Aktiv Druck & Verlag GmbH | ISSN 0170 - 5334 I 02330

www.ai-online.info

64. Jahrgang | März 2023

A&I

ANÄSTHESIOLOGIE & INTENSIVMEDIZIN

Offizielles Organ: Deutsche Gesellschaft für Anästhesiologie und Intensivmedizin e. V. (DGAI)
Berufsverband Deutscher Anästhesistinnen und Anästhesisten e. V. (BDA)
Organ: Deutsche Interdisziplinäre Vereinigung für Intensiv- und Notfallmedizin e. V. (DIVI)

Goodpasture syndrome

Inclusion body myositis

orphanaesthesia

a project of the German Society
of Anaesthesiology and Intensive Care Medicine

SUPPLEMENT NR. 4 | 2023

OrphanAnesthesia –

ein krankheitsübergreifendes Projekt des Wissenschaftlichen Arbeitskreises Kinderanästhesie der Deutschen Gesellschaft für Anästhesiologie und Intensivmedizin e.V.

Ziel des Projektes ist die Veröffentlichung von Handlungsempfehlungen zur anästhesiologischen Betreuung von Patientinnen und Patienten mit seltenen Erkrankungen. Damit will OrphanAnesthesia einen wichtigen Beitrag zur Erhöhung der Patientensicherheit leisten.

Patientinnen und Patienten mit seltenen Erkrankungen benötigen für verschiedene diagnostische oder therapeutische Prozeduren eine anästhesiologische Betreuung, die mit einem erhöhten Risiko für anästhesieassoziierte Komplikationen einhergehen. Weil diese Erkrankungen selten auftreten, können Anästhesistinnen und Anästhesisten damit keine Erfahrungen gesammelt haben, sodass für die Planung der Narkose die Einholung weiterer Information unerlässlich ist. Durch vorhandene spezifische Informationen kann die Inzidenz von mit der Narkose assoziierten Komplikationen gesenkt werden. Zur Verfügung stehendes Wissen schafft Sicherheit im Prozess der Patientenversorgung.

Die Handlungsempfehlungen von OrphanAnesthesia sind standardisiert und durchlaufen nach ihrer Erstellung einen Peer-Review-Prozess, an dem eine Anästhesistin bzw. ein Anästhesist sowie eine weitere Krankheitsexpertin bzw. ein weiterer Krankheitsexperte (z. B. Pädiaterin bzw. Pädiater oder Neurologin bzw. Neurologe) beteiligt sind. Das Projekt ist international ausgerichtet, sodass die Handlungsempfehlungen grundsätzlich in englischer Sprache veröffentlicht werden.

Ab Heft 5/2014 werden im monatlichen Rhythmus je zwei Handlungsempfehlungen als Supplement der A&I unter www.ai-online.info veröffentlicht. Als Bestandteil der A&I sind die Handlungsempfehlungen damit auch zitierfähig. Sonderdrucke können gegen Entgelt bestellt werden.

Bisher in A&I publizierte Handlungsempfehlungen finden Sie unter:

www.ai-online.info/Orphsuppl
www.orphananesthesia.eu

OrphanAnesthesia –

a project of the Scientific Working Group of Paediatric Anaesthesia of the German Society of Anaesthesiology and Intensive Care Medicine

The target of OrphanAnesthesia is the publication of anaesthesia recommendations for patients suffering from rare diseases in order to improve patients' safety. When it comes to the management of patients with rare diseases, there are only sparse evidence-based facts and even far less knowledge in the anaesthetic outcome. OrphanAnesthesia would like to merge this knowledge based on scientific publications and proven experience of specialists making it available for physicians worldwide free of charge.

All OrphanAnesthesia recommendations are standardized and need to pass a peer review process. They are being reviewed by at least one anaesthesiologist and another disease expert (e.g. paediatrician or neurologist) involved in the treatment of this group of patients.

The project OrphanAnesthesia is internationally oriented. Thus all recommendations will be published in English.

Starting with issue 5/2014, we'll publish the OrphanAnesthesia recommenations as a monthly supplement of A&I (Anästhesiologie & Intensivmedizin). Thus they can be accessed and downloaded via www.ai-online.info. As being part of the journal, the recommendations will be quotable. Reprints can be ordered for payment.

