Evidenztabelle Literatur 2012 bis 2016 Bräuer Intraoperative Wärmung

Nr.	Autor, Titel, Referenz	Studien-typ	Oxford Evidenz grade	n	Patienten Merkmale	Maßnahme	Vergleich	Dauer Nachunter suchung	Outcome Messung	Effekt Größe Ergebnis	Finan-zie-rung	Kom-mentar
Systemat. Reviews												
1	Alderson P et al. Thermal insulation for preventing inadvertent perioperative hypothermia. Cochrane Database of Systematic Reviews 2014, Issue 6. CD009908.	Syst. Review und Meta-analyse	1a	16 Studien	Chirurgische Patienten	Isolation	Verschiedene Isolationsverfahren vs Standardbehandlung und vs konvektive Luftwärmung		Einfluss auf die Körperkern-temperatur Einfluss auf Blutung, Zittern und Verweildauer im Aufwachraum	Aktive Wärmezufuhr mit konvektiver Luftwärmung ist effektiver als Isolation: 0.67 °C 95% CI -.95-.39 Kein Einfluss auf Blutung, Zittern und Verweildauer im Aufwachraum.	keine	
2	Campbell G et al. Warming of intravenous and irrigation fluids for preventing inadvertent perioperative hypothermia. Cochrane Database of Systematic Reviews 2015, Issue 4. CD009891.	Syst. Review und Meta-analyse	1a	24 Studien mit 1250 Pat.	Chirurgische Patienten	Infusions-wärmung und Wärmung von Spülflüssig-keiten	Infusionswärmung vs keine Infusionswärmung. Wärmung von Spüllösungen vs keine Wärmung von Spüllösungen		Einfluss auf die Körperkern-temperatur Einfluss auf, Zittern	Infusionswärmung mit höherer Körperkern-temperatur um 0,5˚C; reduziert das Risisko von postoperativem Zittern. Wärmung von Spüllösungen macht keinen signifikanten Unterschied	keine	
RCT's												
3	Brandes IF et al. Effektivität einer neuen Wärme-decke. Prospek-tive randomi-sierte Studie. Anaesthesist 2013;62:137–42	RCT mono-zentrisch	1b	160	Patienten mit HNO Eingriff	Konduktive Wärmung mit Barrier EasyWarm Decke versus Bettdecke	Temperaturmes-sungen	Bis Ende der Verweil-dauer im Aufwach-raum	Körperkern-temperatur im Verlauf	Kein signifikanter Unterschied	Keine	Konduktive Wärmung mit Barrier EasyWarm Decke genauso effektiv wie Isolation mit Bettdecke

Nr.	Autor, Titel, Referenz	Studien-typ	Oxford Evidenz grade	n	Patienten Merkmale	Maßnahme	Vergleich	Dauer Nachunter suchung	Outcome Messung	Effekt Größe Ergebnis	Finan-zie-rung	Kom-mentar
4	John M et al. Comparison of resistive heating and forced-air warming to pre-vent inadvertent perioperative hypothermia. BJA 2016;116:249–54	RCT mono-zentrisch	1b	160	Patienten mit Elektiv-eingriffen	Konduktive Wärmung mit Inditherm Heizmatte unter dem Rücken versus konvektive Luftwärmung	Temperaturmes-sungen, Blutverlust	Bis Ende der Verweil-dauer im Aufwach-raum	Körperkern-temperatur im Verlauf, Blutverlust	Aktive Wärmezufuhr mit konvektiver Luftwärmung ist effektiver als konduktive Wärmezufuhr über den Rücken. Kein Einfluss auf den Blutverlust		
5	Tanaka N et al. A randomised controlled trial of the resistive heating blanket versus the convective warming system for preventing hypothermia during major abdominal surgery. J Perioper Pract 2013; 23:82-6	RCT mono-zentrisch	1b	70	Patienten mit großen Bauch-eingriffen	Konduktive Wärmung mit Kohlefaser-matte versus konvektive Luftwärmung	Temperaturmes-sungen, Blutverlust	Bis OP Ende	Körperkerntemp eratur im Verlauf, Blutverlust	Kein signifikanter Unterschied	Keine Angab e	Konduktive Wärmung mit Oberkörper-Heizmatte „non-inferior“ zu konvektiver Luftwärmung über dem Oberkörper; BW-Tuch zwischen Pat. und Decke kann Wärmung behindert haben
	Tasdögen A et al. Effects of line type blood-liquid warmer on two different infusion sets. J Pak Med Assoc. 2015;65:362-5.											Ausschluß. Studie zur Luftblasen-bildung bei Infusions-wärmern
6	Triffterer L et al. Forced-Air Warming During Pediatric Surgery: A Randomized Comparison of a Compressible with a Non-compressible Warming System. Anesth Analg 2016;122:219-25	RCT mono-zentrisch	1b	80	Kinder unter 2 Jahren	2 konvektive Luftwärme-systeme mit Kinder-decken (Moeck vs. 3M Bair Hugger)	Temperaturmessung von Körperkerntempera-tur und Hauttemperatur	Bis OP Ende	Temperaturen im Verlauf	Beide Systeme waren gut geeignet, das BairHugger System war etwas effizienter	keine	

Nr.	Autor, Titel, Referenz	Studien-typ	Oxford Evidenz grade	n	Patienten Merkmale	Maßnahme	Vergleich	Dauer Nachuntersuchung	Outcome Messung	Effekt Größe Ergebnis	Finanzierung	Kommentar
Kohorten-studien etc.												
7	Rowley B et al. Perioperative Warming in Surgical Patients: A Comparison of Interventions. Clin Nurs Res 2015;24:432-41	Prospektive, nicht randomisierte Kohortenstudie	2b	220	Patienten mit verschiedenen Eingriffen	1. Routinevorgehen 2. Vorwärmung 3. Vorwärmung und Erhöhung der OP-Saal Temperatur 4. Erhöhung der OP-Saal Temperatur	Temperaturmessungen	Bis zum Ende der Aufwachraumzeit	Körperkerntemperatur im Verlauf	Kein Unterschied in den Körperkerntemperaturen	keine	Körperkerntemperaturmessung mit ungenauer Methode
	Wood AM et al. Infection control hazards associated with the use of forced-air warming in operating theatres. J Hosp Infect 2014; -88:132-40	Narrat. Review	5	10 Studien	Patienten mit verschiedenen Eingriffen					Konvektive Luftwärmung könnte evtl. ein Risiko bei Eingriffen in laminar air flow Operationssälen sein. Definitive Studien, die dieses Risiko belegen fehlen jedoch.	keine	Ausschluß
8	Witt L et al. Prevention of intraoperative hypothermia in neonates and infants: results of a prospective multicenter observational study with a new forced-air warming system with increased warm air flow. Paediatr Anaesth 2013;23:469-74	Prospektive, nicht randomisierte Kohortenstudie	2b	119	Kinder< 1 Jahr und unter 10 kg	Beobachtungsstudie eines konvektiven Luftwärmesystems mit Kinderdecken (Moeck)	Körperkerntemperatur	Bis OP Ende	Körperkerntemperatur im Verlauf	Guter Effekt des Systems.	keine	Gefahr der Überwärmung

Evidenztabelle Literatur 2016 bis 2018 Bräuer Intraoperative Wärmung

Nr	Autor, Titel, Referenz	Studien-typ	Ox-ford Evid enz-grad	N	Patienten merkmale	Maßnahme	Vergleich	Dauer Nachuntersu chung	Outcome Messung	Effekt Größe Ergebnis	Finanzie rung	Kommen-tar
Systemat. Reviews												
9	Balayssac D, Pereira B, Bazin JE, Le Roy B, Pezet D, Gagnière J.Warmed and humidified carbon dioxide for abdominal laparoscopic surgery: meta-analysis of the current literature. Surg Endosc 2017;31(1):1-12. Erratum Balayssac et al. 2017	Syst. review und Meta-analyse	1a	17 Stud.	Patienten mit laparos-kopischen Eingriffen	Anwärmung, Anfeuchtung des insufflierten CO2 bei laparos-kopischen Eingriffen	Anwärmung, Anfeuchtung des insufflierten CO2 versus ungewärmtes u. trockenes CO2	Bis Ende des Krankenhaus aufenthalts	Intraoperative Körperkern-temperatur und postoperative Körperkern-temperatur	Die intraoperative Körperkerntemperatur war bei den Patienten die angewärmtes und angefeuchtetes CO2 insuffliert bekamen höher, die postoperative Körperkerntemperatur war gleich	keine	
RCTs												
10	Lauronen SL, Kalliomäki ML, Aho AJ, Kalliovalkama J, Riikonen JM, Mäkinen MT, Leppikangas HM, Yli-Hankala AM. Thermal suit in preventing unintentional intraoperative hypothermia during general anaesthesia: a randomized controlled trial. Acta Anaesthesiol Scand 2017 Oct;61(9):1133-1141	RCT mono-zentrisch	1b	100	Patienten mit roboter-assistierter laparos-kopischer Prostat-ektomie	Prä-/intraop. Isolation mit T-Balance-Anzug gegen Standardiso. alle Pat. plus konvekt. Wärmung, Infusions-wärmung, Heizmatte unter dem Rücken	Temperatur messungen	Bis zur ersten postoperativ en Kontrolle nach dem Krankenhaus aufenthalt	Körperkern-temperatur im Verlauf	Kein signifikanter Unterschied	Keine	
	Santa Maria PL, Santa Maria C, Eisenried A, Velasquez N, Kannard BT, Ramani A, Kahn DM, Wheeler AJ, Brock-Utne JG. A novel thermal compression device for perioperative warming: a randomized trial for feasibility and efficacy. BMC Anesthesiol 2017; 17:102	RCT mono-zentrisch										Ausschluß da nur Prototyp unter-sucht
11	Torossian A, van Gerven E, Geertsen K, Horn B, van de Velde M, Raeder J. Active perioperative patient warming using a self-warming blanket (BARRIER EasyWarm) is superior to passive thermal insulation:	RCT multi-zentrisch	1b	246	Patienten, die verschied. operativen Eingriffen unterzogen wurden	konduktive BARRIER EasyWarm Decke vs OP-Abdeckung	Körperkernte mperaturmes sung VAS thermischer Komfort	Bis zum Ende der Aufenthaltsd Dauer im Aufwach-raum	Mittlere perioperative Körperkern-temperatur Hypothermie Inzidenz AWR-dauer; thermischer	Die konduktive BARRIER EasyWarm Decke führte im Vergleich zu Standardisolation zu höheren mittleren Körperkerntemp., zu weniger Hypothermie-inzidenz und zu mehr	Studienu nterstüt-zung durch Herstell. der Wärme-decke	Messung der Körper-Kerntemp mittels Infrarot-thermo-metrie im

Nr	Autor, Titel, Referenz	Studien-typ	Ox-ford Evid enz-grad	N	Patienten merkmale	Maßnahme	Vergleich	Dauer Nachuntersu chung	Outcome Messung	Effekt Größe Ergebnis	Finanzie rung	Kommen-tar
	a multinational, multicenter, randomized trial. J Clin Anesth 2016; 34:547-54								Komfort.	thermischem Komfort der Patienten.		Ohr
12	Zeba S, Surbatović M, Marjanović M, Jevdjić J, Hajduković Z, Karkalić R, Jovanović D, Radaković S. Efficacy of external warming in attenuation of hypothermia in surgical patients. Vojnosanit Pregl. 2016 Jun;73(6):566-71.	RCT mono-zentrisch	1b	30	Patienten mit abdominalchi rurgischen Eingriffen	Konduktive Heizmatte (KANMED WarmCloud) unter dem Rücken vs Kontrolle	Körperkernte mperaturmes sung	Bis 90 Minuten nach OP Ende	Körperkerntem peratur im Verlauf	Die Körperkerntemperature nwaren höher unter Wärmetherapie, Shivering selterener und der thermische Komfort der Patienten war besser.	Keine Angabe	
13	Choi JW, Kim DK, Lee SW, Park JB, Lee GH. Efficacy of intravenous fluid warming during goal-directed fluid therapy in patients undergoing laparoscopic colorectal surgery: a randomized controlled trial. J Int Med Res. 2016 Jun;44(3):605-12.	RCT mono-zentrisch	1b	52	Patienten mit laparos-kopischen colorektalen Eingriffen	Infusions-wärmung vs Infusionen bei Raumtem-peratur	Körperkern-temperatur-messung	bis 120 Minuten nach OP Beginn	Körperkerntem peratur im Verlauf	Infusionswärmung führte zu einem geringeren Abfall der Körperkerntemperatur	Keine Angabe	
14	Cobb B, Cho Y, Hilton G, Ting V, Carvalho B. Active Warming Utilizing Combined IV Fluid and Forced-Air Warming Decreases Hypothermia and Improves Maternal Comfort During Cesarean Delivery: A Randomized Control Trial. Anesth Analg. 2016 May;122(5):1490-7	RCT mono-zentrisch	1b	46	Patienten mit Sektio in Spinal-anästhesie	Infusions-wärmung und konvektive Luftwärmung vs keine Wärme-therapie	Körperkern-temperatur-messung; Shivering; Thermischer Komfort	bis Entlass. aus Aufwach-raum	Körperkern-temperatur im Verlauf Shivering; Thermischer Komfort	Infusionswärmung plus konvektive Luftwärmung führte zu einem geringeren Abfall der Körperkerntemperatur, zu weniger Shivering und höherem thermischen Komfort	Keine Angabe	hohe Hypo-thermie-inzidenz
15	Emmert A, Franke R, Brandes IF, Hinterthaner M, Danner BC, Bauer M, Bräuer A. Comparison of Conductive and Convective Warming in Patients Undergoing Video-Assisted Thoracic Surgery: A Prospective Randomized Clinical Trial. Thorac Cardiovasc Surg 2017 Aug;65(5):362-366	RCT mono-zentrisch	1b	48	Patienten mit VATS	Konvektive Luftwärmung versus konduktive Wärmung	Körperkern-temperatur-messung	bis Entlass. aus Aufwach-raum	Körperkern-temperatur-messung	Konvektive Luftwärmung führte zu einem geringeren Abfall der Körperkerntemperatur	Konduk-tives Wärme-system gestellt durch Her-steller	Vorwär-mung und intraop. Wärmethe rapie mit beiden Systemen

