Minerva Anestesiologica 2024 November;90(11):957-68
DOI: 10.23736/S0375-9393.24.18267-3

POSITION PAPER

Recommendations for fast-track extubation in adult cardiac surgery patients: a consensus statement

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ABSTRACT

INTRODUCTION: Enhanced recovery after cardiac surgery in selected low-risk patients, has the potential to improve outcomes and reduce the burden of healthcare costs. Anesthesia-related challenges play a major role in the successful implementation of Enhanced Recovery After Surgery (ERAS) protocols, with particular emphasis placed on fast-track extubation. Acknowledging the importance of this practice, the Italian Association of Cardiac Anesthesiologists and In-

tensive Care (ITACTAIC) has advocated for an initiative to establish a consensus offering practical recommendations for fast-track extubation after adult cardiac surgery.
EVIDENCE ACQUISITION: After conducting a systematic review, all randomised control trials (RCTs) published between 2013 and 2023 were meticulously selected and analysed during a consensus meeting that involved statement voting.
EVIDENCE SYNTHESIS: Out of the 2268 publications identified using the search string, 60 RCTs were selected and classified into six groups, each evaluating specific interventions associated with extubation within 6 hours post-surgery. The authors examined 20 RCTs pertaining to loco-regional anesthesia, 19 analysing elements of general anesthesia, 12 focused on surgery-related aspects and techniques, three examining ventilation, two exploring anesthesia depth monitoring, and four addressing miscellaneous aspects. The expert panel approved 16 statements with 15 achieving high agreement and one obtaining moderate agreement. Finally a total of eight interventions were considered associated with fast-track extubation: parasternal block, erector spinae plane block, alpha agonist in the operating room (OR), opioids in the OR, dexmedetomidine in the intensive care unit (ICU), minimal invasive surgical access, anesthesia depth monitoring, adaptative support ventilation.
CONCLUSIONS: In the first consensus document ever published by a scientific society addressing practical recommendations for fast-track extubation post-cardiac surgery, the authors identified sixteen interventions commonly associated with fast-track extubation in selected adult cardiac surgery patients.

(*Cite this article as:* Silvetti S, Paternoster G, Abelardo D, Ajello V, Aloisio T, Baiocchi M, *et al.* Recommendations for fast-track extubation in adult cardiac surgery patients: a consensus statement. Minerva Anestesiol 2024;90:957-68. DOI: 10.23736/S0375-9393.24.18267-3)

KEY WORDS: Anesthesia; Consensus; Cardiac surgical procedures; Enhanced recovery after surgery; Airway extubation; Intensive care units.

Introduction

In the beginning, ERAS protocols started in the domain of general surgery. Early endeavours towards a fast-track approach after cardiac surgery were evident as early as the 1990s, with the introduction of protocols aimed at facilitating early extubation to improve recovery.[1] Chen *et al.* in 1998 described the concept of "fast-track Heart Surgery", advocating for a multidisciplinary approach to improve patient care in cardiac surgery. These protocols demonstrated the potential for early extubation in the intensive care unit, leading to shorter ICU stays and a potential reduction in costs associated with cardiac surgery.[2] Although it was only in 2017 that a group of cardiac surgeons, anesthesiologists, and intensivists assembled to establish the Enhanced Recovery After Cardiac Surgery (ERACS) Society with the aim of introducing ERAS protocols for cardiac surgery patients. In 2019 a list of 22 recommendations was published.[3]

One of the most important items emphasized by the ERACS society is early extubation. Prolonged mechanical ventilation after cardiac surgery is indeed associated with prolonged hospitalization, higher morbidity and mortality rates, and increased healthcare costs.[4] Conversely, a published meta-analysis has shown that early extubation does not increase perioperative complication rates or significantly reduce the length of stay in the intensive care unit (ICU).[5] This clinical practice is considered safe for most patients undergoing cardiac surgery and is additionally associated with a shortened hospital stay and decreased overall healthcare costs.[6]

In light of this context, strategies aimed at ensuring extubation within six hours of surgery (class IIa, level B non-randomized) are currently recommended.[6] However, optimal strategies and management for achieving extubation within six hours after cardiac surgery have not been systematically addressed previously and are poorly defined to date. To address this pertinent contemporary clinical challenge, the Italian Association of Cardiac Anesthesiology and Intensive Care (ITACTAIC) endorsed a consensus conference. The aim was to gather and analyze all available scientific evidence from randomized control trials (RCTs) on this subject and to provide practical recommendations for fast-track extubation after adult cardiac surgery. After conducting a systematic literature review and engaging in extensive discussions during the expert meeting, a list of sixteen relevant recommendations was compiled.