Find a survey of the recommendations published until now on:

www.ai-online.info/Orphsuppl
www.orphananesthesia.eu

Projektleitung

Prof. Dr. Tino Münster, MHBA

Chefarzt
Klinik für Anästhesie und operative Intensivmedizin
Krankenhaus Barmherzige Brüder Regensburg
Prüfeninger Straße 86
93049 Regensburg,
Deutschland

Tel.: 0941 369-2350

E-Mail: Tino.Muenster@barmherzige-regensburg.de

DGAI
Deutsche Gesellschaft für Anästhesiologie & Intensivmedizin
www.dgai.de

A&I
ANÄSTHESIOLOGIE & INTENSIVMEDIZIN
www.ai-online.info

www.orphananesthesia.eu

orphananesthesia
a project of the German Society of Anaesthesiology and Intensive Care Medicine

orphananesthesia

Anaesthesia recommendations for

Goodpasture syndrome

Disease name: Goodpasture syndrome

ICD 10: M31.0

Synonyms: Goodpasture's syndrome (GS), anti-glomerular basement membrane disease, crescentic glomerulonephritis type 1, GPS

Disease summary: Goodpasture syndrome is a rare and organ-specific autoimmune disease (Gell and Coombs classification type II). It is mediated by anti-glomerular basement membrane (anti-GBM) antibodies [7]. The disease was first described by Dr Ernest Goodpasture in 1919 [6], whereby the glomerular basement membrane was first identified as an antigen in the 1950s. More than one decade later, researchers succeeded in defining the association between antibodies taken from diseased kidneys and nephritis [7].

The disorder is characterised by autoantibodies targeting at the NC1 domain of the α3 chain of type IV collagen in the glomerular and alveolar basement membrane with activation of the complement cascade, among other things [7,17]. The exclusive location of this α3 subunit in basement membranes in lung and kidney only is responsible for the unique affection of these two organs in GPS [7].

Nevertheless, the aetiology and the triggering stimuli for anti-GBM production remain unknown. Due to the fact that patients with specific human leukocyte antigen (HLA) types are more susceptible, a genetic HLA-associated predisposition seems possible [4,7]. However, because this strongly associated allele is frequently present, there seem to be additional behavioural or environmental factors influencing immune response and disease expression. The latter may include respiratory infections (e.g., influenza A2), exposition to hydrocarbon fumes, organic solvents, metallic dust, tobacco smoke, certain drugs (i.e., rifampicin, allopurinol, cocaine), physical damage to basement membrane (e.g., lithotripsy or membranous glomerulonephritis) as well as lymphocyte-depletion therapy (such as alemtuzumab), but unequivocal evidence is lacking [4,7,9,17].

The incidence is estimated to be about 0.5 to 2 cases per million per year in European Caucasoid and Asian populations [7,19,20]. Uncommon for autoimmune diseases, Caucasians males are more affected than females, however, the disease is even more common among the Maori people of New Zealand [19]. It is also a cause of acute renal failure in approximately 10–20 % of all cases of rapidly progressive or crescentic glomerulonephritis. The age distribution shows two peaks: the first occurs between 20 and 30 years (with more frequent haemorrhagic features) and second between 60 and 70 years of age. Regarding age patterns, men have a higher prevalence in the younger age group, whereas it is higher for women in the older age group [4,7].

GPS typically presents as acute renal failure caused by a rapidly progressive glomerulonephritis. This is often accompanied by pulmonary haemorrhage that may be life-

▶ **Citation:** Gaik C, Wiesmann T: Goodpasture syndrome. Anästh Intensivmed 2023;64:S83–S92.
DOI: 10.19224/ai2023.S083

