

How can we decrease mortality in surgery units?

Mariusz Piechota¹, Maciej Banach², Anna Jacoń³, Jacek Rysz⁴

¹Department of Anaesthesiology and Intensive Care Unit, Boleslaw Szarecki University Hospital No. 5 in Lodz, Medical University of Lodz, Poland

²Department of Cardiology, 1st Chair of Cardiology and Cardiac Surgery, University Hospital No. 3 in Lodz, Medical University of Lodz, Poland

³Department of Health Protection Policy, Medical University of Lodz, Poland

⁴2nd Department of Family Medicine, Medical University of Lodz, Poland

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Corresponding author:

Mariusz Piechota, MD, PhD

Department of Anaesthesiology and Intensive Care Unit

Boleslaw Szarecki University Hospital No. 5 in Lodz

Medical University of Lodz

Hallera Sq 1; 90-647 Lodz, Poland

E-mail:

mariuszpiechota@poczta.onet.pl

Abstract

Introduction: Factors affecting mortality of patients hospitalized in general surgery units are very differentiated. The authors analysed the factors affecting the mortality on three general surgery units in 3 different University Hospitals (UH) in Lodz, Poland.

Material and methods: The study comprised 26,020 patients treated in these units from 01.01.2003 to 31.12.2006. The available statistical material was analysed. In the first stage the statistical data were analysed of the Provincial Centre of Public Health in Lodz. In the second stage the structure of the analysed units and the structure of the selected groups of diagnoses were compared. The third stage was focused on explaining the reasons of significantly lower mortality among patients hospitalised in surgical unit of UH No. 5.

Results: The relative structure similarity indices of the hospitalized patients in general surgery units in the selected hospitals according to the basic disease (A00-A99; ...; Z00-Z99) in the years 2003-2006 were respectively: UH No. 1/UH No. 2 – 0.511; UH No. 1/UH No. 5 – 0.549; UH No. 2/UH No. 5 – 0.637 and 0.418 together for UH No. 1/UH No. 2/UH No. 5. The mortality in group of patients with diagnosed C00-C97 was respectively: in UH No. 1 14.52%, in UH No. 2 6.21% and in UH No. 5 2.42% (UH No. 1/UH No. 5, $p < 0.001$ and UH No. 2/UH No. 5, $p < 0.02$). In the most numerous group (K00-K93) the mortality was respectively: in UH No. 1 1.30%, in UH No. 2 0.62% and in UH No. 5 0.10% (UH No. 1/UH No. 5, $p < 0.001$ and UH No. 2/UH No. 5, $p < 0.03$) (after appropriate modification of the structure and number of deaths).

Conclusions: Change of the system of postoperative care consisting in: taking over postoperative care by physicians and anaesthesiological nurses, intensive monitoring of postoperative patients, immediate transfer of patients with life hazard to Intensive Care Unit, which was implemented in UH No. 5, significantly reduces the mortality in a surgical unit.

Key words: postoperative care, mortality, surgery.

Introduction

Mortality in general surgery units in hospitals in Poland oscillates from few tenths of a per cent to a few per cent. It depends on numerous factors. The most important ones include: the unit profile, severity of the admitted patients' clinical condition, skills, knowledge and practice of the unit staff, the unit sanitary conditions [1-3]. In the opinion of the authors of this

study, the model of postoperative care and the principles of the cooperation with the intensive care unit are also of great importance.

In the year 2006, there functioned 10 public health care institutions in the area of Lodz, having in their structure surgical unit classified as general surgery unit (code: 4500). They were three university teaching, three provincial, three county and one departmental hospitals. The lowest percentage of mortality was noted in the surgical unit of University Teaching Hospital No. 5 in Lodz (UH No. 1). The authors decided to analyse the causes of such low mortality in this hospital. Two remaining university teaching hospitals: University Teaching Hospital No. 1 in Lodz (UH No. 1) and University Teaching Hospital No. 2 in Lodz (UH No. 2) were selected for comparative analysis.

Postoperative care at the University Teaching Hospital No 5 is performed by the staff of the Department of Anaesthesiology and Intensive Care Unit. The surgeons are consultants. Such a solution is extremely rare not only in Poland but also all over the world. In the two remaining university hospitals postoperative care is conducted in a traditional way by surgeons in recovery rooms. The authors decided to analyse the factors affecting mortality in selected general surgery units with particular consideration of the functioning model of postoperative care.

Material and methods

The study was a retrospective analysis of mortality in general surgery units located at three university hospitals: N. Barlicki University Hospital No. 1 in Lodz, WAM University Hospital No. 2 in Lodz and B. Szarecki University Hospital No. 5. The selection of the hospitals was dictated by a few reasons. The Medical University of Lodz is the founding body of all the hospitals subjected to analysis. These hospitals are only few kilometres away from each other. The units have similar number of beds, and well-educated medical and nursing staff. Heads of the hospital departments have all been awarded professorships. Health benefits are provided on the basis of the same list of benefits as part of contracts with the same payer – Lodz Provincial Branch of National Health Fund (LPB NHF).

