NICE National Institute for Health and Care Excellence

Desflurane for maintenance of anaesthesia

Evidence review

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This evidence review sets out the best available evidence on desflurane for maintenance of anaesthesia. It should be read in conjunction with the evidence summary, which gives factors for decision making.

Evidence review commissioned by NHS England.

Disclaimer

The content of this evidence review was up to date in August 2023. See summaries of product characteristics (SPCs), British national formulary (BNF) or the Medicines and Healthcare products Regulatory Agency (MHRA) or NICE websites for up-to-date information.

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Background

During general anaesthesia, several different types of medicines are given together (including anaesthetics, opioids and neuromuscular blocking agents). General anaesthesia is usually induced with an intravenously administered anaesthetic (such as propofol), but an inhaled volatile anaesthetic (such as sevoflurane) is sometimes used. Anaesthesia is then maintained with an intravenous or inhaled anaesthetic (such as desflurane, isoflurane or sevoflurane). Total intravenous anaesthesia (TIVA) is a technique in which surgery or procedures are carried out with all anaesthetic drugs given intravenously (see the British National Formulary [BNF] treatment summary for anaesthesia).

Desflurane has a global warming potential 2,500 times greater than carbon dioxide, which is significantly higher than alternative volatile anaesthetic agents (Sherman et al. 2012). It is the first medicine to be decommissioned by the NHS in England because of global warming potential. The purpose of this evidence summary is to support the implementation of the national policy to stop routine use of desflurane in anaesthetic practice in the NHS in England by early 2024 (Greener NHS Putting anaesthetic emissions to bed: commitment on desflurane, 13 January 2023). The evidence summary will inform decision making and, if necessary, guidance development on any exceptional circumstances where continuing to use desflurane is acceptable to ensure patient outcomes are not compromised.

Product overview

Mode of action

Desflurane is one of a family of halogenated methyl ethyl ethers, which are administered by inhalation, producing a dose-related temporary loss of consciousness and of pain sensations, suppression of voluntary motor activity, reduction of autonomic reflexes, and depression of respiration and the cardiovascular system (see the desflurane summaries of product characteristics, SPCs).

Regulatory status

Desflurane has a marketing authorisation for induction and maintenance of general anaesthesia for inpatient and outpatient surgery in adults, and for the maintenance of anaesthesia in infants and children. It is administered by inhalation using a vaporiser specifically designed and designated for use with desflurane (SPC).

Although included in the marketing authorisation, desflurane is no longer recommended for induction of anaesthesia (BNF).

Dosing information

The administration of desflurane must be individualised based on the person's response. The dosage is determined depending on the desired effect, taking into consideration the person's age and clinical status (SPC). Smaller doses are indicated in ill, shocked or debilitated people and those with significant hepatic impairment, while robust people may need larger doses (BNF).

For full details, see the SPC.

Objective

The evidence review summarises the best available evidence on the clinical and cost benefits of using desflurane for maintenance of anaesthesia compared with other general anaesthetic agents in:

- people having neurological procedures
- people with a body mass index (BMI) of at least 30 kg/m^2 having any procedure.

The scope of the evidence review was agreed by NHS England, the Royal College of Anaesthetists and the Association of Anaesthetists of Great Britain and Ireland. The 2 populations included within the scope of the review were identified by NHS England from extensive clinical engagement and consultation with experts. These 2 populations have been most frequently and consistently raised by anaesthetists within the NHS in England as cases where patient outcomes and use of NHS resources could possibly benefit from the use of desflurane over alternatives and, therefore, where an evidence review into the use of desflurane would be most beneficial.

Review questions

A description of the relevant population, intervention, comparison and outcomes (PICO) for this review was developed by NHS England for the topic (see appendix A for more information). The review questions for this evidence review were taken from the scope and include 2 populations.

People having neurological procedures

1. In people having neurological procedures, does the use of desflurane lead to better clinical and cost outcomes compared with other types of general anaesthesia?

2. From the evidence selected, are there any subgroups of patients that may benefit from desflurane compared with general anaesthesia more than the wider population of interest?

People with a BMI of at least 30 kg/m^2 having any type of procedure

1. In people with a BMI of at least 30 kg/m^2 having any type of procedure, does the use of desflurane lead to better clinical and cost outcomes compared with other types of general anaesthesia?

2. From the evidence selected, are there any subgroups of patients that may benefit from desflurane compared with general anaesthesia more than the wider population of interest?

Summary of included studies

A literature search was undertaken for desflurane in people having neurological procedures and in people with a BMI of at least 30 kg/m^2 having any type of procedure. The search identified 133 references (see appendix E for full details of the search). These references were screened using their titles and abstracts and 23 full text references were obtained and assessed for relevance.

Of 10 papers in **people undergoing neurological procedures**, 5 randomised controlled trials are included in this evidence. Three studies compared desflurane inhalation and propofol infusion in adults undergoing aneurysmal neck clipping after subarachnoid haemorrhage (Bhagat et al. 2021, Bhardwaj et al. 2018 and Sharma et

al. 2020). The other 2 studies compared inhaled anaesthetics. Dube et al. (2015) compared desflurane and sevoflurane in adults undergoing elective craniotomy for supratentorial lesions. Joys et al. (2019) compared desflurane and isoflurane in adults undergoing spine surgery.

Of 13 papers assessing desflurane in **people with a BMI of at least 30 kg/m^2 having any type of procedure**, 3 studies are included in this evidence review. One study is a randomised controlled trial (Tanaka et al. 2017), another is a sub-study of a randomised controlled trial (Aftab et al. 2019a), and the other is a is a retrospective cohort study (Zucco et al. 2021). The study by Aftab et al. (2019a) compared desflurane and propofol infusion in adults with a BMI of at least 35 kg/m^2 who had laparoscopic gastric sleeve resection. Tanaka et al. (2017) compared desflurane and propofol infusion in adults aged over 65 years with a BMI over 30 kg/m^2 who had total knee replacement. BMI was not an inclusion criterion in Zucco et al. (2021), which compared desflurane and sevoflurane in adults who had any type of surgery (except cardiac surgery). However, various analyses were undertaken to control for confounding factors, including BMI of at least 35 kg/m^2 (around 9% of the study population).

A summary of the included studies is shown in appendix B. Quality assessment of the included studies is in appendix C.

The remaining 15 studies were excluded. Details of these excluded studies are in appendix F.

Neurological procedures

1. In people having neurological procedures, does the use of desflurane lead to better clinical and cost outcomes compared with other types of general anaesthesia?

2. From the evidence selected, are there any subgroups of patients that may benefit from desflurane compared with general anaesthesia more than the wider population of interest?

Outcomes

Full details of the results are in appendix D. See Terms used in this evidence review for more information on technical terms and outcome scales.

Mortality or survival

Mortality was not reported in any of the papers on neurological procedures included in this evidence review. Bhardwaj et al. (2018) states that mortality was similar in the desflurane and propofol groups, but this outcome does not appear to have been pre-specified and no data or p value was reported. Similarly, 1 person in the desflurane group died in Sharma et al. (2020).

Perioperative complications

In 64 adults aged 18 to 65 years undergoing aneurysmal neck clipping after subarachnoid haemorrhage, Bhardwaj et al. (2018) found no statistically significant differences between desflurane and propofol in the incidence of the following postoperative complications at 24 hours:

- vasospasm (19.4% versus 9.1% respectively, p=0.238)
- infarct (32.2% versus 21.2% respectively, p=0.317)
- tracheostomy (16.1% versus 15.2% respectively, p=0.914)
- decompressive craniectomy (6.4% versus 6.1% respectively, p=0.949)
- new onset neurological deficit (16.1% versus 15.2% respectively, p=0.914).

The studies found no statistically significant differences between desflurane and propofol. However, the studies may lack the statistical power to be able to detect differences between the groups if such differences actually existed. This means that this evidence is uncertain and we cannot exclude the possibility that clinically important differences may be seen in larger, sufficiently powered studies.

Joys et al. (2019) assessed the presence or absence of postoperative delirium in 60 adults aged 18 to 65 years undergoing spine surgery using the Confusion Assessment Method (CAM). The study found no statistically significant differences between desflurane and isoflurane in the incidence of postoperative delirium:

- on day 1 (13.3% and 10.0% respectively, p=0.694)

- or day 3 (0% versus 6.6% respectively, p=0.155).

Similarly, the median severity of delirium was similar in the groups (assessed using CAM-severity on a scale from 0 to 19, with higher scores indicating worse delirium):

- on day 1 (1 versus 1.5, p=0.238, no statistically significant difference)
- and day 3 (0.5 in both groups, p=0.231, no statistically significant difference).

Resource use

No studies reporting resource use in terms of monetary costs were identified. In the study by Bhardwaj et al. (2018), the median length of postoperative hospital stay was 9 days in both the desflurane and propofol groups (p=0.671, no statistically significant difference; primary outcome). Similarly, in Bhagat et al. (2021), the median length of hospital stay was 8 days in the desflurane group and in the propofol group (p=0.393, no statistically significant difference; n=91; secondary outcome). These studies included adults aged 18 to 65 years undergoing aneurysmal neck clipping after subarachnoid haemorrhage.

The study by Dube et al. (2015) included 50 adults aged 18 to 60 years undergoing elective craniotomy for supratentorial lesions. It found no statistically significant differences between desflurane and sevoflurane in the median length of hospital and intensive care unit stays (5 days versus 6 days respectively, p=0.317; and 20.5 hours versus 25.5 hours respectively, p=0.79; secondary outcomes).

Short-term recovery

The studies by Bhagat et al. (2021) and Bhardwaj et al. (2018) found no statistically significant differences in the degree of disability or dependence in daily activities at discharge in adults who received desflurane or propofol during surgery for aneurysmal neck clipping after subarachnoid haemorrhage. In both studies, this outcome was assessed using the Modified Rankin Scale (MRS), a 6-point scale ranging from 0 (no significant disability) to 6 (death).

- In Bhagat et al. (2021), the median MRS at discharge was 1 in the desflurane group and 0 in the propofol group (p=0.575).

- In Bhardwaj et al. (2018), the median MRS at discharge was 2 in the desflurane group and 1 in the propofol group (p=0.909).

Bhardwaj et al. (2018) also found that similar proportions of people in the desflurane and propofol groups had a good outcome (MRS 0 to 1; 45.2% versus 54.5% respectively, p=0.453, no statistically significant difference).

In adults undergoing elective craniotomy for supratentorial lesions, Dube et al. (2015) found no statistically significant difference between the groups in Glasgow Outcome Scale scores (GOS), which range from 5 (no or mild disability) to 1 (death). The median GOS score at discharge was 4.66 in the desflurane group and 4.77 in the sevoflurane group (p=0.43).

Sharma et al. (2020) assessed postoperative cognitive dysfunction in 49 adults aged 18 to 65 years undergoing aneurysmal neck clipping after subarachnoid haemorrhage using the Montreal Cognitive Assessment scale (MCAS). This is a 30-point scale ranging from 0 to 30, with lower scores indicating a higher degree of cognitive impairment.

Sharma et al. (2020) found no statistically significant difference between desflurane and propofol in the proportion of people with an MCAS score below 26 (indicating some degree of cognitive impairment) at discharge or 2 weeks after surgery (81.6% versus 65.4%, p>0.05). At the same timepoint, the mean MCAS score was 19.09 in the desflurane group and 22.81 in the propofol group (p=0.013), which is a statistically significant difference. However, it is unclear if the difference is clinically significant.

Longer-term recovery

Bhagat et al. (2021) found that, 3 months after discharge, there were no statistically significant differences between desflurane and propofol in MRS, GOS or Barthel Index scores. The Barthel Index is used to assess functional independence and ranges from 100 points (totally independent) to 0 to 20 points (totally dependent).

In adults undergoing aneurysmal neck clipping after subarachnoid haemorrhage, in both the desflurane and propofol groups:

- the median MRS score was 0 indicating no significant disability (p=0.424)
- the median GOS score was 5 indicating no or mild disability (p=0.241), and
- the median Barthel Index score was 100 indicating total independence (p=0.414).

