Original Article

Naturopathic Treatment and Complementary Medicine in Surgical Practice

A Systematic Review

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Summary

Background: Many patients in Germany use naturopathic treatments and complementary medicine. Surveys have shown that many also use them as a concomitant treatment to surgery.

Methods: Multiple databases were systematically searched for systematic reviews, controlled trials, and experimental studies concerning the use of naturopathic treatments and complementary medicine in the management of typical postoperative problems (PROSPERO CRD42018095330).

Results: Of the 387 publications identified by the search, 76 fulfilled the inclusion criteria. In patients with abnormal gastrointestinal activity, acupuncture can improve motility, ease the passing of flatus, and lead to earlier defecation. Acupuncture and acupressure can reduce postoperative nausea and vomiting, as well as pain. Moreover, aromatherapy and music therapy seem to reduce pain, stress and anxiety and to improve sleep. Further studies are needed to determine whether phytotherapeutic treatments are effective for the improvement of gastrointestinal function or the reduction of stress. It also remains unclear whether surgical patients can benefit from the methods of mind body medicine.

Conclusion: Certain naturopathic treatments and complementary medical methods may be useful in postoperative care and deserve more intensive study. In the publications consulted for this review, no serious side effects were reported.

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Complementary medicine (CM) and naturopathic treatments (NT) are relevant topics for clinically active physicians. Many patients either would like to have advice about CM/NT or are already using them on their own for mostly harmless and self-limiting diseases (1). Indeed, more than 50% of cancer patients report using CM/NT. This not only affects primary care physicians, but also oncologists, radiotherapists, anesthesiologists, palliative care physicians, and surgeons (1). Nonetheless, little-to-no efforts seem to have been made at integrating CM/NT into everyday surgical routines. Surgeons are confronted not only with the needs of cancer patients but also with those of non-cancer patients undergoing surgery, as up to 30% of patients in this group also report using CM/NT (2, 3). Furthermore, although up to 60% of patients who undergo surgery would like complementary medical advice, almost none of them discuss this with the treating surgeon (3). This is a critical point, as self-medication with herbal supplements can lead to interactions with other drugs and cause risks, such as interference with blood clotting. This article therefore aims to give an overview of possible supportive CM/NT approaches in surgery while at the same time addressing their risks.

Methods

After evaluation of typical postoperative problems by the authors, a systematic literature review was conducted via Medline, Web of Science, and the Cochrane Library. Randomized controlled trials (RCTs) and experimental human studies, as well as systematic reviews, were included. Detailed information on the methodology is presented in the *eMethods* section and in the *eBox*. This review was prospectively registered in PROSPERO (CRD42018095330).

Results

A total of 387 references were identified, of which 76 were suitable for evaluation after checking the inclusion and exclusion criteria (*eFigure*).

Improvement of gastrointestinal function

Three systematic reviews (two of high quality) were identified that reported the use of acupuncture and acupressure for impaired gastrointestinal function

TABLE 1

Acupuncture and acupressure*

Year	Intervention	N	Patients	Surgery	Type/quality	Results
Symptom: Anxiety						
2015 (e4)	3 × auricular acupuncture vs. sham	67	Children	Mixed	SR, Q high	Anxiety reduction (YPAS): WMD = −17 (RR: [−30.51; −3.49])
2015 (e12)	1–3 × auricular acupuncture vs. sham	451	Mixed	Mixed	SR, Q moderate	Anxiety reduction: SMD = –1.11 (95% CI: [−1.61; −0.61]; p <0.01)
Symptom: Gastrointestinal dysfunction						
2016 (e40)	Acupuncture vs. sham/standard	540	Cancer patients	Colorectal surgery	SR, Q high	Flatus: WMD = −7.48 h (95% CI: [−14.58; −0.39]) Defecation: WMD = −18.04 h (95% CI: [−31.9; −4.19])
2017 (e49)	Acupuncture or acupressure vs. sham/standard	776	Cancer patients	Abdominal surgery	SR, Q high	Flatus: SMD = −0.82 (95% CI: [−1.47; −0.17]); Defecation: SMD = −0.98 (95% CI: [−1.73; −0.22])
Symptom: Pain						
2015 (e48)	Acupuncture and acupressure vs. sham	4578	Adults	Mixed	SR, Q high	Pain: SMD = −1.05 (95% CI: [−1.44; −0.67]; p <0.01 [vs. control]), SMD = −0.72 (95% CI: [−1.03; −0.41]; p <0.01 [vs. sham])
2016 (e40)	Acupuncture vs. sham/standard	540	Cancer patients	Colorectal surgery	SR, Q high	No effect on sensation of pain or use of analgesics
2016 (e73)	Acupuncture vs. sham	682	Adults	Mixed	SR, Q moderate	Pain: SMD = −1.27 (95% CI: [−1.83; −0.71]; p <0.01); opioids (dose given in mg): SMD = −0.72 (95% CI: [−1.2; −0.22]; p <0.01)
Symptom: Nausea and vomiting						
2012 (e26)	Acupressure of PC 6	649	Women	Cesarean	SR, Q high	Reduced intraoperative nausea: RR = 0.59 (95% CI: [0.38; 0.9]); no postoperative effect
2015 (e44)	Acupuncture vs. acupressure of PC 6	7667	Mixed	Mixed	SR, Q high	Nausea: RR = 0.68 (95% CI: [0.6; 0.77]) Vomiting: RR = 0.6 (95% CI: [0.51; 0.71])
2016 (e40)	Acupuncture vs. sham/standard	540	Adult cancer patients	Colorectal surgery	SR, Q high	No effect

* The complete table is available on the internet as *eTable 1*

CI, confidence interval; N, sample size; PC 6, pericardium 6 point; Q, quality determined by AMSTAR score; RR, relative risk; sham, acupuncture/acupressure at points for which no healing effects have been attributed; SMD, standardized mean difference; SR, systematic review; WMD, weighted mean difference; YPAS, Yale Preoperative Anxiety Scale

following surgery (*Table 1*, *eTable 1*). All three reviews concluded that the stimulation of acupuncture points can improve motility and lead to both shorter time to first flatus and earlier defecation after surgery. A further eleven systematic reviews (three of high quality, and five of moderate quality) focused on treating postoperative nausea and vomiting through acupuncture and acupressure. Of these, nine reviews reported a positive effect (*Table 1*, *eTable 1*).

Table 2 and *eTable 2* indicate the effectiveness of aromatherapy with various substances at the onset of, and during courses of, nausea and vomiting. A total of nine studies were evaluated, including seven RCTs (of which only one was of good quality) and one systematic review (of high quality). Four RCTs showed that aromatherapy can significantly improve nausea and vomiting. The systematic review, however, showed only low evidence for the use of aromatherapy for reducing nausea and vomiting, with poor overall study quality (e1).

Possible uses of phytotherapy for antiemesis are listed in *Table 3* and *eTable 3*. Currently, studies on treatments of surgical patients have only tested the effects of ginger. We did not find any results for other substances that could have a positive effect on gastrointestinal function, such as artichokes or black pepper. The mechanism of action of ginger has now been elucidated. Similar to the mechanisms of the setron group antiemetics, it seems to be based on the influence of the ingredients gingerol and shogaol on the 5-HT_3 receptors (4). Although the twelve RCTs examined here were mostly of high methodological quality (with only two of poor methodological quality), the results from them were inhomogeneous (*Table 3*, *eTable 3*). In fact, some studies even showed an increase of nausea and vomiting during therapy with ginger. Possible side effects of taking ginger are heartburn and upper abdominal discomfort. Traditionally, ginger is used once nausea has started. As none of the studies examined the effects of a symptom-bound therapy, it still remains unclear whether ginger in this case could have a positive effect.