The study comprised 26,020 patients treated in these units from 01.01.2003 to 31.12.2006. The available statistical material was analysed. In the first stage the statistical data were analysed of the Provincial Centre of Public Health in Lodz. The available statistical material was analysed. In the first stage the statistical data were analysed by the Provincial Centre of Public Health in Lodz (PCPH) (data from centralized public health). The obtained information concerned the number of treated patients, the number of patients transferred, discharged or dead, the number of man-days of treatment, mean bed use, mean hospitalisation time, mean number of patients per bed and mortality.

Authors used also data included in the questionnaires, filled by the heads of surgical departments in Lodz province, including among others the general information about the department, about the number and qualifications of the medical staff and data about the performed surgeries.

In the second stage the structure of the analysed units and the structure of the selected groups of diagnoses were compared. A relative structure similarity index (Pw) was used to compare the structure of hospitalised patients in the analysed units:

$$Pw = \frac{\sum_{k=1}^m \min(u_{k1}, u_{k2})}{\sum_{k=1}^m \max(u_{k1}, u_{k2})}$$

The third stage was focused on explaining the reasons of significantly lower mortality among patients hospitalised in surgical unit of UH No. 5.

The treatment of postoperative patients in recovery rooms in the conditions similar or identical to those in the intensive therapy unit is extremely rare. The general surgery unit of B. Szarecki University Teaching Hospital in Lodz provides such conditions. An anaesthesiologist and 2 anaesthesiological nurses serve permanent medical care (4-bedded rooms). When needed, a surgeon is asked for consultation. All the operated-on patients are moved to recovery rooms where their life functions are monitored. Most frequently the patients stay there for 24 hours after the surgical procedure. The scope of monitoring depends on the kind and range of surgery. Standard monitoring includes: ECG, arterial blood pressure by indirect method, plethysmography, respiratory rate, body temperature, fluid supply, and diuresis. In the case of severe surgery, monitoring is significantly broadened and includes central venous pressure in patients with central venous access, arterial blood pressure by direct method and capnography in ventilated patients. All these allow early detection and treatment of any occurring complications. The application of high quality analgesic treatment with the use of phentanyl infusion in combination with nonsteroidal anti-inflammatory drugs is of importance. Effective analgesia not only improves the patient's comfort but prevents the occurrence of numerous complications as well. In the conditions similar to those in intensive care units, such treatment is completely safe. Wide availability of infusion pumps allows for application of drug infusion (e.g. catecholamines, nitroglycerin, beta-blockers, hypotensive drugs, etc.) and fluids.

Perioperative procedures applied in B. Szarecki University Hospital No. 5 make it easier to transfer the patients immediately after severe surgery into the Intensive Care Unit, which in our opinion is a prevention against the development of serious,

Table I. Structure of hospitalization in general surgery units (code: 4500) in selected hospitals according to basic disease (A00-A99; ...; Z00-Z99) in the years 2003 to 2006

Basic disease acc. ICD 10*	Total (Hospital No. 1; Hospital No. 2; Hospital No. 5)		Hospital No. 1		Hospital No. 5		Hospital No. 2	
	Number of patients	Coefficients of structure (%)	Number of patients	Coefficients of structure (%)	Number of patients	Coefficients of structure (%)	Number of patients	Coefficients of structure (%)
Total:	26020	100	6612	100	13718	100	5690	100
A00-A99	43	0.165	5	0.076	34	0.248	4	0.070
B00-B99	7	0.027	1	0.015	6	0.044	0	0.000
C00-C97	3730	14.335	355	5.369	2599	18.946	776	13.638
D00-D89	2843	10.926	263	3.978	1736	12.655	844	14.833
E00-E90	1882	7.233	596	9.014	1010	7.363	276	4.851
F00-F99	3	0.012	0	0.000	0	0.000	3	0.053
G00-G99	11	0.042	4	0.060	2	0.015	5	0.088
H00-H95	1	0.004	0	0.000	1	0.007	0	0.000
I00-I99	2252	8.655	599	9.059	715	5.212	938	16.485
J00-J99	290	1.115	7	0.106	9	0.066	274	4.815
K00-K93	11305	43.447	3007	45.478	6178	45.036	2120	37.258
L00-L99	594	2.283	267	4.038	173	1.261	154	2.707
M00-M99	61	0.234	29	0.439	9	0.066	23	0.404
N00-N99	445	1.710	66	0.998	350	2.551	29	0.510
O00-O99	3	0.012	1	0.015	1	0.007	1	0.018
Q00-Q99	25	0.096	3	0.045	6	0.044	16	0.281
R00-R99	891	3.424	43	0.650	768	5.598	80	1.406
S00-S99	1423	5.469	1278	19.328	52	0.379	93	1.634
T00-T98	175	0.673	84	1.270	41	0.299	50	0.879
Z00-Z99	36	0.138	4	0.060	28	0.204	4	0.070

(A00-B99) Infections or parasitic diseases; (C00-D48) Neoplasms; (D50-D98) Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism; (F00-F99) Mental and behavioural disorders; (G00-G99) Disease of the nervous system; (I00-I99) Diseases of the circulatory system; (J00-J99) diseases of the respiratory system; (K00-K93) Diseases of the digestive system; (L00-L99) Diseases of the skin and subcutaneous tissue; (M00-M99) Diseases of the musculoskeletal system and connective tissue; (N00-N99) Diseases of the genitourinary system; (O00-O99) Pregnancy, childbirth and puerperium; (P00-P96) Certain conditions originating in the perinatal period; (Q00-Q99) Congenital malformations, deformations and chromosomal abnormalities; (R00-R99) Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified; (S00-T98) Injury, poisoning and certain other consequences of external causes; (Z00-Z99) Factors influencing health status and contact with health services

life-threatening symptoms. The patients who were transferred to the ICU also meet the requirements given by LPB NHF, that is, obtaining the adequate number of points on the TISS 28 scale (25 points).

