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Infective endocarditis: prevention and antibiotic prophylaxis

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After considerable revision of the previous guidelines on infective endocarditis prophylaxis by the American Heart Association in 2007, the Swiss recommendations were revised and published accordingly in 2008 [1]. The Swiss societies of Infectious Diseases (SSI), Pediatric Cardiology and Cardiology and the Pediatric Infectious Disease Group of Switzerland present the current update in a joint initiative. The summary is freely available on the web (https://ssi.guidelines.ch/ → infective endocarditis/prevention).

What is new compared to the 2008 recommendations?

The herein presented endocarditis prophylaxis recommendations differ only in minor points from those published in 2008. Antibiotic prophylaxis is no longer recommended for patients with unrepaired ventricular septal defects and patent ductus arteriosus, in accordance with the guidelines of the European Society of Cardiology (2015) [2]. Antibiotic prophylaxis is recommended only for individuals at high risk. This recommendation has been valid in Switzerland since 2008 and continues to be so. Within this high-risk group there is a ranking order, and the conditions are presented accordingly.

Population at high risk for infective endocarditis

1. Patients with a previous episode of infective endocarditis.
2. Patients with any prosthetic valve (biological or mechanical), including a transcatheter valve (transcatheter valve implantation), or those in whom any prosthetic material was used for cardiac valve repair.
3. Patients with congenital heart disease (CHD).

   (a) Any type of cyanotic CHD (i.e., unrepaired CHD).

   (b) Any type of CHD repaired with prosthetic material, whether placed surgically or by percutaneous techniques. ⇒ At risk up to 6 months *after* the procedure.

   (c) Any type of CHD repaired with prosthetic material, whether placed surgically or by percutaneous techniques. ⇒ At risk for life if residual shunt persists or if residual finding persists *after* the procedure (for example incomplete tissue ingrowth of prosthetic material).
4. There is no evidence to recommend antimicrobial prophylaxis for cardiac transplant recipients who develop cardiac valvulopathy. The indication should be discussed on a case-by-case basis. The patient should contact their transplant specialist to evaluate the indication *prior* to an elective intervention.

Dental and non-dental interventions

Recommendations for antibiotic prophylaxis for the prevention of infective endocarditis focus mainly on dental interventions. Recommendations for antibiotic prophylaxis for other interventions, such as ear-nose-throat surgery, skin surgery or interventions within the respiratory tract, gastrointestinal tract or urogenital tract, are not part of these specific recommendations for antibiotic endocarditis prophylaxis. Detailed recommendations for peri-interventional and perioperative antibiotic prophylaxis for non-dental procedures have been published by Swissnoso [3]. These recommendations apply to all patients, including those with elevated risk for infective endocarditis. A few exceptions for patients at high risk of endocarditis are published as part of these recommendations on the SSI website (https://ssi.guidelines.ch/ → infective endocarditis/prevention and list below). These include, for example, antibiotic treatment when an incision of a skin abscess is performed and the choice of antimicrobial agents for abdominal surgery (i.e., amoxicillin/clavulanic acid instead of cefuroxime or cefazolin to cover activity against *Enterococcus* spp.). Recommendations on the new endocarditis card (similar to an allergy passport that is carried by the patients) are limited to dental interventions. For non-dental interventions, we refer to the published recommendations of the different societies [3, 4] and of the SSI (list below and https://ssi.guidelines.ch/ → infective endocarditis/prevention).

Dental procedures

Antibiotic prophylaxis is not recommended for local anesthetic injections in non-infected tissues, treatment of superficial caries, removal of sutures, dental X-rays, placement or adjustment of removable prosthodontic or orthodontic appliances or braces, following the shedding of deciduous teeth, or superficial trauma to the lips and oral mucosa.

Antibiotic prophylaxis should only be administered for dental procedures with a tendency to bleed, namely those involving:

- manipulation of the gingival or periapical region of the teeth.
- perforation of the oral mucosa.

Antibiotic prophylaxis prior to dental intervention and dental hygiene*

It is recommended to take the antibiotic prophylaxis one hour prior to the intervention:

Amoxicillin

- Adults: 2 g orally (p.o.)
- Children: 50 mg/kg (maximum dose 2 g) p.o.

