# **R** AISING COMPLIANCE OF ANTIBIOTIC PROPHYLAXIS (AP) AMONG RUSSIAN SURGEONS: THE FIRST STEP ON A LONG ROAD

## **Poster # 1539**

Golub A.<sup>1</sup>, Galkin D.<sup>2</sup>, Moskalev A.<sup>1</sup>, Kozlov R.<sup>2</sup>, Pleshkov V.<sup>1</sup> <sup>1</sup> Department of General Surgery, Smolensk State Medical Academy, Smolensk, Russian Federation <sup>2</sup>Institute of Antimicrobial Chemotherapy (IAC), Smolensk State Medical Academy, Smolensk, Russian Federation

# RATIONALE

Surgical site infections (SSI) still contribute as a major source of illness in the surgical patient, accounting for approximately a quarter of all hospital-acquired infections. The use of antibiotic prophylaxis (AP) before surgery has become a standard in the recent three decades. The value of AP in reducing rates of infections has become more evident since improvements in the timing of administration, the appropriate choice of antibiotics, and shorter course durations have been defined more clearly. Currently a single-dose systemic regimen of an appropriate antibiotic given during the immediate preoperative period is safe and the indicated practice. A vast number of papers and guidelines have described optimal surgical prophylaxis. Despite the availability of AP enforcing material, recent studies assessing the current practice of prophylaxis have shown that over-consumption of antimicrobials and inappropriate timing is a general issue in surgical practice. The statement has also been confirmed by a newer prospective study with disappointing results on AP compliance in Russian hospitals.

Thus the aim of our study was to evaluate the quality of AP in hospitals of the Smolensk region with further development of an approach to raising compliance of AP to the existing national recommendations.

# METHODS

**Consecutive case histories of patients who underwent abdominal surgical interventions** (gastroduodenal, biliary, colorectal, appendectomy, and hernia repair) in the second half of the year 2002 were monitored during the first phase of the study in 6 surgical units from various hospitals. To assess the quality of AP we used following indicators: (1) rate of AP on indications; (2) rate of appropriate choice of antibiotic; (3) rate of initiation of the first dose of antibiotic prior to incision.

The second phase of the study was introduced during the years 2004-2005 when the authors of the study have undertaken interventional measures which included: (1) educational events; (2) propagation and distribution of the national recommendations on AP free of charge among surgeons; (3) administrative regulation - implementation of the AP protocol into a routine practice.

A repeated monitoring of AP was introduced during the third phase of the study when we analyzed consecutive case histories of the patients who underwent analogous surgical interventions in the second quarter of 2006. To compare the results, 4 surgical units were combined into a conditional group "A" where AP protocols were inserted into all case histories and the rest two units where protocols were inserted into a less than 30% of case histories were referred into a conditional group "B".

# MAIN RESULTS

Four hundred ninety eight and 230 case histories were enrolled during various years of the study. Rate of AP administration

In a group "A" units with implemented AP protocols in the year 2006 we note a considerable and statistically significant increase in the rate of AP in all types of corresponding abdominal interventions with the exception of hernia repair (Table 1). The proportion of patients who underwent clean-contaminated or contaminated operation and who thus received AP "on indication" has increased from 19,9% in 2002 to 89,0% in 2006.

Table 1. Rate of AP in all types of interventions in the group "A"

Type of surgical	Grou	р	
intervention	year 2002 (n=330)	year 2006 (n=103)	•
Colorectal	31.6% (12/38)	91.7% (11/12)	0.0003
Appendectomy	8.5% (7/82)	91.3% (42/46)	<0.0001
Gastroduodenal	28.6% (14/49)	71.4% (5/7)	0.037
Biliary	20,7% (17/82)	88.2% (15/17)	<0.0001
Hernia repair	7.6% (6/79)	19.0% (4/21)	0.211
"On indication"	19.9% (50/251)	89.0% (73/82)	<0.0001

In a group "B" we noted an increase in rate of AP in clean-contaminated and contaminated operations, i.e. "on indication" (Table 2). The proportion patients who were administered AP in 2006 has increased by 31.6% and was 48.9%. On the other hand we have seen a significant increase in the rate of AP for hernia repair operations from 7.3% in 2002 to 48.5% in 2006.