In the general surgery units of N. Barlicki University Hospital No. 1 in Lodz and WAM University Hospital No. 2 in Lodz, postoperative care is provided by surgeons and surgical nurses. In the conditions of surgical units, there is not always a possibility of application of adequate monitoring and rapid reaction to life-threatening conditions. Very often, analgesic therapy is limited to application of nonsteroidal anti-inflammatory drugs on the patient's demand.

A relatively insignificant percentage of postoperative patients, due to different organizational, medical or

other problems, land in the Intensive Care Units at N. Barlicki University Teaching Hospital No. 1 in Lodz and WAM University Hospital No. 2 in Lodz. These are most frequently patients in very severe conditions. It seems that earlier transfer of patients with high postoperative risk could prevent such conditions.

The statistical analysis was performed with Microsoft Excel. The tests for two means for independent samples ($H_0: \mu_1 = \mu_2$; $H_1: \mu_1 \neq \mu_2$) were used for the statistical analysis.

Results

Structure of hospitalization in general surgery units in selected hospitals according to basic disease

Table II. Mortality in general surgery units (code: 4500) in selected hospitals in the groups of hospitalized patients with the diagnosis C00-C97; D00-D89 and K00-K93 acc. to the basic disease in the years 2003-2006 after modification of the structure and number of deaths

	Hospital No. 1	Hospital No. 5	Hospital No. 2	UH1/UH5	UH2/UH5
Mortality in group of patients with diagnosis C00-C97 acc. basic diagnosis (%)	14.52	2.42	6.21	p<0.001	p<0.02
Mortality in group of patients with diagnosis D00-D89 acc. basic diagnosis (%)	5.38	0.08	0.43	p<0.05	NS
Mortality in group of patients with diagnosis K00-K93 acc. basic diagnosis (%)	1.30	0.10	0.62	p<0.001	p<0.03

(A00-A99; ...; Z00-Z99) in the years 2003 to 2006 is presented in Table I. The relative structure similarity indices of the hospitalized patients in general surgery units in the selected hospitals acc. to the basic disease (A00-A99; ...; Z00-Z99) in the years 2003-2006 were respectively: UH No. 1/UH No. 2 – 0.511; UH No. 1/UH No. 5 – 0.549; UH No. 2/UH No. 5 – 0.637 and 0.418 together for UH No. 1/UH No. 2/UH No. 5.

To compare objectively the mortality, the most numerous groups of patients: with diagnosed C00-C97; D00-D89 and K00-K93 were selected for further analysis.

The mortality in group of patients with diagnosed C00-C97 was in UH No. 1 15.21%, in UH No. 2 8.12% and in UH No. 5 1.46% (UH No. 1/UH No. 5, p<0.001 and UH No. 2/UH No. 5, p<0.001). Relative structure similarity indices were in the range of C00-C97 diagnoses respectively: UH No. 1/UH No. 2 – 0.335; UH No. 1/UH No. 5 – 0.358; UH No. 2/UH No. 5 – 0.271 and 0.207 together for UH No. 1/UH No. 2/UH No. 5. After taking into account these indices (appropriate modification of the structure and number of deaths) the mortality was respectively: in UH No. 1 14.52%, in UH No. 2 6.21% and in UH No. 5 2.42% (UH No. 1/UH No. 5, p<0.001 and UH No. 2/UH No. 5, p<0.02).

The mortality in group of patients with diagnosed D00-D89 was in UH No. 1 5.32%, in UH No. 2 0.59% and in UH No. 5 0.12% (UH No. 1/UH No. 5, p<0.001 and UH No. 2/UH No. 5 NS). Relative structure similarity indices were in the range of D00-D89 diagnoses respectively: UH No. 1/UH No. 2 – 0.236; UH No. 1/UH No. 5 – 0.553; UH No. 2/UH No. 5 – 0.178 and 0.147 together for UH No. 1/UH No. 2/UH No. 5. After taking into account these indices (appropriate modification of the structure and number of deaths) the mortality was respectively: in UH No. 1 5.38%, in UH No. 2 0.43% and in UH No. 5 0.08% (UH No. 1/UH No. 5, p<0.05 and UH No. 2/UH No. 5 NS).

In the most numerous group (K00-K93) the mortality was in UH No. 1 2.49%, in UH No. 2 0.75% and in UH No. 5 0.08% (UH No. 1/UH No. 5, p<0.001 and UH No. 2/UH No. 5, p<0.001). Relative structure similarity indices were in the range of K00-K93 diagnoses respectively: UH No. 1/UH No. 2 – 0.668; UH No. 1/UH No. 5 – 0.486; UH No. 2/UH No. 5 – 0.512 and 0.416 together for UH No. 1/UH No. 2/UH No. 5. After taking into account these indices (appropriate modification of the structure and number of deaths) the mortality was respectively: in UH No. 1 1.30%, in UH No. 2 0.62% and in UH No. 5 0.10% (UH No. 1/UH No. 5, p<0.001 and UH No. 2/UH No. 5, p<0.03).

