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Standard Outpatient Re-Evaluation for Patients Not Admitted to the Hospital After Emergency Department Evaluation for Acute Abdominal Pain

Boudewijn R. Toorenvliet · Rutger F. R. Bakker · Hans C. Flu · Jos W. S. Merkus · Jaap F. Hamming · Paul J. Breslau

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Abstract
Background The aim of the present study was to investigate the efficacy and safety of standard outpatient re-evaluation for patients who are not admitted to the hospital after emergency department surgical consultation for acute abdominal pain.
Methods All patients seen at the emergency department between June 2005 and July 2006 for acute abdominal pain were included in a prospective study using a structured diagnosis and management flowchart. Patients not admitted to the hospital were given appointments for re-evaluation at the outpatient clinic within 24 h. All clinical parameters, radiological results, diagnostic considerations, and management proposals were scored prospectively.
Results Five-hundred patients were included in this analysis. For 148 patients (30%), the final diagnosis was different from the diagnosis after initial evaluation. Eighty-five patients (17%) had a change in management after re-evaluation, and 20 of them (4%) were admitted to the hospital for an operation. Only 6 patients (1.2%) had a delay in diagnosis and treatment, which did not cause extra morbidity.
Conclusions Standard outpatient re-evaluation is a safe and effective means of improving diagnostic accuracy and helps to adapt management for patients that are not admitted to the hospital after surgical consultation for acute abdominal pain at the emergency department.

B. R. Toorenvliet (✉) · H. C. Flu · J. F. Hamming
Department of Surgery, Leiden University Medical Center, P.O. Box 9600, 2300 RC Leiden, The Netherlands
e-mail: br.toorenvliet@tiscali.nl

R. F. R. Bakker · J. W. S. Merkus
Department of Surgery, HAGA Hospital, P.O. Box 40551, 2504 LN Den Haag, The Netherlands

P. J. Breslau
Medical Specialist Registration Committee, KNMG, P.O. Box 20053, 3528 BL Utrecht, The Netherlands

Introduction

Approximately 4–5% of patients evaluated at an emergency department (ED) present with acute abdominal pain [1]. Some patients that require admission for surgical or medical treatment are easily recognized. Others may present during the early stages of surgical pathology and will be difficult to distinguish from patients with mild self-limiting disease. Judgment errors in evaluating these patients with an ambivalent presentation may lead to therapeutic delay, possibly increasing morbidity and even mortality. For this reason diagnostic modalities such as ultrasound (US) and computed tomography (CT) are often used to aid in the diagnostic process and subsequent clinical decision making [2, 3]. Cross-sectional imaging may not, however, be beneficial in the diagnosis of all patients seen in the ED for acute abdominal pain. These examinations are costly, time consuming, and, in the case of CT, subject the patient to ionizing radiation.

Another method often used for the differentiation of mild disease from more serious pathology in ambivalent cases is outpatient re-evaluation. Re-evaluation can allow the disease to present itself through natural progression, permitting surgical cases to become more typical and thus identifiable. In patients with nonspecific abdominal pain or mild nonsurgical diagnoses, the symptoms will regress, allowing the patient to be safely discharged from follow-up.

The present study was performed to assess the efficacy and safety of standard outpatient re-evaluation in a large series of patients with acute abdominal pain seen in our ED but who were not considered to require a hospital admission. Our hypothesis is that serial outpatient re-evaluation for patients with equivocal abdominal pain is safe, can improve diagnostic accuracy, and will facilitate proper treatment selection.

