Perioperative management of antithrombotic drugs in skin surgery –
A survey of dermatologists in Germany

Fabian David Scherer,
Alexander Nast, Matthew Gaskins, Ricardo Niklas Werner, Corinna Dressler
Division of Evidence-Based Medicine, Department of Dermatology, Venereology and Allergology, Charité –
Universitätsmedizin Berlin, Corporate member of Freie Universität Berlin, Humboldt-Universität zu Berlin, and
Berlin Institute of Health, Berlin, Germany

Summary
Background: We identified substantial heterogeneity in the perioperative management of antithrombotic drugs in skin surgery in Germany in 2012 and 2017 in two cross-sectional surveys. The first national guideline on this subject was published in 2014 and updated in 2021. We sought to identify whether the management of these drugs had changed.

Methods: We sent a paper-based survey to 1115 dermatologists throughout Germany asking them about their perioperative management of antithrombotic drugs in skin surgery, as well as their familiarity with the guideline.

Results: We received responses from 65 hospital- and 202 office-based dermatologists. Most dermatologists reported continuing antithrombotic drugs when performing minor surgeries. A notable proportion of dermatologists reported discontinuing phenprocoumon treatment perioperatively and bridging patients with heparin when performing more invasive surgeries. Continuation was less common during combination therapies.

Conclusions: The proportion of physicians in Germany who reported managing antithrombotic drugs during skin surgery in ways that are in concordance with the national guideline has increased since 2012. However, continuing antithrombotic drugs during large excisions and sentinel lymph node biopsies, abstaining from bridging patients on phenprocoumon with heparin, and continuing antithrombotic combination therapies perioperatively need to be further encouraged, especially among office-based dermatologists.

Background

In Germany, prescriptions for antiplatelet drugs increased by 17 % between 2010 and 2019 [1]. Simultaneously, prescriptions for oral anticoagulants increased by more than 130 % [1]. From 2010 to 2020, the crude incidence rate of malignant melanoma rose by 60 % [2, 3]. Furthermore, predictions estimate the crude incidence rate of non-melanoma skin cancer will double from 2017 till 2032 [4]. As a result, the number of patients on antithrombotic drugs who will need to undergo skin surgery is likely to increase substantially.

In 2012, a survey of dermatologists throughout Germany identified substantial heterogeneity in the perioperative management of antithrombotic drugs [5]. For example, 11.9 % of office- and 33.8 % of hospital-based dermatologists reported continuing phenprocoumon when performing large excisions. The percentages for acetylsalicylic acid (ASA; ≤ 100 mg) were 36.3 % and 53.8 %, respectively. These findings contributed to the decision to develop the first German evidence- and consensus-based (S3) guideline on the management of antithrombotic drugs in skin surgery, which was published in 2014 [6]. A follow-up survey in 2017 [7] found that while the heterogeneity identified in 2012 had decreased, more standardization was still needed, especially in the management of the direct oral anticoagulants (DOACs) rivaroxaban, apixaban, edoxaban, and dabigatran. Furthermore, the guideline recommended the perioperative continuation of phenprocoumon and ASA (≤ 100 mg) [6].
But still only 29.9% of office- and 63.9% of hospital-based dermatologists reported continuing phenprocoumon when performing large excisions. The percentages for ASA were 57.9% and 90.2%, respectively.

In 2012, prescriptions for DOACs comprised only around 9% of all prescriptions for oral anticoagulants in Germany [1]. Over the following seven years, however, this share increased to more than 74% and DOACs are now more commonly prescribed than vitamin K antagonists (e.g., phenprocoumon) [1]. To account for this new clinical landscape, the German S3 guideline was updated in 2021 [8], as was the systematic review underpinning its recommendations [9]. Among other recommendations, the new guideline recommends against the perioperative bridging of phenprocoumon with heparin. Additionally, while it generally advises against the perioperative discontinuation of any antithrombotic mono- or combination therapy, it follows the recommendations of the European Heart Rhythm Association [10] in leaving the decision whether to continue or perioperatively discontinue any DOACs to the discretion of the individual dermatosurgeon.

In this paper, we report the results of a third survey on the state of clinical practice in the perioperative management of antithrombotic drugs during skin surgery in Germany.