In an Italian placebo-controlled RCT (n = 60) of good methodological quality according to Jadad-Score

TABLE 2

Effect of perioperative or postoperative aromatherapy on anxiety, stress, pain, nausea, vomiting, and sleep quality*

Year	Intervention	N	Patients	Surgery	Type/quality	Results
Symptom: Anxiety and stress						
2013 (e58)	Bergamot oil vs. placebo (diffuser)	109	Adults	Ambulatory surgery	RCT, Q good	Anxiety reduction: −3 vs. −2 pts (p = 0.02)
2014 (e65)	Postoperative inhalation of lavender vs. water	60	Adults	Cardiac surgery	RCT, Q good	Anxiety reduction: −6.13 vs. −5.27 pts (immediate), −7.4 vs. 6.44 pts (3rd postoperative day)
Symptom: Pain						
2014 (e7)	Massage with eucalyptus–lemon oil vs. carrier oil vs. standard	60	Adults	Vitrectomy	RCT, Q good	Pain reduction: shoulder, −1.1 vs. −0.8 vs. 0.15 FPS; neck, −0.85 vs. −0.8 vs. 0.15 FPS; back, −0.75 vs. −0.6 vs. 0.3 FPS; waist, −0.9 vs. −1 vs. 0.1 FPS; arms, −0.85 vs. −0.05 vs. −0.05 FPS
Symptom: Nausea and vomiting						
2018 (e1)	Perioperative inhalation of diverse aromatic oils vs. placebo	402	Mixed	Mixed	SR, Q high	Nausea: SMD = −0.22 (95% CI: [−0.63; 0.18]; p = 0.28), antiemetic reduction: RR = 0.60 (95% CI: [0.37; 0.97], p = 0.04)
2016 (e37)	Inhalation of ginger/lavender/menthol vs. NaCl	80	Children (4–16 years)	Ambulatory surgery	RCT, Q good	Reduction of retching: 90% vs. 78%; reduction of antiemetics: 52% vs. 44%; reduction of vomiting: 9% vs. 11%

* The complete table is available on the internet as *eTable 2*

CI, confidence interval; FPS, Faces Pain Scale; N, sample size; NaCl, sodium chloride saline solution; pts, points; Q, quality determined by AMSTAR score (for SR) or Jadad score (for RCT); RCT, randomized controlled trial; RR, relative risk; SMD, standardized mean difference; SR, systematic review

(*eMethods*), administration of 3.5 g of psyllium husk after rectal resection (STARR) resulted in significantly less obstruction one week after surgery (obstructed defecation syndrome score according to Longo [ODS]: 6.25 ± 3.55 versus 11.94 ± 4.99, p<0.01; Cleveland clinic constipation score [CCS]: 6.59 ± 2.65 versus 15.10 ± 3.33, p<0.01) and less incontinence (Wexner incontinence score, difference in scores from baseline: 0.5 versus 2.70, p<0.01) (e2). This benefit was also evident in the follow-up after six months (constipation: ODS, 3.40 ± 5.26 versus 4.97 ± 4.21, p<0.05; CCS, 5.00 ± 3.82 versus 6.63 ± 3.68, p<0.01; incontinence, –0.17 versus 1.33, p<0.01). Another controlled study of 38 patients after ileostomy (which was however of poor quality, according to its Jadad score) showed that the group of patients who ate 7 g of psyllium husk each day (n = 20) had a significantly lower ileostomy output after 90 days (–322 mL) than those in the control group (n = 18) (–95 mL; p<0.0001) (e3).

Postoperative wound infection and anastomotic insufficiency

Already in ancient Egypt, infected wounds were treated with fat and honey (5). However, only very few, small studies have addressed acute treatment of surgical wounds, as shown in an overview of the current study situation in *Table 4* and *eTable 4*. The current data situation is heterogeneous and not convincing overall. Many other plant extracts are used worldwide in traditional medical practices for wound healing (6). However, as efficacy has so far only been investigated in isolated cases and in preclinical wound healing models, it can not be adequately assessed clinically.

Wound healing and and healing of colorectal anastomosis seem to be influenced by the composition of the gut microbiome (7, 8). Controlled studies have shown clear indications in humans that the intestinal microbiome changes postoperatively (9); in particular, levels of lactobacilli and bifidobacteria appear to decrease. A 2013 meta-analysis (13 RCTs, 962 patients) of moderate quality found that probiotics significantly reduced the rate of septic complications after general surgery (10). However, the optimal composition and dosage of probiotics remains to be determined. Furthermore, the extent to which the intestinal microbiome is causally involved in postoperative complications in humans is still not clear.

Postoperative pain

Studies on CAM for postoperative pain have been most frequently carried out for acupuncture and acupressure. The results are listed in *Table 1* and *eTable 1*. Six of the ten systematic reviews reported a reduced perception of pain or a reduced need for analgesics in patients treated with acupuncture or acupressure. Two further reviews stated that they could not comment on the effectiveness of acupuncture treatment due to a small sample size or inhomogeneous data.

Aromatherapy seems to offer another option for pain relief. The results of recent studies are shown in *Table 2* and *eTable 2*. Eight studies were identified (including seven RCTs). Due to the lack of blinding in these studies, their methodological quality is

TABLE 3

Potential uses of phytotherapy for surgical patients*

Year	Intervention	N	Patients	Surgery	Type/quality	Results
Symptoms: Anxiety and cognitive dysfunction, studies on therapy with valerian						
2015 (e28)	1060 mg valerian vs. placebo	61	Adults	Cardiac surgery	RCT, Q good	Mini-Mental State: 26.5 vs 24 pts on 10th day; 27.5 vs 24.8 pts on 60th day (OR = 0.11 [95% CI: (0.02; 0.55)])
2014 (e61)	Preoperative 100 mg valerian vs placebo	20	Adults (17–31 years)	OMSF (wisdom teeth)	RCT, Q good	Anxiety: 20% vs 55% (as rated by scientists; p = 0.02), 25% vs 50% (as rated by surgeons, p = 0.102)
Symptoms: Nausea and vomiting, studies on therapy with ginger						
1993 (e60)	Preoperative, 10 mg MCP vs 1 g ginger vs placebo	120	Women	Gynecologic (lap.)	RCT, Q good	Nausea: 27% vs 21% vs 41% (p = 0.05); patients who used antiemetics: 13 vs 6 vs 15 (p = 0.02)
1995 (e10)	Preoperative, placebo vs 0.5 g ginger vs 1 g ginger	108	Women	Gynecologic (lap.)	RCT, Q good	Nausea: 22% vs 33% vs 36%; vomiting:14% vs 17% vs 31% (OR [per 0.5 g ginger] = 1.39 for nausea and OR [per 0.5 g ginger] = 1.55 for vomiting)
2006 (e57)	Preoperative, 1 g ginger vs P	120	Women	Gynecologic	RCT, Q good	Nausea: 48% vs 67%; vomiting: 28% vs 47% (p = 0.04); nausea score: 0 vs 0 pts (immediately), 1 vs 2 pts (at 2/6/12 h), 0.5 vs 0.5 pts (24 h)
2003 (e23)	Perioperative, placebo vs 300 mg ginger vs 600 mg ginger	180	Women	Gynecologic (lap.)	RCT, Q good	Nausea: 49% vs 56% vs 53% Vomiting: 27% vs 43% vs 40%
2006 (e68)	Preoperative, placebo vs 0.5 g ginger	120	Adults	Thyroidectomy	RCT, Q good	Nausea: 23% vs 20%; Vomiting: 5% vs 7% Repeated vomiting: 3% vs 0%
2013 (e35)	Preoperative, 1 g ginger vs placebo	239	Women	Cesarean	RCT, Q good	Intraoperative nausea: 52% vs 61%; Vomiting: 27% vs 37%; Episodes of nausea: VAS = −0.4 (95% CI: [0.74; 0.05]; p = 0.02)
2013 (e56)	Preoperative, 1 g ginger vs placebo	160	Adults	Mixed	RCT, Q good	Nausea (VAS): 2.9 vs 3.5 pts (2 h; p = 0.04)
2017 (e64)	Preoperative, 1 g ginger vs 2 × 500 mg ginger vs placebo	122	Adults	Cataract surgery	RCT, Q good	Nausea: 10% vs 16% vs 0% (immediately; p <0.01); 15% vs 13% vs 0% (at ward; p >0.3); 10% vs 8% vs 0% (2 h; p = 0.04); 3% vs 13% vs 2% (6 h; p <0.02)
2018 (e14)	Preoperative, 500 mg ginger vs placebo	150	Women	Chole-cystectomy (lap.)	RCT, Q good	Nausea: 2.0 vs 2.9 pts (2 h, p = 0.03); 2.8 vs 3.2 pts (4 h; p = 0.35); 1.8 vs 2.0 pts (6 h; p = 0.62); 0.4 vs 1.8 (12 h, p = 0.04)

* The complete table is available on the internet as *eTable 3*

CI, confidence interval; lap., laparoscopic; MCP, metoclopramide drops; N, sample size; OR, odds ratio; pts, points; OMFS, oral and maxillofacial surgery; Q, quality determined by Jadad score; RCT, randomized controlled trial; VAS, Visual Analog Scale

predominantly rated as poor by the Jadad scoring system (see *eMethods*). But it must be emphasized that it is difficult to blind a study on aromatherapy. Five of the eight studies reported significant improvement after aromatherapy. The aroma was mostly lavender. In principle, aromatherapy offers a number of advantages: it is inexpensive, available without prescription, has no risk of addiction, has a low side-effect profile (after allergies have been excluded), and can be independently used and modulated by the patient depending on the application system.

