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Incidence and Risk Factors of Postoperative Pneumonia in Abdominal Operations Patients at a Teaching Hospital in China

To the Editor—Postoperative pneumonia (POP) is defined as hospital-acquired or ventilator-associated pneumonia in postsurgical patients; it is among the most common complications among postsurgical patients, leading to increased morbidity, length of hospital stay, and costs.[1,2] Elucidating the risk factors for POP would help reduce the incidence of this complication; however, few studies have been published concerning POP with abdominal operations in Chinese hospitals.

To determine the incidence of, pathogens implicated in, and risk factors for POP in abdominal operations in China, we conducted a research in The Second Affiliated People's Hospital of Fujian University of Traditional Chinese Medicine, a tertiary-care teaching hospital in southeastern China. All patients who received abdominal operations between January 1, 2015, and December 31, 2015, in this hospital were included in the study. The demographic data and medical records including imaging, and laboratory tests were reviewed, and healthcare-associated infections were monitored as usual. Pneumonia was identified using the 2015 US Centers for Disease Control and Prevention (CDC) criteria for a pneumonia event.[3]

Among the 618 patients who received abdominal operations, 36 patients (5.83%) developed POP. The POP incidence rates differed among abdominal surgery types as follows: gastric, 11 of 56 (19.64%); hepatic, 4 of 27 (14.81%); colorectal, 16 of 127 (12.60%); biliary tract, 4 of 80 (5.00%); appendix, 1 of 156 (0.64%); and inguinal hernia surgery, 0 of 172 ($P < .001$). Lower respiratory tract specimens from 30 POP patients were sent to the microbiology laboratory for pathogen culture, and 12 samples were positive for bacterial growth. The following pathogens were isolated: *Klebsiella pneumoniae* (4 strains), *Pseudomonas aeruginosa* (2 strains), *Escherichia coli* (2 strains), *Staphylococcus aureus* (2 strains), and *Candida albicans* (2 strains).

To determine the risk factors for POP, univariate analysis and multivariable analysis (logistic regression analysis) were used. Patients who developed POP after abdominal operations were included in the POP group. For each POP patient, 2 controls were randomly selected from patients who did not acquire pneumonia before and after abdominal operations and did not develop other healthcare-associated infections during this hospitalization. As shown in Table 1, univariate analysis revealed that POP patients had higher rates of smoking, diabetes mellitus, chronic pulmonary disease, chronic cardiovascular disease; higher levels of serum creatinine; higher American Society of Anesthesiologists (ASA) scores; lower levels of serum albumin and hemoglobin; and longer durations of surgery than control patients. Multivariable analysis demonstrated that smoking and chronic cardiovascular disease were independent risk factors for POP.

The POP incidence has been reported to be between 0.78% and 40%, making it the third most common infection in patients after an operation, with a mortality rate between 30% and 40%.[2,4] The present study shows that the incidence of POP is not considered low in patients undergoing abdominal

TABLE 1. Possible Risk Factors of Postoperative Pneumonia (POP)