Methods

We conducted a survey of office- and hospital-based dermatologists throughout Germany collecting data on the perioperative management of phenprocoumon, ASA (≤ 100 mg), rivaroxaban, and the combinations clopidogrel/rivaroxaban and ticagrelor/ASA for the following surgical procedures:

- punch biopsy,
- small excision (e.g., nevus),
- large excision (e.g., melanoma),
- sentinel lymph node biopsy (SLNB; hospital-based physicians only).

Respondents could select one of the following options to complete the statement “Generally I choose the following approach”:

- I continue the medication.
- I discontinue the medication perioperatively.
- I bridge with heparin (only available for phenprocoumon).
- Due to the antithrombotic medication, I refer the patient to a clinic or other colleagues (office-based physicians only).
- Due to the antithrombotic medication, I request a specialist consultation (hospital-based physicians only).

The survey was based on two earlier surveys conducted in 2012 and 2017 [5, 7]. We used the questions and wording from the previous surveys whenever possible. In 2021, we removed curettages from the procedure list and clopidogrel from the list of included drugs. In 2021, we asked hospital- and office-based physicians to rank (from most to least common) the following reasons for requests for a specialist consultation and for referrals of patients to another colleague or a clinic, respectively, due to antithrombotic drugs:

- Patients have renal or liver dysfunction.
- Patients have a high risk of thromboembolic complications (e.g., pulmonary embolism in the past three months).
- Patients with a positive bleeding history (e.g., spontaneous bleeding in the last two days).
- Procedure with planned delayed closure (hospital-based physicians only).
- The final item asked participants to indicate their degree of familiarity with the guideline on a 5-point Likert scale [11].

We gathered feedback on first drafts of the questionnaires from the expert panel of the 2021 guideline update [8]. Subsequently, we piloted it with three senior dermatosurgeons at the Department of Dermatology, Venerology and Allergology, Charité – Universitätsmedizin Berlin. We used their feedback to finalise the survey.

Sampling

The hospital version of the questionnaire was sent to all 115 chief physicians and medical directors of dermatology departments and clinics in Germany listed on the website of the German Dermatological Society [12]. The same procedure was followed in the two previous surveys, although in 2017 only 112 physicians were included due to retirement.

Another version of the questionnaire was sent to a random sample of 1,000 dermatologists throughout Germany who work in an office-based practice and provide care to patients with statutory health insurance. Approximately 90% of residents in Germany are insured through the statutory system [13]. The contact details for the sample were provided by the National Association of Statutory Health Insurance Physicians in December 2020 after approval by the Federal Ministry of Health. Sampling in 2012 and 2017 was only slightly different: a list of all office-based dermatologists had been generated in 2012 based on data from the State Chambers of Physicians for each of Germany’s states. A random sample comprising 15% (n = 508) of these physicians in each state was contacted. In 2017, this same list of physicians was used, excluding those no longer practising.

In mid-February 2021, we sent out the third survey by standard mail. As in 2012 and 2017, respondents were asked to return the completed surveys by fax (deadline: 12 March 2021).
Data collection and analysis

Data were entered into and analysed in Microsoft Excel, version 16.0. Unreadable answers, questions left blank, and questions requiring one response but answered with multiple responses were coded as "no information".

Descriptive analyses were performed. The results are presented in relative and absolute frequencies. The ranking of reasons for referrals/consultation requests was point-based.

Lastly, we combined the datasets from 2012, 2017, and 2021. Because all three surveys were anonymous, the structure of the data most closely resembled that of unbalanced panel data, where each observation is available only for one time point. We subsequently sought to determine whether there were differences between office- and hospital-based physicians in their perioperative management for phenprocoumon and ASA. We hypothesized that dermatologists familiar with the guideline would be more likely to manage antithrombotic drugs in accordance with the guideline recommendations. Data were analysed using RStudio Version 1.3.1093 [14]. Where possible, the results for office- and hospital-based dermatologists were compared. We used a chi-square test to compare the management of antithrombotic drugs by institution type over the three surveys.

We adhered to good practice guidelines in the conduct of this survey [15]. Approval was obtained from the local institutional ethics committee of Charité – Universitätmedizin Berlin (EA1/023/20).