Whether music therapy can have pain-reducing effects was examined in two systematic reviews, which were of good and moderate quality. Both reviews reported a reduction in pain perception (*Table 5*, *eTable 5*).

A further study, which was however non-controlled and of poor methodological quality, examined an extensive, multimodal, and holistic approach to reducing pain that consisted of multiple preoperative interviews and a combination of several of the therapies mentioned above (11). Even though the study found a significant reduction in pain (of –1.19 points, on a scale of 1 to 10, p<0.001), it is not very meaningful for everyday clinical practice due to methodological shortcomings and a questionable feasibility (as it carries high financial and time expenses).

Sleep disturbances, stress-related symptoms, and postoperative recovery

Depending on the type and extent of surgery, surgical interventions lead to a stress reaction that can become an independent problem in a post-aggression catabolic metabolism (12, 13). A simple and cost-effective way to reduce sympathicotonia and thus reduce sleep onset latency is to apply heat to the extremities (14, 15). Phytotherapeutically, lavender, valerian, and hops (humulus) are used in restlessness and sleep disturbances,

TABLE 4

Honey for wound treatment

Year	Intervention	N	Wound type	Surgery	Type/quality	Results
2006 (e55)	Manuka honey–alginate dressing vs Jelonet from postoperative day 2 onward	100	Acute	Toenail surgery	RCT, Q good	Healing after partial toenail removal (honey vs Jelonet): 32 vs 20 days (p = 0.01); no difference after total removal
2016 (e32)	Postoperative oral treatment with honey vs placebo	264	Acute	Tonsillectomy	SR, Q moderate	Pain: day 1 (SMD = −1.39; p = 0.03); day 5 (SMD = −0.31; p = 0.03) Use of anesthesia: day 1 (SMD = −0.93; p <0.01), day 3 (SMD = −0.93; p <0.01), day 5 (SMD = −1.12; p <0.01) Wound healing: day 1 (SMD = 0.86; p = 0.04), day 4 (SMD = 0.86; p = 0.05), day 7 (SMD = 1.13; p = 0.05), and day 14 (SMD = 0.61; p = 0.03)
2015 (e34)	Honey vs other wound dressings	213	Acute	Minor surgery	SR, Q high	Not assessable due to poor quality of the studies included in the systematic review
2015 (e34)	Honey vs washes (alcohol/iodine)	50	Infected, postoperative wound	Cesarean, hysterectomy	SR, Q high	Moderate evidence for honey: RR = 1.7 (95% CI: [1.1; 2.6])

* The complete table is available on the internet as *eTable 4*

CI, confidence interval; N, sample size; Q, quality determined by AMSTAR score (for SR) or by Jadad score (for RCTs); RCT, randomized controlled trial
RR, relative risk; SMD, standardized mean difference; SR, systematic review

although none of the preparations have been validly analyzed for treating surgical patients. At present there are only two RCTs of good quality that have addressed the effectiveness of valerian in surgical patients (*Table 3, eTable 3*). In the first study, a preoperative dose of valerian was tested for reducing anxiety in patients about to undergo wisdom tooth surgery. In the second study, the effect of valerian on the development of cognitive dysfunction after cardiac surgery was examined (*Table 3, eTable 3*). In both studies, valerian was found to have a positive effect. The efficacy of finished preparations containing lavender, valerian, or hops for sleep disturbances can not be determined due to lack of studies.

Acupuncture and acupressure are also used in CM/NT to reduce stress and anxiety as well as to improve sleep. Two systematic reviews (of high and moderate quality) have examined these for surgical patients, and both report reduction in anxiety (*Table 1, eTable 1*).

Seven studies (including five RCTs) examined the efficacy of aromatherapy in reduction of stress and anxiety related to surgery (*Table 2, eTable 2*). Four studies showed a positive effect from aromatherapy, although only one study was of good methodological quality. Both studies that addressed improving sleep showed a positive, significant effect; however, both were rated to be of poor quality, as they were non-controlled experimental studies. Overall, it is therefore difficult to make a final assessment. None of the studies shown in *Table 2* or *eTable 2* reported any impact on physical parameters, such as blood pressure or heart rate (data not shown).

The effectiveness of the therapeutic use of music to reduce anxiety and stress associated with surgery was analyzed in five systematic reviews of predominantly high quality, in both children and adults. Four out of five systematic reviews found a positive effect for this (*Table 5*, *eTable 5*). Only one review that assessed the anxiety of children (younger than 7 years of age) prior to anesthesia induction found that treatment with midazolame led to a greater reduction of anxiety than music (e4).

Concepts such as mindfulness-based stress reduction (MBSR) have already been used successfully in the area of oncology, among others (16). This systematic search did not find studies testing MBSR or any other form of mind body medicine (MBM) for surgical patients. MBM serves the biopsychosocial strengthening of personal coping resources, in order to give the patient more autonomy and responsibility in dealing with illness. The success of such strategies has been shown in surgery in recent years. Approaches such as the Fast Track (FT) program or the Enhanced Recovery After Surgery (ERAS) program include elements of modern mind body medicine (17, 18). Patients are taught by the surgeon that they are an "active part" of the recovery process. Through a willingness to mobilize and to early normal food intake, the person concerned can actively contribute to the improvement of his or her state of health (19, 20). The contribution of the psyche to the success of FT and ERAS should be examined in more detail in the future.

Postoperative recovery may also be positively influenced by acupuncture, as reported by Asmussen et al. in two systematic reviews of moderate quality (e5, e6). For both cardiac and neurosurgical patients, they concluded that acupuncture treatment is likely to result in a more rapid recovery (*Table 1, eTable 1*).

TABLE 5

Perioperative and postoperative music therapy*

Year	Intervention	N	Patients	Surgery	Type/quality	Results
Symptom: Anxiety, stress, and sleep disturbances						
2013 (e18)	Perioperative: music	955	Adults	Cardiac surgery/ intervention	SR, Q high	Stress reduction: WMD = −1.26 (95% CI: [−2.30; −0.22], p = 0.02); anxiety: SMD = −0.70 (95% CI: [−1.17, −0.22], p <0.01); quality of sleep: SMD = 0.91 (95% CI: [0.03; 1.79], p = 0.04)
2013 (e19)	Preoperative: music	2051	Adults	Mixed	SR, Q high	Anxiety: −5.72 pts (95% CI: [−7.27; −4.17], p <0.01
2015 (e66)	Music vs other procedure or standard	781	Women	Gynecologic	SR, Q moderate	One study each showed a significant reduction of anxiety or fatigue, respectively
2015 (e29)	Postoperative: music	630	Children/ youth up to 18 years old	Orthopedic, cardiac, and ambulatory	SR, Q high	Anxiety: SMD = −0.34 (95% CI: [−0.66; −0.01]) Stress: SMD = −0.50 (95% CI: [−0.84; −0.16])
2015 (e4)	Music vs midazolame	123	Children up to 7 years	Ambulatory surgery	SR, Q high	Significantly better anxiety reduction with midazolame than with music therapy (p = 0.02)
Symptom: Pain						
2015 (e66)	Music vs other procedure or standard	781	Women	Gynecologic	SR, Q moderate	Significant reduction of pain (in five of seven studies) and of need for anesthesia (in one study)
2015 (e29)	Postoperative: music	630	Children/youth up to 18 years old	Mixed	SR, Q high	Pain: SMD = −1.07 (95% CI: [−2.08; −0.07])

* The complete table is available in the *eMethods*
CI, confidence interval; N, sample size; pts, points; Q, quality determined by AMSTAR score; SMD, standardized mean difference; SR, systematic review; WMD, weighted mean difference

Risks of naturopathic treatment and complementary medicine

None of the research documented any serious side effects for the methods used. The safety of acupuncture in routine medical care has been studied in Germany in more than 300 000 patients, with only 0.8% of the patients experiencing side effects requiring treatment (21).

Herbal preparations can be a safety hazard in everyday clinical practice, as they are often taken by patients without consulting a physician (1, 3). Some substances, such as St. John's wort, have a significant interaction risk (22, 23). For instance, substances such as cranberry are suspected of increasing the risk of bleeding (24). Although the risk may be very low, perioperative uncertainties persist. Phytotherapeutic drugs should therefore be discontinued prior to major surgery for safety reasons.

