Health Technology Briefing
May 2026

Sufentanil-ketamine for elective surgical procedures in children aged 1-17 years old

Company/Developer	Proveca

☒ New Active Substance ☐ Significant Licence Extension (SLE)

NIHRIO ID: 33433	NICE ID: Not Available	UKPS ID: Not Available

Licensing and Market Availability Plans

In phase II clinical development.

Summary

Sufentanil-ketamine fixed dose combination is being developed for pain management and sedation in children aged 1-17 years old undergoing elective surgical procedures. Elective surgical procedures are surgeries which are not emergencies and scheduled in advance. Elective surgical procedures can result in pain either due to the disease being treated, the surgical procedure or complications linked to the surgery. Poor pain control may lead to complications after surgery; longer hospital stays and persistent chronic pain. Current medications used to manage pain and sedate children for surgery are associated with serious side effects such as liver and kidney failure, and raised intracranial pressure.

Sufentanil-ketamine fixed dose combination of two pain-relief and sedative medicines. Sufentanil is a strong pain-relief medicine, which reduces the sensation of pain by attaching to specific receptors in the brain and nervous system. Ketamine is a medicine that can produce anaesthesia, sedation, and pain relief, depending on the dose. It works by blocking a specific receptor in the brain called the N-methyl-D-aspartic acid receptor, which is thought to play an important role in how ketamine reduces pain. Sufentanil-ketamine is given through inhalation in the nose, meaning it is easier to take compared to other medicines which have to be given as an injection. Nasal inhalation of sufentanil-ketamine also causes it to act more quickly and reduces potential side effects on the liver. If licenced, sufentanil-ketamine would offer an additional pain management and sedation option for children undergoing elective surgery.

Proposed Indication

For children aged 1-17 years old undergoing elective surgical procedures.[1]

This briefing reflects the evidence available at the time of writing and a limited literature search. It is not intended to be a definitive statement on the safety, efficacy or effectiveness of the health technology covered and should not be used for commercial purposes or commissioning without additional information. A version of the briefing was sent to the company for a factual accuracy check. The company was unavailable to comment.

Copyright © National Institute for Health and Care Research Innovation Observatory, The University of Newcastle upon Tyne.

Technology

Description

Sufentanil-ketamine (CT001) is a fixed dose combination (FDC) of sufentanil and ketamine.[1,2] Ketamine is a water and lipid-soluble N-methyl-D-aspartic acid (NMDA) receptor antagonist which provides dose-dependent anaesthetic, sedative, and analgesic effects.[3] The activity on NMDA receptors may be responsible for the analgesic effects of ketamine.[4] Sufentanil is a synthetic, potent opioid with highly selective binding to μ-opioid receptors. Analgesia induced by sufentanil is thought to be mediated via activation of μ-opioid receptors primarily within the CNS to alter processes affecting both the perception of and the response to pain.[5]

Sufentanil-ketamine is in clinical development for pain management in children aged 1-17 years old undergoing elective surgical procedures.[1] In the phase III trial, NCT04897750, between 2-4 puffs of sufentanil-ketamine (sufentanil 0.5 mcg/kg and ketamine 0.5 mg/kg) is given intranasally prior to surgical procedure.[1]

Key Innovation

In the UK, no medicines have a marketing authorisation specifically for sedation in all infants, children and young people under 19 years. Current analgesic agents for use in children such as midazolam and chloral hydrate are associated with serious side effects such as increased aspiration risk, obstructive sleep apnoea, severe renal or hepatic impairment and raised intracranial pressure.[6-8] Sufentanil-ketamine is given intranasally, which is non-invasive and associated with ease of administration.[9,10] Previous studies have shown due to intranasal administration, sufentanil-ketamine is rapidly absorbed systemically and avoids hepatic first-pass metabolism.[9] The combination of sufentanil-ketamine has been shown to be effective and well-tolerated.[10] If licenced, sufentanil-ketamine would offer an additional therapeutic option for pain relief in children undergoing elective surgical procedures.

Regulatory & Development Status

Sufentanil-ketamine FDC does not currently have marketing authorisation in the UK/EU for any indication.

Sufenanil is licenced as a monotherapy for acute moderate to severe pain in adult patients.[11]

Ketamine is licenced as a monotherapy for:[12,13]

- Induction and maintenance of anaesthesia for short procedures
- Induction and maintenance of anaesthesia for long procedures
- Diagnostic manoeuvres and procedures not involving intense pain
- Sedation prior to invasive or painful procedures

Sufentanil-ketamine FDC is not in phase II/III clinical development for any other indication.[14]

Patient Group

Disease Area and Clinical Need

Acute pain can be caused by injury, surgery, illness, trauma, or painful medical procedures and generally lasts from a few minutes to less than three months.[15,16] Acute pain usually disappears whenever the underlying cause is treated or healed.[15] Perioperative pain is acute and often time-limited, predictable, and (at least severe) preventable. It is caused by the disease itself, the surgical procedure and/or its complications. Perioperative pain must be treated strongly, especially in the first 24 hours after surgery,