Variable		POP Group (N = 36), No. (%)	Control Group (N = 72), No. (%)	Univariate Analysis		Multivariable Analysis	
				Odds Ratio (95% CI)	*P* Value[a]	Odds Ratio (95% CI)	*P* Value
Sex	Male	21 (58.33)	44 (61.11)	0.891 (0.395–2.012)	.781		
	Female	15 (41.67)	28 (38.89)				
Age, y	≥60	30 (83.33)	29 (40.28)	7.414 (2.741–20.053)	<.001		
	<60	6 (16.67)	43 (59.72)				
Surgical wound classification	I	2 (5.56)	3 (4.17)	…	.556[b]		
	II	32 (88.88)	66 (91.67)				
	III	2 (5.56)	3 (4.17)				
American Society of Anesthesiologists (ASA) Score	I	0	17 (23.61)	…	<.001[b]		
	II	28 (77.78)	55 (76.39)				
	III	6 (16.67)	0				
	IV	2 (5.56)	0				
Emergency operation	Yes	6 (16.67)	5 (6.94)	2.680 (0.758–9.472)	.175[c]		
	No	30 (83.33)	67 (93.06)				
Minimally invasive surgery	Yes	24 (66.67)	57 (79.17)	0.526 (0.215–1.290)	.157		
	No	12 (33.33)	15 (20.83)				
Duration of the operation, min	≥180	25 (69.44)	32 (44.44)	2.841 (1.217–6.633)	.014		
	<180	11 (30.56)	40 (55.56)				
Administration of antimicrobial agents in the perioperative period	Yes	34 (94.44)	66 (91.66)	1.545 (0.296–8.071)	.716[c]		
	No	2 (5.56)	6 (8.34)				
Smoking	Yes	18 (50.00)	9 (12.50)	7.000 (2.690–18.216)	<.001	0.055 (0.006–0.497)	.009
	No	18 (50.00)	63 (87.50)				
Diabetes mellitus	Yes	7 (19.44)	2 (2.78)	8.448 (1.655–43.118)	.006[c]		
	No	29 (80.56)	70 (97.22)				
Chronic pulmonary diseases	Yes	8 (22.22)	6 (8.33)	3.143 (0.998–9.879)	.066[c]		
	No	28 (77.78)	66 (91.67)				
Chronic cardiovascular diseases	Yes	8 (22.22)	1 (1.39)	20.286 (2.424–169.743)	.001[c]	0.158 (0.027–0.926)	.041
	No	28 (77.78)	71 (98.61)				
Malignant neoplasm	Yes	4 (11.11)	2 (2.78)	4.500 (0.784–25.837)	.088[c]		
	No	32 (88.89)	70 (97.22)				
Serum albumin (g/L)	≥35	24 (66.67)	71 (98.61)	0.028 (0.003–0.228)	<.001[c]		
	<35	12 (33.33)	1 (1.39)				
Hemoglobin (g/L)	≥110	24 (66.67)	66 (91.61)	0.182 (0.061–0.538)	.001		
	<110	12 (33.33)	6 (8.33)				
Serum creatinine (umol/L)	≥120	5 (13.88)	1 (1.39)	11.452 (1.284–102.128)	.015[c]		
	<120	31 (86.11)	71 (98.61)				

[a] χ^2 test unless otherwise specified.
[b] Mann-Whitney-Wilcoxon Test.
[c] Fisher exact test.

operations, especially in gastric, hepatic, colorectal, or biliary tract surgeries. Gastric juice reflux, aspiration, and/or more serious injury during the procedure might be reasons for this phenomenon. Pathogens causing POP are ubiquitous in healthcare settings, which are similar to those responsible for other hospital-acquired pneumonia.

Several factors have been correlated with POP after abdominal operations; therefore, it is likely that much could be done perioperatively to reduce the frequency of the complication. Most measures are the same strategies used for the prevention of surgical site infections,[5] including the management of underlying disease (especially chronic cardiovascular disease, diabetes mellitus, chronic pulmonary disease), improving the patient's nutritional status, cessation of smoking, improving operation skill, and reducing the duration of surgery. Focusing on these measures in these patients could reduce their risk for POP.

In conclusion, the POP incidence is not low in abdominal operations, and the complication is more common in patients with chronic cardiovascular disease or in habit of smoking, and its major pathogens are gram negative bacteria.

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Clinical Relevance of the 2014 and 2015 National Healthcare Safety Network's Catheter-Associated Urinary Tract Infection Definitions

To the Editor—Catheter-associated urinary tract infection (CAUTI) is the healthcare-associated infection most commonly reported to the National Healthcare Safety Network (NHSN).[1] The Centers for Medicare and Medicaid Services (CMS) use CAUTI rates to help define hospital quality and to determine reimbursement.[2]

The NHSN periodically updates the surveillance definition of CAUTI; substantial revisions occurred in 2009, 2013, and 2015. Previous authors have described poor correlation between surveillance and clinical CAUTI cases. For example, Neelakanta et al[3] reported that >50% of patients with a surveillance CAUTI had a non-UTI source of fever using the 2013 definition. While one would not expect a surveillance definition to precisely mirror clinical cases, many would argue that it is inappropriate to use surveillance data to levy financial penalties on hospitals when it poorly reflects clinical cases.

In this study, we compared 2014 and 2015 surveillance CAUTI to clinical CAUTI in 2 hospitals to determine which surveillance definition has the highest concordance with clinical CAUTI diagnoses.

METHODS

Setting and Population

This retrospective cohort study was conducted at 2 affiliated academic hospitals. Together, the hospitals have ~1,200 medical-surgical and 143 critical-care beds. One hospital has solid organ transplantation, bone marrow transplantation, and burn units. Eligible cases were obtained by querying the NHSN for CAUTI diagnosed between January 1, 2014, and December 31, 2014. A case patient was excluded if his or her medical record was incomplete or if the patient was <18 years old.

An infection preventionist reviewed eligible cases to confirm that they met the 2014 and to determine whether they met the 2015 NHSN CAUTI definitions. An infectious diseases physician reviewed each case of surveillance CAUTI to decide whether it was also a clinical CAUTI. Clinical documentation was used to establish the presence of urinary tract infection