Conclusion

CM/NT offer a wide range of possible supportive therapy options. So far, however, only a few measures have been investigated in surgically-treated patients. The use of acupuncture and acupressure has been evaluated in numerous studies for postoperative nausea and vomiting and pain therapy and has been shown to alleviate symptoms. Although recent studies show that ginger can accelerate gastric emptying, they could not establish it as a drug for prophylaxis of postoperative nausea and vomiting. The effectiveness of phytotherapeutics, such as valerian, hops, and lavender, at reducing anxiety and sleep disturbances of surgical patients can still not be determined with certainty from the current study situation. Non-pharmacological procedures, such as music therapy, have been shown by several studies to alleviate restlessness, stress, anxiety, and pain, both preoperatively and postoperatively. Relaxation techniques and mindfulness-based therapies have not been studied for surgical patients. It also remains unclear whether treatment with honey or other plant-based substances has a positive effect on healing of infected wounds. Finally, research on the roles that the gut microbiome plays in helping to prevent postoperative complications, and its modulation by probiotics, is still in its infancy.

Conflict of interest statement
The authors declare that no conflict of interest exists.

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Key messages

- Basic knowledge of complementary medicine and naturopathic treatments is relevant for all clinically active physicians.
- Acupuncture and acupressure can reduce perioperative anxiety and have a positive effect on postoperative pain, nausea, vomiting, and gastrointestinal dysfunction.
- There is evidence that perioperative music therapy can reduce anxiety, stress and pain.
- Mind body medicine, with respect to strengthening patient self-management, is now part of established pre- and postoperative surgical programs.
- The safety of most naturopathic and complementary treatments has been confirmed, although uncertainties still exist regarding interactions of phytotherapeutic drugs.

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▶ **Supplementary material**

For eReferences please refer to:
www.aerzteblatt-international.de/ref4918

eMethods, eTables, eFigure, eBox:
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Supplementary material to:

Naturopathic Treatment and Complementary Medicine in Surgical Practice

A Systematic Review

by Ann-Kathrin Lederer, Christine Schmucker, Lampros Kousoulas, Stefan Fichtner-Feigl, and Roman Huber

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eTABLE 1

Acupuncture and acupressure

Reference*[1]	Year	Intervention*[2]	N	Patients	Surgery	Type/quality*[3]	Results
Symptom: Anxiety							
(e4)	2015	3 × preoperative auricular acupuncture by parents at relaxation points vs. sham	67	Children	Mixed	Systematic review; quality: high	Reduced anxiety (mYPAS): WMD = −17 (95% CI: [−30.51; −3.49]); increased cooperativeness: RR = 1.59 (95% CI: [1.01; 2.53])
(e12)	2015	1–3 × preoperative acupuncture at relaxation points, either as a one-time stimulation for 20–30 min or as a continuous stimulation on ear, vs. sham	451	Mixed	Before every medical treatment or operation	Systematic review; quality: moderate	Reduced anxiety (VAS): SMD = −1.11 (95% CI: [−1.61; −0.61], p <0.01)
Symptom: Gastrointestinal dysfunction							
(e74)	2015	Finger or body acupuncture or acupressure	*[5]	Women	Gynecologic (ERAS program)	Systematic review; quality: low	Improved motility: 50%, subjective (assessed by auscultation)
(e40)	2016	Postoperative acupuncture (needle/electro) over up to 10 days, daily, for 20–30 min vs. sham or no intervention	540	Adult cancer patients	Colorectal surgery	Systematic review; quality: high	Shorter time to first flatus: MD = −7.48 h (95% CI: [−14.58; −0.39]); shorter time to first defecation: MD = −18.04 h (95% CI: [−31.9; −4.19])
(e49)	2017	Acupuncture (needle/electro) or acupressure for 10–45 min vs. sham, or no intervention, different frequencies	776	Adult cancer patients	Oncological abdominal surgery	Systematic review; quality: high	Shorter time to first flatus: SMD = −0.82 (95% CI: [−1.47; −0.17]); shorter time to first defecation: SMD = −0.98 (95% CI: [−1.73; −0.22]); only acupressure: shorter time to first flatus: SMD = −0.69 (95% CI: [−1.06; −0.31]), no influence on defecation or length of hospital stay
Symptom: Postoperative recovery							
(e11)	2015	Perioperative electroacupuncture	321	Mixed	Cardiac surgery	Systematic review; quality: moderate	Less sedatives: SMD = 0.73 (95% CI: [0.11; 1.35], p = 0.02); shorter ventilation time: SMD = 0.38 (95% CI: [0.13; 0.63], p <0.01); reduced inotropes and vasoactive substances: SMD = 0.952 (95% CI: [0.43; 1.48], p <0.01)
(e5)	2017	Perioperative electroacupuncture	700	Adults	Craniotomy	Systematic review; quality: moderate	Reduced need for anesthesia: SMD = 0.475 (95% CI: [0.36; 0.59], p <0.01); earlier extubation: SMD = 0.38 (95% CI: [0.16; 0.60], p <0.001); earlier transfer: SMD = 0.30 (95% CI: [0.10; 0.50], p <0.01); reduced value of S100β: SMD = 0.52 (95% CI: [0.21; 0.83], p <0.01)
Symptom: Pain							
(e46)	2005	Acupuncture (needle/electro) before anesthesia, different durations	1689	Adults	Mixed	Systematic review; quality: moderate	No conclusive results due to inhomogeneous data
(e62)	2012	Acupuncture vs. sham	70	Adults	Knee arthroplasty (TKA), shoulder operation	Systematic review; quality: moderate	No conclusive results due to inhomogeneous data
(e15)	2013	Perioperative acupressure, auricular or body acupuncture vs. sham	222	Adults	Ambulatory knee surgery	Systematic review; quality: moderate	Reduced pain (in one of four studies); reduced need for analgesics (in three of four studies: p = 0.01 as well as p = 0.04; in one, not significant)

Reference*1	Year	Intervention*2	N	Patients	Surgery	Type/quality*3	Results
(e22)	2015	Perioperative acupuncture vs. sham or no intervention	480	Adults	Back surgery	Systematic review; quality: moderate	Reduced pain (VAS after 24 h): acupuncture vs. sham: SMD = −0.67 (95% CI: [−1.04; −0.31], p <0.01, N = 123); acupuncture vs. no treatment : SMD = −0.69 (95% CI: [−1.06; −0.33], p <0.01, N = 124); reduced need for opioids: SMD = −0.77 (95% CI: [−1.14; −0.41], p <0.01)
(e51)	2014	Acupuncture (needle/electro) or acupressure vs. sham	*4	Adults	Plastic surgery	Systematic review; quality: low	Reduced need for opioids: WMD (after 8 h) = −3.14 mg (95% CI: [−5.15; −1.14]),WMD (after 24 h) = −8.33 mg (95% CI: [−11.06; −5.61]),WMD (after 72 h) = −9.14 mg (95% CI: [−16.07; −2.22])
(e74)	2015	Auricular acupuncture vs. electrodes at the same site	*5	Women	Gynecologic (ERAS-program)	Systematic review; quality: low; only one study on pain	No difference
(e48)	2015	Acupuncture (needle/electro/plaster or seed) and acupressure vs. sham, no intervention or herbal therapy, different durations/frequencies	4578	Adults	Mixed	Systematic review; quality: high	Reduced pain (according to VAS): acupuncture vs. control: SMD = −1.05 (95% CI: [−1.44; −0.67], p <0.01, N = 1227), acupuncture vs. sham: SMD = −0.72 (95% CI: [−1.03; −0.41], p <0.01, N = 1284); reduced need for opioids: SMD = −4.99, (95% CI: [−7.51; −2.47], p <0.01, N = 399)
(e73)	2016	Perioperative acupuncture, different duration/ frequency, vs. sham	682	Adults	Mixed	Systematic review; quality: moderate	Reduced pain on 1st postoperative day: SMD = −1.27 (95% CI: [−1.83; −0.71], p <0.01); reduced need for opioids: SMD = −0.72 (95% CI: [−1.21; −0.22], p <0.01) (dose measured in mg)
(e40)	2016	Postoperative acupuncture (needle/electro; up to 8 points) over up to 10 days, 20–30 min vs. sham or no intervention	540	Adult cancer patients	Colorectal surgery	Systematic review; quality: high	No effect on pain sensation or need for analgesics
(e70)	2017	Preoperative electroacupuncture vs. sham	176	Adults	Craniotomy	Systematic review; quality: moderate	Better control of pain, reduced need for opioids, reduced dizziness (no calculations available)
Symptom: Nausea and vomiting							
(e71)	1996	Acupuncture (needle/electro) and acupressure (also with armband) vs. sham, antiemetic or no intervention	2305	Mixed	Mixed (>50% gynecologic)	Systematic review; quality: low	Inhomogeneous study situations, overall possible positive effects
(e45)	1999	Acupuncture (needle/electro) or acupressure vs. sham, no intervention or antiemetic	1679	Mixed	Mixed (>50% gynecologic)	Systematic review; quality: moderate	Better than placebo; early nausea (<6 h postoperative): RR = 0.34 (95% CI: [0.2; 0.58], NNT = 4), late nausea (>6 h postoperative): RR = 0.47 (95% CI: [0.34; 0.64], NNT = 5); comparable to antiemetics for early vomiting (RR = 0.89 (95% CI: [0.47; 1.67], NNT = 63) and late vomiting (RR = 0.8 (95% CI: [0.35; 1.81], NNT = 25), no difference for children
(e26)	2012	Acupressure of Pericardium 6	649	Women	Cesarean	Systematic review; quality: high	Reduced intraoperative nausea: RR = 0.59 (95% CI: [0.38; 0.9]), no effect on postoperative nausea or on intra- or postoperative vomiting
(e21)	2013	Acupuncture (needle/electro) and acupressure (also with armband) of Pericardium 6 vs. sham or no intervention	2534	Mixed	Mixed (47% gynecologic)	Systematic review; quality: moderate	Acupuncture: reduced frequency of vomiting (0–6 h): RR = 0.36 (95% CI: [0.19; 0.71], p <0.01), reduced nausea (0–24 h): RR = 0.25 (95% CI: [0.1; 0.61], p <0.01); acupressure: reduced nausea : RR = 0.71 (95% CI: [0.57; 0.87], p = 0.01), reduced frequency of vomiting (>24 h): RR = 0.62 (95% CI: [0.49; 0.8], p <0.01)
(e20)	2014	Acupuncture vs. antiemetic or no intervention, different durations/frequencies	370	Adults	Abdominal surgery	Systematic review; quality: moderate	Improvement of gastroparesis: only acupuncture: RR = 1.27 (95% CI: [1.13; 1.44], p <0.01) acupuncture and medication: RR = 1.37 (95% CI: [1.18; 1.58], p <0.01)