Patients and methods

The present study was performed in a middle-sized teaching hospital with a 24 h emergency service with surgery, radiology, intensive care, and on call consultants in pediatrics, gynecology, and internal medicine. All consecutive patients with acute abdominal pain evaluated in the ED by a resident of the surgical department between June 2005 and July 2006 were included in the study. The surgical resident always made the primary assessment, and the consultant surgeon evaluated the patient if necessary. Patients who were evaluated at another hospital for the same complaint, patients with abdominal pain caused by trauma, and patients who had undergone radiological examination (US or CT) prior to surgical consultation were excluded. For all patients, a structured diagnostic and management strategy algorithm was followed (Fig. 1). First, a "clinical diagnosis" (D1) was made based on the patient's history, physical examination, and biochemical blood and urine analyses. The resident recorded his/her degree of certainty for the clinical diagnosis given on a scale from 1 to 5. An initial management proposal (S1) was then made based on the clinical diagnosis. All clinical parameters, the clinical diagnosis (D1), and the proposed strategy (S1) were registered on a study form. After a conference with the consulting surgeon, a decision was made about whether or not to perform additional radiological examinations. When such studies were performed, the radiologist was asked to confirm the clinical diagnosis or provide an alternative diagnosis. All US and CT examinations were performed by 1 of 5 certified radiologists with similar levels of experience. After learning the radiological results (RD1), the resident and the surgeon reassessed the initial clinical diagnosis and strategy, which were altered if necessary (CD1 & CS1). Again all results and considerations were registered on the study form. Patients were admitted to the surgical ward if they were thought to have an abdominal condition that required immediate operation or a medical therapy necessitating admission. All patients that were not directly admitted to the surgical ward after surgical consultation at the ED were given appointments for re-evaluation at the outpatient clinic within 24 h. There, the diagnosis and management strategies were reassessed (D2 and S2) by the consultant surgeon or a surgical resident under the supervision of a consultant surgeon. Additional radiological or endoscopic examinations were made if they were deemed necessary. Patients were discharged from out-patient follow-up when a definitive diagnosis was made and the treatment was successfully initiated or completed, or if the patient no longer had abdominal complaints. The final diagnosis (FD) was based on intraoperative findings or pathological

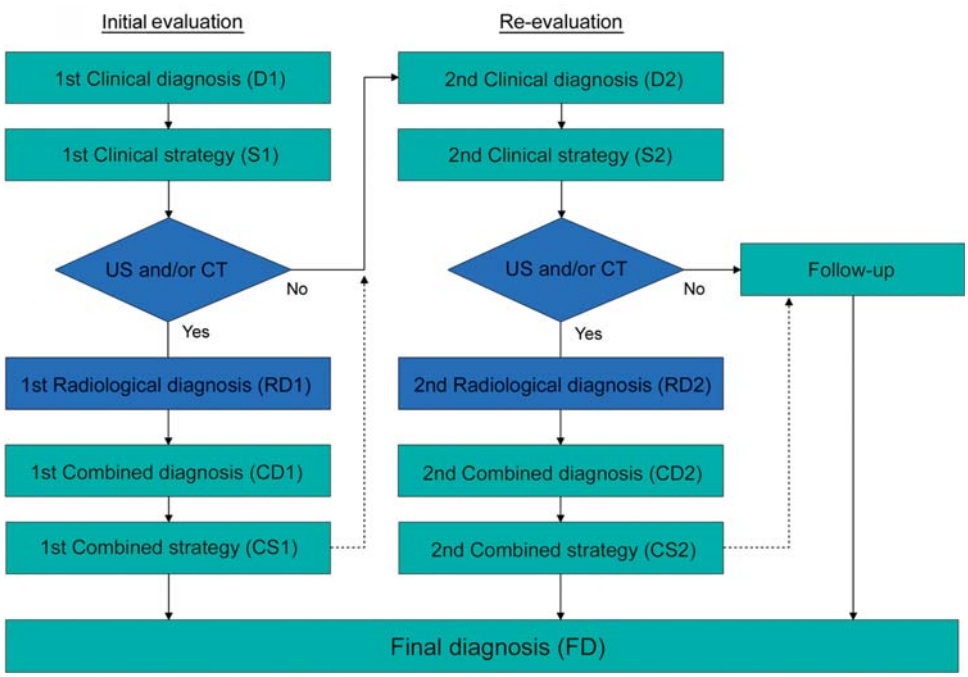

Fig. 1 Study design for patients presenting with abdominal pain at the emergency department for surgical consultation. (Reprinted with permission Wiley-Blackwell Publishing.)

examination of the resected organs. If patients were not operated, the final diagnosis was made from the clinical and/or radiological diagnosis in combination with the clinical response to medical therapy at standard re-evaluation and follow-up as described above.