Alternatives in case of penicillin allergy

- Adults: cefuroxime axetil 1 g p.o. in patients with delayed hypersensitivity reaction
- Children: cefuroxime axetil 50 mg/kg p.o. (maximum dose 1 g) in patients with delayed hypersensitivity reaction
- Adults: clindamycin 600 mg p.o. in patients with immediate hypersensitivity reaction
- Children: clindamycin 20 mg/kg p.o. (maximum dose 600 mg) in patients with immediate hypersensitivity reaction

In case of inability to swallow the antibiotic pill

- Adults: amoxicillin 2 g intravenously (i.v.)
- Children: amoxicillin 50 mg/kg i.v. (maximum dose 2 g)

Alternatives in case of penicillin allergy and inability to swallow the antibiotic pill

- Adults: cefazolin 1 g i.v. or ceftriaxone 2 g i.v. in patients with delayed hypersensitivity reaction
- Children: cefazolin 25 mg/kg i.v. (maximum dose 1 g) or ceftriaxone 50 mg/kg i.v. (maximum dose 2 g) in patients with delayed hypersensitivity reaction
- Adults: clindamycin 600 mg i.v. or vancomycin 1 g i.v. in patients with immediate hypersensitivity reaction
- Children: clindamycin 20 mg/kg i.v. (maximum dose 600 mg) or vancomycin 20 mg/kg i.v. (maximum dose 1 g) in patients with immediate hypersensitivity reaction

* There will be a separate endocarditis card for adults and children

Non-dental interventions

Ear-Nose-Throat procedures

- Perioperative antimicrobial prophylaxis is not recommended for tonsillectomy in patients not at risk for infective endocarditis. There is no evidence-based recommendation for perioperative antimicrobial prophylaxis in patients with risk for infective endocarditis.
- Tonsillectomy is associated with bacteremia in a considerable proportion of patients undergoing this procedure. There is no evidence that perioperative antimicrobial prophylaxis prevents infective endocarditis in patients at risk. The majority of the expert group favor perioperative antimicrobial prophylaxis for tonsillectomy in patients at risk for infective endocarditis. The agent should contain activity against microorganisms belonging to the oral microbiom.
- The expert group clearly categorizes this statement as an expression of opinion and not as a guideline recommendation. The expert group states also that the number of opinions does not correlate with the level of evidence.

Respiratory tract procedures

- Antibiotic prophylaxis is not recommended for bronchoscopy, laryngoscopy, or transnasal or endotracheal intubation.
- For invasive procedures to treat an established infection (i.e., drainage of abscesses), an empiric antibiotic regimen containing anti-staphylococcal activity (*S. aureus*) should be used.

Gastrointestinal/genitourinary procedures

- Antibiotic prophylaxis is not recommended for gastroscopy, colonoscopy, low risk laparoscopic biliary tract procedures (see also the 2015 recommendations

for perioperative antimicrobial prophylaxis of Swissnoso), cystoscopy, vaginal or caesarean delivery, or transesophageal echocardiography.

– In the case of an established infection, an empiric antibiotic regimen containing anti-enterococcal activity should be used.
– If antibiotic therapy is indicated to prevent wound infection or sepsis associated with a gastrointestinal or genitourinary tract procedure, perioperative or peri-interventional antimicrobial prophylaxis containing anti-enterococcal activity should be used (see table 1, dose recommendations are based on normal renal and liver function).

Skin and soft tissue procedures

– Antibiotic prophylaxis is not recommended for any procedure.
– For surgical procedures on infected skin/skin structure (e.g., incision of skin abscess): an empiric antibiotic regimen should contain an agent with activity against staphylococci and beta-hemolytic streptococci.