Reference *1	Year	Intervention*2	N	Patients	Surgery	Type/quality*3	Results
(e51)	2014	Acupuncture (needle/electro) or acupressure vs. sham	*4	Adults	Plastic surgery	Systematic review; quality: low	Reduced nausea : RR = 0.67 (95% CI: [0.53; 0.86])
(e44)	2015	Perioperative acupuncture (also electro-) or acupressure (using an armband) of Pericardium 6	7667	Mixed	Mixed	Systematic review; quality: high	Reduced nausea : RR = 0.68 (95% CI: [0.6; 0.77], N = 4742); reduced frequency of vomiting: RR = 0.6 (95% CI: [0.51; 0.71], N = 5147); reduced need for emergency antiemetics: RR = 0.64 (95% CI: [0.55; 0.73], N = 4622) Similar effects as conventional antiemetics in direct comparison
(e74)	2015	Acupressure	*5	Women	Gynecologic (ERAS-program)	Systematic review; Quality: low	Reduced frequency of vomiting, reduced nausea : mean 27% (results of other studies: 30%, 16%, 38%, 32%)
(e40)	2016	Postoperative acupuncture (needle/electro; up to 8 points) over up to 10 days, daily, 20–30 min vs. sham, or no intervention	540	Adult cancer patients	Colorectal surgery	Systematic review; quality: high	No effect on nausea or vomiting
(e5)	2017	Perioperative electroacupuncture	700	Adults	Craniotomy	Systematic review; quality: moderate	Reduced frequency of vomiting, reduced nausea : OR = 2.56 (95% CI: [1.18; 5.55], p <0.02)
(e50)	2017	Perioperative acupressure	894	Adults	Gynecologic and abdominal surgery	Systematic review; quality: moderate	Reduced nausea : OR = 0.52 (95% CI: [0.39; 0.7], p <0.01]; reduced frequency of vomiting: OR = 0.54 (95% CI: [0.39; 0.75], p <0.01)

*1 See *eReferences*, *2 Unless otherwise stated, the reference group was inhomogeneous (sham acupuncture/no intervention/other intervention),
*3 Calculated according to AMSTAR score, *4 15 RCTs evaluated, total number of patients not given; *5 Total number not given
CI, confidence interval; ERAS, enhanced recovery after surgery; mYPAS, modified Yale Preoperative Anxiety Scale (20–60); N, sample size; NNT, number needed to treat; OR, odds ratio; RR, relative risk; sham, acupuncture/acupressure at points for which no healing effects are attributed; SMD, standardized mean difference; VAS, Visual Analog Scale (1–10); WMD, weighted mean difference

eTABLE 2

Effect of perioperative or postoperative aromatherapy on anxiety, stress, pain, nausea, vomiting, and sleep quality

Reference*1	Year	Intervention	N	Patients	Surgery	Type/quality	Results
Symptom: Anxiety and stress							
(e24)	2011	Preoperative inhalation of lavender oil or water	72	Adults	Cardiac and general surgery	Quasi-experimental study, quality*2: bad	STAI (intervention vs. placebo): −12.4 vs. −2.4 pts (p <0.01)
(e33)	2012	Postoperative massage with mandarin oil (A), carrier oil (B), or no intervention (C)	60	Children up to 3 years	Craniofacial surgery	RCT, quality*2: bad	COMFORT-B (groups A / B / C):11.1 / 11.6 / 12.1 pts; NAS (stress): 2 / 4 / 3 pts; NAS (pain): 1 / 0 / 1 pt (p not given)
(e58)	2013	Aroma diffuser with bergamot oil or placebo	109	Adults	Ambulatory surgery	RCT, quality*2: good	STAI (intervention vs. placebo): −3 vs. −2 pts (p = 0.02)
(e65)	2014	Inhalation on the 2nd and 3rd postoperative days of lavender oil versus water	60	Adults	Cardiac surgery	RCT, quality*2: good	STAI (intervention vs. placebo): before intervention : 48.73 vs. 48 pts; after intervention 42.6 vs. 42.73 pts, on 3rd postoperative day: 41.33 vs. 41.56 pts (p not significant at any point)
(e72)	2017	Preoperative inhalation of lavender essential oil versus no intervention	100	Adults	Ambulatory ENT surgery	Controlled study, quality*2: bad	Anxiety reduction according to VAS (intervention vs. control): −1.07 vs. −0.01 (p <0.01)
(e69)	2017	Aromatherapy during biopsy with lavender-sandal-wood (A), orange-peppermint (B), or placebo (C)	87	Women	Breast biopsy	RCT, quality*2: bad	STAI: group A, from 48 to 37 pts; group B, from 43 to 37 pts; group C, from 43 to 39 pts; difference A vs. C, p = 0.03
(e13)	2018	Preoperative massage with lavender oil or no intervention	80	Adults	Colorectal surgery	RCT, quality*2: bad	STAI (intervention vs. control): 35.25 vs. 45.40 pts on morning of surgery (p <0.01)
Symptom: Pain							
(e39)	2016	Postoperative inhalation of lavender oil or oxygen	50	Women	Breast biopsy	RCT, quality*2: bad	NAS (Intervention vs. control): 5 min after arrival on ward 0.2 vs. 1.26 pts, after 30 min 0.6 vs. 1.1 pts, after 60 min 0.6 vs. 1.42 pts; emergency medication required: 1 vs. 6; excellent satisfaction with pain control: 92% vs. 52% (p <0.05)
(e38)	2006	Postoperative inhalation of lavender oil or baby oil	54	Adults	Bariatric surgery	RCT, quality*2: bad	Need for anesthesia (intervention vs. control): 42% vs. 82% (p <0.01); use of anesthesia (intervention vs. control): 2.38 mg vs. 4.26 mg morphine (p = 0.04)
(e27)	2011	Perioperative inhalation of lavender oil or neutral oil	200	Women	Cesarean	RCT, quality*2: bad	VAS (intervention vs. control): baseline 6.16 vs. 5.78, after 30 min 3.67 vs. 5.29 (p <0.01), after 8 h 2.01 vs. 4.64 (p <0.01), after 16 h 0.67 vs. 4.05 (p <0.01)
(e67)	2013	Postoperative inhalation of lavender oil or no intervention	48	Children (6–12 years)	Tonsillectomy	RCT, quality*2: bad	Number of oral paracetamol doses (intervention vs. control): 1st day, 2.1 vs. 2.6 (p <0.05), 2nd day: 2.1 vs. 3.4 (p <0.01), 3rd day: 1.3 vs. 2.4 (p <0.01) VAS: 1st day, 7.0 vs. 7.6 pts, 2nd day: 6.8 vs. 7.0 pts, 3rd day 3.9 vs. 5.9 pts (p not given)
(e63)	2014	Postoperative inhalation of lavender oil	40	Adults	Cardiac surgery	Single-arm study, quality*2: bad; no control group	NAS reduction: from 5.6 to 5.0 pts after lavender inhalation (p not significant)