Results

We received completed questionnaires from 65 hospital- and 202 office-based dermatologists, representing response rates of 56.5 % and 20.2 %, respectively. Table 1 gives an overview of answers regarding the management of different antithrombotic drugs.

Management of monotherapies

Most physicians indicated that they continue phenprocoumon during minor surgeries, i.e., punch biopsies and small excisions. 18.8 % of the office-based physicians reported bridging phenprocoumon with heparin during large excisions. Similarly, 20.0 % of hospital-based physicians reported bridging patients with heparin when performing SLNB.

Most physicians reported continuing ASA during minor surgeries. However, 25.2 % of office-based dermatologists indicated that they discontinue ASA when performing large excisions.

Most dermatologists indicated that they continue rivaroxaban perioperatively when performing minor surgeries. More than half of dermatologists reported discontinuing rivaroxaban when performing large excisions. 64.6 % of hospital-based dermatologists reported discontinuing rivaroxaban in SLNB.

Figure 1 shows the management of antithrombotic monotherapies over time based on data from the surveys conducted in 2012, 2017, and 2021.

The management of antithrombotic drugs when performing minor surgeries differed only somewhat across the three waves of the survey. For large excisions there were pronounced differences over time: the proportion of hospital-based physicians who continued phenprocoumon rose from 33.8 % in 2012 to 63.9 % in 2017 and to 76.9 % in 2021. Similarly, the proportion of office-based physicians who continued treatment with phenprocoumon rose from 11.9 % in 2012 to 29.9 % in 2017 and to 38.1 % in 2021.

The proportion of respondents who managed phenprocoumon in accordance with the guideline when performing large excisions (i.e., who continued phenprocoumon or requested a specialist consultation/referred their patients) differed in a statistically significant manner by institution type in 2021, \( \chi^2 (1, n = 248) = 11.2, p < 0.001 \), but not in 2017, \( \chi^2 (1, n = 194) = 0.3, p = 0.589 \), and not in 2012, \( \chi^2 (1, n = 213) = 0.0, p = 0.948 \). Sensitivity analysis indicates that when "referral/specialist consultation" were coded as "no information" a statistically significant difference became apparent in 2017 and 2012.

The proportion of respondents who continued ASA when performing large excisions also differed from year to year, rising among hospital-based physicians from 53.8 % in 2012 to 90.2 % in 2017 and 92.3 % in 2021, and among office-based physicians from 36.3 % in 2012 to 57.8 % in 2017 and 65.3 % in 2021.

The proportion of respondents who managed ASA in accordance with the guideline recommendation when performing large excisions (i.e., who continued ASA or requested a specialist consultation/referred their patients) differed in a statistically significant manner by institution type in 2021, \( \chi^2 (1, n = 259) = 10.25, p < 0.01 \) and in 2017, \( \chi^2 (1, n = 194) = 0.3, p = 0.589 \), but not in 2012, \( \chi^2 (1, n = 213) = 0.0, p = 0.948 \). Sensitivity analyses confirmed the results when "referral/specialist consultation" were coded as "no information".

The proportion of office-based physicians who continued their patients when a large excision was needed decreased from 2012 to 2021.

A change over time was also seen for DOACs. Compliance with the guideline recommendations for these drugs cannot be measured, however, because there was a change from the recommendation in 2017 to discontinue treatment perioperatively to an open recommendation in 2021 (i.e., consider continuation or perioperative discontinuation).
Table 1 Perioperative management of antithrombotic drugs for various kinds of skin surgeries in 2021. Answers coded as “no information” are not displayed. Answers coded as “no information” are excluded from the analyses of combination therapies.