Evidence Tabelle: „Prewarming zur Prophylaxe der perioperativen Hypothermie“ 07.08.2018, Autor: Horn

Nr.	Autor, Titel, Referenz	Studientyp	Oxford Evidenzgrad	n	Patienten Merkmale	Maßnahme	Vergleich	Dauer Nachuntersuch.	Outcome Messung	Effekt Größe, Ergebnis	Finanzierung	Kommentar
1	Horn E.P. et al. Warming before and after epidural block before general anaesthesia for major abdominal surgery prevents perioperative hypothermia: A randomised controlled trial.EJA 2016; 33: 334-40	RCT, clinical, randomized, not blinded, prospective	1a	99	Elective major abdom. Surgery combined general and regional anesthesia (EDA)	pass. warming, 15 min. prewarm. 2x 15 prewarming	3 groups		core temp and satisfaction status	Incidence of postop. hypothermia: no prewarming 72%, 15 min. prewar. 6%, 2x 15 min. prewarm. 0%	no data	even 15 min prewarming effectively reduces postop. hypothermia
2	Wasfie, T. J. et Barber, K. R. Value of extended warming in patients undergoing elective surgery. Int Surg 2015; 100, 105-8	RCT, clinical, randomized, not blinded, prospective	1b	94	elective surgery	extended warming	2 groups	no	core temp and satisfaction status	no significant differences in core temp between groups	no data	portable warming gown vs standard warming procedure; not blinded
3	Chan T.N., Venus J. The effect of 30 to 60 minutes of forced-air pre-warming on maintaining intraoperative core temperatures during the first hour post-anesthesia induction in adult patients undergoing general anesthesia: a systematic review protocol. JBI Database System Rev Implement Rep. 2016, 41-8	systemic review	1a		elective surgery	30 to 60 min prewarming	-	-	-	forced air warming is effective to reduce hypothermia when applied for prewarming of surgical patients	no data	same studies de Brito Poveda, A systematic review on the effectiveness of prewarming to prevent perioperative hypothermia, J Clin Nurs 2012+ 4 newer
4	Emmert A., Gries G., Wand S., Buentzel J., Bräuer A. et al. Association between perioperative hypothermia and patient outcomes after thoracic surgery: A single center retrospective analysis. Medicine (Baltimore). 2018, 17, e0528	observational cohort study, clinical, randomized, retrospective	2b	396	elective thoracic surgery under combined general and regional anesthesia	197 with general and epidural anesthesia, 199 with general anesthesia alone	with or without epidural anesthesia	no	hypothermia postop transfusion; length of stay ICU, hospital mortality	incidence of hypothermia 64.3%, extent of hypothermia for thoracotomy use of epidural anesthesia; no difference in transfusions, ICU LOS or mortality	no data	incidence of hypothermia without prewarming is high (64%) following open thoracotomy
5	Rosenkilde C. et al. Efficacy of Prewarming With a Self-Warming Blanket for the Prevention of Unintended Perioperative Hypothermia in Patients Undergoing Hip or Knee Arthroplasty. J Perianesth Nurs. 2017, 32, 419-28	clinical case control study, not randomized, not blinded, prospective	2b	60	elective surgery	prewarming or not	prewarming minimal 30 min with self-warming blanket vs. warming intraop alone	no	hypothermia rate	hypothermia was 13% in the prewarmed group and 43% in controls. Mean core temperature signific. higher in prewarmed group.	no data	prewarming with self-warming blanket is effective
6	Connelly L. et al. The Optimal Time and Method for Surgical Prewarming: A	systemic review	1a	14 RCTs	elective surgery	optimal method and time to prewarm surgical	-	-	no	forced-air prewarming produced in 81%	no data	30 min prewarm., min. 10 min of

Nr.	Autor, Titel, Referenz	Studientyp	Ox-ford Evi-denz grad	n	Patienten Merkmale	Maßnahme	Vergleich	Dauer Nach-unter-such.	Outcome Messung	Effekt Größe, Ergebnis	Finan-zierung	Kommentar
	Comprehensive Review of the Literature. J Perianesth Nurs, 2017, 32, 199-209					patients to prevent hypothermia				of the studies significantly higher core temperature intra- and postoperatively		prewarming reduces hypothermia and its adverse effects
7	Koenen M. et al. "Keeping Them Warm"-A Randomized Controlled Trial of Two Passive Perioperative Warming Methods. J Perianesth Nurs, 2017, 32, 188-198	RCT, clinical, randomized, not blinded, prospective	1b	328	elective surgery of less than 1 hour		reflective blankets vs. cotton blankets during preoperative phase	no	temporal artery temp	reflective blanket group significantly smaller reduction in temporal artery/foot temperature gradient (1.13 vs 1.64˚C, P < .001) and increase in foot temperature (0.64 vs 0.11˚C, P < .001)	no data	preoperatively reflective blankets are more effective than cotton blankets in warming patients
8	Torossian A. et al. Active perioperative patient warming using a self-warming blanket (BARRIER EasyWarm) is superior to passive thermal insulation: a multinational, multicenter, randomized trial. J Clin Anesth 2016; 34: 547-54	RCT, clinical multinational, multicenter randomized prospective open-label	1a	246	elective orthopedic; gynecologic; ear, nose, throat surgery, 30-120 min general anesthesia	BARRIER EasyWarm blanket 30 min before general anesthesia throughout perioperative period	prewarming with self-warming BARRIER EasyWarm blanket vs. warmed cotton blankets	no	core temp, tympanic infrared thermo-meter	BARRIER EasyWarm blanket improved perioperative core body temperature compared to cotton blankets 36.5˚C, SD .4˚C, vs 36.3, SD .3˚C; p<.001 hypothermia rate was 38% vs. 60% in the control group p=.001	no data	BARRIER EasyWarm blanket improved perioperative core body temperature, reduces hypothermia, improves patients' thermal comfort
9	Akhtar Z. et al. A randomized trial of prewarming on patient satisfaction and thermal comfort in outpatient surgery. J Clin Anesth, 2016, 33, 376-85	RCT, clinical, randomized, not blinded, prospective	1b	115	prewarming outpatient surgery patients less than 4 h		prewarming with Mistral-Air warming system (43˚C) or no prewarming	no	core temp, patients satisfac-tion, thermal comfort	prewarming did not reduce hypothermia (temp diff. 0.18˚C), increased not patients satisfaction and increased thermal comfort with an overall difference of 6.6 mm (95% CI, 1.0-12.9; P=.02).	no data	13 drop outs active prewarming increased thermal comfort in outpatient surgery patients
10	Tjoakarfa C. et al. Reflective Blankets Are as Effective as Forced Air Warmers in	RCT, clinical, randomized, not	1b	50	hip or knee arthroplasty (hip or knee)	prewarming and intraop reflective	reflective blankets vs. forced air	no	sublin-gual temp at a 15-min intervals	no differences in the sublingual	no data	after prewarming reflective

Nr.	Autor, Titel, Referenz	Studientyp	Oxford Evidenzgrad	n	Patienten Merkmale	Maßnahme	Vergleich	Dauer Nachuntersuch.	Outcome Messung	Effekt Größe, Ergebnis	Finanzierung	Kommentar
	Maintaining Patient Normothermia During Hip and Knee Arthroplasty Surgery. J Arthroplasty, 2017, 32, 624-627	blinded, prospective				blankets or forced air warming	warming after prewarming			temperatures in the 2 groups		blankets are as effective as forced air warming to maintain normothermia
11	Görges M. et al. Preoperative warming and undesired surgical and anesthesia outcomes in pediatric spinal surgery-a retrospective cohort study. Paediatr Anaesth, 2016, 9, 866-75	observational cohort study, clinical, retrospective	2b	334	intraop temperature maintenance in children spinal deformity surgery	underbody forced air warming	evaluate the effects of preoperative warming before on surgical site infection rate, length of hospitalization, and bleeding	no	data were obtained by retrospective chart review 2009- 2012	after prewarming OR SSI 0.47 (95% CI 0.15-1.49); for cell salvaged blood transfusion 0.89 (95% CI 0.55-1.41); for allogeneic packed red blood cell transfusion 0.43 (95% CI 0.22-0.83); and for a length of hospitalization >6 days 1.24 (95% CI 0.77-1.99)	no data	prewarming reduced allogeneic packed red blood cell transfusion. prewarming reduced not allogeneic blood transfusion estimated blood loss, length of hospitalization, or the incidence of surgical site infection
12	Menzel M. et al Bräuer A. Implementation of a thermal management concept to prevent perioperative hypothermia : Results of a 6-month period in clinical practice. Anaesthesist 2016, 65, 423-9	observational cohort study, clinical, retrospective	2b	3228 1329 with pre-warming	temperature data of patients undergoing surgery, 6 months period	standard operating procedure to prevent perioperative hypothermia in surgical patients	Prewarming vs no prewarming	no	core temp	32.6 % in all patients occurred hypothermia with prewarming 25.3 % without prewarming 39.1 % at the end of the operation	no data	without prewarming risk of hypothermia was 1.8-fold increased
13	Emmert A. et al Bräuer A. Comparison of Conductive and Convective Warming in Patients Undergoing Video-Assisted Thoracic Surgery: A Prospective Randomized Clinical Trial. Thorac Cardiovasc Surg, 2017 65, 362-366	RCT, clinical, randomized, not blinded, prospective	1b	60	patients undergoing elective thoracic surgery with VATS	all patients were prewarmed	warming with underbody blanket vs. conductive warming with an underbody mattress and additional warming of the legs.	no	core temp assessed by sub-lingual temp	patients in conduction group had lower intraoperative core temperatures and a higher incidence of intraoperative (73.9 vs. 24%) and postoperative hypothermia (56.5 vs. 8%) compared with convective warming.	no data	warming with underbody blanket prevents perioperative hypothermia during VATS better than conductive warming

Nr.	Autor, Titel, Referenz	Studientyp	Ox-ford Evi-denz grad	n	Patienten Merkmale	Maßnahme	Vergleich	Dauer Nach-unter-such.	Outcome Messung	Effekt Größe, Ergebnis	Finan-zierung	Kommentar
14	Darvall J. et al. Prewarming neurosurgical patients to minimize hypotension on induction of anesthesia: a randomized trial. Can J Anaesth, 2016, 63, 577-83	RCT, clinical, randomized, not blinded, prospective	1b	32	elective neurosurgery	one hour of forced-air convective warming at 46°C or routine care with full body blanket	prewarming vs. none prewarming to higher mean arterial pressure during anesthesia induction	no	MAP Hypo-tension SBP< 90 or MAP< 60 mmHg	no difference between groups in the incidence of hypotension (100% of prewarmed vs 93%)	no data	Prewarming did not prevent hypotension during the induction of general anesthesia
15	Waeschle R.M. et al. Perioperative thermal management in Germany varies depending on the hospital size. Anaesthesist, 2015, 64, 612-22	observational cohort study, clinical, retrospective	2b	-	subgroup analysis differentia-ting size of hospitals	no	online survey of German Society of Anesthesio-logy about perioperative thermal management	no	no	frequency of prewarming and frequency of intraoperative temperature measurement increased with hospital size	no data	improvement potential to handle hypothermia was found in smaller hospitals
16	Erdling A. et Johansson A. Core temperature—the intraoperative difference between esophageal versus nasopharyngeal temperatures and the impact of prewarming, age, and weight: a randomized clinical trial. AANA J, 2015, 83, 99-105	RCT, clinical, randomized, not blinded, prospective	1b	43	colorectal surgery		prewarming (n=21) vs. non prewarming (n=22)	no	esopha-geal and nasopha-rynxgeal temp	esophageal temperature in group prewarming was 36.5 ± 0.6 vs 35.8 ± 0.7 in group none-prewarming	no data	prewarming, age and BMI have an impact on measured temperatures
17	Constantine R.S. et al. The impact of perioperative hypothermia on plastic surgery outcomes: a multivariate logistic regression of 1062 cases. Aesthet Surg J 2015, 35: 81-8	observational cohort study, clinical, retrospective	2b	1062	complex plastic surgery typically lasting at least 1 hour	no	no	no	wound infection	Perioperative hypothermia was not a predictor of wound problems (OR = 0.83; P = .28) and did not significantly impact wound problems	no data	mild perioperative hypothermia independent of wound complications. no core temp assessed, no standard protocol
18	Kim E.J. et al. Preoperative factors affecting the intraoperative core body temperature in abdominal surgery under general anesthesia: an observational cohort. Clin Nurse Spec, 2014, 28, 268-76	observational cohort study, clinical, retrospective	2b	147	abdominal surgery under general anesthesia	identify preoperative factors affecting the intraoperative core body temperature	no	no	core temp	Low preoperative body temperature and low weight were risk factors of intraoperative hypothermia	no data	no new information or results