Evidence acquisition

The consensus process, endorsed by ITACTAIC, involved the collaboration of cardiac anesthesiologists, intensivists, and cardiac surgeons. Initially, a systematic literature review

was conducted using the MEDLINE, Embase, and Google Scholar databases to identify all articles providing data on early extubation and duration of mechanical ventilation in cardiac surgery patients. Supplementary Digital Material 1, Supplementary Text File 1 contains the complete search string. Given the dynamic nature of clinical practice and the aim of deriving practical recommendations, we limited the search period to articles published between January 1st, 2013 and September 20th, 2023. Furthermore, a manual search of the references cited in all the selected papers was carried out.

The initial search was conducted by two members of ITACTAIC, following which a new group, known as the "core team," comprising 11 investigators, further analyzed the interventions identified in the initial search.

Abstracts of publications were considered for selection only if they met the following criteria: 1) full publication in a peer-reviewed journal; 2) involving an adult population undergoing cardiac surgery; 3) published in English 4) reporting outcomes related to extubation or duration of ventilation; and 5) using an RCT design. Studies involving patients with congenital heart disease and pediatric cardiac surgery were excluded. Techniques and/or topics supported solely by a single RCT were also excluded (Supplementary Digital Material 2: Supplementary Table I). The core team meticulously reviewed all data, obtaining essential information including article type, study design, intervention type, sample size, patients' characteristics, outcomes, and main findings.

After selecting articles deemed potentially relevant, the full text was retrieved. Articles with incomplete data regarding extubation time or duration of mechanical ventilation were excluded, as were articles without access to full text.

To identify interventions specifically associated with fast-track extubation, only interventions in the RCT's where more than 75% of patients were extubated within six hours were considered "potentially associated".

The consensus process was conducted as follows:

1) The core team analyzed each intervention and formulated questions and statements for the expert panel (September to December, 2023);

2) A consensus meeting was held in Milan (on 12th January, 2024). The core team presented the included studies and statements to a panel comprising nine experts. These experts were selected based on their clinical and academic experience, each having >10 years of tenure as Head of Cardiac Anesthesia and Intensive Care or Head of Cardiac Surgery Departments. During the consensus meeting, the following steps were undertaken:

• A-The expert panel meticulously reviewed the presented recommendations and anonymously declared their level of agreement with the new draft statements. The first voting process used a numerical rating scale ranging from one to nine for all items. A rating of nine represented "complete agreement," while five indicated "uncertainty," and one signified "complete disagreement." Disagreement, uncertainty, or agreement were predefined as voting intervals between-one to three, four to six, and seven to nine, respectively. The panel consensus was assessed and characterized as "low" if three or more votes were allocated to the one to three rating range, combined with three or more votes falling within the seven to nine rating range. Conversely, consensus was categorized as "high" if a minimum of eight votes fell within a single voting interval (one to two; four to six; or seven to nine). Notably, high consensus could be for agreement, uncertainty, or disagreement. Any other voting combinations were classified as indicative of "moderate" levels of agreement.

• B-Subsequently, a second round of voting was conducted, during which the discussion was directed towards statements that garnered high consensus for uncertainty (defined as a minimum of eight votes falling within the four to six rating range) or statements that attained either low or moderate consensus. These identified statements were then reformulated.

• C-The core group then developed final statements, which were approved by the expert panel.

Evidence synthesis

A total of 2268 publications were selected based on predefined search criteria. After a second screening round, 102 abstracts were selected for