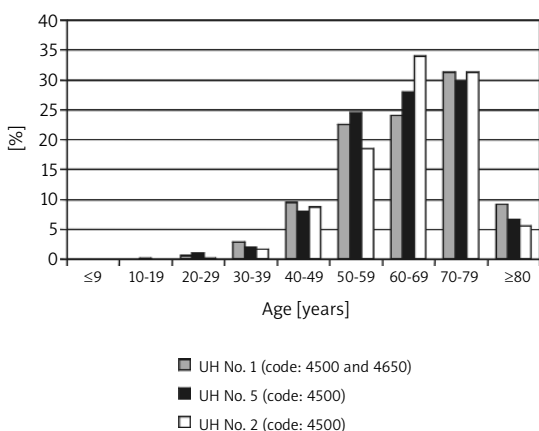


Figure 1. The age structure of patients with the diagnosis C00-C97 admitted to the surgical department of the selected hospitals between 2003-2006

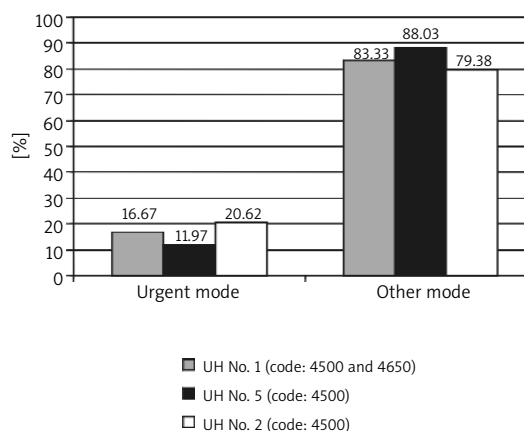


Figure 2. The mode of admission to the surgical departments of the selected hospitals with the diagnosis C00-C97 between 2003-2006

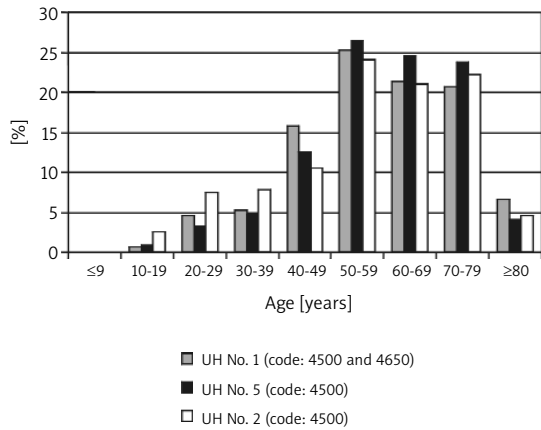


Figure 3. The age structure of patients with the diagnosis D00-D89 admitted to the surgical department of the selected hospitals between 2003-2006

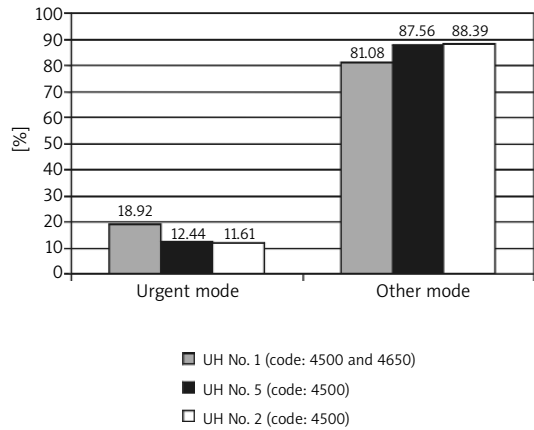


Figure 4. The mode of admission to the surgical departments of the selected hospitals with the diagnosis D00-D89 between 2003-2006

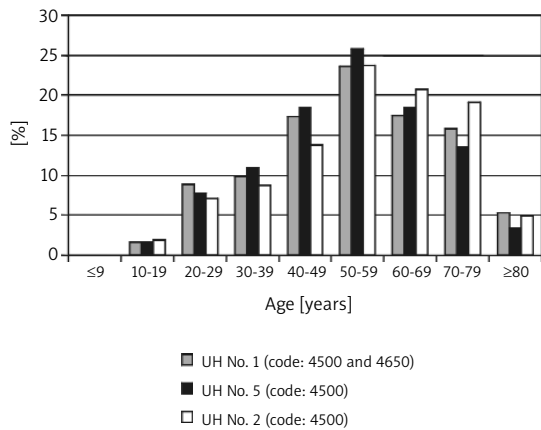


Figure 5. The age structure of patients with the diagnosis K00-K93 admitted to the surgical department of the selected hospitals between 2003-2006