Cardiac or vascular interventions

– Preoperative screening for nasal carriage of *Staphylococcus aureus* is recommended before elective cardiac surgery in order to treat carriers.
– Local treatment without screening for *S. aureus* is not recommended.
– Potential sources of infection (e.g., dental foci) should be treated/removed ≥2 weeks prior to the intervention.
– Perioperative antibiotic prophylaxis is recommended before placement of a pacemaker or implantable cardioverter defibrillator.
– Perioperative antibiotic prophylaxis should be administered in patients undergoing surgical or transcatheter implantation of a prosthetic valve, intravascular prosthetic or other foreign material (for example graft implantation for endovascular aneurysm repair).
– Prophylaxis should be started immediately before the procedure and repeated if the procedure is prolonged. Prophylaxis should not be prolonged for longer than 48 hours.

Table 1: Perioperative or peri-interventional antimicrobial prophylaxis for gastrointestinal/genitourinary procedures.

Perioperative antimicrobial prophylaxis	No allergy to penicillin	Allergy to penicillin
Adults Single dose 30 – 60 minutes before procedure	Amoxicillin/clavulanate 2.2 g i.v.	Vancomycin 1 g i.v. *plus* gentamicin* 3 mg/kg i.v. (or ciprofloxacin 400 mg i.v.) *plus* metronidazole 500 mg i.v.
Children Single dose 30 – 60 min before procedure	Amoxicillin/clavulanate 50 mg/kg i.v. (maximum 2.2 g i.v.)	Vancomycin 20 mg/kg i.v. (maximum 1 g i.v.) *plus* gentamicin 2.5 mg/kg (maximum 80 mg) i.v. *plus* metronidazole 10 mg/kg i.v. (maximum 500 mg i.v.)

*Alternative to gentamicin; another aminoglycoside (e.g., amikacin) can be administered. Kindly contact your institutional infectious diseases physician.

Areas of uncertainty

Heart transplantation

There is no scientific evidence to support a recommendation for or against antibiotic prophylaxis in cardiac transplant patients who develop valvulopathy. The majority of members of the expert group do not recommend antibiotic prophylaxis for this patient group. At the same time, the expert group states that it is not meaningful to express a generalizable recommendation for a patient population that is relatively small with (different) complex disease histories in Switzerland. Because all heart transplant patients are followed in specialized institutions, it is within the responsibility of the treating transplant physician to prescribe antibiotic prophylaxis prior to the intervention following a case-by-case evaluation.

Tonsillectomy

Bacteremia occurs frequently during tonsillectomy [5-8]. However, perioperative antibiotic prophylaxis is *not* recommended for tonsillectomy in patients *not* at risk for developing infective endocarditis [3, 9]. The majority of the expert group favor the administration of antimicrobial prophylaxis in high-risk patients undergoing tonsillectomy [1, 8, 10]. The antimicrobial agent must have activity against organisms belonging to the oral microbiome (e.g., amoxicillin/clavulanic acid, 2.2 g in adults and 50 mg/kg [maximum dose 2.2 g] in children, given intravenously 30 minutes prior to incision). However, due to a lack of evidence, the expert group clearly categorizes this statement as expert opinion and not as a guideline recommendation.

Information and communication strategy

The major focus of the revised recommendations is a comprehensive prevention campaign for all patients at risk for infective endocarditis (figure 1).