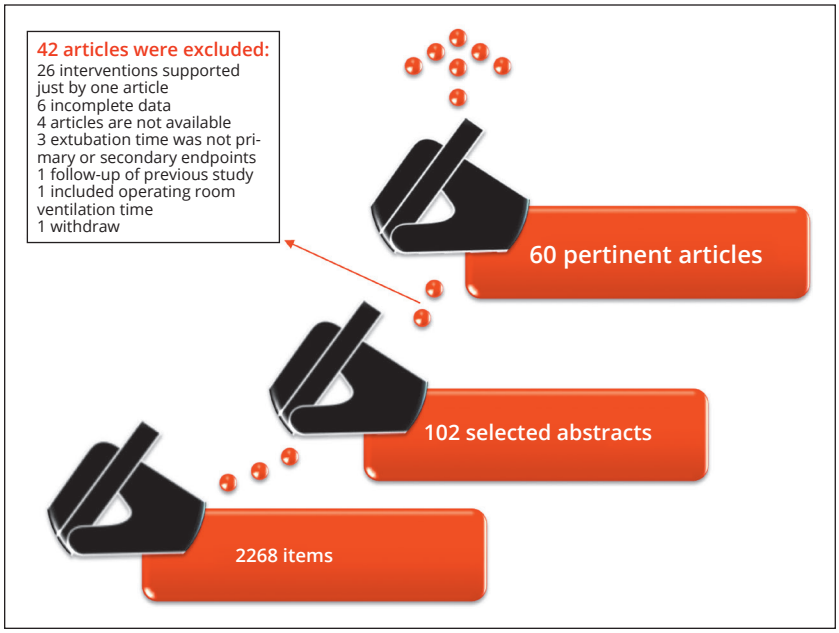

Figure 1.—Flow chart of the included study selection process.

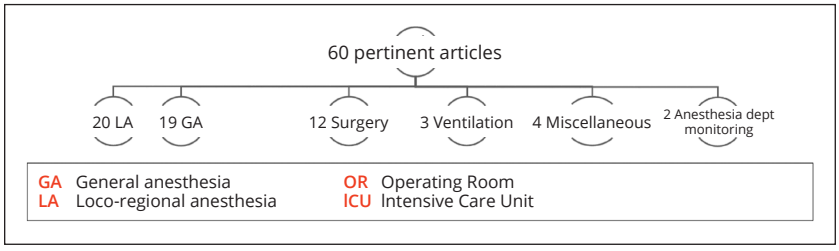

Figure 2.—Topics of included studies, at least two studies for each topic selected.

further consideration. After a thorough examination of each manuscript, 42 articles were excluded. The flow chart illustrating the study selection process is presented in Figure 1. Comprehensive details of the 60[7-66] included RCTs are shown in Supplementary Digital Material 3, Supplementary Table II. Subsequently, the selected studies were categorized into six groups (loco regional anesthesia, general anesthesia, Surgical technique, ventilation, Anesthesia depth monitoring, miscellaneous) based on their respective topics and their effects on early extubation (Figure 2).

The core team elaborated 17 statements corresponding to 17 clinically relevant interventions, as described in the 60 selected papers. After three rounds of voting, the expert panel validated 16 final statements, while one statement was not approved and consequently removed, eight of these were associated with fast track extubation (Table I): parasternal block, erector spinae plane block, alpha agonist in the OR, opioids in the OR, dexmedetomidine in the ICU, minimal invasive surgical access, anesthesia depth monitoring, adaptative support ventilation. The other eight interventions were considered not associated (volatile anesthesia in the OR, propofol in the ICU, paracetamol in the ICU, off-pump, minimal invasive extracorporeal circulation, temperature, intravenous vitamin C, cell savage) (Table II). Voting results and levels of agreement are provided in Supplementary Digital Material 4, Supplementary Table III.

Loco-regional anesthesia

The administration of parasternal block and erector spinae plane (ESP) block is associated with fast-track extubation in patients undergo-

TABLE I.—*Drugs, techniques, and strategies that might be associated with fast-track extubation after cardiac surgery. Final statements.*

Topic	Statement	N. of RCTs in support
Loco-regional anesthesia	In patients scheduled for elective cardiac surgery with sternotomy, postoperative parasternal block is associated with fast-track extubation.	6
Loco-regional anesthesia	In patients scheduled for elective cardiac surgery (sternotomy or minimally invasive approach), an erector spinae plane block is associated with fast track extubation.	5
General anesthesia	In elective cardiac anesthesia the use of alpha-agonists in theatre is associated with fast-track extubation.	3
General anesthesia	In patients undergoing elective cardiac surgery, the use of low-dose or short-acting opioids in theatre is associated with fast-track extubation.	3
General anesthesia	In low-risk cardiac surgery patients undergoing CABG surgery, ICU sedation with dexmedetomidine is associated with fast-track extubation.	3
Surgical technique	Minimally invasive surgical access is associated with fast-track extubation.	2
Ventilation	In patients undergoing elective cardiac surgery, postoperative adaptative support ventilation is associated with fast-track extubation.	3
Anesthesia depth monitoring	In patients undergoing general anesthesia with volatile agents, anesthesia depth monitoring with either processed EEG or halogenated end tidal concentration is associated with fast-track extubation.	2

CABG: coronary artery bypass graft; EEG: electroencephalogram; ICU: intensive care unit.

