

## An analysis of missed cases with surgical emergencies admitted in non-surgical departments. Case series and a review of the literature

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*"Experience is the name everyone gives to their mistakes"*  
Oscar Wilde

**SUMMARY: An analysis of missed cases with surgical emergencies admitted in non-surgical departments. Case series and a review of the literature.**

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**Introduction.** *The delayed diagnosis in emergency surgery can be associated with significant morbidity and mortality and often lead to litigations. The aim of the present work is to analyse the outcome in cases with non-trauma surgical emergencies wrongly admitted in non-surgical departments.*

**Methods.** *A retrospective trial in two independent University hospitals was conducted. The first group encompassed the patients worked-up in the Surgical unit of Emergency department (2014-2018). The second one included all cases visited Emergency department (2018). Only cases with acute abdomen and delayed diagnosis*

*and operation were included. The analysis included the proportion of the delayed diagnosis, time between admission and operation, intraoperative diagnosis, complications and mortality rate.*

**Results.** *In the first group there were 30 194 visits in the surgical unit with 15 836 hospitalizations (52.4%). Twenty patients of the last (0.13%) were admitted in the Clinic of Infectious disease and subsequently operated. The mean delay between hospitalization and operation was 3 days (1-10). Seventeen patients (85%) were operated with mortality of 10%. In the second group, there were a total of 22 760 visits with 11 562 discharged cases. Of the last, 1.7% (n=192) were re-admitted in a surgical ward, 25 of which underwent urgent surgery (0.2%).*

**Conclusions.** *The missed surgical cases represent only a small proportion of the patients in emergency department. The causes for wrong initial admissions in our series were misinterpretation of the symptoms, insufficient clinical examination and underuse of US and CT. The careful clinical assessment, point-of care US and CT may decrease the rate of the delayed diagnosis.*

KEY WORDS: Emergency surgery - Delayed diagnosis - Missed cases - Surgery - Outcome.

### Introduction

As M. Schein noted in the emergency surgery the situation is *"always the same: you confronting a patient, he – in pain, suffering and anxious. And you are*

*anxious as well – anxious about the diagnosis, concerned about which is the best management, troubled about your own abilities to do what is correct ... The time is changing' but, practically, nothing has changed; it is the patient and you (often with the entire 'system' against you) – you who are bound to provide a correct management plan and execute it"* (1).

Despite the routine every acute surgery patient represent an unique case requiring prompt and time-limited decisions and actions. A recent paper of World Society of Emergency Surgery (WSES) *"highlights the difficulty for the emergency general surgeon to plan and endorse appropriate management schemes to optimize timely treatment."* (2).

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The aim of the present study is to analyse the rate and outcome of the cases with non-trauma surgical emergencies wrongly admitted in non-surgical departments and experiencing a delay of the diagnosis and surgical intervention.

## Patients and methods

A multicenter retrospective trial in two independent University hospitals was conducted. The first one is Military Medical Academy, Sofia, which is a teaching hospital and tertiary center for the whole country. The study period includes the last five years (2014-2018) and is focused on the patients worked-up only in the surgical unit of Emergency department (ED).

The second center is the University hospital in Pleven. In this group, all cases visited ED during 1 year (2018) were included. All cases in both groups were retrieved from the centralized hospital information systems.

The study was performed according to PICO (Patients, Intervention, Comparison, Outcome) framework as follows:

**Patients:** only cases with acute abdomen and wrong initial diagnosis admitted in other than surgical clinics were included. All of them experienced a delay in the diagnosis and were transferred later to a surgical clinic for operation or intervention.

**Interventions:** none.

**Comparison:** none.

**Outcome:** the analysis included the following outcomes – proportion of the cases with wrong initial diagnosis, mean time from the start of the complaints, diagnostic tools used, mean time between admission and operation, intraoperative diagnosis, complication and mortality rates.

## Results

In the first group there were a total of 30 194 visits with 15 836 hospitalizations (52.4%). Twenty patients of the last 0.13% (19/15 836) and 0.06% (20/30 194) of all were admitted in the Clinic of Infectious disease and subsequently were operated

because of signs of acute abdomen (Table 1). There were 8 males and 12 females with mean age 53 years (26-75). The mean time between the start of complaints and the initial exam in ED was 5.6 days (1-12). The mean delay between hospitalization and operation was 3 days (1-10).

TABLE 1 - DESCRIPTIVE ANALYSIS OF THE INCLUDED PATIENTS IN THE FIRST ARM (N=20).