Nr.	Autor, Titel, Referenz	Studientyp	Ox-ford Evi-denz grad	n	Patienten Merkmale	Maßnahme	Vergleich	Dauer Nach-unter-such.	Outcome Messung	Effekt Größe, Ergebnis	Finan-zierung	Kommentar
19	Perl T. et al Bräuer A. Efficacy of a novel prewarming system in the prevention of perioperative hypothermia. A prospective, randomized, multicenter study. Minerva Anestesiol, 2014, 80, 436-43	RCT, clinical, prospective, randomized, multi-center, controlled study	1a	90	surgery of 30-120 min duration with general anesthesia	all patients received warmed IV fluids and forced air warming after induction of anesthesia	standard insulation (A) passive preoperative insulation with a commercial prewarming suit (B) active preoperative prewarming with a forced-air warmer (C)	no	sub-lingual temp	higher core temperature in the actively prewarmed patients of group C compared to groups A and B at 15, 30, 45, 60, and 75 min after induction of anesthesia and at the end of surgery	no data	active prewarming with a forced-air warmer and an insulating prewarming suit achieves significantly higher core temperatures during anesthesia and at the end of surgery
20	Fettes S. et al. Effect of preoperative forced-air warming on postoperative temperature and postanesthesia care unit length of stay. AORN J, 2013, 97, 323-8	RCT, clinical, prospective, randomized,	2a	128		quality improvement project	prewarming or not	no		prewarming patients before surgery did not have an effect on patients' postoperative temperatures	no data	Results in contrast to all other studies
21	Nicholson M. A comparison of warming interventions on the temperatures of inpatients undergoing colorectal surgery. AORN J, 2013, 97, 310-22.	observational cohort study, clinical, retrospective	2b		colorectal surgery	prewarming patients 30 min	preoperative two different warming interventions	no			no data	prewarming may contribute to normothermia in the immediate postoperative period
22	Jo Y.Y. et al. Effect of Preoperative Forced-Air Warming on Hypothermia in Elderly Patients Undergoing Transurethral Resection of the Prostate. Urol J, 2015, 12, 2366-70	RCT, clinical, randomized, not blinded, prospective	1b	50	transurethral resection of the prostate (TURP) under spinal anesthesia	-	20 min preoperative forced-air skin warming (n = 25) or not (n = 25)	no	core temp shivering	intraoperative hypothermia were not different between goups (10/25 [40%] vs. 15/24 [62.5%], P = .259). Severities of hypothermia were different (p=.019). No patient in the pre-warmed group showed moderate or profound hypothermia.	no data	preoperative forced-air warming did not completely prevent intraoperative hypothermia and shivering prewarming reduces the severity of hypothermia in patients under spinal anesthesia
Excluded Papers												
-	Cho Y.J. et al Effect of Prewarming during Induction of Anesthesia on											Eliminated because of

Nr.	Autor, Titel, Referenz	Studientyp	Oxford Evidenzgrad	n	Patienten Merkmale	Maßnahme	Vergleich	Dauer Nachuntersuch.	Outcome Messung	Effekt Größe, Ergebnis	Finanzierung	Kommentar
	Microvascular Reactivity in Patients Undergoing Off-Pump Coronary Artery Bypass Surgery: A Randomized Clinical Trial. PLoS One, 2016, 21 e0159772											Cardio-Anesthesia
-	Iden T, Höcker J. Prevention of Perioperative Hypothermia - Guidelines for Daily Clinical Practice AINS, 2017, 52, 554-562											Eliminated because of Gudeline
-	Görges M. et al. Using physiological monitoring data for performance feedback: an initiative using thermoregulation metrics. Can J Anaesth, 2017, 64, 245-251											Eliminated because of no Prewarming
-	Tveit C, Belew J., Noble C. Prewarming in a pediatric hospital: process improvement through interprofessional collaboration. J Perianesth Nurs, 2015, 30, 33-8											Eliminated because no study
-	Bräuer A. et al. Prewarming. Yesterday's luxury, today's minimum requirement. Anaesthesist, 2014, 63, 406-14											Eliminated because no study
Evidence table in 2013												
1	de Brito Poveda, A systematic review on the effectiveness of prewarming to prevent perioperative hypothermia, J Clin Nurs. 2012 Sep 17	SR	1a	14 RTC's				none		forced air warming is effective to reduce hypothermia when applied for prewarming of surgical patients	no data	14 studies included from 730 identified between 1/1990 and 11/2011
2	Melling, Effects of preoperative warming on the incidence of wound infection after clean surgery: a randomized controlled trial, Lancet, 2001, 358, 876-80	RCT, clinical, randomized, double blinded, prospective	1b	421	elective patients undergoing breast, varicose, vein, hernia surgery	30 min preoperative forced air warming	3 groups, warming of the whole patient vs. the skin of the surgical area vs. no warming	none	wound infections	wound infections in 19/139 (14%) non-warmed patients vs. 13/277 (5%) of warmed patients; p=0.001. non-warmed patients received more	no data	wound infection reduction independent if general warming or local warming of the skin of the surgical field

Nr.	Autor, Titel, Referenz	Studientyp	Ox-ford Evi-denz grad	n	Patienten Merkmale	Maßnahme	Vergleich	Dauer Nach-unter-such.	Outcome Messung	Effekt Größe, Ergebnis	Finan-zierung	Kommentar
										antibiotics; p=0.002		
3	Fossum, A comparison study on the effects of prewarming patients in the outpatient surgery setting, J Perianesth Nurs, 2001, 16, 187-94	RCT, clinical, randomized, prospective	1b	100	elective outpatient surgery	30 min preoperative warming	2 groups, forced air warming vs. cotton blankets	none	Temp at arrival on PACU	patients with preop forced air warming had significantly higher temperatures on arrival of PACU than patients with warming blankets	no data	nur geringe Temperatur Unterschiede, Wärmeperiode nicht klar definiert
4	Horn, Active warming during cesarean delivery, Anesth Analg, 2002, 94, 409-14	RCT, clinical, randomized, double blinded, prospective	1b	30	female, parturients	15 min preoperative warming before under epidural anesthesia	2 groups, forced air warming and intraoperative warming vs. cotton blankets	none	core temp, shivering babies umbilical vein pH	core temp higher in warmed patients; shivering less in warmed mothers; babies of warmed mothers higher core temp and umbilical vein pH	none	
5	Wong, Randomized clinical trial of perioperative systemic warming in major elective abdominal surgery, Br J Surg, 2007, 94:421-6	RCT, clinical, randomized, blinded, prospective	1b	103	elective patients undergoing major abdominal surgery	using a conductive carbon polymer mattress	2 groups, warming intraoperatively vs. additionally 2 h before and after surgery	none	core temp	in the warming group patients had mean blood loss 200 ml vs. 400 ml in the control group; p = 0.011; complication rates was 15/47 (32%) vs. 30/56 (54%); p = 0.027	no data	patients with additionally warming 2 h before and after surgery had lower blood loss and complication rates
6	Andrzejowski, Effect of prewarming on post-induction core temperature and the incidence of inadvertent perioperative hypothermia in patients undergoing general anaesthesia. Br J Anaesth, 2008. 101, 627-31	RCT, clinical, randomized, blinded, prospective	1b	68	elective patients undergoing spinal surgery	60 min prewarming	2 groups, prewarming vs. "normal" care	none	core temp	core temp maintained above 36°C in 21/31 (68%) prewarmed patients vs. 16/37 (43%) patients with "normal" care; p<0.05	no data	preoperative warming results in smaller decreases in core temp intraoperatively
7	De Witte, Resistive-heating or forced-air warming for the prevention of redistribution hypothermia, Anesth Analg. 2010, 10:829-33	RCT, clinical	1b	27	elective patients, laparoscop.colorectal surgery	30 min prewarming	3 groups, no prewarming vs. carbon fiber cover vs. forced air warming	none	core temp	core temp differed significantly between control and carbon fiber group from 40 to 90 min	no data	

Nr.	Autor, Titel, Referenz	Studientyp	Ox-ford Evi-denz grad	n	Patienten Merkmale	Maßnahme	Vergleich	Dauer Nach-unter-such.	Outcome Messung	Effekt Größe, Ergebnis	Finan-zierung	Kommentar
8	Leeth, Normothermia and patient comfort: a comparative study in an outpatient surgery setting, J Perianesth Nurs. 2010, 25:146-51	RCT, randomized clinical	1b	150	elective ambulatory surgery	30 min prewarming	forced-air gowns vs warmed cotton blankets	none	oral temp thermal comfort	no differences in postoperative oral temp higher comfort scores after 30 min warm-air gowns	no data	
9	Horn, The effect of short time periods of pre-operative warming in the prevention of peri-operative hypothermia, Anesthesia, 2012, 67, 612-617	RTC, clinical, randomized blinded, prospective	1b	200	patients undergoing surgeries from 30-90 min duration	prewarming for 10, 20 or 30 min	4 groups, prewarming for 0, 10, 20, 30 min	none	core temp	69% hypothermia without prewarming, 10, 20, 30 min with 13%, 7%, 6% hypothermia, 10 patients shivered without prewarming vs. 3,3,1	none	10 and 20 min of prewarming effictively prevents perioperative hypothermai up to 90 min duration of surgery
10	Chung, Effect of preoperative warming during cesarean section under spinal anesthesia, Korean J Anesthesiol, 2012, 62:454-60	RCT, clinical	1b	45	elective patients, cesarean section, spinal anesthesia	15 min prewarming	3 groups, control vs. warmed fluids vs. forced air	none	core temp	core temp at 45 min decreased less in warmed fluids and forced air warming patients -0.5 +/- 0.3 vs -0.6 +/- 0.4 vs -0.9 +/- 0.4, p = 0.004	no data	
11	Vanni, Preoperative combined with intraoperative skin-surface warming avoids hypothermia caused by general anesthesia and surgery, J Clin Anesth, 2003, 15, 119-25	RCT, clinical, randomized, blinded, prospective	2b	30	elective patients undergoing abdominal surgery	30 min prewarming	2 groups, no warming vs. pre- and intraoperative warming	none	core temp	pre- and intraoperatively warmed patients had during 2 h of anesthesia higher core temperature; all patients warmed intraoperatively were postop normothermic	no data	small groups
12	Bräuer, Preoperative prewarming as a routine measure. First experiences, Anaesthesist, 2010, 59:842-850	observational cohort study	2b	127	elective surgery patients	different duration of prewarming	evaluation of prewarmed patients	none		prewarming effective, even in short terms	no data	Patients with prewarming increased temp 0,3°C +/- 0,3
13	Brandes, Intensified thermal management for patients undergoing transcatheter aortic valve implantation (TAVI), J Cardiothorac Surg. 2011	observational cohort study	2b	39	elective patients undergoing aortic valve implanta-tion	30 min prewarming	2 groups, standard water blanket and warmed infusion vs. prewarming	none	Core temp	prewarming provides higher core temp 36,4+/- 0,7 vs. 35,5 +/- 0.9 p = 0,0001, less time to achieve normothermia, shorter ventilatory time	no data	

Nr.	Autor, Titel, Referenz	Studientyp	Ox-ford Evi-denz grad	n	Patienten Merkmale	Maßnahme	Vergleich	Dauer Nach-unter-such.	Outcome Messung	Effekt Größe, Ergebnis	Finan-zierung	Kommentar
14	Cobbe, Preventing inadvertent hypothermia: comparing two protocols for preoperative forced-air warming, J Perianesth Nurs, 2012, 27:18-24	Pilot study	not									eliminated because of pilot study
15	Wen, Pre-operative forced-air warming as a method of anxiolysis, Anaesthesia. 2009, 64:1077-80	RTC, clinical, randomized blinded, prospective	not	120	elective surgery patients	cotton blanket (CB) forced-air warming(FA) intravenous saline (sal) or midazolam (mid)	4 groups, CB + sal FA + sal. CB +mid FA + mid	none	anxiety thermal comfort	prewarming had no influence on anxiety	no data	eliminated because of core temp not outcome parameter
16	Wagner, Effects of comfort warming on preoperative patients, Aorn J, 2006, 84, 427-48	RTC, clinical, randomized, prospective	not	34	elective surgery patients	-	2 groups	none	anxiety thermal comfort	-	no data	eliminated because of core temp not outcome parameter
17	Hynson, The effects of preinduction warming on temperature and blood pressure during propofol/ nitrous oxide anesthesia, Anesthesiology, 1993, 79, 219-28	volunteers, cross over	not	6	volunteers	1 h general anesthesia after 2 h forced air warming or passive cooling		none	core temp	core temp decreased after 1 h anesthesia to 34.9+/-0.4°C in not warmed and to 36.1+/-0.4°C in warmed volunteers	no data	eliminated because of volunteers
18	Sessler, Optimal duration and temperature of pre-warming, Anesthesiology, 1995, 82, 674-81	volunteers	not	7	volunteers	Up to 120 min of prewarming	different durations of prewarming	none	leg tissue heat contents	volunteers felt not uncomfortably during 1 h of warming but started sweating during 2 h	no data	eliminated because of volunteers