Reference*[1]	Year	Intervention	N	Patients	Surgery	Type/quality	Results
(e7)	2014	Massage of different body regions with eucalyptus-lemon oil (A), neutral oil (B), or no intervention (C)	60	Adults	Vitrectomy	RCT, quality*[2]: good	FPS, day 1 (for groups A / B / C): shoulder: −1.1 / −0.8 / +0.15 pts; neck: −0.85 / −0.8 / +0.15 pts; back: −0.75 / −0.6 / +0.3 pts; waist: −0.9 / −1 / +0.1 pts; arms: −0.85 / −0.05 / −0.05 pts (p not given); pain reduction also observed on days 2 and 3 (data not shown)
(e11)	2015	Inhalation on 2nd postoperative day of lavender oil or oxygen	50	Adults	Cardiac surgery	RCT, quality*[2]: bad	VAS (intervention / placebo): baseline, 5.62 / 6.27 pts; after 5 min, 4.26 / 6.23 pts (p <0.01); after 30 min, 4.39 / 6.3 pts (p <0.01); after 60 min, 4.11 / 6.35 pts (p <0.01)
(e53)	2015	Postoperative inhalation of rose oil or almond oil	64	Children (3–6 years)	Mixed	RCT, quality*[2]: bad	TPPPS (intervention / placebo) directly at arrival on ward: 3.8 vs. 3.1 pts, after 3 h: 1.0 / 2.6 pts, after 6 h: 1.03 vs. 2.03 pts, after 9 h: 0.9 / 1.6 pts, after 12 h 0.4 / 1.1 pts (p <0.01 for all time points)
Symptom: Nausea and vomiting							
(e9)	2004	Inhalation (upon request) of peppermint, propanol, or NaCl	33	Adults	Ambulatory surgery	RCT, quality*[2]: bad	VAS (for all therapies): −1.79 pts (p <0.05), but not difference between the groups
(e31)	2011	Inhalation (upon request; using an aroma pad) of mix of ginger, spearmint, peppermint and cardamom (A) vs. ginger alone vs. isopropyl alcohol vs. NaCl	303	Adults	Gynecologic abdominal surgery	RCT, quality*[2]: bad	Ginger (OR = 1.86 [95% CI: (1.22; 3.0), p <0.01]) or mix (OR = 2.7 [95%-CI: (1.78; 4.56), p <0.01]) better than NaCl or alcohol (95% CI: [1.08; 2.13], p = 0.02; 95% CI: [1.5; 3.17], p <0.01) for nausea and need for antiemetics (95% CI: [−43.1; −8], p = 0.02; 95% CI: [−57.8; −22.7], p <0.01)
(e25)	2012	Inhalation (upon request) of peppermint oil or NaCl, or treatment with Zofran	71	Women	Mixed	RCT, quality*[2]: bad	VAS (1–20, peppermint / NaCl / Zofran): before intervention: 12.5 / 11.9 / 11.3 pts; after 5 min: 8.0 / 7.5 / 6.8 pts; after 10 min: 2.4 / 3.4 / 5.8 pts (p not significant at any time point)
(e42)	2012	Inhalation of peppermint oil or placebo, or treatment with standard antiemetics	35*[3]	Women	Cesarean	RCT, quality*[2]: bad	Reduction of nausea and vomiting for 17 out of 19 patients at 2 min and 5 min after peppermint treatment; no improvement after placebo or antiemetics (at either 2 min or 5 min)
(e1)	2018	Perioperative inhalation of different aromatic oils (including peppermint) or placebo	402	Mixed	Mixed	Systematic review, quality*[2]: high	General aromatherapy vs. placebo: SMD = −0.22 (95% CI: [−0.63; 0.18], p = 0.28; reduced need of antiemetic treatment after aromatherapy: RR = 0.60 (95% CI: [0.37; 0.97], p =0.04; peppermint inhalation vs. placebo: SMD = −0.18 (95% CI: [−0.86; 0.49], p = 0.59
(e30)	2014	Inhalation for nausea (upon request) of spearmint, peppermint, lavender, and ginger vs. placebo	339	Adults	Mixed	RCT, quality*[2]: bad	Nausea for 121 Patienten, of whom 94 were randomized (54 intervention, 40 placebo); NAS (intervention / placebo): initial 5.4 / 5.6 pts, after use 3.4 / 4.4 pts (p = 0.03)
(e8)	2015	Postoperative inhalation (2 drops every 30 min, aroma pad) of ginger extract or NaCl	120	Adults	Nephrectomy	RCT, quality*[4]: bad	VAS (intervention / placebo): 7.1 / 7.4 pts after 30 min, 4.2 / 7.4 pts after 60 min, 2.4 / 7.4 pts after 90 min, 2.0 / 7.4 after 120 min, 1.1 / 6.5 after 6 h (for all, p <0.01); need for ondansetron: 1.9 / 3.9 mg (p <0.01)
(e54)	2015	Inhalation (upon request) of spearmint, peppermint, lavender, and ginger	70	Adults	Ambulatory surgery	Exploratory study, quality*[4]: bad; no control group	Nausea reported for 25 patients; NAS (after use), −4.78 pts (p not given)
(e47)	2017	Postoperative inhalation of ginger oil or NaCl	60	Adults	Abdominal surgery	Quasi-experimental study, quality*[4]: bad	RINVR (intervention / placebo): 11.8 / 11.57 pts (baseline), 1.6 / 10.47 pts after 6 h, 1.0 / 9.07 pts after 12 h, 0.83 / 7.2 pts after 24 h; lower pts after intervention (p <0.01)
(e37)	2016	Inhalation for nausea of lavender, menthol, ginger, or NaCl	80	Children (4–16 years)	Ambulatory surgery	RCT, quality*[2]: good	BARF (intervention / placebo): reduction by 2 pts, 90% / 78%; use of antiemetic therapy, 52% / 44%; vomiting, 9% / 11% (p not significant in any case)

Reference*1	Year	Intervention	N	Patients	Surgery	Type/quality	Results
Improvement of sleep quality							
(e36)	2017	Postoperative massage with lavender oil or no intervention	60	Adults	General surgery	Experimental study, quality*4: bad	RCSF: increase of 25.72 pts (p <0.01) (as compared to control)
(e13)	2018	Preoperative massage with lavender oil or no intervention	80	Adults	Colorectal surgery	Experimental study, quality*4: bad	RCSF: increase of 24.02 pts (p <0.01) (as compared to control)

*1 See *eReferences;* *2 Calculated according to the Jadad score scale; *3 Unbalanced group sizes: of the 35 patients, 22 were in the intervention group, 8 in the placebo group, and 5 in the standard therapy group; *4 Calculated according to the AMSTAR score scale
BARF, Baxter Animated Retching Faces scale; CI, confidence interval; COMFORT-B, comfort behavior scale (pain, sedation) for young children; FPS, Faces Pain Scale; N, sample size; NaCl, sodium chloride saline solution; NAS, numeric analog scale (1–10);
OR, odds ratio; pts, points; RCSF, Richard Campbell sleep questionnaire; RCT, randomized controlled trial; RINVR, Rhodes Index of Nausea, Vomiting, and Retching; RR, relative risk; SMD, standardized mean difference;
STAI, State-Trait Anxiety Inventory; TPPPS, Toddler-Preschooler Postoperative Pain Scale; VAS, Visual Analog Scale (1–10)

eTABLE 3

Potential uses of phytotherapy for surgical patients[*1]