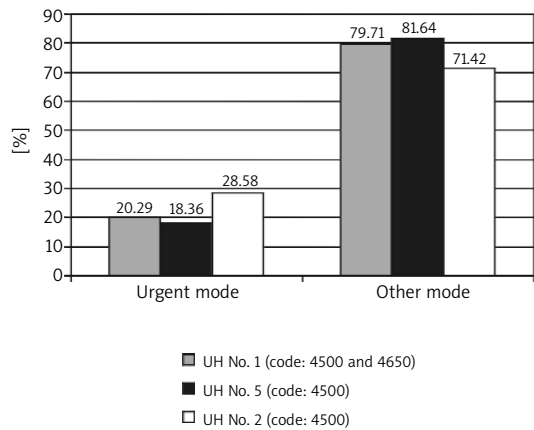


Figure 6. The mode of admission to the surgical departments of the selected hospitals with the diagnosis K00-K93 between 2003-2006

Mortality and statistical significance in the group of hospitalized patients with the diagnosis C00; ...; C97; D00; ...; D89 and K00; ...; K93 according to the basic disease in general surgery units in selected hospitals in the years 2003-2006 after modification of the structure and number of deaths are presented in Table II. The age structure of patients and the mode of hospital admission with the diagnosis C00; ...; C97; D00; ...; D89 and K00; ...; K93 for the selected hospitals between 2003-2006 year are presented on Figures 1-6.

To assess the effect of the quality of postoperative care and the current model of postoperative care on mortality, the mortality of patients with the same diagnoses was subjected to analysis according to the basic disease in the groups C00; ...; C97; D00; ...; D89 and K00; ...; K93 (after modification of the structure and the number of deaths). The results are demonstrated in Table III. The selected data from the

questionnaires filled annually by heads of surgical departments are presented on Table IV.

Discussion

The available in literature reports comparing mortality in surgical units concern first of all the mortality of patients subjected to a specific surgical procedure. The comparison of mortality in surgical units, comprising both the patients operated on and those treated conservatively, is very rare due to methodological difficulties faced by researchers as well as numerous factors hard to objectivize, affecting mortality in the analysed units. The structure of the admitted patients, their clinical condition, the kind of performed procedures, skills and experience of the operating surgeons, kind of postoperative care, cooperation with other units including intensive care unit are the most essential factors affecting mortality in surgical units.

Table III. Number of hospitalizations, mortality and statistical significance in general surgery units (code: 4500) in selected hospitals in the groups of hospitalized patients with the diagnosis C00; ...; C97, D00; ...; D89; K00; ...; K93 according to basic disease in the years 2003 to 2006 after modification of the structure and number of deaths

Treated patients					Mortality					Statistical significance	
Basic disease*	Total	Hospital No. 1	Hospital No. 5	Hospital No. 2	Basic disease*	Total (%)	Hospital No. 1 (%)	Hospital No. 5 (%)	Hospital No. 2 (%)	Hospital No. 1/ Hospital No. 5	Hospital No. 2/ Hospital No. 5
C15	2.87	0.27	2.00	0.60	C15	2.63	18.18	0.00	4.35	NS	NS
C16	283.60	26.99	197.60	59.00	C16	5.54	17.65	3.52	6.78	NS	NS
C18	461.44	43.92	321.53	96.00	C18	3.17	20.31	1.47	1.04	p<0.01	NS
C19	100.94	9.61	70.33	21.00	C19	3.43	10.00	0.71	9.52	NS	NS
C20	336.47	32.02	234.45	70.00	C20	1.32	8.11	0.36	1.43	NS	NS
C21	28.84	2.74	20.10	6.00	C21	6.93	0.00	0.00	33.33		NS
C22	22.96	2.19	16.00	4.78	C22	15.11	8.33	18.75	6.00	NS	NS
C23	10.05	0.96	7.00	2.09	C23	6.40	23.53	0.00	20.00	NS	NS
C24	21.53	2.05	15.00	4.48	C24	10.90	11.11	6.67	25.00	NS	NS
C25	126.29	12.02	88.00	26.27	C25	9.90	15.49	6.82	17.65	NS	NS
C26	4.81	0.46	3.35	1.00	C26	6.33	0.00	9.09	0.00	NS	NS
C44	1.44	0.14	1.00	0.30	C44	69.68	0.00	100.00	0.00		
C50	4.31	0.41	3.00	0.90	C50	0.00	0.00	0.00	0.00		
C53	4.81	0.46	3.35	1.00	C53	6.34	66.67	0.00	0.00	NS	
C54	4.81	0.46	3.35	1.00	C54	20.80	0.00	0.00	100.00		
C73	33.65	3.20	23.44	7.00	C73	0.00	0.00	0.00	0.00		
C76	20.09	1.91	14.00	4.18	C76	13.97	12.50	7.14	37.50	NS	NS
C78	24.03	2.29	16.75	5.00	C78	1.59	16.67	0.00	0.00	NS	
C79	5.74	0.55	4.00	1.19	C79	5.20	0.00	0.00	25.00		NS
D12	97.29	9.00	59.41	28.88	D12	0.00	0.00	0.00	0.00		
D13	23.58	2.18	14.40	7.00	D13	0.00	0.00	0.00	0.00		
D17	54.04	5.00	33.00	16.04	D17	0.00	0.00	0.00	0.00		
D18	1.64	0.15	1.00	0.49	D18	0.00	0.00	0.00	0.00		
D21	8.19	0.76	5.00	2.43	D21	0.00	0.00	0.00	0.00		
D22	10.81	1.00	6.60	3.21	D22	0.00	0.00	0.00	0.00		
D23	13.10	1.21	8.00	3.89	D23	0.00	0.00	0.00	0.00		
D24	8.19	0.76	5.00	2.43	D24	0.00	0.00	0.00	0.00		
D29	3.37	0.31	2.06	1.00	D29	0.00	0.00	0.00	0.00		
D30	3.37	0.31	2.06	1.00	D30	0.00	0.00	0.00	0.00		
D35	10.11	0.93	6.17	3.00	D35	0.00	0.00	0.00	0.00		
D37	397.48	36.77	242.71	118.00	D37	1.17	8.90	0.16	0.85	NS	NS
D39	10.81	1.00	6.60	3.21	D39	0.00	0.00	0.00	0.00		
D41	10.81	1.00	6.60	3.21	D41	0.00	0.00	0.00	0.00		
D44	33.68	3.12	20.57	10.00	D44	0.00	0.00	0.00	0.00		
D48	98.26	9.09	60.00	29.17	D48	0.66	7.14	0.00	0.00	NS	
D73	3.37	0.31	2.06	1.00	D73	0.00	0.00	0.00	0.00		
K20	3.76	1.00	2.05	0.71	K20	0.00	0.00	0.00	0.00		
K21	5.33	1.42	2.91	1.00	K21	0.00	0.00	0.00	0.00		
K22	10.98	2.92	6.00	2.06	K22	0.00	0.00	0.00	0.00		
K25	58.56	15.58	32.00	10.98	K25	4.46	11.12	0.00	8.00	NS	NS
K26	58.56	15.58	32.00	10.98	K26	3.82	7.32	0.00	10.00	NS	NS
K28	5.33	1.42	2.91	1.00	K28	4.43	16.67	0.00	0.00	NS	NS