	Referenz	Studientyp	n	Kollektiv	Methode Prüftest	Zielparameter	Ergebnisse Präzision, Akkuratheit, Sensitivität, "Hypothermiedetektion", Spezifität	Finanz	Bem.	Evidenzgrad/Empfehlung
1	**Drake-Brockman** et al. Anaesth Int Care 2014; 42:315-20	Correlational prospective study, convenience sample	200	Kinder 0-17 J. Elekt. OP, nicht-kardial	Nasopharyngeale (**Ref.**), - IR Ohr,, Temp. arterie, Axilla, Haut (Brust) Temperatur Bland-Altman plots	Temp.abweichung	Mittl. Diff. zu nasopharynx: li., re. Ohr + 0.24, Temp.art. + 0,35, Axilla -0,38, Haut -1,7°C 36°C cutoff: Ohr 76%, Temp.art 71%, Axilla 70%, Haut 62%	Klinik, Woolworths Australia	Schlechte Korrelation	II b/ **0** für altern. Meßorte
2	**Erdling A** AANA J 2015;83:99-105	Prospective, randomized (envelope) parallel group	43	Erwachs. 32-92	ösophag. vs. nasophar.; prewarmed vs. intraop. warmed	Temp.abw., SPSS, Fallzahlberechnung	stat. signif. 0,2°C Diff.; klin. nicht relevant! alle Pat. hypotherm vor Anä.!	? Kein Int.konfl.	Keine Verblind., ein Unters.	II b/ **B** für nasophar.
3	**Eshragi** et al. A&A 2014;119: 543-49		105	elective Kardichir. -	SpotOn vs PA Temp Ausschluß HLMZeit	Temp.abweichung, Bland-Altman Plot	-0,23°C (corrected) 95% LoA: 0,82°C	3M Strong conflicts		IIb/ **0**
4	**Höcker** et al EJA2012 29 70-74	Correl. prospect., convenience sample	171	Erwachs. 18-75 ASA I-II	Thermocouple Tymp. Membran vs. subling. (Temp-Plus II)	Temp.abweichung, Bland-Altman Plot	Subl. Temp. Higher tymp. Temp 0,1-0,2°C; SD - 0,09 (0,21) and - 0,15 (0,24)	keine		II a/**A** f. subling.
5	**Iden** et al. EJA2015 32 387-91	observational	120	83 Erwachs., elekt. Gyn u. Traumapat.	Zero-heat flux SpotOn vs nasoph. and subling.	Temp.abweichung Bland-Altman Plot	SpotOn vs. nasophar. 0,07, p=0,1424 SpotOn vs. Subling. 0,35, p<0,0001 SD 0,07(0,21) and –0,35(0,29)	3M provided sensors		II a/ **B** f. zero-heat-flux
6	**Imani** et al. Anesth Pain Med 2016; 6 E31046	Correl., conven. sample	124	Kinder 2-6 J., elekt. Chirurgie	Hauttempsensor über A.carotis vs. rektal Temp.	Modellgenerierung z. Abschätzung der Kerntemp.	Rektal 36,47±0,54 A.carotis 35,45±0,62; Formel: A.carotis Temp x 0,561+16,583	Klinik	Formel, Schätzung KKT	II b/ **0**

Evidenztabelle: Körperkerntemperaturmessung AT 10.07.2018

	Referenz	Studientyp	n	Kollektiv	Methode Prüftest	Zielparameter	Ergebnisse Präzision, Akkuratheit, Sensitivität, "Hypothermiedetektion", Spezifität	Finanz	Bem.	Evidenzgrad/Empfehlung
7	**Kimberger** et al.Can J Anesth 2013 60:1190-96	Correl., conv. sample	56	36 Pat. AA, 20 Pat. RA, trauma, orthop. 18-80 J.	Double-sensor Hauttemp. vs. Ösophag. u. Harnblasen Temp.	Tempabweich. Bland-Altman Plot	Double sens. - 0,01°C (-0,61-0,59). 90% < 0,5°C zu ösophag. Temp.; Sensiti. Hypothermie: 0,70, spezif. 0,78	Dräger, Advis. board		II a/ **B** f. double sensor
8	**Sahin** et al. JCA 2012; 24:647-51	Prosp. Randomized?	60	Kinder ASA I, II	TAT vs. nasopha., axillär	Temp.abweichung Bland-Altman Plot	Good correl. TAT vs. nasopharyng.	Klinik, Keine IK		II b/ **0**
9	**Tan** et al. Ped Anesth 2013 23:1180-6	Prosp. correl	80	Kinder ASA I,II 0-18 J.	Cobra-PLUS LM vs. TAT vs. IR Ohr	Platzierbarkeit Temp.abweichung Bland-Altman Plot	Cobra Temp. -0,9(TAT) bzw. -0,6°C (IR Ohr)	Pulmodyne INc. (Cobra) Keine IK	Nur intraop Keine ref.	III/ - **(entfällt)**
10	**de Brito Poveda** Rev Esc Enferm USP 2016; 50:945-50	Longitudinal Correl., conv.sample	51	ASA I-III, 18+J. AA+EDA AA+SPA, AA	IR Ohrtemp. vs. ösoph. Temp	Temp.abweichung	-1,24°C zu ösophag. Temp			III/ **D (neg.)**
11	**Mäkinen** et al.J Cardioth Vasc Anesth 2016;30:978-8	Prosp. observ. study	30	15 Pat. Gefäßch 15 Pat. kard. Bypass	Zero-heatflux SpotOn Stirn vs. Ösoph. Temp bzw. nasopharyng. U. Harnblasentemp.	Temp.abweichung Bland-Altman Plot	SpotOn vs. Ösophag. 0,08°C (-0,25-0,40); vs. PA Temp. -0,05°C (-0,56-0,47); vs. Nasoph. -0,12 (-0,94-0,71) Schlechte Korr. Hypothermie < 32°C	?	Kleine Fallzahl	II b/ **0**
12	**Selveraj** et al. Anesth Ess Res 2016;10:291	Prospektiv doppelblind	97	ASA I,II 18-40 J, elektive OP	Hauttemp. über A.carotis vs. Nasopharyng. 0, 15, 30, 45 u. 60 min.	Temp.abweichung Bland-Altman Plot	-0,82, -0,79, -0,71, -0,7, -0,64°C	Kein fin. Keine IK		IIb/ **B**
13	**Wang** et al. A&A 2016; 122:1434-8	Correl., conven. sample	36	nicht kardiochir. Pat.	Nasophar. vs. Ösoph.	Temp.abweichung Bland-Altman Plot	Nasopha. 10-20 cm -0,1°C (±0,15) vs. Ösoph.			II a/ **A**

	Referenz	Studientyp	n	Kollektiv	Methode Prüftest	Zielparameter	Ergebnisse Präzision, Akkuratheit, Sensitivität, "Hypothermiedetektion", Spezifität	Finanz	Bem.	Evidenzgrad/Empfehlung
14	**Geijer** et al. BMJ open 2016 e009509	Syst. Review GRADE deutsch, engl., nord. Sprache	5026	Fieberfreie Pat. u. Freiwillige PROSPERO Reg.	Temp.art. (TAT) vs. Kerntemp.	Primär: accuracy 95% LoA Sek.: sens., spez. für Fieber	Pooled diff. -0,19°C; sensitiv. 0,72; spezif. 0,94 für Fieber Große Studien Heterogenität, moderate Evidenzqualität n. GRADE	Keine; Keine IK	Keine Hypothermiedetek.	I/ **D (neg.,** vgl. IR Ohrmess.)
Evidenztab. 2013										
1	**Barnason S,** et al. J Emerg Nurs 2012; 38:523-30	syst. review 12/80-10/11, nur englisch, Handsuche der Referenzen		Notfallaufnahme- und Nichtnotfallaufnahmepat., Erwachsene u. Kinder	Vergleich mit Kerntemperatur (PA, rect., ösoph.): oral, IR- tymp., temporal, axillär	Vergleich nichtinvasiver Körpertemperaturmessung: oral, tympanisch, Temporalarterie, chemisch, zu pulmonalarteriell	Auswertung nach versch. Gruppen:Erwachsene, febrile, unterkühlte, intubierte, pädiatrische Pat. und febrile pädiatrische Pat.	kA		I b/ oral **A** Erwachsene u. Kinder ab 3 M. IR tymp. wenig Evidenz bei Erwachs. **D** bei Kindern

	Referenz	Studientyp	n	Kollektiv	Methode Prüftest	Zielparameter	Ergebnisse Präzision, Akkuratheit, Sensitivität, "Hypothermiedetektion", Spezifität	Finanz	Bem.	Evidenzgrad/Empfehlung
2	**Hooper VD**, Andrews JO Biol Res Nurs 2006; 8:24-34	syst. review 1/82-3/05: 223 „klinische Studien", davon 23 eingeschlossen		Intensivpatienten; über 18; Pulm.art als invasive Kerntemp.; tymp., oral o. Temp.art. als nicht-invas. Messung	Qualitätsindikatoren: Thermometer: Wasserbadeichung; Training, interrater variability,Akkurat-heit,Linearität.	Vergleich nichtinvasiver Körpertemperaturmessung: oral, tympanisch, Temporalarterie zu pulmonalarteriell	**Oral vs. pulm.art**.(Messort: unter der Zunge, rostral): 6 Studien Akkuratheit: 0,2-0,5°C (meist 0,3), Linearität in 3 Studien. SD 0,34-0,36°C, im Bereich 34,2-39°C 0,0-0,16°C; 2 Studien zeigen Abweichung 0,24°C ($p<0.05$), 1 Studie 0,36 ($p<0,001$) **Tymp. vs. pulm.art**.: 6 Akkuratheit: 0,2-0,5°C (meist 0,3), Linearität in 6 Studien. Techniktraining, 10 Studien befürworten tymp. als Kerntemp.mess., davon nur 4 im Kerntemp.messmodus; 8 Studien negieren tymp. (88% core modus), 2 Studien inkonklusiv; Abweichung 0,42°C ($p<0,001$); 2 Studien: 0,36-0,57°C **Oral/tymp. vs. Pulm.art**.: 1 Studie nur pulm.art. gibt Kerntemp., 2 Studien oral/tymp. ebenso, 4 Studien oral besser als tymp. auch beim intub. Pat. **Temp.art. vs. Pulm.art** : nur 1 Studie : 89% der Messungen außerhalb der Akkuratheit von 0,5°C ; sensitivität 0% f. Hyperthermie	kA		I b/ **A** für orale Mess. **D** für tymp. Mess.

	Referenz	Studientyp	n	Kollektiv	Methode Prüftest	Zielparameter	Ergebnisse Präzision, Akkuratheit, Sensitivität, "Hypothermiedetektion", Spezifität	Finanz	Bem.	Evidenzgrad/Empfehlung
3	**Craig JV**, Lancaster GA Lancet 2002; 360:603-9	syst. review 1966-2000, medline suchstrategie u.a., 44 verbleiben		Kinder Neugeb.-18J., rect. Referenz, tymp. versch. Modi., Ausschluß: <35°C, Frühchen	2 reviewer extrahieren Daten u. beurt. Studienqualität	**Rect. Vs. tymp.**	**Overall** pooled: 0,29 (-0,74-1,32)°C, d.h. 38 rektal=37,04-39,2 tymp.: Tymp.mess. auch im „Kern"meßmodus unpräzise	kA	Letter by Ng: versch. Tymp.thermometer u. versch. Modi! gepoolt, kA zur Technik	II a/ **D f**ür tymp. Mess. bei Kindern
4	**Baringer LB** JPeriAnesth Nurs 2011	Repeated measures comp. Conv. sample	86	PACU u. holding area; keine demograph daten	Elect. Axilla, oral SureTemp. Vs TAT	SureTemp. vs TAT	Präop oral TA -0,27°F (kleinste Diff); Postop oral TA -0,12°	kA	Keine hypothermen Pat. Kein gold standard	III, TAT **C**
5	**Bliss-Holtz J** Nurs Res 1989; 38:85-7	Kohorte, monozentr.	120	62w, 58m, Neugeb. 12-48h, 2,6-4,9 kg; Ausschluß: fetale anoxie, phototherapie, anomalien, die bestimmte T.messung ausschließen	Hg-in-glass; kalibriert, sterilisiert, unter 94°F geschüttelt. Mess. Unter Air Shield radiator (Thermometer geschützt); li. axilla, rektal 2,5 cm, ingu.li.	Rectal vs inguinal vs axillär	nur korrelationen; rektal max. temp. Nach 5 min: 100%; inguinal 5 min. 98%; axillär 5, min. 95%. Inguinal-rectal abw. 0,8°F, beste Korrel.	kA	Keine verblind., keine Fallzahl-berech.	IV
6	**Bräuer A**, Weyland W, Fritz U, Schuhmann MU et al. Anaesthesist 1997	retrospekt. Analyse	60	60 sed., nachbeatm. Pat.	Blasen und Rektaltemp. Referenz Ösoph.-stethoskop (Mallinckrodt) 5 meßpkte (schnell u. langs. Wiedererwär.); Abweich. < 5% =±0,35°; Präzision < 15%=1,05°.	Ösoph. vs. Rectal vs. blase	Ösoph. Anfangstemp. 35,1±1°, Erwärm. 0,7±0,27°/h; rektal langsam: 0,06 (±0,7), schnell: -0,13 (±0,86); Blasentemp. besser geeignet- auch in **Hypothermie**	kA	Meßunsicherheit zu groß gewählt	II b/ Blasentemp. **B**
7	**Bräuer A**, Martin JD AINS 2000	prosp. klin. studie	17	17 über 18, ASA I-III, Baucheingr.	Blasentemp. gegen Hi-Lo Ösophag.temp.; Klassifiz. Stundenurin <50/100/250, >250 ml/h- Einige warmtouch/ Thinsulate, OPtemp 20-22°	Ösoph. vs. blase	33,5-38 °; OberbauchOP 0,02±0,42°; Unterbauch – 0,14±0,82°- auch in **Hypothermie**; < 250ml/h größere diff.	kA		II b/ Blasentemp. m. Einschränk. **B**