For the purposes of the present study, all hospital records were reviewed by two surgical residents (B. T. and R. B.), double-checking the available information and verifying the final diagnoses for all patients entered into the database. Patients were excluded from analysis if they did not show up for the re-evaluation appointment or if the study form was not returned or was incomplete. For all these patients, the hospital records were searched and patients were contacted for additional information. If a patients could not be contacted, that patient's general practitioner was consulted. All diagnoses were categorized according to the 10th version of the International Classification of Diseases (10-ICD) [4]. Complications noted during the hospital admission were scored twice daily in a prospective database as reported earlier [5]. Statistical analysis was performed with SPSS 16.0. Chi square tests were used to compare binomial proportions with the Yates continuity correction; $P < 0.05$ was considered significant.

Results

During the study period 972 patients were evaluated. Forty-nine patients (5.0%) were excluded when they did not show up for their re-evaluation appointment, and another 121 (12.4%) patients were excluded as the study forms were incomplete or not returned. Twenty-three patients were lost to follow-up (2.4%). The diagnosis and management data for excluded patients are shown in Table 1. Of the 802 patients eligible for inclusion, 302 patients (37.7%) were admitted to the hospital, and 123 (15.3%) underwent operation on the day of first evaluation. The other 500 patients (62.3%) were not admitted and were re-evaluated according to the study protocol (Fig. 2).

All patients were evaluated by one of 16 surgical residents with different levels of experience. Eighty-eight percent of the patients, however, were seen by residents in their first 3 years of training.

Of the 500 patients enrolled in the study, 205 patients were under 17 years old (41.0%) and 290 patients were female (58.0%). Thirty-nine patients (7.8%) had a fever defined as a temperature above 38°C, 160 patients (32.0%) had a C-reactive protein (CRP) level higher than 8, and 111 patients (22.2%) had a leukocyte count of more than 12. Plain abdominal radiographs were acquired in 211 patients (42.2%), and 31 (6.2%) had chest x-rays. A US study of the abdomen was done in 139 patients (27.8%), a CT of the abdomen was done in 8 (1.6%), and 17 patients (3.4%) underwent both an US and a CT at initial evaluation. At re-evaluation 145 patients (29.0%) had an US, 15 (3.0%) had a CT, and 14 (2.8%) had both an US and a CT. Sixteen patients (3.2%) underwent additional cross-sectional imaging at the initial evaluation as well as at re-evaluation.

The final diagnoses for the 500 patients that had a standard re-evaluation are given in Table 2. The average follow-up was 12 days (range: 1–275 days), but most of the patients (46.2%) could be discharged from follow-up after just one outpatient visit.

For 148 patients (29.6%) the final diagnosis (FD) was different from the initial clinical diagnosis (D1) or the combined diagnosis (CD1) after additional radiological imaging on the day of first evaluation (Table 3). Eighty-five (17.0%) patients had a change in management, 20 of which (4.0%) were considered major (Table 4). A change in management was regarded as major if the clinical strategy changed to a surgical procedure when the initial strategy was conservative. Seventeen patients underwent operation after re-evaluation for presumed appendicitis (1 negative appendectomy), one for an incarcerated umbilical hernia, another for an incarcerated ventral hernia; one patient underwent laparotomy for intestinal obstruction due to adhesions.