threatening, especially without prompt diagnosis and treatment [7,17]. Symptoms may begin slowly and become rapidly progressive in a matter of days [1]. Fatigue, weakness, lethargy, nausea, vomiting, diarrhoea, pruritus, loss of appetite and weight, malaise, chills, fever, headache, arthralgias, a pale appearance and general discomfort or even seizures may be rather unspecific and initial symptoms [4,7,21,22,23]. About 60–80 % of the cases display clinically apparent renal and pulmonary manifestations, whereas 20–40 % have renal disease alone, and in less than 10 % of the patients, manifestation is limited to the lungs [4,7,19]. Pulmonary symptoms include haemoptysis, dry cough, shortness of breath, inspiratory crackles over lung bases, chest pain, cyanosis, dyspnoea, tachypnoea up to respiratory failure [7]. Regarding children, they do not present commonly with pulmonary findings before puberty [15]. Affection of the kidney may lead to haematuria, foamy urine, swelling of the hands and feet, high blood pressure, oedema, uraemia, oliguria, anuria and back pain in the kidney area [4,7,9]. Autoimmune inner ear disease (AIED) may be associated and present with vertigo, a ringing, hissing or roaring sound in the ear up to a sudden hearing loss in one ear progressing rapidly to the second ear (within weeks or months) [7].

More than 90 % of the patients with GPS have circulating serum anti-GBM antibodies [2]. A definitive diagnosis is substantiated by percutaneous kidney biopsy (preferred in comparison to a lung biopsy) and confirmed by immunofluorescent techniques and tested by an enzyme-linked immunosorbent assay (ELISA) for the presence of pathognomonic circulating anti-GBM serum antibodies [7].

There is a lack of systematic data of this rare syndrome. As yet, no causal therapy or, at least, controlled therapeutic trials are available. Nevertheless, rapid recognition and treatment is crucial in GPS. The three principles in therapy of GPS are (1) rapid removal of circulating antibodies (primarily by plasmapheresis), (2) stopping any further production of antibodies by drug-induced immunosuppression (high-dose corticosteroids and cyclophosphamide represent the standard therapy, but other immunosuppressive agents like azathioprine or rituximab are also established) and (3) removal of offending agents that may have initiated the antibody production [7]. Renal-replacement therapy as well as renal transplantation may help to replace renal function. Most centres therefore recommend a 6-month period of sustained negative testing for anti-GBM antibodies before undertaking transplantation surgery [14]. There are several case reports of necessary extracorporeal membrane oxygenation (ECMO) due to refractory hypoxemic respiratory failure in GPS with severe pulmonary haemorrhage [1,3,9,12,15].

GPS has a poor prognosis and it largely depends on the diagnosis and treatment timeline of this rapidly progressive disease. Untreated, the lethality of GPS ranges from 77 to 96 % [9]. Under the triple therapeutic regime comprising corticosteroids, immunosuppressive therapy and plasmapheresis, a survival of 70–90 % in one year and up to 80 % in five years may be obtained [4,7]. Besides, in patients with dialysis due to end-stage renal disease in New Zealand and Australia, the median survival was nearly six years [20]. In addition to age, a history of pulmonary haemorrhage is associated with an increased risk of mortality on dialysis [12,20]. Dialysis dependency at presentation rarely generates full recovery of renal function. Nevertheless, patients requiring temporary dialysis may recover a good renal function and only less than 30 % of the surviving patients require long-term dialysis [4,7,12,13]. Double positivity for serum ANCAs and anti-GBM is another indicative of a worse renal prognosis and higher mortality [4]. Pulmonary patients can also often fully recover from lung damage with fast and adequate treatment [3,19]. The long-term outcome of GPS might be better in children than in adults [15].

© Anästh Intensivmed 2023;64:S83–S92 Aktiv Druck & Verlag GmbH

Medicine is in progress

Perhaps new knowledge

Every patient is unique

Perhaps the diagnosis is wrong

Find more information on the disease, its centres of reference and patient organisations on Orphanet: www.orpha.net

Emergency information

	AIRWAY / ANAESTHETIC TECHNIQUE	No special airway malformations, but GA may be challenging (due to respiratory status) – availability of tracheal suction (pulmonary bleeding) – anaesthesia only in cases of stable disease if applicable – be aware of severe / refractory hypoxaemic failure due to pulmonary haemorrhage with necessity of VV-ECMO – consider neuraxial / peripheral RA as a feasible alternative if applicable
B	**BLOOD PRODUCTS (COAGULATION)**	Be prepared for recurring transfusions in case of persistent intrapulmonary bleeding (sufficient storage of blood products) – be aware of low platelets and fibrinogen in patients undergoing plasmapheresis
C	**CIRCULATION**	Anticipate haemodynamic deviation due to pre-existing hypertension when undergoing anaesthesia – consider IBP (blood gas analysis) and (non-)invasive haemodynamic (to avoid fluid overload)
D	**DRUGS**	No risk for MH – be aware of secondary insufficiency of the adrenal glands (long-term corticosteroid-therapy) and infectious complications (immunosuppressive therapy) – consider drug dose adaption in case of renal impairment
E	**EQUIPMENT**	Use ultrasound for vessel cannulation / peripheral RA (oedema, swollen limbs) – perioperative availability of dialysis may be necessary