	Referenz	Studientyp	n	Kollektiv	Methode Prüftest	Zielparameter	Ergebnisse Präzision, Akkuratheit, Sensitivität, "Hypothermiedetektion", Spezifität	Finanz	Bem.	Evidenzgrad/Empfehlung
8	Chamberlain JM, Grandner Clin Pediatr 1991	Klin. Studie, conv. sample		Aufnahme	Tymp. Vs rektal/oral	IR Tymp.	Fieber PPV 0,88, NPV 0,96	kA	6 nurses, physicians Keine fallz.berechn keine Hypothermie-detektion	III
9	Chamberlain JM, Terndrup Ann Emerg Med 1995	Cross-sectional, convenience sample	2447	12h-103 J; exclusion: medikation 24h beeinflußt temp, fieber, Impfung 14 Tage	IR Thermoscan pro-1 (ohne Korrektur) vs electron. Diatek oral u. axillär; Kalibration, water bath. Meßwiederholung. training	IR tymp	Alter, SD, 99% percentile re. Ohr 37,9°C Kinder <11J. und 37,6°C> 11J.;	kA	keine Hypothermie-detektion	II b
10	Childs C, Harrison R Arch Dis Child 1999		42	gesunde Kinder, 20 fiebrige Kinder m. Verbrennung	IVAC CoreCheck vs axilla elect. IVACTemp Plus II	IVAC	Gesunde diff. Zwischen ohren 0,6°; bei fieber zw. 0,4 bis -0,8°.	kA	keine Hypothermie-detektion Auf ein ohr beschränken, mehrfachmess	III
11	Davis K Pediatr Nurs 1993	Correlational study, convenience sample	209	kinder, neugeb.-12 j., ohne sauerstoffmaske	Tymp. Firsttemp vs axilla, oral, rektal	Firsttemp	Korrel.: tymp oral 0.76, tymp. Rect. 0,82, tymp. Axillär 0,53 ; sens. Spez. Für fieber, subgruppen	kA	keine Hypothermie-detektion	III
12	El-Radhi AS Arch Dis Child 2006	syst. review		Pubmed 80-2003 582 artikel	Tymp.tmp vs. axilla, rektal, pac, oral	nur tabell.übersicht, keine metaanalyse	13 studien favorisieren tymp., 6 nicht	kA	techn. Probleme der tymp. Mess.	III
13	Erickson RS Am J Crit Care 1994	Convenience sample, consecutive	50	50 adults with pac on icu, 36m, 14 w	Tymp. Core/ unadjust., bladder, oral, axill Mean diff., sd	Tymp.	Am besten genius, core mode o.thermoscan unadjust.; blasentemp zu PA gut;	kA	variabilität	II b
14	Farnell S J Clin Nurs 2005	prospective	25	icu pat. Mit pac, 160 temp.sets, über 6 mon.	Genius first temp3000a, tempadot3m	Diff. pa, bland-altman und clinical signif. "expert panel"	75% chemical, 51% tymp.mess 0-0,4° dif. Zu PAC, korrelation 0,81 u. 0,59; 15% zu 21% verzögerte behandlung; 29% bzw. 38% unnötige behandlung	kA	Further research	II b / Keine Empf.

	Referenz	Studientyp	n	Kollektiv	Methode Prüftest	Zielparameter	Ergebnisse Präzision, Akkuratheit, Sensitivität, "Hypothermiedetektion", Spezifität	Finanz	Bem.	Evidenzgrad/Empfehlung
15	Fetzer SJ J Peri Anesth Nurs 2008	Prosp. Conv.sample, correlational	??	Prä- u. postop.	Genius TM3300 vs. TAT Exergen	Korrelation 1˚C	Korrelation > 1˚C!!	kA	Kein gold standard!!	IV
16	Fisk J, Arcona S Nurs Management 2001	Prospect. Consecutive sample, monoz.	56	31m, 25f, nach unkompl.Herzop, mit pac auf Intensiv	genius firsttemp3000a	Tymp. vs PA, Bland-Altman	Abweichung tymp. Zu PA bis zu 2˚	kA	Keine hypothermen Pat. „kliniksintern"	III
17	Giuliano 1999	Prospect. Comparative, convenience sample	102	intubiert mit pac auf icu	Oral 670, welch allyn, genius 3000˚, nurse training, calibrated black box	Scatter, BA plots, Oral/ PA PA/tymp Oral/ tymp	4 excluded-tymp.membran nicht zu sehen; oral/PA –0,15˚ sd 0,36 tymp.core/PA –0,1 sd 0,57 tymp.oral/PA –0,52 sd 0,53	kA	Keine hypothermen Pat. Nur 4 nurses	II b, oral **A**
18	Greenes DS Arch Pediatr Adolesc Med 2001	Conv. sample	304	kinder unter 1 j.	TA re.,li. (Exergen), genius 3000a vs rektal digit. (Welsh Allyn)	nur Korrel. Kein BA plot	TA rect. 0,79; tymp. Rect. 0,75; Fieber sensitivität TA 0,66 tymp 0,49	kA	Keine Hypotherm.	III
19	Hebbar K Pediatr Crit Care Med 2005	Observational study, unblinded, aber fallzahlberechnung für delta 0,3˚	44	Kinderintensiv, 2-34 mon. Auch unter katechol., febril	Temp.art. re.u.li.(Exergen) , axilla digit.(Allegiance) vs rekt digit.(Allegiance) und PAC n=3	rect. alle, 3 PA, BA plot Mean bias, sd Sens.+spez. Für fieber	75 pairs nur für rekt vs ta:0,09±1˚ Ta oder ax nicht zu empfehlen; rektal besser, wenn invas. nicht möglich eher ta	kA	Zu wenige hypotherm	II b, rektal A
20	Höcker J et al. EJA 2012	Prospective comparative	171	18-75, intub./ LMA	Tymp. Thermocouple vs. Sublingual Sure Temp	Scatter, BA plots	Oral 0,1-0,2 ˚C höher als tymp. Thermocouple ; Coefficient 0,50-0,59; BA (SD) 0,21-0,24 ˚C bias	No external funding	Wenige hypotherm	II b, oral **A**
21	Hoffman Can J Nurs Res 1999	Prospective, über 11 mon.	304+ 108	ED pat. 3 mon.-87J. ICU 40-84 J. Exclusion: rektum op, anomalie, ohrschmerzen	3 ITT vs rect. U. pac	bias, sd, scatter plot, sens., spec. For fever,	304 pairs ED (tymp, rect) mean diff. thermoscan 0,18, sd 1˚, kategorisierung nach alter- unter 3 j. größte abweichung von rect. 1˚C		hypothermia zu wenig daten	III, tymp D, thermoscan noch am besten

	Referenz	Studientyp	n	Kollektiv	Methode Prüftest	Zielparameter	Ergebnisse Präzision, Akkuratheit, Sensitivität, "Hypothermiedetektion", Spezifität	Finanz	Bem.	Evidenzgrad/Empfehlung
22	Imamura M Acta Anaesthesiol Scand 1998	Prospective, randomisiert	10	kardiochir. Pat., 2w, 8m, 69±7 j. zieltemp.32	Genius, thermoscan, quickthermo, thermopit li. Ohr alle 5 min.während op vs. Mon-a-therm thermocouple gleichz. Re. ohr	bias, sd, scatter plot, correlation.	0,5° offset a priori (diff.+1sd=1°range) accuracy 0 für genius, thermoscan, 1,1 quickthermo, 2,3 thermopit, sd immer um 0,8° (d.h. 67% mess. Im bereich von 1,6° oder 97% intervall=3°)	Thermocouple Mallinckrodt, NIH grant	Thermopit calibration error? Keine sens, spez. Für hypothermie	II b, Alle itt klinisch unbrauchbar
23	Jensen BN J Adv Nurs 1994	Kohorte, 2 studien fieberscreening	184	72w, 112m, 70 j. med. 91 (41w, 50m), 59 j. med. Exclusion rek.op, shivering, nahrung bis 30 min. vorher	Oral digit. Terumo wct, rekt. Digit. Terumo vs rektal quecksilber	mean, sd sens, spez für fieber	Rect. Oral mean diff. 0,7°C SD 0,5 (in 27% d. Mess. 1°C Abweich.!) Bei Fieber (38°C) Abw. Bis 1,9°		Keine hypothermie	II b, rektal besser als oral
24	Kimberger O Anesth Analg 2007	Correlational study	70	OR u. NCH Int. 30m, 40w	Blasé vs. TAT5000	Fieber u. Hypothermie- detektion (< 35,5°C)	280 mess pairs; bias 0,07-0,79 sens. HT 0,29 spez 0,95 PPV 0,31, NPV 0,95	No ext. fund		II b, TAT **D**
25	Kimberger O et al BJA 2009	kohorte	68	Pat. periop u. ICU	Double sensor vs dist ösophag.	BA plot	1287 meas.pairs mean bias -0.08°C sens. Spec. Hypothermia: 0,77, 0,93 Lin's CCC 0,93	Dräger		II b, double sens. Alternative zu ösopgaeal
26	Langham GE et al. Anesthesiology 2009	Conv. sample	50	Pat. PACU	Referenz Blasentemp., nicht-invas. Temp.:oral, axillär, Stirn, Temporalart.	Scatter plots, BA	Blase intraop. 34-38,6°C, distal ösoph. -0,56-0,45°C abw.;oral postop. Geringste Abweich. Mittel -0,25°,			II b, oral am besten
27	Lanham DM Pediatr Nurs 1999	Correl. study	178	Päd. Notaufnahme, kleiner 6 Jahre	Ref. Rectal, tymp.firsttemp	Bland-altman, fiberdetektion, multivar. analyse	TT vs RT 0,6±0,54, 20/100Fieber nicht erfaßt			II
28	Lefrant	prospective	42	Intensiv, 52-75J.	Blasé, rektal, öso., axillär, inguinal vs. PA	BA plots	529 vergleiche, ösoph. PA: 0,11+/-0,3°, Blasé PA:-0,21+/-0.2°, rectal			II b
29	Manian FA Am J Infect Control 1998	Prosp. convenience	406	Normalstation innere u. chirurg.	Hg oral vs electr. Oral vs IR IVAC	Korrel.	95% Intervall: -2,11 – 2,81°F			III, tymp. Schlecht zu oral

	Referenz	Studientyp	n	Kollektiv	Methode Prüftest	Zielparameter	Ergebnisse Präzision, Akkuratheit, Sensitivität, "Hypothermiedetektion", Spezifität	Finanz	Bem.	Evidenzgrad/Empfehlung
30	Nathan N Ann Fr Anesth Reanim 1995	Prosp., comparative	150	AWR	Tymp. IVAC vs. thermocouple	nur Korrel.	Mediane Abweich. 0, aber ger. Präzision tymp.- 6% hypotherme Pat. Wurden nicht erkannt		10 nurses	III,
31	Nierman 1991	Prosp., consecutive	15	intensiv	PA vs. Blase u. tymp.	BA plots	PA Blase bias -0,04°; PA tymp.-0,38°; Blase tymp. -0,34°C			II, tymp. Nicht empfohlen
32	O'Brian DL Acad Emerg Med 2000	Conven sample, monozentr., nicht rand.	500	Notaufnahme	Oral vs. tymp. IRED	BA plot, konf.	Oral prädikt. Thermom. 1/7 Fieber n. erkannt, IR firsttemp 3000a 1/8 n erkannt			
33	Pontious SL Pediatr Nurs 1994	Multi-correlational, randomisiert	176	Kindernotaufnahme	TempaDOT vs FirstTEMP,Genius Ref. Hg thermometer Tylenolgabe	Kontingenztab. Analyse temp. schwankungen	960 Mess.		Keine Abb!	III, TempaDot gut
34	Prentice D Geriatr Nurs 1999	Conv sample	30	Geriatrie, keine demoskop Angab.	Hg oral Ref vs IR Thermoscan und TempPlus oral	Korrel., Konvidenzintervalle	Fieber 37,5; Tempplus: sens.60%, spez.84% (95% CI 17, 100); IR: 60%, 92% (CI 81,100)		Keine Hypother.	
35	Schmitz T Am J Crit Care 1995	Conv sample	13	Intensivpat. Febril, 37-86	5 methodenvergleich: PA, oral, IR, axillär, rectal	Korrel., BA	Rect. Beste Korrel. Mit PA, gefolgt von oral	Braun: Thermometer		II b
36	Stavem K Intens Care Med 1997	Conv sample	16+ 103	ICU u. Aufnahmen Innere	Ohrtemp. Vs. PA, rectal, öso. Ohrtemp. Vs. rektal	Scatter plots, BA	Abw. Ohr PA bis 0,74°, Rect. -0,16°, ösoph. -0,11°		Keine Hypotherm.	II b, IR Ohr D
37	Washington GT J Peri Anesth Nurs 2008	Conv sample, sample size cal. Descriptive, correlational	752	PACU	Alaris TurboTemp 3M TempaDot	vs. last OR Temp Ösophag.!!	Diff. Electronic 0,49; chemical – 0,57		Schlechtes design-	III, TempaDot D