Subgroup analysis was performed for sex, age, additional radiological imaging on the day of evaluation, the diagnosis "nonspecific abdominal pain" (NSAP) after initial evaluation (D1 or CD1) and the resident's degree of certainty for the initial clinical diagnosis (Table 5). Female patients had more strategy changes than male patients ($P < 0.05$), and patients older than 16 years had significantly more strategy changes than children ($P < 0.0001$). When patients underwent additional imaging (US and or CT) on the day of initial evaluation, they had fewer diagnostic changes when compared to those who did not ($P = 0.0002$). This, however, did not lead to a significant change in management ($P = 0.106$). Those patients whose abdominal complaints could not be differentiated and were given the diagnosis "nonspecific abdominal pain (NSAP) after initial evaluation ($n = 90$), had more diagnostic changes at re-evaluation ($P = 0.006$). This occurred irrespective of whether they underwent additional radiological imaging on the day of initial evaluation: 39 of the 90 patients (43.3%) underwent additional radiological imaging, and 18 of those 39 patients (47.4%) had diagnostic changes at re-evaluation. When a resident had a high degree of certainty about his/her initial clinical diagnosis (4 or 5), there were significantly fewer diagnostic changes at re-evaluation ($P < 0.0001$). There were no significant differences for major changes in management in any of the subgroups.

Of the 500 patients, only 6 (1.2%) had diagnoses that should preferably have been made on the initial day of evaluation, leading to immediate treatment. Three of those patients had acute perforated appendicitis, one patient had

Table 1 Diagnosis and management data for 170 excluded patients

Lost to follow-up	No form			No show			Total
	15			8			23
	H	O	N	H	O	N	
Self-limiting nonspecific abdominal pain	1	1	44			27	73
Viral intestinal infection, unspecified			8	1		2	11
Abdominal pain due to metastasized cancer	6	1		1			8
Calculus of gallbladder without cholecystitis	6 (5)[a]	1 (1)[a]					7
Constipation			4	1		2	7
Acute appendicitis, not perforated	6 (6)[b]						6
Gynecological pathology, NOS	1		2	1 (1)[a]	1		5
Calculus of kidney and ureter	3		1				4
Irritable bowel syndrome	1		1		1	1	4
Pneumonia	2						2
Pancreatitis	2						2
Extra-uterine gravidity	2 (2)[b]						2
Gastritis and duodenitis		1	1				2
Cystitis						2	2
Peptic ulcer, site unspecified	1						1
Acute appendicitis, perforated	1 (1)[b]						1
Inguinal hernia with obstruction, without gangrene	1 (1)[b]						1
Ventral hernia with obstruction, without gangrene	1 (1)[b]						1
Crohn's disease	1						1
Ileus, unspecified	1						1
Diverticular disease of the large intestine	1 (1)[a]						1
Acute tubulo-interstitial nephritis	1						1
Functional diarrhea	1						1
Benign neoplasm of the colon	1						1
Inguinal hernia			1				1
Moderate pre-eclampsia				1			1
Total	40 (17)	4 (1)	62	5 (1)	2	34	170

[a] Elective operation

[b] Acute operation

No form study form was incomplete or not returned; *No show* patient did not show up for the re-evaluation appointment at the surgical outpatient clinic; *H* patient was treated at our hospital; *O* patient was treated at another hospital; *N* patient did not contact another caregiver for abdominal complaints. Numbers in parentheses indicate the number of patients that underwent operation

an incarcerated ventral hernia without gangrene, one patient had an incarcerated umbilical hernia without gangrene, and another patient had intestinal adhesions with obstruction, but also without gangrene. After recovering from their operations, these patients were discharged from the hospital without complications.

Discussion

Patients presenting with acute abdominal pain at the ED need to be diagnosed correctly and treated accordingly. As the majority of patients will have self-limiting pathology not requiring surgical intervention, most will not require an admission to the hospital. Patients with abdominal pathology requiring surgical treatment, however, should not be missed. To diagnose patients with abdominal pain, many diagnostic modalities can be used to complement the "basic" clinical evaluation of patient history, physical examination, and blood and urine analysis. Diagnostic measures such as US, CT, laparoscopy, and clinical observation have all been reported in the literature. Ultrasound, for example, can assist in the diagnosis of many gastrointestinal causes of acute abdominal pain [6], and its