Table III. Number of hospitalizations, mortality and statistical significance in general surgery units (code: 4500) in selected hospitals in the groups of hospitalized patients with the diagnosis C00; ...; C97; D00; ...; D89; K00; ...; K93 according to basic disease in the years 2003 to 2006 after modification of the structure and number of deaths

Basic disease*	Treated patients				Basic disease*	Mortality				Statistical significance	
	Total	Hospital No. 1	Hospital No. 5	Hospital No. 2		Total (%)	Hospital No. 1 (%)	Hospital No. 5 (%)	Hospital No. 2 (%)	Hospital No. 1/ Hospital No. 5	Hospital No. 2/ Hospital No. 5
K29	139.10	37.00	76.02	26.09	K29	0.00	0.00	0.00	0.00		
K31	85.32	22.69	46.63	16.00	K31	1.11	4.17	0.00	0.00	NS	
K35	197.63	52.57	108.00	37.06	K35	0.12	0.46	0.00	0.00	NS	
K36	3.66	0.97	2.00	0.69	K36	0.00	0.00	0.00	0.00		
K38	5.33	1.42	2.91	1.00	K38	0.00	0.00	0.00	0.00		
K40	1085.12	288.63	593.00	203.49	K40	0.04	0.00	0.00	0.21		NS
K41	26.66	7.09	14.57	5.00	K41	0.00	0.00	0.00	0.00		
K42	151.88	40.40	83.00	28.48	K42	0.92	3.45	0.00	0.00	NS	
K43	362.32	96.37	198.00	67.94	K43	0.39	1.47	0.00	0.00	NS	
K44	42.66	11.35	23.31	8.00	K44	0.00	0.00	0.00	0.00		
K45	18.30	4.87	10.00	3.43	K45	0.63	0.00	0.00	3.33		NS
K46	5.33	1.42	2.91	1.00	K46	0.00	0.00	0.00	0.00		
K50	22.56	6.00	12.33	4.23	K50	0.00	0.00	0.00	0.00		
K51	18.80	5.00	10.27	3.53	K51	0.00	0.00	0.00	0.00		
K52	30.08	8.00	16.44	5.64	K52	0.00	0.00	0.00	0.00		
K55	16.00	4.26	8.74	3.00	K55	16.37	61.54	0.00	0.00	p<0.03	
K56	138.65	36.88	75.77	26.00	K56	3.63	12.33	0.65	0.00	p<0.04	NS
K57	67.67	18.00	36.98	12.69	K57	0.00	0.00	0.00	0.00		
K58	3.76	1.00	2.05	0.71	K58	0.00	0.00	0.00	0.00		
K59	26.66	7.09	14.57	5.00	K59	0.00	0.00	0.00	0.00		
K60	93.99	25.00	51.36	17.63	K60	0.00	0.00	0.00	0.00		
K61	37.60	10.00	20.55	7.05	K61	0.00	0.00	0.00	0.00		
K62	86.47	23.00	47.25	16.22	K62	0.00	0.00	0.00	0.00		
K63	191.97	51.06	104.91	36.00	K63	2.00	5.56	0.00	2.78	NS	NS
K65	42.66	11.35	23.31	8.00	K65	7.35	10.00	0.00	25.00	NS	NS
K66	43.92	11.68	24.00	8.24	K66	1.21	4.55	0.00	0.00	NS	
K72	3.76	1.00	2.05	0.71	K72	18.21	0.00	33.32	0.00	NS	NS
K74	12.81	3.41	7.00	2.40	K74	8.16	18.93	0.00	16.67	NS	NS
K75	11.28	3.00	6.16	2.12	K75	0.00	0.00	0.00	0.00		
K76	36.60	9.73	20.00	6.86	K76	0.00	0.00	0.00	0.00		
K80	2744.48	730.00	1499.81	514.67	K80	0.09	0.00	0.12	0.15	NS	NS
K81	301.93	80.31	165.00	56.62	K81	0.42	0.88	0.00	1.00	NS	NS
K82	56.73	15.09	31.00	10.64	K82	2.76	6.85	0.00	5.00	NS	NS
K83	115.28	30.66	63.00	21.62	K83	0.45	0.78	0.00	1.30	NS	NS
K85	277.29	73.76	151.54	52.00	K85	1.06	2.73	0.62	0.00	NS	NS
K86	230.56	61.33	126.00	43.24	K86	0.00	0.00	0.00	0.00		
K91	16.00	4.26	8.74	3.00	K91	0.00	0.00	0.00	0.00		
K92	95.99	25.53	52.45	18.00	K92	0.82	3.08	0.00	0.00	NS	