	Referenz	Studientyp	n	Kollektiv	Methode Prüftest	Zielparameter	Ergebnisse Präzision, Akkuratheit, Sensitivität, "Hypothermiedetektion", Spezifität	Finanz	Bem.	Evidenzgrad/Empfehlung
38	Winslow EH JPeriAnesth Nurs 2012	Conv sample: 109- 45 excluded	64	OR- PACU	WelshAllyn oral, TAT vor OP- Blasé während OP- TA Blasé nach OP	Hypothermie-detektion (96,8°F) BA plots	Im OP 33 Pat (52%) hypotherm; PACU 27 (42%)- TAT keine Hypothermie erkannt!!			II, TAT D

Evidenztabelle „Shivering – Therapie+Prävention“ Stand: 03.08.2018, Horn (alt)/ Höcker

Blaue Literaturstellen: Literatur (n=16) der Aktualisierungsrecherche

Nr.	Referenz	Studientyp	Kollektiv	Methode	Ziel- parameter	Ergebnisse	Kommentar
	Sehr gute Datenlage: Clonidine, 17x Meperidine/Pethidine, 10x Tramadol, 6x **(Fluid) Warming 4x** Gute Datenlage Dexmedetomedine, 4x Odansetron, 4x Physostigmine, 2x Ketamin, 3x Parecoxib 2x Mäßige Datenlage Metamizol, 1x Nefopam, 2x Doxapram, 1x Fentanyl, 1x Ketanserin, 1x Unklare Datenlage Vecuronium Nalbuphine Ramosetron Dexamethasone Novamin (amino acid) Proved to be not effective: Urapidil Midazolam Lignocaine Alfentanil						
	clonidine						
1	Bergendahl, Clonidine vs. midazolam as premedication in children undergoing adeno-tonsillectomy: a prospective, randomized, controlled clinical trial, Acta Anaesthesiol Scand, 2004, 48, 1292-300	clinical, randomized, double blinded, prospective	100 child-dren	rectal premedicat-ion with midazolam or clonidine	visual shivering	shivering was not observed in the clonidine group 0/48 five patients with midazolam shivered 5/52 (p = 0.057)	Keine Temp Messungen, deshalb Wirkung von Clonidin auf Shivering nicht beurteilbar
2	Buggy, Clonidine at induction reduces shivering after general anaesthesia, Can J Anaesth, 1997, 44, 263-7	clinical, randomized, double blinded, prospective	60	150 micrograms clonidine at induction of anaesthesia or saline	core temp shivering, percepti on of cold	core temperature decreased without difference between groups, shivering less with clonidine 6/30 (20%) vs. 20/30 (67%), p<0.001	clonidine 150 µg iv at induction of anaesthesia reduces the incidence of shivering

Nr.	Referenz	Studientyp	Kollektiv	Methode	Ziel- parameter	Ergebnisse	Kommentar
3	Capogna I.V. clonidine for post-extradural shivering in parturients: A preliminary study, Br J Anaesth, 1993, 71, 29-295	clinical, randomized, double blinded, prospective	40	30 micrograms clonidine boluses in shivering paturients with epidural anesthesia	visual shivering	75% of clonidine treated patients stopped shivering after first dose; 0% of the patients treated with saline improved	paturients epidural anesthesia no temp control or assessment
4	Grundmann, Comparative study of pethidine and clonidine for prevention of postoperative shivering. A prospective, randomized, placebo-controlled double-blind study. AINS, 1997. 32: p. 36-42.	clinical, randomized, double blinded, prospective	60	5 min prior to end of surgery pethidine 0.3 mg/kg or clonidine 2 micrograms/kg or placebo 0.9% NaCl	incidence of post-operative shivering, pain level	ncidence of postoperative shivering in the clonidine group 5%, in the pethidine group 25% in the saline group 55%	Intraoperative administration of 2 µg/kg clonidine preventions postoperative shivering
5	Hommeril, Effects of intravenous clonidine on postoperative shivering, Ann Fr Anesth Reanim, 1991, 101 554-8.	clinical, randomized, double blinded, prospective	50	n=25 clonidine 5 micrograms.kg-1 n=25 placebo	incidence of post-operative shivering	clonidine treated patients had core temperature 36.2 +/- 0.3°C saline 36.5 +/- 0.2°C No differences in shivering	no effects of clonidine in postoperative shivering in normothermic patients
6	Horn, Physostigmine prevents postanesthetic shivering as does meperidine or clonidine. Anesthesiology, 1998. 88, p. 108-13.	clinical, randomized, double blinded, prospective	60	0.04 mg/kg physostigmine vs saline vs 5 mg/kg meperi-dine vs 1.5 microg/kg clonidine	incidence of post-operative shivering, pain level	6/15 of saline patients shivered 40% 1/15 of physostigmine, 7% 0/15 clonidine 0/15 meperidine	physostigmine inhibited shivering as well as meperidine and clonidine
7	Horn, Late intraoperative clonidine administration prevents postanesthetic shivering after total intravenous or volatile anesthesia. Anesth Analg, 1997. 84, p. 613-7	clinical, randomized, double blinded, prospective	60	isoflurane or propofol anesthesia saline or 3 micrograms/kg IV clonidine	incidence of post-operative shivering, pain level	without clonidine 53% patients shivered given isoflurane 13% of the patients given propofol without No patient given clonidine shivered	Less PAS after propofol than isoflurane anesthesia; IV 3 µg/kg clonidine prevents PAS
8	Joris, Clonidine and ketanserin both are effective treatment for postanesthetic shivering. Anesthesiology, 1993. 79, p. 532-9.	clinical, randomized, double blinded, prospective	54	shivering patients received saline or 50 microgram clonidine or 10 mg ketanserin	duration of shivering	Duration of shivering was shorter following clonidine 2.1 +/- 0.9 min, ketanserin 4.3 +/- 0.9 min than after saline 12.0 +/- 1.6 min	150 µg clonidine or 10 mg ketanserin are effective treatment for postanesthetic shivering
9	Mao, Pre-anesthetic oral clonidine is effective to prevent post-spinal shivering. Acta Anaesthesiol Sin, 1998. 36, p. 137-42	clinical, randomized, double blinded, prospective	100	n=48 preoperatively oral clonidine 150 micrograms n=52 placebo	post-spinal shivering incidence and grade	post-spinal shivering, graded as none, mild, moderate, and severe after 150 micrograms of clonidine was 83%, 10%, 10%, 0% and saline 42%, 6%, 19%, 33%	Premedication with oral clonidine 150 µg effectively prevents post-spinal shivering following elective urological surgery.
10	Mercadante, Effect of clonidine on postpartum shivering after epidural analgesia: a randomized, controlled, double-blind study. J Pain Symptom Manage, 1994, 9, p. 294-7	clinical, randomized, double blinded, prospective	60	shivering obstetrics after PDA, n=20 clonidine 0.15 mg n=20 meperidine 50 mg, n=20 saline	control of shivering	clonidine and meperidine were in 100% of the patients effective to control shivering	clonidine is effective in controlling shivering after delivery using epidural analgesia

Nr.	Referenz	Studientyp	Kollektiv	Methode	Ziel- parameter	Ergebnisse	Kommentar
11	Piper, A comparison of urapidil, clonidine, meperidine and placebo in preventing postanesthetic shivering. Anesth Analg, 2000. 90, p. 954-7	clinical, randomized, double blinded, prospective	120	after surgery prophylactic each n=30 0.2 mg/kg urapidil, 0 3 microg/kg clonidine or 0.4 mg/kg mepe-ridine or saline 0.9%	Incidence of shivering	clonidine and meperidine significantly reduced the incidence and the severity of shivering in comparison with placebo. No difference was found between urapidil and placebo	urapidil was not effective to prevent postanesthetic shivering
12	Piper, A comparison of nefopam and clonidine for the prevention of postanaesthetic shivering: a comparative, double-blind and placebo-controlled dose-ranging study. Anaesthesia, 2004. 59, 559-64	clinical, randomized, double blinded, prospective	371	abdominal or orthopaedic surgery 0.2 mg/kg nefopam 0.1 mg/kg nefopam 0.05 mg/ nefopam 1.5 microg/kg clonidine or saline	Incidence of shivering	clonidine and nefodepam reduced shivering; nefopam 0.2 mg/kg was more effective than clonidine 1.5 µg/kg	clonidine and nefodepam safely prevent patients from postanesthetic shivering
13	Schwarzkopf, A comparison between meperidine, clonidine and urapidil in the treatment of postanesthetic shivering. Anesth Analg, 2001. 92, p. 257-60	clinical, randomized, double blinded, prospective	60	treatment of PAS n=20 25 mg iv meperidine n=20 0.15 mg iv clonidine n=20 25 mg iv urapidil	Control of shivering	Clonidine stopped shivering in all patients, Meperidine in 18 of 20 patients, the other 2 patients needed a second dose. Urapidil stopped shivering in 6/20 patients (p<0.01 vs. clonidine and meperidine), the second dose in another 6 patients	Meperidine 25 mg and clonidine 0,15 mg controlled shivering, whereas urapidil 25/50 mg was only effective in 60% of patients treated.
14	Sia, I.v. clonidine prevents post-extradural shivering. British Journal of Anaesthesia, 1998. 81, p. 145-6	clinical, randomized, double blinded, prospective	100	n= 50 IV clonidine 1 microgram kg-1 before epidural block, n=50 received saline	prevention of shivering	with clonidine 3/50 patients shivered (6%), with saline 19/50 (38%, P < 0.001); Patients with severe shivering were seen only in saline treated patients	Clonidine 1 µg/kg IV reduces the incidence of shivering after epidural anesthesia
15	Stapelfeldt, Intraoperative clonidine administration to neurosurgical patients. Anesth Analg, 2005. 100, p. 226-32.	clinical, randomized, double blinded, prospective	34	n=17 3 microg/kg clonidine at the beginning of dural closure; n=17 saline	prevention of shivering	With 3 µg/kg IV clonidine after neurosurgical procedures 1 h before the end of anesthesia patients did not shiver postop.; 80% of saline treated patients shivered postoperatively	clonidine prevents postoperative shivering after neurosurgical surgery with mild hypothermia.
16	Vanderstappen, The effect of prophylactic clonidine on postoperative shivering. A large prospective double-blind study. Anaesthesia, 1996. 51, 351-5	clinical, randomized, double blinded, prospective	280	n=140 2 µg/kg clonidine after induction of an-esthesia for elective peripheral surgery; n=140 saline	prevention of shivering	Clonidine reduces the incidence (p = 0.024), severity (p = 0.005) and duration (p = 0.01) of postoperative shivering.	Clonidine 2 µg/kg IV after induction of anaesthesia reduces postoperative shivering in peripheral surgery.

Nr.	Referenz	Studientyp	Kollektiv	Methode	Ziel- parameter	Ergebnisse	Kommentar
17	Yang, Effect of intravenous clonidine on prevention of postepidural shivering. Ma Zui Xue Za Zhi, 1993. 31, p. 121-6.	clinical, randomized, double blinded, prospective	40	n=20 clonidine IV 150 µg or n=20 saline in ESWL Patients in epidural anesthesia	prevention of shivering	clonidine treated patients shivered in 5%, saline treated patients shivered in 55% (p = 0.002)	clonidine 150 µg effectively prevents shivering in patients receiving epidural anesthesia
18	Shao, Effects of clonidine and midazolam on postoperative shivering, nausea, and vomiting. Masui, 2005. 54, p. 1253-7.	clinical, randomized, prospective	-	-	-	-	-
	meperidine/pethidine						
19	Alfonsi, The effects of pethidine, fentanyl and lignocaine on postanaesthetic shivering. Anaesthesia, 1995. 50, 214-7	clinical, randomized, double blinded, prospective	52	n=12 pethidine 0.85 mg/kg, n=10 fentanyl 1.7 µg/kg n=15 lignocaine 1 mg/kg n=15 saline	treatment of shivering	core temp was below 36°C in all patients wih shivering, 15 min after administration patients still shivered 15/15 after saline 12/15 after lignocaine, 3/10 after fentanyl ($p < 0.01$ versus saline); 1/12 after pethidine ($p < 0.001$ versus saline)	pethidine 0.85 mg/kg and fentanyl stops shivering Lignocaine is not effective to stop shivering.
20	Casey, Intravenous meperidine for control of shivering during caesarean section under epidural anaesthesia. Can J Anaesth, 1988. 35, 128-33	clinical, randomized, double blinded, prospective	46	shivering patients received n=23 meperidine IV 50 mg or n=23 saline	treatment of shivering	12/20 patients stopped shivering after meperidine, 1/20 patients receiving saline stopped shivering ($p<0.01$); No differences in core temperature	meperidine stopped postanesthetic shivering in hypothermic patients
21	Cruise, Comparison of meperidine and pancuronium for the treatment of shivering after cardiac surgery. Can J Anaesth, 1992. 39, 563-8	clinical, randomized, double blinded, prospective		-	-	-	No saline group
22	Kelsaka, Comparison of ondansetron and meperidine for prevention of shivering in patients undergoing spinal anesthesia. Reg Anesth Pain Med, 2006. 31, 40-5	clinical, randomized, double blinded, prospective	75	spinal anesthesia n=25 ondansetron IV 8 mg, n=25 meperidine IV 0.4 mg/kg, n=25 saline	prevention of shivering	after ondansetron 2/25 patients shivered after meperidine 9/25 patients shivered after saline 23/25 shivered	meperidine and ondansetron are effective in preventing postanesthetic shivering
23	Leslie, Pethidine and skin warming to prevent shivering during endovascular cooling. Anaesth Intensive Care, 2004. 32, 362-7	clinical, randomized, prospective	-	-	-	-	no saline group
24	Miyakawa, A comparison of pethidine, magnesium sulfate and droperidol in patients with post-anesthesia shivering	-	-	-	-	-	no saline group