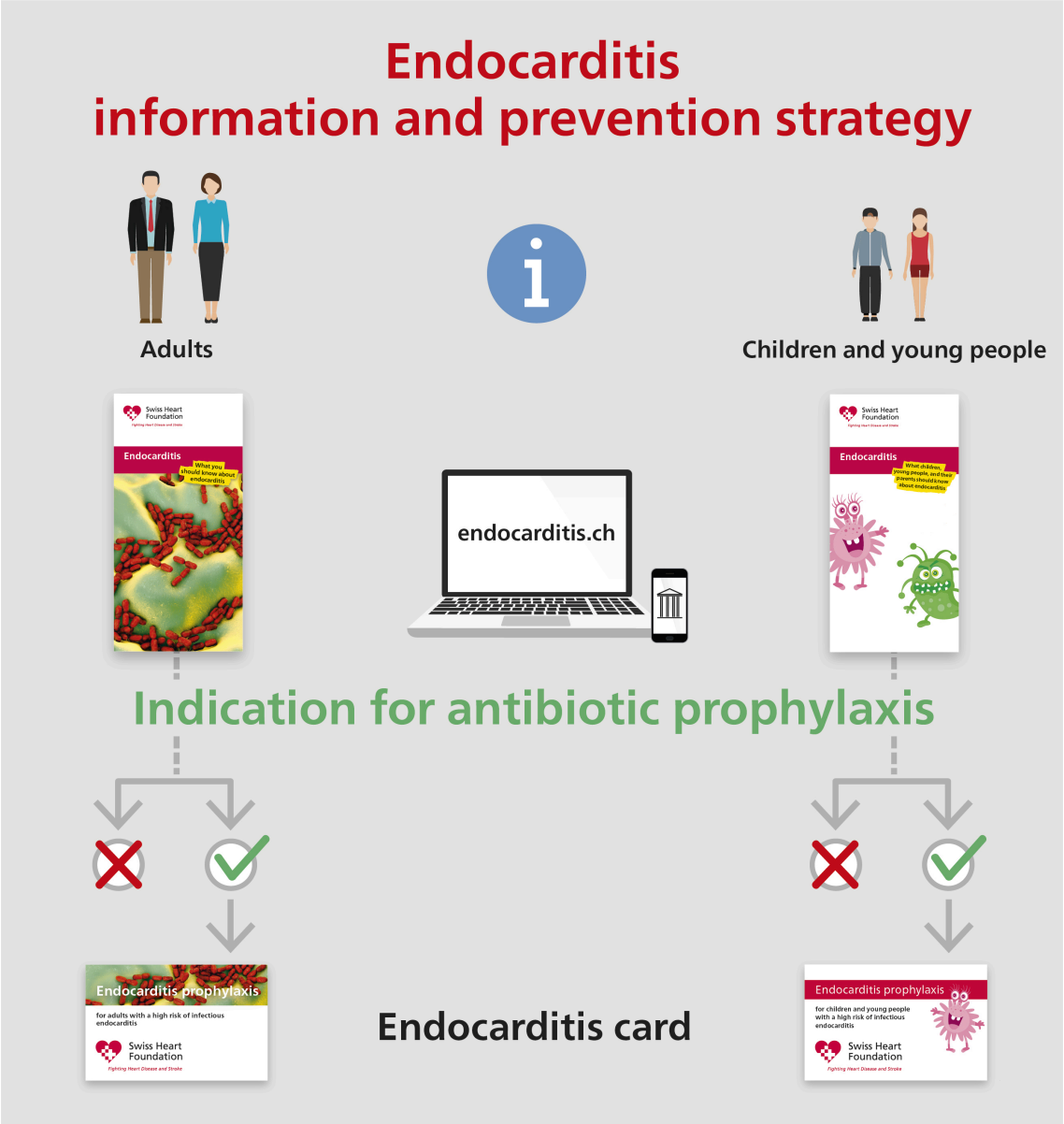
The information strategy includes the following key elements:

– Knowledge transfer to increase awareness for good dental and skin hygiene
– Education on symptoms consistent with infective endocarditis and the appropriate steps when these symptoms occur (i.e., get in contact with the doctor, obtain blood culture prior to administration of antibiotic therapy)

Considering that early diagnosis and appropriate treatment of infective endocarditis can be lifesaving, patient education is a central element of the prevention strategy. For this reason, the Swiss expert group, in collaboration with the Swiss Heart Foundation, has created a flyer illustrating the most important issues concerning infective endocarditis. This flyer is being distributed to *all* patients at risk for infective endocarditis, irrespective of their risk categorization (figure 1). The purpose of this flyer is for patient education and as a supportive instrument for care givers and providers in the field of heart diseases.

Patients with the highest risk for infective endocarditis require antibiotic prophylaxis prior to dental intervention. These patients only will also receive a separate antibiotic card. There are flyer and card versions for adults and for children (figure 1). For non-dental interventions, specific

Figure 1: Information and prevention strategy: prevention campaign for all patients at risk for infective endocarditis.



recommendations can be found on the corresponding websites (figure 2).

Additional patient information can be found on the following websites: www.endocarditis.ch [German] and www.endocardites.ch [French]. An educational movie will be available soon.