TABLE II.—*Drugs, techniques, and strategies not associated with fast-track extubation after cardiac surgery. Final statements.*

Topic	Statement	N. of RCTs in support
General anesthesia	In elective cardiac surgery, volatile anesthesia is not associated with fast-track extubation.	3
General anesthesia	In low-risk cardiac surgery patients undergoing CABG and complex surgery, the use of propofol alone or in association with other agents for ICU sedation is not associated with a fast-track extubation.	2
General anesthesia	In patients undergoing elective cardiac surgery, the use of paracetamol alone or in combination with opioids is not associated with fast-track extubation.	3
Surgical technique	Off-pump surgery is not associated with fast-track extubation.	6
Surgical technique	MiECC is not associated with fast-track extubation.	2
Surgical technique	In patients undergoing elective valve surgery, normothermia *versus* moderate hypothermia is not associated with fast-track extubation.	2
Miscellaneous	In low-risk cardiac surgical patients, intravenous vitamin C administration is not associated with fast-track extubation.	2
Miscellaneous	In patients scheduled for planned cardiac surgery, intraoperative use of cell savage devices is not associated with fast-track extubation.	2

CABG: coronary artery bypass graft; ICU: intensive care unit; MiECC: minimally invasive extracorporeal circulation.

ing sternotomies. Additionally, ESP block is also associated with fast-track extubation in patients undergoing minimally invasive approaches (high agreement for both).

Data from three RCTs confirm the finding that neuraxial anesthesia is associated with fast-track extubation in selected cardiac surgery patients. Notably, a single study revealed that all patients administered neuraxial anesthesia were successfully extubated within the first hour after surgery.[42]

After the first vote, the statement received a low consensus from the expert panel (vote between one to three: four (44.4%); four to six: zero; seven to nine: five (55.6%). After further discussion and considering the potential side effects and complications associated with neuraxial anesthesia in the cardiac surgery population, the expert panel decided not to recommend neuraxial anesthesia as a routine approach for expediting extubation in cardiac surgery. Consequently, this statement was not approved.[7-26]

General anesthesia

During elective cardiac surgery, the administration of alpha-agonists (such as dexmedetomidine and clonidine) rather than halogenated anesthetics is associated with fast-track extubation.

Analgesia with low-dose or short-acting opioids is associated with fast-track anesthesia recovery.

The administration of dexmedetomidine, as opposed to propofol, during the ICU stay after CABG surgery is associated with fast-track extubation. Propofol administration is not associated with fast-track extubation. The administration of paracetamol, whether alone or in combination with opioids, is not associated with fast-track extubation.

For all these statements, a high level of agreement was reached.[27-45]

Surgical technique

The expert panel highly agreed on the beneficial effect of minimally invasive surgical access on fast-track extubation. Data from RCTs did not support the effects of other surgical techniques and approaches, such as off-pump cardiac surgery, minimally invasive extracorporeal circulation (MiECC), or body temperature, on fast-track extubation.[46-57]

Ventilation

Postoperative adaptive supportive ventilation has been demonstrated to be associated with fast-track extubation. Initially, this statement attained a moderate level of agreement at the end of the first round of voting. After discussion and a second round of voting, the result remained "moderate consensus". The panel agreed that this result likely stems from the limited availability of this ventilatory setting in the minority of currently used mechanical ventilators.[58, 59]

Anesthesia depth monitoring

The use of either processed electroencephalography or end-tidal concentrations of volatile anesthetics for anesthesia depth monitoring in patients receiving volatile agents is associated with fast-track extubation (high agreement).[60-62]

Miscellaneous

Among interventions categorized as miscellaneous, the salvage of red blood cells was not considered associated with fast-track extubation (high agreement). Contradictory evidence emerged regarding the impact of vitamin C administration *per se*, yet a high level of consensus was attained for the statement asserting that vitamin C supplementation is not associated with fast-track extubation.[63-66]

Discussion

Key findings

We found randomized evidence and reached high agreement among experts for eight interventions associated with extubation within six hours after elective cardiac surgery in selected low-risk patients, the majority of them being anesthesia strategies.