Nr.	Referenz	Studientyp	Kollektiv	Methode	Ziel- parameter	Ergebnisse	Kommentar
25	Monso, A randomized, double-blind, placebo-controlled trial comparing pethidine to metamizol for treatment of post-anaesthetic shivering. Br J Clin Pharmacol, 1996. 42, 307-11	clinical, randomized, double blinded, prospective	104	Treatment of PAS with n=35 pethidine 0.4 mg/ kg, n=37 metamizol 25 mg/kg, n=32 saline	treatment of shivering	still shivering patients 15 min after administration of pethidine 2/35 metamizol 25/37, placebo 27/32	pethidine and metamizol suppress postanaesthetic shivering, but pethidine is quicker and has more reliable response.
26	Singh, Double-blind comparison between doxapram and pethidine in the treatment of postanaesthetic shivering. Br J Anaesth, 1993. 71, 685-8	clinical, randomized, double blinded, prospective	60	Treatment of PAS with n=20 pethidine 0.33 mg/kg, n=20 doxapram 1.5 mg/kg, n=20 saline	treatment of shivering	still shivering patients after pethidine 0/20 doxapram 3/20 saline 15/20	pethidine and doxapram are effective in the treatment of postoperative shivering
27	Sladen, Comparison of vecuronium and meperidine on the clinical and metabolic effects of shivering after hypothermic cardiopulmonary bypass. J Cardiothorac Vasc Anesth, 1995. 9, 147-53.	clinical, randomized, double blinded, prospective	20	-	-	-	geringe Anzahl untersuchter Patienten, keine Saline Gruppe
28	Terasako, Comparison between pentazocine, pethidine and placebo in the treatment of post-anesthetic shivering. Acta Anaesthesiol Scand, 2000. 44, 311-2.	clinical, randomized, double blinded, prospective	45	patients with PAS, after routine surgery, n= 15 pethidine 17,5 mg n=15 pentazocine 7.5 mg, n=15 saline	treatment of shivering	10 min after administration patients stopped shivering with pethidine 13/15 patients, pentazocine 4/15 p<0.01, saline 2/15, p<0.01	pethidine is effective in the treatment of shivering, whereas pentazocine 7.5 mg is not
29	Tsai, A comparison of tramadol, amitriptyline, and meperidine for postepidural anesthetic shivering in parturients. Anesth Analg, 2001. 93, 1288-92.	clinical, randomized, double blinded, prospective	45	-	-	-	keine Saline Gruppe
30	Wang, A comparison among nalbuphine, meperidine, and placebo for treating postanesthetic shivering. Anesth Analg, 1999. 88, 686-9.	clinical, randomized, double blinded, prospective	90	treament of PAS, n=30 nalbuphine 0.08 mg/kg iv, n=30 meperidine 0.4 mg/kg, n=30 saline	treatment of shivering	patients PAS following nalbuphine 24/30 (80%) meperidine 25/30 (83%) saline 0/30 (0%) (P < 0.01)	nalbuphine and meperidine provide a similar antishivering effect
31	Wrench, Comparison between alfentanil, pethidine and placebo in the treatment of post-anaesthetic shivering. Br J Anaesth, 1997. 79, 541-2.	clinical, randomized, double blinded, prospective	90	treatment ofPAS n=30 pethidine 25 mg, n=30 alfentanil 250 micrograms, n=30 saline	treatment of shivering	pethidine stopped PAS in 26/30 (87%) of patients; alfentanil stopped PAS in 12/30 (40%) patients (P < 0.0001); saline stopped PAS in 7/30 (23%) patients (p<0.002)	pethidine 25 mg stopped PAS effectively; alfentanil 250 µg was not effective in the treatment of PAS

Nr.	Referenz	Studientyp	Kollektiv	Methode	Ziel- parameter	Ergebnisse	Kommentar
32	Wrench, The minimum effective doses of pethidine and doxapram in the treatment of post-anaesthetic shivering. Anaesthesia, 1997. 52, 32-6.	clinical, randomized, double blinded, prospective	120	Ten doses of doxapram 0.18-1.4 mg/kg and 5 doses of pethidine 0.12-0.35 mg/kg and saline	treatment of shivering	doxapram stopped PAS in a dose of 0.18 mg.kg-1 more effective than saline ($p < 0.01$); pethidine stopped PAS in 95% of patients in a dose of 0.35 mg.kg-1	0.35 mg/kg pethidine is the minimum dose to treat PAS effectively. 0.18 mg/kg doxapram is effective to stop PAS
1	**Tie, Efficacy and safety of ondansetron in preventing postanesthesia shivering: a meta-analysis of randomized controlled trials. BMC Anesthesiol. 2014 Mar 3;14:**	**MA of RCTs**	**Six trials including 533 subjects**	**Ondanseron compared with placebo and meperidine**	**prevention of postoperative shivering**	**Compared with placebo, ondansetron significantly reduced PAS (RR 0.43, 95% CI, 0.27-0.70), without risk of bradycardia (RR 0.37, 95% CI, 0.12-1.15). Compared with meperidine, incidence of PAS did not differ (RR 0.68, 95% CI, 0.39-1.19) and bradycardia (RR 2.0, 95% CI, 0.38-10.64).**	**Ondansetron has a preventive effect on PAS without a paralleled side effect of bradycardia. Ondansetron is as effective as meperidine.**
	physostigmine						
33	Rohm, Physostigmine for the prevention of postanaesthetic shivering following general anaesthesia - a placebo-controlled comparison with nefopam. Anaesthesia, 2005. 60, 433-8.	clinical, randomized, double blinded, prospective	89	n=31 physostigmine 2 mg, n=30 nefopam 10 mg, n=28 saline, temp was measured	prevention of shivering	patients shivering following physostigmine 3/31 (10%, $p<0.01$) nefopam 1/30 (3%, $p<0.01$) saline 15/28 (53.6%), temperature was similar in all groups	physostigmine reduces the incidence of PAS as did nefopam
	tramadol						
34	Bhatnagar, Tramadol for postoperative shivering: a double-blind comparison with pethidine. Anaesth Intensive Care, 2001. 29, 149-54.	clinical, randomized, double blinded, prospective	-	-	-	-	no saline control group
35	Bilotta, Nefopam and tramadol for the prevention of shivering during neuraxial anesthesia. Reg Anesth Pain Med, 2002. 27, 380-4	clinical, randomized, double blinded, prospective	90	n=30 nefopam 0.15 mg/kg IV, n=30 tramadol 0.5 mg/kg IV, n=30 saline	prevention of shivering	PAS was less in patients treated with nefopam than in those treated with tramadol or placebo and in patients treated with tramadol than in those treated with placebo	tramadol 0.5 mg/kg and nefopam 0.15 mg/kg are effective in preventing postanesthetic shivering

Nr.	Referenz	Studientyp	Kollektiv	Methode	Ziel- parameter	Ergebnisse	Kommentar
36	Chan, Control of shivering under regional anesthesia in obstetric patients with tramadol. Can J Anaesth, 1999. 46, 253-8	clinical, randomized, double blinded, prospective	36	treatment of shivering during epidural anesthesia for cesarean section n=12 tramadol 0.5 mg/kg, n=12 tramadol 0.25 mg/kg, n=13 saline	treatment of shivering	PAS was controlled by tramadol 0.25 mg/kg in 10/12 patients (80%),; tramadol 0.5 mg/kg 11/12 patients (92%); saline 3/12 patients (27%)	no temperature assessment tramadol iv was effective in the treatment of shivering during regional anesthesia for cesarean section
37	Chen, The evaluation of the anti-shivering effect of tramadol during epidural anesthesia. Kao Hsiung I Hsueh Ko Hsueh Tsa Chih, 1994. 10, 632-9.	clinical, randomized, double blinded, prospective	60	treatment of shivering under epidural anesthesia n=30, tramadol 1 mg/Kg, n=30, saline		following tramadol the arrest time of shiveringin was 179 +/- 71 sec following saline the arrest time was 2790+/-440 sec p<0.001	tramadol 1mg/kg is effective to treat shivering during epidural anesthesia
38	Pausawasdi, The use of tramadol hydrochloride in the treatment of post-anesthetic shivering. J Med Assoc Thai, 1990. 73, 16-20	clinical, randomized, double blinded, prospective	-	-	-	-	no control group
39	Heid, Intraoperative tramadol reduces shivering but not pain after remifentanil-isoflurane general anaesthesia. A placebo-controlled, double-blind trial. Eur J Anaesthesiol, 2008. 25 468-72.	clinical, randomized, double blinded, prospective	60	before skin closure n=30 tramadol 2 mg/kg n=30 saline	prevention of shivering	3/30 patients treated with tramadol shivered (20%); 21/30 patients treated with saline shivered (70%, p=0.0009)	intraoperative 2 mg/kg tramadol reduces the incidence of PAS
2	**Hidayah, Ketamine and tramadol for the prevention of shivering during spinal anaesthesia. Clin Ter. 2014;165(4)**	**clinical, randomized, double blinded, prospective**	**150, only Spinal anesthesia**	**prophylactic IV ketamine 0.5 mg/kg, IV tramadol 0.5 mg/kg, saline as control after intrathecal bupivacaine**	**Prevention of shivering associated with spinal anaesthesia**	**The incidence of shivering was 8% in Group K, 16% in Group T and 24% in Group P.**	**Prophylactic IV ketamine 0.5 mg/kg significantly reduced PAS after spinal, but exhibited side effects**
40	Mohta, Tramadol for prevention of postanaesthetic shivering: a randomised double-blind comparison with pethidine. Anaesthesia, 2009. 64, 141-6	clinical, randomized, double blinded, prospective		at the time of wound closure iv n=33 tramadol 1mg/kg or 2 mg/kg or 3 mg/kg, n=33 pethidine 0.5 mg/kg, n=33 saline	prevention of shivering	all three doses of tramadol were effective and comparable to pethidine in preventing postanaesthetic shivering	1 mg/kg tramadol is effective in preventing PAS
	nefopam						
41	Rosa, Control of post anaesthetic shivering with nefopam hydrochloride in mildly hypothermic patients after neurosurgery. Acta Anaesthesiol Scand, 1995. 39, 90-95	clinical, randomized, double blinded, prospective	-	-	-	-	no saline group

Nr.	Referenz	Studientyp	Kollektiv	Methode	Ziel- parameter	Ergebnisse	Kommentar
41	**Piper**, Prophylactic nefopam administration for post-anesthetic shivering, Anasthesiol Intensivmed Notfallmed Schmerzther, 1998. 33, 786-9	clinical, randomized, double blinded, prospective	30	directly after the end of isoflurane n=15 nefopam 0.15 mg/kg, n=15 saline	prevention of shivering	after nefopam 1/15 patients shivered (7%); after saline 9/15 patients shivered (60%, p < 0.05)	nefopam 0,15 mg/kg suppresses postanaesthetic shivering
3	**Ly,** Nefopam for the prevention of perioperative shivering: a meta-analysis of randomized controlled trials. BMC Anesthesiol. 2015 Jun 9;15:87.	MA, of RCTs	??	efficacy of nefopam for prev of PAS in different types of anaesthesia compared with placebo and others	prevention of shivering	prophylactic nefopam reduced PAS under general and neuraxial anaesthesia (RR 0.08; 95% CI 0.05-0.13). compared with clonidine, nefopam was more efficacious in Prev.of PAS 0.34; 95% CI 0.17-0.70).	nefopam is associated with the decrease of risk of perioperative shivering following anaesthesia
	ketanserin						
42	**Crisinel,** Efficacy of ketanserin on postanesthetic shivering]. Ann Fr Anesth Reanim, 1997. 16, 120-5	clinical, randomized, double blinded, prospective	50	n=25 ketanserin 10 mg, n=25 saline	prevention of shivering	temp was similar between groups PAS duration was shorter following Ketanserin (8.8+/-1.5 min) than after saline (15.5+/-1.5 min; P < 0.01)	10 mg Ketanserin reduces the duration of PAS
	ketamin						
43	**Dal,** Efficacy of prophylactic ketamine in preventing postoperative shivering. Br J Anaesth, 2005. 95, 189-92	clinical, randomized, double blinded, prospective	90	n=30 ketamine 0.5 mg/kg, n=30 pethidine 25 mg; n=30 saline	prevention of shivering	Following 0,5mg/kg ketamin and 25 mg pethidin shivering on arrival in the recovery room was less compared to saline (p<0.005)	Prophylactic low-dose ketamine is effective in preventing PAS.
44	**Kose**, The efficacy of ketamine for the treatment of postoperative shivering. Anesth Analg, 2008. 106 120-2	clinical, randomized, double blinded, prospective	90	shivering following general anesthesia meperidine 25 mg ketamine 0.5 mg/kg or 0.75 mg/kg	-	-	no saline group
-	**Hidayah**, Ketamine and tramadol for the prevention of shivering during spinal anaesthesia. Clin Ter. 2014;165(4)	clinical, randomized, double blinded, prospective	150, only Spinal anesthesia	prophylactic IV ketamine 0.5 mg/kg, IV tramadol 0.5 mg/kg, saline as control after intrathecal bupivacaine	prevention of shivering associated with spinal anaesthesia	The incidence of shivering was 8% in Group K, 16% in Group T and 24% in Group P.	Prophylactic IV ketamine 0.5 mg/kg significantly reduced perioperative shivering after spinal anaesthesia but exhibited side

