NICE guidance on antibiotic prophylaxis to prevent infective endocarditis: a survey of clinicians’ attitudes

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Received 1 October 2012 and in revised form 25 November 2012

Summary

Background: Since the introduction of the National Institute for Health and Clinical Excellence (NICE) guideline (CG064) in 2008 recommending cessation of antibiotic prophylaxis (AP) against infective endocarditis (IE), low level prescribing persists in the UK and is a potential reason why there has been no significant change in the general upward trend in cases of IE.

Aim: To undertake a survey of dentists (Ds), cardiologists and cardiothoracic surgeons (C/CTSs) and infection specialists (ISs) to determine why this might be the case.

Design: Internet questionnaire-based survey.

Methods: A questionnaire was distributed by email to specialists via UK national societies.

Results: A total of 1168 responses were received. All the specialist groups are aware of the guideline (99%). Ds are broadly satisfied, whereas C/CTSs are not. Most Ds follow the NICE guidance (87%), whereas many C/CTSs (39%) do not; ISs adopt a middle course (56%). Even amongst Ds, a significant proportion believe that patients with a prosthetic heart valve (25%) or previous history of IE (38%) should receive AP. A total of 36% of Ds have prescribed AP since March 2008 and many have undertaken procedures where AP has been prescribed by someone else. The majority of respondents (65%) feel that more evidence is required, preferably in the form of a randomized controlled trial.

Conclusions: Many patients perceived to be at high risk of IE are still receiving AP in conflict with current NICE guidance.

Introduction

Infective endocarditis (IE) is a rare disease, affecting 100–150 people per month in the UK.1 It requires prolonged inpatient use of intravenous antibiotics and often cardiac surgery. Complications, such as stroke and renal failure, are severe and the inpatient mortality is high and estimated at around 15–30%.1

As bacteria found in the oral cavity cause many cases of IE, antibiotic prophylaxis (AP) prior to dental and other invasive procedures for patients deemed to be at high risk, has been recommended for more than 50 years in the Western world. In 1955, the American Heart Association (AHA) released the first guidelines recommending AP for the prevention of IE in patients with congenital or rheumatic heart disease undergoing dental procedures.2 The subsequent history of AP is presented in the most recent 2007 AHA guidelines.3

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This approach was pragmatic but not evidence-based. Nonetheless, the most recent international guidelines still recommend AP for high-risk patients.\textsuperscript{3,4} In March 2008, following a detailed literature review, the National Institute for Health and Clinical Excellence (NICE) recommended that AP should cease except in a very few predefined circumstances.\textsuperscript{5} This was a radical departure from standard practice that has provoked debate since.\textsuperscript{6–9} The guidance appeared to be enthusiastically adopted by commissioners and many, but not all, dental practitioners. It met with considerable resistance from cardiologists and cardiothoracic surgeons (C/CTSs).

Overall, the effect of the NICE guidelines was dramatic, with a rapid and highly significant 78% reduction in AP prescribing\textsuperscript{1}, but no significant change in the general upward trend in cases of IE. Notably, however, AP prescribing persists at 20–22% of original levels before introduction of the guidelines.

To determine the reasons underlying this residual prescribing we undertook a questionnaire survey amongst C/CTSs, dentists (Ds) and infection specialists (microbiologists and infectious disease physicians) (ISs), concerning the NICE guidelines and current patterns of AP prescribing.

### Methods

Surveys containing a common core set of questions plus further questions tailored for each professional group were created using SurveyMonkey (www.surveymonkey.com) (see Supplementary Material online) and distributed electronically by the British Cardiovascular Society (BCS, number of members = 1900), the Faculty of General Dental Practitioners (FGDPs, number of members = 2000), the Society of Cardiothoracic Surgeons (SCTSs, number of members = 300), the British Dental Association (BDA, number of members = 17 000) and the British Infection Association (BIA, number of members = 1200) between January and April 2012 (Supplementary Material online). Surveys were closed once there had been no responses for more than 7 days. Data were analysed with SPSS using Fisher’s exact test for comparisons of two groups and chi-squared analyses for larger groups. A $P$-value of $<0.05$ was taken as significant.