Typical surgery

Percutaneous kidney biopsy and alternatively transbronchial or (rarely) open-lung biopsy for diagnosis [7]

Bronchoscopy/(rarely) thoracoscopy for diagnostic issues [7]

Renal transplantation [7,11]

Arteriovenous fistula for dialysis.

Type of anaesthesia

A general recommendation regarding an ideal anaesthetic approach cannot be given as there is a lack of data for anaesthesia in patients with GPS. As usual, and whenever possible, anaesthesia should only be considered in cases of a stable disease.

Anaesthetists/intensive care physicians are often involved in securing the airway in instable GPS patients with pulmonary haemorrhage.

General anaesthesia might be challenging due to the respiratory status of a patient with GPS.

Neuraxial (epidural) anaesthesia has been used in a patient with GPS undergoing bilateral nephrectomy and has been described as uneventful [16].

Peripheral regional anaesthesia techniques should be applicable to most patients. Due to possible generalised oedemas especially located in the extremities, a landmark-guided approach may be difficult and ultrasound-guided regional anaesthesia recommended.

Necessary additional preoperative testing (beside standard care)

Chest radiography: May show normal findings (18 %) as well as infiltrates and patchy parenchymal consolidations which are usually bilateral, symmetric perihilar and bibasilar [1,7,19]

Chest radiography / ultrasound: Pleural effusions are unusual but can occur [7,19].

Computed tomography: May reveal localised/nodular/diffuse/extensive/bilateral infiltrates with a pattern of alveolar damage [1]

Pulmonary function test: May help to better characterise or identify further progress of pulmonary impairment before scheduled surgery

Blood testing: May show anaemia of variable degree (due to pulmonary bleeding or often secondary to iron deficiency as well as renal failure), high level of waste products as well as elevated blood urea nitrogen (BUN) and serum creatinine levels

Urine analysis: Proteinuria and/or haematuria may be observed.

Particular preparation for airway management

As far as is known, there are no anatomic peculiarities due to GPS itself. Nevertheless, a standardised approach to airway examination and the detection of airway challenges is recommended. A thorough preparation for airway management should be based on the examination results.

In case of pulmonary bleeding, urgent endotracheal intubation might be performed. Depending on the degree of haemoptysis and pulmonary bleeding in the individual patient, intubation performed with video-assistance or the application of a fibreoptic technique may be considered. Of course, direct laryngoscopy should also be available, and for some anaesthetists and in individual (bleeding) situations it may be the more reliable option.

As pulmonary bleeding is usually a bilateral phenomenon, lung separation techniques are normally not helpful when it comes to “distinguishing a good lung from a bad”. In refractory bleeding with the development of severe hypoxemia, urgent transfer to an ECMO centre might be the only life-saving approach as a VV-ECMO might serve as a bridge to recovery in combination with the underlying medical therapy of the GPS.

Particular preparation for transfusion or administration of blood products

No specific recommendations have been given. No typical bleeding disorders were reported for GPS patients. Nevertheless, problems may arise during plasmapheresis when platelets drop and fibrinogen is removed.

However, patients with GPS often show significant anaemia (due to persistent intrapulmonary bleeding) with appropriate recurring transfusions [7,9]. Therefore, depending on scheduled surgery as well as the degree of haemoptysis/pulmonary bleeding, an adequate amount of blood products should be available.

Particular preparation for anticoagulation

Especially in cases of pulmonary haemorrhage, dialysis or plasmapheresis, the method and intensity of anticoagulation should be calculated by weighing the risks and benefits in each individual patient and should depend on surgery.

Particular precautions for positioning, transportation and mobilisation

There are no specific recommendations for patients with GPS.