Relationship to previous literature

Loco-regional anesthesia

A noteworthy finding of this consensus is the promising role of loco-regional anesthesia in association with general anesthesia as a strategy to facilitate fast-track extubation after surgery.

The use of loco-regional anesthesia in cardiac surgery still remains debated. While until 2015, more literature was available on neuraxial anesthesia,[67] in the last decade, fascial plane blocks have emerged as a viable alternative to conventional opioid-based analgesia and to neuraxial blockade. Increasing evidence supports the safety and efficacy of fascial plane blocks across various cardiac surgery approaches (sternotomy and mini-thoracotomy).[68, 69]

The parasternal intercostal block (PIB) targets the anterior cutaneous branches of the T2-T6 intercostal nerves, providing coverage to the anterior and medial chest walls. Evidence regarding the efficacy of PIB in pain management for sternotomy is growing, with several RCTs and meta analyses published in support of its effectiveness.[70] Therefore, Statement No. 1 of the Consensus is well substantiated by the literature.

A current and controversial topic in cardiac surgery concerns the timing of PIB block administration, whether before or at the end of surgery. Intriguingly, among the selected publications, only three trials noted that PIB was not associ-

ated with fast-track extubation, and notably, in all three studies, it was administered before the surgical incision. Consequently, the panel suggests performing the PIB at the end of surgery to ensure efficient analgesia during the crucial initial hours after surgery, facilitating fast-track extubation.

The ESP block is a posterior chest wall block that functions by blocking the anterior and posterior branches of the thoracic spinal nerve, along with the sympathetic branch communications, at the level of the intervertebral foramen. Bilateral ESP block (whether administered as a single shot or continuously) has been effectively documented for pain management in sternotomy surgery.[71] Monolateral ESP block can also be conducted to manage pain in mini-invasive mitral valve surgery (MI-MVS) through a thoracotomy access.[72] Based on the existing evidence, the panel of experts supports (statement n.2) the use of ESP block for pain management in both traditional and mini-invasive cardiac surgery.

Although the Serratus anterior plane block is one of the most widely used techniques for pain management in MI-MVS, the available evidence predominantly comprises observational studies or case series, which is not consistent with the methodological approach of this consensus. Consequently, no statements have been formulated on this topic.

The important risks associated with neuraxial anesthesia (*i.e.*, epidural hematoma),[67] although rare, seem unwarranted in the present era, particularly considering that alternate ultrasound-guided techniques for chest wall blocks provide enhanced safety profiles with comparable efficacy in achieving fast-track endpoints. Consequently, the expert panel did not recommend the use of neuraxial anesthesia.

General anesthesia

The effect of general anesthesia on extubation time has been the subject of many studies, with the majority of the strongest data coming from a small number of RCTs and meta-analyses. In general, scientific research provides strong support for the statements as in this Consensus. While evidence supports the use of volatile anesthetics in cardiac surgery, as they may improve major clinical outcomes,[73] no evidence exists in favor of fast-track. Additionally, the peri-operative administration of dexmedetomidine, mainly examined as a postoperative sedative drug in the ICU for the reduction of delirium incidence, has been associated with a reduced duration of tracheal intubation following cardiac surgery.[74]

The ERAS approach supports the concept that adopting an opioid-sparing approach may be linked to enhanced and quicker respiratory recovery after surgery. The preference for utilizing a low-dose and short-acting opioid molecule is reinforced by a recent meta-analysis,[75] and the expert panel has lent their support to this statement.

Valuable insights are derived from a recent review[76] examining factors associated with delayed extubation in patients undergoing ERACS. Notably, among the 37 interventions studied, no role was observed for general anesthesia. Delayed extubation was mainly related to preoperative patient characteristics and procedural factors related to cardiac surgery. Careful selection of anesthesia drugs is essential for the fast-track protocol's success and is not related to failure in suitable patients. Furthermore, it should be emphasized that the method of administration of general anesthetic drugs (bolus *vs.* continuous infusion, standard *vs.* TCI continuous infusion, etc.) might have an influence on faster recovery and extubation, but only a limited number of publications have addressed this challenge.