### Results

A total of 1168 people responded to the survey. The breakdown by speciality and as a proportion of individuals surveyed is summarized in Table 1.

<table>
<thead>
<tr>
<th>Group</th>
<th>$n$</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>C/CTSs</td>
<td>413</td>
<td>19</td>
</tr>
<tr>
<td>Ds</td>
<td>664</td>
<td>3.5</td>
</tr>
<tr>
<td>Faculty of General Dental Practice BDA</td>
<td>517</td>
<td>26</td>
</tr>
<tr>
<td>ISs</td>
<td>91</td>
<td>7.5</td>
</tr>
<tr>
<td>Total</td>
<td>1168</td>
<td>5.2</td>
</tr>
</tbody>
</table>

![Figure 1. Satisfaction with NICE clinical guideline by professional group.](image1)

![Figure 2. Clinical guideline usage by each professional group.](image2)

The C/CTSs and Ds were mainly in the age range 45–55 years, whereas the infectious specialists were mainly in the range 35–45 years.

Most of the C/CTS group were cardiologists (319/383, 83%); the majority were consultants (281/383, 73%). Most of the Ds who responded were general Ds working in primary care (528/626, 84%). Most of the ISs were microbiologists (63/75, 84%); the majority were again consultants (58/75, 77%).

As expected, the vast majority of respondents (99%) are aware of the NICE guideline with no intergroup differences.
There are clear differences between the groups with regard to their satisfaction with the guidelines (Figure 1). Less than one-third of the C/CTSs are satisfied or very satisfied, whereas over three quarters of Ds ($P<0.0001$) and more than half of ISs ($P<0.0001$) are satisfied.

In total, 87% of Ds base their practice on the NICE guidance vs. 55% of ISs and 39% of C/CTSs (Figure 2; $P<0.0001$). Most C/CTSs clearly feel that AP still has a role in certain situations as illustrated by their use of alternative guidelines.

Amongst C/CTSs and Ds there was a significant relationship between age and compliance with the NICE guideline (C/CTSs: $P=0.037$; Ds: $P<0.001$). Taking only the respondents who revealed their age range and expressed a preference either for the NICE or alternative guideline, C/CTSs over the age of 45 were more likely to follow a guideline other than the NICE guideline (Figure 3). Younger cardiologists (25–35) principally followed NICE guidance (34/36, 94%). Ds of any age overwhelmingly followed the NICE recommendations. Just fewer than 10% (12/126, 9.5%) of Ds older than 55 did not follow the guidelines (Figure 4). The number of ISs was too low to draw meaningful conclusions.

Although 31% of C/CTSs are satisfied or very satisfied with the NICE guidelines only 13% believe that no patients should receive AP. Over two-thirds feel that patients with prosthetic heart valves should have AP (67%) and almost four-fifths (80%) feel those with previous IE should have AP. Similarly, although 87% of Ds base their clinical practice on the NICE guidelines, a significant proportion believe that patients with a prosthetic heart valve (25%) or patients with a previous history of IE (38%) should receive AP prior to invasive dental procedures. Amongst ISs, 52 and 49% believe that patients with prosthetic valves or a previous history of IE should receive AP, respectively.

A majority (65%) of all three professional groups feel there is a need for more evidence on which to base decisions about the benefit of providing AP (C/CTSs 82%; Ds 54%; ISs 64%). Amongst those who feel there is a need for more evidence, the overwhelming majority indicate that this would be best provided by a double blind placebo controlled trial (C/CTSs 72%; Ds 62%; ISs 82%). Some feel a case control study would provide sufficient evidence (C/CTSs 20%; Ds 20%; ISs 26%), whereas others suggest a clinical audit would suffice (C/CTSs 25%; Ds 35%; ISs 10%).

The C/CTSs feel that invasive dental procedures make a substantial contribution to the development of IE, whereas daily activities are relatively unimportant. In contrast, Ds feel that invasive dental procedures are most likely to make only a small contribution to the development of IE, whereas daily activities, such as eating and tooth brushing are likely to make a substantial contribution (Figures 5 and 6). The ISs feel very similarly to the Ds.
Cardiologists/cardiothoracic surgeons report that almost half their patients are dissatisfied or very dissatisfied (177/383, 46%) with the new guidance. Ds have a different perspective and feel that only a minority of patients are dissatisfied or very dissatisfied with the guidance (88/632, 14%). This difference is highly significant ($P < 0.0001$). ISs were not asked this question as most do not consult directly with well patients with regard to their general dental care.