Copyright © National Institute for Health and Care Research Innovation Observatory, The University of Newcastle upon Tyne.

given that surgical trauma and systemic inflammation intensity peak. Poor pain control may lead to postoperative complications, longer hospital stays and persistent chronic pain, increasing morbidity and costs.[15] Elective surgery is a surgical procedure that is scheduled in advance and does not involve a medical emergency, allowing for flexibility in timing without impacting treatment and recovery.[17]

In 2020, there were 134,369 elective paediatric surgical procedures, with the median length of hospital stay being 1 day.[18] The 90-day mortality rate for children who had undergone any surgical procedure was 360 per 100,000 between 2015-2020.[18]

Recommended Treatment Options

There is no treatment option recommended by the National Institute for Health and Care Excellence (NICE) for pain management in children aged 1-17 years old undergoing elective surgical procedures. NICE guidance for sedation in under 19-year-olds undergoing painful procedures recommends either;[19]

- Midazolam
- Nitrous oxide
- Ketamine
- Fentanyl

The European Society for Paediatric Anaesthesiology (ESPA) recommends the following treatments for perioperative pain management in children:[20]

- Non-steroidal anti-inflammatories
- Clonidine
- Preservative-free ketamine
- Dexmedetomide
- Lidocaine
- Metamizole
- Fentanyl
- Tramadol
- Nalbuphine

Clinical Trial Information

Trial	NCT04897750; **EudraCT** 2021-000137-14; Pharmacokinetic Study of Intranasal CT001 in Children 1-17 Years of Age Undergoing Elective Surgical Procedures **Phase II –** Completed **Location:** Denmark **Study Completion Date:** May 2022
Trial Design	Single group assignment, open-label.
Population	N (actual) = 25. Paediatric participants with planned elective surgical procedures; aged 1-17 years.
Intervention(s)	Sufentanil 0.5 mcg/kg-ketamine 0.5 mg/kg as nasal spray, followed by an additional dose 10 -15 minutes after, if needed, prior to placement of peripheral venous catheter for induction of anaesthesia.
Comparator(s)	No comparator.
Outcome(s)	Primary outcomes:

Copyright © National Institute for Health and Care Research Innovation Observatory, The University of Newcastle upon Tyne.

	• Total absorption over time. [Time frame: 0-120 minutes] • Maximum absorption. [Time frame: 0-120 minutes] • Distribution. [Time frame: 120-240 minutes] • Elimination. [Time frame: 120-240 minutes] See trial record for full list of other outcomes.
Results (efficacy)	-
Results (safety)	-

Estimated Cost

The cost of sufentanil-ketamine FDC is not yet known.

Relevant Guidance

NICE Guidance

- NICE Clinical Guideline. Sedation in under 19s: using sedation for diagnostic and therapeutic procedures. CG112. December 2010.

NHS England (Policy/Commissioning) Guidance

- NHS Standard Contract 2013/14. NHS Standard Contract for Paediatric Surgery: Surgery and Surgical pathology, Anaesthesia & Pain. E02/S/a

Other Guidance

- European Society for Paediatric Anaesthesiology. Postoperative Pain Management in children: guidance from the Pain Committee of the European Society for Paediatric Anaesthesiology (ESPA Pain Management Ladder Initiative) Part II. 2024.[20]
- Royal College of Anaesthetists. Chapter 10: Guidelines for the Provision of Paediatric Anaesthesia Services 2025. 2023.[21]

Additional Information

Proveca did not enter information about this technology onto the UK PharmaScan database; the primary source of information for UK horizon scanning organisations on new medicines in development. As a result, the NIHR Innovation Observatory has had to obtain data from other sources. UK PharmaScan is an essential tool to support effective NHS forward planning; allowing more effective decision making and faster uptake of innovative new medicines for patients who could benefit. We urge pharmaceutical companies to use UK PharmaScan so that we can be assured of up-to-date, accurate and comprehensive information on new medicines.

References

Copyright © National Institute for Health and Care Research Innovation Observatory, The University of Newcastle upon Tyne.