|                      | Perioperative continuation | Perioperative discontinuation | Bridging therapy with heparin | Request for specialist consultation | Referral |
|----------------------|----------------------------|-------------------------------|-----------------------------|-----------------------------------|----------|
|                      | Hospital-based             | Office-based                  | Hospital-based              | Office-based                      | Hospital-based | Office-based |
| Phenprocoumon        |                            |                               |                             |                                   |           |
| Punch biopsy         | 98.5 % (64/65)             | 94.1 % (190/202)              | 0 % (0/65)                 | 3.0 % (6/202)                     | 0 % (0/65) | 0.5 % (1/202) |
| Small excision       | 95.4 % (62/65)             | 86.6 % (175/202)              | 3.1 % (2/65)               | 8.4 % (17/202)                    | 0 % (0/65) | 2.0 % (4/202) |
| Large excision       | 76.9 % (50/65)             | 38.1 % (77/202)               | 9.2 % (6/65)               | 21.3 % (43/202)                   | 9.2 % (6/65) | 18.8 % (38/202) |
| SLNB                 | 55.4 % (36/65)             | –                             | 9.2 % (6/65)               | –                                 | 20.0 % (13/65) | 4.6 % (3/65) |
| ASA (≤ 100mg)        |                            |                               |                             |                                   |           |
| Punch biopsy         | 96.9 % (63/65)             | 96.0 % (194/202)              | 1.5 % (1/65)               | 1.5 % (3/202)                     | 0 % (0/65) | 1.5 % (3/202) |
| Small excision       | 96.9 % (63/65)             | 92.1 % (186/202)              | 1.5 % (1/65)               | 5.0 % (10/202)                    | 0 % (0/65) | 1.5 % (3/202) |
| Large excision       | 92.3 % (60/65)             | 65.3 % (132/202)              | 6.2 % (4/65)               | 25.2 % (51/202)                   | 0 % (0/65) | 5.9 % (12/202) |
| SLNB                 | 81.5 % (53/65)             | –                             | 6.2 % (4/65)               | –                                 | 1.5 % (1/65) | – |
| Rivaroxaban          |                            |                               |                             |                                   |           |
| Punch biopsy         | 92.3 % (60/65)             | 87.6 % (177/202)              | 6.2 % (4/65)               | 9.4 % (19/202)                    | 0 % (0/65) | 1.5 % (3/202) |
| Small excision       | 83.1 % (54/65)             | 71.8 % (145/202)              | 13.8 % (9/65)              | 24.3 % (49/202)                   | 0 % (0/65) | 1.5 % (3/202) |
| Large excision       | 33.8 % (22/65)             | 30.2 % (61/202)               | 56.9 % (37/202)            | 55.0 % (111/202)                  | 4.6 % (3/65) | 8.9 % (18/202) |
| SLNB                 | 15.4 % (10/65)             | –                             | 64.6 % (42/65)             | –                                 | 4.6 % (3/65) | – |
Table 1 Continued.

|                  | Hospital-based | Office-based | Hospital-based | Office-based | Hospital-based | Office-based | Hospital-based | Office-based | Hospital-based | Office-based | Hospital-based | Office-based | Hospital-based | Office-based | Hospital-based | Office-based |
|------------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|
| **Clopidogrel & rivaroxaban** |                |              |                |              |                |              |                |              |                |              |                |              |                |              |                |              |
| Punch biopsy     | 93.5 % (43/46) | 77.4 % (72/93) | 0 % (0/46)     | 3.2 % (3/93)  | 6.5 % (3/46)   | 4.3 % (4/93)  | 0 % (0/46)     | 10.8 % (10/93)| 0 % (0/46)     | 4.3 % (4/93)  |
| Small excision   | 80.9 % (38/47) | 55.9 % (52/93)| 0 % (0/47)     | 12.9 % (12/93)| 17.0 % (8/47)  | 9.7 % (9/93)  | 0 % (0/47)     | 12.9 % (12/93)| 2.1 % (1/47)   | 8.6 % (8/93)  |
| Large excision   | 32.0 % (16/50) | 13.5 % (17/126)| 6.0 % (3/50)   | 18.3 % (23/126)| 42 % (21/50)   | 11.1 % (14/126)| 2 % (1/50)     | 12.7 % (16/126)| 18.0 % (9/50)  | 44.4 % (56/126) |
| SLNB             | 17.8 % (8/45)  |              | 6.7 % (3/45)   |              | 46.7 % (21/45) |              | 0 % (0/45)     |              | 28.9 % (13/45) |              |
| **Ticagrelor & ASA** |                |              |                |              |                |              |                |              |                |              |
| Punch biopsy     | 95.7 % (44/46) | 82.1 % (78/95)| 0 % (0/46)     | 4.2 % (4/95)  | 2.2 % (1/46)   | 2.1 % (2/95)  | 2.2 % (1/46)   | 7.4 % (7/95)  | 0 % (0/46)     | 4.2 % (4/95)  |
| Small excision   | 91.3 % (42/46) | 62.1 % (54/87)| 0 % (0/46)     | 8.1 % (7/87)  | 2.2 % (1/46)   | 5.8 % (5/87)  | 6.5 % (3/46)   | 16.1 % (14/87)| 0 % (0/46)     | 8.1 % (7/87)  |
| Large excision   | 50.0 % (23/46) | 15.0 % (18/120)| 6.5 % (3/46)  | 15.0 % (18/120)| 2.2 % (1/46)   | 3.3 % (4/120) | 21.7 % (10/46) | 21.7 % (26/120)| 19.6 % (9/46)  | 45.0 % (54/120) |
| SLNB             | 42.9 % (18/42) |              | 7.1 % (3/42)   |              | 0 % (0/42)     |              | 21.4 % (9/42)  |              | 28.6 % (12/42) |              |