Subgroups

No subgroups of patients undergoing neurological procedures were identified that may benefit from desflurane compared with other anaesthetics more than the wider population of interest in the papers included in this evidence.

Limitations of the evidence

The 5 studies that assessed desflurane for neurological procedures were randomised controlled trials, Four were generally well-designed and reported, but Sharma et al. (2020) failed to recruit sufficient participants and probably lacked statistical power. All the studies were undertaken in India, which may limit their generalisability to the UK because of differences in, for example, ethnicity and genetics, socio-economic factors, healthcare systems and clinical practice.

During the quality assessment, 2 of the studies were considered to be at low risk of bias (Bhardwaj et al. 2018 and Joys et al. 2019), but there were some concerns over the other 3 (Bhagat et al. 2021, Dube et al. 2015 and Sharma et al. 2020). The studies were small, with results analysed for between 49 and 91 participants only, divided across 2 groups. Therefore, some analyses may lack statistical power, particularly secondary outcomes in all the studies and all outcomes in Sharma et al. (2020). This means these results are uncertain and we cannot exclude the possibility that clinically important differences may be seen in larger, sufficiently powered studies. Nevertheless, point estimates did not consistently favour 1 general anaesthetic over another.

Three studies included people undergoing aneurysmal neck clipping after subarachnoid haemorrhage (Bhagat et al. 2021, Bhardwaj et al. 2018 and Sharma et al. 2020). The other studies included people undergoing elective craniotomy for supratentorial lesions (62% glioma; Dube et al. 2015) and spine surgery (fracture 42%, prolapsed intervertebral disc 32%; Joys et al. 2019) respectively. The results are unlikely to be relevant to people undergoing all types of neurological surgery

requiring general anaesthesia; however, the findings could be extrapolated to groups undergoing surgeries of similar length or level of invasiveness which need comparable anaesthetic approaches. A specialist reviewer noted that, in some UK centres, aneurysms are often treated endovascularly rather than by surgery for aneurysmal neck clipping. Another specialist noted that the studies looked at neuro-oncology and neuro-vascular surgery lasting up to 6 hours so applicability may be limited for surgery lasting much longer, such as skull base surgery.

Participants in all 5 studies were aged between 18 years and 60 or 65 years (mean approximately 35 to 45 years). Across the studies, participants were assessed as being relatively healthy (American Society of Anesthesiologists Physical Status [ASA] grade I or II), fully responsive with only minor brain injury (Glasgow Coma Scale [GCS] 15 or World Federation of Neurosurgeons [WFNS] grade I to II) or at low risk of mortality (Hunt and Hess grade I to II). The results of the studies may not be applicable to children or older adults, or people with poor health status, severe brain injury or at higher risk of mortality. A specialist considered that some people presenting for neurosurgery in the UK are older and have a worse health status (ASA III) than participants in the studies.

Baseline characteristics were generally balanced between the groups in all studies. However, in Bhagat et al. (2021), 15 people (34%) in the propofol group had hypertension compared with 12 people (21%) in the desflurane group. Propofol is commonly associated with hypotension (propofol SPCs) whereas desflurane is associated with both hypotension and hypertension (desflurane SPCs). In Joys et al. (2019), 7 people (23%) in the isoflurane group had cognitive dysfunction compared with only 1 person (3%) in the desflurane group. These imbalances may have affected the studies' outcomes.

Three studies compared desflurane inhalation with propofol infusion (TIVA; Bhagat et al. 2021, Bhardwaj et al. 2018 and Sharma et al. 2020). Only 1 study compared desflurane and sevoflurane inhalation (Dube et al. 2015). The comparator in the other study was isoflurane inhalation, (Joys et al. 2019), which specialist reviewers advised is less frequently used than sevoflurane in the UK. Duration of anaesthesia was balanced between the groups in all studies and ranged from 185 to 331 minutes across all studies.

In Bhagat et al. (2021) and Bhardwaj et al. (2018), the intervention was discontinued in people who had major intraoperative complications. This was a pre-specified exclusion criterion and was generally balanced across the groups in the studies, but it is unclear if the interventions could have caused the complications. Both studies report that study recruitment was increased to allow for surgical exclusions. People were also excluded after randomisation because of major complications in Sharma et al. (2020) and Dube et al. (2015), most of which were not reported to have been pre-specified.

In Bhagat et al. (2021), around 10% of people in each group were lost to follow up. Although the proportions were balanced across the groups, no reasons are reported so it is unclear if outcomes such as mortality were similar in the groups.

In studies in which desflurane inhalation was compared with propofol infusion (Bhagat et al. 2021, Bhardwaj et al. 2018 and Sharma et al. 2020), anaesthetists could not be blinded because the anaesthetics are administered in different ways. However, healthcare professionals and outcome assessors in all these studies were blinded, as were patients in Bhagat et al. (2021) and Bhardwaj et al. (2018) (not reported in Sharma et al. 2020).

Patients and outcome assessors were blinded to the allocation groups in Joys et al. (2019). However, only the neurosurgeons who measured intracranial pressure were blinded in Dube et al. (2015), and assessors for the outcomes relevant to the PICO (length of hospital stay and GOS at discharge) were not blinded. This may be a source of bias in this study, but the relevant outcomes are reasonably objective.

Overall, the studies found no statistically significant differences between desflurane and other anaesthetics for all but 1 of the outcome measures relevant to the PICO (which are core outcome measures for perioperative and anaesthetic care, Boney et al. 2021). The only exception was in Sharma et al. (2020), which found that the mean cognitive impairment (MCAS) score at discharge or 2 weeks after surgery was statistically significantly worse with desflurane compared with propofol (19.09 compared with 22.81 respectively, p=0.013). By contrast, there was no statistically significant difference between the groups in the incidence of cognitive impairment (MCAS score below 26) at the same timepoint (81.6% versus 65.4%, p>0.05).

Analyses of all the outcomes in Sharma et al. (2020) and secondary outcomes in all the studies may lack statistical power to detect differences between the groups, and these results should be interpreted cautiously. In Sharma et al. (2020), the sample size was estimated based on the mean difference in cerebral metabolic rate with propofol compared with desflurane; however, cerebral metabolic rate was not reported in the study, suggesting the study was not powered correctly. Also, a large proportion of people were excluded from the study after randomisation (34% of people in the desflurane group and 26% of people in the propofol group), which was not addressed sufficiently in the sample size calculation.

BMI at least 30 kg/m^2 having any procedure

1. In people with a BMI of at least 30 kg/m^2 having any type of procedure, does the use of desflurane lead to better clinical and cost outcomes compared with other types of general anaesthesia?

2. From the evidence selected, are there any subgroups of patients in either of the groups that may benefit from desflurane compared with general anaesthesia more than the wider population of interest?

Outcomes

Full details of the results are in appendix D. See Terms used in this evidence review for more information on technical terms and outcome scales.

Mortality or survival

Mortality was not reported in any of the papers on surgical procedures in people with a BMI of at least 30 kg/m^2 included in this evidence review, although Aftab et al. (2019a) state that there were no postoperative deaths.

Perioperative complications

Aftab et al. (2019a) assessed the incidence of postoperative complications leading to readmission within 30 days (using the Clavien-Dindo Classification tool) in 93 adults with a BMI of at least 35 kg/m^2 who had laparoscopic gastric sleeve resection. The study found no statistically significant difference between desflurane and propofol (4.3% compared with 8.5% respectively, p value not reported).

The incidence of postoperative delirium up to 48 hours after surgery (assessed using CAM) was similarly low in the desflurane and propofol groups in the study by Tanaka et al. (2017) (0% compared with 2.22% respectively, p=0.315, no significant difference). The study included 90 adults aged over 65 years with a BMI of more than 30 kg/m^2 who had total knee replacement.

Zucco et al. (2021) retrospectively assessed postoperative respiratory complications in adults who had undergone non-cardiac surgery using general anaesthesia (n=108,438). BMI was not an inclusion criterion, but various analyses were undertaken to control for confounding factors, including risk factors such as BMI of

35 kg/m^2 or more. Postoperative respiratory complications were defined as a composite of early post extubation desaturation or the need for re-intubation within 7 days. There was no statistically significant difference between desflurane and sevoflurane in the incidence of postoperative respiratory complications in the study population (all BMI; 10.3% compared with 9.0% respectively, p=0.598). This was reflected in the subgroup analysis in people with a BMI of at least 35 kg/m^2 (around 9% of the study population; p=0.144, no statistically significant difference).

Resource use

No studies reporting resource use in terms of monetary costs were identified. In the study by Aftab et al. (2019a), a similar number of people in the desflurane and propofol groups were discharged the same day as surgery (28.3% compared with 38.3%, p=0.280, no statistically significant difference).

Short-term recovery

Tanaka et al. (2017) found no statistically significant differences between desflurane and propofol in the following measures of cognitive function assessed 48 hours after surgery:

- Digit Symbol Substitution Test (DSST), a measure of cognitive impairment, with higher scores indicating better cognitive function (average score 46.2 compared with 32.5 respectively, p=0.214)
- Digit Span Subtest (DST), a measure of attention and working memory, with higher scores indicating a better outcome (average score 10.3 compared with 12.5 respectively, p=0.754)
- Trail Making Test (TMT), a measure of memory and executive function in 2 parts, with lower scores indicating a better outcome (average TMTa score 48.7 compared with 32.5 respectively, p=0.142; average TMTb score 48.7 compared with 40.0 respectively, p=0.435).

The studies found no statistically significant differences between desflurane and propofol. However, the studies may lack the statistical power to be able to detect differences between the groups if such differences actually existed. This means that this evidence is uncertain and we cannot exclude the possibility that clinically important differences may be seen in larger, sufficiently powered studies.

Longer-term recovery

No outcomes relating to longer-term recovery were reported in the papers on procedures in people with a BMI of at least 30 kg/m^2 included in this evidence review.

Subgroups

No subgroups of patients with a BMI of at least 30 kg/m^2 undergoing any procedure were identified that may benefit from desflurane compared with other anaesthetics more than the wider population of interest in the papers included in this evidence.

Limitations of the evidence

One of the studies on procedures in people with a BMI of at least 30 kg/m^2 included in this evidence review was a randomised controlled trial (Tanaka et al. 2017) and another was a sub-study of a randomised controlled trial (Aftab et al. 2019a). The quality assessment raised some concerns over Tanaka et al. (2017), and Aftab et al. (2019a) was considered to be at high risk of bias. It is unclear why, of 101 people included in the original randomised controlled trial by Aftab et al. (2019b) who underwent sleeve gastrectomy, only 93 (92%) are included in the sub-study.

The studies were small, with results analysed for around 90 participants only, divided across 2 groups. Therefore, some analyses may lack statistical power. Based on other reports, Tanaka et al. (2017) note that their study may have been underpowered to detect a difference between desflurane and propofol. The study was powered to find a large difference in clinical outcome for the primary outcome, which may have affected the powering for secondary outcomes with smaller differences in effect sizes.

The third study was a large retrospective cohort study (Zucco et al. 2021, n=108,438). Observational studies such as cohort studies are subject to bias and confounding and cannot prove that an intervention caused an outcome, only that it is associated with that outcome. Nevertheless, the quality assessment found the study to be of good quality for a non-randomised study.

Two of the studies were undertaken in the USA (Tanaka et al. 2017 and Zucco et al. 2021) and 1 was undertaken in Norway (Aftab et al. 2019a). There are similarities between the populations and healthcare systems in these countries and the UK. This means the results of the studies are probably generalisable to the UK, although all were undertaken in single centres only and ethnicity, which can affect generalisability, was not reported.

The study by Aftab et al. (2019a) included adults aged over 18 years (mean 42 years) with a BMI of at least 35 kg/m^2 (mean 42 kg/m^2) who had laparoscopic gastric sleeve resection. Tanaka et al. (2017) included adults aged over 65 years (average 70 years) with a BMI over 30 kg/m^2 (average 36 kg/m^2) who had total knee replacement. It is not known if the results of these studies are relevant to children or people undergoing other types of surgery.

