Letters to the Editor

An anesthesia perspective on surgical antibiotic prophylaxis: Results of a comprehensive infectiology survey study in German hospitals

To the Editor:

It was with great interest that we read 2 recent articles on the topic of surgical antibiotic prophylaxis (SAP).[1,2] Broom et al[1] interviewed 17 surgeons (including 7 residents) and 3 anesthetists (including 1 resident) regarding SAP administration. All physicians were working in a 450-bed tertiary referral hospital in Sydney, Australia. The authors concluded that the administration of SAP according to official guidelines is negatively influenced by the interaction of surgeons and anesthetists, and also by the hierarchy within/between surgical and anesthetic teams. Schmitt et al[2] analyzed 1,011 neurosurgical procedures performed in 2010 in 9 hospitals in São Paulo, Brazil, and found that the SAP guidelines were correctly followed or adhered to in only 10% of patients (range, 0-29%).

Inadequate implementation of SAP leads to increases in surgical site infections, hospital expenses, and multidrug-resistant strains.[3,4] Jointly, surgeons and anesthetists must initiate SAP according to the guidelines. However, there is a clear lack of data regarding the role of anesthetists in hospital's provision of SAP, as shown by the results reported by Broom et al.[1]

A recent study from German anesthetists may clarify some open questions. Between June and October 2017, a validated survey assessing aspects of antibiotic prescription and resistance (MR2; Multi-institutional Reconnaissance of Practice with Multiresistant Bacteria[5]) was performed. Knowledge and skills of anesthetists related to their educational level were assessed to identify capabilities for improvement, necessary educational activities, and interventional possibilities.

To characterize the interviewees, 5 items focusing on their educational level preceded the survey; another 50 items evaluated the following aspects:

- Individual certainty concerning antibiotic prescription
- Self-assessment of knowledge of MRP and antibiotic prescription
- Classification of MRP-associated issues
- Individual basis for decision making concerning calculated antibiotic prescription
- Frequency of participation in specific educational activities
- Practical knowledge of Antibiotic Stewardship measures
- Assessment of the curriculum for the German anesthesiologic board certification on the topic of anti-infective agents.

Questionnaires returned with ≥94% data completeness (≥52 of 55 items) were accepted for evaluation. The independent impact of the group variable (consultants vs residents) on defined endpoints was analyzed by separate multivariable logistic regression models adjusted for the following criteria: gender, practice in an intensive care unit during the previous 12 months, discrete responsibility for indications and antibiotic administration during the previous 7 workdays, level of care of each hospital, participation in continuing education programs regarding a rational antibiotics ordinance, and in the interviewee's department, colleagues with full completion of the additional training course on antibiotic stewardship. Internal validity was evaluated with the bootstrap method based on 1,000 samples.

In all 16 participating departments (7 university departments), a total of 1,268 questionnaires were distributed (1 questionnaire per physician; median team size, 45; interquartile range, 32-105). A total of 684 returned questionnaires met the aforementioned quality criteria (return rate, 54%), of which 676 (residents, n = 315 [46.6%]; consultants, n = 361 [53.4%]) were evaluable. In all 16 centers, internal guidelines exist that predefine the handling of anti-invectives for SAP.

The survey results and their statistical analysis are presented in Table 1. For this study, we defined 8 endpoints. Here 49% of the anesthetists stated that the specification of the SAP is determined by the surgeon (endpoint 1), and 49% stated that it is determined by in-hospital guidelines (endpoint 2). In accordance with the adjusted models, compared with residents, consultants estimated that endpoint 1 was reached 45% less often (P < .001) and endpoint 2 was reached 89% more often (P < .001). Only 24% of the participating anesthetists confirmed that a reapplication of SAP during extended operations is regulated by in-clinic guidelines (endpoint 5). Compared with residents, consultants stated that this endpoint was reached 75% more often (P = .007). There were items inquiring about specific knowledge (endpoints 6-8); the correct answers followed the currently applicable guidelines.[3] The correct answers regarding the time between application of SAP with cefazolin and beginning of surgery (endpoint 6) and concerning the correct choice of SAP for total knee joint endoprosthesis (endpoint 7) and at a colorectal surgery (endpoint 8) were given by 79%, 71%, and 89% of the anesthetists, respectively. At 2 of these 3 endpoints, the differences between consultants and residents were not significant, but consultants named the correct antibiotic for SAP for total knee joint endoprosthesis 57% more often (P = .021) (Table 1).

Survey studies such as ours are associated with several limitations, including a nonresponse bias. Nonetheless, our return rate of 54% is >10% higher than achieved for the previously conducted MR2 surveys of urologists, surgeons, gynecologists, and internists.[4,5] Furthermore, despite different return rates, the results of the participating hospitals displayed homogeneity in separate analyses (data not shown), and our multivariate analyses were adjusted by the status of the hospital (ie, university hospitals vs nonuniversity hospitals). In addition, only larger German hospitals were evaluated, which might not be representative of the entire national clinical reality. When interpreting our results, it is also significant that although each hospital provided guidelines regarding SAP, we have no information on

Table 1
Raw response rates and multivariable logistic regression models for evaluating the independent impact of board certification status (certification for anesthesiology) on selected endpoints