*Abbr.: ASA, acetylsalicylic acid; SLNB, sentinel lymph node biopsy.*
Management of combination therapies

For patients undergoing minor surgeries and taking either clopidogrel/rivaroxaban or ticagrelor/ASA, most physicians reported continuing therapy.

For patients undergoing large excisions and taking clopidogrel/rivaroxaban, 32.0 % of hospital- and 13.5 % of office-based physicians reported continuing both, whereas 18.0 % of hospital-based physicians reported requesting a specialist consultation and 44.4 % of office-based physicians reported referring patients.

For patients undergoing large excisions and taking ticagrelor/ASA, 50.0 % of hospital-based and 15.0 % of office-based physicians reported continuing both, whereas 19.6 % of hospital-based physicians reported requesting a specialist consultation and 45.0 % of office-based physicians reported referring patients.

For patients undergoing SLNB and taking clopidogrel/rivaroxaban, 17.8 % of hospital-based dermatologists reported continuing both, 53.4 % reported discontinuing at least one drug, and 28.9 % reported requesting a specialist consultation. For patients undergoing SLNB and taking ticagrelor/ASA, 42.9 % of hospital-based dermatologists reported continuing the drugs, 28.5 % reported discontinuing at least one of the two drugs, and 28.6 % reported requesting a specialist consultation.

For the questions regarding combination therapies, between 23.1 % and 35.4 % of answers by hospital-based physicians and between 37.6 % and 56.9 % of answers by office-based physicians were coded as “no information”.

Ranking of reasons for specialist consultations and referrals

Hospital- and office-based physicians reported that the most frequent reason for specialist consultations and referrals (63.9 % and 52.4 %, respectively) was a high risk of thromboembolic complications. The second most frequent reason was a positive bleeding history and patients with renal or liver dysfunction took the 3rd rank. This was the same for hospital- and office-based physicians. Moreover, hospital-based dermatologists ranked patients with planned delayed closures as the least common reason for requesting a specialist consultation. 44.6 % (n = 65) of hospital- and 58.5 % (n = 202) of office-based dermatologists’ answers for this question were coded as “no information”.

Familiarity with the guideline

Most office-based dermatologists indicated that they were at least moderately familiar with the guideline. Only 5.4 % and 13.9 % replied that they were not at all or only slightly familiar with it, respectively. These latter two proportions were lower than those in 2017 (16.3 % and 16.3 %) (Figure 2). The percentage of hospital-based physicians who indicated

Table 2 Selected recommendations from the German S3 guideline for the management of antithrombotic drugs in skin surgery. Strong consensus (100 %) on all recommendations. Taken from the published version of the guideline [8] and modified.

| Recommendation                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Switching from VKA to heparin (Bridging) is **not recommended** for dermatological surgery (strong recommendation).                                  |
| It is **recommended** to continue VKA medication when dermatological surgery is performed (strong recommendation).                               |
| In cases of small-scale curettage and punch biopsies of the skin it is **suggested** that DOAC medication be continued (weak recommendation).       |
| **Rivaroxaban** is usually administered once a day. For dermatological surgery, it **may be considered** to either continue intake as normal or observe an interval of 24 hours between the last intake and the surgical procedure. The latter means that if the regular daily dose is taken in the evening, this will be omitted. If the regular daily dose is taken in the morning, this will be delayed until one hour after surgery (open recommendation). |
| It is **recommended** that medically necessary ASA be continued in cases of dermatological surgery (strong recommendation).                       |
| In most cases, there is an absolute indication for continuing medication with ASA plus ticagrelor for cardiovascular protection over a certain period of time (statement). |