Zucco et al. (2021) included adults who had any type of surgery, except those who had cardiac surgery. Of the population in the study, 27% had a BMI over 30 kg/m^2 (n=29,259) and 9% had a BMI over 35 kg/m^2 (n=9,430).

Across the studies, participants were assessed as having mild or severe systemic disease (ASA grade II or III). The results of the studies may not be applicable to people with a worse health status, at higher risk of mortality.

Baseline characteristics were generally balanced between the groups in the studies. However, in Tanaka et al. (2017), people in the desflurane group had a statistically significantly higher BMI at baseline than people in the propofol group (36.5 kg/m^2 compared with 34.0 kg/m^2 respectively, p=0.0069). The cohort study by Zucco et al. (2021) controlled for confounding factors (for example, patient, anaesthetic and surgical factors) and high-risk groups (for example, people with a BMI of 35 kg/m^2 or more and those aged over 65 years).

The randomised controlled trial (Tanaka et al. 2017) and sub-study (Aftab et al. 2019a) compared desflurane inhalation with propofol infusion and the cohort study (Zucco et al. 2021) compared desflurane with the inhaled anaesthetic that is most commonly used in the UK according to specialist reviewers, sevoflurane.

In the studies in which desflurane inhalation was compared with propofol infusion (Tanaka et al. 2017) and sub-study (Aftab et al. 2019a), anaesthetists could not be blinded because the anaesthetics are administered in different ways. However, healthcare professionals and outcome assessors in the studies were blinded, as were patients in Tanaka et al. (2017) (not reported in Aftab et al. 2019b).

In Aftab et al. (2019a), there was a difference between desflurane and propofol in the proportions of missing outcome data. Of 8/101 people in in the randomised controlled trial by Aftab et al. (2019b), who were not included in the sub-study, 2/49 were in the desflurane group (4%) and 6/52 were in the propofol group (11%). It is unclear whether this imbalance may have affected the results of the study. In Tanaka et al. (2017), 11/90 people (12%) did not do the cognitive tests because of postoperative adverse effects. However, the proportion was similar in both groups.

Overall, the studies found no statistically significant differences between desflurane and propofol or sevoflurane for outcome measures relevant to the PICO. However, some of the outcomes, particularly the secondary outcomes measured, may lack the statistical power to be able to detect differences between the groups if such differences actually existed. This means that the evidence on the relative effects of the anaesthetic agents is uncertain and we cannot exclude the possibility that clinically important differences may be seen in larger, sufficiently powered studies. Nevertheless, point estimates did not consistently favour 1 general anaesthetic over another.

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Development of the evidence review

Process

The evidence summary: process guide sets out the process NICE uses to select topics for evidence summaries and details how the summaries are developed, quality assured and approved for publication.

Expert advisers

Details of expert advisers and any declarations of interest

Name, job title and organisation	Declaration of interest
Matthew Davies Consultant Anaesthetist, North West Anglia NHS Trust; President, Association of Anaesthetists	No relevant interests declared
Will Donaldson Consultant Anaesthetist, Northern Health and Social Care Trust	No relevant interests declared
Andrew McKechnie Consultant Anaesthetist, Lewisham and Greenwich NHS Trust; President Society of Obesity and Bariatric Anaesthesia (SOBA UK)	Private anaesthetic practice, financial interest Educational Honorarium Verathon UK, financial interest
Gemma Nickols Consultant Anaesthetist, North Bristol NHS Trust	Neuroanaesthesia and Critical Care Society Council member, non-financial and indirect interest
Joe Sebastian Consultant Neuroanaesthetist, Manchester Centre for Clinical Neurosciences, Salford Care Organisation, Northern Care Alliance NHS Foundation Trust	Publication: Armstrong F. and Sebastian J. Is it time to stop using desflurane? Br J Hosp Med 2020; 81(4):1-2, non-financial interest Neuro Anaesthesia & Critical Care Society Council member, non-financial interest
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Terms used in this evidence review

American Society of Anesthesiologists Physical Status

The American Society of Anesthesiologists (ASA) classification system is used to estimate functional capacity. The scale ranges from I (normal healthy person) to VI (a declared brain-dead person).

Barthel Index

The Barthel Index is used to assess functional independence in people with stroke or other disorders by measuring the degree of assistance needed for 10 activities of daily living (for example, feeding, bathing, grooming, dressing and using the toilet). It ranges from 100 points (totally independent) to 0 to 20 points (totally dependent).

Bispectral Index

The Bispectral Index (BIS) is used in combination with standard clinical monitoring and clinical skills to indicate depth of anaesthesia during surgery. The target range of BIS values is 40 to 60, which indicates a low probability of awareness with recall.

Clavien-Dindo Classification

The Clavien-Dindo Classification tool is used to rank complications of surgery. It ranges from I (any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions) to V (death).

Confusion Assessment Method

The 3D-Confusion Assessment Method (CAM) is a 3-minute questionnaire used to identify the presence or absence of delirium based on 4 criteria (acute onset and fluctuating course, inattention, disorganised thinking and altered levels of consciousness). The test is considered to be positive for delirium if the first 2 criteria are present, with at least one of the third and fourth.

Confusion Assessment Method-Severity

The 3D-Confusion Assessment Method-Severity (CAM-S) score is used to rate the severity of delirium based on the presence or absence symptoms. It is available in short and long forms, with the 4-item short form recommended for clinical practice and the 10-item long form recommended for research studies. Scores range from 0 to 7 for the short form and 0 to 19 for the long form, with higher scores indicating worse delirium.

Digit Symbol Substitution Test

The Digit Symbol Substitution Test (DSST) is used to assess cognitive impairment. During the test numbers and symbols are matched to measure attention, working memory, sustained visual attention and psychomotor speed. The number of correct responses in 90 to 120 seconds is measured, with higher scores indicating better cognitive function.

Digit Span Subtest

The Digit Span Subtest (DSS) is used to assess attention and working memory, by asked the person to repeat a random series of digits in either the order presented (forward span) or in reverse order (backwards span). Outcome measures include the longest sequence successfully reached and passed, with longer sequences indicating a better outcome.

Entropy

Entropy monitoring is used in combination with standard clinical monitoring and clinical skills to indicate depth of anaesthesia during surgery. The target range for entropy (state and response) values is 40 to 60, which indicates a low probability of awareness with recall.

Glasgow Coma Scale

The Glasgow Coma Scale (GCS) is used to assess level of consciousness based on eye opening, verbal response and motor response. The scores for these 3 criteria are added together to provide a total score between 3 (severe injury, comatose) and 15 (mild injury, fully responsive).

Glasgow Outcome Scale

The Glasgow Outcome Scale (GOS) is a 5-pont scale used to assess outcomes after neurological disorders such as traumatic brain injury, stroke and subarachnoid haemorrhage. It ranges from 5 (no or mild disability) to 1 (death).

Hunt and Hess grading

Hunt and Hess grading is used to estimate the risk of mortality after subarachnoid haemorrhage based on the person's clinical condition, including their level or arousal and the severity of neurological deficit. It ranges from 1 (least severe) to 5 (most severe).

Modified Rankin Scale

The Modified Rankin Scale (MRS) is a 6-point scale used to assess the degree of disability or dependence in the daily activities of people who have suffered a stroke or other causes of neurological disability. It ranges from 0 (no significant disability) to 6 (death).

Montreal Cognitive Assessment Scale

The Montreal Cognitive Assessment scale (MCAS) is 30-point scale used to assess cognitive function using questions in several domains (including visuospatial and executive functions, naming, attention, abstraction, memory and delayed recall and orientation). The score ranges from 0 to 30, with lower scores indicating a higher degree of cognitive impairment. A score of 26 or more is considered as normal.

Patient State Index

The Patient State Index (PSI) is a clinically validated measure of the effect of anaesthesia and sedation. The recommended range for general anaesthesia is 25 to 50.

Trail Making Test

The Trail Making Test (TMT) is used to test memory and executive function. In part A the participant is asked to draw a line to connect consecutive numbers. In part B they

are asked to connect alternate numbers and letters in consecutive order (1 to A, A to 2, 2 to b, and so on). The score is the time taken to complete the test, with shorter times indicating a better outcome.

World Federation of Neurosurgeons grading

The World Federation of Neurosurgeons (WFNS) grades subarachnoid haemorrhage using motor scores and Glasgow Coma Scale (GCS) scores to determine severity of injury and risk of mortality. The scale ranges from 1 (least severe) to 5 (most severe).

Appendices

Appendix A: PICO table

PICO table

Criteria	Details
P – Population and indication	People with any BMI having neurological procedures People with BMI ≥30 kg/m^2 having any procedure
I – Intervention	Desflurane
C – Comparator(s)	Sevoflurane Isoflurane Total intravenous anaesthesia
O – Outcomes	(i) Mortality or survival (postoperative mortality, long-term survival) (ii) Perioperative complications (major postoperative complications/adverse events; complications or adverse events causing permanent harm) (iii) Resource use (length of hospital stay, unplanned readmission within 30 days) (iv) Short-term recovery (discharge destination, level of dependence, or both) (v) Longer-term recovery (overall health-related quality of life) (Boney et al. 2021)
Inclusion criteria	-
Study design	Systematic reviews, randomised controlled trials, controlled clinical trials, comparative observational studies
Language	English
Patients	Human studies only
Age	All
Date limits	2000 onwards
Exclusion criteria	-
Publication type	Pre-prints prior to peer review, letters, conference abstracts or studies that have not been published in full
Study design	Non-comparative studies, case series, case reports

Appendix B: Summary of included studies

Neurological procedures

Study	Number of participants analysed	Population	Intervention	Comparison	Relevant outcomes
Bhagat et al. (2021) Blinded RCT India	n=91	Adults aged 18-65 years undergoing aneurysmal neck clipping after subarachnoid haemorrhage (WFNS grade I to II)	Maintenance anaesthesia using desflurane inhalation to maintain BIS 40-60 (n=47, mean age 45 years, WFNS grade I 75%, hypertension 21%, mean duration of anaesthesia 199 minutes)	Maintenance anaesthesia using propofol infusion (TIVA) to maintain BIS 40-60 (n=44, mean age 50 years, WFNS grade I 80%, hypertension 34%, mean duration of anaesthesia 201 minutes)	GOS 3 months after discharge (primary outcome) Major postoperative complications Length of hospital stay MRS at discharge and 3 months after discharge Barthel Index 3 months after discharge (secondary outcomes)
Bhardwaj et al. (2018) Blinded RCT India	n=64	Adults aged 18-65 years undergoing aneurysmal neck clipping after subarachnoid haemorrhage (WFNS grade I to II, ASA grade I to III)	Maintenance anaesthesia using desflurane inhalation to maintain entropy 40-60 (n=31, mean age 45 years, WFNS grade I 70%, ASA grade I 65%, mean duration of anaesthesia 214 minutes)	Maintenance anaesthesia using propofol infusion (TIVA) to maintain entropy 40-60 (n=33, mean age 44 years, WFNS grade I 74%, ASA grade I 58%, mean duration of anaesthesia 217 minutes)	Length of postoperative hospital stay (primary outcome) MRS at discharge (secondary outcome)
Dube et al. (2015) RCT India	n=50	Adults aged 18-60 years undergoing elective craniotomy for supratentorial lesions (GCS score 15, lesion was glioma in 62% and 54% of people in the desflurane and sevoflurane	Maintenance anaesthesia using desflurane inhalation (n=24, mean age 35 years, ASA grade I 75%, mean duration of anaesthesia 311 minutes)	Maintenance anaesthesia using sevoflurane inhalation (n=26, mean age 39 years, ASA grade I 77%, mean duration of anaesthesia 331 minutes)	Length of hospital stay GOS at discharge (secondary outcomes)