Criteria	Consultant, %	Resident, %	OR (95% CI)	P	P (BC)
Endpoint 1: It is stated that the decision for SAP is determined by surgeon (vs other options)					
Anesthetic consultant vs resident	40	58	0.55 (0.39-0.76)	<.001	<.001
Endpoint 2: It is stated that the decision for SAP is always defined by in-hospital guidelines (vs other options)					
Anesthetic consultant vs resident	55	39	1.89 (1.35-2.64)	<.001	<.001
Endpoint 3: It is stated that the need for re-SAP in long surgeries is determined by the surgeon (vs other options)					
Anesthetic consultant vs resident	16	32	0.42 (0.28-0.64)	<.001	<.001
Endpoint 4: It is stated that the need for re-SAP in long surgeries is determined by the anesthetist (vs other options)					
Anesthetic consultant vs resident	35	39	0.90 (0.63-1.27)	.535	.530
Endpoint 5: It is stated that the need for re-SAP in long surgeries is defined by in-hospital guidelines (vs other options)					
Anesthetic consultant vs resident	30	17	1.75 (1.17-2.62)	.007	.008
Endpoint 6: Correct answer to the question of how many minutes before surgery must SAP with cefazolin be performed (30-60 minutes) (vs other options)					
Anesthetic consultant vs resident	78%	79%	0.89 (0.60-1.33)	.570	.552
Endpoint 7: Correct answer to the question of what SAP is needed when implanting a total knee joint endoprosthesis (correct answer: cefazolin once) (vs other options)					
Anesthetic consultant vs resident	75%	65%	1.57 (1.07-2.29)	.021	.029
Endpoint 8: Correct answer to the question of what SAP is needed in colorectal surgery (correct answer: cefuroxime/metronidazole once) (vs other options)					
Anesthetic consultant vs resident	89%	90%	0.83 (0.48-1.41)	.484	.500

NOTE: All multivariable logistic regression models were adjusted for the following criteria: sex of interviewee; occupation of the interviewee at an intensive care unit during the previous twelve months preceding survey conduction; discrete definition of indications and antibiotic prescription by the interviewee during the 7 days before the survey; level of care of the corresponding hospital (of each interviewee); participation in continuing education programs by the interviewee regarding a rational antibiotics ordinance; in the interviewee's department there are colleagues with complete completion of additional training on antibiotic stewardship.
BC, bootstrap-corrected; *CI*, confidence interval; *OR*, odds ratio; *SAP*, surgical antibiotic prophylaxis.

their adherence in daily practice. This translates into the following notable information: endpoints 2 and 5 might be not correct, and endpoints 1, 3, and 4 are false.

Our survey results and data reported by Broom et al[1] and Schmitt et al[2] underscore the need for further training of anesthetists regardless of their educational level, as well as the need for further implementation of structured Antibiotic Stewardship programs in German hospitals. It is the responsibility of hospitals as well as of anesthetists as a medical specialty to meet this challenge. Although formal SAP guidelines are available at most institutions, the rate of adherence to them is questionable. One result of our study merits reconsideration: the perspective of anesthetic consultants and residents on how SAP is organized in their practice differs significantly. Finally, this is proof of certain arbitrariness in performing SAP and is far off the aim of implementing universal standards for SAP on a guideline basis.[3]

Acknowledgments

References

1. Broom JK, Broom AF, Kirby ER, Post JJ. How do professional relationships influence surgical antibiotic prophylaxis decision making? A qualitative study. Am J Infect Control 2018;46:311-5.
2. Schmitt C, Lacerda RA, Turrini RNT, Padoveze MC. Improving compliance with surgical antibiotic prophylaxis guidelines: a multicenter evaluation. Am J Infect Control 2017;45:1111-5.
3. Bratzler DW, Dellinger EP, Olsen KM, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Am J Health Syst Pharm 2013;70:195-283.
4. May M, Obermaier R, Novotny A, Wagenlehner FM, Brookman-May SD. Face to face with multi-resistant pathogens: an urgent call to action for modern surgeons to pioneer in antibiotic stewardship. Surg Infect (Larchmt) 2017;18:645-6.
5. Lebentrau S, Gilfrich C, Vetterlein MW, et al. Impact of the medical specialty on knowledge regarding multidrug-resistant organisms and strategies toward antimicrobial stewardship. Int Urol Nephrol 2017;49:1311-8.

Conflicts of interest: None to report.

Haitham Mutlak, MD
Department of Anesthesiology, Intensive Care Medicine and Pain Therapy, University Hospital Frankfurt, Goethe University, Frankfurt, Germany

Odilo Maurer, MD
Department of Urology, St. Elisabeth-Hospital Straubing, Straubing, Germany

Kai Zacharowski, MD
Department of Anesthesiology, Intensive Care Medicine and Pain Therapy, University Hospital Frankfurt, Goethe University, Frankfurt, Germany

Julika Schön, MD
Department of Anesthesiology and Intensive Care Medicine, Brandenburg Medical School Theodor Fontane, Ruppiner Kliniken, Neuruppin, Germany

Matthias Jacob, MD
Department of Anesthesiology, Intensive Care Medicine, and Pain Therapy, St Elisabeth-Hospital Straubing, Straubing, Germany

Matthias May, MD, PhD*
Department of Urology, St. Elisabeth-Hospital Straubing, Straubing, Germany MR2 Study Group

*Address correspondence to Matthias May, MD, PhD, Department of Urology, St Elisabeth-Hospital Straubing, St Elisabeth-Str 23, 94315 Straubing, Germany.
E-mail address: matthias.may@klinikum-straubing.de (M. May).