**Abbr.:** ASA, acetylsalicylic acid; DOAC, direct oral anticoagulant; VKA, vitamin K antagonist.
Figure 1  Perioperative management of antithrombotic drugs during skin surgery 2012 vs. 2017 vs. 2021. Green = management of a typical patient in line with the recommendations of the 2014 guideline (surveys 2012, 2017) and the 2021 guideline update (survey 2021); yellow = not in line with the guideline. Hospital-based dermatologists - 2012 and 2017: referrals in grey, 2021: consultation requests in grey. Phenprocoumon – in 2012, discontinuation and bridging with heparin were combined into one answer option. Direct oral anticoagulants (DOACs) – in 2017, the question referred to DOACs whereas in 2021 it referred to rivaroxaban alone. Throughout the figure: 2012: n = 168 office-based dermatologists, n = 65 hospital-based dermatologists, 2017: n = 147 office-based dermatologists, n = 61 hospital-based dermatologists, 2021: n = 202 office-based dermatologists, n = 65 hospital-based dermatologists.

Abbr.: SLNB, sentinel lymph node biopsy.
that they were moderately, quite, or very familiar with the guideline was almost 100% in 2017 and 2021.

Relationship between familiarity and conformity with the guideline

Simple visual inspection of the data suggests that the degree of familiarity with the guideline was not strongly related to reporting management in accordance with the guideline in either 2017 or 2021 (Figure 3), except that most of those who were very familiar with the guideline indicated that they acted in line with guideline recommendations.

Discussion

We surveyed 1,115 German hospital- and office-based dermatologists to inquire about their perioperative management of antithrombotic drugs and their familiarity with the German national guideline [8]. Selected recommendations of the German S3 guideline for the management of antithrombotic drugs in skin surgery are presented in Table 2 [8]. In line with guideline recommendations [8], most dermatologists reported continuing monotherapies with phenprocoumon, ASA (≤ 100 mg), and rivaroxaban when performing minor surgeries.

Figure 2  Familiarity with the guideline (hospital-based dermatologists in 2017: n = 61; in 2021: n = 65; office-based dermatologists in 2017: n = 147; in 2021: n = 202).

Figure 3  Guideline conformity (green) and non-conformity (yellow) in the perioperative management of ASA or phenprocoumon and familiarity with the guideline; 2021 (top) and 2017 (bottom) (in n; NA/grey = not applicable/no information).  
Abbr.: ASA, acetylsalicylic acid.
The management of monotherapies was, however, more heterogeneous during more invasive surgeries, especially for phenprocoumon and rivaroxaban, as well as among office-based dermatologists. A notable proportion of dermatologists bridged patients on phenprocoumon with heparin during more invasive surgeries, even though the German guideline recommends continuing phenprocoumon. Several systematic reviews suggest that bridging phenprocoumon with heparin during skin surgery might increase the risk of bleeding complications [9, 16, 17]. Furthermore, bridging complicates treatment as it requires restarting phenprocoumon postoperatively.

During minor surgeries, most dermatologists acted in conformity with the guideline and continued both drugs of combination therapies, albeit less frequently than was the case for monotherapies.

During more invasive surgeries, clinical practice was, again, more heterogeneous, and a sizeable proportion of physicians tended to discontinue at least one of the drugs. This may be because physicians are aware that patients taking more than one antithrombotic drug tend to have a relatively high risk of thromboembolic complications. Indeed, this high risk was ranked by our respondents as the most important reason for referrals and consultation requests, which might suggest a degree of risk aversion when operating on this patient cohort. Physicians might be concerned that combination therapies have a multiplicative and unpredictable effect on perioperative bleeding risk. Furthermore, the only combination therapy for which the guideline provides recommendations, is ASA/P2Y12 inhibitors (e.g., clopidogrel), whereas it provides specific recommendations for all relevant monotherapies [8]. These factors might partially explain the observed heterogeneity in clinical practice.