### Table 2. Rate of AP in the group "B"

Type of surgical	Group	р	
intervention	year 2002 (n=168)	year 2006 (n=127)	
Colorectal	35.3% (6/17)	0% (0/2)	1
Appendectomy	12.2% (5/41)	37.3% (19/51)	0.006
Gastroduodenal	10.7% (3/28)	14.3% (1/7)	1
Biliary	19.5% (8/41)	76.5% (26/34)	<0.0001
Hernia repair	7.3% (3/41)	48.5% (16/33)	<0.0001
"On indication"	17.3% (22/127)	48.9% (46/94)	<0.0001

As initially we noted a rather similar rate of AP in 2002 in the units of both groups, in the year 2006 we have seen an increase of AP in the group "A" in comparison to "B" in all types of surgical procedures (p<0.05) except gastroduodenal and biliary operations (Table 3).

#### Table 3. Rate of AP in 2006 in the study groups

Type of surgical	Group "A" (n=103)	Group "B" (n=127)	р
intervention			
Colorectal	91.7% (11/12)	0% (0/2)	0.033
Appendectomy	91.3% (42/46)	37.3% (19/51)	<0.0001
Gastroduodenal	71.4% (5/7)	14.3% (1/7)	0.102
Biliary	88.2% (15/17)	76.5% (26/34)	0.463
Hernia repair	19.0% (4/21)	48.5% (16/33)	0.029
"On indication"	89.0% (73/82)	48.9% (46/94)	<0.0001

#### Choice of an antibiotic for AP

I-III generation cephalosporins ([CS], cefazolin, cefuroxime, cefotaxime, ceftriaxone) were used in 2002 in the group "A" which accounted for 78.6% (44/56) of all cases of antibiotics administration (Table 4). The rate of use of antibiotics of other classes did not exceed 8.9% (5/56) for aminoglycosides (gentamicin and amikacin).

#### Table 4. Antibiotics used for AP in the group "A"

	_			0								
		Rate of antibiotics administration %(n)										
	Year of the study	Cefazolin	Cefuroxime	<b>Co-amoxiclav</b>	Ciprofloxacin	Cefotaxime	Ceftriaxone	Oxacillin	Gentamicin	Amikacin	Metronidazloe	Others
Hernia repair	2002	50.0 (3/6)				16.6 (1/6)		33.3 (2/6)				
	2006	50.0 (2/4)		50.0 (2/4)								
Appendectomy	2002	28.5 (2/7)				28.5 (2/7)	14,2 (1/7)		14.2 (1/7)		14.2 (1/7)	
	2006	21.3 (10/47)		61.7 (29/47)		2.1 (1/47)			6.4 (3/47)		4.3 (2/47)	4.3 (2/47)
Biliary	2002	23.5 (4/17)	5.8 (1/17)			11.7 (2/17)	23,5 (4/17)		17.6 (3/17)			17.6 (3/17)
	2006	25.0 (4/16)	25.0 (4/16)	31.3 (5/16)		12.5 (2/16)					6.2 (1/16)	
Gastroduodenal	2002	57.1 (8/14)				7.1 (1/14)	21,4 (3/14)			7.1 (1/14)	)	7.1 (1/14)
	2006	20.0 (1/5)		80 (4/5)								
Colorectal	2002	16.7 (2/12)				8.3 (1/12)	75,0 (9/12)					
	2006	8.3 (1/12)	8.3 (1/12)	8.3 (1/12)	8,3 (1/12)	50.0 (6/12)					8.3 (1/12)	8.3 (1/12)

In the year 2002 in the group "A" units cefazolin - 34.0% (19/56), ceftriaxone - 30.4% (17/56) and cefotaxime 12.5% (7/56) were the most often used for AP antibiotics. Rate of administration of other antibiotics did not exceed 10%.

In the year 2006 a significant decrease in use of I-III generations CS in the group "A" and a considerable increase in the use for AP of inhibitor protected penicillins (amoxicillin/clavulanic acid) was noted. The rate of administration of which was 38.0% (32/84) and 48.8% (41/84) correspondingly.

Co-amoxiclav was the most prevalent AP drug in abdominal surgery and its share among all administrations was 48.8% (41/84), use of cefazolin was noted in 21.4% (18/84) of all cases. Cefotaxime was administered in 10.7% (9/84) of cases mainly for AP in colorectal operations. Besides that in the year 2006 we noted a dramatic decrease from 42.8% (24/56) in 2002 to 10.7% (9/84) in 2006 in general rate of CS III administration for AP.