Study	Number of participants analysed	Population	Intervention	Comparison	Relevant outcomes
		groups respectively)			
Joys et al. (2019) Blinded RCT India	n=60	Adults aged 18-65 years undergoing spine surgery (ASA grade I or II, GCS score 15, fracture 42%, prolapsed intervertebral disc 32% intradural extramedullary tumour 18%, other 8%)	Maintenance anaesthesia using desflurane inhalation (n=30, mean age 37 years, ASA grade I 87%, preoperative cognitive dysfunction 3%, median duration of anaesthesia 185 minutes)	Maintenance anaesthesia using isoflurane inhalation (n=30, mean age 35 years, ASA grade I 93%, preoperative cognitive dysfunction 23%, median duration of anaesthesia 195 minutes)	Postoperative delirium (CAM) on days 1 and 3 (primary outcome) CAM-S delirium severity on days 1 and 3 (secondary outcome)
Sharma et al. (2020) Blinded RCT India	n=49	Adults aged 18-65 years undergoing aneurysmal neck clipping after subarachnoid haemorrhage (Hunt and Hess grade I to II, ASA grade I to III)	Maintenance anaesthesia using desflurane inhalation to maintain entropy 40-60 (n=23, mean age 45 years, ASA grade I 74%, GCS score 15 74%, Hunt and Hess grade II 57%, WFNS grade I 70%, mean duration of anaesthesia 218 minutes)	Maintenance anaesthesia using propofol infusion (TIVA) to maintain entropy 40-60 (n=26, mean age 42 years, ASA grade I 62%, GCS score 15 85%, Hunt and Hess grade II 85%, WFNS grade I 73%, mean duration of anaesthesia 225 minutes)	MCAS at discharge or 2 weeks after surgery (primary outcome)

Abbreviations: ASA; American Society of Anesthesiologists Physical Status, a 6-point scale ranging from I (normal healthy person) to VI (a declared brain-dead person); BIS, Bispectral Index; CAM, 3D-Confusion Assessment Method; CAM-S, 3D-Confusion Assessment Method-Severity long form; GCS, Glasgow Coma Scale, with scores ranging from 3 (severe injury, comatose) to 15 (mild injury, fully responsive); GOS, Glasgow Outcome Scale; MCAS, Montreal Cognitive Assessment Scale (Hindi version); MRS, Modified Rankin Scale; RCT, randomised controlled trial;; WFNS, World Federation of Neurosurgeons grading of subarachnoid haemorrhage, a 5-point scale ranging from 1 (least severe) to 5 (most severe).

Hunt and Hess grading is used to estimate the risk of mortality after subarachnoid haemorrhage and ranges from 1 (least severe) to 5 (most severe). See Terms used in this evidence review for more information on technical terms and outcome scales.

BMI at least 30 kg/m^2 having any procedure

Study	Number of participants	Population	Intervention	Comparison	Outcomes
Aftab et al. (2019a) Sub-study of a blinded RCT (Aftab et al. 2019b) Norway	n=93 (n=101 in Aftab et al. 2019b: it is unclear why numbers differ)	Adults with BMI ≥35 kg/m^2 who were eligible for laparoscopic gastric sleeve resection under Norwegian clinical guidelines (mean age 42 years, mean BMI 42 kg/m^2, ASA grade II 84%, mean duration of anaesthesia 50 minutes)	Maintenance anaesthesia using desflurane inhalation (n=46)	Maintenance anaesthesia using propofol infusion (TIVA, n=47)	Discharge the same day as surgery (primary outcome) Complications leading to readmission within 30 days (Clavien-Dindo Classification, secondary outcome)
Tanaka et al. (2017) Blinded RCT USA	n=90	Adults aged over 65 years with BMI >30 kg/m^2 undergoing total knee replacement (ASA II or III)	Maintenance anaesthesia using desflurane inhalation to maintain PSI 30-50 (n=45, average age 70 years, average BMI 36 kg/m^2, ASA grade III 51%, average duration of anaesthesia 143 minutes)	Maintenance anaesthesia using propofol infusion (TIVA) to maintain PSI 30-50 (n=45, average age 71 years, average BMI 34 kg/m^2, ASA grade III 42%, average duration of anaesthesia 137 minutes)	Postoperative delirium (CAM) at various timepoints including 48 hours (primary outcome) Measures of cognitive function (DSST, DST and TMT) at 48 hours (secondary outcomes)
Zucco et al. (2021) Retrospective cohort study USA	Total n=108,438 BMI >30 kg/m^2 n=29,259 (27%) BMI >35 kg/m^2 n=9,430 (9%)	All adults who underwent non-cardiac surgery under general anaesthesia	Maintenance anaesthesia using desflurane inhalation (n=23,830, mean age 55 years, mean BMI 30 kg/m^2, ASA grades II and III 86%; BMI	Maintenance anaesthesia using sevoflurane inhalation (n=84,608, mean age 54 years, mean BMI 28 kg/m^2, ASA grades II and III 84%; BMI	Postoperative respiratory complications (a composite of early post extubation desaturation or need for re-intubation within 7 days) (primary outcome)

Study	Number of participants	Population	Intervention	Comparison	Outcomes
			>35 kg/m^2 n=2,556, 11%)	>35 kg/m^2 n=6,874, 8%)	

Abbreviations: ASA, American Society of Anesthesiologists Physical Status, a 6-point scale ranging from I (normal healthy person) to VI (a declared brain-dead person); BMI, body mass index; CAM, 3D-Confusion Assessment Method; DSST, Digit Symbol Substitution Test; DST, Digit Span Subtest; RCT, randomised controlled trial; TIVA, total intravenous anaesthetic; TMT, Trail Making Test

See Terms used in this evidence review for more information on technical terms and outcome scales.

Appendix C: Quality assessment of included studies

Neurological procedures

Quality assessment of Bhagat et al. (2021)

Question	Bhagat et al. (2021)
Domain 1: Risk of bias arising from the randomisation process	-
1.1 Was the allocation sequence random?	Yes
1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	Yes
1.3 Did baseline differences between intervention groups suggest a problem with the randomisation process?	Probably no, although more people in the propofol group had hypertension
Risk of bias judgement	**Low**
Domain 2: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	-
2.1. Were participants aware of their assigned intervention during the trial?	No
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	Yes, the anaesthetist managing the patient in the operating theatre could not be blinded but had no further part in the study. Others were blinded
2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the trial context?	Yes. The intervention was discontinued in some patients (major intraoperative complications, a pre-specified exclusion criterion). Other patients (around 10% in each group) were lost to follow up
2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	No information
2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	Yes
2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	Yes
2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomised?	Not applicable
Risk of bias judgement	**Some concerns**
Domain 2: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	-
2.1. Were participants aware of their assigned intervention during the trial?	No
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	Yes, the anaesthetist managing the patient in the operating theatre could not be blinded but had no further part in the study. Others were blinded

Question	Bhagat et al. (2021)
2.3. [If applicable:] If Y/PY/NI to 2.1 or 2.2: Were important non-protocol interventions balanced across intervention groups?	Not applicable
2.4. [If applicable:] Were there failures in implementing the intervention that could have affected the outcome?	Probably no
2.5. [If applicable:] Was there non-adherence to the assigned intervention regimen that could have affected participants' outcomes?	Probably no
2.6. If N/PN/NI to 2.3, or Y/PY/NI to 2.4 or 2.5: Was an appropriate analysis used to estimate the effect of adhering to the intervention?	Not applicable
Risk of bias judgement	**Low**
Domain 3: Missing outcome data	-
3.1 Were data for this outcome available for all, or nearly all, participants randomised?	No. The intervention was discontinued in some patients (major intraoperative complications, a pre-specified exclusion criterion). Other patients (around 10% in each group) were lost to follow up
3.2 If N/PN/NI to 3.1: Is there evidence that the result was not biased by missing outcome data?	No
3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	Probably no
3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	Not applicable
Risk of bias judgement	**Low**
Domain 4: Risk of bias in measurement of the outcome	-
4.1 Was the method of measuring the outcome inappropriate?	No
4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	Probably no
4.3 If N/PN/NI to 4.1 and 4.2: Were outcome assessors aware of the intervention received by study participants?	No. Not for the outcomes relevant to the PICO, which were assessed at discharge or 3 months after discharge
4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	Not applicable
4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	Not applicable
Risk of bias judgement	**Low**
Domain 5: Risk of bias in selection of the reported result	-
5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	Probably yes
5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome	Probably no

Question	Bhagat et al. (2021)
measurements (e.g. scales, definitions, time points) within the outcome domain?	
5.3 Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible analyses of the data?	Probably no
Risk of bias judgement	**Low**
Overall risk of bias judgement	**Some concerns**

Checklist used: Cochrane risk of bias 2 tool.

Quality assessment of Bhardwaj et al. (2018)

Question	Bhardwaj et al. 2018
Domain 1: Risk of bias arising from the randomisation process	-
1.1 Was the allocation sequence random?	Yes
1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	Probably yes
1.3 Did baseline differences between intervention groups suggest a problem with the randomisation process?	No
Risk of bias judgement	**Low**
Domain 2: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	-
2.1. Were participants aware of their assigned intervention during the trial?	No. The trial registry reports that participants were blinded
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	No. The neurosurgeon and neurosurgical residents who assessed outcomes were blinded
2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the trial context?	Not applicable
2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	Not applicable
2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	Not applicable
2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	Yes
2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomised?	Not applicable
Risk of bias judgement	**Low**
Domain 2: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	-

Question	Bhardwaj et al. 2018
2.1. Were participants aware of their assigned intervention during the trial?	No. The trial registry reports that participants were blinded
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	No. The neurosurgeon and neurosurgical residents who assessed outcomes were blinded
2.3. [If applicable:] If Y/PY/NI to 2.1 or 2.2: Were important non-protocol interventions balanced across intervention groups?	Not applicable
2.4. [If applicable:] Were there failures in implementing the intervention that could have affected the outcome?	Probably no
2.5. [If applicable:] Was there non-adherence to the assigned intervention regimen that could have affected participants' outcomes?	Probably no
2.6. If N/PN/NI to 2.3, or Y/PY/NI to 2.4 or 2.5: Was an appropriate analysis used to estimate the effect of adhering to the intervention?	Not applicable
Risk of bias judgement	**Low**
Domain 3: Missing outcome data	-
3.1 Were data for this outcome available for all, or nearly all, participants randomised?	No. The intervention was discontinued in some patients (major intraoperative complications, a pre-specified inclusion criterion)
3.2 If N/PN/NI to 3.1: Is there evidence that the result was not biased by missing outcome data?	No
3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	Probably no
3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	Not applicable
Risk of bias judgement	**Low**
Domain 4: Risk of bias in measurement of the outcome	-
4.1 Was the method of measuring the outcome inappropriate?	No
4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	Probably no
4.3 If N/PN/NI to 4.1 and 4.2: Were outcome assessors aware of the intervention received by study participants?	No. Not for the outcomes relevant to the PICO, which were assessed at discharge
4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	Not applicable
4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	Not applicable
Risk of bias judgement	**Low**
Domain 5: Risk of bias in selection of the reported result	-
5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	Probably yes

Question	Bhardwaj et al. 2018
5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	Probably no
5.3 Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible analyses of the data?	Probably no
Risk of bias judgement	**Low**
Overall risk of bias judgement	**Low**

Checklist used: Cochrane risk of bias 2 tool.

