

CHAPTER 7.6 Vaccinations before and after organ transplantation in children

Maximilian Stich & Susanne Rieger

Heidelberg University, Medical Faculty, Department of Paediatrics I, University Children's Hospital Heidelberg, Germany

ORCIDs:

Maximilian Stich: <https://orcid.org/0000-0002-6237-9058>
Susanne Rieger: <https://orcid.org/0009-0005-4799-713x>

Recommendations for practice

The question of the benefits and risks of vaccinations in children after organ transplantation often arises. On one hand, the impaired immune system and the resulting increased susceptibility to infections represent a strong indication for many vaccinations (e.g. influenza). On the other hand, concerns persist regarding potential side effects and the risk of triggering rejection through immunostimulation. This brief guide aims to address the uncertainty that often leads to an unfounded reluctance to vaccinate organ transplant recipients.

Importance of the immunosuppressive regimen

- ▶ Immunosuppressive drugs reduce the induction and maintenance of humoral and cellular immunity.
- ▶ High-dose immunosuppression (especially MMF) is associated with a weaker vaccination response
- ▶ The level of antibody titres does not correlate reliably with immunity.

Opportunities and risks

- ▶ Sufficiently large vaccination studies for most inactivated vaccines: Side effects are rare and there is no evidence of organ rejection after vaccination with inactivated vaccines [Laws et al; Bundesgesundheitsbl. 2020; 63:588–644].

- ▶ Live vaccines are generally not recommended after organ transplantation as their safety has not been sufficiently proven. For unvaccinated patients: individual decision after thorough risk assessment.

Vaccination BEFORE organ transplantation:

As a better vaccination response is achieved before transplantation and immunity is not lost through transplantation, early vaccination before transplantation is recommended. Complete the standard vaccinations as recommended by the Standing Committee on Vaccination, Robert Koch Institute (www.rki.de):

- ▶ Measles-Mumps-Rubella-Varicella: permitted from 9 months of age (in urgent cases from 6 months of age).

Table 1 Additional recommended vaccinations

Hepatitis A	From 12 months of age (Liver transplant recipients: from 6 months of age)
Pneumococci	Age 2–17 years: sequential administration of PPSV23 (Pneumovax [®]) at the earliest 2 (preferably 6–12) months after PPV13 (Prevenar13 [®]) Age \geq 18 years: 1 dose of PCV20 (Prevenar20 [®]) at least 6 years after PPSV23
Meningococcal ACWY	From 12 months of age: 1 dose (Nimenrix [®] approved from 6 weeks, but then 2nd dose + booster at 1 year)
Influenza	From 6 months of age: annual booster in autumn; for the 1st vaccination: 2nd dose after 4–6 weeks
COVID-19	From 6 months of age: annual autumn booster; Basic immunisation: \geq 3 antigen contacts; of which \geq 1 vaccination
Tick-borne encephalitis	If exposed to ticks in risk areas Basic immunisation: 3 doses (at intervals of 1–3 and 5–12 months)
Herpes zoster	Age \geq 18 years and after primary VZV infection 2 doses of Shingrix [®] (2–6 months apart)

- ▶ Complete vaccination series with inactivated vaccines at least 2 weeks and with live vaccines at least 4 weeks (measles-mumps-rubella) or 6–8 weeks (varicella) prior to transplantation.
- ▶ Serological assessment of anti-VZV (anti-measles/mumps/rubella) and anti-HBs 4–8 weeks after completion of the vaccination series and anti-HBs annually prior to transplantation
 - ◆ Anti-HBs < 100 IU/L, re-vaccination and repeat anti-Hbs monitoring
 - ◆ Anti-HBs < 10 IU/L, determination of HBsAG and anti-HBc. If chronic HBV infection is excluded, revaccinate.

Vaccination AFTER organ transplantation

Live vaccines: are in general contraindicated after organ transplantation and require careful risk assessment in unvaccinated patients (see Laws et al.; Bundesgesundheitsbl. 2020; 63(5):588–644). But after individual risk assessment, live vaccines can also be considered for unprotected patients after organ transplantation [3].

Contraindicated vaccinations in immunosuppressed patients:

- ▶ Measles, mumps, rubella, varicella (attenuated live viruses)
- ▶ Rotavirus (attenuated live virus)
- ▶ Typhoid oral live vaccine
- ▶ Oral poliomyelitis live vaccine (OPV)
- ▶ Yellow fever (attenuated live virus)
- ▶ Tuberculosis: Bacillus Calmette-Guerin vaccine (BCG)
- ▶ Live nasal influenza vaccine

Inactivated vaccines: After organ transplantation, vaccinations can and should be given after the end of high-dose immunosuppression, usually 6 months after transplantation. An exception is the influenza vaccination, which can be given as early as 4 weeks after transplantation, depending on the season. If the basic immunisation with inactivated vaccines (standard and indication vaccines) has not been completed before transplantation, it should be completed after the end of high-dose immunosuppression, usually 6 months after transplantation.