When asked directly how they would respond if asked for advice about providing AP for a patient deemed to be ‘high-risk’, just over half of C/CTSs responded that they would recommend AP (195/383, 51%). In a situation where the C/CTS regarded AP as necessary but the dentist felt they should comply with the NICE guidelines, almost half of the C/CTSs would either issue a prescription themselves or ask the patient’s general practitioner (GP) to do so (175/377, 47%). Almost one quarter would emphasize to the patient that they had the right to insist that their dentist should provide AP (90/377, 24%). Almost a half said that they would communicate with the Ds to express their opinion (181/377, 48%) (note: more than one answer was permissible).

We asked whether Ds still come under pressure to provide AP: more than half (339/632, 54%) report that they do, principally from the patient (254/339, 75%) and/or the patient’s C/CTS (228/339, 67%). Many patients find it difficult to accept that AP is suddenly not required after emphasis on its importance for many years. Despite many Ds clear support for the NICE guidance, over one-third have provided AP since March 2008 (225/630, 36%). One-third have also undertaken dental treatment where someone else had prescribed the AP (GP 115/214, 54%; C/CTS 132/214, 62%). In situations where Ds feel uncertain over whether or not to provide AP, many simply follow NICE guidance (224/626, 36%), although more said that they would contact the patient’s C/CTS for advice (274/626, 44%).

When ISs were asked what their advice would be concerning a patient at high risk of IE, more than half (44/79, 56%) would recommend compliance with NICE guidance while less than one-third (23/79, 29%) would recommend AP.

There were frequent opportunities to make free text comments throughout the questionnaire.

**Cardiologists and cardiothoracic surgeons**

Many doctors in this group still feel that AP is important for high-risk cases. When commenting about patient attitudes, it was surprising how few respondents commented that patients are worried and stressed, although many reported that patients are confused. Some commented that the risk of AP had been exaggerated, and that this was irrelevant for the many patients who had received AP safely in the past. A significant number of respondents felt they had seen an increase in the number of IE cases since publication of the NICE guideline, although this is not supported by national statistics.

**Dentists**

Many Ds are still giving AP on the advice of other professionals (principally cardiologists). There is clear evidence in the responses that immunocompromised patients are also felt to be at high risk. Although Ds responded that most patients are satisfied with the new guidelines, there are clearly some who remain concerned and confused with the change in practice: ‘many of them don’t understand, and question, why something that was once considered essential, is now not required’. Many comments were broadly supportive of the NICE guideline and suggest that many patients are relieved not to have to take AP. Many also feel that dogmatic application of the NICE guideline in all cases is not sensible given the lack of data. The comments reveal that there are still many C/CTSs who pressurize Ds into prescribing AP.

**Infection specialists**

This group provided relatively few free text responses. It is clear that some hospital trusts have their own guidelines that differ from NICE and some feel that the risk of anaphylaxis after use of AP is exaggerated.

**Discussion**

We aimed to explore reasons for the non-compliance with NICE guideline 64 that has been recently observed. Since 99% of respondents were
The risks of developing IE after dental treatment

are

very small. These innate human characteristics go

remote. For Ds, therefore, the ‘losses’ that may be

foremost in their minds are the inconvenience of

managing AP and the theoretical risk of anaphyl-

axis. ISs are in the difficult position of having to

balance the risks of IE against the risks of in-

creasing antibiotic resistance. ISs are in-

creasingly exposed to the consequences of anti-

microbial resistance and adverse reactions to

antimicrobials but are well aware of the conse-

quences of IE. Given these different perspectives,

A recent article in the British Medical Journal titled

‘breaking the rules’ highlighted many reasons for

non-compliance with guidelines but did not tackle

the problem of the interpretation of science behind

a guideline. A further key reason for non-

compliance appears to be different beliefs as to

whether dental work causes IE and the effectiveness

of AP in preventing IE. Ds and ISs feel that routine
daily activities, such as tooth brushing, are more likely
to be the principal cause of IE than invasive dental
procedures. In direct contrast, C/CTSs are more likely
to believe that invasive dental procedures are the
cause. Because a cornerstone of the NICE recommen-
dations is the theory that bacteraemias resulting from
normal daily activities are primarily responsible for IE,
it is not surprising that many C/CTSs do not feel comfort-
able following the recommendations.