As the 2002 monitoring has shown that in the group "B" units AP was most frequently performed with I and III generation CS (cefazolin, cefotaxime) which accounted 68.0% (17/25) of all administrations (Table 5). Aminoglycosides (gentamicin, amikacin) and nitroimidazoles (metronidazole) were administered in 16.0% (4/25) and 12.0 % (3/25) cases correspondingly. A majority of administrations among single drugs was noted for cefazolin - 64.0% (16/25), gentamicin and metronidazole - 12.0% (3/84) each. A change towards wider use of I and III generation CS (cefazolin, cefotaxime, ceftriaxone)

was registered in 2006 and accounted for 94.7% (72/76) cases. The share of aminoglycosides accounted for 5.3% (4/76). Cefazolin - 88.1% (67/76), ceftriaxone and gentamicin - 3.9% (3/76) each were the most frequently used single antibiotics.

Table 5. Antibiotics for AP in the group "B"

				0								
		Rate of antibiotics administration %(n)										
	Year of the study	Cefazolin	Cefuroxime	Co-amoxiclav	Ciprofloxacin	Cefotaxime	Ceftriaxone	Oxacillin	Gentamicin	Amikacin	Metronidazloe	Others
Hernia repair	2002	100 (3/3)						33.3 (2/6)				
	2006	100 (21/21)										
Appendectomy	2002	80.0 (4/5)							20.0 (1/5)			
	2006	68.2 (15/22)				9.1 (2/22)	9.1 (2/22)		9.1 (2/22)	4.5 (1/22)		
Biliary	2002	62							25 (2/8)			13 (1/8)
	2006	(5/8)							3.1 (1/32)			
Gastroduodenal	2002	96.9 (31/32)				33.3 (1/3)					33.3 (1/3)	
	2006	33.3 (1/3)					100 (1/100)					
Colorectal	2002									16.6 (1/6)	33.3 (2/6)	
	2006	50.0 (3/6)										

A comparison of the structure of antibiotics that were used in 2006 in the units of both groups has revealed considerable difference both in the groups and single antibiotics (Table 6). For instance, in the units of the group "A" co-amoxiclav and cefazolin were the most prevalent antibiotics and accounted for 70.2% (n=59/84) of all administrations. Cefotaxime was used in 10.7% (n=9/84) cases.

Cefazolin in the group "B" was used for AP in the majority of cases which accounted for 88.1% (n=67/76). Rate of administration of other antibiotics did not exceed 6.0% for each drug.

Table 6. Antibiotics that were used for AP in 2006 in the units of both groups

								0	•			
		Rate of antibiotics administration %(n)										
	Group	Cefazolin	Cefuroxime	<b>Co-amoxiclav</b>	Ciprofloxacin	Cefotaxime	Ceftriaxone	Oxacillin	Gentamicin	Amikacin	Metronidazloe	Others
Hernia repair	A	50.0 (2/4)		50.0 (2/4)								
	B	100										
Appendectomy	Α	(21/21)		61.7 (29/47)		2.1 (1/47)		6.4 (3/47)	20.0 (1/5)		4.3 (2/47)	4.3 (2/47)
	В	21.3 (10/47)				9.1 (2/22)	9.1 (2/22)	9.1 (2/22)	9.1 (2/22)	4.5 (1/22)	)	
Biliary	Α	68.2 (15/22)	25,0 (4/16)	31,3 (5/16)		12,5 (2/16)			25 (2/8)		6.2 (1/16)	
	В	25.0 (4/16)						3.1 (1/32)	3.1 (1/32)			
Gastroduodenal	A	96.9 (31/32)		80.0 (4/5)								
	В	20.0 (1/5)					100					
Colorectal	Α		8.3 (1/12)	8.3 (1/12)	8.3 (1/12)	50.0 (6/12)	(1/1)				8.3 (1/12)	8.3 (1/12)
	B	8.3 (1/12)										

In 2006 the proportion of compliance to the choice of antibiotic in accordance to national recommendations has increased in the group "A" to 38.0% and was 60.0% (48/80) cases (Table 7). 
 Table 7. Choice of antibiotic in the group "A" units

Variable	2002	2006	р
# of administrations	50	80	
Adequate choice	22.0% (n=11)	60.0% (n=48)	<0.0001