C16 (stomach cancer), C18 (colon cancer), C20 (malignant neoplasm of the rectum), D37 (oral cavity and digestive system neoplasms of uncertain behaviour and/or unspecified nature), K29 (gastritis and duodenitis), K31 (other diseases of stomach and duodenum), K35 (acute appendicitis), K40 (inguinal hernia), K42 (umbilical hernia), K43 (abdominal hernia), K56 (paralytic ileus), K60 (fissure and fistula of anus and rectum), K62 (other diseases of anus and rectum), K63 (other intestinal diseases i.e. abscess, perforation, fistula), K80 (cholelithiasis), K81 (cholecystitis), K83 (other disorders of biliary tract), K85 (acute pancreatitis), K86 (other diseases of pancreas) and K92 (other diseases of digestive system)

Table IV. The selected data of provincial consultant from surgery on the basis of questionnaires for year 2005

Parameter	UH No. 1	UH No. 5	UH No. 2
Patients subjected to surgery (%)	77.49	68.28	91.62
Urgent mode of surgery (%)	13.58	4.45	3.76
Planned mode of the surgery (%)	86.42	95.55	96.24
Patients with malignant neoplasm subjected to surgery (%)	81.39	83.46	84.70

Postoperative care performed by surgeons in the conditions of a recovery room or intensive (surgical) care room is widespread solution also in other countries. Sometimes an anesthesiologist is included into the surgical team, however his task is first of all anaesthetization of patients admitted to this unit, less frequently he takes part in the process of postoperative treatment.

Among well educated physicians it does not matter if you are a surgeon or an anesthesiologist but the conditions to care the patients. However, experience of anesthesiologists in the management of patients with respiratory, circulatory or urinary dysfunction is in Poland significantly greater than that of surgeons. It results first of all from the binding model of education and from the organization of national health care system. Similar situation is found in a lot of countries all over the world. From this point of view lower mortality in a surgical unit, where postoperative care is conducted by anesthesiologists, should not be a surprise. In the opinion of the authors of this study, the higher is the per cent of patients operated on in severe condition or with significant burden, the more noticeable should be the difference in mortality in the case of the change in postoperative care organization.

High-intensity ICUs have been associated with improved outcomes. Angus et al. defined an ICU as "high intensity" if $\geq 80\%$ of patients were cared for by a critical care physician (intensivist) and defined an ICU as compliant with Leapfrog if it was both high-intensity and providing some form of in-house physician coverage during all hours [1-3]. In case of UH No. 5 all patients subjected to surgery are under the intensive care for all day (and for at least 1 day), whereas in the University Hospitals No. 1 and 2 the intensive care finishes in the moment when patients comes round from the anesthetic. High-intensity vs. low-intensity ICU physician staffing is associated with reduced hospital and ICU mortality and hospital and ICU [4].

The authors analysed in detail the patients with the diagnoses C00; ...; C97; D00; ...; D89 and K00; ...; K93 according to the basic disease, from the years 2003-2006. The patients with these diagnoses, the number of whom was at least 15 in each hospital (after modification of the structure) were qualified

for further analysis. These diagnoses had the following statistical numbers: C16 (stomach cancer), C18 (colon cancer), C20 (malignant neoplasm of the rectum), D37 (oral cavity and digestive system neoplasms of uncertain behaviour and/or unspecified nature), K29 (gastritis and duodenitis), K31 (other diseases of stomach and duodenum), K35 (acute appendicitis), K40 (inguinal hernia), K42 (umbilical hernia), K43 (abdominal hernia), K56 (paralytic ileus), K60 (fissure and fistula of anus and rectum), K62 (other diseases of anus and rectum), K63 (other intestinal diseases i.e. abscess, perforation, fistula), K80 (cholelithiasis), K81 (cholecystitis), K83 (other disorders of biliary tract), K85 (acute pancreatitis), K86 (other diseases of pancreas) and K92 (other diseases of digestive system).