Nr.	Referenz	Studientyp	Kollektiv	Methode	Ziel- parameter	Ergebnisse	Kommentar
							effects
4	**Kose**, Prophylactic ketamine to prevent shivering in parturients undergoing Cesarean delivery during spinal anaesthesia. J Clin Anesth. 2013 Jun;25(4)	clinical, randomized, double blinded, prospective placebo-controlled study	120, SPA	ketamine 0.25 mg/kg with ketamine 0.5 mg/kg to	Prevention of shivering in patients undergoing Cesarean delivery	shivering was significantly less in Group K-0.25 and in Group K-0.5 than in Group control	Prophylactic IV ketamine 0,25 and 0.5 mg/kg reduced shivering after spinal Anaesthesia. Sedation scores of Group K-0.5 were higher than in Group K-0.25 or Group C
	urapidil						
45	**Piper**, Urapidil does not prevent postanesthetic shivering: a dose-ranging study. Can J Anaesth, 2001. 48, 742-7	clinical, randomized, double blinded, prospective	150	n=30 0.2 mg/kg, n=30 0.3 mg/kg, n=30 0.4 mg/kg urapidil, n=30 3 microg/kg clonidine n=30 saline	prevention of shivering	There were no significant differences between the urapidil and placebo groups.	Urapidil showed no beneficial effect on shivering.
	vecuronium						
46	**Dupuis**, Pancuronium or vecuronium for treatment of shivering after cardiac surgery. Anesth Analg, 1994. 79, 472-81	-	-	-	-	-	No saline group. No temp assesment
	nalbuphine						
47	**Gotz,** Treatment of postoperative shivering with nalbuphine. Anasthesiol Intensivmed Notfallmed Schmerzther, 1995. 30, 28-31	clinical, randomized, double blinded, prospective	100	PAS after elective surgery, n=50 meperidine 25 mg; n=50 nalbupine 10 mg			No saline group

Nr.	Referenz	Studientyp	Kollektiv	Methode	Ziel- parameter	Ergebnisse	Kommentar
	dexmedetomedine						
48	**Elvan**, Dexmedetomidine and postoperative shivering in patients undergoing elective abdominal hysterectomy. Eur J Anaesthesiol, 2008. 25, 357-64	clinical, randomized, double blinded, prospective	90	n=45 dexmedetomi-dine 1 microg/kg for 10 min followed by 0.4 microg/kg/ h; n=45 saline	prevention of shivering	following dexmedetomedine 7/45 patients shivered; following saline 21/45 patients shivered (p= 0.001) perioperative tympanic temperatures were not different between groups	Intraoperative dexmedetomidine infusion may be effective in the prevention of post-anaesthetic shivering
5	**Wang**, Effect of Dexmedetomidine in Preventing Postoperative Side Effects for Laparoscopic Surgery: A Meta-Analysis of Randomized Controlled Trials and Trial Sequential Analysis (PRISMA), Medicine (Baltimore). 2016 Mar;95(10	MA of RCTs	15 Studies, 899 Pat.	Laparoscopic Surgery, keine Dosierungen	prevention of ostanaesth. shivering, nausea	DEX could significantly reduce the incidence of postoperative shivering (RR and 95% CI, 0.19 [0.11, 0.35], P<0.00001),	common adverse effects: lower heart rate and MAP. **Firm conclusions cannot be made on postoperative shivering**, rescue antiemetic, and dry mouth until more RCTs were included
6	**Liu,** Efficacy of dexmedetomidine on postoperative shivering: a meta-analysis of clinical trials. Can J Anaesth. 2015 Jul;62(7):	MA of RCTs	39 Studies, 2478 Pat.			DEX reduced PAS compared with Placebo RR=0.26; 95%CI 0.20-.34), min.effectivedose:0.5µg/k g RR0.36 95%CI:0.21-.60. anti-shivering effect i.v. or epidurally administered 2h prior to end of surgery. Efficacy of dex was similar to fentanyl, meperidine, tramadol, clonidine	dexmedetomidine shows superiority over placebo, but not over other anti-shivering agents
7	**Kim**, Optimal dose of prophylactic dexmedetomidine for preventing postoperative shivering. Int J Med Sci. 2013 Aug 13;10(10):	RCT	132	elective laparoscopic total hysterectomy, dexmedetomidine in four groups: 1. saline, 2. DEX 0.5 µg/kg, 3. DEX 0.75 µg/kg, 4. DEX 1 µg/kg)	optimum dosage of dexmedetomidine for prevention of postanesthetic shivering	The incidence of shivering was significantly lower in group DEX 0.75 and DEX1.0 than in group S (P < 0.05).	Dosisfindungstudie dexmedetomidine 0.75 or 1.0 µg/kg effective prophylaxis for PAS, but intraoperative requirement for atropine, sedation in recovery period, delayed extubation
	parecoxib						

Nr.	Referenz	Studientyp	Kollektiv	Methode	Ziel- parameter	Ergebnisse	Kommentar
8	**Li,** Effect of parecoxib sodium on postoperative shivering: a randomised, double-blind clinical trial. Eur J Anaesthesiol. 2014 Dec;31(12):	clinical, randomized, double blinded, prospective	120	efficacy and side-effects of prophylactic parecoxib 40 mg with tramadol 2mg/kg or placebo	prevention of postoperative shivering	postoperative shivering was lower in Groups P and T than in Group S (P<0.001). sedation scores were higher in Group T than in P and S (P<0.05).	IV parecoxib 40mg before the end of surgery reduces postoperative shivering after general anaesthesia
9	**Shen**, Parecoxib for the prevention of shivering after general anesthesia, Parecoxib for the prevention of shivering after general anesthesia	clinical, randomized, double blinded, prospective	80	minor urological surgeries under general anesthesia, n = 40 group P:40 mg IV parecoxib n=40 group S:normal saline	Prophylaxis of postoperative shivering	Parecoxib reduced the of shivering in comparison with placebo. PAS was observed in 22 patients in group S (55%), compared with nine in group P (22.5%) (P = 0.003).	Prophylactic administration of parecoxib produces dual effects on antishivering and postoperative analgesia
	ondansetron						
10	**Lin,** Preventative effect of ondansetron on postanesthesia shivering in children undergoing caudal anesthesia: a randomized double-blinded clinical trial. Pediatr Res. 2016 Jan;79(1-1):96-9	clinical, randomized, double blinded, prospective	59 Children 8-13y undergoing IV +caudal anesthesia	4 mg ondansetron IV or equal volume of normal saline	Prophylaxis of postoperative shivering	ondansetron associated with decreased odds of PAS symptoms compared to control. There was also significant decrease in shivering score with time after anesthesia.	Ondansetron decreases PAS in children receiving caudal block after intravenous anesthesia.
-	**Tie,** Efficacy and safety of ondansetron in preventing postanesthesia shivering: a meta-analysis of randomized controlled trials. BMC Anesthesiol. 2014 Mar 3;14:	MA of RCTs	Six trials including 533 subjects	Ondanseron compared with placebo and meperidine	prevention of postoperative shivering	Compared with placebo, ondansetron significantly reduced PAS (RR 0.43 95% CI,0.27-0.70), without risk of bradycardia (RR 0.37, 95% CI,0.12-1.15). Compared with meperidine, incidence of PAS (RR 0.68, 95% CI, 0.39-.19) and bradycardia did not differ (RR 2.0, 95% CI, 0.38-10.64).	Ondansetron has a preventive effect on PAS without a paralleled side effect of bradycardia. Ondansetron is as effective as meperidine.
	ramosetron						
11	**Song,** Effects of ramosetron and dexamethasone on postoperative nausea, vomiting, pain, and shivering in female patients undergoing thyroid surgery. J Anesth. 2013 Feb;27(1):29-34.	clinical, randomized, double blinded ?, prospective	123 female patients thyroid surgery	three groups: the control group (group C, n = 41), dexamethasone group (group D, n = 41), or the ramosetron group (group R, n = 41)	prevention of postoperative shivering	significant differences in incidence and severity of shivering, severity of pain, and analgesic consumption between group C and group R or D. Incidence of shivering, pain severity, and analgesic consumption did not differ between groups R and D. The	ramosetron and dexamethasone, decreased severity of shivering. Ramosetron was inferior to dexamethasone for reducing the incidence of shivering.

Nr.	Referenz	Studientyp	Kollektiv	Methode	Ziel- parameter	Ergebnisse	Kommentar
						severity of shivering was significantly lower in group R than in group D.	
	dexamethasone						
-	**Song,** Effects of ramosetron and dexamethasone on postoperative nausea, vomiting, pain, and shivering in female patients undergoing thyroid surgery. J Anesth. 2013 Feb;27(1):29-34.	clinical, randomized, double blinded ?, prospective	123 female patients thyroid surgery	three groups: the control group (group C, n = 41), dexamethasone group (group D, n = 41), or the ramosetron group (group R, n = 41)	prevention of postoperative shivering	significant differences in the incidence and severity of shivering, severity of pain, and analgesic consumption between group C and group R or D. Incidence of shivering, pain severity, and analgesic consumption did not differ between groups R and D. The severity of shivering was significantly lower in group R than in group D.	ramosetron and dexamethasone, decreased severity of shivering. Ramosetron was inferior to **dexamethasone** for reducing the incidence of shivering.
	Novamin (amino acid)						
12	**Zhou,** Novamin infusion: a new method to cure postoperative shivering with hypothermia. J Surg Res. 2014 May 1;188(1):69-76.		60 PACU patients with shivering grade >1 and <36˚C	Novamin 18 AAs (2 mL/kg/h), pethidine (0.5 mg/kg), or tramadol (1 mg/kg).	Treatment of PAS	Shivering stopped within 5 min in the pethidine and tramadol groups versus 90% stopped within 15 min in AA group. There were five cases of reshivering in the tramadol group versus none in the AA or pethidine groups	Novamin infusion can stop postoperative shivering and alleviates hypothermia and improves thermal comfort more effectively than tramadol and pethidine
	warming						
13	**Park,** Efficacy of Nonpharmacological Antishivering Interventions: A Systematic Analysis. Crit Care Med. 2015 Aug;43(8)	MA of experimental and clinical trials	65 studies (3,361 subjects)	investigating the antishivering efficacy of nonpharmacological interventions	prevention of postoperative shivering	Active cutaneous warming was the most commonly studied intervention, and it was associated with the highest prevalence of positive results when compared with controls	active cutaneous warming was the most effective nonpharmacologic antishivering intervention in the perioperative and induced hypothermia

Nr.	Referenz	Studientyp	Kollektiv	Methode	Ziel- parameter	Ergebnisse	Kommentar
							settings.
14	**Horn,** The incidence and prevention of hypothermia in newborn bonding after cesarean delivery: a randomized controlled trial. Anesth Analg. 2014 May;118(5)	RCT	40 female for cesarean delivery	Mothers and newborns received passive insulation or FAW during surgical procedure and bonding period.		FAW increased mean skin temperatures of infants, maternal temperatures, maternal thermal comfort, and reduced perioperative shivering.	FAW of mothers and newborns after cesarean delivery reduces incidence of infant and maternal hypothermia and maternal shivering,
15	**Sultan,** The Effect of patient warming during Caesarean delivery on maternal and neonatal outcomes: a meta-analysis. Br J Anaesth. 2015 Oct;115(4)	MA of RCTs	13 studies, 789 patients (416 warmed and 373 controls	trials utilizing FAW or warmed fluid within 30 min of neuraxial anesthesia placement, efficacy of active warming on outcomes after Caesarean delivery		Warming was associated with less shivering (RR 0.58 [0.43, 0.79]; P=0.0004);	Active warming decreases incidence of hypothermia and shivering.
16	**Kim,** Effect of pre-warmed intravenous fluids on perioperative hypothermia and shivering after ambulatory surgery under monitored anesthesia care. J Anesth. 2014 Dec;28(6)	RCT	n = 27 interventio n group; n = 26 control group	evaluate effects of pre-warmed (41˚C) IV fluids on perioperative hypothermia and postoperative shivering in females	prevention of postoperative shivering	shivering incidence was significantly lower in the pre-warmed group **(n = 2)** than in the room temperature group **(n = 8,** p = 0.039).	Infusion of pre-warmed IV fluid improved the postoperative recovery profile by decreasing hypothermia and shivering (sehr kleine RCT)