Variable	n	%
Abdominal pain	18	90
Nausea, vomiting	18	90
Diarrhea	9	45
Rectal bleeding	2	10
Fever	17	85
Jaundice	3	15
Leukocytosis	15	75
Elevated CRP (mean 169)	20	100
X-ray	19	95
US	9	45
CT	6	30
Operated	18	85
Complications	2	10
Lethal outcome	2	10

US – ultrasound, CT – computed tomography.

The most common initial diagnosis was “acute gastroenteritis” – 45% (9/20), followed by “virus fever” – 30% (n=6), “virus hepatitis” – 15% (n=3), and “non-specific abdominal pain” (NSAP) – 10% (n=2).

Eighteen patients (85%) were operated after mean 3 days (1-10) after the hospitalization. The intraoperative diagnosis was as follows: acute appendicitis – 8 (6 destructive with diffuse peritonitis), perforated diverticulitis with retroperitoneal abscesses and diffuse purulent peritonitis – 1, acute cholecystitis – 2, pancreatic head cancer with obstructive

jaundice and acute cholangitis – 1, supralelevator abscess – 1, mechanical bowelobstructive – 3, mesenteric thrombosis – 1, cryptogenic diffuse peritonitis – 1.

In eight cases the intraoperative diagnosis was acute appendicitis. In 63% (5/8) the initial diagnosis was gastroenteritis. None of the patients was examined by US or CT at the admission. All cases were operated after 24 hours, but the mean time between the start of complaints and hospitalization was 3 days (1-7). Subsequent CT was performed in 3 cases with 100% concordance with the intraoperative diagnosis. In 5/8 (63%) a retrocecal localization of the appendix was observed. In 75% (6/8) cases there was diffuse peritonitis. In one case, the first diagnosis was non-specific abdominal pain (NSAP), subsequently changed to incarcerated right groin hernia. The intraoperative finding, however, revealed a large amount of pus. At the subsequent laparotomy perforated gangrenous appendicitis was found. No mortality and morbidity were seen in this subgroup.

In the second group a total 22 760 patients were evaluated in ED, 11 562 of which were discharged home (51%) (Table 2). Eight hundred seventy patients of the last were re-admitted in ED and hospitalized after 24 hours. Approximately 2% (192/11 562) of the initially discharged were admitted in surgical ward. Of them, 13% (25/192) suffered from acute surgical disease, requiring urgent operative intervention (endoscopic hemostasis or operation). In

TABLE 2 - THE CHARACTERISTIC OF THE CASES IN THE SECOND ARM (UH-PLEVEN, 1 JAN 2018-31 DEC 2018).

Variable	n	%
Total visits	22 760	100
Hospitalized (total)	11 198	49
Hospitalized in surgical ward	3 301	14.5
Discharged	11 562	51
Discharged and hospitalized within 24 hours	870	3.4
Discharged and hospitalized in surgical clinic	192	0.84
Urgent intervention (endoscopic, operation)	25	0.11

fact, these missed cases represented only 0.2% (25/11 562) of the initially discharged or 0.1% of all visits. The definitive diagnoses were as follows: gastrointestinal bleeding - 9, acute cholecystitis - 6, acute appendicitis - 7, diverticulitis with diffuse peritonitis - 3.

## Discussion

The work in the Emergency department, and particularly the Emergency surgery unit, is very specific due to several factors – unknown patients, different time interval elapsed after the onset of the complaints, limited diagnostic tools, need for critical decision making, night work, increased workload, wide participation of residents et ct.

The acute NSAP accounts for 6-9% of all ED visits (3-6). Approximately 17-48% of these cases are hospitalized (3-5, 7). The Greek experience showed that 14% of the ED visitors were admitted in surgical ward, whereas another 24% in internal medicine and other wards (64%), which is similar to our experience (5). The Authors from Bologna also reported 15% admission rate in surgical ward, but did not show the rate of missed surgical cases hospitalized in other wards (4).

In a retrospective series from Italy, the Authors reported 5- and 30-days revisiting rates in ED of 4% and 6.5%, respectively, which is similar to the present study (3.4%) (3). In the 5-day group, 29% (n=44) were hospitalized. Of them, 9/13 had acute cholecystitis, eight of which were operated. Interestingly, in 13 cases a different diagnosis was made, 8 cases with NSAP turned out to have appendicitis (n=2), diverticulitis (n=3), bowel obstruction (n=1) and ct. In other words, 1.1% (10/885) requiring operation were missed during the first visit, which is in unison to the present results and others (10). In the 30-days group the rate of re-hospitalized was 10% (n=31) with 5/6 acute cholecystitis being operated. In 13 cases with NSAP, the diagnosis was changed to appendicitis (n=3), diverticulitis (n=4), bowel obstruction (n=1) and ct. The rate of the missed patients requiring operation was 3% (9/302).