Disclosure statement

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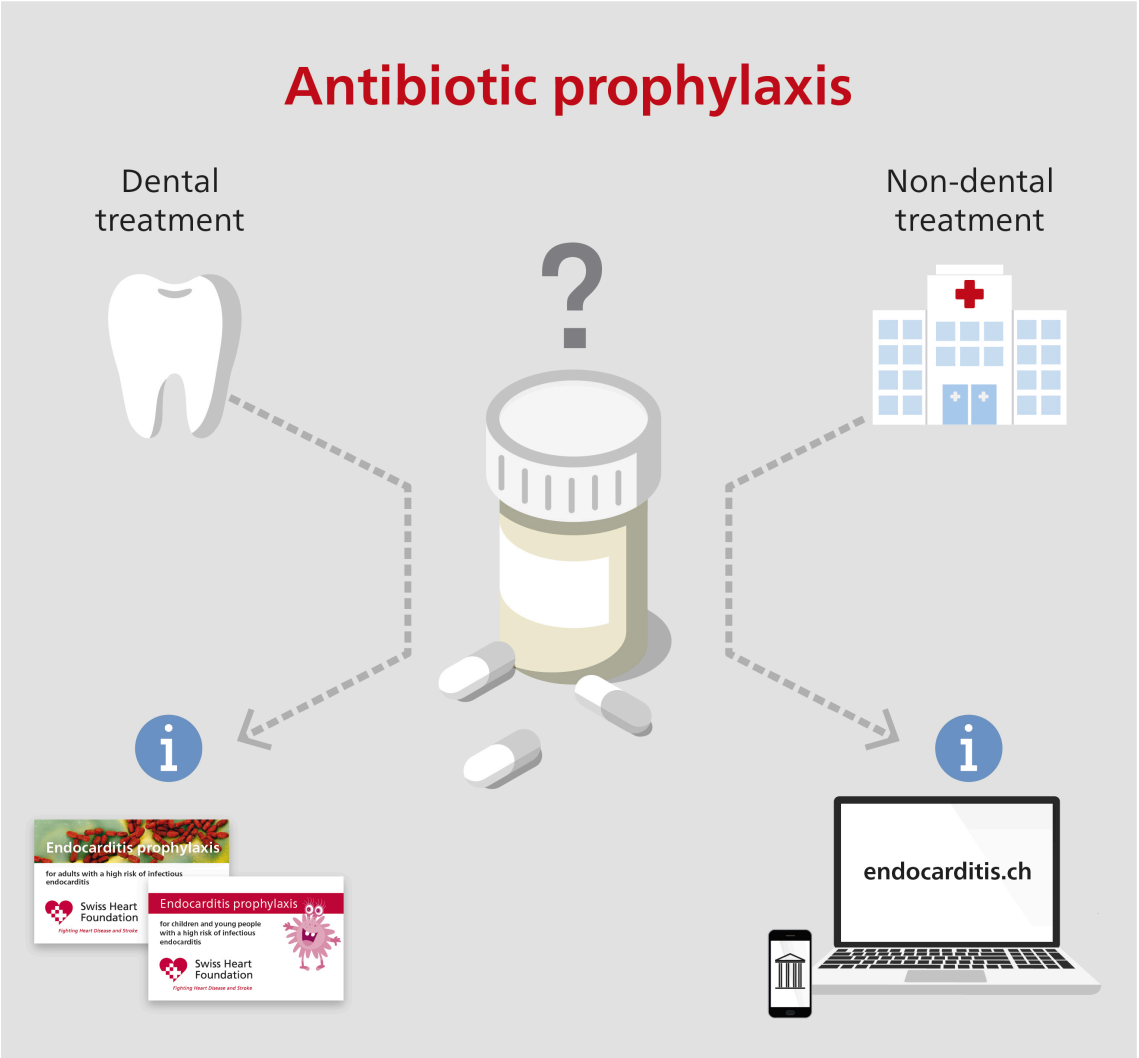
Figure 2: Patients with the highest risk for infective endocarditis require antibiotic prophylaxis prior to dental intervention. These patients only will also receive a separate antibiotic card. For non-dental interventions, specific recommendations can be found on the corresponding websites.



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