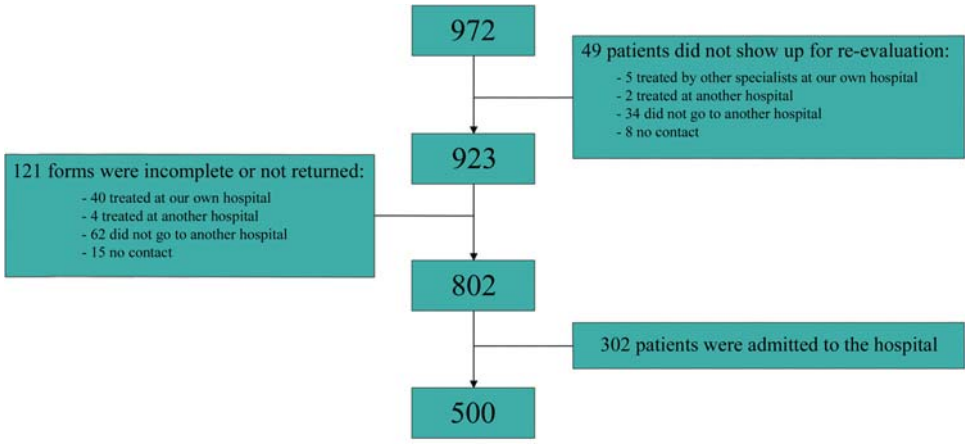

Fig. 2 Summary of the inclusion process for eligible patients

Table 2 The final diagnoses for 500 patients who were not admitted to the hospital but who underwent standard outpatient re-evaluation after presentation at the emergency department for acute abdominal pain

Final diagnosis (FD)	Patient age					
	>16 years		≤16 years		Total	
	n	%	*n*	%	*n*	%
Other and unspecified abdominal pain	53	18.0	36	17.6	89	17.8
Constipation	35	11.9	46	22.4	81	16.2
Viral intestinal infection, unspecified	25	8.5	45	22.0	70	14.0
Nonspecific mesenteric lymphadenitis	3	1.0	33	16.1	36	7.2
Cystitis	25	8.5	8	3.9	33	6.6
Calculus of kidney and ureter	27	9.2	0	0	27	5.4
Calculus of gallbladder without cholecystitis	21	7.1	0	0	21	4.2
Diverticular disease of intestine	20	6.8	0	0	20	4.0
Gynecological pathology, NOS	17	5.8	1	0.5	18	3.6
Gastritis and duodenitis	12	4.1	4	2.0	16	3.2
Acute appendicitis, not perforated	8	2.7	6	2.9	14	2.8
Ileocaecitis	6	2.0	6	2.9	12	2.4
Pneumonia, organism unspecified	1	0.3	7	3.4	8	1.6
Acute tubulo-interstitial nephritis	5	1.7	1	0.5	6	1.2
Myalgia (abdominal wall)	3	1.0	2	1.0	5	1.0
Bronchitis, not specified as acute or chronic	0	0	4	2.0	4	0.8
Peptic ulcer, site unspecified	3	1.0	0	0	3	0.6
Other	31	10.5	6	2.9	37	7.4
Total	295		205		500	

NOS not otherwise specified

routine use by surgeons for such patients has been shown to increase diagnostic accuracy [7]. Computer tomography has also been reported to increase diagnostic accuracy and reduce hospital admissions by 24% [8], and it is said to be the best predictor of the need for an urgent intervention [9]. The use of cross-sectional imaging for all patients presenting with acute abdominal pain, however, is costly, time consuming, and, in the case of CT, exposes patients to ionizing radiation. The last issue is important as the growing use of CT is steadily increasing the collective dose of medical radiation to which patient populations are subjected. Even though the cancer risk from an abdominal CT is small for the individual, the increasing use of the modality may create a future health concern, especially for children [10]. The indications for ordering a CT should therefore always be carefully scrutinized by medical personnel, especially when other diagnostic modalities can attain similar results [11].