Quality assessment of Dube et al. (2015)

Question	Dube et al. (2015)
Domain 1: Risk of bias arising from the randomisation process	-
1.1 Was the allocation sequence random?	No information
1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	No information
1.3 Did baseline differences between intervention groups suggest a problem with the randomisation process?	Probably no
Risk of bias judgement	**Some concerns**
Domain 2: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	-
2.1. Were participants aware of their assigned intervention during the trial?	No information
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	Probably yes. Only the neurosurgeons who measured intracranial pressure were blinded
2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the trial context?	Yes. Some patients were excluded because they needed post operative ventilation or re-intubation
2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	No
2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	Not applicable
2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	Yes
2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomised?	Not applicable
Risk of bias judgement	**Some concerns**

Question	Dube et al. (2015)
Domain 2: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	-
2.1. Were participants aware of their assigned intervention during the trial?	No information
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	Probably yes. Only the neurosurgeons who measured intracranial pressure were blinded
2.3. [If applicable:] If Y/PY/NI to 2.1 or 2.2: Were important non-protocol interventions balanced across intervention groups?	Not applicable
2.4. [If applicable:] Were there failures in implementing the intervention that could have affected the outcome?	Probably no
2.5. [If applicable:] Was there non-adherence to the assigned intervention regimen that could have affected participants' outcomes?	Probably no
2.6. If N/PN/NI to 2.3, or Y/PY/NI to 2.4 or 2.5: Was an appropriate analysis used to estimate the effect of adhering to the intervention?	Not applicable
Risk of bias judgement	**Low**
Domain 3: Missing outcome data	-
3.1 Were data for this outcome available for all, or nearly all, participants randomised?	Yes
3.2 If N/PN/NI to 3.1: Is there evidence that the result was not biased by missing outcome data?	Not applicable
3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	Not applicable
3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	Not applicable
Risk of bias judgement	**Low**
Domain 4: Risk of bias in measurement of the outcome	-
4.1 Was the method of measuring the outcome inappropriate?	No
4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	Probably no
4.3 If N/PN/NI to 4.1 and 4.2: Were outcome assessors aware of the intervention received by study participants?	Yes. Assessors for the outcomes relevant to the PICO were not blinded
4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	Probably no. The outcomes relevant to the PICO are relatively objective
4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	Not applicable
Risk of bias judgement	**Low**
Domain 5: Risk of bias in selection of the reported result	-
5.1 Were the data that produced this result analysed in accordance with a pre-specified	No information

Question	Dube et al. (2015)
analysis plan that was finalized before unblinded outcome data were available for analysis?	
5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	Probably no
5.3 Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible analyses of the data?	Probably no
Risk of bias judgement	**Some concerns**
Overall risk of bias judgement	**Some concerns**

Checklist used: Cochrane risk of bias 2 tool.

Quality assessment of Joys et al. (2019)

Question	Joys et al. (2019)
Domain 1: Risk of bias arising from the randomisation process	-
1.1 Was the allocation sequence random?	Yes
1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	Probably yes
1.3 Did baseline differences between intervention groups suggest a problem with the randomisation process?	Probably no, although more people in the isoflurane group had cognitive dysfunction
Risk of bias judgement	**Low**
Domain 2: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	-
2.1. Were participants aware of their assigned intervention during the trial?	No
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	Probably yes. It is unclear if carers and anaesthetists were blinded but investigators assessing study outcomes were
2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the trial context?	No
2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	Not applicable
2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	Not applicable
2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	Yes
2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomised?	Not applicable

Question	Joys et al. (2019)
Risk of bias judgement	**Low**
Domain 2: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	-
2.1. Were participants aware of their assigned intervention during the trial?	No
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	Probably yes. It is unclear if carers and anaesthetists were blinded but investigators assessing study outcomes were
2.3. [If applicable:] If Y/PY/NI to 2.1 or 2.2: Were important non-protocol interventions balanced across intervention groups?	Not applicable
2.4. [If applicable:] Were there failures in implementing the intervention that could have affected the outcome?	Probably no
2.5. [If applicable:] Was there non-adherence to the assigned intervention regimen that could have affected participants' outcomes?	No
2.6. If N/PN/NI to 2.3, or Y/PY/NI to 2.4 or 2.5: Was an appropriate analysis used to estimate the effect of adhering to the intervention?	Not applicable
Risk of bias judgement	**Low**
Domain 3: Missing outcome data	-
3.1 Were data for this outcome available for all, or nearly all, participants randomised?	Yes
3.2 If N/PN/NI to 3.1: Is there evidence that the result was not biased by missing outcome data?	Not applicable
3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	Not applicable
3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	Not applicable
Risk of bias judgement	**Low**
Domain 4: Risk of bias in measurement of the outcome	-
4.1 Was the method of measuring the outcome inappropriate?	No
4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	Probably no
4.3 If N/PN/NI to 4.1 and 4.2: Were outcome assessors aware of the intervention received by study participants?	No
4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	Not applicable
4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	Not applicable
Risk of bias judgement	**Low**
Domain 5: Risk of bias in selection of the reported result	-

Question	Joys et al. (2019)
5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	Probably yes
5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	Probably no
5.3 Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible analyses of the data?	Probably no
Risk of bias judgement	**Low**
Overall risk of bias judgement	**Low**

Checklist used: Cochrane risk of bias 2 tool.

Quality assessment of Sharma et al. (2020)

Question	Sharma et al. (2020)
Domain 1: Risk of bias arising from the randomisation process	-
1.1 Was the allocation sequence random?	Yes
1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	Probably yes
1.3 Did baseline differences between intervention groups suggest a problem with the randomisation process?	No
Risk of bias judgement	**Low**
Domain 2: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	-
2.1. Were participants aware of their assigned intervention during the trial?	No information
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	No. The neurosurgical team and the clinical psychologist were blinded
2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the trial context?	Yes. The intervention was discontinued in some patients (major complications, including tracheostomy, which was pre-specified)
2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	No information
2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	Probably yes
2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	Yes
2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to	Not applicable

Question	Sharma et al. (2020)
analyse participants in the group to which they were randomised?	
Risk of bias judgement	**Some concerns**
Domain 2: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	-
2.1. Were participants aware of their assigned intervention during the trial?	No information
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	No. The neurosurgical team and the clinical psychologist were blinded
2.3. [If applicable:] If Y/PY/NI to 2.1 or 2.2: Were important non-protocol interventions balanced across intervention groups?	Not applicable
2.4. [If applicable:] Were there failures in implementing the intervention that could have affected the outcome?	Probably no
2.5. [If applicable:] Was there non-adherence to the assigned intervention regimen that could have affected participants' outcomes?	Probably no
2.6. If N/PN/NI to 2.3, or Y/PY/NI to 2.4 or 2.5: Was an appropriate analysis used to estimate the effect of adhering to the intervention?	Not applicable
Risk of bias judgement	**Low**
Domain 3: Missing outcome data	-
3.1 Were data for this outcome available for all, or nearly all, participants randomised?	No. The intervention was discontinued in some patients (major complications)
3.2 If N/PN/NI to 3.1: Is there evidence that the result was not biased by missing outcome data?	No
3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	Probably no
3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	Not applicable
Risk of bias judgement	**Low**
Domain 4: Risk of bias in measurement of the outcome	-
4.1 Was the method of measuring the outcome inappropriate?	No
4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	Probably no]
4.3 If N/PN/NI to 4.1 and 4.2: Were outcome assessors aware of the intervention received by study participants?	No
4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	Not applicable
4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	Not applicable
Risk of bias judgement	**Low**

Question	Sharma et al. (2020)
Domain 5: Risk of bias in selection of the reported result	-
5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	No information
5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	Probably no
5.3 Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible analyses of the data?	Probably no
Risk of bias judgement	**Some concerns**
Overall risk of bias judgement	**Some concerns**

Checklist used: Cochrane risk of bias 2 tool.

BMI at least 30 kg/m^2 having any procedure

Quality assessment of Aftab et al. (2019a) (sub-study of Aftab et al. 2019b)

Question	Aftab et al. (2019a)
Domain 1: Risk of bias arising from the randomisation process	-
1.1 Was the allocation sequence random?	Yes
1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	Probably yes
1.3 Did baseline differences between intervention groups suggest a problem with the randomisation process?	No
Risk of bias judgement	**Low**
Domain 2: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	-
2.1. Were participants aware of their assigned intervention during the trial?	No information
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	No. The surgeons, postoperative nursing staff, anaesthesiologists and staff at the obesity clinic were blinded
2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the trial context?	No information. It is unclear why, of 101 people who underwent sleeve gastrectomy in Aftab et al. 2019b, only 93 (92%) are included in the sub-study
2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	Not applicable
2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	Not applicable

Question	Aftab et al. (2019a)
2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	Yes
2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomised?	Not applicable
Risk of bias judgement	**Some concerns**
Domain 2: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	-
2.1. Were participants aware of their assigned intervention during the trial?	No information
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	No. The surgeons, postoperative nursing staff, anaesthesiologists and staff at the obesity clinic were blinded
2.3. [If applicable:] If Y/PY/NI to 2.1 or 2.2: Were important non-protocol interventions balanced across intervention groups?	Not applicable
2.4. [If applicable:] Were there failures in implementing the intervention that could have affected the outcome?	Probably no
2.5. [If applicable:] Was there non-adherence to the assigned intervention regimen that could have affected participants' outcomes?	Probably no
2.6. If N/PN/NI to 2.3, or Y/PY/NI to 2.4 or 2.5: Was an appropriate analysis used to estimate the effect of adhering to the intervention?	Not applicable
Risk of bias judgement	**Low**
Domain 3: Missing outcome data	-
3.1 Were data for this outcome available for all, or nearly all, participants randomised?	Probably no. It is unclear why, of 101 people who underwent sleeve gastrectomy in Aftab et al. 2019b, only 93 (92%) are included in the sub-study
3.2 If N/PN/NI to 3.1: Is there evidence that the result was not biased by missing outcome data?	No
3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	No information
3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	Probably yes. There appears to be a difference between the desflurane and propofol groups in the proportions of missing outcome data
Risk of bias judgement	**High**
Domain 4: Risk of bias in measurement of the outcome	-
4.1 Was the method of measuring the outcome inappropriate?	No
4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	Probably no
4.3 If N/PN/NI to 4.1 and 4.2: Were outcome assessors aware of the intervention received by study participants?	No. The surgeons, postoperative nursing staff, anaesthesiologists and staff at the obesity clinic were blinded

Question	Aftab et al. (2019a)
4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	Not applicable
4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	Not applicable
Risk of bias judgement	**Low**
Domain 5: Risk of bias in selection of the reported result	-
5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	No information
5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	Probably no
5.3 Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible analyses of the data?	Probably no
Risk of bias judgement	**Some concerns**
Overall risk of bias judgement	**High**

Checklist used: Cochrane risk of bias 2 tool.

Quality assessment of Tanaka et al. (2017)

Question	Tanaka et al. (2017)
Domain 1: Risk of bias arising from the randomisation process	-
1.1 Was the allocation sequence random?	Yes
1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	Probably yes
1.3 Did baseline differences between intervention groups suggest a problem with the randomisation process?	Probably no, although people in the desflurane group had a higher BMI at baseline
Risk of bias judgement	**Low**
Domain 2: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	-
2.1. Were participants aware of their assigned intervention during the trial?	No
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	Yes. The anaesthesiologist could not be blinded because of the different administration techniques for the 2 anaesthetics. However, the surgeons and study investigators were blinded
2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the trial context?	Probably yes. 11/90 people (12%) did not do the cognitive tests because of postoperative adverse effects

Question	Tanaka et al. (2017)
2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	No information
2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	Yes
2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	Yes
2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomised?	Not applicable
Risk of bias judgement	**Some concerns**
Domain 2: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	-
2.1. Were participants aware of their assigned intervention during the trial?	No
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?	Yes. The anaesthesiologist could not be blinded because of the different administration techniques for the 2 anaesthetics. However, the surgeons and study investigators were blinded
2.3. [If applicable:] If Y/PY/NI to 2.1 or 2.2: Were important non-protocol interventions balanced across intervention groups?	Not applicable
2.4. [If applicable:] Were there failures in implementing the intervention that could have affected the outcome?	Probably no
2.5. [If applicable:] Was there non-adherence to the assigned intervention regimen that could have affected participants' outcomes?	Probably no
2.6. If N/PN/NI to 2.3, or Y/PY/NI to 2.4 or 2.5: Was an appropriate analysis used to estimate the effect of adhering to the intervention?	Not applicable
Risk of bias judgement	**Low**
Domain 3: Missing outcome data	-
3.1 Were data for this outcome available for all, or nearly all, participants randomised?	No. 11/90 people (12%) did not do the cognitive tests because of postoperative adverse effects
3.2 If N/PN/NI to 3.1: Is there evidence that the result was not biased by missing outcome data?	No
3.3 If N/PN to 3.2: Could missingness in the outcome depend on its true value?	Probably yes
3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	No. Similar numbers of people did not do the tests in both groups
Risk of bias judgement	**Some concerns**
Domain 4: Risk of bias in measurement of the outcome	-
4.1 Was the method of measuring the outcome inappropriate?	No
4.2 Could measurement or ascertainment of the outcome have differed between intervention groups?	Probably no

Question	Tanaka et al. (2017)
4.3 If N/PN/NI to 4.1 and 4.2: Were outcome assessors aware of the intervention received by study participants?	No. study investigators were blinded
4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	Not applicable
4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	Not applicable
Risk of bias judgement	**Low**
Domain 5: Risk of bias in selection of the reported result	-
5.1 Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	Probably yes
5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	Probably no
5.3 Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple eligible analyses of the data?	Probably no
Risk of bias judgement	**Low**
Overall risk of bias judgement	**Some concerns**

Checklist used: Cochrane risk of bias 2 tool.