In a series with acute appendicitis, in 1994 Rusnak et al. reported that in 50% of the cases with

wrong initial diagnosis, the first diagnosis was gastroenteritis (8). Most errors occurred when only one examination was performed. The mean delay was 39 hours, 95% had a perforation with 56% postoperative complications and 3% mortality. Over 63% of the cases in our series had gastroenteritis as an initial diagnosis. Similarly, 75% of our cases with acute appendicitis were complicated with diffuse peritonitis, but fortunately neither major morbidity nor mortality were seen.

According to the literature, the wrong or delay diagnosis and wrong tactic are the most common medical errors (9). Actually, a delayed diagnosis was seen in all of our cases. Despite the technological advance, the rate of the diagnosis "NSAP" remains high in all studies – 32-55% (3, 4, 7). So, the question is how to improve the diagnostic process and the detection of the cases requiring operative intervention. The review of the literature clearly shows the following strategies:

- observation with re-evaluation;
- computed tomography (CT), ultrasound (US);
- early laparoscopy;
- hospital admission;
- outpatient review clinic.

The outpatient observation and re-evaluation is a common practice in our country that does not increase the hospital costs, but this requires a complete compliance of the patients. One prospective study demonstrated that the routine re-evaluation within 24 hours changed the diagnosis and management plan in 30% and 17% respectively. Four percent were referred to surgical treatment (10). A delay of diagnosis was observed in only 1.2%, but this did not lead to an increased morbidity and mortality. In fact, the change of strategy was more frequent in women than in males. Of the 20 operated patients 17 had appendicitis, 2 incarcerated umbilical and ventral hernia, and 1 bowel obstruction due to adhesions. US, CT, or both were performed in 29%, 3% and 3%, respectively.

Evaluating two strategies for management of the acute NSAP in women, Morino et al. demonstrated improved diagnostic accuracy of the early laparoscopy vs clinical observation (83% vs. 45%) and less interventions after discharge (0% vs 14%) (11). Of note, however, even in the lap group 21% of the

cases had no diagnosis after the procedure. Interestingly, in this group appendectomy was performed in 98% of the cases but there was pathological confirmation in only 30% of them. At the 3-month follow-up 2/10 cases dismissed without diagnosis was operated due to acute appendicitis and another 3 with complicated ovarian cysts.

In the observation group, clinical diagnosis was possible in only 45% of the cases. Approximately 39% of the patients underwent surgical intervention within 69 hours after admission without increased morbidity and mortality. In 15% of them, laparoscopy did not reveal any pathological finding. In fact, the observed difference in diagnostic accuracy was due to higher detection rate of acute appendicitis in lap group (30% vs 6%). The laparoscopy also found significantly more ovarian cysts (19% vs 4%). Nevertheless, the overall morbidity, mortality, costs and recurrent pain after 1-year follow-up were similar in both groups. On the other hand, it should be noted that 49% of the cases in observation group actually avoided surgical intervention. In fact, the Authors concluded that "*early laparoscopy did not show a clear benefit in women with NSAP. A higher number of diagnoses and a shorter hospital stay in the LAP group did not led to a significant reduction in symptoms recurrence at 1 year*" and suggest "*selective indication to laparoscopy after a short period of active clinical observation*", which is confirmed by others (12).

In a meta-analysis of randomized controlled trials till 2010 (including both women and males), Dominguez et al. found that the early laparoscopy was associated with higher diagnostic, but lower therapeutic utility in non-specific abdominal pain in comparison to active observation (13). In contrast, a recent small randomized study reported significant increase of the morbidity (12% vs 3%) and recurrent pain (42% vs 4%) (14).

Regarding US and CT, a tremendous increase of their utilization has been observed worldwide (over 6-fold increase) (6, 15). In the present series they were used in 30% and 45% respectively. Caporale et al. showed that CT was performed in only 17%, but led to pathological finding in 87% of the cases, whereas X-ray was performed in 35% but was negative in 87% of the cases (4). Similarly, CT was per-

formed during the hospitalization in only 30% of our cases with a concordance rate with the final diagnosis in 83% and 100% in the subgroup with acute appendicitis. The X-ray was positive in only 4/19 (21%) of the cases. Others also pointed out that CT can reduce the unnecessary admissions with 24% (16). In elderly patients, Gardner et al. reported that CT detected clinically unsuspected diagnoses in 43% of the cases, which influenced treatment plans in 65% and surgical tactic in 48% of the cases. Others pointed out that CT also had a significant influence on the admissions and discharges (15).