Laparoscopy can also accurately distinguish patients that require surgery from those that can be treated

Table 3 Changes in the diagnosis after standard outpatient re-evaluation

	Final Diagnosis (FD)								
D1 or CD1	VII	NML	GD	AA	CO	NSAP	GYN	Other	Total
Viral intestinal infection, unspecified (VII)		2	2	2	5	6	1	10	28
Nonspecific mesenteric lymphadenitis (NML)	1			2	1	2		1	7
Acute appendicitis, not perforated (AA)	5	4	1		2	2			14
Constipation (CO)				1		8	3	5	17
Calculus of kidney and ureter						2		5	7
Nonspecific abdominal pain (NSAP)	6	1	2	2	10		2	11	34
Other	2	1	2	1	2	17	1	15	41
Total	14	8	7	8	20	37	7	47	148

D1 first clinical diagnosis; *CD1* "combined" diagnosis after additional radiological imaging (on the day of initial evaluation); *GD* gastritis and duodenitis; *GYN* gynecological pathology; *NOS* not otherwise specified

Table 4 Strategy changes after standard outpatient re-evaluation

	Final strategy after re-evaluation				
S1 or CS1	LAP	ADM	OPFU	COS	Total
Laparotomy (LAP)			2		2
Outpatient re-evaluation	20	5		52	77
Consultation of other specialty (COS)			5	1	6
Total	20	5	7	53	85

S1 first clinical strategy; *CS1* "combined" strategy after additional radiological imaging (on the day of initial evaluation); *ADM* admission; *OPFU* outpatient follow-up

Table 5 Subgroup analysis for diagnostic and strategy changes

	N	ΔD	%ΔD	ΔS	%ΔS	MΔS	%MΔS
All patients	500	148	29.6	85	17.0	20	4.0
Male	210	54	25.7	27*	12.9	10	4.8
Female	290	94	32.4	58*	20.0	10	3.4
>16 years	295	87	29.5	67**	22.7	11	3.7
≤16 years	205	61	29.8	18**	8.8	9	4.4
US/CT on day 0	164	30*	18.3	21	12.8	5	3.0
No US/CT on day 0	336	118*	35.1	64	19.0	15	4.5
NSAP	90	38*	42.2	13	14.4	2	2.2
Non NSAP	410	110*	26.8	72	17.6	18	4.4
Degree of certainty (4–5)	231[a]	50**	21.6	33	14.3	8	3.5
Degree of certainty (1–3)	206[a]	81**	39.3	42	20.4	12	5.8

[a] Missing data: $n = 63$

* $P < 0.05$

** $P < 0.0001$

ΔD change in diagnosis; *ΔS* change in strategy; *MΔS* major change in strategy

conservatively [12], and it has been proposed as routine management for patients with acute abdominal pain for whom the decision to operate is uncertain [13]. Nevertheless, laparoscopy in itself is an operation, and can be regarded as too invasive as a first-line diagnostic measure when similar accuracy can be achieved without an operation.

Hospital admission for patients with equivocal abdominal complaints has been a common practice for many years. The effectiveness of this practice is limited because most patients ultimately have NSAP for which an admission to hospital is in fact not required [14–16]. In recent years the percentage of hospital admissions for patients with acute abdominal pain has decreased, possibly as a result of advances in diagnostic technology and improved ED faculty presence [1].

Another method often used to help distinguish surgical pathology from mild self-limiting disease in patients with equivocal abdominal pain is outpatient re-evaluation. Patients with abdominal pathology requiring surgery who initially present during the early stages of the disease will become more easily identifiable, whereas the symptoms will regress in those patients with self limiting disease allowing them to be safely discharged from follow-up.