Quality assessment of Zucco et al. (2021)

Question	Zucco et al. (2021)
Domain: Selection	-
1. Representativeness of the exposed cohort	Somewhat representative of the average adult in the community undergoing non-cardiac surgery using desflurane
2. Selection of the non-exposed cohort	Drawn from the same community as the exposed cohort
3. Ascertainment of exposure	Secure record (Anaesthesia Research Data Repository)
4. Demonstration that outcome of interest was not present at start of study	Yes
Domain: Comparability	-
1. Comparability of cohorts on the basis of the design or analysis	Study controls for confounding factors, including patient, anaesthetic and surgical factors Study controls for high-risk groups; for example, people with a BMI of 35 kg/m^2 or more and people aged over 65 years
Domain: Outcome	-
1. Assessment of outcome	Record linkage

Question	Zucco et al. (2021)
2. Was follow up long enough for outcomes to occur	Yes
3. Adequacy of follow up of cohorts	Complete follow up (all subjects accounted for)
Overall standard	**Good quality**

Checklist used: Newcastle – Ottawa quality assessment scale.

Appendix D: Results tables

Neurological procedures

Results table for Bhagat et al. (2021)

Outcome	Intervention: desflurane inhalation	Comparator: propofol infusion (TIVA)	Analysis
Primary outcome	**n=47**	**n=44**	**-**
Median GOS score 3 months after discharge (10th to 90th percentile)	5 (1 to 5)	5 (2 to 5)	p=0.241 (No significant difference)
Secondary outcomes	**n=47**	**n=44**	**-**
Median length of hospital stay in days (10th to 90th percentile)	8 (5 to 11.2)	8 (6 to 14)	p=0.393 (No significant difference)
Median MRS score at discharge (10th to 90th percentile)	1 (0 to 3)	0 (0 to 4)	p=0.575 (No significant difference)
Median MRS score 3 months after discharge (10th to 90th percentile)	0 (0 to 6)	0 (0 to 5)	p=0.424 (No significant difference)
Median Barthel Index score 3 months after discharge (10th to 90th percentile)	100 (0 to 100)	100 (10 to 100)	p=0.414 (No significant difference)

Abbreviations: GOS, Glasgow Outcome Scale, a 5-pont scale ranging from 5 (no or mild disability) to 1 (death); MRS, Modified Rankin Scale, a 6-point scale ranging from 0 (no significant disability) to 6 (death); p, p value; TIVA, total intravenous anaesthetic

The Barthel Index is used to assess functional independence and ranges from 100 points (totally independent) to 0 to 20 points (totally dependent). See Terms used in this evidence review for more information on technical terms and outcome scales.

Results table for Bhardwaj et al. (2018)

Outcome	Intervention: desflurane inhalation	Comparator: propofol infusion (TIVA)	Analysis
Primary outcome	**n=31**	**n=33**	**-**
Median length of postoperative hospital stay in days (IQR)	9 (7 to 12)	9 (6 to 14)	p=0.671

			(No significant difference)
Secondary outcomes	**n=31**	**n=33**	**-**
Number of participants with vasospasm at 24 hours (%)	6/31 (19.4%)	3/33 (9.1%)	p=0.238 (No significant difference)
Number of participants with infarct at 24 hours (%)	10/31 (32.2)	7/33 (21.2%)	p=0.317 (No significant difference)
Number of participants with tracheostomy at 24 hours (%)	5/31 (16.1%)	5/33 (15.2%)	p=0.914 (No significant difference)
Number of participants with decompressive craniectomy at 24 hours (%)	2/31 (6.4%)	2/33 (6.1%)	0.949 (No significant difference)
Number of participants with new onset neurological deficit at 24 hours (%)	5/31 (16.1%)	5/33 (15.2%)	0.914 (No significant difference)
Median MRS score at discharge (IQR)	2 (1 to 4)	1 (1 to 4)	p=0.909 (No significant difference)
Number of participants with a good outcome (MRS 0 to 1) at discharge (%)	14/31 (45.2%)	18 (54.5%)	p=0.453 (No significant difference)

Abbreviations: IQR, interquartile range; MRS, Modified Rankin Scale, a 6-point scale ranging from 0 (no significant disability) to 6 (death); p, p value; TIVA, total intravenous anaesthetic

Results table for Dube et al. (2015)

Outcome	**Intervention: desflurane inhalation**	**Comparator: sevoflurane inhalation**	**Analysis**
Primary outcome	**n=24**	**n=26**	**-**
Not relevant to PICO (postoperative recovery)	-	-	-
Secondary outcomes	**n=24**	**n=26**	**-**
Median length of hospital stay in days (range)	5 (3 to 18)	6 (3 to 10)	p=0.31 (No significant difference)
Median length of stay in ICU in hours (range)	20.5 (11 to 129)	25.5 (10 to 60)	p=0.79 (No significant difference)
Median GOS score at discharge (±SD)	4.66 (±0.5)	4.77 (±0.4)	p=0.43 (No significant difference)

Abbreviations: GOS, Glasgow Outcome Scale, a 5-pont scale ranging from 5 (no or mild disability) to 1 (death); ICU, intensive care unit; p, p value; SD, standard deviation

Results table for Joys et al. (2019)

Outcome	Intervention: desflurane inhalation	Comparator: isoflurane inhalation	Analysis
Primary outcome	**n=30**	**n=30**	**-**
Number of participants with postoperative delirium (CAM) on day 1 (%)	4/30 (13.3%)	3/30 (10.0%)	p=0.694 (No significant difference)
Number of participants with postoperative delirium (CAM) on day 3 (%)	0/30 (0%)	2/30 (6.6%)	p=0.155 (No significant difference)
Secondary outcomes	**n=30**	**n=30**	**-**
Median CAM-S delirium severity on day 1 (IQR)	1 (0 to 2.5)	1.5 (0.75 to 4.25)	p=0.238 (No significant difference)
Median CAM-S delirium severity on day 3 (IQR)	0.5 (0 to 1)	0.5 (0 to 2)	p=0.231 (No significant difference)

Abbreviations: CAM, 3D-Confusion Assessment Method, a questionnaire used to identify the presence or absence of delirium based on 4 criteria; CAM-S, 3D-Confusion Assessment Method-Severity long form, a 10-item scale ranging from 0 to 19, with higher scores indicating worse delirium; IQR, interquartile range; p, p value

Results table for Sharma et al. (2020)

Outcome	Intervention: desflurane inhalation	Comparator: propofol infusion (TIVA)	Analysis
Primary outcome	**n=23**	**n=26**	**-**
Mean MCAS scores at discharge or 2 weeks after surgery (±SD)	19.09 (±5.66)	22.81 (±4.45)	p=0.013 (Statistically significant difference)
Number of participants with an MCAS score below 26 indicating some degree of cognitive impairment at discharge or 2 weeks after surgery (±SD)	19/23 (81.6%)	17/26 (65.4%)	p>0.05 (No significant difference)
Secondary outcomes	**n=23**	**n=26**	**-**
No relevant PICO outcomes	-	-	-

Abbreviations: MCAS, Montreal Cognitive Assessment Scale, a 30-point scale ranging from 0 to 30, with lower scores indicating a higher degree of cognitive impairment; p, p value; SD, standard deviation; TIVA, total intravenous anaesthetic

BMI at least 30 kg/m^2 having any procedure

Results table for Aftab et al. (2019a) (sub-study of Aftab et al. 2019b)

Outcome	Intervention: desflurane inhalation	Comparator: propofol infusion (TIVA)	Analysis
Primary outcome	**n=46**	**n=47**	**-**
Number of participants discharged the same day as surgery (%)	13/46 (28.3%)	18/47 (38.3%)	p=0.280 (No significant difference)
Secondary outcomes	**n=46**	**n=47**	**-**
Number of participants with complications leading to readmission within 30 days using Clavien-Dindo Classification (%)	2/46 (4.3%)	4/47 (8.5%)	No significant difference (p value not reported)

Abbreviations: p, p value; TIVA, total intravenous anaesthetic

The Clavien-Dindo Classification tool is used to rank complications of surgery and ranges from I (any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions) to V (death). See Terms used in this evidence review for more information on technical terms and outcome scales.

Results table for Tanaka et al. (2017)

Outcome	Intervention: desflurane inhalation	Comparator: propofol infusion (TIVA)	Analysis
Primary outcome	**n=45**	**n=45**	**-**
Number of participants with postoperative delirium (CAM) up to 48 hours after surgery (%)	0/45 (0%)	1/45 (2.22%)	p=0.315 (No significant difference)
Secondary outcomes	**n=40**	**n=39**	**-**
Average DSST score at 48 hours (range)	46.2 (29.8 to 62.5)	32.5 (17.3 to 47.7)	p=0.214 (No significant difference)
Average DST score at 48 hours (range)	10.3 (0.293 to 20.2)	12.5 (1.79 to 23.2)	p=0.754

			(No significant difference)
Average TMTa score at 48 hours (range)	48.7 (32.3 to 65.1)	32.5 (17.3 to 47.7)	p=0.142 (No significant difference)
Average TMTb score at 48 hours (range)	48.7 (32.3 to 65.1)	40.0 (24.1 to 55.9)	p=0.435 (No significant difference)

Abbreviations: CAM, 3D-Confusion Assessment Method, a questionnaire used to identify the presence or absence of delirium based on 4 criteria; DSST, Digit Symbol Substitution Test, a measure of cognitive impairment, with higher scores (number of correct responses) indicating better cognitive function; DST, Digit Span Subtest, a measure of attention and working memory, with higher scores (longest sequence of digits accurately repeated) indicating a better outcome; p, p value; TIVA, total intravenous anaesthetic; TMT, Trail Making Test, a measure of memory and executive function in 2 parts, with lower scores (time taken to complete the test) indicating a better outcome

Results table for Zucco et al. (2021)

Outcome	**Intervention: desflurane inhalation**	**Comparator: sevoflurane inhalation**	**Analysis**
Primary outcome	**Total n=23,830**	**Total n=84,608**	**-**
Number of people (all BMI) with postoperative respiratory complications (%)	2,465/23,830 (10.3%)	7,640/84,608 (9.0%)	Adjusted OR 0.99 (95% CI 0.94 to 1.04), p=0.598 (No significant difference)
Subgroup analysis	**BMI >35, n=2,556 (10.7%)**	**BMI >35, n=6,874 (8.1%)**	
Association between desflurane and postoperative respiratory complications in the subgroup of people with BMI ≥35 kg/m^2	Numbers not reported	Numbers not reported	Adjusted OR 0.93 (95% CI 0.85 to 1.02), p=0.144 (No significant difference)
Secondary outcomes	**-**	**-**	**-**
No relevant PICO outcomes	-	-	-

Abbreviations: BMI, body mass index; CI, confidence interval; p, p value; OR, odds ratio

Appendix E: Literature search strategy

Database search strategies

Database: Medline

Platform: Ovid
Version: 1946 to May 11 2023
Search date: 12/05/2023
Number of results retrieved: 164
Search strategy:

Ovid MEDLINE(R) <1946 to May 11, 2023>

1 Neurosurgery/ 16721
2 exp Neurosurgical Procedures/ 212979
3 (neurosurg* or neurologic* or nerv* or brain or spin* or cerebr*).jn. 104927
4 ((surg* or operation* or intervention*) adj4 (nerv* or brain* or spin* or cerebr* or neurologic*)).tw. 66576
5 (neurosurg* or pyschosurg* or lobotom* or leukotom* or crani* or foraminotom* or denerv* or hypophysectom* or laminectom* or laminoplast* or pallidotom* or stereota* or lobectom* or neuroendoscop* or parasympathectom* or sympathectom* or axotom* or cordotom* or hemispherectom* or shunt* or trephining or block* or rhizotom*).tw. 1124303
6 exp Obesity/ 258203
7 obes*.tw. 321799
8 (("body mass ind*" or "body fat ind*" or BMI or BFI) adj2 (3* or 4* or 5* or 6* or thirty or forty or fifty or sixty)).tw. 48655
9 or/1-8 1732942
10 desflurane/ or Isoflurane/aa 1768
11 (desflurane* or suprane*).tw. 2227
12 or/10-11 2405
13 9 and 12 396
14 animal/ not human/ 5086092
15 13 not 14 322
16 limit 15 to english language/ 293
17 Observational Studies as Topic/ 8716
18 Observational Study/ 141412
19 Epidemiologic Studies/ 9325
20 exp Case-Control Studies/ 1413726
21 exp Cohort Studies/ 2478587
22 Cross-Sectional Studies/ 465622
23 Controlled Before-After Studies/ 724
24 Historically Controlled Study/ 227
25 Interrupted Time Series Analysis/ 1818
26 Comparative Study.pt. 1912479
27 case control$.tw. 137651
28 (cohort adj (study or studies)).tw. 266216

29 cohort analy$.tw. 10029
30 (follow up adj (study or studies)).tw. 51266
31 (observational adj (study or studies)).tw. 130456
32 longitudinal.tw. 270742
33 prospective.tw. 619306
34 retrospective.tw. 618225
35 cross sectional.tw. 412069
36 or/17-35 5070318
37 randomized controlled trial.pt. 592176
38 randomi?ed.mp. 961232
39 placebo.mp. 224411
40 or/37-39 1018485
41 (MEDLINE or pubmed).tw. 257606
42 systematic review.tw. 209884
43 systematic review.pt. 220899
44 meta-analysis.pt. 180489
45 intervention$.ti. 166080
46 or/41-45 559162
47 36 or 40 or 46 5994849
48 16 and 47 205
49 limit 48 to yr="2000 -Current" 164

Database: Medline in-process

Platform: Ovid
Version: 1946 to May 11 2023
Search date: 12/05/2023
Number of results retrieved: 0
Search strategy:

Ovid MEDLINE(R) In-Process & In-Data-Review Citations <1946 to May 11, 2023>

1 Neurosurgery/ 0
2 exp Neurosurgical Procedures/ 0
3 (neurosurg* or neurologic* or nerv* or brain or spin* or cerebr*).jn. 11
4 ((surg* or operation* or intervention*) adj4 (nerv* or brain* or spin* or cerebr* or neurologic*)).tw. 6
5 (neurosurg* or pyschosurg* or lobotom* or leukotom* or crani* or foraminotom* or denerv* or hypophysectom* or laminectom* or laminoplast* or pallidotom* or stereota* or lobectom* or neuroendoscop* or parasympathectom* or sympathectom* or axotom* or cordotom* or hemispherectom* or shunt* or trephining or block* or rhizotom*).tw. 98
6 exp Obesity/ 0
7 obes*.tw. 63
8 (("body mass ind*" or "body fat ind*" or BMI or BFI) adj2 (3* or 4* or 5* or 6* or thirty or forty or fifty or sixty)).tw. 10
9 or/1-8 177
10 desflurane/ or Isoflurane/aa 0
11 (desflurane* or suprane*).tw. 0
12 or/10-11 0

13 9 and 12 0
14 animal/ not human/ 0
15 13 not 14 0
16 limit 15 to english language/ 0
17 Observational Studies as Topic/ 0
18 Observational Study/ 1
19 Epidemiologic Studies/ 0
20 exp Case-Control Studies/ 0
21 exp Cohort Studies/ 0
22 Cross-Sectional Studies/ 0
23 Controlled Before-After Studies/ 0
24 Historically Controlled Study/ 0
25 Interrupted Time Series Analysis/ 0
26 Comparative Study.pt. 0
27 case control$.tw. 25
28 (cohort adj (study or studies)).tw. 107
29 cohort analy$.tw. 3
30 (follow up adj (study or studies)).tw. 7
31 (observational adj (study or studies)).tw. 48
32 longitudinal.tw. 78
33 prospective.tw. 114
34 retrospective.tw. 184
35 cross sectional.tw. 158
36 or/17-35 555
37 randomized controlled trial.pt. 0
38 randomi?ed.mp. 139
39 placebo.mp. 30
40 or/37-39 146
41 (MEDLINE or pubmed).tw. 99
42 systematic review.tw. 103
43 systematic review.pt. 4
44 meta-analysis.pt. 1
45 intervention$.ti. 52
46 or/41-45 176
47 36 or 40 or 46 791
48 16 and 47 0
49 limit 48 to yr="2000 -Current" 0

Database: Medline epubs ahead of print

Platform: Ovid
Version: May 11 2023
Search date: 12/05/2023
Number of results retrieved: 1
Search strategy:

Ovid MEDLINE(R) Epub Ahead of Print <May 11, 2023>

1 Neurosurgery/ 0
2 exp Neurosurgical Procedures/ 0

3 (neurosurg* or neurologic* or nerv* or brain or spin* or cerebr*).jn. 1254
4 ((surg* or operation* or intervention*) adj4 (nerv* or brain* or spin* or cerebr* or neurologic*)).tw. 1757
5 (neurosurg* or pyschosurg* or lobotom* or leukotom* or crani* or foraminotom* or denerv* or hypophysectom* or laminectom* or laminoplast* or pallidotom* or stereota* or lobectom* or neuroendoscop* or parasympathectom* or sympathectom* or axotom* or cordotom* or hemispherectom* or shunt* or trephining or block* or rhizotom*).tw. 11782
6 exp Obesity/ 0
7 obes*.tw. 4669
8 (("body mass ind*" or "body fat ind*" or BMI or BFI) adj2 (3* or 4* or 5* or 6* or thirty or forty or fifty or sixty)).tw. 900
9 or/1-8 19084
10 desflurane/ or Isoflurane/aa 0
11 (desflurane* or suprane*).tw. 18
12 or/10-11 18
13 9 and 12 3
14 animal/ not human/ 0
15 13 not 14 3
16 limit 15 to english language/ 3
17 Observational Studies as Topic/ 0
18 Observational Study/ 1
19 Epidemiologic Studies/ 0
20 exp Case-Control Studies/ 0
21 exp Cohort Studies/ 0
22 Cross-Sectional Studies/ 0
23 Controlled Before-After Studies/ 0
24 Historically Controlled Study/ 0
25 Interrupted Time Series Analysis/ 0
26 Comparative Study.pt. 0
27 case control$.tw. 1872
28 (cohort adj (study or studies)).tw. 8074
29 cohort analy$.tw. 288
30 (follow up adj (study or studies)).tw. 485
31 (observational adj (study or studies)).tw. 3696
32 longitudinal.tw. 6181
33 prospective.tw. 10368
34 retrospective.tw. 15992
35 cross sectional.tw. 9162
36 or/17-35 42843
37 randomized controlled trial.pt. 1
38 randomi?ed.mp. 11779
39 placebo.mp. 2324
40 or/37-39 12521
41 (MEDLINE or pubmed).tw. 8280
42 systematic review.tw. 8385
43 systematic review.pt. 200
44 meta-analysis.pt. 82
45 intervention$.ti. 3474
46 or/41-45 14771

47 36 or 40 or 46 62007
48 16 and 47 1

Database: Embase

Platform: Ovid
Version: 1974 to 2023 May 11
Search date: 12/06/2023
Number of results retrieved: 533
Search strategy:

Embase <1974 to 2023 May 11>

1 exp Neurosurgery/ 302831
2 (neurosurg* or neurologic* or nerv* or brain or spin* or cerebr*).jn. 151102
3 ((surg* or operation* or intervention*) adj4 (nerv* or brain* or spin* or cerebr* or neurologic*)).tw. 115343
4 (neurosurg* or pyschosurg* or lobotom* or leukotom* or crani* or foraminotom* or denerv* or hypophysectom* or laminectom* or laminoplast* or pallidotom* or stereota* or lobectom* or neuroendoscop* or parasympathectom* or sympathectom* or axotom* or cordotom* or hemispherectom* or shunt* or trephining or block* or rhizotom*).tw. 1663170
5 exp Obesity/ 652083
6 obes*.tw. 556039
7 (("body mass ind*" or "body fat ind*" or BMI or BFI) adj2 (3* or 4* or 5* or 6* or thirty or forty or fifty or sixty)).tw. 130366
8 or/1-7 2803195
9 desflurane/ 6774
10 (desflurane* or suprane*).tw. 3431
11 or/9-10 7052
12 8 and 11 1536
13 nonhuman/ not human/ 5299773
14 12 not 13 1448
15 limit 14 to (books or chapter or conference abstract or conference paper or "conference review" or editorial or letter or "preprint (unpublished, non-peer reviewed)") 273
16 14 not 15 1175
17 limit 16 to english language/ 1110
18 Clinical study/ 162952
19 Case control study/ 205555
20 Family study/ 25766
21 Longitudinal study/ 193029
22 Retrospective study/ 1461742
23 comparative study/ 1003637
24 Prospective study/ 873944
25 Randomized controlled trials/ 259490
26 24 not 25 863036
27 Cohort analysis/ 1031209
28 cohort analy$.tw. 19391
29 (Cohort adj (study or studies)).tw. 466583

30 (Case control$ adj (study or studies)).tw. 172332
31 (follow up adj (study or studies)).tw. 73694
32 (observational adj (study or studies)).tw. 253174
33 (epidemiologic$ adj (study or studies)).tw. 122412
34 (cross sectional adj (study or studies)).tw. 336987
35 prospective.tw. 1099333
36 retrospective.tw. 1248749
37 or/18-23,26-36 5301802
38 random:.tw. 1962419
39 placebo:.mp. 522744
40 double-blind:.tw. 244950
41 or/38-40 2239145
42 (MEDLINE or pubmed).tw. 408426
43 exp systematic review/ or systematic review.tw. 511193
44 meta-analysis/ 292015
45 intervention$.ti. 264270
46 or/42-45 968226
47 37 or 41 or 46 7529618
48 17 and 47 561
49 limit 48 to yr="2000 -Current" 533

Database: Cochrane Library – incorporating Cochrane Database of Systematic Reviews (CDSR); CENTRAL

Platform: Wiley
Version:
CDSR –Issue 5 of 12, May 2023
CENTRAL – Issue 5 of 12, May 2023
Search date:
Number of results retrieved: CDSR 2; CENTRAL 260

ID Search Hits
#1 MeSH descriptor: [Neurosurgery] explode all trees 225
#2 MeSH descriptor: [Neurosurgical Procedures] explode all trees 8769
#3 ((surg* or operation* or intervention*) near/4 (nerv* or brain* or spin* or cerebr* or neurologic*)):ti,ab,kw 19408
#4 (neurosurg* or pyschosurg* or lobotom* or leukotom* or crani* or foraminotom* or denerv* or hypophysectom* or laminectom* or laminoplast* or pallidotom* or stereota* or lobectom* or neuroendoscop* or parasympathectom* or sympathectom* or axotom* or cordotom* or hemispherectom* or shunt* or trephining or block* or rhizotom*):ti,ab,kw 115766
#5 MeSH descriptor: [Obesity] explode all trees 21084
#6 (obes*):ti,ab,kw 52753
#7 ((body next mass next ind* or body next fat ind* or BMI or BFI) near/2 (3* or 4* or 5* or 6* or thirty or forty or fifty or sixty)):ti,ab,kw 28395
#8 {or #1-#7} 195331
#9 MeSH descriptor: [Desflurane] explode all trees 734
#10 MeSH descriptor: [Isoflurane] explode all trees and with qualifier(s): [analogs & derivatives - AA] 483
#11 (desflurane* or suprane*):ti,ab,kw 1890
#12 #9 or #10 or #11 1890
#13 #8 and #12 493
#14 conference:pt or (clinicaltrials or trialsearch):so 678650