Interactions of chronic disease and anaesthesia medications

Long-term medication with corticosteroids should be considered due to secondary insufficiency of the adrenal glands. Thus, additional “stress-dose corticosteroid dosing” might reduce the risk of perioperative adrenal insufficiency [24].

Immunosuppressive therapy might be related to a higher risk of infectious complications.

Anaesthetic procedure

Preoperative evaluation: See details above.

Premedication: might be performed by weighing the benefits and risks in individual patients.

Patient positioning: No specific recommendations.

IV line: Placement might be difficult due to swelling/oedema of the limbs [3,7].

Invasive blood pressure measurement: Facilitates frequent arterial blood gas analysis, especially in case of pulmonary and renal (i.e., potassium levels) impairment.

(Mechanical) ventilation: Pulmonary restriction and reduced diffusing capacity are characteristics in patients with GPS. Moreover, lung-protective ventilation should be performed with adequate low tidal volumes to avoid baro-/volutrauma. Frequent tracheal suction due to pulmonary bleeding may be necessary [16].

© Anästh Intensivmed 2023;64:S83–S92 Aktiv Druck & Verlag GmbH

Anaesthesia: Total intravenous or balanced anaesthesia using volatile anaesthetics can be performed safely. The use of fentanyl, remifentanil and propofol is reported as uneventful for induction and maintenance [5,16]. An increased oxygen tension in the anaesthetic gas mixture may be necessary due to pulmonary impairment, especially due to a pathologic degree of ventilation-perfusion [16]. There are no absolute or known relative contraindications for anaesthesia-related drugs just because of the disease GPS, but drug doses should be adapted depending on the degree of the patient's renal impairment. There is no specific risk for malignant hyperthermia.

Regional anaesthesia can be performed as described above.

Particular or additional monitoring

Haemodynamic monitoring (invasive or noninvasive): may be reasonable to avoid fluid overload in patients with GPS [7].

Possible complications

Pulmonary bleeding/haemorrhage and resulting respiratory failure/hypoxemia as well as anaemia.

Necessity of (long-term) dialysis due to renal failure.

Haemodynamic deviation due to pre-existing hypertension when undergoing anaesthesia.

Infections in case of fulminant immunosuppression.

Postoperative care

Postoperative care should be based upon the patient's pre-existing conditions as well as the surgical or interventional procedure.

Especially respiratory and renal function as well as blood pressure should be monitored in an appropriately extended stay in PACU, IMC or ICU before transfer to the normal ward (or discharge at home) is acceptable.

Disease-related acute problems and effect on anaesthesia and recovery

Emergency-like situations: diffuse alveolar or pulmonary haemorrhage with necessary ventilation, recurring re-intubations up to implantation of (VV-)ECMO in refractory hypoxaemia due to pulmonary bleeding [3,7,19,21].

Differential diagnostics: Wegener granulomatosis, systemic lupus erythematosus, microscopic polyangiitis, other forms of systemic vasculitides (i.e., Churg-Strauss syndrome, essential mixed cryoglobulinaemia, Henoch-Schönlein purpura, microscopic polyarteritis, drug-induced vasculitis), pulmonary embolism, other disorders or infections (i.e., pneumocystis carinii pneumoniae, rheumatoid arthritis) [4,7,19].

Ambulatory anaesthesia

Specific recommendations for or against ambulatory anaesthesia cannot be given as there is no published literature on this topic. In stable GPS disease, ambulatory procedures will be possible if patients are ASA status I–III and do not show relevant contraindications for ambulatory anaesthesia.

Obstetrical anaesthesia

Patients with GPS are fertile, thus an obstetrical anaesthetist might have to deal with female GPS patients with for labour analgesia. During pregnancy, the disease can seriously threaten the lives of both mother and child. Apart from prematurity, abortion (on account of the teratogenic effect of an indispensable therapy) will be possible. Gestational diabetes may occur due to steroid therapy. Therefore, an appropriate clinical management of pregnant women with GPS will require intensive care, a centre with an adequate expertise and a multidisciplinary co-operation among the attending medical specialists [8,10,22].