Surgical technique

The literature review of the last 10-15 years has highlighted various topics within the surgical area. The main focus is on the importance of off-pump coronary artery bypass (OPCAB) *versus* on-pump coronary artery bypass (OnCAB). Three studies[50-52] illustrated a significant reduction in postoperative ventilation time after OPCAB surgery, yet none of these studies attained the target of fast-track extubation (<six hours). A recent study[51] examined patients with chronic obstructive pulmonary disease (COPD) and showed significant reductions in postoperative ventilation time. Another RCT[52] analyzed patients undergoing OnCAB through a minimally invasive approach (a small incision in the left chest). However, none of these studies designated the time of mechanical ventilation or the

time to extubation as a primary endpoint. Other studies[53-55] showed no statistically significant difference in extubation time between patients undergoing OPCAB or OnCAB. Notably, one of the studies compared mitral valve surgery + OPCAB with entirely on-pump surgery,[54] while another study compared MiECC with OPCAB.[55] In none of these studies was fast-track extubation considered an outcome measure, and ventilation time was only regarded as a secondary endpoint. Although there is moderate evidence supporting off-pump surgery in reducing mechanical ventilation time, none of these studies endorses its role in a fast-track strategy.

MiECC may reduce the negative effects of conventional cardiopulmonary bypass, potentially enabling fast-track extubation. However, recent publications, consisting of only two RCTs,[48, 49] both demonstrated a significant reduction in extubation time for patients undergoing cardiac surgery with MiECC support. Nevertheless, neither study met the requested time criteria for fast track extubation (<six hours).

Temperature management was not associated with fast-track extubation in either valvular[57] or coronary surgery patients.[56] Surprisingly, hypothermia in patients undergoing valvular surgery was associated with a shorter ventilation time compared to normothermia.[57]

A minimally invasive surgical approach facilitates fast-track extubation techniques in cardiac surgery. This evidence is supported by two RCTs.[46, 47] In one study,[47] "reversed C sternotomy" in patients undergoing surgery for valvular disease or septal defects was associated with fast-track extubation. However, this study is limited by a very small sample size and exclusively involves young patients. Another study[46] explored the hospital length of stay and mechanical ventilation time in patients undergoing OPCAB surgery, comparing left mini-thoracotomy and classic sternotomy. Both groups met the criteria for fast-track extubation, but the minimally invasive approach showed significantly shorter extubation times.

Mechanical ventilation

A limited number of studies[77, 78] examined the role of adaptive support ventilation (ASV) for postoperative weaning in cardiac surgery patients. ASV is a recent ventilatory technology characterized by automated, closed-loop ventilation with automatic adjustments based on the patient's respiratory requirements.[78] In certain trials, ASV was associated with a significantly shorter time to extubation compared to conventional ventilation.[79] However, this ventilatory technology is only accessible on specified types of mechanical ventilators. Therefore, the expert panel supported this statement with moderate consensus.

Anesthesia depth monitoring

Intraoperative monitoring of anesthesia depth, aimed at preventing under- or overdosing of anesthetics and facilitating fast-track extubation, has become a common clinical practice. Despite its widespread use, only a limited number of studies have examined the relationship between time to extubation and brain monitoring.[80, 81] The literature results are contradictory, leaving uncertainty regarding whether Bispectral Index -guided anesthesia affects the time to tracheal extubation after cardiac surgery compared to other standard monitoring techniques (*e.g.*, minimum alveolar concentration-guided anesthesia). The expert panel advocates for any form of anesthesia depth monitoring.

Miscellaneous

Vitamin C is one of the first-line antioxidants in the human body. Researchers have endeavored to illustrate its protective effect on the human lungs; however, the exact mechanism is unclear.[82] The association with early extubation in cardiac surgery patients is contradictory, leading an expert panel to conclude that vitamin C supplementation does not support fast-track extubation.

The utilization of cell salvage devices is known for its capacity to reduce circulating inflammatory mediators.[83] This reduction in inflammation could reduce the injury to the alveolar-capillary membrane. Several researchers have explored the impact of cell salvage on pulmonary complications. However, no study has indicated an association between cell savage and fast-track extubation.