This differs from pre-transplant vaccination:

- ▶ Tick-borne encephalitis: 4 instead of 3 vaccine doses (0,1,3,12 months) or serological control 4 weeks after the 2nd dose
- ▶ Meningococcal ACWY: 2 doses instead of 1 (interval 1–2 months)
- ▶ Hepatitis B: double the standard dose if necessary (off-label)

Table 2 Recommended booster doses of inactivated vaccines after completion of basic immunisation

Vaccine	Booster vaccination
Tetanus	every 5–10 years
Diphtheria	every 5–10 years or antibody titre < 0.1 IU/mL
Pertussis	every 5–10 years
Poliomyelitis	once at the age of 9–16 years
Hepatitis B	if anti-HBs < 100 IU/L (monitor anti-HBs titre annually and 4–8 weeks after booster vaccination)
Meningococcal B	every 5 years
Meningococcal ACWY	every 5 years
TBE	3 years after the 3rd dose, then every 5 years
Influenza	annually in autumn
COVID-19	annually in autumn
Pneumococci	Age < 18 years: every 6 years PPSV23 Age ≥ 18 years: PCV20 6 years after PPSV23

Vaccination of household contacts

Complete age-appropriate standard immunisations as recommended by the Standing Committee on Vaccination, Robert Koch Institute (www.rki.de).

Additional recommended vaccinations

- ▶ Annual influenza and SARS-CoV-2
- ▶ Tetanus, diphtheria and pertussis: booster vaccination every 10 years
- ▶ Hepatitis B
- ▶ Hepatitis A: in case of increased risk of exposure or child with LTx
- ▶ Measles, mumps, rubella, varicella in the absence of immunity (if an exanthema occurs after varicella vaccination, contact with immunosuppressed persons should be avoided until the exanthema has subsided).

Contraindicated vaccines

- ▶ Oral poliomyelitis live vaccine (OPV)
- ▶ Live nasal influenza vaccine

Travel recommendations

Before travelling

- ▶ Do not travel to countries with an increased risk of infection within the first 12 months after transplantation
- ▶ Timely health advice and vaccinations before travelling (e.g., according to the recommendations of the Standing Committee on Vaccination (STIKO) and the German Society for Tropical Medicine, Travel Medicine and Global Health e.V. (DTG) on travel vaccinations. *Epid Bull* 2024; 14:1–206)
- ▶ Adequate supply of medicines
- ▶ Translation of medical report/patient ID card
- ▶ Certificate of contraindication to yellow fever vaccination
- ▶ Planning for return in case of need for rapid return

During the trip

- ▶ Boiled water only
- ▶ Cooked or peeled food only
- ▶ Beware of diarrhoea:
 - ◆ Dehydration worsens kidney function

- Altered absorption of immunosuppressive drugs: tacrolimus level↑, cyclosporine level↓
- ▶ Barrier protection against mosquito bites and sun exposure

These recommendations do not relieve the treating physician of the responsibility to make individual therapeutic decisions for each patient.

Further information: www.rki.de STIKO recommendations, Robert Koch Institute



The recommendations of the Standing Committee on Vaccination (STIKO) are also available as a free STIKO@rki app. There is also a web version of the app at www.STIKO-webapp.de, which can be used on a PC.

www.dtg.org Recommendations for travel vaccinations and malaria prophylaxis, German Society for Tropical Medicine and Global Health

References

- 1 Empfehlungen der Ständigen Impfkommission (STIKO) am Robert-Koch-Institut 2024: *Epid Bull* 2024;4:1–72. doi:10.25646/11892.3
- 2 Ständige Impfkommission und Deutsche Gesellschaft für Tropenmedizin, Reisemedizin und Globale Gesundheit e.V.: Empfehlungen der Ständigen Impfkommission (STIKO) und der Deutschen Gesellschaft für Tropenmedizin, Reisemedizin und Globale Gesundheit e.V. (DTG) zu Reiseimpfungen. *Epid Bull* 2024;14:1–206. doi:10.25646/12006.2
- 3 Laws HJ, Baumann U, Bogdan C, et al. Impfen bei Immundefizienz: Anwendungshinweise zu den von der Ständigen Impfkommission empfohlenen Impfungen. (III) Impfen bei hämatologischen und onkologischen Erkrankungen (antineoplastische Therapie, Stammzelltransplantation), Organtransplantation und Asplenie. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz*. 2020;63(5):588–644. doi:10.1007/s00103-020-03123-w

- 4 Niehues T, Bogdan C, Hecht J, et al. Impfen bei Immundefizienz: Anwendungshinweise zu den von der Ständigen Impfkommission empfohlenen Impfungen. (I) Grundlagenpapier. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz. 2017;60(6):674–684. doi:10.1007/s00103-017-2555-4