1 ClinicalTrials.gov. *Pharmacokinetic Study of Intranasal CT001 in Children 1-17 Years of Age Undergoing Elective Surgical Procedures. Trial ID: NCT04897750*. 2021. Status: Completed. Available from: https://clinicaltrials.gov/study/NCT04897750 [Accessed 27 March 2026].
2 Cessatech. *Cessatech Pipeline*. 2026. Available from: https://cessatech.com/pipeline/ct001-napatrin-nasal-spray/ [Accessed 07 May 2026].
3 Richards ND, Howell SJ, Bellamy MC, Beck J. The diverse effects of ketamine, jack-of-all-trades: a narrative review. *British Journal of Anaesthesia*. 2025;134(3):649-61. Available from: https://doi.org/10.1016/j.bja.2024.11.018.
4 Electronic Medicines Compendium. *Ketamine 50 mg/ml Injection*. 2025. Available from: https://www.medicines.org.uk/emc/product/6935/smpc [Accessed 27 March 2026].
5 Electronic Medicines Compendium. *Dzuveo 30mcg Sublingual tablet*. 2024. Available from: https://www.medicines.org.uk/emc/product/13984/smpc [Accessed 26 March 2026].
6 NHS Scotland. *Sedation for diagnostic and therapeutic procedures on children*. 2025. Available from: https://www.clinicalguidelines.scot.nhs.uk/ggc-paediatric-guidelines/ggc-paediatric-guidelines/medical-paediatrics/sedation-for-diagnostic-and-therapeutic-procedures-on-children/?searchTerm=BUCCAL%20APFRACTURE%20LEGION [Accessed 27 March 2026].
7 British National Formulary. *Chloral Hydrate: Contra-indications*. 2026. Available from: https://bnfc.nice.org.uk/drugs/chloral-hydrate/#contra-indications [Accessed 07 May 2026].
8 British National Formulary. *Midazolam: Contra-indications*. 2026. Available from: https://bnfc.nice.org.uk/drugs/midazolam/#contra-indications [Accessed 07 May 2026].
9 Nielsen BN, Friis SM, Rømsing J, Schmiegelow K, Anderson BJ, Ferreirós N, et al. Intranasal sufentanil/ketamine analgesia in children. *Pediatric Anesthesia*. 2014;24(2):170-80. Available from: https://doi.org/10.1111/pan.12268.
10 Schoemaker R, Werner M, Juhl M. *Quantification of the analgesic effect of intranasal coadministration of ketamine and sufentanil in adults to support the development of a pain relief treatment (CT001) in children*. 2024. Available from: https://www.page-meeting.org/wp-content/uploads/pdf_abstracts/11064-abstract.pdf [Accessed 27 March 2026].
11 British National Formulary. *Sufentanil*. 2026. Available from: https://bnf.nice.org.uk/drugs/sufentanil/ [Accessed 02 April 2026].
12 British National Formulary. *Ketamine*. 2026. Available from: https://bnf.nice.org.uk/drugs/ketamine [Accessed 02 April 2026].
13 British National Formulary for Children. *Ketamine*. 2026. Available from: https://bnfc.nice.org.uk/drugs/ketamine/#indications-and-dose [Accessed 07 May 2026].
14 ClinicalTrials.gov. *ClinicalTrials.gov: Search*. 2026. Available from: https://clinicaltrials.gov/search?term=%22CT001%22%20OR%20%22ketamine%22%20OR%20%22sufentanil%22&spons=Cessatech%20A%2FS&viewType=Card [Accessed 27 March 2026].
15 Eizaga Rebollar R, Lamadrid Castrillón EM, Chover Navarro C, García Palacios MV. Perioperative pain in children: an opioid-sparing perspective. *World Journal of Pediatrics*. 2025;21(6):542-9. Available from: https://doi.org/10.1007/s12519-025-00925-3.
16 NHS Wirral University Teaching Hospital. *The difference between chronic and acute pain*. 2026. Available from: https://www.wuth.nhs.uk/our-departments/a-z-of-departments/wirral-chronic-pain-service/the-difference-between-chronic-and-acute-pain/ [Accessed 02 April 2026].
17 ScienceDirect. *Elective Surgery*. 2026. Available from: https://www.sciencedirect.com/topics/medicine-and-dentistry/elective-surgery [Accessed 02 April 2026].

Copyright © National Institute for Health and Care Research Innovation Observatory, The University of Newcastle upon Tyne.

18 Althonayan J, Fowler AJ, Allin B, Sogbodjor A, Bradnock T, Orban N, et al. Trends in Paediatric surgical volume and associated mortality in England: a nationwide study over an eight year period. *BJA Open*. 2025;16. Available from: https://doi.org/10.1016/j.bjao.2025.100505.

19 National Institute for Health and Care Excellence. *Sedation in under 19s: using sedation for diagnostic and therapeutic procedures* (*CG112)*. Available from: https://www.nice.org.uk/guidance/cg112/chapter/Recommendations#painful-procedures [Accessed 02 April 2026].

20 Vittinghoff M, Lönnqvist PA, Mossetti V, Heschl S, Simic D, Colovic V, et al. Postoperative Pain Management in children: guidance from the Pain Committee of the European Society for Paediatric Anaesthesiology (ESPA Pain Management Ladder Initiative) Part II. *Anaesthesia Critical Care & Pain Medicine*. 2024;43(6):101427. Available from: https://doi.org/10.1016/j.accpm.2024.101427.

21 Royal College of Anaesthetists. *Chapter 10: Guidelines for the Provision of Paediatric Anaesthesia Services 2025*. 2023. Available from: https://rcoa.ac.uk/gpas/chapter-10 [Accessed 30 March 2026].

Copyright © National Institute for Health and Care Research Innovation Observatory, The University of Newcastle upon Tyne.