It was reported that US achieved a diagnosis different from the clinical one in 23% of the cases with a change in the management plans in 47% and a concordance with the discharge diagnosis in 79-87% (17). More recently, Pidgeon et al. reported significantly reduced hospital admission rate (18% vs 9%) from their outpatient acute surgical clinic and a diminished use of CT scan (from 14% to 5%) after the implementation of dedicated ultrasonography service (18). Due to the lack of enough specialists, a valuable alternative is the so called Point-of-care US (POCUS) – a focused US examination to confirm or to rule out a specific diagnostic suspicion (19). Similar to FAST in trauma patients, POCUS is fast, non-invasive and bedside procedure that become an important diagnostic tool in emergency care patients for detection of free fluid and air, intestinal obstruction, acute appendicitis et ct. US was used in 45% of our patients, but during the hospitalization. A positive finding was found in 67% (6/9) with 83% concordance with the final diagnosis. Unfortunately, at the admission, US was not used in none of our patients, whereas the subsequent examination was 100% concordant with the final diagnosis.

Nevertheless, some Authors questioned the “undoubted” role of these diagnostic modalities (6). In a 35-year retrospective, they compared the use and results in 2007 survey compared with similar studies conducted at the same Institution and published in 1972 and 1993. Intriguingly, the Authors did not found decrease of the hospital admissions nor of the rate of the missed surgical cases, but observed significant increase of the physician time expenditures. Moreover, there are certain limitations to perform CT such as medical contraindications, lack of facili-

ties in poor countries, significant increase of the radiation dose et ct.

The decision making based on algorithms may play important role to diminish the mistakes or the missed surgical cases. In this light, the Leeds’s experience appears intriguing (7). The Authors reported 48% admission rate with a correct diagnosis in 57% of the cases (28% discharged within the first 24 hours). After the implementation of Clinical Decision Unit (CDU) protocol they increased the rate of the discharged to 85% (67% in the first 24 hours) and decreased hospitalizations to 15%. Approximately 60% of the hospitalized had non-specific pain, whereas 43% had a correct diagnosis (n=12). Four of these 12 patients underwent surgical intervention (14% of all hospitalized and 2% of all visitors). Actually, the Authors achieved an increase of the correct diagnosis from 69% to 94% after the implementation of the CDU protocol. However, they also stated that “*Doctors are often reluctant to adopt protocols, citing that they do not allow clinical freedom and very often result in increased paperwork. Every effort was made to keep the CDU AAP protocol simple and user friendly but some clinicians appeared to prefer that such patients should continue to be managed in the surgical bed base and did not change their behaviour*” (7).

Last, but not least, in two of our cases (the supralelevator abscess and the incarcerated inguinal hernia and acute appendicitis) there was an obvious mistake due to insufficient first clinical examination. In this light, it should be kept in mind that in emergency setting several conditions may lead to symptoms that can easily be misinterpreted such as an atypical localization of the appendix that can mimic gastroenteritis or right renal colic, supralelevator abscesses which can manifest with diarrhea, the presence of defecation even in cases with intestinal obstruction et ct.

All these facts clearly demonstrate the still ongoing need for careful clinical assessment and judicious use of the modern diagnostic modalities.

Finally, is there still room for the surgical intuition in the era of the evidence based medicine? A recent study demonstrated that for the simple clinical problems and most of the technical problems the guidelines and consensus recommendations exceed the intuition, but the last play more important role in complex situations or rare complications (20).

The limitations of the present study are related to its retrospective design, the small sample size, the lack of data for the outcome in the second group and lack of control group. Nevertheless, we agree with Greenhalgh et al. that “narrative review is not the poor cousin of the systematic review but is complementary form of scholarship”, which “provides interpretation and deepening understanding” (21). This could become more important, especially in the light of the obvious crisis in the evidence-based medicine (22, 23).

## Conclusions

The missed surgical cases represent only a small proportion of the patients in ED. The causes for wrong initial admissions in our series were the misinterpretation of the symptoms, insufficient clinical examination, underuse of US and CT.

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Based on the literature, the focused US and contrast CT may be helpful to decrease the rate of the missed cases. The early laparoscopy is associated with an improved diagnostic accuracy and higher rate of detection of acute appendicitis, but with comparable outcome. This demonstrated that clinical observation still plays an important role and helps avoiding operation in 50% of the cases. Despite the technological advance the careful clinical assessment and judicious use of the modern diagnostic tools remain of paramount importance.

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The Authors report no conflict of interest.

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## Data availability

All data are available in corresponding Author.

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