Clinical practice implications and future research

This consensus document provides straightforward information that can be immediately applied

to daily clinical practice. Some elements (*i.e.*, drugs' selection and dosage) should be carefully evaluated for the formulation of a fast-track cardiac surgery protocol. Monitoring tools (*i.e.*, anesthesia depth monitoring) contribute to the administration of tailored anesthesia for each patient, highlighting the potential significance of "precision medicine" in the setting of fast-track cardiac surgery. As central blocks may be associated with major complications, scientific research is currently focusing on fascial blocks. This area holds promise for cardiac surgery; studies have evidenced that fascial blocks are both safe and may be a powerful perioperative analgesic strategy for such patients. It is noteworthy that the ERACS documents recommend the use of fascial blocks to facilitate opioid sparing and promote fast-track extubation;[3] however, no specific guidelines have been formulated. The role of the serratus anterior plane and parasternal blocks should be central to future research endeavors aimed at advancing fast-track cardiac surgery. Fascial plane blocks have been associated with extubation occurring within three hours after surgery.[8, 9, 11, 14, 17, 20] This further reduction of extubation times (conventional fast-track extubation time is considered to be less than six hours after surgery) could have a significant impact on clinical practice and organizational challenges in cardiac surgery.

Selecting patients for extubation within three hours after surgery could quicken patient turnover in the cardiac surgery ICU (with only limited bed availability). This, in turn, may increase the number of surgical cases performed per day. Consequently, there is a potential for reduced overall costs within the healthcare system and a reduced waiting list for patients.

Limitations of the study

We did not implement a threshold for study quality during the selection process. The scientific relevance of the included journals was extremely heterogeneous, and most studies were conducted in non-European and non-North American countries. We encountered a limited number of studies for each specific intervention, with the sole exception of loco-regional anesthesia and the sample size in each arm of the included studies was relatively small. As detailed in the methods section, an intervention was defined as "associated" with early extubation when more than 75% of patients were extubated within six hours. While this threshold of 75% is rigorous, it remains arbitrary. Furthermore, it should be acknowledged that while we were able to offer recommendations regarding strategies potentially associated with fast-track cardiac surgery, the impact of such interventions on major clinical outcomes (particularly hospital survival) remains unexplored and was not the focus of this consensus. We believe that these topics are worth further investigation.

Conclusions

We presented the first consensus document on interventions and strategies associated with fast-track extubation after cardiac surgery: parasternal block, ESP block, use of alpha agonist in the OR, opioids in the OR, dexmedetomidine in the ICU, minimal invasive surgical access, anesthesia depth monitoring, adaptative support ventilation. It is important for anesthetists to possess knowledge in established clinical strategies to implement and promote fast-track extubation in cardiac surgery. This study is the first expert consensus statement to evaluate strategies associated with early extubation after cardiac surgery.

Key messages

- Some anesthesia interventions are associated with fast-track extubation after cardiac surgery.
- Minimal invasive cardiac surgery techniques are associated with fast-track extubation after cardiac surgery.
- Anesthetists and surgeons' decision strategies could influence patients recovery.

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Conflicts of interest
The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Authors' contributions
Simona Silvetti conceived the idea and did the inital search; Filippo Sanfilippo formulated the search strategy; Valentina Ajello, Tommaso Aloisio, Paolo Capuano, Alessandro Caruso, Daniele Maraniello, Marina Pieri, Gianluca Paternoster, Antonio Toscano and Mario Zaccarelli analyzed the interventions identified in the initial search; Massimo Baiocchi, Paolo A Del Sarto, Fabio Guarracino, Giovanni Landoni, Cristopher M Munch, Marco Ranucci, Giuseppe Sepolvere, Lucia Torracca and Sabino Scolletta were the experts during the consensus meeting; Domenico Abelardo analyzed the data; Simona Silvetti, Marina Pieri and Gianluca Paternoster wrote the manuscript; Giovanni Landoni, Marco Ranucci and Sabino Scolletta supervised the findings of this work. All Authors participated to the Consensus and mentioned the results. All authors read and approved the final version of the manuscript.

Acknowledgements
This manuscript is in memory of Blanca Martinez, who made major contributions to the present work but passed away prematurely before its publication.

History
Manuscript accepted: July 8, 2024. - Manuscript revised: June 21, 2024. - Manuscript received: May 4, 2024.

Supplementary data
For supplementary materials, please see the HTML version of this article at www.minervamedica.it