References[*1]	Year	Intervention	N	Patients	Surgery	Type/quality[*2]	Results
Symptom: Anxiety and cognitive dysfunction Studies on therapy with valerian							
(e28)	2015	Group 1: 1060 mg valerian Group 2: placebo (given perioperatively, every 12 h for 8 weeks)	61	Adults	Cardiac surgery	RCT, quality: good	MMSE (group 1 vs 2): preoperatively, 27.0 vs 27.0 pts; on 10th post-operative day, 26.5 vs 24.0 pts, on 60th postoperative day, 27.5 vs 24.8 pts (OR = 0.11; 95% CI: [0.02; 0.55])
(e61)	2014	Group 1: 100 mg valerian Group 2: placebo (given preoperatively)	20	Adults (17–31 years)	OMSF (wisdom teeth)	RCT, quality: good	DAS (group 1 vs 2): anxiety (as rated by scientists), 20% vs 55% (p = 0.02); anxiety (as rated by surgeons), 25% vs 50% (not significant)
Symptom: Nausea and vomiting Studies on therapy with ginger							
(e17)	1990	Group 1: 1 g ginger and placebo injection Group 2: placebo and MCP injection Group 3: placebo and placebo injection (given preoperatively)	60	Women	Gynecologic	RCT, quality: bad	Nausea rate: 28% in group 1, 30% in group 2, and 51% in group 3 (p = 0.05); patients who required additional antiemetics: none in group 1, one in group 2, and six in group 3 (p = 0.05)
(e60)	1993	Group 1: 10 mg MCP Group 2: 1 g ginger Group 3: placebo (lactose) (given preoperatively)	120	Women	Gynecologic (laparoscopic)	RCT, quality: good	Nausea rate: 27% in group 1, 21% in group 2, and 41% in group 3 (p = 0.05); patients who required additional antiemetics: 13 in group 1, six in group 2, and 15 in group 3 (p = 0.02)
(e10)	1995	Group 1: placebo Group2: 0.5 g ginger Group 3: 1 g ginger (given preoperatively)	108	Women	Gynecologic (laparoscopic)	RCT, quality: good	Nausea vs vomiting: group 1, 22% and 14% ; group 2, 33% and 17%; group 3, 36% and 31% (OR [per 0.5 g ginger] = 01.39 for nausea; OR [per 0.5 g ginger] = 1.55 for vomiting)
(e57)	2006	Group 1: 1 g ginger Group 2: placebo (given preoperatively)	120	Women	Gynecologic	RCT, quality: good	Nausea vs vomiting: group 1, 48% and 28%, group 2, 67% and 47% (p = 0.04); VAS (group 1 vs 2): immediately, 0 vs 0 ; 2 h postoperatively, 1.1 vs 2.0 ; 6 h postoperatively, 1.4 vs 2.4; 12 h postoperatively, 1.3 vs 2.0; 24 h postoperatively, 0.5 vs 0.5
(e23)	2003	Group 1: placebo Group 2: 300 mg ginger Group 3: 600 mg ginger (given pre- and postoperatively [3 h, 6 h])	180	Women	Gynecologic (laparoscopic)	RCT, quality: good	Nausea and vomiting: group 1, 49% and27% group 2, 56% and 43% group 3, 53% and 40% , respectively
(e68)	2006	Group 1: placebo Group 2: 0.5 g ginger (given preoperatively; both groups also received dexamethasone)	120	Adults	Thyroidectomy	RCT, quality: good	Nauseaa and vomiting: group 1: 23% and 5%, respectively; 3% repeated vomiting group 2: 20% and 7%, respectively; no repeated vomiting
(e35)	2013	Group 1: 1 g ginger Group 2: placebo (given preoperatively)	239	Women	Cesarean	RCT, quality: good	Intraoperatively: group 1, 52% nausea (nausea episodes reduced by −0.4, [95% CI: (0.74; 0.05), p = 0.02]), 27% vomiting; group 2: 61% nausea, 37% vomiting; postoperatively, no difference
(e56)	2013	Group 1: 1 g ginger Group 2: placebo (given preoperatively)	160	Adults	Mixed	RCT, quality: good	VAS (group 1 vs 2): 2.9 vs 3.5 after 2 h (p = 0.04) (only significant difference)

References[*1]	Year	Intervention	N	Patients	Surgery	Type/quality[*2]	Results
(e52)	2014	Group 1: 1 g ginger Group 2: placebo (given preoperatively; both also received 4 mg ondansetron)	100	Adults	Ambulatory surgery	RCT, quality: bad	Group 1: no nausea or vomiting in the first 12 h Group 2: at the maximum, 22% with nausea and vomiting (depending on time measured)
(e75)	2016	Group 1: 25 droups ginger extract in water Group 2: only water (given preoperatively)	92	Pregnant women	Cesarean	RCT, quality: bad	Average VAS score (group 1 vs 2): intraoperatively, 0.8 vs 2.3, p = 0.01; 2 h postoperatively, 0.3 vs 0.8, p = 0.13; 4 h postoperatively, 0.05 vs 0.1, p = 0.57
(e64)	2017	Group 1: 1 g ginger Group 2: 2 × 500 mg ginger Group 3: placebo (given preoperatively)	122	Adults	Cataract surgery	RCT, quality: good	Nausea, group 1 vs 2 vs 3: immediately postoperatively, 10% vs 16% vs 0% (p <0.01); upon arrival at ward: 15% vs 13% vs 0% (*P* >0.0.3); 2 h post-operatively, 10% vs 8% vs 0% (p = 0.04); 6 h postoperatively, 3% vs 13% vs 2% (p <0.02)
(e14)	2018	Group 1: 500 mg ginger Group 2: placebo (given preoperatively)	150	Women	Chole-cystectomy (laparoscopic)	RCT, quality: good	Nausea, average NAS score (group 1 vs 2): 2 h postoperatively, 2.0 vs 2.9, p = 0.03; 4 h postoperatively, 2.8 vs 3.2, p = 0.35; 6 h postoperatively, 1.8 vs 2.0, p = 0.62; 12 h postoperatively, 0.4 vs 1.8, p = 0.04

[*1] See *eReferences;* [*2] Calculated according to Jadad score
DAS, Dental Anxiety Score; MCP, metoclopramide; MMSE, Mini-Mental State Examination; N, sample size; NAS, Numeric Analog Scale (1–10); OMFS, oral and maxillofacial surgery; OR, odds ratio; pts, points; RCT, randomized controlled trial; VAS, Visual Analog Scale (1–10)

eTABLE 4

Honey for wound treatment

Reference[*1]	Year	Intervention	N[*4]	Wound type[*4]	Surgery	Type/quality	Results
(e55)	2006	Manuka honey–alginate dressing vs Jelonet on 2nd postoperative day	100	Acute	Toenail surgery	RCT, quality[*2]: good	Complete healing after partial toenail removal (honey vs Jelonet): 32 vs 20 days (*P* = 0.01); no difference after total removal
(e59)	2005	Honey dressing vs EUSOL (chlorinated lime and boric acid), twice daily for three weeks	43	Acute infected (abscess)	None	RCT, quality[*2]: bad	Wound on day 7 (honey vs EUSOL): clean and dry, 100% vs 66% (*P* < 0.01); granulation tissue, 100% vs 50% (*P* < 0.01); epithelialization, 87% vs 35% (*P* = 0.001); completion of epithelialization on day 21, 87% vs 55% (*P* = 0.05); duration of hospital stay: 16.08 vs 18.61 days (*P* = 0.02)
(e32)	2016	Postoperative oral treatment with honey vs placebo	264	Acute	Tonsillectomy	Systematic review, quality[*3]:- moderate	Pain on day 1 (SMD = −1.39; *P* = 0.03) and day 5 (SMD = −0.31; *P* = 0.03); use of anesthesia on day 1 (SMD = −0.93; *P* < 0.01), day 3 (SMD = −0.93; *P* < 0.01), and day 5 (SMD = −1.12; *P* < 0.01); wound healing on day 1 (SMD = 0.86; *P* = 0.04), day 4 (SMD = 0.86; *P* = 0.05), day 7 (SMD = 1.13; *P* = 0.05), and day 14 (SMD = 0.61; *P* = 0.03)
(e34)[*4]	2015	Honey vs other wound dressings	213	Acute	Minor surgery	Systematic review, quality[*3]: high	Not assessable due to poor quality
(e34)[*4]	2015	Honey vs washes (alcohol and povidone-iodine)	50	Infected post-operative wounds	C-section, hysterectomy	Systematic review, quality[*3]: high	Moderate evidence for honey: RR = 1.7 (95% CI: [1.1; 2.6])