Hypertension and proteinuria are the most common findings in pregnant GPS patients. Although difficult during pregnancy, it is important to determine whether these symptoms are caused by preeclampsia or a renal abnormality due to GPS [10]. For definitive diagnosis, serologic studies and renal biopsy should be considered, whereby the latter does not seem to be associated with an increased risk during pregnancy [22]. Apart from blood-pressure monitoring, the management of pregnant women with GPS should include a serial assessment of renal function, haematologic values and pulmonary function tests for an assessment of a restrictive pattern or hypoxaemia [23]. Deterioration in renal function may potentially exacerbate by hypertension related to pregnancy [22].

Vaginal delivery as well as caesarean section are both reported in parturient with GPS [10,18,23].

In general, neuraxial as well as general anaesthesia might be performed in this patient population. Severe complications due to anaesthesia have not been reported. However, the lack of reports on obstetrical anaesthesia should result in proper shared decision-making regarding the selection of anaesthesia techniques for specific women.

© Anästh Intensivmed 2023;64:S83–S92 Aktiv Druck & Verlag GmbH

References

1. Balke L, Both M, Arlt A, Rosenberg M, Bewig B. Severe Adult Respiratory Distress Syndrome from Goodpasture Syndrome. Am J Respir Crit Care Med 2015;191:228–229
2. Collard HR, Schwarz MI. Diffuse alveolar hemorrhage. Clinics Chest Med 2004;25:583–592
3. Dalabih A, Pietsch J, Jabs K, Hardison D, Bridges BC. Extracorporeal Membrane Oxygenation as a Platform for Recovery: A Case Report of a Child with Pulmonary Hemorrhage, Refractory Hypoxemic Respiratory Failure, and New Onset Goodpasture Syndrome. J Extra Corpor Technol 2012;44:75–77
4. Dammacco F, Battaglia S, Gesualdo L, Racanelli V. Goodpasture's disease: A report of ten cases and a review of the literature. Autoimmun Rev 2013;12:1101–1108
5. Fukuhara A, Okutani R, Oda Y. Anesthesia for living donor renal transplantation in a patient with Goodpasture's syndrome with a history of repeated alveolar hemorrhage. Masui 2013;62:1199–1202
6. Goodpasture EW. The significance of certain pulmonary lesions in relation to the etiology of pneumonia. Am J Med Sci 1919;158,6:863–870
7. Greco A, Rizzo MI, De Virgilio A, Gallo A, Fusconi M, Pagliuca G, et al. Goodpasture's syndrome: a clinical update. Autoimmun Rev 2015;14:246–153
8. Hatfield T, Steiger R, Wing DA. Goodpasture's Disease in Pregnancy: Case Report and Review of the Literature. Am J Perinatol 2007;24:619–621
9. Herbert DG, Buscher H, Nair P. Prolonged venovenous extracorporeal membrane oxygenation without anticoagulation: a case of Goodpasture syndrome-related pulmonary haemorrhage. Crit Care Resusc 2014;16: 69–72
10. Huser M, Wagnerova K, Jnaju P, Malaskova L, Stourac P. Clinical Management of Pregnancy in Women with Goodpasture Syndrome. Gynecol Obstet Invest 2015;79:73–77
11. Lahmer T, Küchle C, Schirmer L, Heemann U, Lutz J, Thürmel K. Kidney Transplant After Preexisting Posterior Reversible Encephalopathy Syndrome Induced by Goodpasture's Syndrome. Exp Clin Transplant 2012;10:299–301
12. Levy JB, Turner AN, Rees AJ, Pusey CD. Long-Term Outcome of Anti-Glomerular Basement Membrane Antibody Disease Treated with Plasma Exchange and Immunosuppression. Ann Int Med 2001;134:1033–1042
13. Marques C, Carvelli J, Biard L, Faguer S, Provôt F, Matignon M, et al. Prognostic Factors in Anti-glomerular Basement Membrane Disease: A Multicenter Study of 119 Patients. Front Immunol 2019;10:1665
14. McAdoo SP, Pusey CD. Antiglomerular Basement Membrane Disease. Seminars in Respiratory and Crit Care Med 2018;39:494–503
15. Menzi CP, Bucher BS, Bianchetti MG, Ardissino G, Simonetti GD. Management and outcomes of childhood Goodpasture's disease. Pediatr Res 2018;83:813–817
16. Saegusa R, Ando M, Nishino T, Yonezawa T. Anesthetic management of bilateral nephrectomy in Goodpasture's syndrome. The Japanese Journal of Anesthesiology 1977;26: 335–341
17. Salant DJ. Goodpasture's Disease - New Secrets Revealed. New Engl J Med 2010;363:388–391
18. Shah A, Bailey E, Hughes S. Goodpasture's syndrome, haemodialysis and pregnancy. Br J Hosp Med 2007;68:48–49
19. Sinha VK, Hibbert C. Near-lethal acute kidney injury due to Goodpasture's syndrome: A case report. J Intensive Care Soc 2015;16:350–354
20. Tang W, McDonald SP, Hawley CM, Badve SV, Boudville NC, Brown FG, et al. Anti-glomerular basement membrane antibody disease is an uncommon cause of end-stage renal disease. Kidney Int 2013;83:503–510
21. Ting IPL, Halim SA, Adnan A, Jaafar H. Status epilepticus as the initial presentation of antibody-negative Goodpasture's syndrome. BMJ Case Rep 2017:bcr-2017-219628. DOI: 10.1136/bcr-2017-219628
22. Vasiliou DM, Maxwell C, Shah P, Sermer M. Goodpasture Syndrome in a Pregnant Woman. Obstet Gyn 2005;106:1196–1199
23. Wells SR, Kuller JA, Thorp JM. Pregnancy in a patient with Goodpasture syndrome and renal transplantation. Am J Perinatol 1996;13:79–80
24. Woodcock T, Barker P, Daniel S, Fletcher S, Wass JAH, Tomlinson JW, et al. Guidelines for the management of glucocorticoids during the peri-operative period for the patients with adrenal insufficiency. Guidelines from the Association of Anaesthetists, the Royal College of Physicians and the Society for Endocrinology UK. Anaesthesia 2020;75:654–663.

