute appendicitis are managed and operated upon by surgical trainee residents with limited experience. The routine evaluation of females of reproductive age by gynecologists, liberal use of ultrasound, and increasing deployment of diagnostic laparoscopy in patients with acute abdomen, may explain, in part, the low incidence of negative appendectomy in our admissions. Laparoscopic intervention for gallstone disease and other causes of acute abdomen was the second most common procedure in this study illustrating the emerging role of laparoscopy in patients with NTAA. The success of laparoscopic cholecystectomy with low and manageable rate of complications has already prompted the service planners in our institution to embark on short-stay surgical unit, re-organization of anesthesia service and perioperative care. In the long term, therefore, training strategies and educational profile of the institution may look different from what it is now.

A comparatively low (4 days or less) hospital stay in the majority of our patients foretells the shape of things to come. Understandably the hospital stay for the older age group (≥ 40) was significantly longer as is the experience of others.⁴ Co-morbidities are much more frequent in the elderly demanding different and time consuming as well as expensive diagnostic and management approach. Social issues too are more prevalent in this age group where an early discharge may not be an option.

The tide of emergency admissions has been rising for the last 2 decades¹⁹ and the plateau is not likely to be reached soon. It appears to be a global phenomenon.²⁰ What does this all mean in our setting? Are we truly becoming emergency surgeons?²⁰ This may perhaps be an over statement but it does suggest that emergency room services need to be

reconfigured, and inpatient organization must match that configuration. The fact that 35% of NTAA patients are admitted and not operated, is there way to reduce these admissions to prevent erosion of elective beds? Perhaps an intelligent use of Helical CT in NTAA as a diagnostic service may improve the diagnostic rate as shown in the study by MacKersie et al.²¹

The rising emergency admissions have implications for both undergraduate and postgraduate training in Surgery. This concern has been strongly expressed by the Associations of Surgeons of Great Britain and Ireland,²² and others.²³ It is obvious that today's surgical trainee must be exposed to emergency surgical practice as an essential component of training. If the elective beds are not enough to admit a patient mix for students and trainees then provision must be made for ambulatory facility for adequate trainee exposure. It is also incumbent upon national policy makers that the charter for clinical training includes provision for training and education in other health organizations including private sector²⁴ that may cater for emergencies but is prone not to handle complicated cases.

The question of cost is crucial. It was estimated that during the study period, the cost for a total hospital stay of 7,220 days (excluding costs of other services such as investigations and surgical interventions) was approximately SR8,000,000 (\$2,130,000). This could be reduced if appropriate options are used to configure the services at regional and national level. In SA, most health organizations are self-contained within tight boundaries and for diagnostic facilities. The burgeoning private sector is subsidized too but does not contribute to education and training and this may have bearing on public health sector spending.²⁵ Although there are a number of models^{19,26,27} that could be adapted in rationalizing services, we are of the opinion that there is a strong case for regionalization of specialist centers, such as trauma, neurosurgery, pediatric surgery, and others.

However, before any changes are made to existing structure, it is important that evidence must be collected by much larger collaborative study with participation by all health sectors in determining the current and future needs of the community.

In conclusion, NTAA was the most common cause of emergency general surgical admissions at KFHU. Most of the admissions were young and acute appendicitis was the most common diagnosis. It is evident that the clinical map in emergency surgical practice is changing rapidly. This change has direct implications for elective surgery, education and training. Training authorities in surgery must produce emergency-competent and not only "emergency-safe

surgeons". Evidence-based studies are needed to configure emergency and other services, as well as education.

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