#15 #13 not #14 with Cochrane Library publication date Between Jan 2000 and May 2023 262

Database: INAHTA

Website: https://database.inahta.org/
Search date: 12/05/2023
Number of results retrieved: 2
Search strategy:

((desflurane* or suprane*)[Title] OR (desflurane* or suprane*)[abs]) OR ("Isoflurane"[mh]) OR ("Desflurane"[mhe])

Database: EUnetHTA

Website: https://www.eunethta.eu/assessment-archive/
Search date: 10/05/20203
Number of results retrieved: 0
Search strategy:

Additional search using bariatric surgery terms

Database: Medline

Ovid MEDLINE(R) <1946 to May 22, 2023>

1 desflurane/ or Isoflurane/aa 1770
2 (desflurane* or suprane*).tw. 2229
3 1 or 2 2407
4 exp Bariatric Surgery/ 33170
5 ((bariatric or stomach or metabolic or weight loss or weight reduc*) adj4 (surg* or operat* or procedure*)).tw. 28592
6 (stomach adj4 stapl*).tw. 100
7 ((gastr* or stomach or ileojejunal or intestin* or jejuno*) adj4 (bypass or diver*)).tw. 19728
8 (gastrojejunostom* or gastroplast* or lipectom* or lipolysis or liposuction or lipoplast* or gastrectom* or "roux en y").tw. 59735
9 ((gastr* or stomach) adj4 (band* or sleeve* or balloon*)).tw. 11731
10 Biliopancreatic Diversion/ 1108
11 ((biliopancreatic or bilio pancreatic) adj4 (bypass or diver*)).tw. 1299
12 or/4-11 94506
13 3 and 12 42
14 animal/ not human/ 5089661
15 13 not 14 42
16 limit 15 to english language/ 39
17 limit 16 to yr="2000 -Current" 39

Database: Medline in-process

Ovid MEDLINE(R) In-Process & In-Data-Review Citations <1946 to May 22, 2023>

1 desflurane/ or Isoflurane/aa 0
2 (desflurane* or suprane*).tw. 0
3 1 or 2 0
4 exp Bariatric Surgery/ 0
5 ((bariatric or stomach or metabolic or weight loss or weight reduc*) adj4 (surg* or operat* or procedure*)).tw. 3
6 (stomach adj4 stapl*).tw. 0
7 ((gastr* or stomach or ileojejunal or intestin* or jejuno*) adj4 (bypass or diver*)).tw. 1
8 (gastrojejunostom* or gastroplast* or lipectom* or lipolysis or liposuction or lipoplast* or gastrectom* or "roux en y").tw. 6
9 ((gastr* or stomach) adj4 (band* or sleeve* or balloon*)).tw. 2
10 Biliopancreatic Diversion/ 0
11 ((biliopancreatic or bilio pancreatic) adj4 (bypass or diver*)).tw. 0
12 or/4-11 10
13 3 and 12 0
14 animal/ not human/ 0
15 13 not 14 0
16 limit 15 to english language/ 0
17 limit 16 to yr="2000 -Current" 0

Database: Medline epubs ahead of print

Ovid MEDLINE(R) Epub Ahead of Print <May 22, 2023>

1 desflurane/ or Isoflurane/aa 0
2 (desflurane* or suprane*).tw. 20
3 1 or 2 20
4 exp Bariatric Surgery/ 0
5 ((bariatric or stomach or metabolic or weight loss or weight reduc*) adj4 (surg* or operat* or procedure*)).tw. 596
6 (stomach adj4 stapl*).tw. 3
7 ((gastr* or stomach or ileojejunal or intestin* or jejuno*) adj4 (bypass or diver*)).tw. 365
8 (gastrojejunostom* or gastroplast* or lipectom* or lipolysis or liposuction or lipoplast* or gastrectom* or "roux en y").tw. 775
9 ((gastr* or stomach) adj4 (band* or sleeve* or balloon*)).tw. 302
10 Biliopancreatic Diversion/ 0
11 ((biliopancreatic or bilio pancreatic) adj4 (bypass or diver*)).tw. 30
12 or/4-11 1296
13 3 and 12 0
14 animal/ not human/ 0
15 13 not 14 0
16 limit 15 to english language/ 0
17 limit 16 to yr="2000 -Current" 0

Database: Embase

Embase <1974 to 2023 May 22>

1 desflurane/ 6792
2 (desflurane* or suprane*).tw. 3434
3 1 or 2 7072
4 exp bariatric surgery/ 57257
5 ((bariatric or stomach or metabolic or weight loss or weight reduc*) adj4 (surg* or operat* or procedure*)).tw. 56156
6 (stomach adj4 stapl*).tw. 271
7 ((gastr* or stomach or ileojejunal or intestin* or jejuno*) adj4 (bypass or diver*)).tw. 37172
8 (gastrojejunostom* or gastroplast* or lipectom* or lipolysis or liposuction or lipoplast* or gastrectom* or "roux en y").tw. 94755
9 ((gastr* or stomach) adj4 (band* or sleeve* or balloon*)).tw. 27405
10 ((biliopancreatic or bilio pancreatic) adj4 (bypass or diver*)).tw. 2280
11 or/4-10 154565
12 3 and 11 211
13 nonhuman/ not human/ 5305319
14 12 not 13 210
15 limit 14 to english language/ 204
16 limit 15 to (books or chapter or conference abstract or conference paper or "conference review" or editorial or letter or "preprint (unpublished, non-peer reviewed)") 43
17 15 not 16 161
18 limit 17 to yr="2000 -Current" 161

Search Name: desflurane and bariatric surgery
Date Run: 23/05/2023 16:26:47
Comment:

ID Search Hits
#1 MeSH descriptor: [Desflurane] explode all trees734
#2 MeSH descriptor: [Isoflurane] explode all trees and with qualifier(s): [analogs & derivatives - AA] 483
#3 (desflurane* or suprane*):ti,ab,kw 1890
#4 #1 or #2 or #3 1890
#5 MeSH descriptor: [Bariatric Surgery] explode all trees 1625
#6 ((bariatric or stomach or metabolic or weight loss or weight reduc*) near/4 (surg* or operat* or procedure*)):ti,ab,kw 33987
#7 (stomach near/4 stapl*):ti,ab,kw 37
#8 ((gastr* or stomach or ileojejunal or intestin* or jejuno*) near/4 (bypass or diver*)):ti,ab,kw 2714
#9 (gastrojejunostom* or gastroplast* or lipectom* or lipolysis or liposuction or lipoplast* or gastrectom* or "roux en y"):ti,ab,kw 7446
#10 MeSH descriptor: [Biliopancreatic Diversion] explode all trees 39
#11 ((biliopancreatic or bilio pancreatic) near/4 (bypass or diver*)):ti,ab,kw 164
#12 {or #5-#11} 38845

#13 #4 and #12 154
#14 conference:pt or (clinicaltrials or trialsearch):so 678650
#15 #13 not #14 with Cochrane Library publication date Between Jan 2000 and May 2023 94

Appendix F: Excluded studies

Neurological procedures

Study reference	Reason for exclusion
Bastola P, Bhagat H, Wig J (2015) Comparative evaluation of propofol, sevoflurane and desflurane for neuroanaesthesia: a prospective randomised study in patients undergoing elective supratentorial craniotomy. Indian Journal of Anaesthesia 59(5): 287-94	Poor relevance against search terms (no relevant outcomes)
Cata JP, Hagan KB, Bhavsar SDO et al. (2017) The use of isoflurane and desflurane as inhalational agents for glioblastoma surgery. A survival analysis. Journal of clinical neuroscience: official journal of the Neurosurgical Society of Australasia 35: 82-7	Poor relevance against search terms (intervention and comparator confounded)
Jiang Z, Wu Y, Liang F et al. (2023) Brain relaxation using desflurane anesthesia and total intravenous anesthesia in patients undergoing craniotomy for supratentorial tumors: a randomized controlled study. BMC Anesthesiology 23(1): 15	Poor relevance against search terms (no relevant outcomes)
Lu C-H, Wu Z-F, Lin B-F et al. (2016) Faster extubation time with more stable hemodynamics during extubation and shorter total surgical suite time after propofol-based total intravenous anesthesia compared with desflurane anesthesia in lengthy lumbar spine surgery. Journal of Neurosurgery: Spine 24(2): 268-74	Poor relevance against search terms (no relevant outcomes)
Paul AP, Vedantam A, Korula G et al. (2017) A comparison of the recovery profiles of desflurane and isoflurane anesthesia in patients undergoing elective supratentorial craniotomy: A randomized controlled trial. Neurology India 65(5): 1053-8	Poor relevance against search terms (no relevant outcomes)

BMI at least 30 kg/m^2 having any procedure

Study reference	Reason for exclusion
Afifi Ahmed SM, El-Medany Aly SM, Fouad Shaaban HA et al. (2023) Comparative study between desflurane and sevoflurane regarding haemodynamics and recovery profiles in obese patients undergoing laparoscopic sleeve gastrectomy. Egyptian Journal of Anaesthesia 39(1): 210-7	Poor relevance against search terms (no relevant outcomes)
Demirel I, Yildiz Altun A, Bolat E et al. (2021) Effect of patient state index monitoring on the recovery characteristics in morbidly obese patients: comparison of inhalation anesthesia and total intravenous anesthesia. Journal of perianesthesia nursing: official journal of the American Society of PeriAnesthesia Nurses 36(1): 69-74	Poor relevance against search terms (no relevant outcomes)

Study reference	Reason for exclusion
Elbakry A-E, Sultan W-E, Ibrahim E (2018) A comparison between inhalational (desflurane) and total intravenous anaesthesia (propofol and dexmedetomidine) in improving postoperative recovery for morbidly obese patients undergoing laparoscopic sleeve gastrectomy: a double-blinded randomised controlled trial. Journal of Clinical Anesthesia 45: 6-11	Poor relevance against search terms (no relevant outcomes)
Juvin P, Vadam C, Malek L et al. (2000) Postoperative recovery after desflurane, propofol, or isoflurane anesthesia among morbidly obese patients: a prospective, randomized study. Anesthesia and Analgesia 91(3): 714-9	Poor relevance against search terms (no relevant outcomes)
Kaur A, Jain AK, Sehgal R et al. (2013) Hemodynamics and early recovery characteristics of desflurane versus sevoflurane in bariatric surgery. Journal of Anaesthesiology Clinical Pharmacology 29(1): 36-40	Poor relevance against search terms (no relevant outcomes)
La Colla L, Albertin A, La Colla G et al. (2007) Faster wash-out and recovery for desflurane vs sevoflurane in morbidly obese patients when no premedication is used. British Journal of Anaesthesia 99(3): 353-8	Poor relevance against search terms (no relevant outcomes)
Liu F-L, Cherng Y-G, Chen S-Y et al. (2015) Postoperative recovery after anesthesia in morbidly obese patients: a systematic review and meta-analysis of randomized controlled trials. Canadian journal of anaesthesia = Journal Canadien d'Anesthesie 62(8): 907-17	Poor relevance against search terms (no relevant outcomes)
Neimark MI and Kiselev RV (2019) Application of accelerated activation in retroperitoneal video endoscopic adrenalectomy for cushing syndrome. Obshchaya Reanimatologiya 15(3): 19-30	Poor relevance against search terms (intervention and comparator confounded)
Vallejo MC, Sah N, Phelps AL et al. (2007) Desflurane versus sevoflurane for laparoscopic gastroplasty in morbidly obese patients. Journal of Clinical Anesthesia 19(1): 3-8	Poor relevance against search terms (no relevant outcomes)
Wong SSC, Chan WS, Irwin MG et al. (2020) Total intravenous anesthesia (TIVA) with propofol for acute postoperative pain: a scoping review of randomized controlled trials. Asian Journal of Anesthesiology 58(3): 79-93	Poor relevance against search terms (no relevant populations)