Smolensk State Medical Academy, P.O.Box 5, 214019, Smolensk, Russia Tel.: +7 4812 61 13 27 E-mail: golub@antibiotic.ru

In the group "B" units we also noted a change in the practice of antibiotics administration in 2006 however this was a trend towards significant decrease of adequate choice of antibiotic. This variable share was 3.6% (n=2/55) (Table 8). Table 8. Choice of a drug in the group "B"

Variable	2002	2006	р
# of administrations	22	55	
Adequate choice	18.1% (n=4)	3.6% (n=2)	0.052

When the results of the adequacy of antibiotic choice in the year 2006 was compared in both groups we revealed a higher adequate choice (56.4%, p<0.05) of antibiotic in accordance with national recommendations and AP protocols in the group "A" (Table 9).

Table 9. Choice of antibiotic in 2006 in groups "A" and "B"

Variable	Group "A"	Group "B"	р
# of administrations	80	55	
Adequate choice	60.0% (n=48)	3.6% (n=2)	<0.0001

Rate of initiation of the first dose of antibiotic prior to incision

A priority to introduction of intra- and postoperative AP for all types of abdominal operations was registered in both groups in 2002. Year 2006 was marked by significant changes in the structure of AP timing towards more frequent initiation of antibiotic administration before the incision.

The rate of preoperative AP has increased in the group "A" by 17.8% and was 46.4% (39/84) (Table 10) and in the group "B" by 29.4% and was 46.0% (35/76) (**Table 11**).

Table 10. Time of initiation of the first dose of antibiotic in the group "A"

		0					
Variable	2002	2006	р				
# of AP procedures	56	84					
Preoperative AP	28.6% (n=16)	46.4% (n=39)	0.034				
Table 11. Time to initiation of the first dose of antibiotic in the group "B" units							
Variable	2002	2006	р				
# of AP procedures	25	76					
Preoperative AP	16.6% (n=4)	46.0% (n=35)	0.007				

Meanwhile as we noted a significant increase in the rate of antibiotic administration before the incision in both patient groups in the year 2006, no difference was revealed in terms of preoperative AP between the compared groups (Table 12).

Table 12. Adequate administration of the first dose of antibiotic in 2006 in the groups "A" and "B"

Variable	Group "A"	Group "B"	р					
<b># of AP procedures</b>	84	76						
<b>Preoperative AP</b>	46.4% (n=39)	46.0% (n=35)	0.962					

# CONCLUSION

1. The quality of AP in surgical units of the Smolensk region was low in 2002: the rate of AP in clean-contaminated and contaminated operations was 17.3-19.9%; adequate antibiotic choice was in 18.1-22.0% of cases, correct time of antibiotic initiation in 16.6-28.6% of cases.

2. Introduction of a multicomponent approach in 2006 has allowed to significantly increase the quality of AP: rate of AP on indication to 89.0%, adequate choice of drug to 60.0%, and correct time of administration - to 46.4%.

3. After introduction of an AP protocol, the quality variables have exceeded by 40.1% those numbers in protocol naive units if tested for AP "on indication" and by 56.4% by adequate antibiotic choice.

1. Gorecki P., Schein M., Rucinski J.C., Wise L. Antibiotic administration in patients undergoing common surgical procedures in a community teaching hospital: the chaos continues. Burke J.P. Maximizing appropriate antibiotic prophylaxis for surgical patients: an update from LDS hospital, Salt Lake City. CID 2001; 33:78-83.
 Welch L., Teague A.C., Knight B.A., et al. A quality management approach to optimizing delivery and administration of preoperative antibiotics. Clin Perform Qual Health Care

4. Gindre S., Carles M., Aknouch N., et al. Antimicrobial prophylaxis in surgical procedures: assessment of the guidelines application and validation of antibiotic prophylaxis kits. Ann Fr Anesth Reanim 2004; 23:116-23. 5. Van Kasteren M.E.E., Kullberg B.J., Boer A.S., Mintjes-de Groot J., Gyssens I.C. Adherence to hospital guidelines for surgical antimicrobial prophylaxis: a multicentre audit in Dutch hospitals. J Antimicrob Chemother 2003: 51:1389-96. 6. Pons-Busom M., Aguas-Compaired M., Delas J., Eguileor-Partearroyo B. Compliance with local guidelines for antibiotic prophylaxis in surgery. Infect Control Hosp Epidemiol 2004;