Date last modified: **May 2021**

This recommendation was prepared by:

Christine Gaik, Anaesthesiologist, University-Clinic of Marburg, Germany
gaikc@med.uni-marburg.de

Thomas Wiesmann, Anaesthesiologist, University-Clinic of Marburg, Germany
wiesmann@diakoneo.de

Disclosure The authors have no financial or other competing interest to disclose. This recommendation was unfunded.

This recommendation was reviewed by:

Martin Jöhr, Anaesthesiologist, Adligenswil, Switzerland
joehrmartin@bluewin.ch

Alan D. Salama, Nephrologist, UCL Department of Renal Medicine, Royal Free Hospital, London, United Kingdom
a.salama@ucl.ac.uk

Disclosure The reviewers have no financial or other competing interest to disclose.

Herausgeber

DGAI
Deutsche Gesellschaft für Anästhesiologie und Intensivmedizin e.V.
Präsident: Prof. Dr. B. Pannen, Düsseldorf

BDA
Berufsverband Deutscher Anästhesistinnen und Anästhesisten e.V.
Präsident: Prof. Dr. G. Geldner, Ludwigsburg †

Schriftleitung
Präsident/in der Herausgeberverbände

Gesamtschriftleiter/Editor-in-Chief:
Prof. Dr. Dr. Kai Zacharowski, ML FRCA FESAIC, Frankfurt

Stellvertretender Gesamtschriftleiter/Deputy Editor:
Prof. Dr. T. Volk, Homburg/Saar

CME-Schriftleiter/CME-Editor:
Prof. Dr. W. Zink, Ludwigshafen

Redaktionskomitee/Editorial Board
Prof. Dr. G. Beck, Wiesbaden
Prof. Dr. A. Brinkmann, Heidenheim
Prof. Dr. H. Bürkle, Freiburg
Prof. Dr. B. Ellger, Dortmund
Prof. Dr. K. Engelhard, Mainz
Prof. Dr. M. Fischer, Göppingen
Prof. Dr. U. X. Kaisers, Ulm
Prof. Dr. T. Loop, Freiburg
Prof. Dr. W. Meißner, Jena
Prof. Dr. C. Nau, Lübeck
RAin A. Pfundstein, Nürnberg
Dr. M. Rähmer, Mainz
Prof. Dr. A. Schleppers, Nürnberg
Prof. Dr. M. Thiel, Mannheim
Prof. Dr. F. Wappler, Köln
Prof. Dr. M. Weigand, Heidelberg

Redaktion/Editorial Staff
Carolin Sofia Kopp B.A.