[*1] See *eReferences*; [*2] Calculated according to the Jadad score; [*3] Calculated according to the AMSTAR score [*4] Results given separately as they represent distinct wound types
CI, confidence interval; EUSOL, Edinburgh University Solution of Lime; N, sample size; RCT, randomized controlled trial; RR, relative risk; SMD, standardized mean difference

eTABLE 5

Perioperative and postoperative music therapy

Reference*1	Year	Intervention	N*2	Patients*2	Surgery*2	Type/quality*3	Results
Symptom: Anxiety, stress and sleep disturbances							
(e18)	2013	Music therapy before, during, and after intervention, using different lengths and types, vs no intervention	955	Adults	Cardiac surgery/ intervention	Systematic review, quality: high	Stress reduction: MD = −1.26 (95% CI: [−2.30; −0.22], p = 0.02); anxiety: SMD = −0.70 (95% CI: [−1.17, −0.22], p <0.01); quality of sleep: SMD = 0.91 (95% CI: [0.03; 1.79], p = 0.04, N = 122)
(e19)	2013	Preoperative music therapy (mostly around 30 min and by patient's choice)	2051	Adults	Mixed	Systematic review, quality: high	Anxiety: −5.72 pts in STAI (95% CI: [−7.27; −4.17], p < 0.01) as well as −0.6 pts on other standardized anxiety scales (95% CI: [−0.9; −0.31], p <0.01)
(e66)	2015	Music therapy (relaxing or by patient's choice) vs other procedure or no intervention	781	Women	Gynecologic	Systematic review, quality: moderate	One study each showed a significant reduction of anxiety or fatigue, respectively
(e29)	2015	Postoperative music therapy (immediately after surgery, for 30–45 min)	630	Children/ youth up to 18 years old	Orthopedic, cardiac, and ambulatory surgery	Systematic review, quality: high	Anxiety: SMD = −0.34 (95% CI: [−0.66; −0.01]) Stress: SMD = −0.50 (95% CI: [−0.84; −0.16])
(e4)	2015	Music during induction of anesthesia vs midazolame	123	Children up to 7 years old	Ambulatory surgery	Systematic review, quality: high	Midazolame was significantly better than music therapy for anxiety reduction (p = 0.02)
Symptom: Pain							
(e66)	2015	Music therapy (relaxing or by patient's choice) vs other procedure or no intervention	781	Women	Gynecologic	Systematic review, quality: moderate	Significant reduction of pain (in five of seven studies) and of need for anesthesia (in one study)
(e29)	2015	Postoperative music therapy (immediately after surgery; for 30–45 min)	630	Children/ youth up to 18 years old	Orthopedic, cardiac, and ambulatory surgery	Systematic review, quality: high	Pain: SMD = −1.07 (95% CI: [−2.08; −0.07])

*1 See *eReferences;* *2 Refers only to patients who were enrolled in studies on music therapy; *3 Calculated according to the AMSTAR score
CI, confidence interval; MD, mean deviation; N, sample size; pts, points; SMD, standardized mean difference; STAI, State-Trait Anxiety Inventory

eBOX

Keyword search

- **Typical postoperative problems (as evaluated by all authors)**
  - Disturbance of gastrointestinal function (postoperative nausea and vomiting [PONV], paralytic ileus)
  - Wound infection/disturbed wound healing
  - Anastomotic leak
  - Pain
  - Sleep disturbances and stress-related symptoms
  - Delayed postoperative recovery

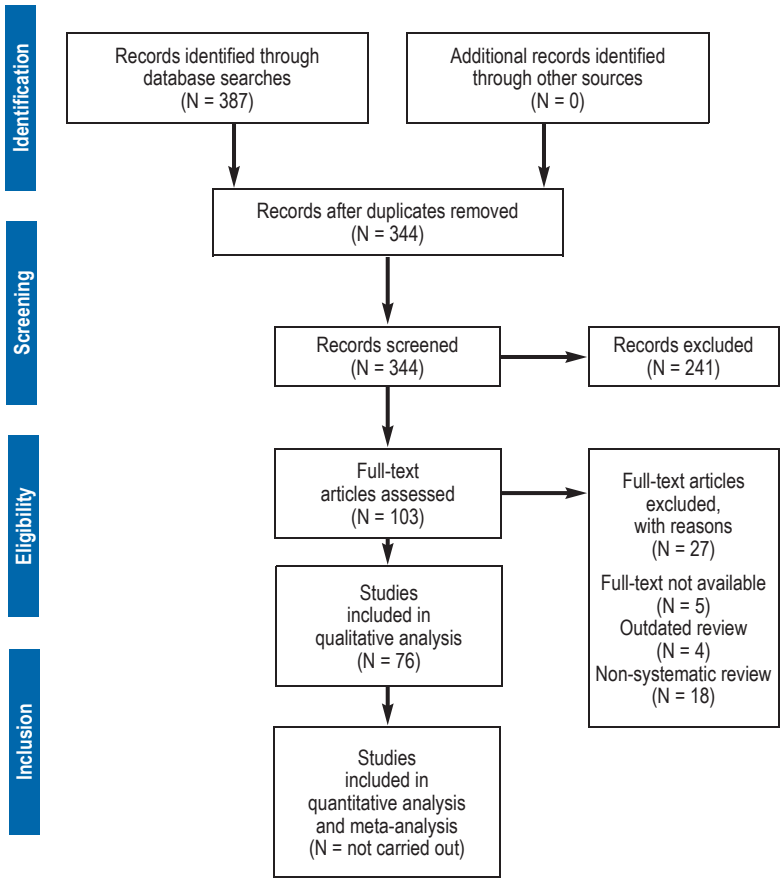
- **Possible treatment options to improve the typical postoperative problems (as evaluated by the two authors who are naturopaths, AKL and RH)**
  - "Acupuncture"
  - "Acupressure"
  - "Ginger"
  - "Black pepper"
  - "Artichoke"
  - "Psyllium" (as well as "fleaseed" and "plantago")
  - "Honey"
  - "Music therapy"
  - "Aroma therapy"
  - "Essential oil"
  - "Valerian"
  - "Humulus"
  - "Lavender"
  - "Mindfulness-based stress reduction"
  - "Mindfulness"
  - "Mind body medicine"

Search strategy

Search command: "keyword from list 2" [tiab] + surgery [tiab] + study design limit: systematic review

If no result: re-search without study design limit. The complete preset search period of the search engine was used. No limitations were applied for year of publication. Language limitations were set to considering only articles in English, German, Spanish, French, Italian, or Greek.

eFIGURE



PRISMA flow chart

eMETHODs

This review was carried out as a joint project of the Center for Complementary Medicine and the Department for General and Visceral Surgery of the Medical Center, University of Freiburg. Initially, an evaluation of the typical postoperative problems was carried out by all authors (*eBox*). Based on the clinical and scientific experience of two authors (AKL and RH), potentially suitable complementary medical procedures for treatment were defined for the systematic search (*eBox* „Keywords“).

The systematic literature review and evaluation were carried out according to the PRISMA guidelines by two authors (AKL and RH) via Medline (ncbi.nlm.nih.gov/pubmed), the Cochrane Library (cochranelibrary.com), and WebOfScience (webofknowledge.com). For evaluation, only articles in English, German, Spanish, French, Italian, or Greek were considered. As determined before beginning search, the title or abstract of appropriate articles had to be related to acute treatment in surgery (for all areas of surgery, including specialty disciplines, such as ophthalmology and otorhinolaryngology) and complementary medicine, as well the specified keywords. No restrictions were made regarding age, sex, or origin of patients. The search did not include studies comparing surgical and conventional therapy, or burns or wounds due to malignant, metabolic, or vascular diseases. The first search step looked for systematic reviews. In cases where the systematic reviews that were retrieved had different overall objectives (i.e., not in line with the inclusion and exclusion criteria of this review), any appropriate studies from the reference list were used to evaluate this review. If no systematic reviews were retrieved, a search for randomized controlled trials, controlled trials, and experimental studies on humans was carried out. All results were evaluated for inclusion by title and abstract.

Study logs, non-systematic summaries, and outdated versions of reviews that already had an update were not used for evaluation.

The quality assessment of the included publications was done by a scoring system. The modified German version of the AMSTAR score (e76) was used for systematic reviews, and the Jadad score, for clinical trials (e77). The German version of the AMSTAR score examines over eleven different questions that evaluate the planning of the review, the search strategy, the bias risk, conflicts of interest, the quality of systematic reviews, and meta-analyses. The maximum score is 11 points, with a score of 9–11 considered as high, 5–8 as moderate, and 0–4 as low. The Jadad score is a validated questionnaire that evaluates clinical intervention studies and assesses randomization, blinding, and dropout rates. It consists of five questions, with a maximum score of 5 points; a study is rated as “good” if it has a value of 3 or higher.

The article section “Risks of naturopathic treatment and complementary medicine” is based on a selective literature search by the two naturopathic authors and thus represents an expert opinion.