The study has confirmed that there are divisions of
opinion between professional groups. The guideline
has broad support from Ds and ISs, but has aroused
disquiet amongst C/CTSs. Many of this latter group
still use international guidelines that recommend AP
in certain situations. However, it is interesting that a
majority of C/CTSs under the age of 35 years base
their clinical practice on the NICE guidelines. A
smaller age effect was seen amongst Ds.

The fact that many Ds and cardiologists consider
that some patients should receive AP is in keeping
with the findings of a smaller study by Soheilipour
et al.19 In this study, there were concerns about how
patients who had previously taken AP would react to
being told that it was no longer required. This has not
proven to be a major issue for Ds in our survey.
However, the free text comments suggest that some
patients have struggled to accept the new guidance.
This difference may stem from the fact that our survey
was conducted 2 years later. In keeping with our
study, however, concerns were also expressed that the
guidelines may not be appropriate in all cases
and there was scepticism about the evidence base.

In 2009, Ní Riordáin and McCrea published a
survey of the views of Irish practitioners and patients
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in Ireland. In total, 290 Ds responded, but only 20 cardiologists. Forty-three percent of Ds, but only 20% of cardiologists, saw the guidance as positive, although three quarters of the cardiologists were happy for Ds to follow the NICE guidance.

The majority of respondents in all groups feel that there is a need for more evidence to inform decisions around AP and support a double blind placebo controlled trial.

This is the largest study to date of medical and dental practitioner attitudes towards NICE guideline 64. There are always clear limitations to surveys and these weaknesses have been reviewed in detail elsewhere.21 Advantages include relative ease of access, speed of acquiring data and cost. Sampling concerns, however, are relevant and may introduce bias.22,23 Although we had a large number of respondents, the percentage of the groups we approached was low (Table 1). Such issues must be borne in mind when attempting to generalize the data.

Responses are also based partly on opinion rather than observed fact. Thus, Ds reported that patients were satisfied with the NICE guidance, while 54% also said that they came under pressure to use AP, mostly from the patients. Although 87% of Ds said that they used the NICE guidelines, 38% still thought that AP should sometimes be used.

The responses to our questionnaire suggest that a significant proportion of residual AP prescribing after the introduction of the NICE guideline1 might be directed at patients considered at highest risk from IE, as defined in the AHA and ESC guidelines.3,4 As a result, the lack of a significant increase in the reported incidence of IE1 following the introduction of the NICE guideline could reflect the fact that patients at highest risk from IE are continuing to receive AP. Unfortunately, this makes it difficult to conclude that there is no benefit from AP in this group of patients and the only way we are likely to be able to determine the efficacy (or not) of AP in this group is to perform a clinical trial amongst high-risk patients.

In summary, our results demonstrate considerable variation in compliance amongst professional groups and significant residual support for AP in particular situations. Some of the non-compliance relates to differences in beliefs about the pathogenesis of IE and the quality of evidence to support recommendations. The majority of respondents feel that a double blind placebo controlled trial would be the preferred method to generate further data to inform the debate. Because of the NICE guidelines, the UK is probably the only nation in the world where such a trial could be ethically undertaken.

Supplementary material
Supplementary material is available at QJM online.

Acknowledgements
We are grateful to the support of the following societies for distributing the survey to their members: the BCS, the FGDPs, the SCTSs, the BDA and the BIA.

Funding
This work was supported by the Somerset Heart Research Fund.

Conflict of interest: None declared.

References
8. Mohindra RK. A case of insufficient evidence equipoise: the Nice guidance on antibiotic prophylaxis for the
16. Ahlstedt S. Penicillin allergy—can the incidence be reduced? Allergy 1984; 39:151–64.