Further efforts to inform dermatologists about the recommendations for antithrombotic combination therapies might address some of the existing uncertainty surrounding them. More specific recommendations for different combination therapies in future updates of the guideline might serve a similar purpose. Together, such measures might have the potential to lower the burden that referrals and specialist consultations place on the medical system.

Generally, clinical practice appeared to be more heterogeneous when patients were on rivaroxaban. This might be a result of the weak evidence base guiding clinical decision making with regard to DOACs and skin surgery [9]. Furthermore, dermatologists have less experience with DOACs because these are novel drugs that were not widely prescribed before 2012 [1]. The change of the 2014 guideline recommendation on DOACs (i.e., discontinue perioperatively) to an open recommendation in 2021 (i.e., consider either continuation or perioperative discontinuation) depicts current practice, which is likely to remain heterogeneous [6, 8]. Future studies on the management of DOACs in patients on combination therapies and monotherapies with a focus on more invasive skin surgeries would provide valuable evidence on risks and benefits for patients.

Across all antithrombotic therapies and types of surgery, the proportion of hospital-based dermatologists who acted in concordance with the guideline recommendations and continued antithrombotic drugs was higher than that of their office-based colleagues. In 2017 and 2021, the proportion of hospital-based dermatologists who managed phenprocoumon and ASA during large excisions in conformity with the guideline was significantly higher than that of their office-based colleagues. Hospital-based dermatologists were considerably more familiar with the guideline than their office-based colleagues in the 2017 and 2021 surveys, although there does not seem to be a straightforward relationship between guideline familiarity and guideline conformity overall. One reason for these observed differences might be that, compared with our random sample of office-based dermatologists, chief physicians of dermatology departments in Germany (i.e., our sample of hospital-based dermatologists) were, on average, likely to be more experienced surgeons and to have more resources (e.g., equipment, medical staff) at their disposal that could help them control any perioperative complications on site.

Regular surveys monitoring changes in the perioperative management of antithrombotic drugs during skin surgery might be useful to focus guideline implementation efforts and thereby improve medical care. Additional qualitative research could deliver valuable information by identifying clinical decision situations in which more guidance is needed as well as practical barriers to successful guideline implementation. Guideline adherence might be further improved by conducting presentations at conferences and symposia, especially at the yearly conference of the German Society for Dermatosurgery. The dissemination of a poster summarizing the guideline recommendations in a flow chart to all dermatology practices and hospital departments might be a cost-effective way to help standardize the perioperative management of antithrombotics.

Our study has several important limitations. First, office- and hospital-based dermatologists might define large excisions differently because the latter group tends to treat patients with more severe and extensive skin conditions. Therefore, our results might underestimate the gap in guideline conformity between the groups for comparable operations. Second, respondents might differ systematically from non-respondents. The magnitude of this nonresponse bias is hard to estimate and might vary considerably between survey questions [18]. Dermatologists who were less familiar with the guideline might have been less likely to respond. This would bias our results towards overestimating guideline conformity. Third, high rates of invalid answers were given for questions on monotherapies during SLNB,
combination therapies, and the ranking of reasons for referrals and consultation requests. This lowers the representativeness of our data. Fourth, the survey questions and answer options for antithrombotic monotherapies differed somewhat from those in 2012 and 2017 – e.g., whereas the previous survey inquired about the management of DOACs in general, we focused on rivaroxaban specifically.

Conclusion

The proportion of physicians in Germany who reported managing antithrombotic drugs during skin surgery in ways that are in concordance with the national guideline has increased steadily since our surveys in 2012 and 2017. This improvement in patient care is probably due, at least in part, to the national guideline itself and to efforts to improve its implementation. However, continuing antithrombotic drugs during large excisions and SLNB, abstaining from bridging patients on phenprocoumon with heparin, and continuing antithrombotic combination therapies perioperatively need to be further encouraged, especially among office-based dermatologists.

Acknowledgment

We thank Simon Rass, statistician of the National Association of Statutory Health Insurance Physicians, for generating the random sample of 1000 German office-based dermatologists.

Open access funding enabled and organized by Projekt DEAL.