Outpatient re-evaluation for patients with equivocal abdominal complaints has not been reported extensively in the literature. Only one study comparing outpatient follow-up to active clinical observation for patients with NSAP in the ED concluded that outpatient evaluation seems to be a

safe option that is not accompanied by an increased incidence of complications [17]. The present study is the first to report the value of standard outpatient re-evaluation for patients that are presumed not to require a hospital admission after evaluation at the ED for acute abdominal complaints. After standard re-evaluation 30% of the patients had a different final diagnosis than the diagnosis initially given after evaluation at the ED. A change in management was seen in 17% of the cases after re-evaluation, and 4% of the patients were later admitted to hospital for surgery. These are important changes from the patient's point of view, demonstrating that standard outpatient re-evaluation is a valuable method that improves diagnostic accuracy and helps to select the proper management strategies in this patient population. The initial management decisions made by the evaluating physician at the ED regarding whether patients should receive additional imaging or be admitted to the hospital were not scrutinized in this study. The study was designed to mimic daily practice, and allowed for these management decisions to be made just as they are in daily routine where basic clinical judgment plays a fundamental role. Apparently these clinical assessments are precise enough to triage accurately without detrimental effects for the patient. Only 6 patients (1.2%) had diagnoses that should preferably have been made at initial evaluation. This however did not lead to increased morbidity.

Conclusions

The present study supports the hypothesis that serial outpatient re-evaluation is safe, and will improve diagnostic accuracy and facilitate proper treatment selection for patients that are not admitted to the hospital after surgical consultation for acute abdominal pain at the emergency department.

References

1. Powers RD, Guertler AT (1995) Abdominal pain in the ED: stability and change over 20 years. Am J Emerg Med 13:301–303
2. Hayes R (2004) Abdominal pain: general imaging strategies. Eur Radiol 14(Suppl 4):L123–L137
3. Leschka S, Alkadhi H, Wildermuth S et al (2005) Multi-detector computed tomography of acute abdomen. Eur Radiol 15:2435–2447
4. World Health Organization. International statistical classification of diseases and related health problems: 10th Revision (2007) Available at http://apps.who.int/classifications/apps/icd/icd10online/ Accessed December 8 2009
5. Veen MR, Lardenoye JW, Kastelein GW et al (1999) Recording and classification of complications in a surgical practice. Eur J Surg 165:421–424
6. Puylaert JB (2003) Ultrasonography of the acute abdomen: gastrointestinal conditions. Radiol Clin North Am 41:1227–1242
7. Allemann F, Cassina P, Rothlin M et al (1999) Ultrasound scans done by surgeons for patients with acute abdominal pain: a prospective study. Eur J Surg 165:966–970
8. Rosen MP, Sands DZ, Longmaid HE III et al (2000) Impact of abdominal CT on the management of patients presenting to the emergency department with acute abdominal pain. AJR Am J Roentgenol 174:1391–1396
9. Gerhardt RT, Nelson BK, Keenan S et al (2005) Derivation of a clinical guideline for the assessment of nonspecific abdominal pain: the Guideline for Abdominal Pain in the ED Setting (GAPEDS) Phase 1 Study. Am J Emerg Med 23:709–717
10. Brenner DJ, Hall EJ (2007) Computed tomography—an increasing source of radiation exposure. N Engl J Med 357:2277–2284
11. Hall EJ, Brenner DJ (2008) Cancer risks from diagnostic radiology. Br J Radiol 81:362–378
12. Vander Velpen GC, Shimi SM, Cuschieri A (1994) Diagnostic yield and management benefit of laparoscopy: a prospective audit. Gut 35:1617–1621
13. Paterson-Brown S (1993) Emergency laparoscopic surgery. Br J Surg 80:279–283
14. de Dombal FT (1979) Acute abdominal pain—an O.M.G.E. survey. Scand J Gastroenterol Suppl 5629–5643
15. Laurell H, Hansson LE, Gunnarsson U (2006) Diagnostic pitfalls and accuracy of diagnosis in acute abdominal pain. Scand J Gastroenterol 41:1126–1131
16. Sheridan WG, White AT, Havard T et al (1992) Non-specific abdominal pain: the resource implications. Ann R Coll Surg Engl 74:181–185
17. Onur OE, Guneysel O, Unluer EE et al (2008) "Outpatient follow-up" or "active clinical observation" in patients with nonspecific abdominal pain in the emergency department. A randomized clinical trial. Minerva Chir 63:9–15