Among these diagnoses: K35 (acute appendicitis), K40 (inguinal hernia), K42 (umbilical hernia), K43 (abdominal hernia), K60 (fissure and fistula of anus and rectum), K62 (other diseases of anus and rectum) and K80 (cholelithiasis) are the ones in which mortality should be low and it should not differ statistically. If such statistically significant differences occurred, they would manifest inadequate qualifications of the operating surgeons and/or improper sanitary rigour. The diagnoses: C16 (malignant neoplasm of the rectum), C18 (colon cancer), K56 (paralytic ileus), K85 (acute pancreatitis) are the ones with the increased risk of complications and death, in which proper postoperative care or in cases of need – the treatment in intensive care unit may be of importance to decrease mortality. The decrease of mortality in these groups of patients in any of the analysed hospitals at insignificant difference in mortality of patients with the diagnoses of: K35, K40, K42, K43, K60, K62 or K80 would manifest, according to the authors of this study, the advantage of the postoperative care system in this hospital over the other system.

The carried out statistical analysis demonstrated very low mortality in the groups of patients with the diagnoses of: K35, K40, K42, K43, K60, K62 and K80. The mortality in these groups of patients did not differ statistically among the analysed hospitals. In the opinion of the authors it proves that the skills of the operating team similar (high) in all the analysed hospitals and typical complications for these diagnoses e.g. infections, were not a distinct problem from the point of view of mortality in these groups of patients. It also points indirectly to the sufficient sanitary rigor.

The presented in Table III number of hospitalizations, mortality and statistical significance concern the group of patients after modification of the structure and number of deaths. It is obvious that this procedure is necessary in the case of the comparison of aggregated mortality. However, it is not necessary in the comparison of mortality within the same basic diagnosis. Then, mortality is the same

before and after modification and only the number of hospitalizations and deaths changes. These, of course affect the level of statistical significance in the carried out analyses. For instance, before modification of the structure and the number of deaths, more statistically significant difference in mortality was observed in the diagnosis of C16 (UH No. 1/UH No. 5, $p < 0.02$), C18 (UH No. 1/UH No. 5, $p < 0.001$) and K56 (UH No. 1/UH No. 5, $p < 0.01$). The influence of the sample quantity is obvious in comparison to the data presented in Table III. However, the sample size did not affect the statistical significance in the case of the following diagnoses: K35, K40, K42, K43, K60, K62 and K80.

It is also worth paying attention to the fact that mortality in the group of patients with diagnosed C00-C97 was respectively: in UH No. 1 14.52%, in UH No. 2 6.21% and in UH No. 5 2.42% (UH No. 1/UH No. 5, $p < 0.001$ and UH No. 2/UH No. 5, $p < 0.02$) and in the group of patients with diagnosed K00-K93 the mortality was respectively: in UH No. 1 1.30%, in UH No. 2 0.62% and in UH No. 5 0.10% (UH No. 1/UH No. 5, $p < 0.001$ and UH No. 2/UH No. 5, $p < 0.03$) (after appropriate modification of the structure and number of deaths). In the opinion of the authors, on one hand the results demonstrate that the mortality in the analysed groups of patients is significantly lower in UH No. 1 than in the other hospitals, on the other hand they consider in the analysis the patients with increased risk of complications and death in whom proper postoperative care may be of importance to decrease mortality.

Information that the Department of General and Colorectal Surgery at the University Hospital No. 5 has been functioning since January 2003 deserves particular attention. Until 31 December, 2002 majority of physicians and nurses from this team (including the Head of the Department) worked in the surgical unit of the Ministry of Internal Affairs and Administration Hospital in Lodz. The system of postoperative care in surgical unit of that hospital was organized in similar way as in University Hospital No. 1 and No. 2 and mortality was on the average 1.55% in the years 2000-2002. The range of surgical procedures was significantly smaller than those performed in University Hospital No. 5, both in objective (ICD-10) and subjective (operating surgeons) evaluation.

Analyzing the questionnaires handed every year by the heads of the surgical units to the provincial consultant in surgery, the authors did not find any other significant causes explaining the differences in mortality of patients in the analysed surgical units of the selected hospitals.

A detailed analysis of the diagnoses and of mortality allows to presume that early postoperative intensive care in severely ill patients and in cases of need immediate admission to ICU significantly decrease mortality. The latter is of great importance in the case of explanation of the difference in mortality between surgical units of UH No. 1 and UH No. 2. The Intensive Care Unit at UH No. 2 can admit more patients from other hospital units due to underestimation of the value of contract with National Health Fund and thus fewer patients than in ICU at UH No. 1.

The authors are aware of the fact that with continuous shortage of places in intensive care units for first of all the treatment of traumatic cases and acute cardio-pulmonological states, rapid change of the system of treatment of postoperative patients is impossible. Nevertheless, the significance of the numbers quoted in this study seems to justify the usefulness of considering such activities.

In conclusions the change of the system of postoperative care consisting in: taking over postoperative care by physicians and anaesthesiological nurses, intensive monitoring of postoperative patients, immediate transfer of patients with life hazard to Intensive Care Unit, decreases significantly mortality in a surgical unit.

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