Conflict of interest

FS, AN, and CD contributed to the development of the German S3 guideline “Management of anticoagulants and platelet inhibitors during cutaneous surgery”. MG and RNW declare that they have no conflicts of interest.

Correspondence to

Alexander Nast, MD
Department of Dermatology, Venereology and Allergology
Division of Evidence-Based Medicine (dEBM)
Charité – Universitätsmedizin Berlin
Charitéplatz 1
10117 Berlin, Germany
E-mail: debm01@charite.de

References

1 Hein L, Wille H. Antithrombotika und Antihämorrhagika. In: Schwabe U, Ludwig WD: Arzneiverordnungs-Report 2020. Berlin, Heidelberg: Springer, 2020: 395–420.
2 Robert Koch Institute, the Association of Population-based Cancer Registries in Germany: Cancer in Germany 2009/2010. 9th edition. Berlin, 2014. Available from: https://www.krebsdaten.de/Krebs/EN/Content/Publications/Cancer_in_Germany/cancer_chapters_2009_2010/cancer_germany_2009_2010.pdf [Last accessed August 23, 2021].
3 The Global Cancer Observatory. Table – Germany. Available from: https://gco.iarc.fr/today/home [Last accessed February 27, 2021].
4 Leiter U, Keim U, Eigentler T et al. Incidence, Mortality, and trends of nonmelanoma skin cancer in Germany. J Invest Dermatol 2017; 137: 1860–67.
5 Nast A, Ernst H, Rosumeck S et al. Management of anticoagulation during dermatosurgical procedures in Germany – results from a cross-sectional study. J Dtsch Dermatol Ges 2013; 11: 52–9.
6 Sporbeck B, Bechara FG, Höfner HM et al. S3 guidelines for the management of anticoagulation in cutaneous surgery. J Dtsch Dermatol Ges 2015; 13: 346–56.
7 Gaskins M, Dittmann M, Eisert L et al. Management of antithrombotic agents in dermatologic surgery before and after publication of the corresponding German evidence-based guideline. J Dtsch Dermatol Ges 2018; 16: 297–305.
8 Nast A, Höfner HM, Kolk A et al. S3 guideline: Management of anticoagulants and antiplatelet agents in cutaneous surgery. J Dtsch Dermatol Ges 2021; 19: 1531–46.
9 Scherer FD, Dressler C, Avila Valles G, Nast A. Risk of complications due to antithrombotic agents in cutaneous surgery: a systematic review and meta-analysis. J Dtsch Dermatol Ges 2021; 19: 1421–32.
10 Steffel J, Verhamme P, Potpara TS et al. The 2018 European Heart Rhythm Association Practical Guide on the use of non-vitamin K antagonist oral anticoagulants in patients with atrial fibrillation. Eur Heart J 2018; 39: 1330–93.
11 Likert R. A technique for the measurement of attitudes. Archives of psychology 1932; 2: 5–55.
12 Deutsche Dermatologische Gesellschaft. Hautkliniken Datenbank Deutschland. Available from: https://derma.de/hautkliniken/uebersicht/ [Last accessed December 19, 2021].
13 Blümel M, Spranger A, Achstetter K et al. Germany: health system review. Health Systems in Transition. World Health Organization, Regional Office for Europe, 2020; 22: i-273.
14 RStudio Team. RStudio: Integrated Development for R [Computer program]. Version 1.3.1093, RStudio, PBC, Boston, MA, 2020. Available from: http://www.rstudio.com/.
15 Kelley K, Clark B, Brown V, Sitzia J. Good practice in the conduct and reporting of survey research. Int J Qual Health Care 2003; 15: 261–6.
16 Kuo HC, Liu FL, Chen JT et al. Thromboembolic and bleeding risk of periprocedural bridging anticoagulation: A systematic review and meta-analysis. Clin Cardiol 2020; 43: 441–9.
17 Eijgenraam P, ten Cate H, ten Cate-Hoek A. Safety and efficacy of bridging with low molecular weight heparins: a systematic review and partial meta-analysis. Curr Pharm Des 2013; 19: 4014–23.
18 Fowler FJ. Survey Research Methods. SAGE Publications, Inc., 2009. https://doi.org/10.4135/9781452230184.