Korrespondenzadresse:
Neuwieder Straße 9 | 90411 Nürnberg | Deutschland | Tel.: 0911 9337812
E-Mail: anaesth.intensivmed@dgai-ev.de

Die Beiträge aus der A&I finden Sie online unter:
www.ai-online.info

Verlag & Druckerei

Aktiv Druck & Verlag GmbH
An der Lohwiese 36 |
97500 Ebelsbach | Deutschland
www.aktiv-druck.de

Geschäftsführung
Wolfgang Schröder | Jan Schröder | Nadja Schwarz
Tel.: 09522 943560 | Fax: 09522 943567
E-Mail: info@aktiv-druck.de

Anzeigen | Vertrieb
Pia Müller | Robert Kux
Tel.: 09522 943570 | Fax: 09522 943577
E-Mail: anzeigen@aktiv-druck.de

Verlagsrepräsentanz
Jürgen Distler
Neuwieder Straße 9 | 90411 Nürnberg
Tel.: 0171 9432534
E-Mail: jdistler@bda-ev.de

Herstellung | Gestaltung
Pia Müller | Robert Kux | Stefanie Triebert
Tel.: 09522 943570 | Fax: 09522 943577
E-Mail: ai@aktiv-druck.de

Titelbild
Dipl.-Designerin Monique Minde, Nürnberg

Erscheinungsweise 2023
Der 64. Jahrgang erscheint jeweils zum Monatsanfang, Heft 7/8 als Doppelausgabe.

Bezugspreise (inkl. Versandkosten):

- **Einzelhefte** 30,- €
- **Jahresabonnement:**
  Europa (ohne Schweiz) (inkl. 7 % MwSt.) 258,- €
  Schweiz 266,- €
  Rest der Welt 241,- €

  Mitarbeiter aus Pflege, Labor, Studenten und Auszubildende (bei Vorlage eines entsprechenden Nachweises)
  Europa (ohne Schweiz) (inkl. 7 % MwSt.) 94,- €
  Schweiz 90,- €
  Rest der Welt 94,- €

Für Mitglieder der DGAI und/oder des BDA ist der Bezug der Zeitschrift im Mitgliedsbeitrag enthalten.

Allgemeine Geschäfts- und Lieferbedingungen
Die allgemeinen Geschäfts- und Lieferbedingungen entnehmen Sie bitte dem Impressum auf www.ai-online.info

Indexed in **Current Contents®/Clinical Medicine, EMBASE/Excerpta Medica; Medical Documentation Service; Research Alert; Sci Search; SUBIS Current Awareness in Biomedicine; VINITI: Russian Academy of Science.**

Wichtiger Hinweis
Für Angaben über Dosierungsanweisungen und Applikationsformen kann vom Verlag und den Herausgebern keine Gewähr übernommen werden. Derartige Angaben müssen vom jeweiligen Anwender im Einzelfall anhand anderer Literaturstellen auf ihre Richtigkeit überprüft werden. Gleiches gilt für berufs- und verbandspolitische Stellungnahmen und Empfehlungen.

Allein aus Gründen der besseren Lesbarkeit wird auf die gleichzeitige Verwendung männlicher, weiblicher und weiterer Sprachformen verzichtet. Sämtliche Personenbezeichnungen gelten für alle Geschlechterformen. Dies impliziert keinesfalls eine Benachteiligung der jeweils anderen Geschlechter, sondern ist als geschlechtsneutral zu verstehen.

CONTACT US

Please do not hesitate to contact us. We will be glad to answer and provide further information to you at any time.

.....
Name

.....
First Name

.....
Department / Hospital

.....
Place

.....
Telephone

.....
E-Mail

.....
Date / Signature

Please contact me for further information ○

I would like to participate in the project ○

ADDRESS

German Society of Anaesthesiology and
Intensive Care Medicine
Ursula Homberg
Neuwieder Straße 9 | 90411 Nuremberg | Germany
Tel.: +49-911-9337828
Email: uhomberg@orphananesthesia.eu